



WUNNA EDUCATIONAL SERVICES
PHYSICS UCE ASSESSMENT EXAMINATION
TIME ALLOWED:_____

NAME:_____CLASS/STEAM_____

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MARKS SCORED	PERCENTAGE MARK	TEACHER’S COMMENT

Which of the following is not a basic unit?
kilogram B. newton C. second D. metre

Calculate the mass of air of density 1.29kgm-3 in a room of floor 10m x 10m x 5m
A. 3.88 x 103kg B. 6.45 x 102kg C. 1.29 x 10-2kg D. 2.58 x 10-4kg

An empty density bottle weighs 26.5g. When full of a salt solution it weighs 82.5g and 76.5g when full of water. Calculate the density of salt solution
A. 1.078gcm-3 B. 1.120gcm-3 C. 112gcm-3 D. 1078gcm-3

An empty 20litre jerry can has a mass of 0.8kg. What will be its mass when full of water. A.
20.8kg B. 20.0kg C. 19.2kg D. 16.0kg

Which of the following is a scalar quantity?
weight B. mass C. velocity D. force

The mass of a rectangular block 4cm x 6cm x 10cm is 0.18kg. What is its density in gcm⁻³?

- A. 0.75 B. 4.32 C. 240 D. 750

80cm³ of water was mixed with 100cm³ of liquid of density 0.8gcm⁻³. What is the density of the mixture if there is no change in total volume in mixing?

- A. 0.889gcm⁻³ B. 0.800gcm⁻³ C. 1.320gcm⁻³ D. 1.500gcm⁻³

Which of the following physical properties changes when a body is moved from the earth to the moon?

- A. mass B. volume C. density D. weight

Which of the following can be used to measure the diameter of a bicycle spoke accurately?

- A. metre rule B. vernier caliper
B. tape measure D. micrometer screw gauge

44g of salt of density 2.2gcm⁻³ are dissolved in 100g of water. What is the density of the salt solution if the resulting volume of solution is the same as the volumes of salt and water together?

- A. 1.20gcm⁻³ B. 1.44gcm⁻³ C. 1.80gcm⁻³ D. 2.00gcm⁻³

A tin containing $6 \times 10^{-3} \text{ m}^3$ of paint has a mass of 8kg, if the mass of empty tin with the lid is 0.5kg. Calculate the density of paint in kgm⁻³

- A. $\frac{8 \times 0.5}{6 \times 10^{-3}}$ B. $\frac{7.5}{6 \times 10^{-3}}$ C. $\frac{8}{6 \times 10^{-3} \times 0.5}$ D. $\frac{8.5}{6 \times 10^{-3}}$

Which of the following sets contains only vector quantities?

- A. weight, displacement, acceleration, magnetic field
B. energy, electric field, momentum, distance
C. mass, velocity, force, speed
D. specific heat capacity, power, time, volume

The three fundamental physical quantities are

- density, mass and time B. length, time and mass
B. length, time and weight D. volume, temperature and weight

A rectangular block of tin is 0.5m long and 0.01m thick. Calculate the width of the block if it has a mass of 0.365kg and density of 7300kgm⁻³

- A. 0.001m B. 0.01m C. 0.1m D. 1m

Which of the following is a vector quantity?

- speed B. mass C. temperature D. displacement



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The density of a stone of volume 25cm^3 is 10kgm^{-3} . Find its mass in kg

- A. 2.5×10^{-4} B. 2.5×10^4 C. 2.5×10^2 D. 2.5×10^1

A set of apparatus that is suitable for measurement of volume of irregular solid include

- A. Overflow can, measuring cylinder and a flask
B. Overflow can, burette, string and resort stand
C. Overflow can, measuring cylinder and a string
D. Burette, overflow can, measuring cylinder, string and a retort stand.

The width of a metre rule is accurately measured by a

- A. micrometer screw gauge B. vernier caliper
B. tape measure D. metere rule

The easily compressed state of matter is
solid B. liquid C. metal D. gas

Which of the following is true about a dry cell, it converts
mechanical energy to electrical energy B. electrical energy to kinetic energy
C. chemical energy to electrical energy D. chemical energy to mechanical

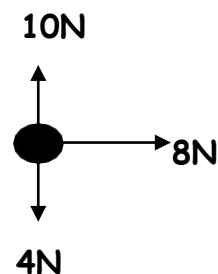
Two forces of 3N and 4N act at a point at right angles to each other. The magnitude of their resultant is

- A. 25N B. 7N C. 5N D. 1N

The unit of energy is

- B. the joule B. the watt C. the newton D. the newton per metre

Forces of 10N, 8N, 4N acts an object as shown in the figure below.



Find the magnitude of the resultant force on the object.

- A. 10.0N B. 16.1N C. 22.0N D. 100.0N

Which of the following sources of energy are exhaustible?

- i) Solar energy ii) fossil fuels iii) tidal power

- A. (i) only correct
C. (ii) only correct
B. (ii) and (iii) correct
D. (i) and (iii) correct



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Power is defined as

- A. rate of doing work, measured in watts
- B. ability to do work, measured in joules
- C. energy x time, measured in joule time
- D. $\frac{energy}{time}$, measured in joules per hour

The forces that hold the molecules in a mercury drop together are called

- A. surface tension
- B. adhesive forces
- B. cohesive forces
- D. electrostatic forces
- C.

A pump is rated at 400W. How many kg of water can it raise in one hour through a height of 720m? A. 0.8kg B. 5.6kg C. 33.3kg D. 200.0kg

A body of mass 2kg was dropped from the top of the building. It has kinetic energy of 900J when it hits the ground, the height of the building was

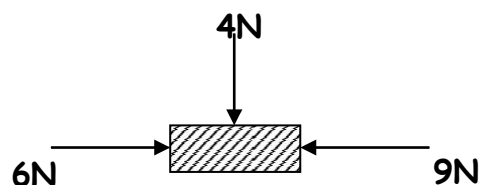
- A. 450m
- B. 180m
- C. 90m
- D. 45m

A mouse of mass 0.03kg climbs through a distance of 2m up a wall in 4 seconds. The power developed in watts is

- A. 0.024
- B. 0.15
- C. 0.6
- D. 2.4

A force of 50N moves an object through a distance of 200m in 40 seconds. Find the power developed
A. 100W B. 250W C. 160W D. 200W

A vertical force of 4N and horizontal forces of 6N and 9N were applied on a block as shown below



Find the magnitude of the resultant force on the block

- D. 3N B. 5N C. 15N D. 19N

Two forces of 12N and 5N act on a body of right angles their resultant force is
A. 7N B. 13N C. 17N D. 169N

A newton is defined as the

- E. Unit of force
F. Force which produces an acceleration of 1ms^{-2}
G. Force which gives a mass of 1kg an acceleration of 1ms^{-2}
H. Force which gives any mass an acceleration of 1ms^{-2} .
I.

The rate of doing work is measure in

- J. watts B. joules C. newtons D. metres

The energy transformation that takes place when a cell is producing electricity is

- K. chemical to electrical B. mechanical to electrical
B. heat to electrical D. electrical to heat

The weight of body is defined as the,

- L. gravitation force on it B. quantity of matter it contain
C. Maximum pressure it can exert D. the product of its density and volume.

Which of the following have the same units?

- M. energy and power B. energy and work
C. power and work D. kinetic energy and power

The weight of a body varies from place to place on the earth's surface because

- N. of the rotation of the earth
- O. weight acts towards the earth
- P. of the motion of objects in the atmosphere
- Q. of the total gravitational force on the body

An object of mass 6kg is raised from the ground to height of 4m. The work done is A. 100J B. 240J C. 3000J D. 2400J

When water spreads on a glass plate, the force between its molecules and glass molecules is due to

- R. surface tension
- B. adhesion
- C. cohesion
- D. viscosity



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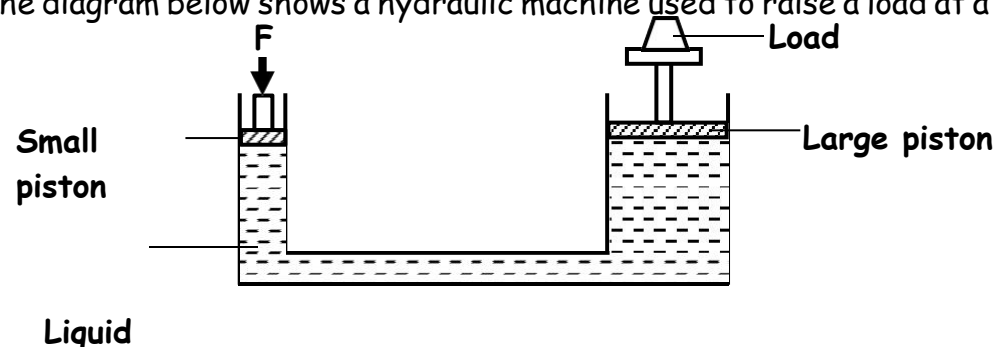
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- A glass block of density 2500kgm^{-3} measures $20\text{cm} \times 10\text{cm} \times 5\text{cm}$. What is the maximum pressure it exerts on a flat horizontal surface
A. $5,000\text{ Nm}^{-2}$ B. $1,250\text{ Nm}^{-2}$ C. 500 Nm^{-2} D. 5 Nm^{-2}
- A paraffin reservoir tank contains paraffin of density 800kgm^{-3} to a depth of 5m . What is the pressure at the base of the reservoir?
A. $6.25 \times 10^4\text{ Nm}^{-2}$ B. $4.00 \times 10^4\text{ Nm}^{-2}$ C. $1.60 \times 10^2\text{ Nm}^{-2}$ D. $6.25 \times 10^{-3}\text{ Nm}^{-2}$
- In a crushing can experiment, the can collapses because
A. it is weakened by the hot water
B. pressure outside is greater than pressure inside
C. it is made of very light materials
D. pressure inside is atmospheric
- Which of the following devices depends on atmospheric pressure to operate?
A. hydraulic lift B. bicycle pump
B. automatic flushing tank D. bourdon pressure gauge

5. Which of the following is true about a lift pump?
- A. it consists of only three valves
 - B. atmospheric pressure determines the height to which water is pumped
 - C. on the down-stroke all valves are open
 - D. on the up-stroke all valves are closed
6. A water manometer connected to the gas mains reads 70mm. Calculate the gas pressure in Nm^{-2} A. 700 B. 830 C. 103,360 D. 104,060
7. A rectangular block of metal weighs 3N and measures 2cm x 3cm x 4cm. What is the greatest pressure it can exert on a horizontal surface?
- A. $5.0 \times 10^3 \text{Nm}^{-2}$ B. $3.75 \times 10^3 \text{Nm}^{-2}$ C. $2.50 \times 10^3 \text{Nm}^{-2}$ D. $7.5 \times 10^{-3} \text{Nm}^{-2}$

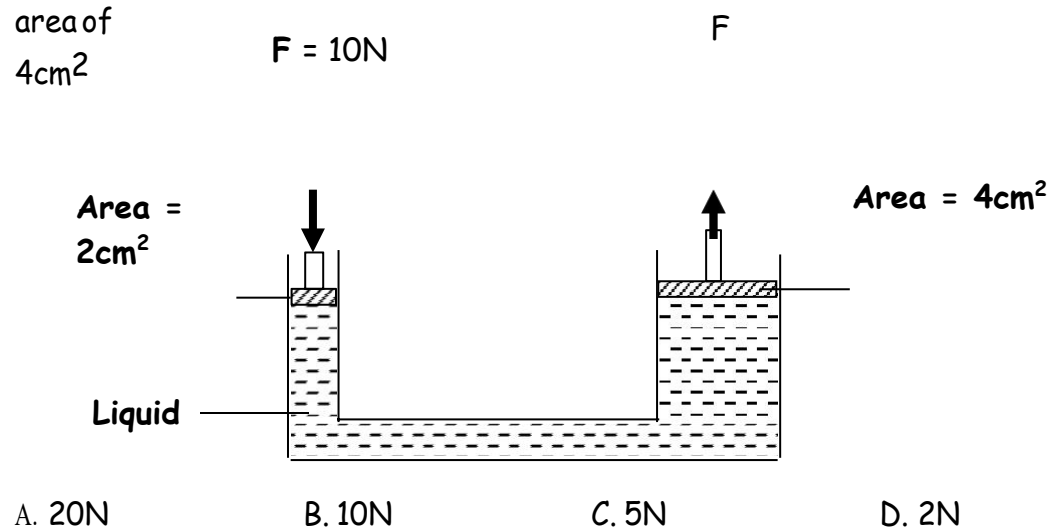
8. The diagram below shows a hydraulic machine used to raise a load at a petrol station



- What is the minimum force required to lift a car of mass 1500kg, if the cross section area of the small and large pistons are 0.15m^2 and 5m^2 respectively
- A. 3000N B. 750N C. 450N D. 225N
9. Which of the following is true about pressure in liquids?
- A. depends on the shape of the container
B. is directly proportional to the depth
C. is the same at equal depth in all liquids
D. increases with the surface area of the liquid
10. A cylindrical container of height 30cm is filled with water. Calculate the pressure exerted by the water at the bottom of the container. (Density of water = 1000kgm^{-3})
- A. 300Pa B. 3,000Pa C. 30,000Pa D. 300,000Pa
11. In a liquid pressure is
- A. transmitted equally in a specific direction B. transmitted equally in all directions
C. decreased with depth D. decreased with density
12. In a hydraulic press, the area of the piston on which the effort is applied is made smaller in order to
- A. obtain a pressure as larger as possible
B. transmit pressure equally throughout the liquid
C. overcome a force as large as possible of the load
D. facilitate the movement of the piston downwards
13. A hydraulic brake works on the principle of
- A. transmission of pressure in a liquid B. distribution of force in a liquid
C. existence of viscosity in a liquid D. high density of a liquid
14. A hipototamus can easily walk on mud without sinking while a goat will sink because
- A. a hippotatomus has more weight than that of a goat
B. the centre of gravity of hipototamus is lower than that of a goat

- C. a hipototamus exerts more pressure on the ground than a goat
D. a hipotatomus exerts less pressure on the ground than the goat
15. The mass of a cuboid of dimensions $4\text{m} \times 2\text{m} \times 3\text{m}$ is 48kg . The minimum pressure it can exert is A. 20Nm^{-2} B. 40Nm^{-2} C. 60Nm^{-2} D. 80Nm^{-2}
16. A diver dives to a depth of 20m below the surface of water of density 1000kgm^{-3} . Calculate the increase in pressure he experiences in Nm^{-2}
A. 500 B. 10,000 C. 20,000 D. 200,000
17. A rectangular block of dimensions $4\text{cm} \times 2\text{cm} \times 1\text{cm}$ exerts a maximum pressure of 2000Nm^{-2} when resting on a table. Calculate the mass of the block
A. 4g B. 16g C. 40g D. 400g

18. A rectangular block of mass 50kg measures 8cm by 10cm by 20cm. What is the minimum pressure it can exert on a given surface?
A. $6.25 \times 10^4 \text{Pa}$ B. $6.25 \times 10^3 \text{Pa}$ C. $2.5 \times 10^4 \text{Pa}$ D. $2.5 \times 10^3 \text{Pa}$
19. The hydraulic machine below has a force of 10N acting on an area of 2cm^2 . What force will act on an area of 4cm^2





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- 1. A string increases in length from 10cm to 25cm when a force is applied.
Find the tensile strain A. 1.5 B. 2.5 C. 15 D. 35
- 2. Which one of the following quantities is the odd one out?
A. wood B.glass C.concrete D. steel
- 3. A long piece of chalk is
A. stiff and brittle B. ductile but not stiff
C. ductile and stiff D. brittle but not stiff

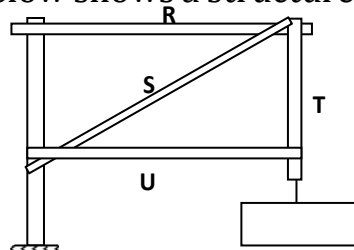
4. Surface tension of a liquid
 - A. reduces with increase in temperature
 - B. reduces with drop in temperature change
 - C. is not affected by temperature changes
 - D. increases with increase in temperature
5. Paraffin moves up the wick of a lamp by a process called
 - A. transpiration
 - B. osmosis
 - C. surface tension
 - D. capillarity
6. A force of 20N extends a spring by 10mm. Find extension in mm caused by a mass of 0.5kg
 - A. 0.25
 - B. 1.00
 - C. 2.50
 - D. 10.00
7. A material that can be rolled into sheets or drawn into wires without breaking is said to be
 - A. strong
 - B. elastic
 - C. ductile
 - D. brittle
8. Reinforced concrete is stronger than ordinary concrete because concrete and steel are
 - A. both brittle materials
 - C. strong in compression and tension respectively
 - B. both ductile materials
 - D. strong in tension and compression respectively
9. When smoke is introduced in a smoke cell and observed under a microscope, it is observed as particles moving at random. This is mainly because the particles
 - A. are hot
 - B. collide with one another
 - C. collide with air molecules
 - D. collide with walls of the smoke cell
10. Which of the following is a brittle material?
 - A. rubber
 - B. plastic
 - C. glass
 - D. copper
11. A 2kg mass extends a spring by 20cm. Find the extension in cm, caused by a mass of 0.5kg
 - A. 0.2
 - B. 0.5
 - C. 2.5
 - D. 5.0
12. A drop of oil of volume 0.00008cm^3 spread out and covered an area of 320cm^2 . The thickness of the oil drop on the water was
 - A. $1.28 \times 10^{-2}\text{cm}$
 - B. $4.0 \times 10^{-7}\text{cm}$
 - C. $5.0 \times 10^{-7}\text{cm}$
 - D. $2.5 \times 10^{-7}\text{cm}$
13. Which of the following statements is true about concrete?
 - A. it is both brittle and ductile
 - B. concrete in tension is weak and strong in compression
 - C. it is a ductile material
 - D. concrete in tension is strong and weak in compression
14. Which of the following substances is not elastic?
 - A. glass
 - B. rubber
 - C. plasticine
 - D. copper

15. A mass of 500g produces an extension of 10cm in a spring. Find the force that will produce an extension of 25cm
A. 0.5N B. 12.5N C. 50.0N D. 200.0N
16. Notches and cracks spread more rapidly when brittle material are under
A. strain B. tension C. compression D. extension
17. Strain by definition is the ratio of
A. force to original length C. extension to original length
B. extension to force D. force to change in length
18. $1.8 \times 10^{-4} \text{cm}^3$ of oil spreads to form a patch of area 150cm^2 . Calculate the thickness of the film
A. $1.2 \times 10^{-6} \text{cm}$ B. $2.7 \times 10^{-2} \text{cm}$ C. $8.3 \times 10^5 \text{cm}$
D. $2.5 \times 10^{13} \text{cm}$

19. In an oil drop experiment, the diameter of the oil film formed on water surface is 5cm and the volume of the drop used is 0.005cm^3 . Find the thickness of the oil molecule.

A. $2.55 \times 10^{-4}\text{cm}$ B. $6.36 \times 10^{-5}\text{cm}$ C. $1.00 \times 10^3\text{cm}$ D. $1.96 \times 10^1\text{cm}$

20. The figure below shows a structure supporting a load



Which of the girders R, S, T and U is under compression?

- A. U and R B. T and R C. S and U D. S and T



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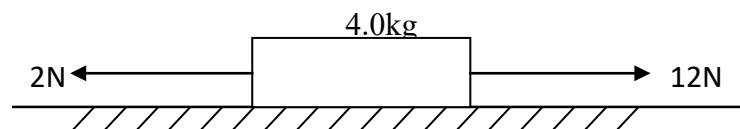
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1. A car of mass 500kg starts from rest and gains a speed of 80ms^{-1} in 5 seconds.
Calculate the force applied on the car
A. 16N B. 500N C. 800N D. 8000N
2. When a car is suddenly brought to rest, a passenger jerks forward because of
A. inertia B. friction C. gravity D. momentum
3. A 1.5kg mass accelerates across a smooth table at 15ms^{-2} . What is the net
force applied to the mass A. 0.1N B. 10.0N C. 15.0N D.
22.5N
4. A bullet of mass 3g travelling at 100ms^{-1} penetrates deeply into a fixed target
and is brought to rest in
0.01 seconds. Calculate the average retarding force exerted on the bullet
A. 3N B. 30N C. 300N D. 3000N
5. A railway truck of mass 1800kg moving at 4ms^{-1} collides with a truck of mass
1200kg moving in the same direction at 3ms^{-1} , if they move together, what is
their combined velocity just after collision
A. 3.5ms^{-1} B. 3.6ms^{-1} C. 7.0ms^{-1} D. 8.2ms^{-1}

6. A man of mass 70kg stands in a lift. What will he weigh if the lift accelerates at 0.5ms^{-2} upwards? A. 665N B. 686N C. 700N D. 735N
7. A block of mass 10kg accelerates uniformly at a rate of 3ms^{-2} along a horizontal table when a force of 40N acts on it. Find the frictional force between the block and the table
A. 10.0N B. 13.3N C. 30.0N D. 70.0N
8. When a steadily increasing force is applied to a moving object all the following change except
A. acceleration B. momentum C. speed D. mass
9. An object of mass 2kg moving at 5ms^{-1} collides with another object of mass 3kg at rest. Find the velocity of the two bodies if they stick together after collision
A. 1ms^{-1} B. 2ms^{-1} C. 2.5ms^{-1} D. 5ms^{-1}
10. A bullet of mass 0.02kg is fired with a speed of 40ms^{-1} . Calculate its kinetic energy A. 0.4J B. 0.8J C. 16J D. 32J
11. A bullet of mass 30g is fired with a speed of 400ms^{-1} from the riffle. The riffle recoils with a speed of 4ms^{-1} . Find the mass of the riffle
A. 0.6kg B. 0.3kg C. 6.0kg D. 3.0kg
12. A boxer while training notices that a punch bag is difficult to set in motion and difficult to stop. What property of the punch bag accounts for both these observations?
A. friction B. inertia C. volume D. density
13. Two forces of 24N and 32N act at right angles on a body of mass 2kg. Calculate the acceleration of the body in ms^{-2}
A. 40 B. 20 C. 10 D. 6
14. The product of mass and acceleration is
A. force B. inertia C. velocity D. momentum
15. A body continues in its of rest or uniform motion in a straight line unless acted upon by external force is a statement of
A. newton's second law of motion B. newton's first law of motion
C. newton's third law of motion D. newton's law of gravitation

16. When two bodies collide elastically
 A. only momentum is conserved B. both momentum and kinetic energy are conserved
 C. only kinetic energy is conserved D. both momentum and kinetic energy are not conserved
17. Eggs packed in a soft, shock-absorbing box are placed in a car. When the car suddenly starts or stops moving, the eggs do not crack because:
 A. the force acting on them causes fast change in momentum.
 B. no force acts on them.
 C. the force acts on them for only a short time.
 D. the force on them is small and acts for a longer time.
18. A body of mass m travelling with speed $5u$ collides with and adheres to a body of mass $5m$ travelling in the same direction with speed u . The speed with which the two travel together in the original direction is
 A. 0 B. $\frac{8}{10}u$ C. $\frac{6}{5}u$ D. $\frac{10}{6}u$
19. A body of mass 4kg initially at rest is acted upon by a force of 10N for 10 seconds. Find the final velocity of the body.
 A. 2.5ms^{-1} B. 20ms^{-1} C. 25ms^{-1} D. 80ms^{-1}
20. The figure below shows a wooded block of mass 4.0kg acted upon by forces of 12N and 2N .



The acceleration of the block is

- A. 2.5ms^{-2} B. 10.0ms^{-2} C. 3.5ms^{-2} D. 40.0ms^{-2}



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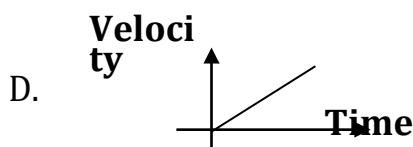
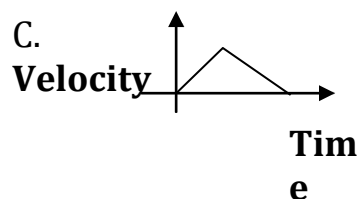
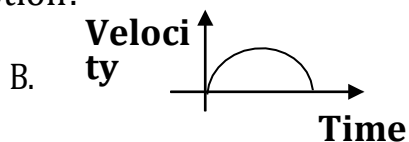
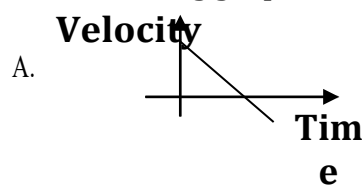
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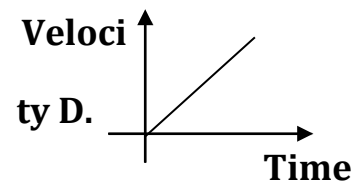
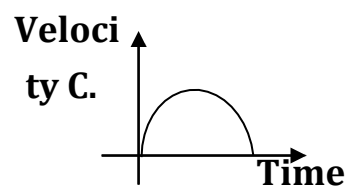
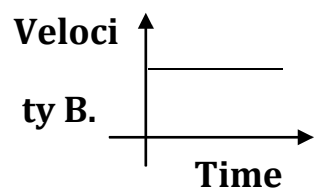
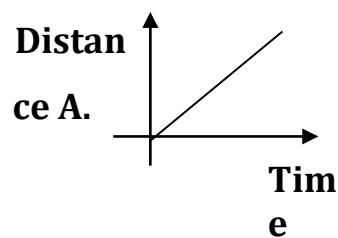
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1. A 5kg mass is projected vertically upwards with a speed of 15ms^{-1} . To what height does the mass rise? A. 3.00m B. 8.00m C. 11.25m D. 25.00m
2. A body is accelerated uniformly from rest at 10ms^{-2} . What is its velocity after 6s? A. 16ms^{-1} B. 20ms^{-1} C. 36ms^{-1} D. 60ms^{-1}
3. An object moving with a velocity of 10ms^{-1} is accelerated uniformly at 2ms^{-2} . Find its velocity when it has traveled 24m. A. 14ms^{-1} B. 16ms^{-1} C. 18ms^{-1} D. 24ms^{-1}
4. A car is travelling at 72kmh^{-1} and when the brakes are applied it experiences a uniform retardation of 2ms^{-2} . How long does it take the car to stop? A. 5s B. 10s C. 15s D. 100s
5. A ball is thrown vertically upwards with a velocity of 15ms^{-1} . Calculate the time it takes to rise and fall back to the ground level A. 1.5s B. 3.0s C. 4.5s D. 6.0s
6. A stone is thrown downwards from the top of a building with a velocity of 4ms^{-1} and reaches the ground in 2 seconds. Find the height of the building

- A. 56m B. 28m C. 16m D. 12m
7. The rate at which distance covered by a body in a particular direction changes with time is called
A. speed B. velocity C. acceleration D. displacement
8. A straight line through the origin of a velocity – time graph shows that the
A. velocity is uniform B. distance is increasing uniformly
C. acceleration is uniform D. motion is retardation
9. A cyclist traveling at a constant acceleration of 2ms^{-2} passes through two points A and B in a straight line, if the speed of the cyclist at A is 10ms^{-1} and the points are 75m apart. Find the speed at B
A. 15.8ms^{-1} B. 17.3ms^{-1} C. 20.0ms^{-1} D. 400.0ms^{-1}
10. A body falls freely from a height of 10m to the ground. Calculate its velocity as it hits the ground
A. 4.47ms^{-1} B. 10.00ms^{-1} C. 14.14ms^{-1} D. 25.00ms^{-1}
11. A ball thrown vertically upwards returns to the point of projection 12 seconds later. Calculate the speed with which the ball was thrown
A. 10ms^{-1} B. 30ms^{-1} C. 60ms^{-1} D. 120ms^{-1}
12. A car starts from rest and gains a speed of 80ms^{-1} in 5 seconds. Calculate acceleration of the car
A. 400ms^{-2} B. 85ms^{-2} C. 75ms^{-2} D. 16ms^{-2}
13. A body initially travelling at 10ms^{-1} is given a retardation of 2ms^{-2} in 3s, its velocity is
A. 4ms^{-1} B. 15ms^{-1} C. 16ms^{-1} D. 60ms^{-1}
14. A stone thrown vertically upwards returns to the ground after sometime. Which of the following graphs describes its motion?



15. The gradient of displacement-time graph represents the
A. acceleration of the body B. speed of the body
C. velocity of the body D. distance covered by the body
16. The slope of a velocity-time graph is the
A. speed of the body B. velocity of the body
C. acceleration of the body D. distance travelled by the body
17. A car accelerates from 4ms^{-1} to 20ms^{-1} in 8 seconds. How far does it travel in this time? A. 32m B. 96m C. 128m
D. 160m
18. A body of mass 2kg is projected vertically upwards with a velocity of 10ms^{-1} . Find the maximum height reached
A. 0.5m B. 5.0m C. 10.0m D. 50.0m
19. A body starts from rest accelerates at 2ms^{-2} for 6 seconds, it then travels at constant speed for 10 seconds then decelerates uniformly to rest in 4 seconds. How far did it travel?
A. 36m B. 80m C. 180m D. 600m
20. Which of the following graphs describes uniformly accelerated motion?





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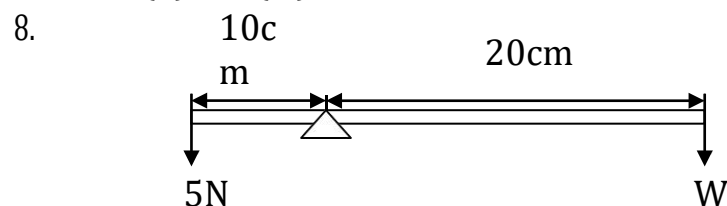
- 60J of useful work is done by a machine when 75J of energy is supplied, what is the efficiency of the machine
A. 60% B. 75% C. 80% D. 125%
- Find the velocity ratio of an inclined plane of length 12m if the height from the ground is 3m
A. 6 B. 4 C. 3 D. 2
- A single movable pulley has an efficiency of 85%. What load can be raised by an effort of 400N?
A. 340N B. 480N C. 680N D. 800N
- The efficiency of a machine is
A. the ratio of useful work done by the machine to the total work put into the machine
B. the ratio of velocity ratio to mechanical advantage
C. ratio of work input to work out put
D. ratio of distance moved by the load to distance moved by the effort in the same time
- A uniform metre rule is pivoted at its mid-point,. 0.6N weight is suspended from one end. How far from the other end must a 1N weight be suspended for the metre rule to balance?
A. 20cm B. 25cm C. 40cm D. 80cm

6. A plank AB 5m long weighs 68kg and its Centre of gravity is 2m from A. It rests on two bars one 0.5m from A, the other 0.6m from B. Find the reaction at the bar near A

A. 180N B. 240N C. 300N D. 480N

7. An object in unstable equilibrium continues to fall when slightly displaced because its

i) Centre gravity is lowered ii) centre of gravity is raised
iii) Potential energy is reduced iv) potential energy is increased
A. (iv) only correct B. (i), (ii) and (iii) correct
C. (ii) and (iv) correct D. (i) and (iii) correct



Two weights are balanced on a rod of negligible mass. What is W

A. 2.5N B. 10.0N C. 30.0N D. 40.0N

9. A bus carrying a heavy load on its rack is more un-stable when moving because

A. its centre of gravity is raised B. the friction on the ground is increased
C. its total weight is increased D. the pressure on the tyres is increased

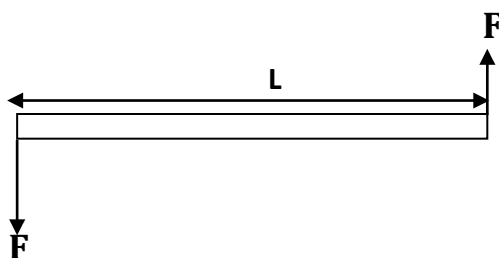
10. This consists of simple machines only.

A. Lever, hydraulic press, gears, wedge. B. Lever, wheel and axel, generator.
C. Gears, screw, wedge, generator. D. Gears, pulley, screw, motor.

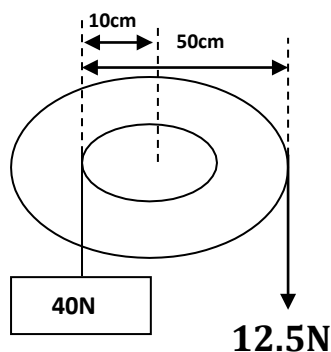
11. An object in stable equilibrium comes back to its original point when slightly displaced and released because its

i) Centre gravity is lowered ii) centre of gravity is raised
iii) Potential energy is reduced iv) potential energy is increased
A. (iv) only correct B. (i), (ii) and (iii) correct
C. (ii) and (iv) correct D. (i) and (iii) correct

12. Which of the following statements are true about two equal forces F acting on a bar of length, L as shown below?



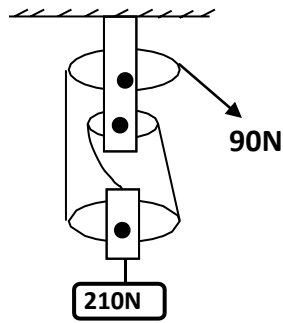
- i) The bar is in equilibrium
 ii) The forces cause a rotational effect
 iii) The forces produce different turning effects
- A. (i) only correct B. (i), (ii) and (iii) correct
 C. (i) and (ii) correct D. (i) and (iii) correct
13. A machine consisting of a wheel of radius 15cm and axle of radius 2.5cm is used to lift a load of mass 6kg with an effort of 20N. The efficiency of the machine is
- A. 75% B. 50% C. 80% D. 60%
14. The diagram below shows the forces acting on a wheel and axle



- The efficiency of the machine is
- A. 20% B. 80% C. 100% D. 125%
15. The turning effect of a force depends upon
- A. centre of gravity and the moment of the force.
 B. the force and the perpendicular distance from the force to the fulcrum.
 C. the force and the centre of gravity that the force acts on.

- D. the fulcrum and the force.
16. How can the mechanical advantage of a wedge be increased?
A. make it thicker B. make it longer
C. make it shorter D. make it out of steel
17. A pulley that is 80.0% efficient and has mechanical advantage of 4.0 does 560J of work in lifting a bale of papers. How much work did the worker do pulling out the rope from the pulley to raise the bale?
A. 140J B. 448J C. 700J D. 2240J

18. Calculate the efficiency of the pulley system shown in the figure below, if the minimum effort needed to raise a load of 210N is 90N.



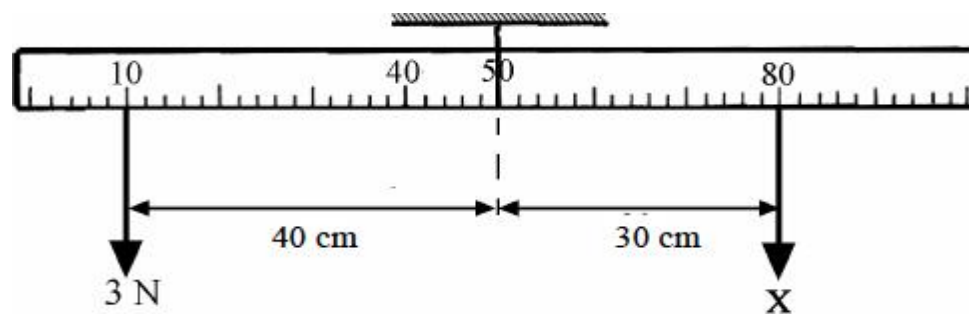
A: $\frac{90}{210}$
3 100

B: $\frac{90}{210}$
100

C: $\frac{210}{3}$
 $\frac{100}{90}$

D: $\frac{210}{90}$ $\frac{100}{3}$

19. A uniform metre-stick, suspended at its mid-point is balanced as shown.



What is the force X?

20. Machines increase the amount of work done on them by
- A. 4 N B. 1.5 N C. 10 N D. 0.375 N
- A. increasing the effort exerted on them B. increasing the power exerted on them
- C. reducing friction acting on the machine D. not increasing the work done on them



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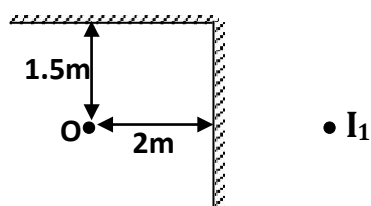
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1. A pin-hole camera forms an image of a distant objects which is
A. virtual, erectand magnified B. virtual, inverted and diminished
C. real, inverted and diminished D. real, inverted and magnified
2. An object 6cm high is placed 24cm from a tiny hole in a pin-hole camera. If the distance from the hole to the screen is 8cm, find the size of the image on the screen
A. 0.2cm B. 2.0cm C. 18.0cm D. 32.0cm
3. During the eclipse of the sun
A. the sun is between the earth and the moon
B. the earth is in between the sun and the moon
C. the moon is in between the sun and the earth
D. the earth casts the shadow on to the sun
4. Which of the following statements about eclipses is notcorrect?
A. during the eclipse of the sun, the shadow of the moon falls on the earth
B. during the eclipse of the moon, the earth is between the sun and the moon
C. during the eclipse of the sun the moon is between sun and the earth
D. during the eclipse of the moon, the shadow of the moon falls on the earth
5. The formation of eclipse of the sun can be explained by the fact that light

- A. can travel through a vacuum B. can be reflected
 - C. travels in a straight line D. can be refracted
6. Annular eclipse takes place when
- A. the sun is between the earth and the moon
 - B. the earth is near the moon in lunar eclipse
 - C. the moon is in between the sun and the earth
 - D. the earth is in between the sun and the moon
7. The sharpness of the image formed by a pin-hole camera depends on
- A. the brightness of the object B. the shape of the pin-hole
 - C. the size of the object D. the size of the pin-hole
8. During the lunar eclipse
- A. light from the sun is reflected by the moon
 - B. the earth lies between the sun and the moon
 - C. the moon lies between the earth and sun
 - D. the sun lies between the moon and the earth

9. The image of a distant object formed by a pin-hole camera is
i) Real ii) Diminished iii) Erect
A. (i), (ii) and (iii) correct B. (i) and (ii) only correct
C. (ii) and (iii) only correct D. (i) only correct
10. The brightness of the image formed by a pin-hole camera depends on
A. the size of the object B. the shape of the object
C. the size of the pin-hole D. the shape of the pin-hole
11. An object is placed 30cm in front of a plane mirror. If the mirror is moved a distance of 6cm towards the object, find the distance between the object and its image
A. 24cm B. 36cm C. 48cm D. 60cm
12. We are able to see objects because of
A. regular reflection B. light from object is reflected into our eyes
C. light travels in a straight line D. diffuse reflection
13. Two mirrors inclined at an angle of 60° forms
A. 6 images B. 5 images C. 4 images D. 3 images
14. What is the number of images formed by plane mirrors inclined at 45° to each other? A. 8 B. 7 C. 6 D. 5
15. The images of an object O placed 2m and 1.5m from plane mirrors M1 and M2 respectively are I1 and I2 as shown below



- Find the shortest distance between I1 and I2
A. 3.0m B. 3.5m C. 4.0m D. 5.0m
16. Which of the following is not true about the plane mirrors?
A. they form virtual image
B. they form images of the same size as their objects
C. the images formed are laterally inverted
D. the images are closer to the mirrors than the objects are

17. When reflection occurs in a plane mirror
- i) The image is real, erect and magnified
 - ii) The angle of reflection is equal to the angle of incidence
 - iii) The incident and reflected rays lie in different planes
 - iv) The object distance and image distance are the same
- A. (i), (ii) and (iii) only correct B. (i) and (iii) only correct
C. (ii) and (iv) only correct D. (iv) only correct
18. An object of height 2cm is placed at 16cm from pin-hole camera of the length 4cm. Find the size of the image formed
- A. 2.00cm B. 4.00cm C. 0.50cm D. 0.25cm

19. Which of the following is true about the plane mirrors?
- A. the images formed are laterally inverted
 - B. they form images of the different size as their objects
 - C. they form real image
 - D. the images are closer to the mirrors than the objects are
20. Calculate the angle of incline of two plane mirrors in order to produce 8 images
- A. 40° B. 45° C. 51° D. 60°



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- An object is placed at a distance of 20cm from a convex mirror of focal length 10cm. The image formed by a mirror is
A. virtual B. inverted
C. magnified D. between the object and the mirror
- An object is placed at a distance of 30cm from a concave mirror of focal length 15cm. The image formed by the mirror is
A. real B. virtual C. magnified D. erect
- Rays of light that pass through the principal focus of a concave mirror after reflection
A. pass through the pole of the mirror B. pass through the centre of curvature
C. are parallel to the principal axis D. appear to be coming from the focal point
- Which of the following is best when shaving?
A. convex lens B. plane mirror C. concave mirror D. convex mirror
- Planets are
A. luminous heavily bodies revolving around a star
B. non luminous heavily bodies revolving around the sun
C. luminous heavily bodies revolving around the moon

- D. luminous heavily bodies
6. Rays of light which are close and parallel to the principal axis of a concave mirror after reflection
- A. pass through the pole of the mirror B. pass through the centre of curvature
- C. pass through the focal point D. appear to be coming from the focal point
7. Parallel rays can be obtained practically from a point source of light if the source is placed at;
- A. the centre of curvature of a concave reflector
- B. the centre of curvature of a convex reflector
- C. the principal focus of a concave reflector
- D. the principal focus of a convex reflector
8. An object is placed between the focal point and the centre of curvature of a concave mirror, which of the following fully describes the image formed
- A. virtual, erect and magnified B. virtual, inverted and diminished
- C. real, erect and magnified D. real, inverted and magnified
9. An image 5cm high is formed by a converging mirror. If the magnification is 0.4, find the height of the object
- A. 12.5cm B. 5.4cm C. 2.0cm D. 4.6cm

10. The focal length of a concave mirror is the
 - A. distance between the pole of the mirror and the focal point
 - B. distance between the centre of curvature and the mirror
 - C. distance between the object and the image
 - D. diameter of the mirror
11. A boy stands straight in front of a mirror at a distance away from it. He sees his erect image whose height is a fifth of his real height. The mirror he is using is
 - A. plane mirror
 - B. concave mirror
 - C. convex mirror
 - D. Plano-convex mirror
12. The focal length of a concave mirror is 50cm. Where should the object be placed so that its image is two times and inverted
 - A. 75cm
 - B. 72cm
 - C. 63cm
 - D. 50cm
13. A convex mirror is used to form the image of an object. Then which of the following statements is wrong
 - A. the image lies between the pole and the focus
 - B. the image is erect
 - C. the image is diminished in size
 - D. the image is real
14. The focal length of a convex mirror is 20cm, its radius of curvature will be
 - A. 10cm
 - B. 20cm
 - C. 30cm
 - D. 40cm
15. An object is placed at a distance beyond the focal point of a concave mirror. The image formed by the mirror is
 - A. real
 - B. virtual
 - C. magnified
 - D. erect
16. An object is placed 15cm from a convex mirror of radius of curvature of 20cm. determine the position of the image
 - A. 0.6cm
 - B. 1.5cm
 - C. 6.0cm
 - D. 10.0cm
17. A concave mirror with a focal length of 10.0 cm creates a real image 30.0 cm away on its principal axis; the corresponding object is located how far from the mirror?
 - A. 20.0cm
 - B. 15.0cm
 - C. 7.5cm
 - D. 5.0cm
18. Use of a parabolic mirror, instead of one made of a circular arc surface, can be used to reduce the occurrence of which of the following effects?
 - A. spherical aberration
 - B. mirages
 - C. chromatic aberration
 - D. light scattering
19. When the image of an object is seen in a concave mirror the image will
 - A. always be real
 - B. always be virtual.
 - C. be either real or virtual
 - D. will always be magnified.

20. Which of the following best describes the image formed by a concave mirror when the object is at a distance further than the center of curvature of the mirror?
- A. Virtual, erect and magnified B. real, inverted and diminished
C. virtual, upright and diminished D. real, inverted and magnified



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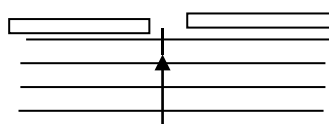
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Assume speed of sound in air = 330ms^{-1} and speed of light in a vacuum = $3 \times 10^8\text{ms}^{-1}$

- Which of the following is the correct order of increasing wavelength of some electromagnetic waves?
A. X-rays, infra red, ultra violet, radio waves
B. infra red, ultra violet, X-ray, radio waves
C. radio waves, infra red, ultra violet, X-rays
D. X-rays, ultra violet, infra red, radio waves
- The point of maximum energy on a stationary wave is called
A. anode B. a crest C. a trough D. an anti-node
- Which of the following electromagnetic waves lies between ultraviolet radiation and infrared radiation?
A. gamma rays B. visible radiation C. X-rays D. microwave radiation
- The basic difference between transverse and longitudinal waves is in
A. amplitude B. direction of vibration
C. wavelength D. medium through which the waves travel

5. Water waves of frequency 6Hz travel 24m in 10s. The wavelength of the waves is A. 0.4m B. 2.5m C. 14.4m D. 40.0m
6. In a ripple tank constructive interference occurs when
A. the wave is stationary B. a crest overlaps with a trough
C. a crest overlaps with a crest D. a wave strikes a barrier
7. A vibrator produces a sound wave that travels a distance of 900m in 3s. If the wavelength of the wave is 10m, find the frequency of the vibrator
A. 30Hz B. 270Hz C. 300Hz D. 3000Hz
8. The electromagnetic radiation which causes the body temperature to rise is called
A. X-rays B. gamma rays C. infrared D. ultraviolet
9. The number of vibrations a wave makes in one second is called the
A. frequency B. wavelength C. period D. amplitude
10. Which of the following are longitudinal waves?
A. water waves B. light waves C. sound waves D. radio waves
11. Points on a stationary wave which are permanently at rest are called
A. crests B. troughs C. nodes D. anti-nodes

12. A vibrator produces a sound wave that travels 140cm in 0.08s. If the distance between two successive crests is 20cm, find the frequency of the vibrator
A. 7.0Hz B. 11.2Hz C. 87.5Hz D. 250.0Hz
13. Which one of the following shows the order in decreasing frequency, of the members of the electromagnetic spectrum?
A. ultraviolet, x-rays, radio waves, infrared B. radio waves, infrared, x-rays, ultraviolet
C. x-rays, ultraviolet, infrared, radio waves D. gamma rays, ultraviolet, radio waves, infrared
14. The diagram below shows parallel wave fronts approaching a narrow gap.



- Waves passing through the gap are likely to undergo
A. reflection B. refraction C. diffraction D. interference
15. Which of the following are transverse waves only?
A. radio waves, sound waves, ultraviolet B. ultraviolet, x-rays, water waves
C. infrared, gamma rays, sound wave D. sound waves, ultraviolet, x-rays
16. A vibrator produces a wave that travels 36cm in 6s. If the distance between successive crests is 3.0cm, find the frequency of the vibrator
A. 2Hz B. 12Hz C. 18Hz D. 72Hz
17. Which of the following does not change when water waves travel from deep to shallow water?
A. frequency B. amplitude C. velocity D. wavelength
18. The particles of the medium through which a longitudinal wave travels
A. vibrate parallel to the direction of propagation of the wave
B. vibrate perpendicular to the direction of the propagation of the wave
C. move along with the wave
D. move in the opposite direction to the wave
19. When sound waves pass through a metal bar, the atoms of the metal
A. rotate in circles B. move along the bar
C. expand and contract D. vibrate about fixed points
20. The components of electromagnetic spectrum have
i) The same velocity

- ii) Different wavelength
 - iii) Different frequencies
 - iv) The same refractive index for a given medium
- A. (i), (ii) and (iii) only correct B. (i) and (iii) only correct
C. (ii) and (iv) only correct D. (iv) only correct



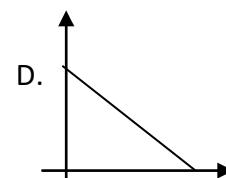
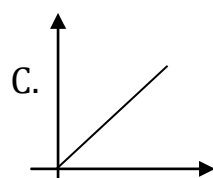
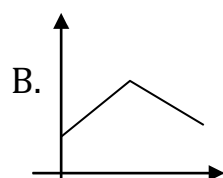
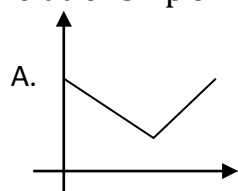
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- The ice and steam points on an un-graduated thermometer are 20cm apart.
What temperature is recorded in $^{\circ}\text{C}$ when mercury thread is 5cm long?
A. 25.0 B. 33.3 C. 84.7 D. 400.0
- The distance between the lower fixed point and upper fixed point on a Celsius scale on unmarked mercury-in-glass thermometer is 25cm. If the mercury level is 5cm below the upper fixed point then the temperature is
A. 5°C B. 20°C C. 80°C D. 95°C
- In order to make mercury thermometer more sensitive, the
A. degree markings must be further apart
B. diameter of the capillary tube must be reduced
C. volume of the mercury bulb must be reduced
D. capillary tube must be open to air
- Which of the following graphs shows the correct density against temperature relationship of water between 0°C and 100°C ?



5. A bimetallic strip operates on the principle that metals
 - A. are heat controllers
 - B. have different rates of expansion
 - C. are good heat conductors
 - D. have the same rates of expansion
6. Which of the following devices does not use a bimetallic strip?
 - A. electric flat iron
 - B. gas oven
 - C. car flasher unit
 - D. hot water tanks
7. Which of the following does not change when a metal is heated?
 - A. mass
 - B. volume
 - C. length
 - D. density

8. What is the mode of heat transfer from a fire to a person seated beside it?
A. conduction B. convection C. radiation D. evaporation
9. Why is water preferred to ethanol as a coolant?
A. water has a higher density than ethanol
B. water has a higher specific heat capacity than ethanol
C. water is more volatile than ethanol
D. ethanol has a higher density than water
10. Which of the following is/are true about a sea breeze?
i) It takes place during day time
ii) Cooler air blows from the land towards the sea
iii) Warmer air blows from the land towards the sea
iv) Cooler air blows from the sea towards the land
A. (ii) only correct B. (i) and (iv) correct
C. (i), (ii) and (iii) correct D. (i), (iii) and (iv) correct
11. In metals heat is transmitted by
A. conduction and radiation B. convection and radiation
C. conduction only D. convection only
12. Which of the following is not true about a vacuum flask?
A. it controls heat loss by radiation using the vacuum
B. the silvering of the walls on the vacuum side reduces loss or gain of heat by radiation
C. the cork is used to reduce loss of heat by conduction
D. it can be used to keep cold liquids cold
13. On a cool day, a metal feels cold to touch because
A. metals contain less heat
B. the temperature of the metal is the same as that of the surroundings
C. the temperature of the metal is less than that of the surroundings
D. the metal conducts heat away from the hand
14. Metals are good conductors of heat because
A. they are ductile B. they contain free protons
C. they contain free electrons D. their atoms can easily be displaced
15. The transfer of heat by actual movement of molecules of matter takes place
A. only in liquids B. only in gases
C. in solids and liquids D. in liquids and gases
16. The triple point of water is

A. 373.00K B. 273.16K C. 100.00K D. 0.00K

17. What are the missing words from the following sentence? Heat is a form of measured in

A. energy and joules B. energy and °C
C. power and °C D. power and joules

18. The unit of heat is the

A. watt B. kilogram C. joule D. newton

19. It is hotter for the same distance over the top of a fire than it is in the side of it, mainly because.
- A. air conducts heat upwards
 - B. convection takes more heat upwards
 - C. heat is radiated upwards
 - D. all processes of heat transfer contribute significantly transferring heat upwards
20. The rate of loss of heat from a body cooling under conditions of forced convection is proportional to its
- i) heat capacity
 - iii) absolute temperature
 - ii) surface area
 - iv) excess of temperature over that of surrounding
- A. (i), (ii) and (iii) correct
 - B. (ii) and (iv) correct
 - C. (i) and (iii) correct
 - D. (iv) only correct



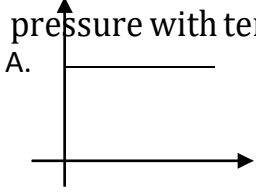
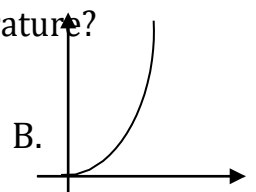
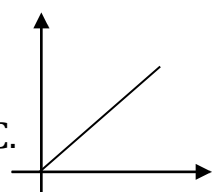
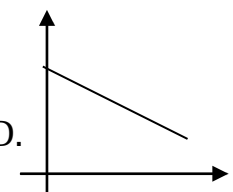
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1. Which of the following does not require absorption of heat?
A. evaporation B.boiling C.sublimation D. condensation
2. At a pressure of 1 atmosphere, a mass of a gas has a volume of 5m³ and temperature 102°C. What will be the new volume if the temperature is lowered to 27°C and the pressure is raised to 2 atmospheres?
A. 7.40m³ B. 2.00m³ C. 0.66m³ D. 0.18m³
3. Which of the following is correct?
A. increase in pressure decreases saturated vapour pressure
B. a liquid boils when its saturated vapour pressure is equal to atmospheric pressure
C. saturated vapours obey gas laws
D. external pressure has no effect on the boiling point of the liquid
4. Apressure cooker,cooks food quickly
because
A. it retains heat energy using its heavy cover
B. it has a safety valve that regulates temperature
C. it loses no heat energy to the surrounding

- D. boiling takes place at a higher temperature due to raised pressure
5. The volume of a fixed mass of a gas is 3litres when a pressure of 50kPa is applied to it. What pressure should be applied to the gas to reduce its volume to 2litres at the same temperature? A. 75Pa B. 7,500Pa C. 33,000Pa D. 75,000Pa
6. A gas in a sealed container has a temperature of 100°C and a pressure of 100Nm^{-2} . To what temperature must the gas be heated for its temperature to become 120Nm^{-2}
A. 447.6K B. 393.0K C. 174.6K D. 32.2K
7. What is the effect of pressure on the melting point of pure ice?
A. increase in pressure raises the meltingpoint
B. changes in pressure have no effect on the melting point of ice
C. increase in pressure lowers the melting point
D. decrease in pressure raises the melting point
8. A gas of mass 2kg and density 1.6kgm^{-3} is heated from -23°C to 127°C at constant pressure. What is the density of the gas at 127°C ?
A. 0.3kgm^{-3} B. 1.0kgm^{-3} A. 2.0kgm^{-3} A. 4.0kgm^{-3}
9. Which of the following graphs shows the correct variation saturated vapour pressure with temperature?
A.  B.  C.  D. 
10. If a fixed mass of a gas is kept at constant temperature
A. the volume increases with decrease in pressure
B. the volume remains constant
C. density remains the same when pressure is varied
D. density is inversely proportional to the pressure

11. Air in a 3litre vessel at 27°C exerts a pressure of 2Nm^{-2} . Calculate the pressure that the same mass of air would exert if it is contained in a 2litre vessel at 33°C
A. 1.1Nm^{-2} B. 2.4Nm^{-2} C. 3.7Nm^{-2} D. 20.0Nm^{-2}
12. The volume of a fixed mass of a gas at 27°C and pressure of 750mmHg is 300cm^3 . What is its volume when the pressure is raised to 900mmHg and the temperature is 327°C ?
A. 125cm^3 B. 180cm^3 C. 500cm^3 D. 720cm^3
13. A given mass of a gas occupies a volume of 200cm^3 at a temperature of 27°C and a pressure of 1 atmosphere. Find the volume when its temperature rises to 54°C at constant pressure
A. 654.0K B. 218.0K C. 54.5K D. 32.7K
14. If a fixed mass of a gas is kept at constant pressure
A. the volume increases with increase in temperature
B. the volume remains constant
C. density remains the same when temperature is varied
D. density is inversely proportional to the temperature
15. Which of the following statements about boiling and evaporation is correct?
A. boiling takes place at all temperatures while evaporation does not
B. evaporation takes place throughout the liquid while boiling takes place at the bottom
C. boiling takes place throughout the liquid while evaporation takes place at the surface
D. evaporation takes place at a lower temperature than boiling does
16. The rate of evaporation of a liquid increases when
i) temperature increases ii) pressure increases iii) its surface area increases
A. (i), (ii) and (iii) correct B. (i) and (iii) correct
C. (ii) and (iii) correct D. (i) and (ii) correct
17. A domestic refrigerator uses a volatile liquid. Which of the following represents the order of the process the liquid undergoes?
A. evaporation, compression, condensation and evaporation
B. cooling, condensation, evaporation, compression and evaporation
C. compression, evaporation, condensation, cooling and evaporation
D. condensation, cooling, evaporation, compression and evaporation
18. Which of the following can produce a cooling effect?

- (i) Compression of a gas (ii) expansion of a gas (iii) evaporation of a liquid
A. (i), (ii) and (iii) correct B. (i) and (iii) correct
C. (ii) and (iii) correct D. (iii) only correct

19. It takes much longer to cook food in the hills than in the plains because
A. in the hills the atmospheric pressure is lower than that in the plains and therefore water boils at a temperature lower than 100°C causing an increase in cooking time
B. due to lower atmospheric pressure on the hills, water boils at a temperature higher than 100°C and therefore takes longer to boil.
C. in the hills the atmospheric density is low and therefore a lot of heat is lost to the atmosphere.
D. in the hills humidity is high and therefore a lot of heat is absorbed by the atmosphere leaving very little for cooking

20. Of the four locations mentioned below the highest inside temperature will be attained in the pressure cooker operated with the pressure valve open
- A. at sea level
 - B. at the top of Mt. Everest
 - C. at the place in a valley below sea level
 - D. in an aeroplane flying at a height of 10,000m with inside pressure maintained at sea level.



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1. If rubbing together materials P and Q makes P acquire a positive charge and Q a negative charge, then during the process
- A. Q loses protons to P B. Q gains electrons from P
- C. P loses protons to Q D. P gains electrons from Q
2. Charging by rubbing is possible with insulators and not with conductors because
- A. electrons move freely through conductors
- B. molecules of an insulator vibrate less violently
- C. conductors repel charge while insulators attract it
- D. electric charge lowers the temperature of an insulator
3. Electrostatic induction occurs due to shifting of
- A. protons of atoms B. nuclei of the atoms
- C. neutrons of the atoms D. electrons of the atoms
4. The energy transformation that takes place when an electrophorus is used to charge bodies is
- A. kinetic to potential B. mechanical to electrical
- C. mechanical to heat D. heat to mechanical

5. The energy transformation that takes place when a cell is producing electricity is
- A. chemical to electrical B. mechanical to electrical
C. heat to electrical C. electrical to heat
6. What is true?
- A. the emf of a cell depends on the size of the cell
B. the lead-acid cell has higher internal resistance than the dry Leclanche cell
C. Manganese (IV) oxide in a dry cell prolongs its life
D. the emf of the battery depends on the number of cells in it.
7. When identical cells are connected in parallel
- A. the effective internal resistance is reduced B. the total emf is greater
C. the effective internal resistance is increased D. the total emf is smaller

8. Which of the following gives a defect and its cause in a simple cell?

Defect	Cause
A. local action	presence of zinc amalgam
B. polarization	hydrogen remaining in gaseous form
C. localaction	adding oxidizing agent
D. polarization	use dilute electrolyte
9. A dry cell in use depreciates with time due to

A. polarization	B. disintegration of the carbon rod
B. local action	D. hardening of ammonium chloride jelly
10. When lead-acid cell is left in a discharged state for long

A. the electrolyte slowly turns into water	C. the plates disintegrate
B. the lead sulphate becomes inconvertible	D. the electrolyte solidifies
11. If a battery is to be recharged, then

A. it is connected in series with the charging source
B. the charging p.d must be lower than that of a battery
C. the electrolyte must be replaced first
D. it is connected in parallel with the charging source
12. When the terminals of a cell are joined directly, the cell heats up because

A. the emf is increased	B. a high current is drawn from the cell
C. there is friction between the terminal	D. the internal resistance is increased
13. When a plastic rod is rubbed with dry piece of cloth, the rod and piece of cloth will

A. both acquire negative charges	B. both acquire positive charges
C. acquire opposite charges	D. have no charge
14. Which of the following statements is true about good insulator?

A. it acquires electric charge when rubbed with suitable materials
B. all its electrons are loosely bound to its atoms
C. electric charge easily flows on its surface
D. some of its electrons are free to move about
15. A body can only be confirmed to be electrically charged when

A. another charged body attracts it
B. it does not affect a leaf of a charged electroscope
C. it is repelled by another charged body
D. it is found to have less protons than electrons
16. Which of the following objects can be charged by friction?

A. safety pin	B. copper plate	C. razor blade	D. plastic ruler

17. An electroscope is negatively charged by
A. gaining electrons B. gaining protons C. losing electrons
D. losing protons
18. Which one of the following actions will cause the leaf of a negatively charged electroscope to fall?
i) Bringing a positively charged rod near the cap
ii) Bringing a negatively charged rod near the cap
iii) Connecting the can to the earth
A. (i) and (ii) correct B. (i) and (iii) correct
C. (ii) and (iii) correct D. (i), (ii) and (iii) correct

19. When a charged body is brought near a cap of a negatively charged gold leaf electroscope, the
- A. the divergence of the leaf does not change
 - B. leaf falls if the body is negatively charged
 - C. leaf diverges if the body is positively charged
 - D. leaf diverges if the body is negatively charged
20. The leaf of a charged gold leaf electroscope gradually collapses with time due to
- A. leakage to surroundings
 - B. surrounding magnetic field
 - C. pressure variations in the surroundings
 - D. similar charges from the surrounding
21. A charged conductor usually loses charge gradually by a process called
- A. induction
 - B. conduction
 - C. insulation
 - D. leakage
22. In a simple cell
- A. polarization is caused by impure zinc
 - B. potassium dichromate is used to prevent polarization
 - C. the formation of hydrogen bubbles on the copper plate causes local action
 - D. hydrogen is produced on the zinc plate and causes polarization
23. The negative plate of a simple cell gradually goes into the solution because of
- A. polarization
 - B. local action
 - C. charging
 - D. gassing
24. When brass is to be copper plated, the suitable electrolyte to be used is
- A. distilled water
 - B. sulphuric acid
 - C. lead(IV) oxide
 - D. copper sulphate
25. The law of electrostatic induction states that
- A. like poles repel and unlike poles attract
 - B. unlike poles repel and like poles attract
 - C. like charges repel and unlike charges attract
 - D. unlike charges repel and like charges attract



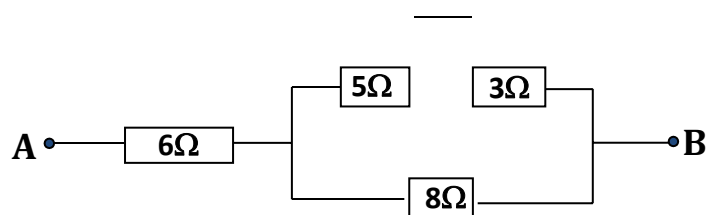
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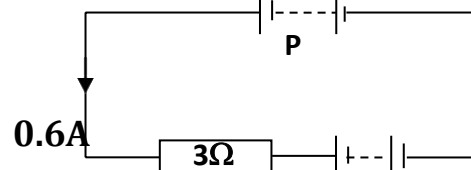
MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

1. An alternative unit that could be used for current is
 A. joule per second B. joule per coulomb
 C. coulomb per second D. volt per metre
2. Ohm's law relates
 A. current, resistance and p.d B. temperature, current and p.d
 C. length, current and p.d D. current, resistance and temperature
3. When the temperature of the wire is raised, its resistance
 A. increases B. remains constant
 C. decreases D. increase and then decreases
4. A uniform wire of length 10cm has a resistance of 1.2 . What resistance will 2m of the wire have?
 A. 24.00 B. 2.40 C. 0.60 D. 0.24
5. If the cross-sectional area of the wire in question 16 is doubled and the length tripled what will be the resistance of the resulting wire
 A. 7.2 B. 1.8 C. 0.8 D. 0.2
6. Find the resistance between points A and B



- A. 22 B. 14 C. 11 D. 10

7. In the circuit diagram below, battery P has internal resistance of 0.5 and emf of 6V while Q has emf of 3V and internal resistance, r



Q

If the current flowing is 0.6A, find the internal

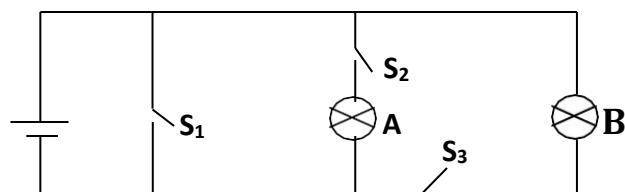
resistance of cell Q A. 0.5 B. 1.5 C.

2.9 D. 11.0

8. A current of 2A flows in a conductor. How much charge flows past a section of the conductor in 3 minutes?

A. 0.67C B. 6C C. 90C D. 360C

9. In the circuit below, A and B are bulbs, S₁, S₂ and S₃ are switches

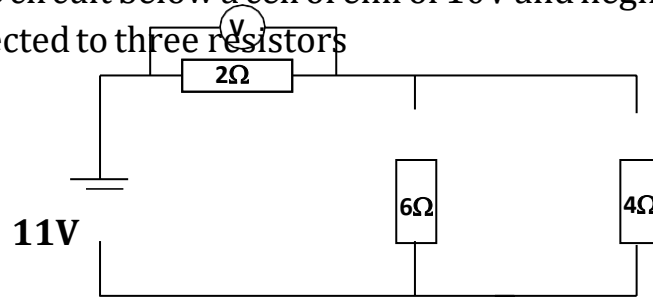


What is true about the circuit?

A. if all the switches are closed, all the bulbs light up

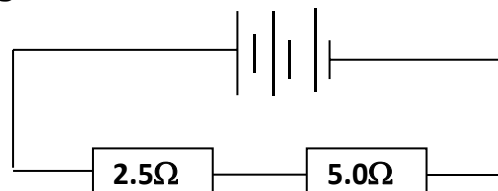
- B. if all the switches are closed no bulb will light up
C. if only switches S1 and S2 are closed only bulb A will light up
D. as long as switch S1 is open no bulb will light up even if S2 and S3 are closed
10. A device connected to a source of 60V consumes electrical energy at a rate of 300W. If it is connected to a source of 36V it will draw a current of
A. 3A B. 5A C. 33A D. 500A
11. Two bulbs, each marked 100W, 240V are connected in series and the combination is connected across a supply of 240V. The power consumed by each bulb is
A. 25W B. 50W C. 100W D. 200W
12. The commercial unit of electrical energy is
A. kilowatt B. kilojoules C. megajoule D. kilowatt hour
13. A suitable material for the filament of a bulb should have
A. high melting point and low resistance B. low melting point but high resistance
C. high melting point and high resistance D. low melting point and low resistance
14. A lighting circuit is supplied through a 5A fuse. What is the maximum number of 75W, 240V bulbs that can be fixed in the circuit?
A. 10 B. 16 C. 48 D. 3600
15. The purpose of a fuse in a circuit is to
A. limit the current in the circuit B. stop the current in case too much of it flows
C. protect the appliance D. reduce the voltage to a safe value
16. Switches are connected on the live and not the neutral
A. because the live is stronger
B. so that the appliances do not remain live when the switch is off
C. because no current flows in the neutral
D. because if it is in the neutral the appliance would not respond to it
17. The purpose of earthing appliances having metallic bodies is
A. to protect the appliance from being blown up
B. to avoid damage due to lightening
C. to protect the user from shock should the live touch the body of the appliance
D. to prevent the short circuit

18. If the cost per unit of electrical energy is 170 / =, what is the cost of operating 6 bulbs each rated at 75W, 220V for 8 hours
- A. 612 / = B. 792 / =
C. 612,000 / = D. 792,000 / =
19. The most appropriate fuse for a 1600W, 220V heater among these is A. 20A B. 15A C. 10A
D. 5A
20. In the circuit below a cell of emf of 10V and negligible internal resistance is connected to three resistors



- What is the reading of the voltmeter, V in circuit diagram?
- A. 2V B. 4V C. 5V D. 10V

21. A p.d of 20V is applied across two resistors of 4 and 6 connected in series.
Determine the p.d across the 6 resistor
A. 1.0V B. 2.0V C. 3.3V D. 12.0V
22. The rate at which electric charge flows past a point in a circuit
is measured in
A. watts B. volts C. amperes D. coulombs
23. In the circuit diagram, each cell has an internal resistance of 0.5



- Find the resistance in the circuit
A. 1.25 B. 7.50 C. 8.00 D. 9.00
24. The resistance of the wire increases when its
A. length increase C. temperature is reduced
B. length decreases D. cross sectional area is doubled
25. Alternating current is preferable to direct current for the
transmission of power because A: it can be rectified B: it is
easier to generate
C: thinner conductors can be used. D: it is safer



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MARKS SCORED	PERCENTAGE MARK	TEACHER’S COMMENT

- 1. Magnetism at the Centre of a bar magnet is
A. minimum B. maximum C. zero D. minimum or maximum
- 2. The shape of a magnetic field around a long straight current carrying wire is:
A. curve B. square
C. circular D. varies depending on the magnitude of the current
- 3. Which of the following statements is not true about magnets?
A. magnetic poles can be separated
B. a paramagnetic material is a material from which strong magnet can be made
C. the neutral point in a magnetic field is a point where there is no force experienced
D. heating a magnet can reduce its magnetism
- 4. Permanent magnets are made from
A. diamagnetic materials B. ferromagnetic materials
C. paramagnetic materials D. dielectric materials
- 5. Which of the following can be deflected by magnetic fields?

(i) Gamma rays (ii) Cathode rays (iii) X-rays (iv) beta particles
A: (i) and (ii) only B: (i) and (iii) only C: (ii) and (iii) only
D: (ii) and (iv) only

6. Which of the following statements is/are correct?

- (i) An electromagnet is a temporary magnet because it can be activated and deactivated
- (ii) The strength of the magnetic field increases as the current through a wire decreases
- (iii) The strength of an electromagnet decreases with decrease of the number of turns around the core.
- (iv) The magnetic field lines form concentric circles about the conductor

A. (i), (ii) and (iii) only correct B. (i) and (iii) only correct

C. (ii) (iii) and (iv) only correct D. (iv) only correct

7. A beam of electrons directed to pass between two poles of a magnet would be

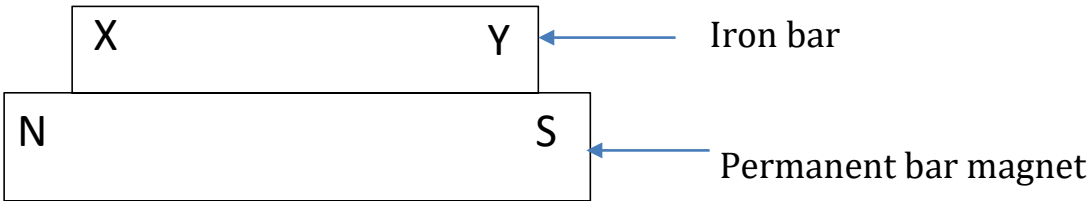
- A. deflected according to Fleming's left hand rule
- B. slowed down
- C. deflected according to Fleming's right hand rule
- D. directed towards the North Pole

8. Which of the following statements are true about magnets?

- (i) Magnets always have opposite polarities
- (ii) A magnet can be used as a compass
- (iii) Repulsion is the only sure test for a magnet
- (iv) Magnets attract all metals

A. (i), (ii) and (iii) only correct
B. (i) and (iii) only correct
C. (ii) and (iv) only correct
D. (iv) only correct

9. An iron bar XY was placed on the middle part of a permanent bar magnet as shown in the diagram below;



The iron bar was later found to have acquired magnetism temporarily, which of the following would be the possible induced polarities

	INDUCED POLARITIES	
	X	Y
A	NORT H	NORT H
B	NORT H	SOUTH
C	SOUTH	NORT H
D	SOUTH	SOUTH

10. The magnitude of the force on a conductor carrying electric current in a magnetic field does not depend on the

- A. length of the conductor
- B. magnitude of the current
- C. magnetic field
- D. direction of the current

11. When the north poles of two bar magnets are brought close together, there will be

- A. a downward force
- B. a force of attraction
- C. no force
- D a force of repulsion

12. When the speed at which a conductor is moved through a magnetic field is increased, the induced voltage

- A. increases
- B. decreases
- C. remains constant
- D. reduces to zero

13. When the current through the coil of an electromagnet reverses, the
- A. magnetic field collapses
 - B. direction of the magnetic field remains unchanged
 - C. direction of the magnetic field reverses
 - D. magnetic field expands
14. A material which is slightly repelled by a magnetic field is known as
- A. ferromagnetic material B. diamagnetic material
 - C. paramagnetic material D. conducting material

15. In the left hand rule, forefinger always represents
A. current B. voltage C. magnetic field D. force
16. Indicate which of the following material does not retain magnetism permanently
A. Soft iron B. Stainless steel C. Hardened steel D. None of the above
17. The direction of magnetic lines of force is
A. from South Pole to north pole B. from North Pole to South Pole
C. from one end to another end D. none of the above.
18. Which electromagnetic device uses brushes and a commutator?
A. speaker B. DC generator C. Relay D. solenoid
19. What are the effects of moving a closed wire loop through a magnetic field?
A. A voltage is induced in the wire
B. A current is induced in the wire.
C. The polarity across the wire depends on the direction of motion.
D. All of the above
20. What do you call the characteristic of a magnetic material whereby a change in magnetization lags the application of a magnetizing force?
A. Hysteresis B. Induction C. leakage D. Reluctance



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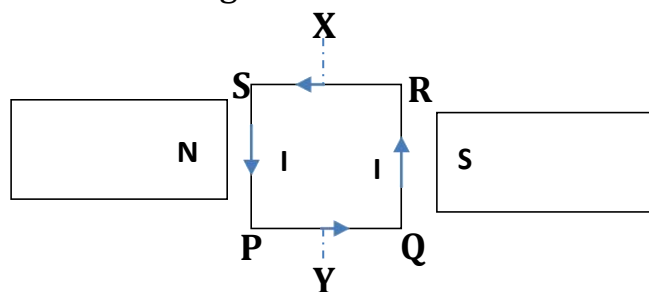
MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

1. A moving coil galvanometer has a resistance of 4 and gives a full scale deflection of 2.5mA. Find the value of the resistor required to convert it to a voltmeter measuring up to 20V.
A. 5.0×10^{-3} B. 5.0×10^{-4} C. 7.966×10^3 D. 7.996×10^3
2. The direction of induced current in a conductor moving in a magnetic field can be predicted by applying
A. faraday's law B. Maxwell's screw rule
C. Fleming's left hand rule D. Fleming's right hand rule
3. A moving coil galvanometer can be
used to
A. detect the presence current and
voltage
B. convert alternating current into direct current
C. convert direct current into alternating current
D. measure the peak value of an alternating current
4. Which of the following factors affect the magnitude of force on a current – carrying conductor in a magnetic field?
(i) The direction of current (ii) The amount of current

(iii) The direction of the magnetic field (iv) The strength of the magnetic field

- A. (i) and (ii) only correct B. (ii) and (iii) only correct
C. (i) and (iii) only correct D. (ii) and (iv) only correct

5. The strength of the magnetic field between the poles of an electromagnet remains the same if the
 - (i) Current in the electromagnet windings is doubled
 - (ii) Direction of the current in the electromagnet windings are reversed
 - (iii) The number of turns are halved
 - A. (i) only correct B. (ii) only correct
 - C. (i) and (ii) only correct D. (ii) and (iii) only correct
6. The sensitivity of a moving coil galvanometer can be increased by using
 - A. smaller coil B. weaker magnet
 - C. weaker hairspring D. fewer turns of the wire on the coil
7. Which of the following factors affect the strength of an electromagnet?
 - (i) Changing the magnitude of the current
 - (ii) Changing direction of the current
 - (iii) Doubling the number of turns
 - A. (ii) only correct B. (i) and (ii) only correct
 - C. (i) and (iii) only correct D. (ii) and (iii) only correct
8. Which of the following statements are true about an electric motor? It changes
 - A. kinetic energy to electrical energy B. electrical energy to light energy
 - C. electrical energy to kinetic energy D. chemical energy to electrical energy
9. The figure below shows a current carrying coil PQRS pivoted about XY between two magnets.



Which of the statements are true about the coil?

- (i) The sides PS and QR shall experience force
 - (ii) As seen from X the coil will rotate anticlockwise
 - (iii) The force on the coil can be increased by increasing the number of turns
 - (iv) The coil will come to rest with PQ at right angles to magnetic field
- A. (i), (ii) and (iii) correct B. (i) and (iii) correct
 - C. (ii) and (iv) correct D. (iv) only correct

10. A moving iron meter
A. measures only direct current C. measures only alternating current
B. has a permanent magnet D. has the pointer attached to the soft iron
11. A galvanometer reads 0.05A at full scale deflection and has resistance of 2.0 Ω . Calculate the resistance that should be connected in series with it to convert it to a voltmeter which reads 15V at full scale deflection
A. 10 B. 280 C. 298 D. 980

12. Electromagnets are used in the following **except** the
A. Telephone receiver B. Moving coil loud speaker
C. Moving coil galvanometer D. Electric bell.
13. Which of the following statements are correct?
(i) The particles of magnetic materials are tiny magnets
(ii) The particles in un-magnetized iron arrange themselves in closed chains
(iii) The particles in a magnet are arranged in open chains with N-pole of one particle against the S-pole of its neighboring particle
(iv) Groups of atoms form a magnetic domain
A. (i), (ii) and (iii) correct B. (i), (iii) and (iv) correct
C. (ii) and (iv) correct D. (iv) only correct
14. The magnitude of the force on the coil of a d.c motor depends on
(i) the strength of the magnetic field (ii) the number of turns on the coil
(iii) the current through the coil (iv) the mass of the coil support
A. (i), (ii) and (iii) only correct B. (i) and (iii) only correct
C. (ii) and (iv) only correct D. (iv) only correct
15. An electric motor is connected by cable to a 240V supply. The p.d across the motor is 239V when the current flowing is 5A. The resistance of the cable is
A. 0.2 B. 5.0 C. 47.8 D. 48.0
16. The current sensitivity of a moving coil galvanometer can be increased by
A. Increasing the magnetic field of the permanent magnet
B. Increasing the number of turns in the coil
C. Increasing the area of the deflecting coil
D. All of the above
17. A small cylindrical soft iron piece is kept in a galvanometer so that
A. a radial uniform magnetic field is produced
B. There is a steady deflection of the coil
C. A uniform magnetic field is produced
D. All of the above
18. The polarity of induced voltage while a field is collapsing is
A. independent of the force creating the field
B. opposite to the force creating the field
C. identical to the force creating the field
D. present only if the force is stationary
19. Which electromagnetic device has a flexible cone?
A. speaker B. DC generator C. Relay D. solenoid

20. The induced voltage across a stationary conductor in a stationary magnetic field is
- A. increased B. decreased C. reversed in polarity
D. zero



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1.

Large transformers, when used for some time, become very hot and are cooled by circulating oil. The heating of the transformer is due to

A. the heating effect of current alone.

B. hysteresis loss alone

C. both the heating effect of current and hysteresis loss

D. intense sunlight at noon.
2.

A high alternating voltage may be obtained from a low alternating voltage by use of

A. a dynamo

B. an induction coil

C. a generator

D. a transformer

3. The production of an e.m.f in a given coil due to the change of e.m.f in a nearby coil is called
A. mutual induction B. self-induction
C. electromagnetic induction D. electrostatic induction
4. Power loss due to eddy currents in the core of a transformer can be minimized by
A. laminating the core
B. using thick copper wires in the windings
C. using a soft iron core
D. winding the secondary coil on top of the primary coil
5. A transformer connected to 240V a.c mains is used to light a 12V, 36W lamp. What current does the lamp draw?
A. 0.05A B. 0.15A C. 0.33A D. 3.00A
6. A 240V mains transformer has 1000 turns in the primary. The number of turns in the secondary if it is used to supply a „12V, 24W“ lamp is
A. 2.0×10^4 B. 5.0×10^2 C. 5.0×10^1 D. 2.0×10^1
7. A transformer is used to step down an alternating voltage from 240V to 12V. Calculate the number of turns on the secondary coil if the primary coil has 1200 turns
A. 3 B. 5 C. 60 D. 100
8. A magnetic material can be magnetized by
(i) Stroking with a permanent magnet
(ii) Using a direct current
(iii) By induction
A. (i) only correct B. (i) and (ii) only correct
C. (ii) and (iii) only correct D. (i), (ii) and (iii) correct
9. The induced current in a generator
A. is a maximum when the coil is vertical
B. is a minimum when the coil is horizontal
C. changes direction when the coil is horizontal
D. increases when the speed of rotation increases
10. The transformer cores are laminated to
A. reduce eddy currents
B. distribute the voltage output equally within the transformer
C. decrease the resistance of the coils
D. determine the energy lost by the transformer

11. A transformer cannot function normally with d.c because a d.c
- A. has extremely high heating effect
 - B. cannot provide high voltage required for power transmission
 - C. cannot produce a changing magnetic field
 - D. reduces the efficiency of the transformer
12. A transformer has twice as many turns in the secondary coil as in the primary coil. The a.c input to the primary is 4V. What is the output voltage
- A. 2V B. 4V C. 8V D. 16V

13. Which of the following statements describes an electric generator?
 - A. Magnet is rotated through a coil of wire to produce an electric current.
 - B. Electric potential in a rotating coil of wire creates a permanent magnet.
 - C. An electrical current causes a coil of wire to rotate in a magnetic field.
 - D. Forces from a permanent magnet allow a coil of wire to rotate.
14. The main function of a step-up transformer is to
 - A. change a.c to d.c
 - B. change d.c to a.c
 - C. increase current
 - D. increase voltage
15. An a.c input voltage of 250V is connected to a transformer with 1000 turns. Calculate the number of turns of the secondary coil if an output of 15V is required
 - A. $\frac{1000}{(250-15)}$
 - B. $\frac{1000}{(250+15)}$
 - C. $\frac{1000 \times 15}{250}$
 - D. $\frac{(1000 \times 250)}{15}$
16. Which one of the following would **not** reduce the energy losses in a transformer?
 - A: using thinner wire for the windings
 - B: using a laminated core instead of a solid core
 - C: using a core made from iron instead of steel
 - D: using a core that allows all the flux due to the primary coil to be linked to the secondary coil
17. Which one of the following would be suitable to use in the construction of transformer core
 - A. lead
 - B. copper
 - C. soft iron
 - D. aluminium
18. An engineering student made a transformer and he found that the output voltage is higher than expected which of these could be the reason.
 - A. Using bare wire for the secondary coil.
 - B. Using d.c instead of an a.c.
 - C. Putting too many turns on the secondary coil.
 - D. Putting too many turns on the primary coil.
19. The efficiency of a d.c motor can be increased by
 - i) Using thick copper coil of low resistance to reduce the heating effect
 - ii) Using a core of hard magnetic material to retain induced magnetism
 - iii) Laminating the core to reduce eddy currents
 - iv) Filling the gaps between the commutators with insulating material
 - A. (i) and (iii) only correct
 - B. (ii) and (iv) only correct

C. (i), (ii) and (iii) only correct D. (ii), (iii) and (iv) only correct

20. Find the root mean square value in each cycle of an alternating current whose peak value is 220V
- A. 311.13V B. 176.75V C. 169.68V D. 155.56V



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- The mass of a radioactive material falls to $\frac{1}{4}$ of its original mass after 10 days.
What is its half-life?
A. 2.5 days B. 5.0 days C. 20.0 days D. 40.0 days
- Which of the following emissions will cause no change in the nucleus of radioactive element?
A. neutron emission B. beta emission C. gamma emission
D. alpha emission
- Which of the following particles are added to the atom of an element to form an isotope of the element?
A. electron B. proton C. alpha particle D. neutron
- A radioactive substance has a half-life of 2 days. After 14 days only 1g remained.
What was the initial mass of a radioactive substance?
A. 128g B. 64g C. 32g D. 2g
- If ${}^a_bZ$ stands for the symbol of an element, which of the following statements are correct
i) Z has „b“ protons in its nucleus
ii) the atom of the element Z has „a“ electrons
iii) the mass number of Z is „a – b“
iv) the atomic number of Z is „b“

- A. (i) and (iv) correct B. (i), (ii) and (iii) correct
C. (ii) and (iv) correct D. all are correct
6. The half-life of radioactive substance is 4minutes. How long will it take 32g to reduce to 2g
A. 16minutes B. 8minutes C. 4minutes D. 2minutes
7. If X is an isotope of Y, then the
A. atomic mass of X is equal to that of Y
B. atomic mass of X is equal to atomic number of Y
C. atomic number of X is equal to that of Y
D. atomic number of X is equal to atomic mass of Y
8. An atom contains 3 electrons, 3 protons and 4 neutrons. Its nucleon number is A. 3 B. 4 C. 6 D. 7
9. An isotope of nuclide $^{35}_{17}\text{X}$ has
A. 18protons and 17 neutrons B. 17 electrons and 18 neutrons
C. 17 protons and 20 neutrons D. 18 protons and 18 neutrons
10. Radioactive elements A and B are of half-lives 400seconds and 800seconds respectively. Starting with 64g of A and 16g of B, how long will it be before the same mass of each remains
A. 2000s B. 1600s C. 1200s D. 800s

11. A radioactive substance has a half-life of 1000 years. After 5000 years what fraction of its initial mass of a radioactive substance will have decayed?
A. $\frac{1}{32}$ B. $\frac{1}{5}$ C. $\frac{4}{5}$ D. $\frac{31}{32}$
12. A radioactive nucleus ${}^{235}_{92}\text{U}$ loses two alpha particles and one beta particle to be isotope ${}^a_b\text{P}$. What are the values of a and b

	a	b
A.	243	95
B.	227	89
C.	231	91
D.	235	92
13. A nuclear reaction of a radioactive element is given by the equation

$${}^{232}_{92}\text{X} \longrightarrow {}^{224}_{91}\text{Y} + a {}^4_2\text{He} + b {}^0_{-1}\text{e}.$$
 Find the values of a and b

	a	b
A.	2.0	0
B.	3.0	2
C.	0.5	6
D.	2.0	3
14. Isotopes are nuclides with the same number of
 A. protons but different number of electrons B. protons but different number of neutrons
 C. neutrons but different number of protons D. electrons but the same number of neutrons
15. Given that ${}^{120}_{80}\text{X}$ is the symbol for a nuclide, the number of neutrons is A. 40 B. 80 C. 120
D. 200
16. The process by which a substance emits radiations spontaneously on its own is called
 A. radiation B. photoelectric effect C. radioactivity D. thermionic emission
17. When the nucleus of a radioactive atom loses an alpha particle, the atomic number
 A. remains the same B. decreases by two
 C. increases by one D. decreases by four
18. Which one of the following radiations is from the nucleus of a radioactive atom?
 A. cathode rays B. infra-red rays C. gamma rays D. ultraviolet rays
19. Which of the following radiations are attracted towards the negative plate in an electric field?

20. In the equation ${}_{91}^{234}\text{X} \longrightarrow {}_{91}^{234}\text{Y} + \text{P}$, P is likely to be
- A. an alpha particle B. a beta particle C. a gamma ray D. a neutron

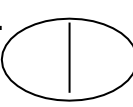
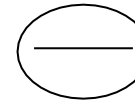


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- By what process are electrons emitted from the cathode ray oscilloscope
A. thermionic emission B. photoelectric emission
C. secondary emission D. field emission
- Which of the following diagrams shows the correct display on the screen of the C.R.O when a direct p.d is connected across the y-plates and the time base is switched on?
A.  B.  C.  D. 
- Which of the following is not true about cathode rays?
A. they are fast moving electrons
B. they are not affected by electric and magnetic fields
C. they carry a charge
D. they are deflected by electric and magnetic fields
- Which of the following is used to control the brightness of the spot on the screen of a C.R.O?
A. x-plates B. anode C. grid D. cathode
- The number of rectifiers used in full wave rectification is

A. 1 B. 3 C. 4 D. 5

6. What device could be connected to the secondary of a transformer in order to get a d.c in the output?

A. diode B. resistor C. rheostat D. thermostat

7. Rectification of alternating current means

A. stepping up alternating current by a transformer
B. converting alternating current into direct current
C. stepping down alternating current by a transformer
D. generating alternating current from a dynamo

8. The brightness on the screen of a T.V is determined by

A. darkness in the room B. the size of the screen
C. the direction of the aerial D. the number of electrons reaching the screen

9. The phenomenon by which electrons are released from a metal surface when radiation falls on it is known as

A. radioactivity B. thermionic emission
C. photoelectric effect D. reflection

10. Streams of electrons moving at high speed are called A. x-rays B. gamma rays C. cathode rays D. alpha particles 11. Which of the following are properties of cathode rays? i) they travel in straight lines ii) they can penetrate thick sheet of paper iii) they affect the photographic plate iv) they are deflected by a magnetic field A. (i), (iii) and (iv) correct C. (i), (ii) and (iii) correct 12. The particles that are emitted from a hot metal surface are called A. electrons B. neutrons 13. Thermionic emission occurs when A. fast moving electrons hit the metal B. a metal surface is given heat energy C. metal surface receives light energy D. a substance undergoes radioactive decay 14. The difference between x-rays and ultraviolet rays is that x-rays have i) a greater velocity ii) a shorter wave length iii) a higher frequency iv) more energy	A. (i), (ii) and (iii) correct B. (i) and (ii) correct C. (ii), (iii) and (iv) correct D. (i), (ii) and (iii) correct 15. The difference between hard and soft x-rays is that A. hard x-rays travel faster than soft x-rays B. hard x-rays penetrate more than soft x-rays C. hard x-rays are less dangerous than soft x-rays D. soft x-rays are produced at very high potential difference 16. Absorbed electrons from the anode to the cathode produce A. Voltages B. Energy C. Current D. Explosion of sub-particles 17. The x-plates and y-plates in a C.R.O make up A. electron gun B. deflection system C. focusing system D. accelerating system 18. The following are uses of x-rays except A. treatment of cancer B. preservation of food C. archeological dating D. detection of flaws in welded joints 19. Rectifiers are used to convert A. direct current to alternating current B. alternating current to direct current

- C. high voltage to low voltage
 - D. low voltage to high voltage.
20. The higher the frequency of light,
- A. The more electrons ejected
 - C. The faster the electrons are ejected
 - B. The fewer electrons ejected
 - D. The larger the electrons are ejected



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2. (a) State **Archimede's** Principle.
(b) Describe an experiment to verify Archimedes's Principle.
(c) A piece of iron weighs 355 N in air. When completely immersed in water, it weighs 305 N and weighs 315 when completely immersed in methylated spirit. Calculate the relative density of methylated spirit.
(d) State the application of Archimedes's principle.

3. (a) State the **law of flotation**.
(b) Describe an experiment to verify the law of flotation.
(c) A piece of wood of volume 40 cm^3 floats with only half of volume submerged. If the density of water is 1000 kg m^{-3} , calculate the density of wood.
4. A balloon has a capacity of 20 m^3 and is filled with hydrogen. The balloon's fabric and the container have a mass of 2.5 kg. Calculate the maximum mass load the balloon can lift. (Density of hydrogen = 0.089 kgm^{-3} and of air = 1.29 kgm^{-3} , gravity, $g = 10 \text{ ms}^{-2}$).
5. A hydrometer consists of a spherical bulb and a cylindrical stem of cross-sectional area 0.4 cm^2 . The total volume of the bulb and stem is 13.2 cm^3 . When immersed in water, the hydrometer floats with 8.0cm of the stem above the water surface in alcohol it floats with 1.0 cm of the stem above the surface. Calculate the density of the alcohol. (0.78 gcm^{-3})
6. (a) Define **terminal velocity**.
(b) Explain with a help of velocity-time graph, what happens to a USA soldier parachuted from a war plane flying at a high altitude in an area free of enemies in Iraq from the time he leaves the plane till he lands to the ground.

7. A glass block weighs 25N in air. When wholly immersed in water, the block weighs 15N. Calculate the;
 - (i) up thrust on the block [10N]
 - (ii) Density of the glass kgm^{-3} [2500 kgm^{-3}]
8. A piece of iron weighs 555N in air. When completely immersed in water, it weighs 530N and weighs 535N when completely immersed in alcohol. Calculate the relative density of alcohol. [R.D=0.8]
9. A rubber balloon of mass 5g is inflated with hydrogen and held stationary by means of a string. If the volume of the inflated balloon is 0.005m^3 , find the tension in the string. (Assume hydrogen is a light gas, and density of air = 1.25kg^{-3}):[Ans: $1.25 \times 10^{-2}\text{N}$]
10. When a metal is completely immersed in liquid A its apparent weight is 5N. When immersed in another liquid B the apparent weight is 16N if the density of B is times that of A. Calculate the mass of the metal. [= 5.2kg].
11. The mass of a piece of cork (0.25g/cm^3) is 20g.
 - (i) What fraction of the cork is immersed when it floats in water?
 - (ii) Find the volume of the cork submerged
12. A solid of volume $1 \times 10\text{m}^3$ floats on water of density $1 \times 10^3 \text{ kgm}^{-3}$ with $\frac{3}{5}$ of its volume submerged. Find the;
 - (i) mass of solid [=0.06kg]
 - (ii) density of solid [= 600kgm^{-3}]
13. A piece of wood that measures 2cm by 3cm at the bottom and 8cm in height floats in water with $\frac{1}{4}$ of its volume submerged. Calculate the:
 - (i) volume of water displaced
 - (ii) mass of the wood
14. A piece of marble of weight 14N and relative density 2.8 is supported by a light string from a spring balance and lowered into a vessel of water standing on a weighing machine. The weighing machine reads 57.5N before the marble enters water. What will be the readings of both the spring balance and the weighing machine when the marble is completely immersed in water?
15. Sulphuric acid has a **specific gravity** of 1.8. This meant that a certain quantity of this acid is 1.8 times heavier than the same quantity of water. Find the weight in kg of two litres of sulphuric acid. [3.6kg].
16. An iron block of mass $3.2 \times 10^3 \text{ kg}$ and volume 0.6 m^3 is totally immersed in a liquid of density $1.56 \times 10^3 \text{ kg}$. Find the weight of the block in:
 - (i) Air
 - (ii) liquid



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1. The abbreviation S.I units in Physics stands for;

- A. Senior One units
- B. Small International units
- C. Standard International units
- D. Standard Improved units

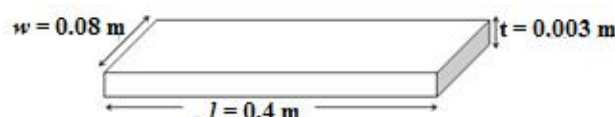
2. Which of the following instruments can be used to accurately measure the volume of a drop of water?

- A. Beaker
- B. Pipette
- C. Burette
- D. Dropper

3. The diameter of motor cycle spoke is measured accurately using.

- A. metre rule
- B. vernier caliper
- C. tape measure
- D. micrometer screw guage.

4. A manufacturer needs to measure accurately the dimensions of a wooden floor tile. The approximate dimensions of the tile are shown.



Which instruments measure each of these dimensions accurately?

	Length, l	Thickness, t	Width, w
A	Metre-rule	Micromet er	Vernier calipers
B	Metre-rule	Vernier calipers	Micromet er
C	Micromet er	Metre-rule	Vernier calipers
D	Vernier calipers	Micromet er	Metre-rule

5. If a farmer measures the thickness of a pole to the nearest 0.1 mm which of the follow instruments can be used?

- A. Screw gauge.
- B. metre rule
- C. Vernier calliper
- D. Tape measure

6. Which of the following instruments is suitable for measuring the length of your desk?

- A. Measuring cylinder B. Vernier caliper
C. Ruler D. Micrometer screw gauge

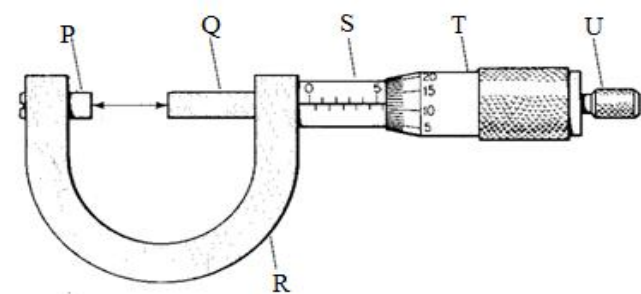
7. If a sphere has a diameter of 10cm. what is its volume;

- A. $\frac{4}{3} \times \frac{22}{7} \times 10 \times 10 \times 10 \text{ cm}^3$
B. $\frac{4}{3} \times \frac{22}{7} \times 5 \times 5 \times 5 \text{ cm}^3$
C. $4 \times \frac{22}{7} \times 10 \times 10 \text{ cm}^3$
D. $4 \times \frac{22}{7} \times 5 \times 5 \text{ cm}^3$

8. Which of the following is not a basic unit of measurement

- A. metre B. mole C. newton
D. second.

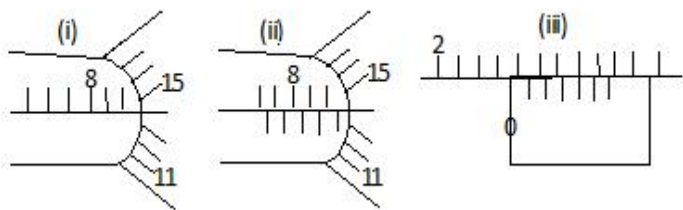
9. The figure below shows an instrument used to measure length. What is the correct labeling of the parts?



	P	Q	R	S	T	U
A	Spindle	Anvil	Frame	Sleeve	Thimble	Ratchet

B	Anvil	Spindle	Frame	Sleeve	Thimble	Ratchet
C	Spindle	Anvil	Thimble	Main scale	Frame	Ratchet
D	Anvil	Spindle	Outer jaws	Main scale	Vernier scale	Ratchet

10. The figures below show some instruments for measuring length. State the reading on each instrument.

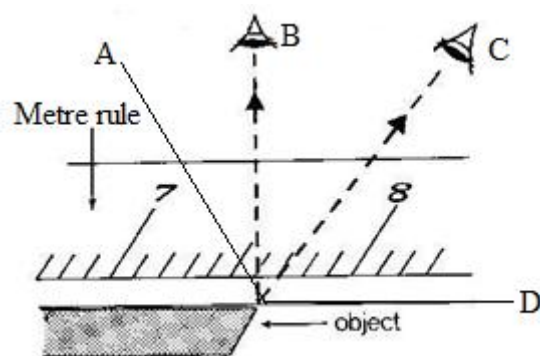


- A. 10.15mm, 10.65mm and 2.34 mm
B. 10.15cm, 10.65cm and 2.34 cm
C. 10.15mm, 10.65mm and 2.34 cm
D. 10.15cm, 10.65cm and 2.34 mm

11. The quantity of matter in an object is referred to as;

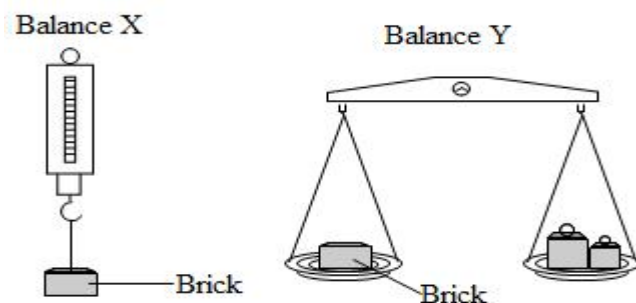
- A. volume B. mass C. density
D. area

12. The figure below shows a metre rule being used to measure the length of an object. What is the correct position of the eye.



- A. B. C.
D.

13. A brick is placed on a newton balance X and then on a beam balance Y. What is measured by each balance?



	Balance X	Balance Y
A	Mass	Mass
B	Mass	Weight
C	Weight	Mass
D	Weight	Weight

14. Which of the following is a fundamental quantity?

A. Time B. Density C. Volume
D. Area

15. What does a beam balance measure?

A. Area B. Mass C. Length
D. Density

16. Which one of the following is not a method of science?

A. Measurement B. Observation

C. Experimentation D. Presentation

17. Which one of the following are not matter?

(i) Steam (ii) Pencil (iii) Light (iv) Space

A. (i) and (ii) B. (ii) and (iii)

C. (iii) and (iv) D. (i) and (iv).

18. How many cubic centimeters are there in a litre?

A. 500 B. 100 C. 2000
D. 1000

19. The sides of a black board are 2m and 5m, what is the surface area in m^2 ?

A. 0.1 B. 10 C. 1 D. 7

20. How many mm^2 are in $0.032 dm^2$.

A. 3.2 B. 320
C. 32 D.

0.0032

21. Find the correct expression.

A. Litre is a unit of length.

B. 1 A is equal to 1 ten-thousandth of a micron.

C. A day is equal to one complete rotation of the earth.

D. A graduated cylinder is used to measure volume.

22. What is equivalent to 5 minutes?

- A. 30s B. 60s
C. 120s D. 300s

23. How many minutes are there between 05:30 and 21:15?

- A. 715 B. 945 C. 1595 D. 900

24. The width of a meter rule is accurately measured by a

- A. micrometer screw gauge B. vernier caliper
C. tape measure D. meter rule

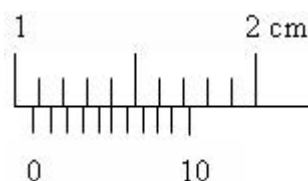
25. A set of apparatus that is suitable for measurement of the volume of an irregular object includes;

- A. Over flow can, measuring cylinder, irregular object and a string.
B. Measuring cylinder, irregular object, over flow cans, flask.
C. Overflow can, Irregular objects, string, retort sand and burette
D. Burette, overflows can, irregular object, a string, measuring cylinder, and retort stand.

26. Convert 25cm^3 into m^3

- A. 02.5×10^5 B. 2.5×10^2
C. 2.5×10^{-1} D. 2.5×10^{-5}

27. The figure shows vernier calipers. The diameter of the object is



- A. 1.05 cm B. 1.06 cm
C. 1.56 cm D. 1.60 cm

28. Three of the fundamental physical quantities are:

- A. Density, mass and time
B. Length, time and mass
C. Length, time and weight

D. Volume, density and mass

29. An S.1 student made a record of 1.34cm in a lesson on measurements. If the value is correct, which instrument did the student use to make the measurement?

- A: metre rule B: micrometer screw gauge
C: vernier calipers D: Tape measure

30. What would be the reading if a relatively second accurate instrument among the above instruments is used?

- A. 1.34 mm B. 13.40 mm C. 0.04 ft
D. 1.34 cm



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1. (a) Define a **physical quantity**.

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(b) Distinguish between **fundamental** and **derived** quantities.

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(c) (i) What is meant by an **S.I** unit?

.....

.....

(ii) List the seven basic quantities of measurements and any seven derived quantities with their respective S.I units.

Basic Quantity	S.I unit	Derived Quantities	S.I unit

(d) Define the following quantities giving at least two instruments used to measure them;

(i) length

.....

(ii) mass

.....

(iii) time

.....

(iv) Volume

.....

(e) Briefly describe an experiment to determine the volume of an irregular object

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(f) State the instrument, which can be used to accurately measure the following quantities;

Quantity	Suitable Instrument
1. Distance around a football field	
2. Length of a table	
3. Internal and external diameter of a beaker	
4. Diameter of a wire	
5. Space occupied by milk in a cup	

(g) State the quantity measured and accuracy of the following laboratory measuring instruments:

Instrument	Quantity measured	Unit	Accuracy
Metre -rule			
Stop watch			
Protractor			
Ammeter			
Voltmeter			

1. (a) Draw and label the diagram of the Vernier calipers.

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(b) Find the thickness of a text book measured using a vernier caliper if the main scale reading is 24 mm and the 8th vernier mark coincides with one of the marks on the main scale.

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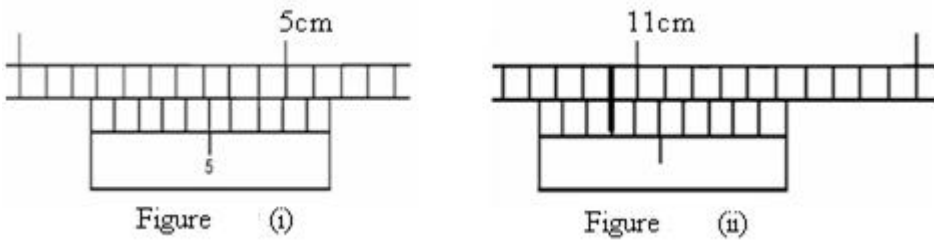
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(c) Find the reading on the verniers shown in the diagrams below.



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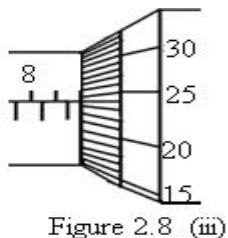
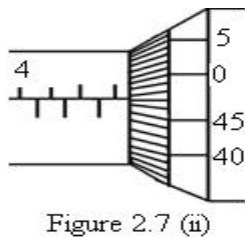
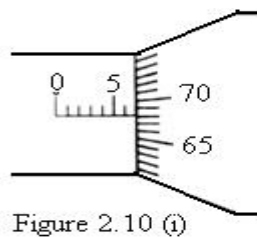
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2. (a) Draw and label the diagram of the micrometer screw gauge.

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(b) Find the reading on the micrometer screw gauge shown in figures below.

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(c) Convert the following:

(i) 125 km to m

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(ii) 0.035m to cm

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(iii) 75cm to mm

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(v) 325 kg to g

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(vi) 0.015kg to g

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(vii) 705g to kg

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(viii) 125 seconds to hours

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(ix) 0.035hours to seconds

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(x) 75days to seconds

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(xi) 125 km² to m²

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(xii) 20 cm² to m²

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(xiii) 0.025 km³ to m³

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(iv) 200 cm³ to m³

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(v) 2 ³/₄ litres to m³

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2. (a) A cuboid has dimensions 2cm by 10cm. Find its width in metre if it occupies a volume of 80cm^3 . [0.04m]

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- (b) Find the volume of water in a cylinder of water radius 7cm if its height is 10cm.[1540cm^3]

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- (c) The volume of the cylinder was 120m^3 .When a stone was lowered in the cylinder filled with water the volume increased to 150cm^3 . Find the height of the cylinder of radius 7cm. [0.078 cm]

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- (d) A Perspex box has 10cm square base and contains water to a height of 10cm. A piece of rock of mass 600g is lowered gently into the water and the level rises to 12cm. Find the;

- (i) Volume of water displaced by the rock.

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(ii) volume of the rock in *cm*³ and *m*³

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(iii) Density of the rock in *gcm*⁻³ and *kgm*⁻³

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SCIENTIFIC NOTATION AND SIGNIFICANT FIGURES.

1. Write the following values in scientific form; (i) 598,000,000..... (ii) 0.00000087m..... (iii) 60220m..... (iv) $\frac{3}{4}$..... ...	(v) $\frac{1}{8}$..... ... 2. Convert the following to scientific form. (i) 4.8×10^2..... (ii) 1.0×10^2..... (iii) 1.25×10^{-1}.....

Questions:

1. How many significant figures are there in each of the following numbers?

- (a) 4.02 (b) 0.008 (c) 8600.
(d) 1 049 (e) 0.0002

2. The following values were taken as part of a set of experimental data: 25.57 cm and 8.48 mm. Find the sum of the two figures.

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3. A water tank measures by 4.5 m by 3.25 m by 5.5 m. Calculate giving the answers with the correct number of significant figures.

(a) Base area (b) Volume of the tank.

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Working out numbers with powers of 10

In working out numbers expressed using powers of ten, we use the following rules.

- (i) When multiplying powers of ten, add the exponents together.
(ii) When dividing powers of ten subtract the exponents.

Examples

1. Work out the following numbers

(a) $10^4 \times 10^8$ [$10^4 \times 10^8 = 10^{(4+8)} = 10^{12}$]

(b) $10^6 \times 10^{-3}$ [$10^6 \times 10^{-3} = 10^{(6+(-3))} = 10^3$]

(c) $\frac{6 \times 10^6}{2 \times 10^3} = \frac{6 \times 10^6}{2 \times 10^3} = 3 \times 10^{(6+(-3))} = 3 \times 10^3$

(d)

$\frac{1.5 \times 10^5}{2 \times 10^{-2}} = \frac{1.5 \times 10^5}{2 \times 10^{-2}} = 0.75 \times 10^{5+2} = 0.75 \times 10^7$

2. Write the following numbers in scientific notation.

- (a) (i) 0.000222 (ii) 0.0025

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(b) (i) 5620 (ii)
75000

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...

(c) (i) 120 million (ii)
20

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(d) (i) 5 (ii) 55 x 20

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(e) (i) 25 km in m (ii) 10 g
in kg.

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4. Write the following to the stated
significant figures.

Number	1s.f	2s.f	3s.f	4s.f
28.8				
$\frac{2}{7}$				
4.027×10^{-2}				
0.00012037				
470023600				

398				
5789				



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Where necessary, use:

-Density of water = 1000 kg m⁻³ -Density of lead = 11400 kg m⁻³ -
Density of petrol = 800 kg m⁻³
-Density of mercury = 13600 kg m⁻³ -Density of milk = 1030 kg m⁻³

SECTION A

1. A bottle weighs 160 g when empty, 760 g when filled with water, and 1 kg when filled with a certain liquid. Calculate the volume of the liquid in bottle.

A. 160 cm³. B. 600 cm³.
C. 760 cm³. D. 1 000 cm³.

2. Calculate the density of the liquid in question (1) above.

A: 1.40 g cm⁻³. B: 1.32 g cm⁻³.
C: 0.76 g cm⁻³. D: 0.21 g cm⁻³.

3. What mass of lead has the same volume as 1600 kg of petrol?

A: 22 800 kg B. 1600 kg C. 11400 kg D. 800 kg.

4. Which of the following will not affect the density of a substance?

A: Changing its state. B. Heating to higher temperature. C. Add impurities to it. D. Dividing it into two unequal portions.

5. A metal cuboid of dimensions 3 cm by 2 cm by 1 cm and 8.9 g cm⁻³ is completely immersed in a liquid of density 0.8 g cm⁻³. The mass of the liquid displaced is

A: 53.4 g. B. 29.1 g. C. 7.5 g. D. 4.8 g.

6. A tank 2m tall and base area of 2.5 m² is filled to the brim with a liquid, which weighs 40000 N. Calculate, the density of the liquid in kg/m³

A: $\frac{4000}{2 \times 2.5 \times 10}$ B. $\frac{4000}{2 \times 2.5 \times 10}$ C. $\frac{40000}{2 \times 2.5 \times 10}$ D. $\frac{40000}{2 \times 25}$

7. Which one of the following statements defines relative density?

A. $\frac{\text{Mass}}{\text{Volume}}$ B. $\frac{\text{Mass of substance}}{\text{Mass of any Volume of water}}$

C. $\frac{\text{Mass of any volume of substance}}{\text{Mass of an equal Volume of water}}$.

D. $\frac{\text{Mass of any volume of substance}}{\text{Equal Volume of water}}$.

8. A bottle weighs 160 g when empty, 760 g when filled with water, and 1

kg when filled with a certain liquid. Calculate the volume of the liquid in bottle.

A: 160 cm³. B: 600 cm³.
C: 60 cm³. D: 1000 cm³.

9. Calculate the density of the liquid in question (4) above.

A: 1.40 g cm⁻³ B. 1.32 g cm⁻³
C. 0.2 g cm⁻³ D. 0.71 g cm⁻³

10. Liquid P of volume 0.4 m³ and density 900 kg m⁻³ is mixed with liquid Q of volume 0.5 m³ and density 600 kg m⁻³. The density of the mixture is;

A. 733 kg m⁻³ C. 630 kg m⁻³
B. 500 kg m⁻³ D. 350 kg m⁻³

11. What is the mass of 1.5 litres of water?

A. 1,500 kg B. 150 kg
B. 15 kg D. 1.5 kg

12. A density bottle has a mass of 70g when empty, 90g when full of water and 94g when full of liquid. What is the relative density of the liquid?

A: 2.5 B. 3.0
C. 1.2 D. 2.1

13. The following readings were recorded when measuring the density of a stone;

Mass of a stone	= 25g
Volume of water	= 25 cm ³
Volume of water and stone	= 35 cm ³
What is the density of the stone?	

A. $\frac{25}{10}$ g cm⁻³ B. $\frac{35}{30}$ g cm⁻³ C. 10 g cm⁻³ D. $\frac{25}{35}$ g cm⁻³

14. 0.002m^3 of a liquid of density 800kgm^{-3} is mixed with 0.003m^3 of another liquid of density 1200kgm^{-3} . What is the density of the mixture?
A. $1,000\text{ kgm}^{-3}$ B. $4,000\text{ kgm}^{-3}$
C. $2,500\text{ kgm}^{-3}$ D. $1,040\text{ kgm}^{-3}$

15. A piece of material of mass 200g has a density of 25kgm^{-3} . Calculate its volume in m^3 .
A. $\frac{200}{25}$ B. $\frac{200}{25 \times 1000}$ C. $\frac{25 \times 1000}{200}$
D. $\frac{200 \times 1000}{25}$

16. A tin containing $6 \times 10^{-3}\text{m}^3$ of paint has a mass of 8kg . If the mass of the empty tin with the lid is 0.5kg , calculate the density of the paint in kgm^3 .
A. $\frac{8 \times 0.5}{6 \times 10^{-3}}$ B. $\frac{7.5}{6 \times 10^{-3}}$ C. $\frac{8 \times 10^6}{6 \times 10^{-3}}$
D. $\frac{8.5 \times 10^6}{6 \times 10^{-3}}$

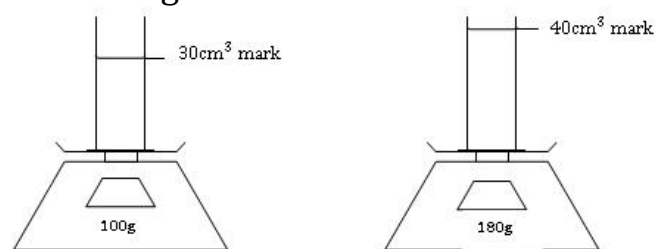
17. A box of dimensions 0.2m by 0.3m by 0.5m is full of a gas of density 200kgm^{-3} . Find the mass of the gas.
A. $3.0 \times 10^{-2}\text{kg}$ B. $6.0 \times 10^0\text{kg}$
C. $2.0 \times 10^2\text{kg}$ D. $6.7 \times 10^3\text{kg}$

18. A piece of metal of mass 120g is placed in a 100ml measuring cylinder containing 20ml of water. If the level of water rises to the

50ml mark, find the density of the metal.

- A. 12 gcm^{-3} . C.
 2.4 gcm^{-3}
B. 4.0 gcm^{-3} . D.
 6.0 gcm^{-3} .

19. A measuring cylinder containing some water stands on a scale pan. A solid ball is lowered into the water. The water level rises from the 30cm^3 mark to 40cm^3 mark. The scale reading increases from 100g to 180g .



What is the density of the material of the ball?

- A: 2.0 gcm^{-3} . B. 4.5 gcm^{-3} . C. 8.0 gcm^{-3} . D. 18 gcm^{-3} .

20. Two solid cubes have the same mass but their surface areas are in the ratio of $1:16$. What is the ratio of their densities?

- A. $1:2$ B. $4:1$ C. $64:1$
D. $1:64$

21. A metal cuboid of dimensions 3 cm by 2 cm by 1 cm and 8.9 g cm^{-3} is completely immersed in a liquid of density 0.8 g cm^{-3} . The mass of the liquid displaced is.

- A. 53.4 g . B. 29.1 g . C. 7.5 g .
D. 4.8 g .

22. 0.002m^3 of a liquid of density 800kgm^{-3} is mixed with 0.003m^3 of another liquid of density 1200kgm^{-3} .

What is the density of the mixture?

- A. $1,000\text{ kgm}^{-3}$ B. $4,000\text{ kgm}^{-3}$ C. $2,500\text{ kgm}^{-3}$ D. $1,040\text{ kgm}^{-3}$

23. A bottle weighs 160 g when empty, 760 g when filled with water, and 1 kg when filled with a certain liquid. Calculate the volume of the liquid in bottle.

- A: 160 cm^3 B: 600 cm^3
C: 760 cm^3 D: 1000 cm^3

24. A metal cuboid of dimensions 3cm by 2cm by 1cm and 8.9 g cm^{-3} is completely immersed in a liquid of density 0.8 g cm^{-3} . The mass of the liquid displaced is

- A. 53.4 g. B. 29.1 g. C. 7.5 g.
D. 4.8 g.

25. A tank 2m tall and base area of 2.5m^2 is filled to the brim with a liquid, which weighs 40000N. Calculate, the density of the liquid in kgm^{-3} .

- A. $\frac{4000}{2 \times 2.5 \times 10}$ B. $\frac{4000}{2 \times 2.5 \times 10}$ C. $\frac{40000}{2 \times 2.5 \times 10}$ D. $\frac{40000}{2 \times 25}$

26. To calculate the density of an object, which one of the following must be known?

- (i) Height (ii) Volume (iii) Area.
(iv) Mass (v) Weight
A. i and ii B. ii and v. C. iii and iv D. ii and iv

27. A block of wood 10m x 5m x 4m has a mass of 80 000 kg. What is the density of this wood?

- A. 2000kgm^{-2} B. 4000 kgm^{-2}
C. 200 kgm^{-2} D. 400 kgm^{-2}

28. The density of gold is 19.3 gcm^{-3} . What is the mass of 10cm^3 gold?

- A. 19.3 g B. 0.193g C. 1.93g D. 193g

29. What is the mass of the copper cube having each side 2cm? (take $d_{\text{copper}} = 9\text{ gcm}^{-3}$)

- A. 0.18g B. 72g C. 180g
D. 36g

30. What is the volume of 60g wood? ($d_{\text{wood}} = 0.6\text{ gcm}^{-3}$)

- A. 10cm^3 B. 36cm^3
C. 100cm^3 D. 360cm^3

31. Study the table below and use it to spot the correct answer.

Material	Density(gcm^{-3})	Mass (g)
K	3	60
L	9	180
M	6	360
N	5	200

From the values shown in the table which material has the biggest volume?

- A. K B. L C. M D. N

32. What is the volume and mass of the block which measures by 2m, by 3m by 5m if its density is 1500 kgm^{-3} ?

- A. 50m^3 ; 75 000 kg B. 100 m^3 ; 75 000 kg
C. 30m^3 ; 75 000 kg D. 30 m^3 ; 75 000 kg

33. Two litres of corn oil has a mass of 1.85kg. What is the density of the oil?

- A. 1850kgm^{-3} B. 925kgm^{-3}
C. 185kgm^{-3} D. 92.5kgm^{-3}

34. If an object of volume 0.02m^3 weighs 500 N in a liquid of density 2000kgm^{-3} , what is the weight in air?

- A. 900 N B. 1000 N
C. 400 N D. 600 N

35. Which one of the following is the SI unit of dens

- A. kgm^3 B. kgm^{-3} C. gcm^{-3}
D. kgm^{-3}

36. If 10g water and 10cm^3 alcohol are mixed what will be the mass of the mixture? ($d_{\text{alcohol}} = 0.80\text{gcm}^{-3}$)

- A. 18g B. 20g C. 16g D. 19g

37. A tin containing 5 litres of paint has a mass of 8.5kg. The mass of the empty tin is 2.0kg, the density of the paint is

- A. 1.3kgm^{-3} B. $1.3 \times 10^3\text{kgm}^{-3}$
C. $1.7 \times 10^3\text{kgm}^{-3}$ D. $2.1 \times 10^3\text{kgm}^{-3}$

38. A rectangular block of tin is 0.5m long and 0.01m thick. Find the width of the block if its mass and density are 0.45kg and 9000kgm^{-3} respectively.

- A. $0.005 \times 0.45 \times 900\text{m}$
B. $\frac{0.005}{0.45 \times 900}\text{m}$
C. $\frac{0.005}{0.45 \times 9000}\text{m}$
D. $\frac{0.45 \times 0.005}{9000}$

39. A box of dimensions 0.2m by 0.3m by 0.5m is full of a gas of density 200kgm^{-3} . The mass of the gas is

- A. $3 \times 10^{-2}\text{kg}$ B. $6.0 \times 10^0\text{kg}$ C. $2 \times 10^2\text{kg}$ D. $6.7 \times 10^3\text{kg}$

40. A piece of material of mass 200g has a density of 25kgm^{-3} . Calculate its volume in m^3 .

- A. $\frac{200}{25}$ B. $\frac{200}{1000 \times 25}$
C. $\frac{1000 \times 25}{200}$ D. $\frac{1000 \times 200}{25}$

41. Two solid cubes have the same mass but their edges are in the ratio 4:1. What is the ratio of their densities?

- A. 1:4 B. 1:8
C. 1:16 D. 1:64

42. A tin containing $6 \times 10^{-3}\text{m}^3$ of paint has a mass of 8kg. If the mass of the empty tin with the lid is 0.5kg, calculate the density of the paint in kgm^{-3}

A. $\frac{8 \times 10^5}{6 \times 10^{-3}}$

B. $\frac{7.5}{6 \times 10^{-3}}$

C. $\frac{8 \times 10^6}{6 \times 10^{-3}}$

D. $\frac{8.5 \times 10^6}{6 \times 10^{-3}}$

A. $\frac{1.0}{2.5}$

B. $\frac{1}{4}$ C. $\frac{2}{4}$

D.

43. A tank 2 m tall base area of 2.5 m^2 is filled to the brim with a liquid which exerts a force of 40000N at the bottom. Calculate the density of the liquid.

A. $\frac{4000}{25 \times 2 \times 10} \text{ kgm}^{-3}$

B. $\frac{40000}{2.5 \times 2 \times 10} \text{ kgm}^{-3}$

C. $\frac{40000}{25 \times 2 \times 10} \text{ kgm}^{-3}$

D. $\frac{40000}{2.5 \times 2} \text{ kgm}^{-3}$

44. The following reading were recorded when measuring the density of a stone; Mass of the stone = 25g, volume of water = 25 cm^3 , volume of water and stone = 35 cm^3 What is the density of the stone?

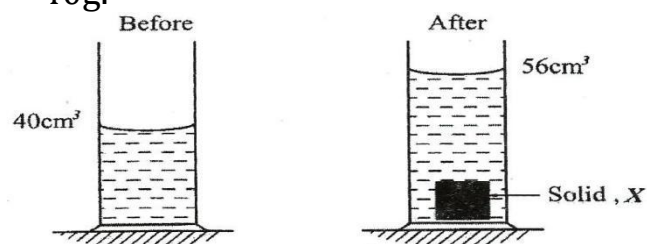
A. $\frac{25}{10} \text{ gcm}^{-3}$

B. $\frac{35}{30} \text{ gcm}^{-3}$

C. 10 gcm^{-3}

D. $\frac{25}{35} \text{ gcm}^{-3}$

45. The Figure shows levels of water in a measuring cylinder before and after immersing a solid X of mass 40g.



The density of solid X in gcm^{-3} is:



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1. (a) A Perspex box has a10cm square base containing water to a height of10 cm. A piece of rock of mass 600g is lowered into the water and the level rises to 12 cm.
- (i) What is the volume of water displaced by the rock?
- [200 cm³]

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(ii) What is the volume of the rock?

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(iii) Calculate the density of the rock.

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(b) The mass of 24.4cm^3 of mercury is 332g. Find the density of mercury.

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(c) An 800g solid measures 10cm by 5cm by 4cm. Determine its density.

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(d) A glass stopper of volume 16cm^3 weighs 40g. Calculate its density in:

(i) gcm^{-3} .

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(ii) kgm^{-3} .

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(e) The density of copper is 8.9gcm^{-3} . What is the mass of 100cm^3 of copper?

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(f) When a piece of irregular stone of mass 200g is lowered in a measuring cylinder, the initial and final volumes were 500cm^3 and 600cm^3 respectively. Calculate the density of the stone.

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(g) An empty beaker weighs 120g in air and 180g when filled with 75cm^3 of methylated spirit. Find the density of methylated spirit.

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(h) What is the mass of 1.5litres of water?

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(i) The oil level in a burette is 25cm^3 . Fifty drops of oil fall from a burette. If the volume of one drop is 0.1cm^3 .What is the final oil level in the burette.

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(j) A measuring cylinder has water level of 13cm.What will be the new water level if 1.6g of a metallic block of density 0.8g/cm^3 is added.

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(k) A Perspex box having 6cm square base contains water to a height of 10cm.
Find the volume of water in the box

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(l) A stone of mass 120g is lowered into the box and the level of water rises to
13cm.

(i) Find the new volume of water?

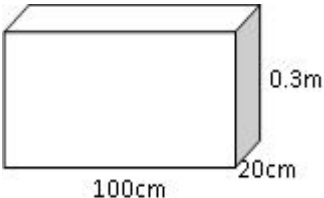
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(ii) Find the volume of the
stone?.....
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(iii) Find the density of the stone.

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(iv) A steel C.P.U below, has a mass of 560g. Find its density;

	(i) in gcm^{-3} 	(ii) in kgm^{-3}

2. In an experiment to determine the density of a pin, 100pins are gently lowered into a measuring cylinder containing 12cm^3 of water. The water in the cylinder rose to 98cm^3 . Find the;

(i) Volume of a pin.

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(ii) Density of the pin in kgm^{-3}

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DENSITY OF MIXTURES

Suppose two substances X and Y are mixed as follows:

Substance	Mass	Volume	Density
X	M _X	V _X	D _X = $\frac{M_X}{V_X}$
Y	M _Y	V _Y	D _Y = $\frac{M_Y}{V_Y}$

Density of mixture

$$= \frac{\text{mass of mixture}}{\text{Volume of mixture}}$$

Density of mixture = $\frac{M_X + M_Y}{V_X + V_Y}$

1. Liquid X of volume 0.5m^3 and density 900kgm^{-3} was mixed with liquid Y of volume 0.4m^3 and density 800kgm^{-3} . What was the density of the mixture?

A. 8500kgm^{-3} B. 1889kgm^{-3} C. 770kgm^{-3} D. 856kgm^{-3}

2. 100cm^3 of fresh water of mass 100g is mixed with 100cm^3 of sea water of mass 103g . Calculate the density of the mixture.

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3. 200g of liquid Y of density 4gcm^{-3} . Calculate the density of the mixture.

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4. Liquids X and Y are mixed to form a solution. If the density of X is 0.8gcm^{-3} and volume is 100cm^3 , density of Y 1.5gcm^{-3} and its volume is 300cm^3 . Find the;

(i) mass of liquid X

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(ii) mass of liquid Y

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(iii) Density of a mixture

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- a. Liquid Y of volume 0.40m^3 and density 90.0kgm^{-3} is mixed with liquid X of volume 0.35m^3 and density 800kgm^{-3} . Calculate the density of the mixture.

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More Practice Questions

2. An alloy is formed by adding 500g of element P of density 5gcm^{-3} to 400cm^3 of element Q of density 4gcm^{-3} . Calculate the density of the alloy. [4.2gcm^{-3}].
3. 500cm^3 of liquid X of density 2gcm^{-3} is combined with 200 g of liquid Y of density 4gcm^{-3} . Calculate the density of the mixture.
4. Liquid M of density 0.5gcm^{-3} is mixed with liquid N in equal volumes. If the mixture has a density of 0.8gcm^{-3} , find the density of liquid N.
5. 3cm^3 of water was mixed with 5cm^3 of milk of density 1500kgm^{-3} . Find the density of the mixture. [1312.5kgm^{-3}].



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RELATIVE DENSITY (R.D)

Note: Density of pure water =1gcm⁻³ = 1000kgm⁻³

1. (a) Define the term Relative density.

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(b) Briefly describe an experiment to determine the Relative density of a liquid using a density bottle.

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(c) State one advantage of using a density bottle in measuring the relative density of a solid compared to other methods.

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2. A density bottle was used to measure the density of mercury. The following measurements were taken:

Mass of empty bottle	= 20g
Mass of bottle full of mercury	= 360g
Mass of bottle full of water	= 45g
Calculate the;	

(a)Relative density of mercury

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(b) Density of mercury

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3. A density bottle has mass 75g when empty, 95g when full of water and 99g when full of a liquid. Calculate the:

(a)Relative density of the liquid.

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(b) Density of the liquid

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More Practice Question:

1. A bottle full of water has a mass of 45g, when full of ethanol, its mass is 36g. If the empty bottle weighs 20g, calculate the density of ethanol.

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2. Density bottle has a mass of 70g when empty, 90g when full of water and 94g when full of liquid. Find the relative density of the liquid and its density.

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3. An empty 60-litre petrol tank weighs 10kg. What will be its mass when full of petrol of relative density 0.72?

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4. A density bottle was used to measure the relative density of a liquid and the following results were obtained.

Mass of empty bottle	:	
=30g		
Mass of bottle full of water	:	
=130g		
Mass of bottle full of liquid	:	
=110g		
		
Calculate the density of the liquid. (=0.8gcm ⁻³)		

5. An empty density bottle is 46.00g. When fully filled with water, it weighs 96.00g. It weighs 86.00g when full of an unknown liquid. Find the density of the liquid. (=0.8gcm⁻³)

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6. A piece of aluminum weighs 80N in air and 50.37N when completely immersed in water. Calculate the relative density of aluminum. (=2.7)

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PHYSICS UCE ASSESSMENT EXAMINATION
TIME ALLOWED:_____

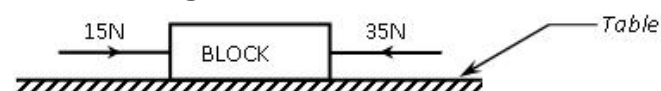
NAME:_____CLASS/STEAM_____

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MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

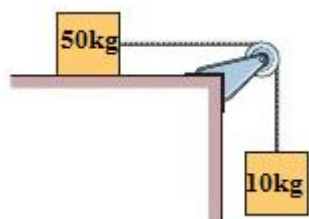
- Two forces of 7N and 9N act perpendicularly on a body of mass 2kg. Find the acceleration of the body.
- A man starts from point A and walks a distance of 20m due north and then 15m due east. Find his new position relative to A.
- A parachutist falling with a constant velocity of 16 ms^{-1} is blown by wind horizontally at 12 ms^{-1} .
 - Find the resultant velocity of the parachutist.
 - If the parachutist jumps from a height of 500m directly above a ground target, find the horizontal distance by which the parachutist will miss the target on landing.
- What is the mass of a man on the earth if his mass on the moon 60kg.
A. 6kg B. 10kg C. 60kg D. 360kg
- Assume that you are taking measurements with a spring balance (dynamometer), where can you get the greatest reading for the same object?
A. At the centre of the earth B. On the moon
C. At the equator D. At the poles.

6. What is the name of any push or pull exerted?
A. Mass B. Force
C. Friction D. Tension
7. What do we call the pull of gravity on an object?
A. Mass B. Weight C. Moment D. Tension
8. Which one of the following is **not** a measuring tool?
A. Equal-arm balance B. Dynamometer
C. Lever D. Ruler
9. Which one of the following is the unit of weight?
A. Newton B. Kilogram C. Meter D. Tonne
10. A mass of 60kg weighs 600N on the earth and 100N on the moon. What is the mass and weight of an object on the earth if it weighs 50N on the moon?
A. 60kg mass, 600N weight
B. 10kg mass, 60N weight
C. 30kg mass, 300N weight D. 5 kg, mass, 100N weight
11. Which one of the following is a force?
A. Energy B. Mass
C. Weight D. Speed
12. Which one of the following statements is **not** correct?
A. Force can change the speed of an object.
B. Force can change the shape of an object.
C. Force can change the direction of motion.
D. Force can change the mass of an object.
13. Which one of the following are SI units of mass and weight?
A. g and n respectively
B. N and kg respectively
C. kg and g respectively
D. kg and N respectively
14. Two forces of 15 N and 35 N act on a block placed on a smooth table as shown in the figure below. Find the resultant force on the block.



- A. 20N. B. 50N. C. 525 N.
D. 1000 N.

- 15.** The diagram above shows a trolley of mass 50kg connected to a mass of 10kg by a light string which passes over a smooth pulley. The trolley moves over a smooth horizontal surface.



- (a) What is the horizontal force acting on the trolley?
 (b) What is the total mass in motion?
 (c) Find the acceleration of the trolley
- 16.** A block of mass 50kg is pulled from rest along a horizontal surface by a rope tied to one of the block as shown below.



The tension in the rope is 220N. the frictional force between the block and the horizontal surface is 120N.

- (i) Find the acceleration of the block.
 (ii) Calculate the distance moved by the block in 4.0s.
 (iii) What is the reaction of the surface on the block.
 (iv) Compare the work done by the tension in the rope during the 4.0s interval with kinetic energy gained.

- 17.** A block of mass 8kg slides on a rough horizontal surface under the action of a force of 48N as shown below.



If the block moves with an acceleration of 5ms^{-2} , calculate the frictional force between the mass and the surface.

- 18.** The mass of a rock on the Earth is 2.0 kg. What is the mass of the rock on the Moon?
 A. 1.7 kg B. 2.0 kg C. 3.4 kg D. 20 kg

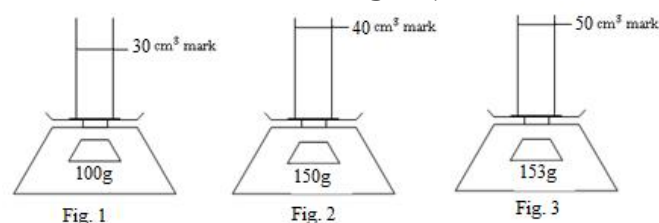
19. The mass of a rock on the Earth is 2.0 kg. What is the weight of the rock on the Moon?
A. 1.7 N B. 2.0 N C. 3.4 N D. 20 N
20. The weight of a rock on the Moon is 200 N. What is the mass of the rock on the Earth?
A. 20 kg B. 118 kg. C. 200 kg D. 1180 kg
21. The weight of a rock on the Moon is 200 N. What is the weight of the rock on the Earth?
A. 20 N B. 118 N C. 200 N D. 1180 N
22. The weights of three objects measured on three celestial bodies are listed below. The weight of object A on the Moon is 200 N. The weight of object B on the Jupiter is 6000 N. The weight of object C on the Mercury is 400 N. Which of the following sequence shows the mass of the three objects in ascending order? (The acceleration due to gravity of the Moon, Jupiter and Mercury are 1.7 m s^{-2} , 25.4 m s^{-2} and 3.8 m s^{-2} respectively.)
A. object A, object B, object C.
B. object C, object A, object B
C. object A, object C, object B
D. object B, object C, object A
23. An astronaut of mass 80 kg jumped out of the rocket after it had landed on Jupiter. The astronaut took 0.40 s to drop for 2.0 m. What was the weight of the astronaut on Jupiter?
A. 800 N. B. 1000 N.
C. 1800 N. D. 2000 N
24. The following experiment was set up. Which of the following substances has the lowest density?
A. Air B. Oil. B. Water. D. Mercury
25. The following experiment was set up. Which of the following is in ascending order of density?
A. water, mercury, oil B. mercury, water, oil.
C. oil, water, mercury oil. D. Oil, mercury, water.
26. The following experiment was set up. Which of the following is a possible density for iron in kg m^{-3} ?
A. 600. B. 1000. C. 8000. D. 14000
27. When solid A of mass 2 g is immersed in a measuring cylinder filled with water, it displaces a volume of 4 cm^3 . What is the density of solid A?
A. 0.5 g per cm cubed. B. 2 g per cm cubed.

- C. 5 N per cm cubed. D. 20 N per cm cubed

28. The figures below show the difference in water level before and after solid A is submerged in measuring cylinder. Given that solid A is 20 g, what is the density of solid A?

- A. 0.3 g per cm cubed B. 0.5 g per cm cubed.
C. 2 g per cm cubed. D. 4 g per cm cubed.

29. In an attempt to find the density of a piece of floating object, the following measurements were carried out. Figure 1: Measuring cylinder with water. Figure 2: Measuring cylinder with water and a piece of stone submerged within. Figure 3: Measuring cylinder with water and a piece of stone tied to the floating object such that the floating object is also submerged under water. What is its density?



- A. 0.23 g per cm cubed. B. 2.65 g per

cm cubed.

- C. 0.30 g per cm cubed. D. 3.06 g per cm cubed

30. What is the mass of a man on the earth if his mass on the moon 60kg.

- A. 6kg B. 10kg C. 60kg D. 360kg

31. When solid A of mass 12 g is immersed in a measuring cylinder filled with water, it displaces the same volume of water as solid B of mass 8 g. What can be deduced about the densities of solids A and B?

- A. Both A and B have the same density.
B. Density of A is 4 times density of B.
C. Density of A is $\frac{2}{3}$ times density of B.
D. Density of A is $\frac{3}{2}$ times density of B.

32. In an attempt to find the average mass of an iron ball, the following measurements were carried out. Figure 1: Measuring cylinder with water. Figure 2: Measuring cylinder with water and 20 iron balls submerged within. Given that iron has a density of 7.5 g cm⁻³, what is the mass of one iron ball?

- A. 1.87 g. B. 5.25 g C. 16.9 g. D. 105 g

33. A bottle full of water has a mass of 200 g. When the same bottle is filled with liquid X, the mass becomes 180 g. If the mass of the empty bottle is 100 g, what is the density of liquid X in g cm^{-3} ?

(Take the density of water to be 1.0 g cm^{-3}).

A. 0.2 B. 0.8 C. 0.9 D. 1.2

34. A wooden block of dimension $1\text{m} \times 1\text{m} \times 1\text{m}$ has a mass of 800 kg. If Ashwin sawed half of the block away, what is the density of the remaining wooden block in kg m^{-3} ?

A. 200. B. 400. C. 800. D. 1000

35. A wooden block of dimension $1\text{ m} \times 1\text{ m} \times 1\text{ m}$ has a mass of 800 kg. Ajay attached a steel plate of dimension $1\text{ m} \times 1\text{ m} \times 0.02\text{ m}$ to the block. Given that the steel plate has a mass of 140 kg, what is the density of the combination in kg m^{-3} ?

A. 800. B. 922. C. 3900. D. 7000

36. 5000 kg of iron is melted and mixed with 2.0 m^3 of molten copper. If the density of molten iron and molten copper are 7.5 g cm^{-3} and 9.0 g cm^{-3} respectively, what is the approximate density of the mixture?

A. 7.5 g per cm^3 . B. 8.3 kg per m^3
C. 8300 kg per m^3 D. 8600 kg per m^3

37. A 100 kg rock is being hung freely on the Moon. When an astronaut pushes the rock upwards, he will feel that the rock;

A. is easier to be pushed than on Earth.
B. is more difficult to be pushed as it is on Earth.
C. requires as much effort to be pushed as on Earth.
D. requires no effort to be pushed.

38. When an astronaut jumps on the Moon (given that the acceleration due to gravity of the Earth and the Moon is 10 m s^{-2} and 1.7 m s^{-2} respectively).

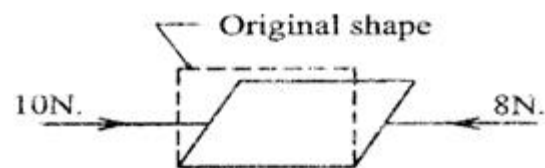
A. He will take a longer time to reach the top and a longer time to come down as compared to jumping on the Earth.
B. He will take a longer time to reach the top and a shorter time to come down as compared to jumping on the Earth.
C. He will take a shorter time to reach the top and a longer time to come down as compared to jumping on the Earth.

D. He will take a shorter time to reach the top and a shorter time to come down as compared to jumping on the Earth.

39. An astronaut in space wants to compare the mass of two balls. He holds the two balls in each of his hands and moves both hands up and down slightly for a few times. What is the reason for doing so?

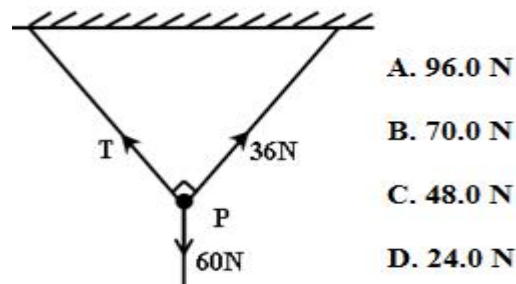
- A. He is trying to compare the inertia of the two balls. The one with a higher mass tends to be more difficult to be moved and to be stopped.
- B. He is trying to compare the inertia of the two balls. The one with a higher mass tends to be easier to be moved and to be stopped.
- C. He is trying to compare the weight of the two balls. The one with a higher weight tends to be more difficult to be moved and to be stopped.
- D. He is trying to compare the weight of the two balls. The one with a higher weight tends to be easier to be moved and to be stopped.

40. The Figure shows two forces of 10 N and 8 N acting on a body. What is the value and direction of the force needed to resolve its original shape?



- A. 2 N to the left.
- B. 18 N to the left.
- C. 2 N to the right.
- D. 18 N to the right.

41. The figure **below** shows two forces of **T** and 36 N acting on a body **P** of weight 60 N. Find the size of the force **T**.

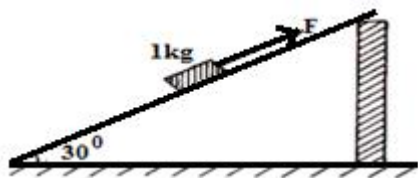


42. Assume that you are taking measurements with a spring balance (dynamometer), where can you get the greatest reading for the same object?

- A. At the centre of the earth
- B. On the moon
- C. At the equator
- D. At the poles.

43. What is the name of any push or pull exerted?
A. Mass B. Force C. Friction D. Tension
44. What do we call the pull of gravity on an object?
A. Mass B. Weight
C. Moment D. Tension
45. Which one of the following is **not** a measuring tool?
A. Equal-arm balance B. Dynamometer
C. Lever D. Ruler
46. Which one of the following is the unit of weight?
A. newton B. kilogram C. meter D. tonne.
47. A mass of 60kg weighs 600N on the earth and 100N on the moon. What is the mass and weight of an object on the earth if it weighs 50N on the moon?
A. 60kg, 600N B. 10kg, 60N
C. 30kg, 300N D. 5kg, 100N

48. A block of mass 1kg is supported by a force F on a rough plane inclined to the horizontal at 30° . If the static frictional force is 5N.



Find the value of F .

- A. 25N B. 8 C. 5.0N D. 0.0N
49. Which one of the following is a force?
A. Energy B. Mass C. Weight D. Speed

50. Which one of the following statements is **not** correct?

- A. Force can change the speed of an object.
- B. Force can change the shape of an object.
- C. Force can change the direction of motion.
- D. Force can change the mass of an object.

51. Which one of the following are SI units of mass and weight?

- A. g and N respectively B. N and kg respectively
- C. kg and g respectively D. kg and N respectively

52. The acceleration due to gravity on the earth is 10ms^{-2} and on the mars it is 4ms^{-2} . A space probe has a mass of 100kg on earth. On mars, its mass will:

- A: and weight will decrease
- B: be smaller but the weight will be the same
- C: be smaller but the weight will have increased
- D: be the same but its weight will have decreased.

63. A 10kg block is pulled by a force, P along a rough surface as shown in the figure below.



If the coefficient of friction between the block and the surface is 0.25 and the acceleration of the block is 3ms^{-2} , find the:

- (i) Friction force, F on the block.
- (ii) Pulling force, P.
- (iii) New acceleration if P, is doubled. (07mrks



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1. (a) Define a **force** and state its **S.I** unit

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(b) Define the following types of force

(i) Gravitational force

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(ii) Weight

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(iii) Centripetal force

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(iv) Shear force

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(v) Tension

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2. (i) Explain Why the weight of a body varies from place to place.

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(ii) State any **five** Differences between Mass and weight

Mass	Weight

1. (a) What is meant by **friction**?

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(b) Distinguish between **static** and **kinetic** friction

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(c) Explain why Static friction is always greater than Kinetic friction.

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(d) Briefly describe an experiment to measure frictional force between two surfaces in contact.

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2. (a) Calculate the static friction when a body of mass 6kg rests on a surface; given that coefficient of friction of surface is 0.5 .

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a) List **five** advantages of friction

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b) List any **five** disadvantages of friction

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c) Explain any **two** ways of Reducing of friction

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(b) State any **two** factors which affect the magnitude of frictional force
between two surfaces in contact.

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1. (a) Distinguish between **scalar** and **vector** Quantities.

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(b) List any five examples of vector and scalar quantities.

(5marks)

	Vector Quantities	Scalar quantities
(i)		
(ii)		
(iii)		
(iv)		
(v)		

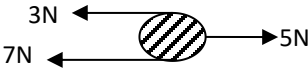
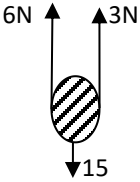
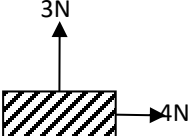
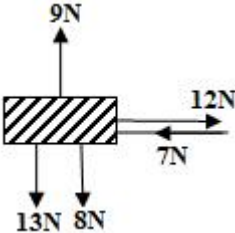
(c) What is meant by a **resultant force**?

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(d) In each of the following cases, find single vector which can produce the same effect.

(i)	
(ii)	
(iii)	
(iv) Calculate the;	(i) resultant force on the mass (ii) acceleration of the mass



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1. Two forces of 7N and 9N act perpendicularly on a body of mass 2kg. Find the acceleration of the body.
2. A man starts from point A and walks a distance of 20m due north and then 15m due east. Find his new position relative to A.
3. A parachutist falling with a constant velocity of 16 ms^{-1} is blown by wind horizontally at 12 ms^{-1} .
 - (i) Find the resultant velocity of the parachutist.
 - (ii) If the parachutist jumps from a height of 500m directly above a ground target, find the horizontal distance by which the parachutist will miss the target on landing.
4. A mass of 15kg is suspended using a string. The string is then pulled by a horizontal force F such that the string makes an angle of 30° with the down ward vertical. Calculate the;
 - (i) Tension in the string.
 - (ai) Horizontal force F.

5. A block of mass 2kg is pulled along a rough horizontal ground by a force of 120N, with the help of a string, which makes an angle of 60° with the horizontal. If the friction between the block and the ground is 50N, calculate the;

(i) Resultant force on the block.
Acceleration of the block.

6. Which of the following is true for an object under shearing forces?

- A. the object does not change in shape.
B. the layers of the object tend to slide on one another.
C. the object gets twisted.
D. the object tends to shorten

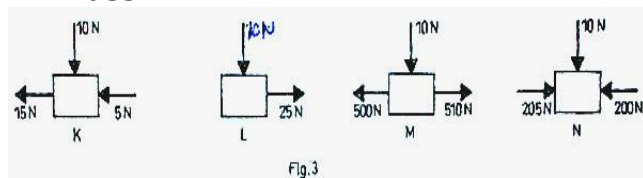
7. Two men Moses and Ebenezer apply forces of 36N and 48N respectively on a rope of mass 3kg as shown below.



- (i) Calculate the resultant force on the rope.
(ii) Find the acceleration of the rope.

8. (2004 PP1.A.Q:25)

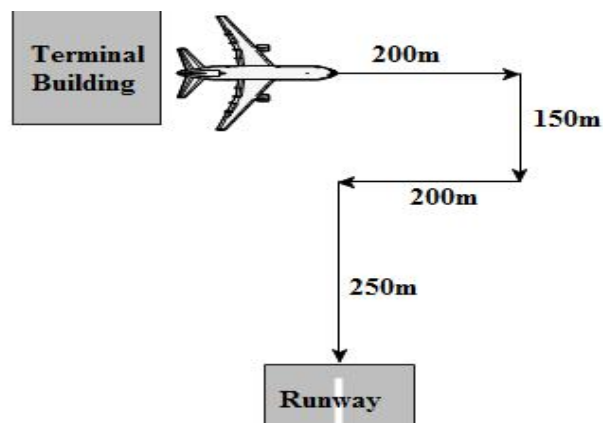
9. The above figure shows forces applied on each of the identical blocks of the same mass.



The block which has the greatest net force is

- A. K B. L C. M D. N

10. At an airport an aircraft moves from the terminal building to the end of the runway.



Which row shows the total distance travelled and the size of the displacement of the aircraft?

	Total distance Travelled (m)	Size of Displacement (m)
A	400	800
B	450	200
C	450	400
C	800	400
E	800	800

11. A plane of mass 750 kg is at rest on a runway. The engine applies a force of 4 kN.



- (a) Calculate the magnitude of the acceleration of the plane assuming there are no other forces acting on the plane at this point.
- (b) The required speed for take-off is 54 m/s. Calculate the time it takes to reach this speed assuming the acceleration is constant.
- (c) In practice the acceleration is not constant. Give a reason for this.



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1. In an experiment to estimate the size of an oil molecule, a volume of 0.12cm^3 was placed on a clean surface and spread into a patch of area 0.0006cm^2 . Calculate the size of the oil molecule.
2. When 0.002 cm^3 of oil was dropped on the surface of water, an oil film of diameter 6.0cm was formed. Calculate the thickness of the film.
3. The volume of 100 drops of certain oil is 1.0cm^3 . One such drop was placed on a water surface and it spread into a circular patch of average diameter 50cm . What is the size of the oil molecule?
4. If $1.8 \times 10^{-4}\text{cm}^3$ oil spreads to form a patch of area 150 cm^2 . Determine the thickness of the patch.
5. A drop of oil of diameter 0.5mm becomes a circular film of oil of diameter 30cm .
(i) Find the thickness of the oil film.
(ii) Calculate the number of molecules in the oil drop.

6. 1cm^3 of oleic acid was dissolved in 99 cm^3 of alcohol to form 100 cm^3 of solution. A 1-cm^3 drop of the solution was put on a water surface sprinkled with lycopodium powder. The alcohol dissolved in water leaving the acid which spread to form a patch of diameter 14 cm^3 .
- (i) Explain why lycopodium powder was used
 - (ii) Calculate the volume of the acid in the 1-cm^3 drop of the solution.
 - (iii) Estimate the size of oleic acid molecule.
7. In an experiment to determine the thickness of an oil molecules the following were done;
- ❖ 1cm^3 of oil was dissolved in 99cm^3 of ether and 1cm^3 of the solution was diluted to 200cm^3
 - ❖ 0.4 cm^3 of the dilute solution was dropped onto the surface of water.
 - ❖ The diameter of film formed was found to be 7cm . from the above. Calculate the thickness of the oil molecules. (Ans: $t = 5.19 \times 10^{-7}\text{ cm}$).
8. A solution was made by dissolving 1cm^3 of cooking oil in 199cm^3 of methanol. When 0.004cm^3 of the solution was dropped onto the water surface, an oil film of diameter 12cm was obtained. Find the thickness of the oil molecule.



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SECTION A

- When a crystal of potassium permanganate is carefully placed at the bottom of a beaker containing water, it spreads uniformly in the water after some days. This is due to:
A. diffusion B. capillarity
C. surface tension D. Brownian motion
- Soap is used to wash clothes because it.
A. increases capillarity in the clothes
B. reduces capillarity in the clothes
C. increases surface tension allowing water to penetrate the dirt easily.
D. reduces surface tension allowing water to penetrate the dirt easily.
- Brownian motion experiment shows that molecules of gasses are
A. Stationary
B. in motion in one direction only
C. In constant random motion
D. More closely packed than molecules in liquid.

4. When mercury is spilt on glass it forms small spherical droplets because its.
 - A. Density is high.
 - B. Surface tension makes its surface elastic.
 - C. Molecules are small
 - D. Cohesive force is greater than adhesive force with the glass.

5. A needle may float on a clean water but sinks when some detergent is added to water because the detergent
 - A. reduces the density of water.
 - B. increases adhesive force between the needle and water molecules.
 - C. lowers the surface tension of water.
 - D. makes water surface slippery.

6. The particles in a solid at room temperature are
 - A. Close together and vibrating.
 - B. Close together and stationary.
 - C. Far apart and moving at random.
 - D. Close together and moving at random.

7. Mercury forms spherical drops when spilt on a wooden bench because it
 - A. is very viscous
 - B. has a high density .
 - C. has a high cohesive force
 - D. has a low surface tension.

8. Water wets glass because.
 - A. adhesive forces between water and glass molecules are greater than cohesive forces.
 - B. adhesive forces between water and glass molecules are more than cohesive forces.
 - C. surface tension forces between water and glass molecules are more than adhesive forces.
 - D. Surface tension forces are less than cohesive forces.

9. The forces which hold the molecules in water drop together are called...
- A. Surface tension C. Adhesive
 - B. Cohesive D. Electrostatic forces
10. When water spreads on a glass plate, the forces between it's molecules and glass molecules are due to
- A. Surface tension C. Adhesion
 - B. Cohesion D. Viscosity.
11. In a Brownian motion experiment, the
- A. smoke particles are seen moving about with uniform velocity.
 - B. motion observed is caused by the air molecules colliding with the smoke particles.
 - C. Size of particles are found to increase the motion.
 - D. smoke cell has a vacuum within it.
12. When smoke is introduced in a smoke cell and observed under a microscope, it is observed as particles moving at random. This is mainly because the particles:
- A. are hot
 - B. collide with one another
 - C. collide with air molecules
 - D. collide with the walls of the smoke cell
13. Which of the following statements is incorrect when a tin containing air tightly sealed is heated?
- A. the average speed of molecules increases
 - B. the molecules of air hit the walls of the tin harder
 - C. The molecules of the air strike the walls of the tin less often.
 - D. The pressure inside the tin increases.
14. When a room is filled with smoke, the smoke tends to concentrate
- A. around the walls
 - B. close to the walls
 - C. close to the roof
 - D. midway between the roof and the floor
15. Capillary rise in a tube dipped in water is due to

- A. Surface tension
- B. adhesive force being greater than cohesive force
- C. high vapour pressure
- D. Atmospheric pressure acting on the surface of the water.

16. Which of the following statements about states of matter is/are true?

- (i) a liquid has a definite volume but no a definite shape.
- (ii) a vapour has no definite volume and no definite shape.
- (iii) a solid has a definite volume and shape.
- (iv) a gas has a definite volume and shape.

- A. (i) and (iii) only C. (i) only
- B. (i), (ii) and (iii) only D. (iii) only

17. When viewing Brownian motion in a smoke cell the observer sees:

- A. Air molecules moving in a random motion
- B. air molecules vibrating regularly
- C. air molecules colliding with each other
- D. Smoke particles in a random motion.

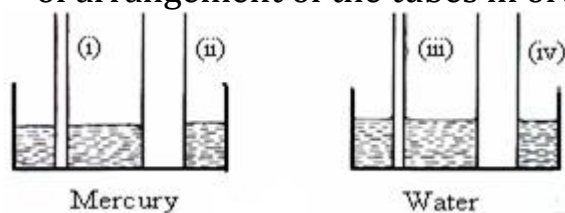
18. Which of the below is a matter?

- A. Heat B. Sound
- C. Air D. Light

19. Which of the following statements below is *wrong*?

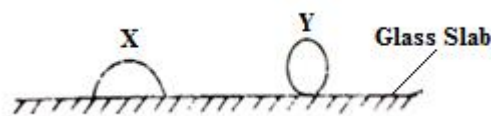
- A. Matter is made up of atoms.
- B. Solid, liquid and gas are states of matter.
- C. Solids and liquids have definite shape and volume.
- D. Gas molecules move freely.

20. The diagrams in figure show two capillary tubes standing in a trough of mercury and two capillary tubes standing in a trough of water. The correct order of arrangement of the tubes in order of increasing height of the liquid column is;



- A. (i), (ii), (iv), (iii)
- B. (ii), (i), (iv), (iii)
- C. (ii), (iv), (i), (iii)
- D. (iii), (iv), (i), (ii)

21. The diagram below shows drops of liquids X and Y carefully put on a clean sheet of flat glass.



Which of the following statements does **NOT** explain why the drops take different shapes?

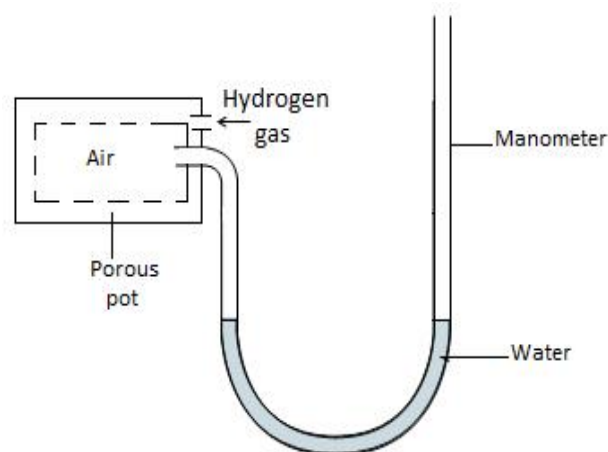
- (i) The force of attraction between molecules of X is less than that between molecules of Y.
 - (ii) The force of attraction between molecules of Y and glass is less than that between molecules of Y.
 - (iii) The force of attraction between molecules of X is less than that between molecules of X and glass.
 - (iv) The force of attraction between molecules of Y and glass is greater than that between molecules of Y.
- A. only (i) B. only (i) and (iv)
C. only (iv) D. only (i),(ii),(iii)

SECTION B

22. Describe the relationship between molecules of liquids, gases and solids in terms of:

- (a) the arrangement of the molecules throughout the bulk of the material,
- (b) the separation of the molecules,
- (c) the motion of the molecules and
- (d) The forces of attraction between the molecules.

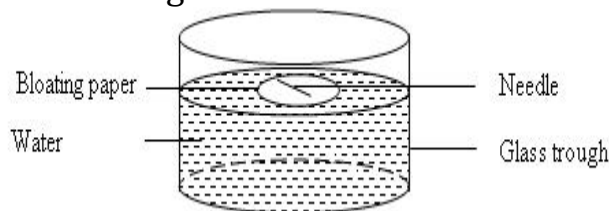
23. (a) (i) What is meant by the term **diffusion**?
(ii) State factors on which diffusion depends.
(b) Describe an experiment to show diffusion in liquids.
(c) A porous pot containing air is connected to a water manometer.



Explain what happens if hydrogen is let in the space surrounding the as shown in the figure.

- (d) (i) Describe a simple experiment to show surface tension in water.
(ii) State two factors, which affect surface tension.

24. A pin is placed on a bloating paper, which is on the surface of water as shown in the figure below

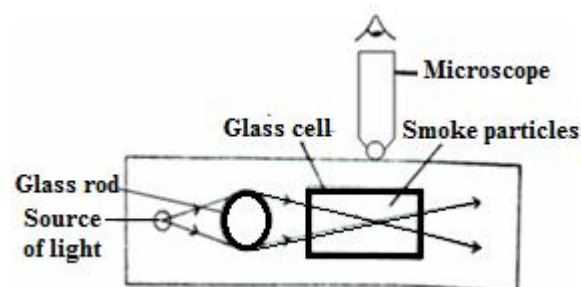


- (a) Explain what happens after some time.
(b) Explain what happens when some soap solution is carefully added to the water.

25. Draw a well labelled diagram you would use to describe Brownian motion.

- (a) How is the motion of the smoke particles best described?
(b) What accounts for the motion of the smoke particles?
(c) The motion is viewed using bigger smoke particles. What difference in the motion would this lead to. Give reason for the difference.

26. The diagram in figure below shows an arrangement for observing Brownian motion.



(a) Explain:

- (i) The observation made.
- (ii) What will be observed when the glass cell temperature is raised.

(b) State one factor which determines the rate of diffusion of a gas.

27. (a) Distinguish between cohesion and adhesion.

(b) Sketch diagrams to show the level of liquid in a capillary tube that is immersed in a liquid which has greater;

- i) Cohesion than adhesion
- ii) Adhesion than cohesion

28. Define **surface tension**.

(b) Describe a simple experiment to show the existence of surface tension in water.

(c) Explain the following observations as fully as you can.

(i) A small needle can be floated on the surface of water, but if a drop of detergent is added to the water the needle sinks.

(ii) Damp proof courses are used in modern houses.

(iii) Gases can easily be compressed but liquids cannot. (iv) Diffusion occurs more easily in a gas than in a liquid.

29. (a) State the **kinetic theory of matter**.

(b) Describe experiments, in each case, to show:

- (i) Diffusion in liquids
- (ii) Diffusion in gases.

(c) Use kinetic theory to explain the result of your experiment demonstrating the diffusion in gases.



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1. (a) What is meant by the term
Matter?

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(b) List any three states of matter
giving an example in each case.

State of matter	Examples

(d) State the **Kinetic Theory of
matter**

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2. (a) What is meant by **Brownian
motion**

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(i) Explain any **three** factors which affect Brownian motion.

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DIFFUSION

3. (a) Define the term **Diffusion**

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(b) Briefly describe an experiment to demonstrate diffusion in liquids

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(c) State any two **applications** of diffusion.

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(a) Define a **molecular force**.

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(a) Distinguish between cohesion and adhesion forces

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State three other characteristics of liquids with the property similar to that exhibited by mercury in (c) above

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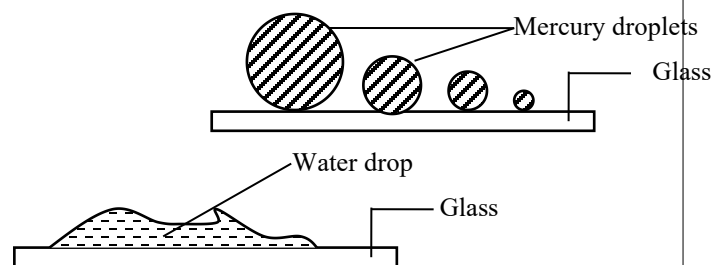
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(c) Mercury forms spherical balls when spilled on a glass surface, while water spreads on the same glass surface



Explain any one practical application of this property exhibited by mercury

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(i) Explain the above observation

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(d) (i) Define **capillarity**

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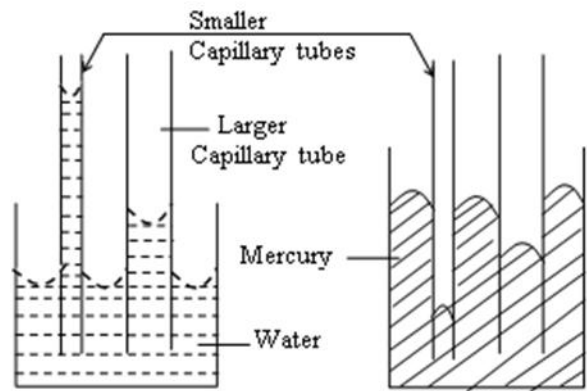
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(ii) Two capillary tubes of different diameters were dipped in a beaker containing water and then in another containing mercury.



(i) Briefly explain the shape of the meniscus in each case

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(ii) State any three uses of capillarity

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(iii) Give one disadvantage of capillarity

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(iv) State the factors which affect capillarity

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SURFACE TENSION:

1. (a) What is meant by **Surface tension?**

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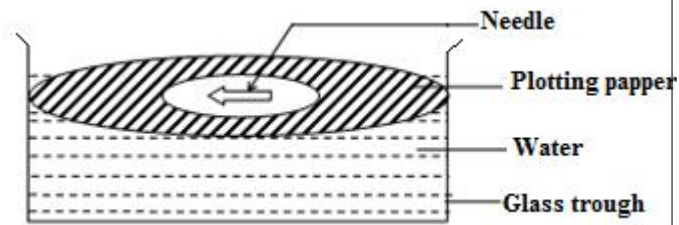
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(b) A clean beaker is filled with water and a blotting paper is placed on the surface of the water. A pin or needle is gently placed on the blotting paper and the set up observed.



(i) State what is Observed:

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(ii) Explain what happens when drops of soap solution are added onto the water surface.

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(iii) Mention any four Effects of surface tension

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(iv) State the Factors that affect surface tension

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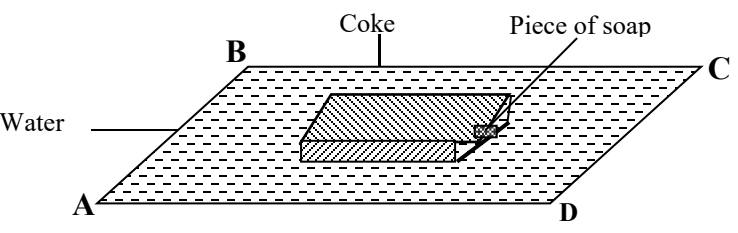
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(b) The diagram below shows the surface of water in a rectangular trough ABCD. A piece of cork to which a slice of soap is attached is lowered on the water surface as shown



(i) State the forces acting on the cork (2 marks)

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(ii) In what direction will the cork move (1 mark)

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(iii) Explain what causes the motion (2 marks)

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1. In an oil film, experiment to estimate the size of a molecule 0.005cm^3 of oleic acid was dropped on lycopodium powder on a water surface. The mean diameter of the acid was 5cm. Calculate the thickness of a molecule of oleic acid.
2. An oil drop of volume $1 \times 10^{-9} \text{ m}^3$ spreads on a water surface to form a patch of area $5 \times 10^{-2} \text{ m}^2$. If the patch is one molecule thick, find the

approximate number of molecules in the drop.

3. In an experiment to estimate the size of an oil molecule, a volume of 0.12cm^3 was placed on a clean surface and spread into a patch of area 0.0006cm^2 . Calculate the size of the oil molecule.
4. When 0.002 cm^3 of oil was dropped on the surface of water, an oil film of diameter 6.0cm was formed. Calculate the thickness of the film.
5. The volume of 100 drops of certain oil is 1.0cm^3 . One such drop was placed on a water surface and it spread into a circular patch of average diameter 50cm. What is the size of the oil molecule?
6. If $1.8 \times 10^{-4} \text{ cm}^3$ oil spreads to form a patch of area 150 cm^2 . Determine the thickness of the patch.
7. A drop of oil of diameter 0.5mm becomes a circular film of oil of diameter 30cm.
 - (iii) Find the thickness of the oil film.
 - (iv) Calculate the number of molecules in the oil drop.
8. 1cm^3 of oleic acid was dissolved in 99 cm^3 of alcohol to form 100 cm^3 of solution. A 1-cm^3 drop of the solution was put on a water surface sprinkled with lycopodium powder. The alcohol dissolved in water

leaving the acid which spread to form a patch of diameter 14 cm^3 .

(iv) Explain why lycopodium powder was used

(v) Calculate the volume of the acid in the 1-cm^3 drop of the solution.

(vi) Estimate the size of oleic acid molecule.

9. In an experiment to determine the thickness of an oil molecules the following were done;

❖ 1cm^3 of oil was dissolved in 99cm^3 of ether and 1cm^3 of the solution was diluted to 200cm^3

❖ 0.4 cm^3 of the dilute solution was dropped onto the surface of water.

❖ The diameter of film formed was found to be 7cm . from the above. Calculate the thickness of the oil molecules.

10. A solution was made by dissolving 1cm^3 of cooking oil in 199cm^3 of methanol. When 0.004cm^3 of the solution was dropped onto the water surface, an oil film of diameter 12cm was obtained. Find the thickness of the oil molecule.

11. 1cm^3 of oleic acid was dissolved in 999cm^3 of alcohol to form 1000cm^3 of solution. A 1cm^3 drop of the solution was put on a water surface sprinkled with lycopodium powder. The alcohol dissolved in the water leaving the acid to spread

forming a patch of diameter of 28cm .

a) Calculate the volume of oleic acid in the 1cm^3 drop of the solution.

b) Estimate the size of oleic acid molecule.

c) Why was lycopodium powder used?



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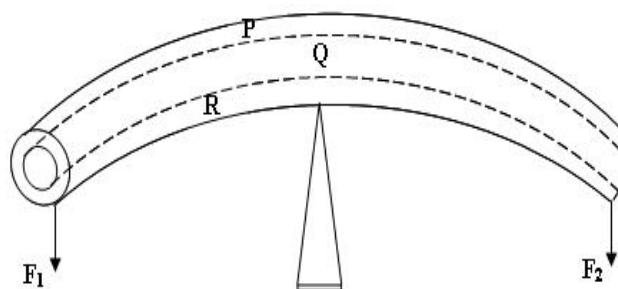
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MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

1. Roofing structures and many bridges are made designed triangular sections to;
- (i) Minimize the material used
 - (ii) Withstand compression forces
 - (iii) Minimize tensile force under compression.
- A. (ii) only B.(ii) and (iii) only.
C. (i) and (iii) only.
D. (i) , (ii) and (iii)

2. The beam shown below is being acted upon by forces F_1 and F_2 as shown.



The regions **P**, **Q** and **R** are respectively,

- A. tension, compression, neutral axis
- B. neutral axis, compression, tension
- C. tension, neutral axis, compression
- D. compression, neutral axis, tension

3. A notch on a material spreads more rapidly when the material is;

- A: reinforced B: in tension
- C: pre stressed
- D: in compression

4. The strength of a material depends on the:

- (j) Nature of the material
 - (ii) Diameter of the material
 - (iii) Length of the material
- A. (i) only B. (i) and (ii) only
C. (ii) and (iii) only
D. (i), (ii) and (iii)

5. A mass of 0.2 kg produces an extension of 8 cm in a spring. The force required to produce an extension of 6cm is

A. 0.75 N B. 1.50 N
C. 2.70 N D. 24.00 N

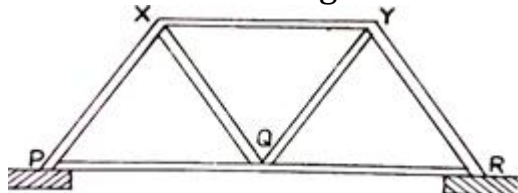
6. A ductile material is that which

A. Is fragile
B. Is not elastic
C. Can be molded into any shape
D. Easily breaks under compression.

7. In a wire supporting a load, stress is given by

A. $\frac{\text{strain}}{\text{area}}$ B. Force x area
C. $\frac{\text{area}}{\text{force}}$ D. $\frac{\text{force}}{\text{area}}$

8. The diagram in figure 6 shows a framework of a bridge



Which of the girders are **ties**?

A. XQ, QY, PX, YR B. PQ, QR, XY
C. XQ, QY D. PX, YR

9. Which of the following are all brittle materials?

A. Leather, rubber, thread.
B. Clay, glass, wood.

C. Glass, cast iron, stone.

D. Rubber, polyester, copper wire.

10. The diagram below shows a structure of wooden beams P, Q, R, S and T supporting a heavy road L. Which of the beams can be replaced by ropes if the same shape is to be maintained?

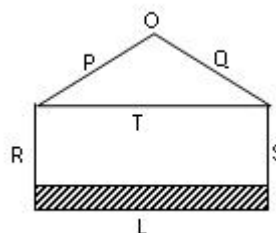
11. A metallic solid of mass 45kg rests on a copper rod of cross sectional area 0.5 cm^2 standing vertically as shown below,

	Calculate the stress in the rod. A. $9.0 \times 10^2 \text{ Nm}^{-2}$ B. $9.0 \times 10^5 \text{ Nm}^{-2}$ C. $9.0 \times 10^6 \text{ Nm}^{-2}$ D. $9.0 \times 10^8 \text{ Nm}^{-2}$

12. A notch on a material spreads more rapidly when the metal is;
A. in tension B. in compression

C. pre-stressed D. reinforced

13. The curve in the figure shows the force versus extension graph for a copper wire.



- A. P, R, S and T and T
C. Q, R, S and T and S
B. P, Q, S
D. P, Q, R

14. A rod of cross-sectional area 40cm^2 needs a tensile force of 2N to break it. What is its breaking stress?

- A. 0.005 Nm^{-2} B. 0.05 Nm^{-2}

- C. 5 Nm^{-2} D. 500 Nm^{-2}

15. A mass of 0.5kg causes a spiral spring to extend by 4cm . The force that would cause an extension of 6cm would be

- A. 2.0 N B. 3.3 N
C. 4.8 N D. 7.5 N

16. If a load 1N extends a spring by 5cm , what extension will a load of 0.6 N produce?

- A. 1.2 cm B. 3.0 cm
C. 8.3 cm D. 30.0 cm

17. Which of the following are brittle substances?

- A. Dry clay, steel, chalk, wood
B. Chalk, steel, plastic, glass.
C. Glass, chalk, concrete and steel

D. Dry clay, glass, chalk and concrete.

18. Reinforced concrete is stronger than ordinary concrete because concrete and the steel are
A. Both brittle materials.

- B. Strong in tension and compression respectively.
C. Both ductile materials.
D. Strong in compression and tension respectively.

19. The graph above represents the extension of a wire with increasing load. Where does the yield point occur?

- A. between point P and Q
B. between point Q and R
C. between point R and S
D. at point S

20. A load of 4 N stretches a spring by 0.5 cm . Calculate the extension when a load of 8 N is applied.

- A. 0.25 cm B. 1.0 cm

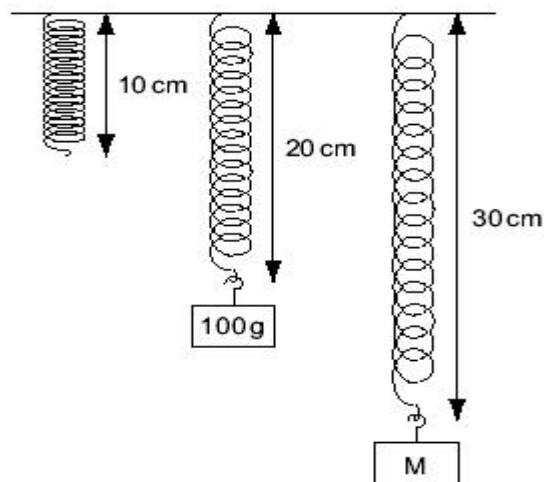
- C. 2.0 cm D. 4.0 cm

21. The strength of a material is its ability to resist

- (i) Compression.
(ii) Shearing forces.
(iii) Change in size or shape.

- A. (i) only. B. (ii) only.
C. (i) and (ii) only. D. (i), (ii) and (iii).

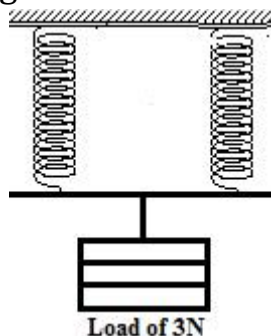
22. Objects with different masses are hung on a 10 cm spring. The diagram shows how much the spring stretches.



The extension of the spring is directly proportional to the mass hung on it. What is the mass of object M?

- A: 110 g B: 150 g C: 200 g
D: 300 g

23. An experimenter applies a force of 6N to a helical spring and it extends by 12cm. She then hangs the spring in parallel with an identical spring and attaches a load of 3N as shown in the figure below.

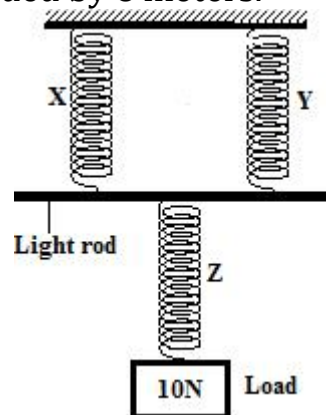


The resulting extension of the system in cm, will be

- A: 3 B: 4 C: 12 D: 36

24. The diagram shows three identical spring balances X, Y, and Z arranged as shown in the figure below supporting a load of 10N. At

equilibrium, the spring Z is extended by e meters.



The extension of X and Y are

X(m)	Y(m)	X(m)
Y(m)		
A. $e/2$	$e/2$	B. e
C. $2e$	$2e$	C. $3e$
		D. $3e$

25. Which of the following are all brittle materials?

- A. Leather, rubber, thread.
B. Clay, glass, wood.
C. Glass, cast iron, stone.
D. Rubber, polyester, copper wire.



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Paper II Questions

26. (a) With the aid of a diagram, describe the effect of a shear force on a body.

(b) (i) What is meant by strength as applied on a material?

(ii) State the factors on which strength on a material depends.

(c)(i) Describe a simple experiment to describe Hooke's law using a spring.

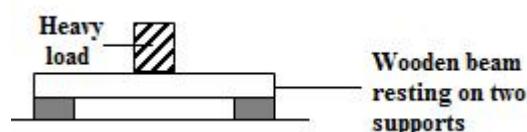
(ii) State any three characteristics of concrete which make it a desirable building material.

27. (a) Explain with the aid of a sketch diagram, how a notch weakens a beam of a brittle material.

(b) State two ways in which concrete may be made stronger.

(c) A force of 100 N stretches an elastic spring by 2 cm. what force would stretch the same spring by 3.5 cm?

(d) The diagram in the above figure shows a simple bridge on a stream.



(i) Mark the neutral axis

(ii) Label the part that will be in tension

(iii) Indicate on the diagram how the bridge can be strengthened.

28. A spring constant of natural length $8.0 \times 10^{-2} \text{m}$ extends by $2.5 \times 10^{-2} \text{mm}$ when a weight of 10N is suspended on it.

(i) Find the spring constant.

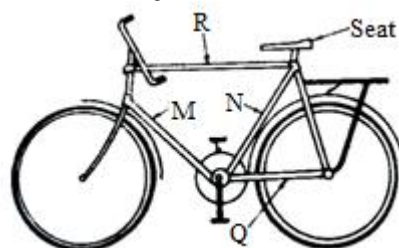
(ii) Determine the extension when a weight of 15N is suspended on the spring

29. A force of 500N extends a wire by 2mm. If the force is reduced by a half, what will be the new length of the wire, if the original length is 10 cm.

30. A vertical spring of length 30 cm is stretched to 36 cm when an object of mass 100g is placed in the pan attached to it. The spring is stretched to 40 cm when a mass of 200g is placed in the pan. Find the mass of the pan.

31. (a) Define the terms **strain** and **stress**.

(b) The figure below shows a diagram of a bicycle.



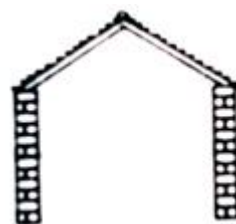
Which of the parts labelled M, N, Q and R would be

- (i) in tension.
- (ii) in compression when a heavy person sits on the seat.

(c) Give four reasons why bicycle frames are made of hollow cylindrical structures

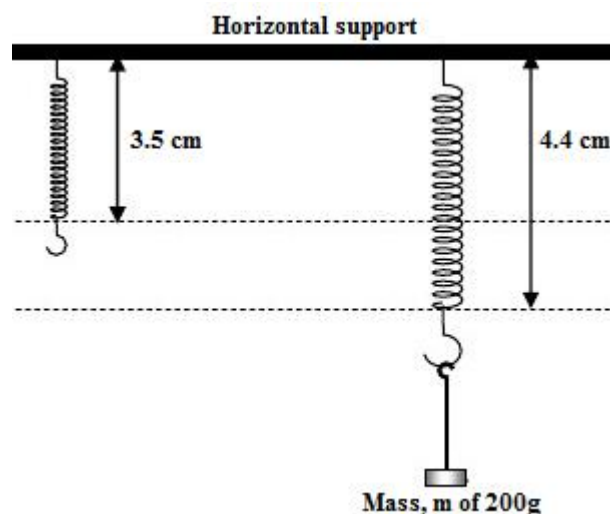
(d) Explain why the lower part of the second floor of a building is made of reinforced concrete while the upper part is not reinforced.

(e) The figure below shows a part of a roof structure.



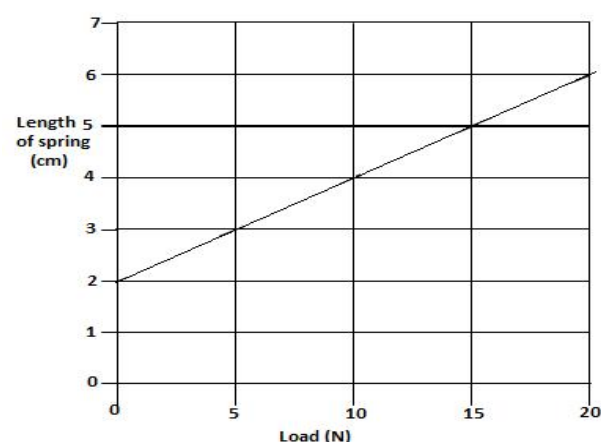
- (i) Copy the diagram and on it show how the structure can be strengthened by using two other girders.
- (ii) Label one tie and one strut on your diagram.

19. The figure below, shows a spring of length 3.5 cm when hanging freely and length of 4.4 cm when a mass of 200g is attached to its free end.



What will be the new length of the spring if a 400g is attached to its free end.

20. A spring balance is calibrated to give readings in newtons. The graph shows how the length of the spring varies with the load.

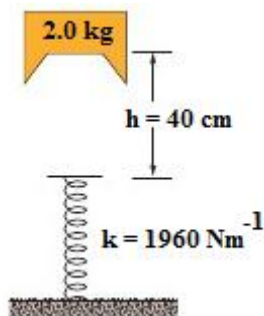


(i) What is the balance reading if a load causes the spring of the balance to extend by 13cm.

(ii) What extension would be produced by a load of 12N.

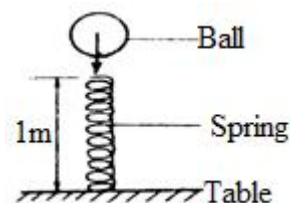
(iii) Determine the spring constant.

21. A block of mass m 2.0 kg is dropped from height h 40 cm onto a spring of spring constant, $k = 1960 \text{ Nm}^{-1}$.



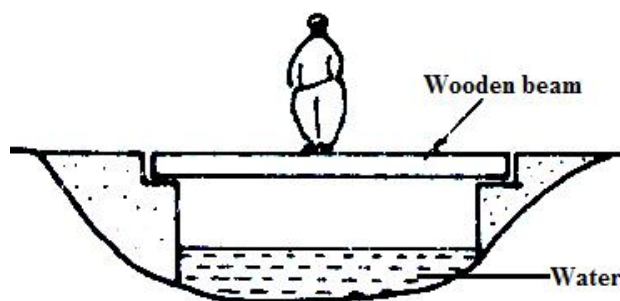
Find the maximum distance the spring is compressed.

22. A ball of mass 100g falls from rest through a height of 2m on to the top of a spring of length 1m placed on the table as shown in the figure below.



- (i) How much energy is passed onto the spring by the ball.
- (ii) If the elastic constant of the spring is 100 Nm^{-1} , what will be the compression in the spring

23. The diagram in the figure below shows a simple bridge on a stream.



- (i) Mark the neutral axis
- (ii) Describe the mechanical state of the beam.
- (iii) Indicate on the diagram how the bridge can be strengthened.
- (iv) Explain what is likely to happen to the bridge if a notch is made on the beam at the:
 - (a) Upper surface.
 - (b) Lower surface



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1. (a) Giving two examples in each case, explain what is meant by the following
Mechanical properties of matter;

Property and definition	Examples
(i) Strength:	
(ii) Stiffness:	

(iii) Hardness:	
(iv) Ductility:	
(v) Brittleness:	
(vi) Elasticity:	
(vii) Plasticity:	

(b) Give the advantages and disadvantages of the following construction materials

Material	Advantage	Disadvantage
(i) Metals		
(ii) Timber		

(iii) Glass		
(iv) Bricks		
(v) Concrete		
(vi) Re-inforced concrete		

BEAMS AND STRUCTURES

(1). (a) Distinguish between a **beam** and a **girder**

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(b) Define the following forces

(i) Compression force

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(ii) Tensile force

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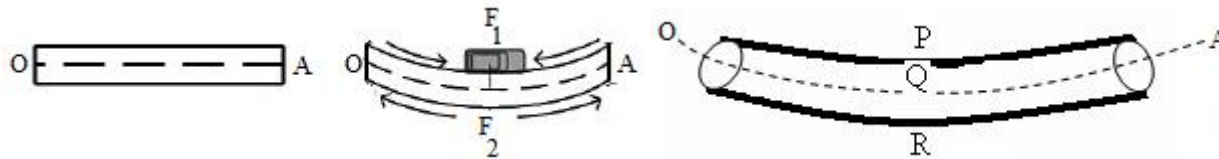
(iii) Shear force

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(c) The diagrams below show a rubber beam before and after bending it.



Name the;

(i) Force

F_1

F_2

(ii) Region,

OA

(iv) Explain the significance of removing the material along region OA

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(g) (i) What is meant by a notch?

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(ii) State one advantage of notches

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(iii) Briefly explain how the of a notch can be minimized in the following materials

Material	How notch effect is minimized
❖ Concrete and cement mortar	
❖ Glass	
❖ Wood	

(h) (i) Distinguish between a **Strut** and a **Tie**

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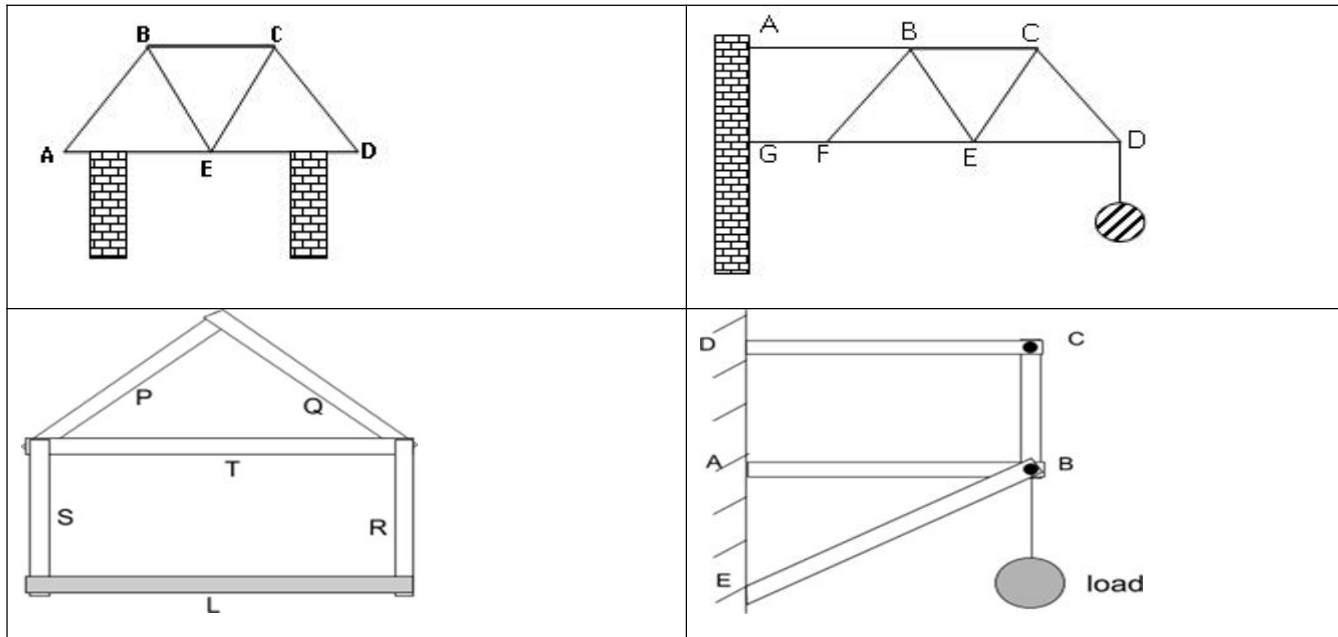
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(ii) State the properties struts and ties

Strut	Tie

(iii) In each of the structures below, identify the girders labeled



2. (a) State **Hooke's law**:

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(b) A spring is stretched by 0.05m by a weight of 5N hung from one end.

(i) What weight will stretch it by 0.03m?

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(ii) Determine the spring constant.

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- (d) A spring increases its length from 20 cm to 25cm when a force is applied. If the spring is constant is 100N/m. Calculate the force.

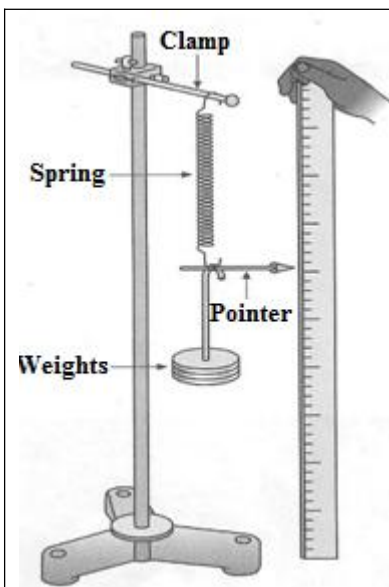
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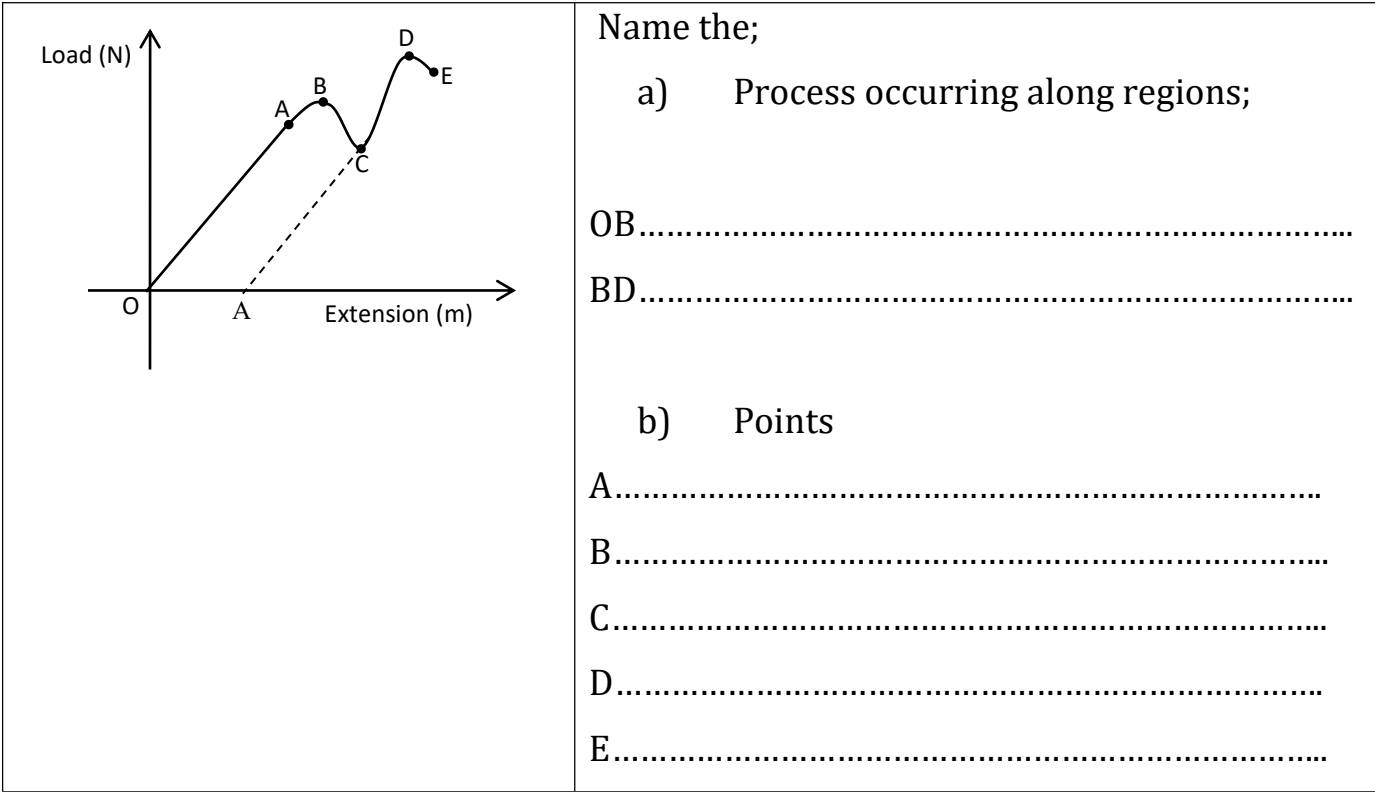
- (e) Briefly describe an experiment to verify Hooke's law



Procedures:

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- (d) The graph below shows the variation of the load with extension for an elastic material like a copper wire



- e) Briefly explain the shape of the graph above.
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- f) Explain the sketch graph above according to the kinetic theory of matter
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-
-

h) Define the following terms

(i) Tensile stress

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(ii) Tensile strain

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(iii) Young's modulus

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i) A wire of cross section area 3m^2 increases in length from 20cm to 25cm, when a force of 5N is applied. Calculate the;

(i) Tensile strain.

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(ii) tensile stress

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(iii) Young’s modulus.

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j) Calculate the tensile stress when a force of 25N acts on a wire of cross sectional area 5m².

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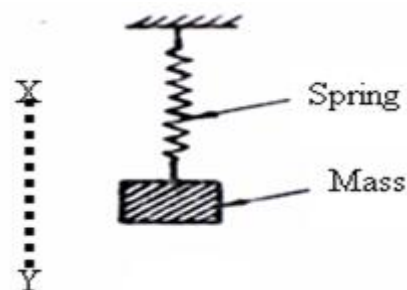
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MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

- A crane raises a mass of 500 kg vertically upwards at a speed of 10 ms^{-1} . Find the power developed
 A. 5.0×10^0 B. 5.0×10^1
 C. 5.0×10^2 D. 5.0×10^4
- A girl whose mass is 50 kg runs up a staircase 25 m high in 4 s. Find the power she develops.
 A. $\frac{50 \times 4}{25} W$ B. $\frac{50 \times 10}{25 \times 4} W$ C. $\frac{50 \times 25}{4} W$ D. $\frac{50 \times 10 \times 25}{4} W$
- A train traveling at a constant speed of 20 m/s overcomes a resistive force of 8 kN. The power of the train is
 A. $(8 \times 20) W$ B. $(8 \times 10 \times 20) W$
 C. $(8 \times 100 \times 20) W$ D. $(8 \times 1000 \times 20) W$
- A pump is rated at 400W. How many kilograms of water can it raise in one hour through a height of 72m?
 A. 0.8kg B. 5.6kg C. 33.3kg D. 2000kg

5. A boy carrying a load of 6 kg runs upstairs. If the work that the boy does is 300 J, find the height of the stairs.
A. 3m B. 5m C. 6m D. 10m
6. Tony can pull a box 2m in 5 seconds. His sister can pull the same box in 10 seconds. Assuming both apply the same force, what is the ratio of Tony's power to his sister's power ?
A. 1 B. 2 C. $\frac{1}{2}$ D. 4
7. An engine exerts a force of 2000N at a speed of 15ms^{-1} . Find the power developed by the engine in kW.
A. 30 000 B. 3 000
C. 300 D. 30
8. A constant force of 5N acts on a body and moves it through a distance of 20m in 10 seconds. Calculate its power.
A. 2.5W B. 10W C. 40W D. 100W
9. A mouse of mass 0.03 kg climbs through a distance of 2 m up a wall in 4 s. The power expended in watts is
A. $0.03 \times 2 \times 4 \times 10$ B. $\frac{0.03 \times 4 \times 2}{10}$ C. $\frac{0.03 \times 4 \times 10}{2}$ D. $\frac{0.03 \times 10 \times 2}{4}$
10. A bullet of mass 0.02kg is fired with a speed of 40m s^{-1} . Calculate its kinetic energy.
A. 0.4 J. B. 0.8 J. C. 16 J. D. 32 J.
11. Which of the following statements is true about an electric motor? It changes
A. Kinetic energy to electric energy B. Electrical energy to light energy
C. Electrical energy to kinetic energy
D. Chemical energy to electrical energy.
12. A body pulls a block of wood with a force of 30N through a distance of 300m in 2 minutes. Find the power he develops, if he pulls the block at a constant speed.
A. $\frac{30 \times 300}{2}$ B. $\frac{30 \times 300}{2 \times 60}$
C. $\frac{30 \times 2 \times 300}{300}$ D. $\frac{300}{2 \times 60 \times 30}$

13. A ball of 1kg bounces off the ground to a height of 2m after falling from a height of 5m, find the energy lost.
A. 5 J B. 20 J
C. 30 J D. 50 J
14. A man weighing 800N climbs a vertical distance of 15m in 30s. What is the average power out put?
A. 80/3 W B. 800/15 W C. 400 W D. 5 kW
15. In which action(s) below is there a work done?
(i) Pushing a wall without moving it.
(ii) Taking a book from a table to a higher shelf.
(iii) Walking on a bridge for 50 m
A. (i) only B. (ii) only
C. (iii) only D. (ii) and (iii) only
16. A bullet of mass 5g is fired at a speed of 400ms^{-1} . How much energy does it have?
A. $\frac{1}{2} \times 5 \times 10^2 \times 400\text{J}$ B. $\frac{1}{2} \times 5 \times 10^3 \times 400\text{J}$
C. $\frac{1}{2} \times 5 \times 10^{-3} \times 400 \times 400\text{J}$ D. $\frac{1}{2} \times 5 \times 10^2 \times 400 \times 400\text{J}$
17. Which of the following forms mechanical energy?
A. Electrical energy and kinetic energy
B. Potential energy and nuclear energy
C. Nuclear energy and kinetic energy D. Potential energy and kinetic energy
18. An object, of mass 2kg, dropped from the top of a building hits the ground with kinetic energy of 900J. The height of the building is
A. 30m B. 45m C. 90m D. 180m.
19. A mass attached to the end of a string moves up and down to maximum and minimum points X and Y as shown in the figure below. When the mass is at X the



- A. kinetic energy is maximum, potential energy is minimum
- B. kinetic energy is zero, potential is maximum
- C. kinetic energy is equal to potential energy
- D. kinetic energy and potential energy are both zero

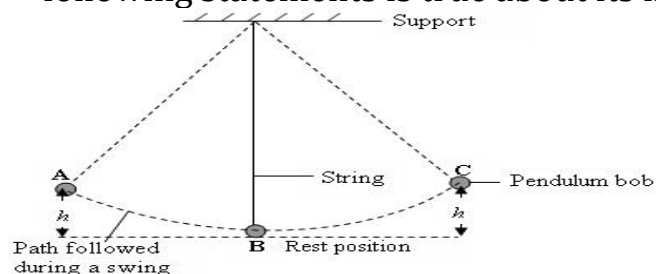
20. An electric motor of power 500 watts lifts an object of 100 kg. How high can the object be raised in 20 sec?

- A. 40m B. 30m C. 20m D. 10m

21. A motor can pull a 400 kg box up to a height of 10m in 4 sec. What is the power of the motor in kW?

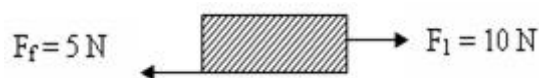
- A. 10 B. 20 C. 30 D. 40

22. The diagram in the figure 3 shows an oscillation pendulum bob. Which of the following statements is true about its motion?



- A. the K.E at B is equal to the K.E at A
- B. the K.E at B is less than the P.E at A
- C. the K.E at B is equal to the P.E at A.
- D. the K.E at B is greater than the P.E at Z.

23. A toy car is pulled with a force of 10 N for 5m. If the friction force between the block and the surface is 5N, what is the net work done on the toy car?

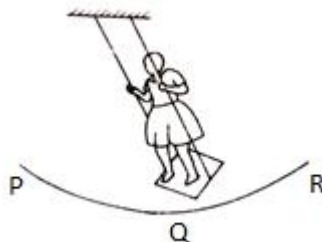


- A. 50 J B. 100 J C. 200 J D. 25 J

24. Allen and Vanessa move identical boxes equal distances in a horizontal direction. Since Allen is a weak child, the time needed for her to carry the box is two times longer than for Vanessa. Which of the following is true for the two girls.

- A. Allen does less work than Vanessa.
- B. Vanessa does less work than Allen.
- C. Each does the same work.
- D. Neither Allen nor Vanessa do any work

25. The below figure shows a child on a swing. The child will have;

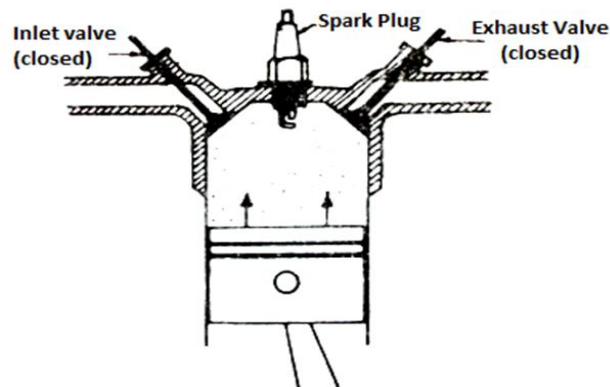


- A. maximum potential energy at P and R
- B. Maximum potential energy at Q
- C. maximum kinetic energy at P
- D. No kinetic energy at Q

26. Which of the following represents the firing order of a four-stroke petrol engine?

- A. exhaust, inlet, compression and power strokes
- B. inlet, power, compression and exhaust strokes
- C. power, compression, inlet and exhaust strikes
- D. inlet, power, exhaust and compression strokes

27. The diagram above shows part of a combustion engine. What is the likely stroke in the cycle?



- A. Inlet stroke
- B. Power stroke

- C. Exhaust stroke D. Compression stroke

28. The energy changes that take place when a stone falls freely from rest to the ground can be orderly arranged as:

- A. Kinetic energy → Potential energy → Sound energy → Heat.
B. Sound energy → Potential energy → Kinetic energy → Heat.
C. Potential energy → Sound energy → Kinetic energy → Heat.
D. Potential energy → Kinetic energy → Heat energy → Sound.

29. In a four stroke internal combustion engine, the work required for initial induction and compression comes from the:

- A: movement of the steering wheel
B: rotation k.e. stored in the fly wheel
C: sparking plug
D: separate starter motor

30. A car is driven along a level road. The total energy input from the petrol is 60kJ, and the car wastes 45kJ of energy.



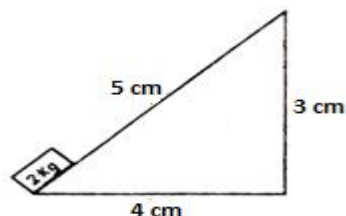
What is the efficiency of the car?

- A.15% B.25% C. 45% D. 75%

31. A ball of 1kg bounces off the ground to a height of 2m after falling from a height of 5m, find the energy lost.

- A.5 J B.20 J C.30 J D.50 J

32. A brick of mass 2kg is lifted to a height of 3m along a smooth, inclined plane 5m long, as shown above. The work done is



- A. 10J B.60J C. 6J D. 100J

33. A man of mass 50kg climbs 40 steps up stairs. If each step is 0.2m high. The potential energy gained is;

- A. 100J. B. 400J. C. 4000J. D. 20,000J

34. Water flows at a rate of $6.25 \times 10^8 \text{ kg}$ per minute over a waterfall. The height of the waterfall is 108 m. The total power delivered by the water in falling through the 108 m is;

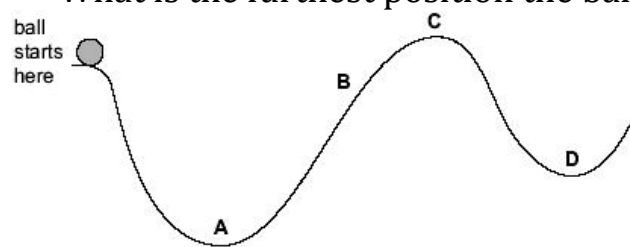
- A. $1.13 \times 10^9 \text{ W}$ B. $1.10 \times 10^{10} \text{ W}$
C. $6.62 \times 10^{11} \text{ W}$ D. $4.05 \times 10^{12} \text{ W}$
E. $3.97 \times 10^{13} \text{ W}$.

35. Which of the following sources of energy is non-renewable?

- (i) Bio fuels
(ii) solar energy
(iii) tidal power

- A. (i) only B. (ii) only
B. C. (ii) and (iii) only D. (i) and (iii) only

36. A ball is released from rest and rolls down a track from the position shown. What is the furthest position the ball could reach?



37. A body of mass 25 kg falls freely from a height of 10 metres to the ground. Calculate its velocity as it hits the ground.

- A. 4.47 ms^{-1} B. 10.0 ms^{-1}
C. 2500 ms^{-1} D. 14.14 ms^{-1}

SECTION B

35. (a) Define the following terms.

- (i) Work. (ii) Power.

(b) State and define the SI units of the terms you have defined above.

(c) A crane lifts a load of 3500 N through a vertical height of 5 m in 5 second. Calculate:

- (i) the work done.
(ii) the power developed by the crane.

36. (a) Define the term energy and state the SI unit for measuring it.

- (b) Distinguish between potential energy and kinetic energy.
- (c) A block of mass 2 kg falls freely from rest through a distance of 3m. Find the kinetic energy of the block.

37. (a) Define a **joule**.

(b) Describe briefly how you can measure your power.

(c) A boy of mass 45 kg runs up a flight of 60 steps in 5 seconds. If each step is 12 cm. Calculate the:

- (i) work done against gravity by the boy.
- (ii) power developed by the boy.

38. (a) (i) State the types of heat engines you know.

(ii) Describe the mechanism of operation of a four stroke petrol engine.

(b) (i) What are the factors that affect the efficiency of an engine?

(ii) State how the factors you have stated in (c) above are minimized in a heat engine.



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1. (a) define the term **Work** and state its **S.I** unit

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(b) (i) Calculate the work done when a force of 9000N acts on a body and makes it move through a distance of 6m.
[W0rk done = 54000J]

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- (i) A block of mass 3kg held at a height of 5m above the ground is allowed to fall freely to the ground. Calculate the work done against gravity.
[Work done = 150J]

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- (ii) A man of mass 80kg runs up a staircase of 10stairs, each of vertical height 25cm. Find the work done against gravity.
[Work done = 2000J]

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- (iii) A crane is used to raise 20 tonnes of concrete to the top floor of a building 30m high. Calculate the total work done by the crane.
[Work done = 6, 000,000J]

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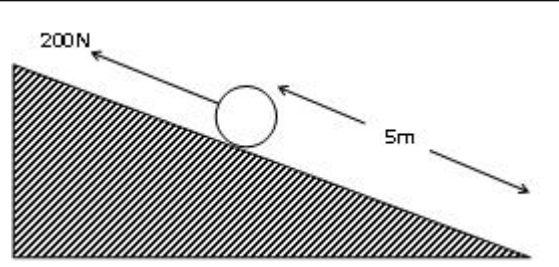
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- (ii) The figure bellow shows a bale of hay being pulled up an inclined plane with a force of 200N. The bale moves down the incline to a distance of 5m.

	(i) Calculate the work done by the force. [Work done= -1000J]

(ai) Explain your answer.

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(iii) An athlete of 80 kg moving at 5ms^{-1} , slides trough a distance of 10m before stopping in 4 seconds. Find the work done by friction on the athlete.

ENERGY

1. (a) Define the term **energy** and state its S.I unit

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(b) What is meant by Sources of energy?

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(c) State the advantages and disadvantages of the types of energy sources.

Type of energy source and examples	Advantage	Disadvantage
(i) Renewable sources of energy		
(ii) Non-renewable sources of energy		

Forms of energy

(c) Energy can exist in the different forms explain the major forms of energy;

(i) Chemical energy:

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(ii) Electrical energy (Electricity):

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(iii) Light energy:

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(iv) Heat energy:

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(v) Sound energy:

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(vi) Mechanical energy:

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(d) Distinguish between **Potential** energy and **kinetic** energy

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(e) State the **principle of conservation of energy**:

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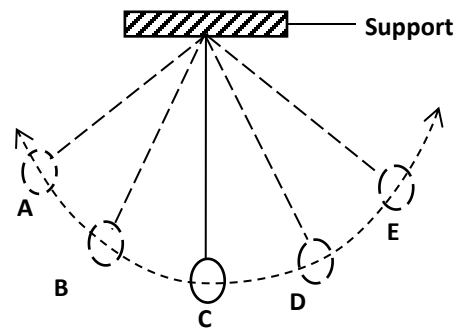
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(f) As energy is changed from one form or state to another, an energy converter (Device) is required to ease the conversion. List examples of such devices in the table below.

Energy Change	Converter	Energy Change	Converter
Chemical to electrical		Electrical to sound	
Light to Electrical		Sound to Electrical	
Electrical to light		Electrical to Kinetic	
Electrical to heat		Kinetic to Electrical	
Heat to Electrical			

(j) A body of mass , m at a height h above the ground, has a potential energy,
P.E = mgh. At this point, the velocity of the body is 0ms^{-1} hence it has no kinetic energy.

(ii) The figure below shows a swinging pendulum. Explain the energy transformations as the bob falls from the left through the central position, to the right.



(h) A ball of mass 200g falls freely from a height of 20m above the ground and hits a concrete floor and rebounds to a height of 5m. Given that $g = 10\text{ms}^{-1}$, find the;

i) P.E of the ball before it fell.

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ii) Its K.E. as it hits the concrete .

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iii) Velocity with which it hits the concrete.

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iv) K.E as it rebounds .

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v) Velocity with which it rebounds.

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vi) Velocity when it has fallen through a height of 15m.

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POWER

1. (a) Define **Power** and state its S.I unit.

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(b) Define the following terms;

(i) a **newton**

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(ii) a **joule**

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(iii) a **watt**

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2. (a) An engine raises 20kg of water through a height of 50m in 10 seconds.
Calculate the power of the engine.

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- (b) An electric bulb is rated 100W. How much electrical energy does the bulb
consume in 2hours.

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- (c) A man uses an electric motor whose power output is 3000W for 1hour. If
the motor consumes 1.44×10^7 J of electricity in that time, find the efficiency of
the motor.

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(d) An effort of 250N raises a load of 1000N through 5m in 10 seconds. If the velocity ratio is five, Calculate the:

i) Power input.

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ii) Efficiency.

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(e) A pulley system of V.R six is used to lift a load of 250N through a distance of 3m. If the effort applied is 50N, calculate how much energy is wasted.

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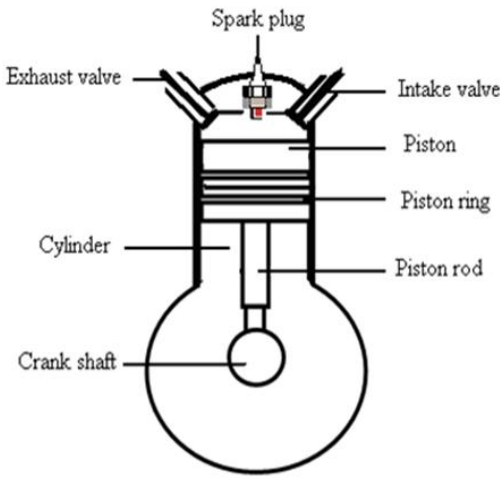
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(f) The figure below shows the four stroke petrol engine. State the major events that occur during each stroke

	(i) Intake. (ii) Compression (iii) Power stroke (i) Exhaust stroke

(g) State any four differences between a petrol engine and a diesel engine

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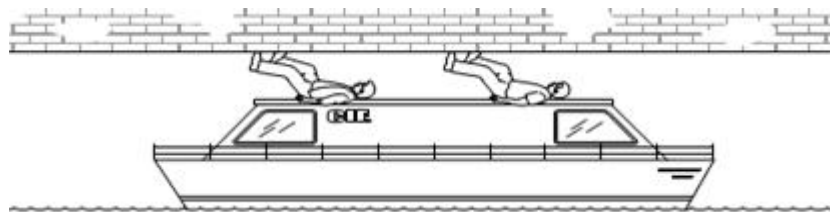
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3. The figure below shows a boat stationary in still water in a narrow tunnel. To move the boat, two men lie on the top of it and push against the tunnel roof with their legs. They exert a total forwards force of 1680 N on the boat.



- (a) The men push the boat 50.0 m to the end of the tunnel. Calculate the work done on the boat by the men.

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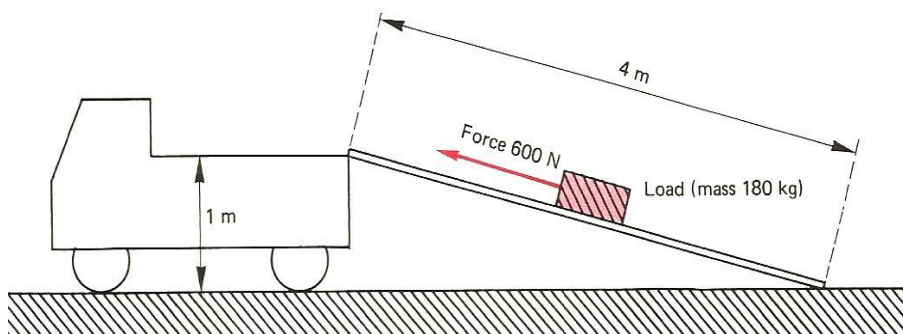
- (b) Explain why the kinetic energy of the boat at the end of the tunnel is less than the work done on the boat by the men.

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4.



The figure above shows a ramp used to get a load which has a mass of 180kg. onto a lorry. The ramp is 4m long and the end of the lorry is 1m above the ground. A force of 600N is needed to pull the load up the ramp. Calculate

(a) The gravitational potential energy gained by the load as it goes from the bottom to the top of the ramp. (02mks)

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(b) The work done by the 600N force in pulling the load up the ramp. (02mks)

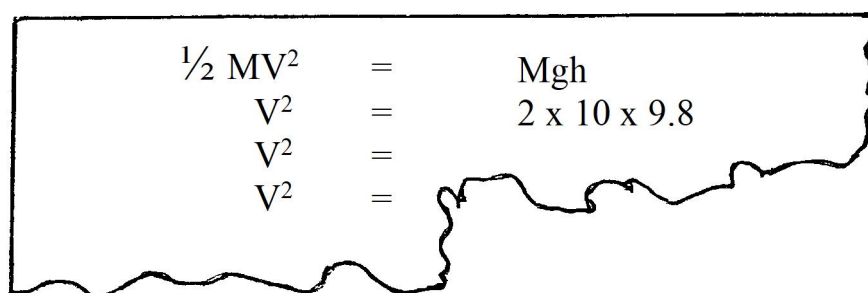
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5. Allan was calculating a problem about the energy of a falling object. After he had completed the calculation, his younger sister Rose used the paper on which he had done the work to light a charcoal stove. The piece of paper which remained is shown below.


$$\begin{array}{rcl} \frac{1}{2} MV^2 & = & Mgh \\ V^2 & = & 2 \times 10 \times 9.8 \\ V^2 & = & \\ V^2 & = & \end{array}$$

- a) From what distance did the object fall?
(01 mark)

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- b) What does M stand for?
(01mark)

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- c) What is the value of V?
(02marks)

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7. An arrow of mass 25g is released from a bow with a kinetic energy of 31.25J. The energy transferred from the bow to the arrow is 60% of the energy stored in the stretched bow. Find the,

- (i) Initial velocity of the arrow.

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- (ii) Energy stored in the stretched bow.

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8. A girl of mass 40kg runs up a staircase in 16 seconds. If each stair is 20cm and she uses 100Js^{-1} , find the number of stairs in the staircase.

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9. A crane can lift 600kg through a vertical height of 12m in 16 seconds.

(i) Find the power output of the motor driving the crane.

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(ii) If the motor is 80% efficient, what is the power in put required?

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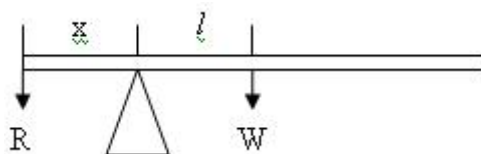
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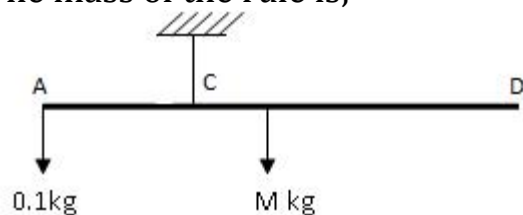
MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

1. The Figure shows a uniform beam in equilibrium when a force R acts on it at one end. Find the weight W of the beam.



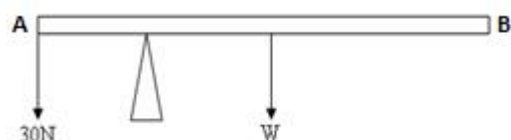
- A. $\frac{x}{Rl}$ B. $\frac{Rl}{x}$ C. $\frac{l}{Rx}$ D. $\frac{Rx}{l}$

2. The diagram in the figure shows a uniform half-meter rule suspended at point C. The mass of the rule is;



- A. .020 kg B. 0.025 kg C. 0.100 kg D. 0.125 kg

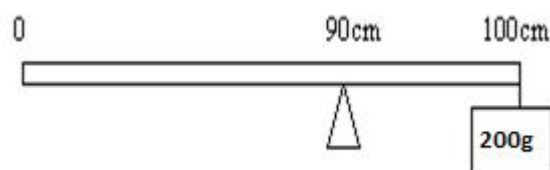
3. A uniform wooden beam of weight W is pivoted at a distance $\frac{1}{5}$ of its length from the end A and kept in equilibrium by applying a force of 30 N as shown in figure below.



The force exerted by the pivot on the beam is;

- A. 50 B. 40 C. 30 D. 20

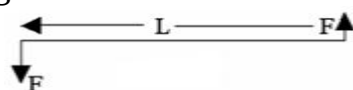
4. A uniform rod 100cm long pivoted at the 90 cm mark, balances horizontally when a mass of 200 g is suspended at the 100cm mark as shown in the figure.



The mass of the rod is;

- A. 40 g B. 50 g C. 400 g D. 800 g

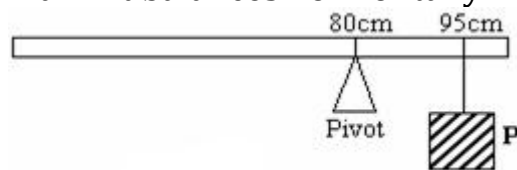
5. Which one of the following statements is true about two equal forces acting on a bar of length L shown in the figure below.



- (i) The resultant force on the bar is zero.
- (ii) The forces cause a rotational effect.
- (iii) The forces act in opposite directions.
- (iv) The forces produce different turning effects.

- A. (i) only B. (i) and (ii) only
C. (i),(ii) and (iii) only D. All

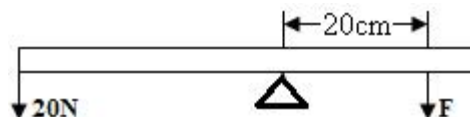
6. The figure below shows a uniform metre rule of mass 0.1kg pivoted at the 80 cm mark. It balances horizontally.



When a mass P is hanging at the 95 cm mark. Find P .

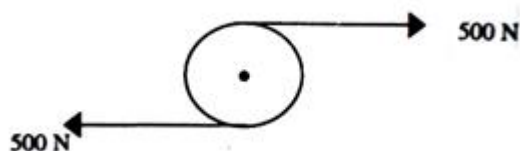
- A. 0.08 kg B. 0.2Kg C. 0.4 kg D. 1 kg

7. A uniform metre-rule is pivoted at its centre shown in the figure. If the rule is in equilibrium, find value of F .



- A. 4 N B. 33.3 N C. 50 N D. 100 N.

8. The shaft in an engine is subjected to two parallel but opposite forces of 500N each as shown in the figure.

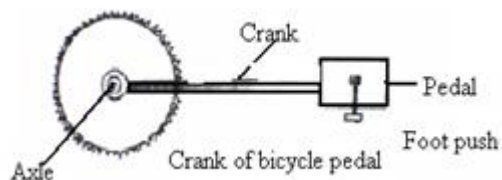


The rotation is best stopped by applying

- A. Two forces of 500 N acting at right angles to each other
B. A single force of 1000 N.
C. Two parallel but opposite forces of 500 N
D. A single force of 250 N.

9. The above figure shows a crank of a bicycle pedal.

The force a cyclist exerts on the pedal varies from a minimum to maximum.



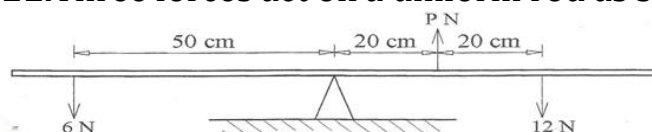
When does the cyclist exert maximum turning effort?

- A. crank makes 90° with the foot push
B. crank makes 0° with the foot push
C. cyclist is climbing a hill
D. cyclist is turning a corner

10. Find the weight, w , of a uniform metre rule if a force of 60N at one end balances it as shown figure.

- A. 24 N B. 40 N C. 90 N D. 100 N

11. Three forces act on a uniform rod as shown in figure.



If the rod balances horizontally, determine the value of p

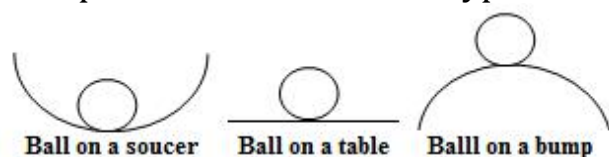
- A. 3N B. 9N C. 16N D. 24N

12. It is easier to use a claw hammer to remove a nail from a piece of wood if the handle is longer because the;

- A. effort applied becomes bigger.
B. turning effect becomes bigger
C. anticlockwise moments will balance clockwise moments.
D. fulcrum is between the effort and the load.

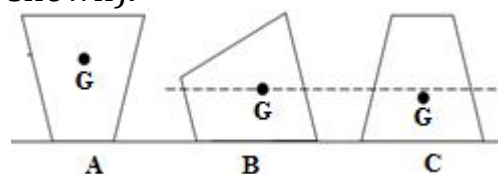
13. A pole AB of length 10.0m and weight 800N has its center of gravity 4.0m from the end A and lies on a horizontal ground. The end B is to be lifted by a vertical force applied to B. Calculate the least force required to do this.

14. The Figure below shows a ball resting on different shaped surfaces. They represent three different types of equilibrium, which are



	Ball on a saucer	Ball on a table	Ball on a bump
Stable	Stable	Neutral	Unstable
Unstable	Unstable	Neutral	Stable
Neutral	Neutral	Stable	Unstable
Unstable	Unstable	Stable	Unstable

15. An object can be placed in 3 different position on a table. Assume object has uniform thickness (not shown).



a) State 2 reasons why Position A is more unstable than Position C.

16. An object in unstable equilibrium continues to fall when slightly displaced because its;

- (i) Centre of gravity is lowered.
(ii) Center of gravity is raised.
(iii) Potential energy is reduced

(iv) Potential energy is increased.

A (i), (ii) and (iii) only. B. (i) and (iii) only. C. (ii) and (iii) only D. (iv) only

17. Two weights are balanced on a rule of negligible mass as shown above. What is the value of W?

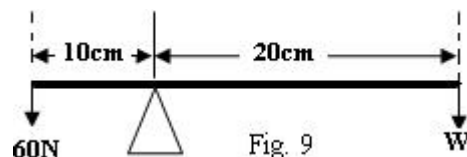
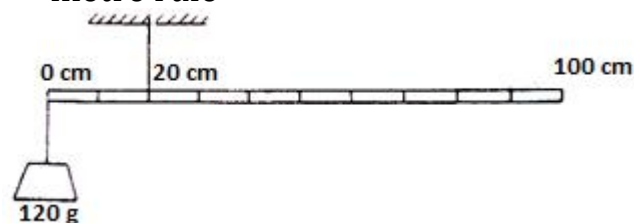


Fig. 9

A. 2.5N B. 10N C. 30N D. 40N

18. A uniform metre rule is suspended with a string at the 20cm mark and is kept horizontal by a mass of 120g from one end as shown above. Find the mass of the metre rule



A. 80g B. 30g C. 24g D. 120g

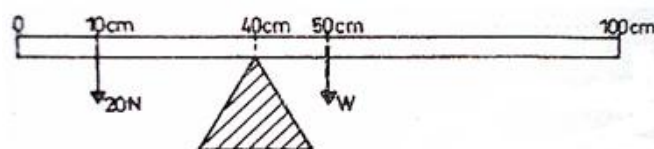
SECTION B

17. (a) (i) Define moment of a force and state its SI unit.

(ii) State the principle of moments.

(iii) State the conditions for a body to be in equilibrium.

(b) A uniform meter ruler is pivoted at the 40 cm mark as shown in the figure below.



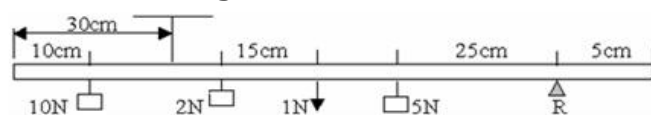
The meter ruler is in equilibrium under its weight W and a 20 N force acting at the 10 cm mark. Calculate:

- (i) The weight W of the metre rule.
(ii) The reaction at the knife edge.

18. (a) Describe an experiment to determine the centre of gravity of an irregular lamina.

(ii) Describe how you would measure the mass of a metre rule using a known mass and a knife-edge only.

(c) If the metre is in equilibrium when weights of 10N, 2N and 5N are attached to it as shown in figure below.



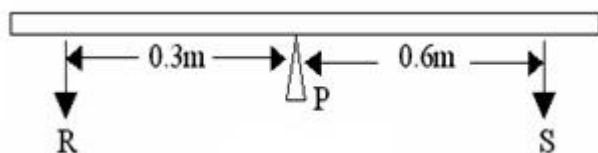
Calculate the: (i) Tension in the string.
(ii) Normal reaction, R, at the wedge.

19. (a) State the (i) types of equilibrium.
(ii) Characteristics associated with the types of equilibrium you have stated in (a) (i) above.

(b) Explain giving reasons whether it is advisable to load a bus on the rack.

(c) Describe how you would design a given structure to have a high stability.

(d) A uniform beam of weight 2.5 N is pivoted at its mid-point P, as shown in figure below.



The beam remains in equilibrium when force R and S act on it. If R is 5N, find the:

(i) Value of S. (ii) Reaction at the pivot

20. A uniform rod AB of length 5cm is suspended at 2m from end A. if the mass of the rod is 10kg. Calculate the mass of the body, which must be suspended at 1m from end A so as for the rod to balance horizontally.



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21. A uniform wooden beam of length 2m and weight 34N rests on two supports A and B placed at 40cm from either end of the beam. Two weights of 40N and 50N are suspended at the end of the beam.

- (i) Draw a diagram to show the forces acting on the beam.
(ii) Calculate the reactions at the supports.

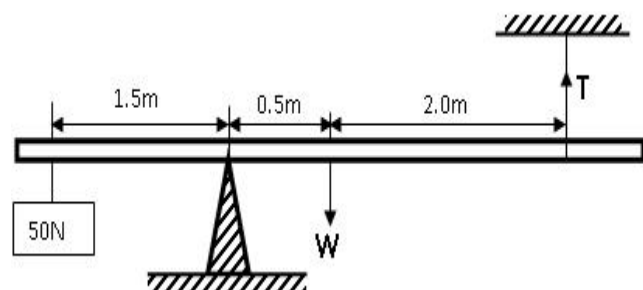
22. A truck of weight 20KN is driving across a uniform 50m long bridge of weight 500KN as shown below. Find the reactions on the wedges.

23. (i) What is meant by **centre of gravity** of a body?

(ii) Given a uniform metre rule, a known mass M_0 , a knife edge and a piece of thread, describe how the mass of the metre rule can be determined. (04 mark)

b) (i) State the conditions for a body to be in equilibrium.

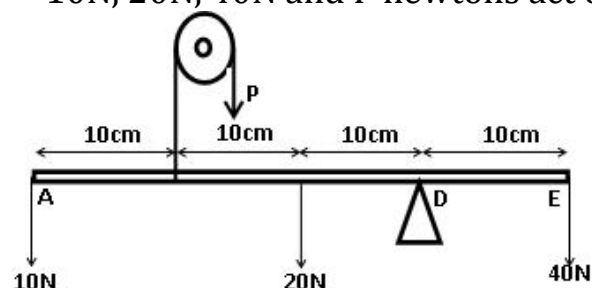
(ii) A uniform beam of weight 500N is made to balance horizontally on a knife edge by a string tied near one end and a weight of 50N hanged near the other end as shown below.



If the weight of the beam is W , find the tension and the reaction of the knife edge on the beam. (04 mark)

24. (a) Briefly describe a simple experiment to determine the mass of a metre rule using a knife edge, a metre rule and a known mass only.

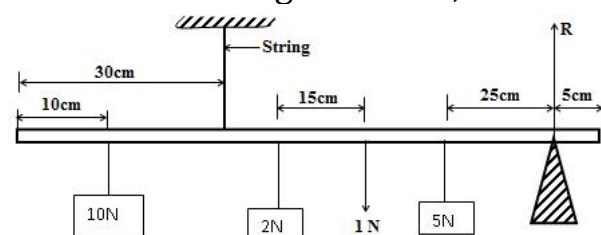
25. (b) A rod AE of negligible weight, 40cm long, is pivoted at point D. Weights of 10N, 20N, 40N and P newtons act on the rod as shown bellow.



Find the value of P and the reaction at pivot D.

26. A uniform metre rule of weight 1N is pivoted on a wedge 5cm away from one end and suspended by a string 30cm from the other end.

If the metre rule is in equilibrium when weights of 10N, 2N and 5N are attached to it as shown in the figure below,



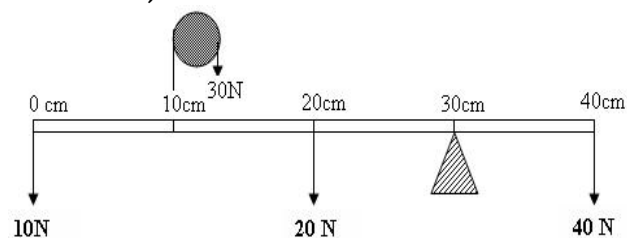
calculate the:

- (i) Tension in the string.
- (ii) Normal reaction, R at the wedge.

27. A uniform half-metre rule is freely pivoted at the 20 cm mark and it balances horizontally when a weight of 10 N is suspended at the 4 cm mark.

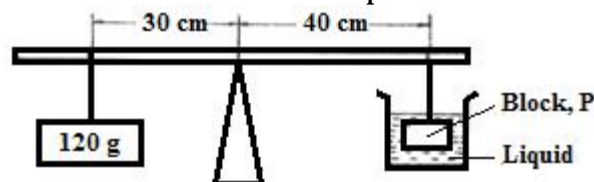
- (a) Draw a sketch diagram showing all the forces acting on the metre rule.
(b) Calculate:
(i) the weight of the metre rule.
(ii) the reaction at the knife edge.

28. Four forces, 10 N, 20 N, 40 N, act downward and 30 N acts upward on a body which is 40 cm long. The 10 N is hung at 0 cm mark, the 30 N acts at 10 cm mark, 20 N acts at 20 cm mark and 40 N acts at 40 cm mark. If the knife edge is placed at 30 cm mark, calculate the resultant moment on the body.



(Ans: 5 Nm acting in a clockwise direction)

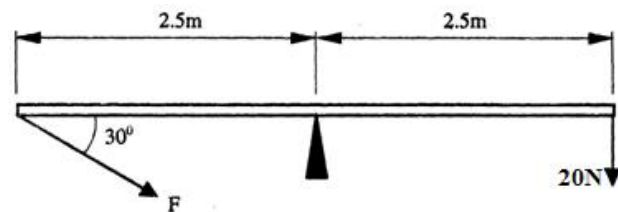
29. A uniform beam is pivoted at its centre



A mass of 120g is suspended at 30cm from the centre of the beam. The beam remains horizontal when a block P suspended at the 40cm mark from the centre of the beam, is immersed in a liquid of density 800kgm^{-3} as shown above. If the volume of the liquid displaced by the block is 10cm^3 , find the;

- (i) mass of the liquid displaced.
(ii) weight of P in air.

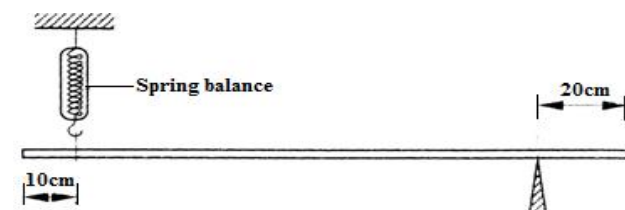
30. The figure shows a uniform bar in equilibrium under action of two forces.



Determine the value of F.

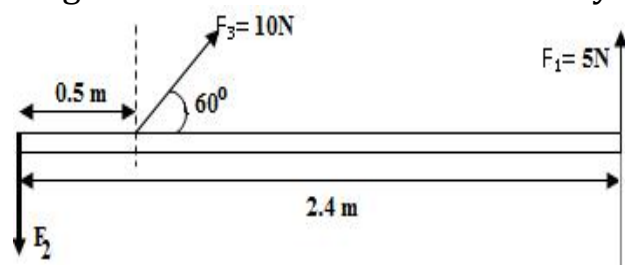
(03marks)

31. The figure below shows a uniform bar of length 1.0m pivoted near one end. The bar is kept in equilibrium by a spring balance as shown below.

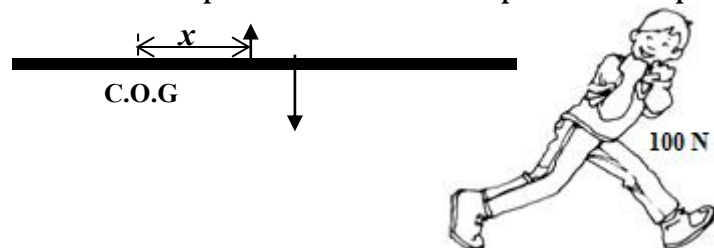


Given that the reading of the spring balance is 0.60N, determine the weight of the bar. (03marks)

32. The forces F_1 , F_2 and F_3 act on a uniform light bar as shown. sketch on the same diagram the fourth force F_4 necessary to keep the bar in equilibrium. (01mark)



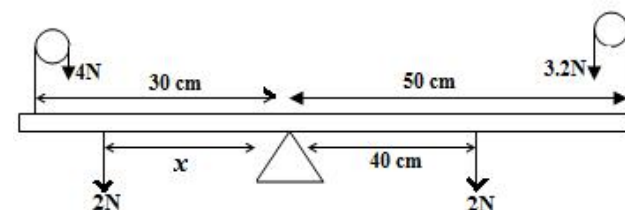
33. Mr. Bagira carried a uniform post of weight 200N horizontally on his shoulder as shown in the figure. He placed the post on his shoulder such that the centre of gravity, C.O.G is x cm behind him. He balanced the post by applying a downward force of 100N at a point 50cm on the part of the pole in front of him as shown.



Determine the value of the distance x . (03marks)

34. A boy of mass 40kg sits at a point 2.0 m from the pivot of a see-saw. Find the weight of a girl who can balance the see-saw by sitting at a distance of 3.2m from the pivot. (02marks)

35. The figure below shows a system at equilibrium under several forces. Find distance x . (03marks)



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1. (a) Define **the moment of a force** and state its S.I unit.
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- (iii) Explain why it is easier to close the door by pushing it at a point as far away from the hinges as possible.
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(iv) State the **principle of moments**.

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(v) State the conditions necessary for a body to be in equilibrium under action of coplanar forces.

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(vi) Briefly describe an experiment to verify the principle of moments.

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(h) A metre-rule suspended from the centre of gravity is in equilibrium, i.e balanced at G, when forces of W_1 , W_2 and W_3 , act at distances of a, b and c respectively from the pivot.

(i) Draw a labeled diagram to show all the forces acting on the metre-rule.

(ii) Write an expression for the sum of the moments.

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(iii) A uniform metre rule is pivoted at its centre and three forces of 6N, 2N and F act at distances of 20cm, 60cm, and 80cm respectively from the zero mark. If the metre rule balances horizontally, find the value of F.

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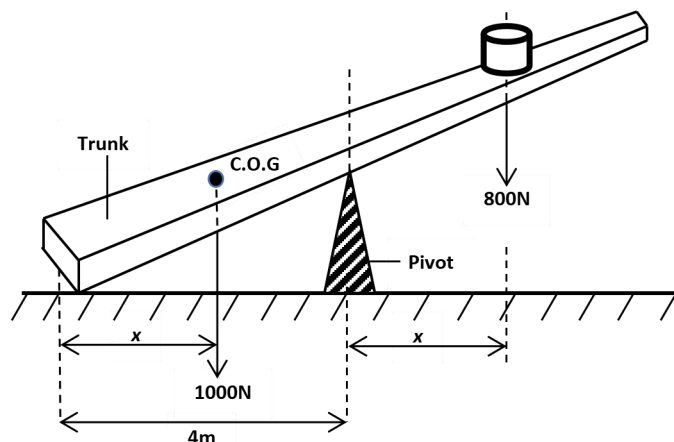
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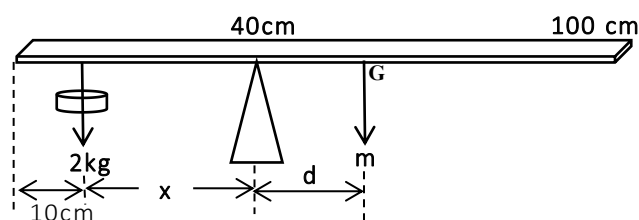
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(J) A non-uniform tree trunk of weight 1000N is placed on a pivot, 4m from the thick end. A weight of 800N is placed on the other side of the pivot, at a distance equal to that from the thick end to the centre of gravity, just tips off the tree trunk. How far is the weight from the thick end?



(k) A uniform metre rule is suspended from 40cm marking as shown in the diagram below. Find the mass of the metre rule if it's in equilibrium. [60kg]



(l) A uniform metre rule pivoted at 10cm mark balance when a mass of 400g is suspended at 0cm mark. Calculate the mass of the metre rule.

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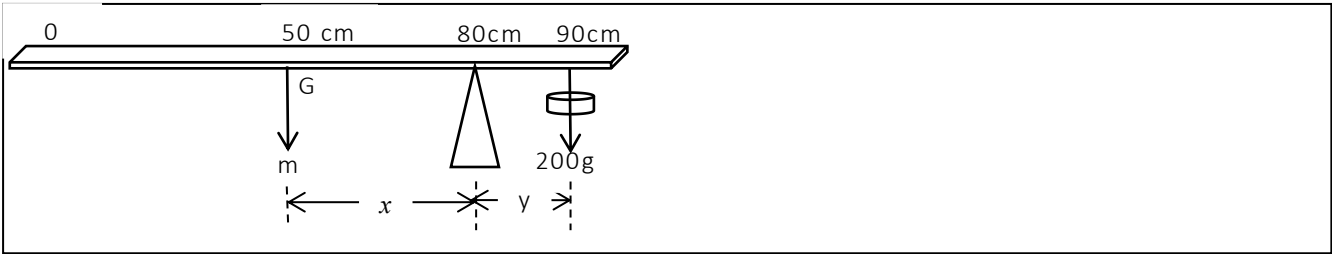
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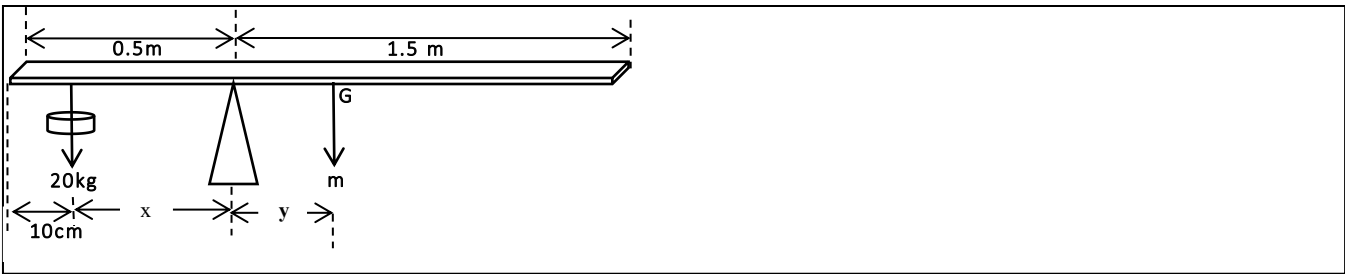
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(m) The diagram below is a metre rule pivoted at 80cm mark. Calculate the mass of the metre.



(n) A uniform beam 2m long is suspended as shown below. Calculate the mass of the metre.



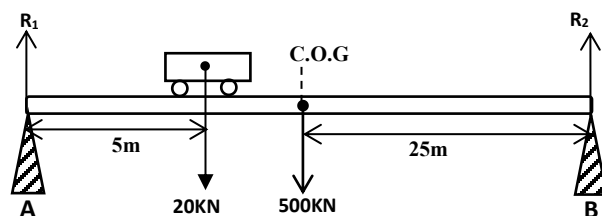
(o) A uniform metre rule is pivoted at 30cm mark. It balances horizontally when a body of mass 20g is suspended at 25cm mark.

a) Draw a force diagram for the arrangement.	a) Calculate the mass of the metre rule.

(p) A uniform half-metre rule is pivoted at 15cm mark and balances horizontally when a body of 40g is hanging from 2cm mark.

a) Draw a force diagram for the arrangement.	b) Calculate the mass of the metre rule

(q) Two labourers “A” and “B” carry between them a load of 500N on a uniform pole of weight 50N. if the pole is 2m long, and the load is 50cm from A towards B.



a) Find the tension on A and B:

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b) Find the fraction of the total weight that is supported by B.

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(c) A uniform rod of mass 10 Kg and length 3.2m is placed horizontally across smooth supports A and B. If A is 20cm from one end and B is 100 cm the other end. Find the reaction at the supports A and B.

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(d) A pole AB of length 10.0 m and weight 800N has its centre of gravity 4.0 m from end A and lies on a horizontal ground. The end B is lifted by a vertical force applied at B. Calculate the least force required to do this.

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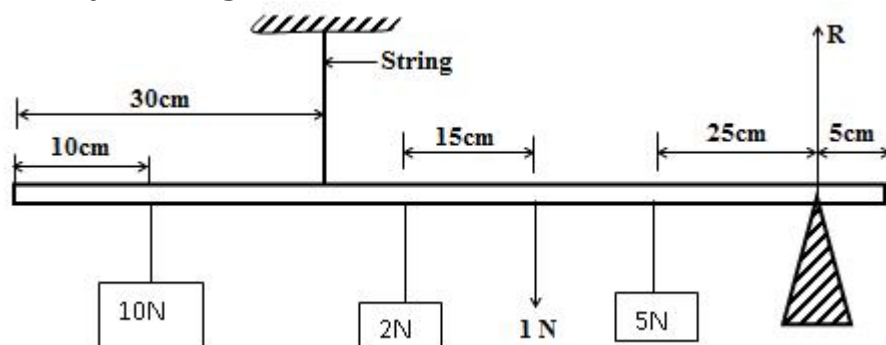
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(e) A uniform metre rule of weight 1N is pivoted on a wedge 5cm away from one end and suspended by a string 30cm from the other end.



If the metre rule is in equilibrium when weights of 10N, 2N and 5N are attached to it as shown in the figure, calculate the:

(iii) Tension in the string.

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(iv) Normal reaction, **R** at the wedge.

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2. (a) What is meant by **Centre of gravity**?

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(b) Briefly describe an experiment to determine the centre of gravity of an irregularly shaped object (lamina)

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(c) Define **stability** of a body.

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(d) State three ways of increasing the stability of a body

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e) Explain the following forms/states of equilibrium.

Type of equilibrium	Explanation
(i) stable equilibrium	
(ii) unstable equilibrium	
(i) neutral equilibrium	



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SECTION A

1. Which one of the following are true for simple machines?

(i) If there is a gain in force, there is a loss in distance.

(ii) The mechanical advantage is the ratio of the load to the effort.

(ii) There is a gain in work.

- A. (i) and (ii) B. (ii) and (iii)
C. (i) and (iii)
D. (i), (ii) and (iii)

2. Which one of the following below is an example of a 3rd class lever?

A. tweezers B. equal –arm balance

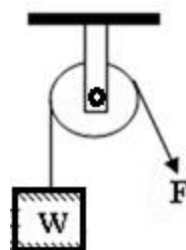
C. see- saw D. fixed pulley

3. The system that uses fixed and movable pulleys is called

A. windlass B. inclined plane

C. block and tackle D. lever

4. Which one of the following describes the type of pulley, and the lever that the pulley represents.



- A. Fixed pulley - 1st class
B. Fixed pulley - 3rd class
C. Movable pulley - 2nd class
D. Movable pulley - 3rd class

5. In a windlass, which changes decrease the force needed to pull up the load

(i) Increasing the radius of the wheel.

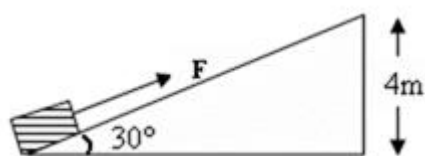
(ii) Decreasing the radius of the wheel

(ii) Decreasing the radius of the axle.

- A. (i) and (ii) only B. (i) and (iii) only
C. (ii) only D. (iii) only

6. A force F is acting on a block of mass 2 kg to push it

on an inclined plane. If F = 5 N, what is the length of the plane?



- A. 4 m B. 8 m C. 12 m
D. 16 m

7. A screw of length 5 cm enters totally into a wooden block after 25 turns. What is the pitch of the screw?

- A. 0.1 cm B. 0.2 cm
C. 0.4 cm D. 0.5 cm

8. The maximum efficiency that can be obtained with four pulleys and a mechanical advantage of 3 is?

- A. 100% B. 75%
C. 12% D. 1.33%

9. Calculate the effort when a load of 72 N is raised using a block and tackle system of 5 pulleys and efficiency 80%.

- A. 11.52N B. 18N
C. 57.6N D. 288N

10. The block and tackle system in the figure has an efficiency of 80%. The load, which can be lifted by an effort of 10N, is

- A. 4N B. 8N C. 40N D. 50N

11. A machine which is 80% efficient is run by an engine with an output of 40 watts. The time taken to raise a load of 1500 N through 0.15 m may be

- A. 4.5s B. 5.6 s
C. 7.0s D. 28.1s

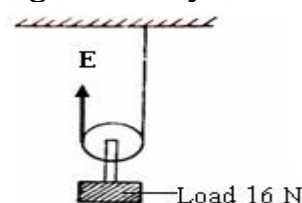
12. Which of the following statements is true of a wedge used as a simple machine?

- A. Very small force is required to lift a big load.
B. Work done is always so much.
C. Effort on the wedge is applied vertically.
D. There is no frictional force.

13. Calculate the effort when a load of 72 N is raised using a block system of 5 pulleys and efficiency 80%.

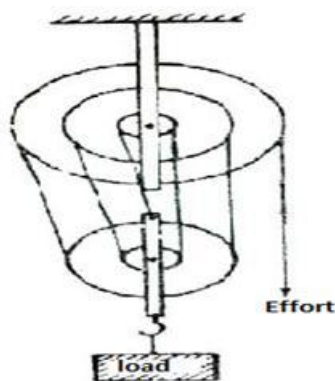
- A. 11.52N B. 18N
C. 57.6N D. 288N

14. The figure shows a light, smooth pulley used to lift a load of 16 N with an effort E. The mechanical advantage of the system is



- A. 128 B. 2 C. 1
D. $\frac{1}{2}$

15. The block and tackle pulley system in the above figure has an efficiency of 80%. The load which can be lifted by an effort of 10N is



- A. 4N B. 8N C. 40N
D. 50N

16. Which one of the following is not a correct formula for calculating velocity ratio?

A. $V.R = \frac{1}{h}$ B. $V.R = \frac{\text{Load distance}}{\text{Effort distance}}$

C. $V.R = \frac{R}{r}$

D. $V.R = \frac{\text{No. of teeth on driven wheel}}{\text{No. of teeth on driving wheel}}$

SECTION B

16. (a) What is meant by a **first class lever**?

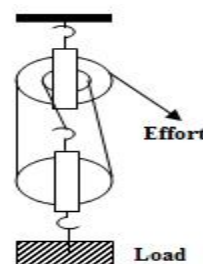
(b) Give two examples of first class lever.

(c) By means of a lever, an effort of 50 N moves a load of 200 N through a distance of 3m. If the effort moves a distance of 16 m, calculate:

- (i) the mechanical advantage
(ii) the efficiency of the system.

17. (a) Define **efficiency** of a machine.

(b) The diagram in the figure below represents a pulley system in which an effort E is applied to raise the load.



(i) Copy the diagram and indicate the forces acting on the string

(ii) Find the velocity ratio of the system?

(iii) How far will the load move if the effort moves 2.4m.

(iv) What effort would just raise a load of 960 N, if the mechanical advantage is 2.4?

(v) Use your results above to calculate the efficiency of the pulley system.

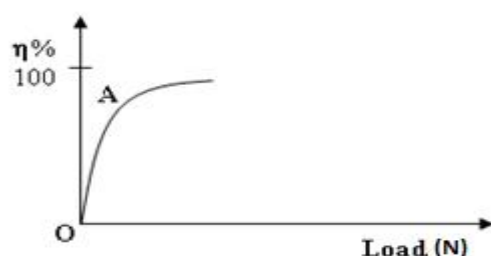
(c) (i) Draw a sketch graph to show how the mechanical advantage of the pulley system in (b) varies with the load.

(ii) Explain the features of the sketch in (c) (i).

(d) Give two practical examples where pulley systems are used.

19. (a) Draw a labeled diagram to illustrate the lever principle as applied to a wheelbarrow.

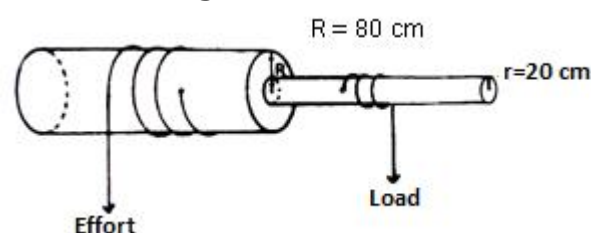
(b) The graph in the figure shows the variation of the efficiency of a pulley system with load.



(c) Explain why:

- (i) Part OA of the graph is almost a straight line
- (ii) From A, the graph curves and finally levels off before reaching 100%.

19. The figure 8.25 shows a wheel and axle system. When an effort of 300 N is applied, a load of 900 N is raised through a distance of 1.0 m.



Calculate;

- (a) the velocity ratio
- (b) the efficiency of the system

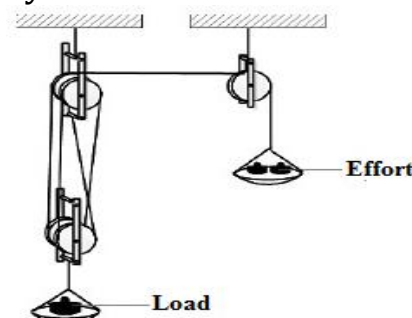
21. (a) State what is meant by each of the following terms as applied to simple machines:

- (i) Mechanical advantage
- (ii) Pitch

(b) (i) Give two reasons why the efficiency of any simple machine is always less than 100%.

- (ii) Give two ways in which the efficiency of a Machine can be increased.

(c) The figure shows a load of 10 N raised slowly by a simple frictionless pulley system.



(i) What is the velocity ratio of the system?

(ii) Calculate the effort required to lift the load if the mass of the pulley is 0.2 kg.

(iii) Explain what happens to the efficiency of the system if the;

- (a) Load is less than 2N
- (b) Load is more than 2N

(iv) If the load is raised through a distance of 5 m in 5 s, calculate the efficiency of the system.

23. A smooth wooden board 3.6 m long is used to raise a box of 600 N to a height of 1.2 m.

Calculate:

- (a) The effort required
- (b) The M.A of the system.

24. A pulley system has two pulleys on the bottom block. A load of 1000N is hung from the bottom block, it is found that an effort of 300N is needed to raise the load.

(i) How much energy is supplied, if the effort moves through 5m?

(ii) If the effort moves through 5m, find how far the load rises.

(ii) Find how much energy is gained by the load if the effort moves through 5m.

25. A pulley system of velocity ratio 3 is used to lift a load of 100N. The effort needed is found to be 60N.

(a) Draw the arrangement of the pulley system.

(b) Calculate the efficiency of the system.

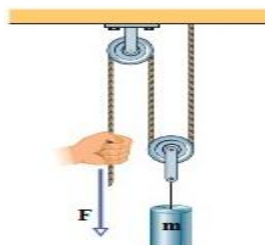
26. The following results were recorded in an experiment to using a set of pulleys.

L(N)	2	5	7	10	12	15	17	20
E(N)	5	0	5	0	5	0	5	0
E(N)	2	3	5	68	82	92	10	12
N)	0	8	4				6	0

(a) Plot a graph of **L** against **E**.

(b) Find the slope of your graph and state what it signifies.

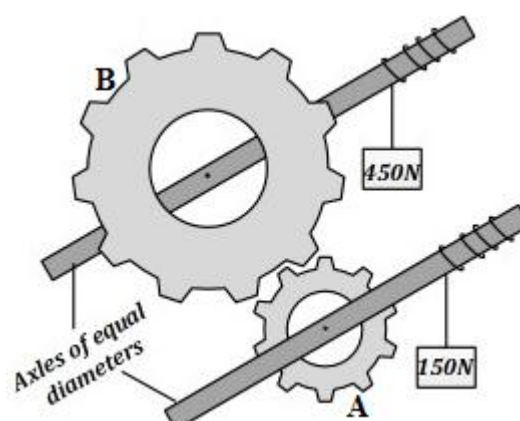
(c) A cord runs around two mass less, frictionless pulleys. A canister with mass m 20 kg hangs from one pulley, and you exert a force F on the free end of the cord.



(i) What must be the magnitude of **F** if you are to lift the canister at a constant speed?

(ii) To lift the canister by 2.0 cm, how far must you pull the free end of the cord? During that lift, what is the work done on the canister by your force (via the cord) and the gravitational force? (Hint: When a cord loops around a pulley as shown, it pulls on the pulley with a net force that is twice the tension in the cord.)

20. Two gear wheels A and B with 80 and 20 teeth respectively lock into each other. They are fastened on axles of equal diameters such that a weight of 150 N attached to a string wound around one axle raises a load of 450 N attached to a string wound around the other axle.



Calculate:

(a) (i) the velocity ratio.

(ii) the efficiency of the system, if the A drives B.

(b) (i) the velocity ratio.

(ii) the efficiency of the system, if the B drives A.



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SECTION A

1. (a) Define a **machine**.

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(b) Define the following terms as used in machines.

(i) Mechanical advantage.

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(ii) Velocity ratio

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(iii) Efficiency

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(iv) Pitch

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(c) List the types of machines

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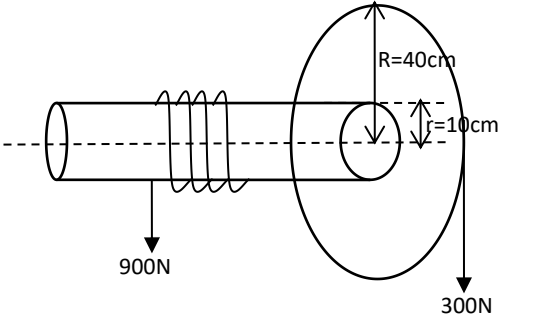
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(d) Complete the table below:

Class of lever	Position of F,E and L	Examples
1 st		
2 nd		
3 rd		

(b) WHEEL AND AXLE MACHINE :

2. (a) The figure below shows a wheel and axle system, which uses an effort of 300N to raise a load of 900N using an axle of radius 10cm. Calculate the;

	(j) Velocity ratio (ii) Efficiency of the system

(b) A wheel and axle machine is constructed from a wheel of diameter 20cm and mounted on an axle of diameter 4cm. Calculate the;

(i) Velocity ratio of the machine.

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(ii) Greatest possible value of mechanical advantage.

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(iii) Explain why the mechanical advantage is likely to be less than this value.

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(c) A common windlass is used to raise a load of 480N by application of an effort 200N at right angles to the handle. If the crank is 33cm from the axis and the radius of the axle is 11cm, calculate the;

(i) Velocity ratio.

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(ii) Efficiency of the windlass.

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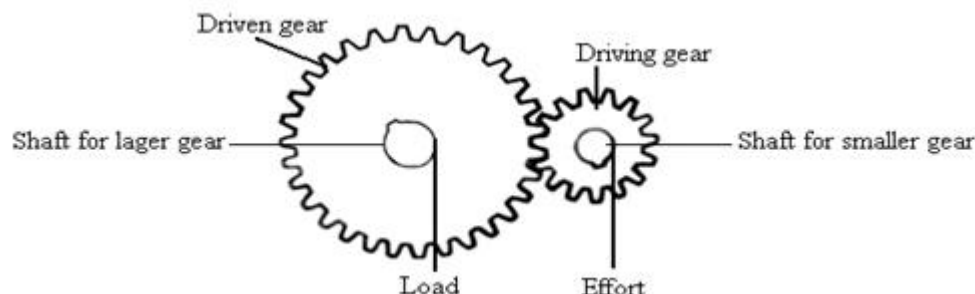
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(c) **GEAR SYSTEM:**

A gear is device consisting of toothed wheels. These are rigidly fixed to the axis and turn with their axis.



1: Two gearwheels A and B with 20 and 40 teeth respectively lock into each other. They are fastened on axles of equal diameters such that a weight of 400N attached to a string wound around one-axle, raises a load of 600N attached to a string wound around the other axle. Calculate the:

(a) Velocity ratio of the system when;

(i) A drives B

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(ii) B drives A

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(b) Efficiency when;

(i) A drives B

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(ii) B drives A

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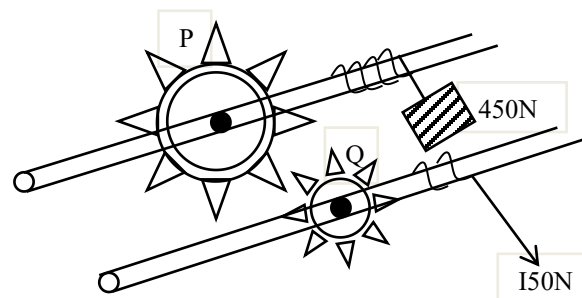
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2. (a) Two gear wheels P and Q with 80 and 20 teeth respectively, lock each other. They are fastened on axles of equal diameters such that a weight of 150 N attached to a string wound around one-axle raises a load of 450N attached to a string wound around the other axle. Calculate the;



(i) Velocity ratio of the gear system.

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(ii) Efficiency of the system.

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(b) Two gear wheels P and Q with 25 and 50teeth respectively lock into each other. They are fastened on axles of equal diameters such that a weight of 400N attached to the string wound around one axle raises a load of 600N attached to a string wound around the other axle. Calculate the:

(i) Velocity ratio and efficiency when Q drives P.

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(ii) Velocity ratio and efficiency when P drives Q.

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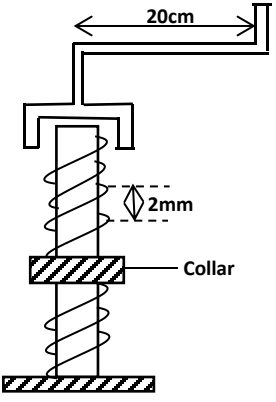
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(d) SCREW MACHINE :

1. The diagram below shows a screw jack being used to lift a car in order that a wheel may be changed. If the car bears down on the car with a force of 5000N and that efficiency of a screw jack is 15%. Calculate the;

	(i) V.R	(ii) M.A	(iii)The effort required to turn the handle

(i) Work done by the operator in order to raise the side or the car by 25cm.

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(ii) Work done by the operator in order to raise the side or the car by 25cm.

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MACHINES

1. (a) In a screw jack, the length of the handle is 56cm and a pitch of 2.5mm. It is used to raise a load of 2000N. Calculate the;
- (i) Effort required to raise the load.

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(iii) V.R

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(iv) Efficiency of the screw, hence explain the significance of your value of efficiency.

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(b) A load of 800N is raised using a screw jack whose lever arm is 49cm has a pitch of 2.5cm.If it is 40% efficient, Find the

(i) V.R

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(iii) M.A

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(d) A certain screw machine has a pitch of 3.5mm. The effort is applied using a handle, which is 44cm long. Calculate its velocity ratio.

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(e) (d) A screw jack with a lever arm of 56 cm, has threads which are 2.5mm apart is used to raise a load of 800N. If its 25% efficient, find the;
(j) Velocity ratio

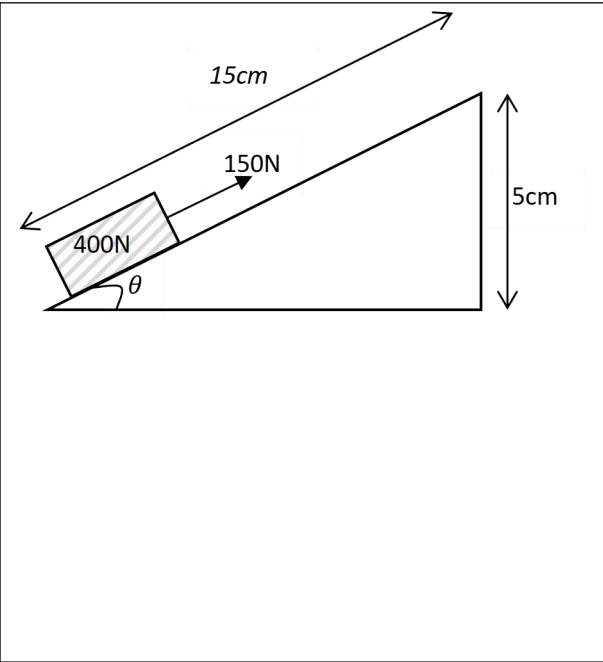
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(ii) Mechanical advantage

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INCLINED PLANE

3. (a) A load of 400N is pulled along an inclined plane as shown below. Calculate the;

	(i) V.R	(ii) Efficiency
	(i) M.A	(ii) Work input

(b) Explain why a longer ladder is preferred to a shorter ladder when climbing a tree.

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4. A wooden plank, 3m long is used to raise a load of 1200N through a vertical height of 60cm. If the friction between the load and the plane is 40N, calculate the:

(i) Effort required

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(ii) Mechanical advantage

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5. A man uses a rope to haul a packing case of weight 750N up an inclined wooden plank of length 4.5m and height 1.5m. The friction force between the plank and the case is 200N. Find the effort, Mechanical advantage and efficiency.

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PULLEY SYSTEM:

1. (a) Define a **pulley**.

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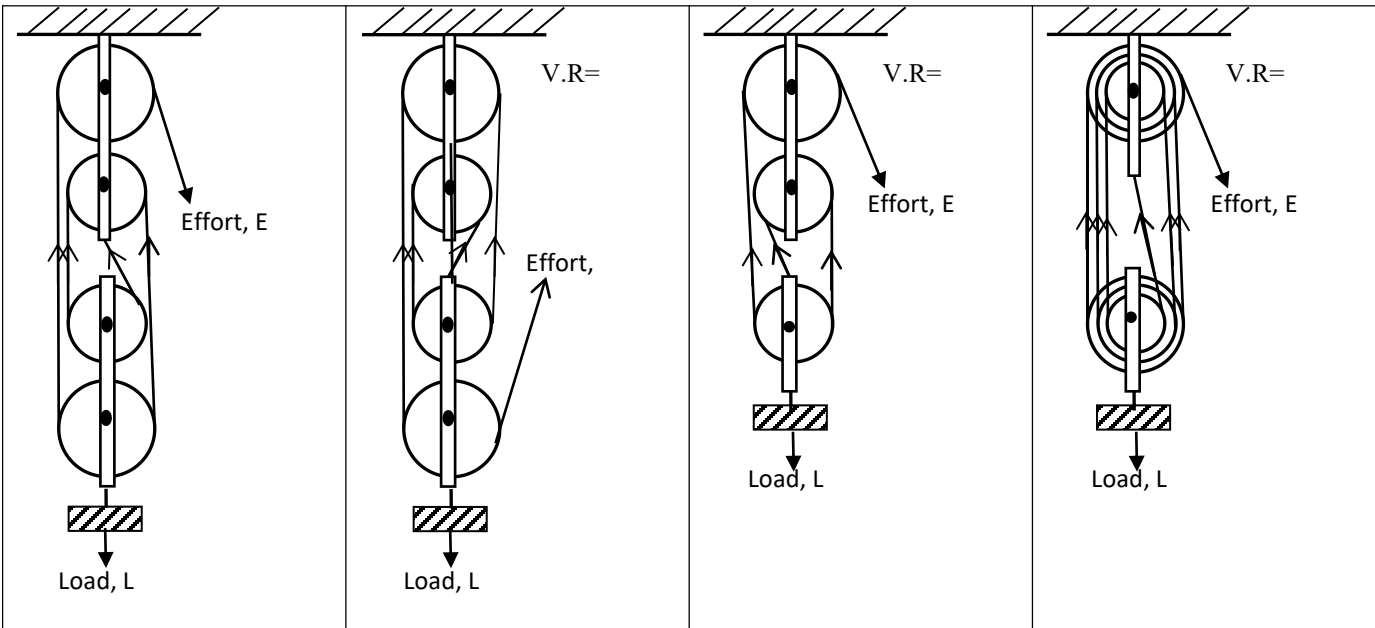
(b) State any two applications of pulley systems

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(c) Draw the following pulley systems and state their velocity ratio.

(i) Single fixed pulley	(ii) Single movable pulley	(iii) Block and tackle pulley system

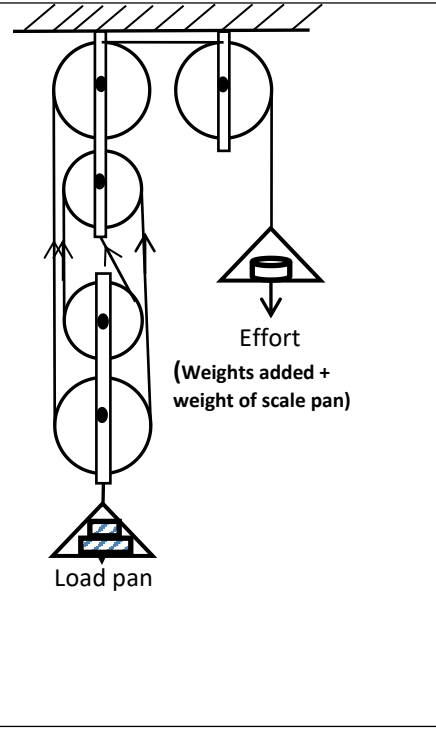
(d) State the velocity ratio of the following pulley systems



(f) Sketch pulley systems with the following velocity ratios

4	7	10	13

f) Briefly describe an Experiment to measure mechanical advantage and efficiency of pulley system.



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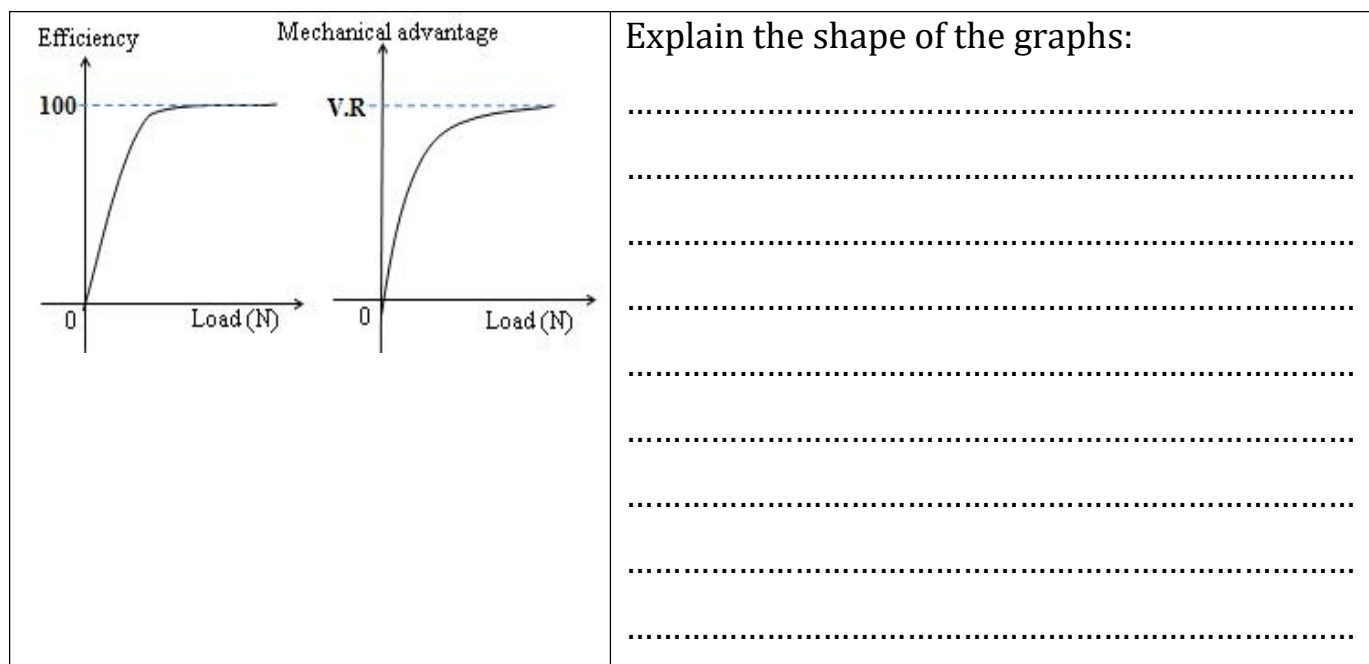
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g) The graphs below show variation of efficiency or mechanical advantage against the load.



2. A pulley system of velocity ratio 3 is used to lift a load of 100N. The effort needed is found to be 60N.

(a) Draw the arrangement of the pulley system.

(b) Calculate the efficiency of the system.

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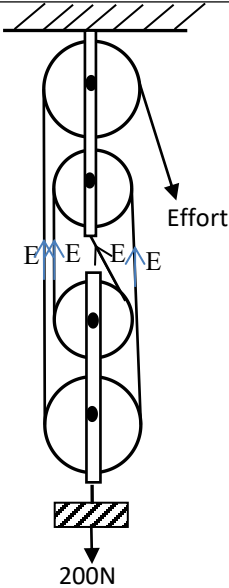
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h) Below is a pulley system of mass 0.4kg, and there is friction of 5N. Calculate the;



(i) Velocity ratio of the system;

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(ii) Effort required to raise the load. ;

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(iii) Mechanical advantage of the system;

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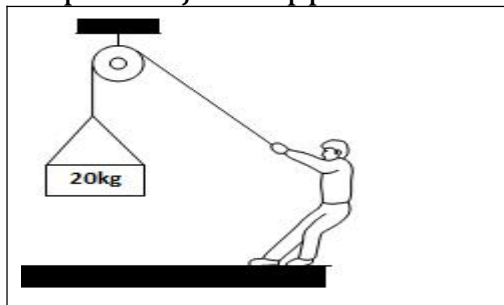
(iv) If the load is raised through 6m, calculate the distance the effort moves at the same time. ;

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3. A person just supports a mass of 20kg suspended from a rope.



What is the resultant force acting on the mass?

- A. 0N
- B. 10N
- C. 20N
- D. 200N

4. A pulley system has two pulleys on the bottom block. A load of 1000N is hung from the bottom block, it is found that an effort of 300N is needed to raise the load.

(i) How much energy is supplied, if the effort moves through 5m?

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(ii) If the effort moves through 5m, find how far the load rises.

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(iii) Find how much energy is gained by the load if the effort moves through 5m.

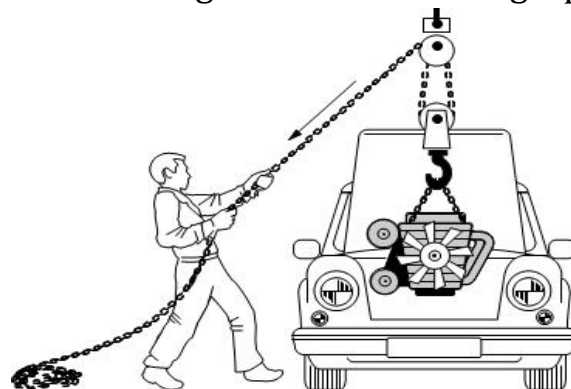
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5. In a garage, a mechanic lifts an engine from a car using a pulley system.



- (a) The mechanic pulls $4\frac{1}{2}$ m of chain with a constant force of 250 N. Calculate the work done by the mechanic.

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- (b) The engine has a mass of 144 kg and is raised by 5.0 m. Calculate the gravitational potential energy gained by the engine.

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- (c) Calculate the percentage efficiency of the pulley system.

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PRESSURE

- Using Hare's apparatus, with water another liquid A in a container, water rises to a height of 60cm and liquid A rises to a height of 48cm. If liquid A weighs 5g, determine the volume of liquid A.
- A tank is filled with water to a depth of 3 m. What is the pressure at the bottom of the tank due to the water alone? ($d_{\text{water}} = 1000\text{kgm}^{-3}$).

SECTION A

- 30 kPa
 - 15 kPa
 - 3 000 Pa
 - 1 500 Pa
- A diver is searching for treasure at a depth of 40m below the surface. What is the pressure exerted on the diver. ($P_{\text{atm}} = 100,000 \text{ Nm}^{-2}$; $d_{\text{water}} = 100 \text{ kg/m}^3$)
 - 400 000 N/m^2
 - 200 000 N/m^2
 - 500 000 N/m^2
 - 50 000 N/m^2

4. What is the pressure at the bottom of a 3 km deep oil well filled with oil of density 860 kg/m^3 ?
A. 5 400 kPa B. 1 080 kPa
C. 10 800 kPa D. 25 800 kPa
5. What is the total pressure on a fish swimming in the sea at a depth of 2 m below the surface? ($d_{\text{sea}} = 1\,125 \text{ kg/m}^3$, $P_{\text{atm}} = 101\,300 \text{ Pa}$)
A. 22.5 kPa B. 123.8 kPa
C. 32.6 kPa D. 132.5 kPa
6. The piston of a hydraulic automobile lift has 0.48 m^2 area. What pressure is required to lift a car of mass 1 200 kg?
A. 25 kPa B. 12 kPa
C. 30 kPa D. 60 kPa
7. In the hydraulic lift, the area of the smaller piston is one fourth that of the larger piston. If 40 N force is applied on the smaller piston, what is the force on the bigger piston?
A. 640 N B. 160 N C. 10 N
D. 320 N
8. In a hydraulic press a force of 40 N is applied to a piston of area 0.1 m^2 . The area of the other piston is 4 m^2 . What is the pressure transmitted through the liquid and the force on the other piston?
A. 800 N/m^2 ; 3 200 N
B. 400 N/m^2 ; 1 600 N
C. 400 N/m^2 ; 400 N
D. 800 N/m^2 ; 1 600 N
9. A hydraulic jack is made with a small piston 12 cm^2 that is used to move a large piston 108 cm^2 . If a man can exert a force of 270 N on the small piston, how heavy a load can he lift with the jack?
A. 1 215 N B. 2 430 N
C. 4 860 N D. 3 645 N
10. A hydraulic press has a large piston with a cross-sectional area of 250 cm^2 and a small piston with a cross-sectional area of 1.25 cm^2 . What is the force on the large piston when a force of 1 250 N is applied to the small piston?
A. 375 000 N B. 125 000 N
C. 500 000 N D. 250 000 N
11. In a liquid, pressure is,
A. Transmitted in a specific direction
B. Transmitted in all direction.
C. Decreased with depth
D. Decreased with density
12. Pressure in a liquid is independent of the,
A. density of the liquid
B. depth below the surface of the liquid
C. pressure exerted on the surface of the liquid above
D. cross-sectional area and the shape of the vessel containing the liquid.

13. A rectangular block of metal weighs 3N and measures (2 x 3 x 4) cm³. What is the greatest pressure it can exert on a horizontal surface.

- A. $5.0 \times 10^3 \text{ Nm}^{-2}$ B. $3.75 \times 10^3 \text{ Nm}^{-2}$
C. $2.5 \times 10^3 \text{ Nm}^{-2}$ D. $7.5 \times 10^{-1} \text{ Nm}^{-2}$

14. The mass of a cuboid of dimensions 4 m x 2 m x 3 m is 48 kg. The minimum pressure it can exert is,

- A. 20 Nm^{-2} B. 40 Nm^{-2}
C. 60 Nm^{-2} D. 80 Nm^{-2}

15. In a hydraulic machine,

- A. an object displaces its own weight of fluid
B. the pressure transmitted in the fluid is the same in all directions.
C. the volume of fluid compressed is proportional to the applied force.
D. an object experiences an upthrust equal to the weight of fluid displaced.

16. Which one of the following is true about a manometer?

- (i) It uses mercury because mercury is a good conductor of heat.
(ii) It is used for measuring gas pressures.
(iii) The maximum height of mercury it can support is 760mm.
A. (i) and (ii) only B. (i) and (iii) only
C. (ii) only D. (ii) and (iii) only.

17. What is 730mm Hg in Nm^2 ?

- A. $\frac{13600 \times 1000 \times 10}{730}$ B. $\frac{13600 \times 730 \times 10}{1000}$
C. $\frac{13600 \times 730}{1000 \times 10}$ D. $\frac{13600 \times 10}{1000 \times 730}$

18. A metal cylinder contains a liquid of density 1100 kg/m³. The area of the base of the cylinder is 0.005 m² and the height of liquid is 5m. Calculate the force exerted by the liquid on the base of the cylinder.

- A. 27.5 N B. 55 N
C. 220 N D. 275 N

19. Which one of the following are true about a hydraulic brake?

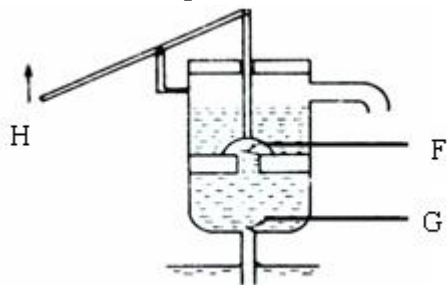
- (i) It uses water.
(ii) The brake pedal is connected to the master cylinder.
(iii) The return spring returns the brake drum in position.
(iv) The return spring returns the brake shoe in position.
A. (i) (ii) and (iii) B. (ii) (iii) and (iv)
C. (ii) and (iv) D. (iii) and (iv) only.

20. Which one of the following statements is false? The pressure in a liquid.

- A. at any one point in a liquid would not change even when more liquid is added.
B. at any one point depends only on the depth and density.

- C. at any one point acts equally in all directions.
D. increases with depth.

21. When the handle, H, of the force pump shown in figure below is moved upwards, the valves at



- A. F and G will both close
B. F and G will both open
C. F will close, and G will open
D. F will open and G will close

22. A rectangular block of dimensions 4 cm x 2 cm x 1cm exerts a maximum pressure of 200 Nm^{-2} when resting on a table. Calculate the mass of the block.

- A. 4 g B. 16 g
C. 40 g D. 400 g

23. Calculate the increase in pressure which a diver experience when he descends 30m in sea water of density 1.2×10^3 .

- A. $3.0 \times 10^2 \text{ Nm}^{-2}$ B. $1.2 \times 10^4 \text{ Nm}^{-2}$
C. $3.6 \times 10^4 \text{ Nm}^{-2}$ D. $3.6 \times 10^5 \text{ Nm}^{-2}$

24. In a hydraulic press, the area of the piston on which the effort is applied is made smaller in order to,

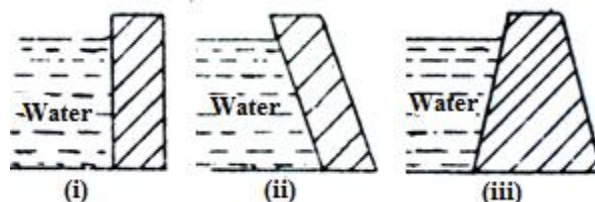
- A. facilitate the movement of the piston downwards

- B. transmit a force as large as possible to the load
C. transmit pressure equally throughout the liquid
D. obtain a pressure as large as possible.

25. Which of the following is true about pressure in liquids? It

- A. increases with the surface area of the liquid
B. is directly proportional to the depth
C. depends on the shape of the container
D. is the same at equal depths in all liquids.

26. The diagrams below show the possible shapes of water dams.



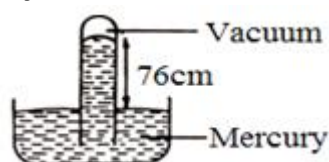
Which shape(s) is /are preferable?

- A. (i) and (ii) only B. (ii) and (iii) only
C. (i) and (iii) only D. (iii) only

29. Calculate the increase in pressure which a diver experiences when he descends 30m in the sea water of density $1.2 \times 10^3 \text{ kgm}^{-3}$

- A. $3.0 \times 10^2 \text{ Nm}^{-2}$
B. $1.2 \times 10^4 \text{ Nm}^{-2}$
C. $3.6 \times 10^4 \text{ Nm}^{-2}$
D. $3.6 \times 10^5 \text{ Nm}^{-2}$

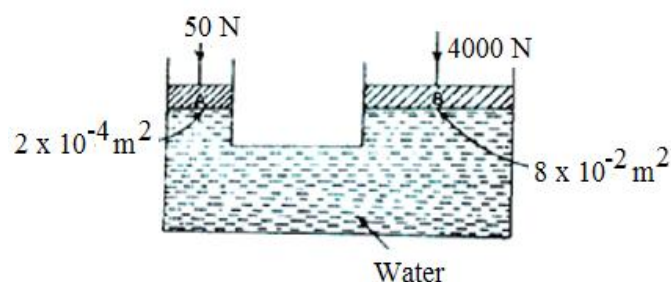
30. The figure below shows a simple barometer. The height of the mercury column is 76cm



When the tube is slightly tilted, the height of the mercury column will:

- A. be slightly higher than 76cm
 - B. be lower than 76cm
 - C. not change
 - D. oscillate about 76cm
31. The pressure exerted by a gas decreases when its volume is increasing at a constant temperature because the molecules:
- A. move faster
 - B. move closer to one another
 - C. hit the walls more often
 - D. hit the walls less frequently

32. Forces of 50N and 400N are applied to pistons A and B respectively as shown below.



The areas of cross-section of A and B are $2 \times 10^{-4} \text{ m}^2$ and $8 \times 10^{-2} \text{ m}^2$ respectively. Which of the following is not true?

- A. Both pistons A and B remain at the same level
- B. The upthrust on piston B is equal to 20000N.
- C. The pressure exerted on the water by piston B is $5 \times 10^4 \text{ Nm}^{-2}$.
- D. Piston B is going to move upwards



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MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

1. (a) (i) State the ***principle of transmission of pressure*** in fluids.

(ii) Give one assumption on which the principle is based.

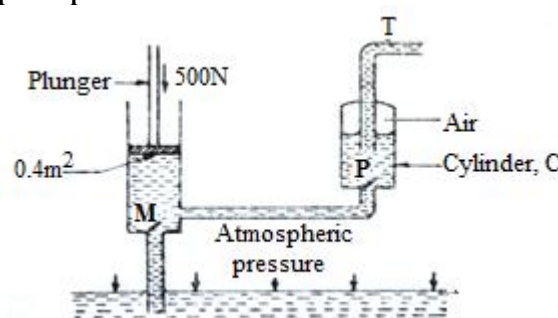
(iii) State two application of the principle.

(iv) In a hydraulic press the smaller piston has a diameter of 14 cm while the larger has a diameter of 280 cm. If a force of 77 N is exerted on the smaller piston, calculate the force exerted the larger piston.

(b) With a help of diagram, describe how hydraulic brake works.

2. (a) Explain why large water reservoirs are much wider at the base than at the top.

(b) The Figure below shows the structure of a force pump.



(i) Describe the action of the pump.

(ii) If a downward of 500 N is exerted of the plunger whose surface area is 0.4 m^2 , calculate the pressure which forces water into cylinder C.

3. (a) Define term **pressure** and state its unit.

(b) (i) Describe how a simple mercury barometer can be set up to measure the atmospheric pressure.

(ii) The difference between the atmospheric pressure at the top and bottom of a mountain is $1 \times 10^4 \text{ N m}^{-2}$. If the density of air is 1.25 kgm^{-3} , calculate the height of the mountain.

4. Hydraulic press machine is used to raise a load W placed on a piston of cross-sectional area of 100 cm^2 by using an effort of 20 N at a piston of cross-sectional area of 2 cm^2 . Calculate the;

(i) Pressure transmitted through the liquid [$P = 100000 \text{ Pa}$]

(ii) Load, W . [$W = 1000 \text{ N}$]

5. A force of 100 N is applied on a small piston of area 0.002 m^2 . Find the maximum load that can be lifted by a piston of area 0.8 m^2 .

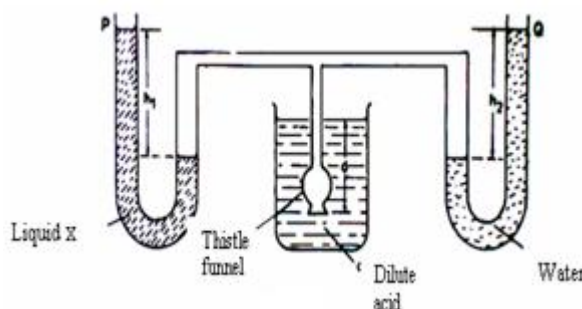
6. Calculate the pressure at the bottom of a swimming pool 1000 cm deep. {density of water = 1000 kgm^{-3} }

7. A diver dives to a depth of 20 m below the surface of sea water of density 1200 kgm^{-3} . Calculate the pressure experienced.

8. (a) (i) Define **pressure** and state its units.

(ii) With the aid of a diagram, describe how you would show that the pressure of a liquid is independent of cross-sectional area and shape of a container.

(b) Two manometers P and Q contain a liquid X , and water respectively at the same level. They are then connected to a thistle funnel covered with a rubber membrane as shown in figure 9.23.



9. When the thistle funnel is lowered into a beaker containing a dilute acid of density 1200 kgm^{-3} , the heights h_1 and h_2 are 15 cm and 12 cm respectively.

Find the:

(i) Ratio of the density of liquid X to that of water,

(ii) Depth d of the thistle funnel below the surface of the dilute acid.

10. Explain why a ship floats in water although it is made mainly of metal.

END



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- 11. (a) (i)** State the principle of transmission of pressure in fluids.
(ii) Give one assumption on which the principle is based.
(iii) State two application of the principle.

- 12. (a)** In a hydraulic press the smaller piston has a diameter of 14 cm while the larger has a diameter of 280 cm. If a force of 77 N is exerted on the smaller piston, calculate the force exerted the larger piston.

- (b)** With a help of diagram, describe how hydraulic brake works.

- (c)** Explain why large water reservoirs are much wider at the base than at the top.

- 13. (a)** Define term pressure and state its unit.

- (b) (i)** Describe how a simple mercury barometer can be set up to measure the atmospheric pressure.

- (ii)** The difference between the atmospheric pressure at the top and bottom of a mountain is $1 \times 10^4 \text{ Nm}^{-2}$. If the density of air is 1.25 kgm^{-3} , calculate the height of the mountain.

- 14. (a)** With a diagram, demonstrate how pressure in liquids increases with increase in depth. (3 marks)

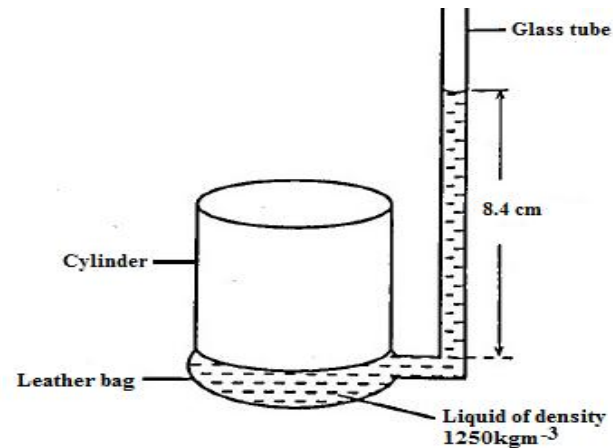
- (b)** Describe with the aid of a labeled diagram, how a force pump works (4 marks)

- (c)** State one factor that determines the height to which water is risen in a force pump. (1 mark)

(d) Explain why it may be difficult to suck a soda using a straw which has a hole along its column.

(2 marks)

(e) A leather bag is filled with a liquid of density 1250kgm^{-3} and attached to a vertical glass tube. When a cylinder of radius 0.78m is placed on the leather bag, the liquid rises in the glass tube by 8.4cm as shown below.



Calculate the weight of the cylinder.
(4 marks)



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SECTION A

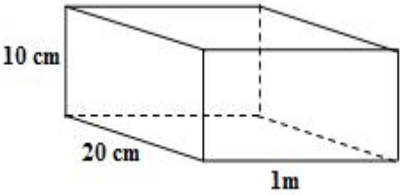
1. (a) Define **pressure** and state its S.I unit.

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(b) Define a **pascal**.

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(c) A box of dimensions 20cm by 1m by10cm weighs 30kg. Determine the maximum and minimum pressures exerted by the box on the ground.



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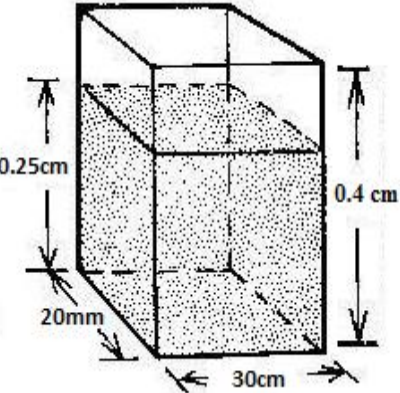
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(d) The tank below has a mass of 2.5kg. Determine the minimum and maximum pressure exerted by the tank on the ground, When it is;



Empty

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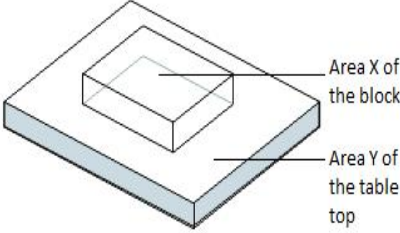
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Filled with water up to a height of 0.25cm.

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The diagram shows a glass block resting on a table top. The area of the block in contact with the table is X and the area of the table top is Y. The weight of the block is P and the weight of the table is Q. Which expression gives the pressure exerted on the table by the block?

A. $\frac{P}{X}$ B. $\frac{P}{Y}$ C. $\frac{Q}{X}$ D. $\frac{Q}{Y}$

(e) Explain why a hippopotamus is able to walk on soft grounds without sinking unlike a goat.

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2. Explain the following observations

(i) A large reservoir is much wider at the base than at the top

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(iii) In supply of water, smaller pipes are preferred to larger ones.

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3. A lead block which measures 60cm by 15cm by 40cm is placed on a floor. Given that the density of lead is 11gcm^{-3} , find the ;

(i) Maximum pressure the block can possibly exert when resting on a flat surface.

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(ii) Minimum pressure the block can possibly exert when resting on a flat surface.

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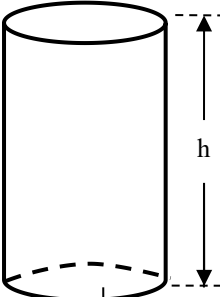
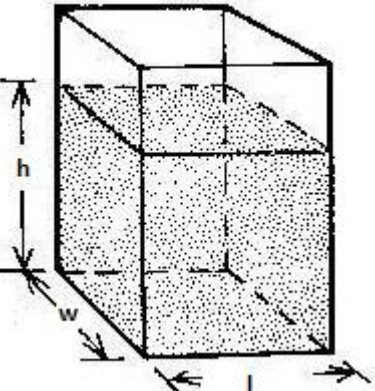
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PRESSURE IN FLUIDS:

Defining pressure in fluids

Fluids refer to gas or liquids. These take up the shape of the container, so the volume of the liquid filling a cylindrical container is equal to the volume of that cylindrical container.

 Area of base = πr^2 Volume of liquid = $\pi r^2 h$ Mass of liquid = $\pi r^2 h \rho$ Weight of liquid = $\pi r^2 h \rho g$ Area of base = πr^2		Then from the definition of pressure: $\text{Pressure} = \frac{\text{Force(N)}}{\text{Area(m}^2\text{)}}$ $= \frac{(\pi r^2) h \rho g}{(\pi r^2)}$ $= h \rho g$ Pressure = $h \rho g$

1. (a) State the **factors** on which **pressure in fluids** depends.

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(b) Briefly describe an experiment to show that **pressure depends on the depth of the liquid**.

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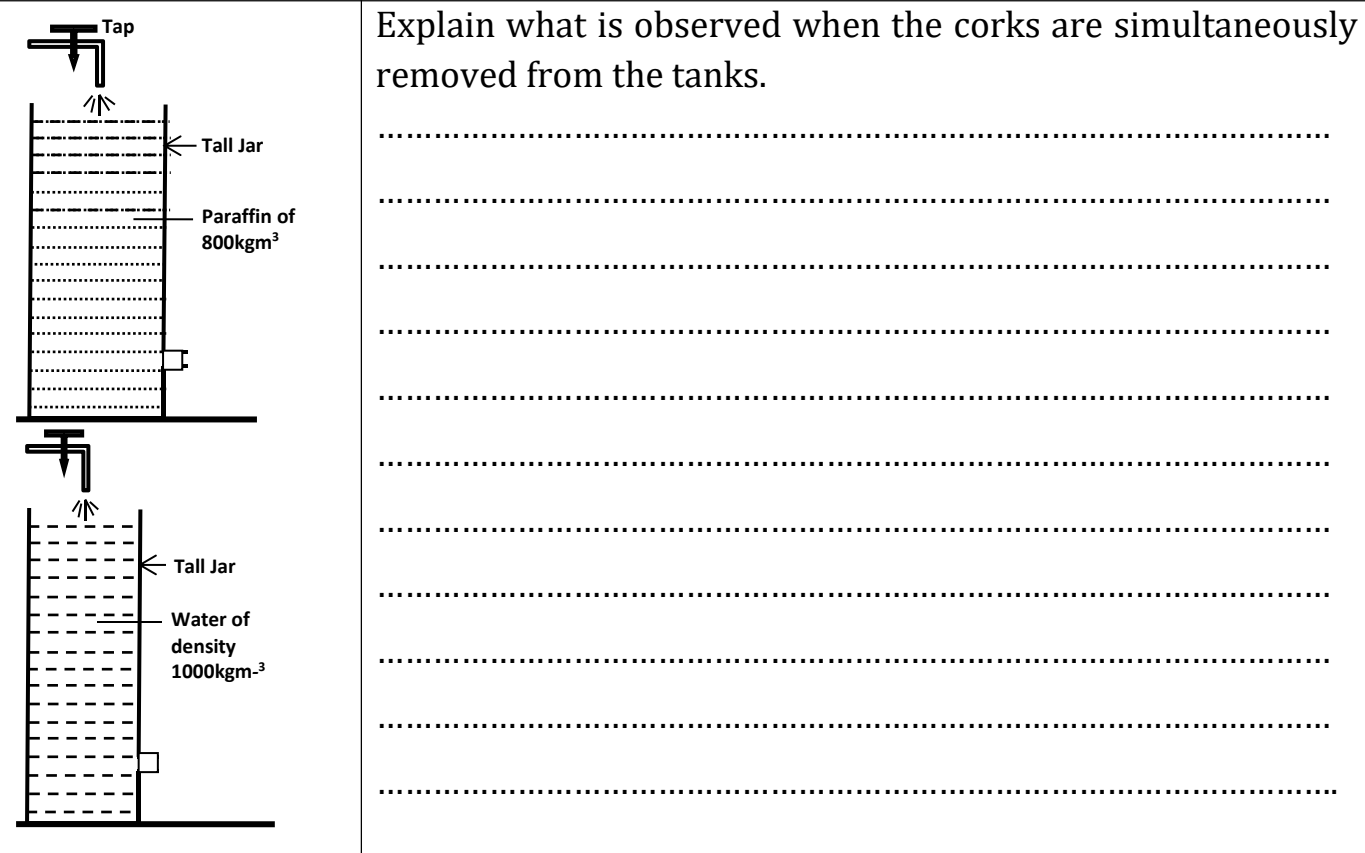
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(c) In an experiment to investigate the effect of density on the pressure of a fluid, two tall jars of the same size and height, each with a hole punched at equal depth are used. The holes are covered with cork and the jars filled to the same height, with liquids of different densities e.g paraffin and water.



(f) Describe an experiment to show that pressure in fluids is independent of the cross-sectional area and shape of the container.

(g)(i) State **Pascal's principle**.

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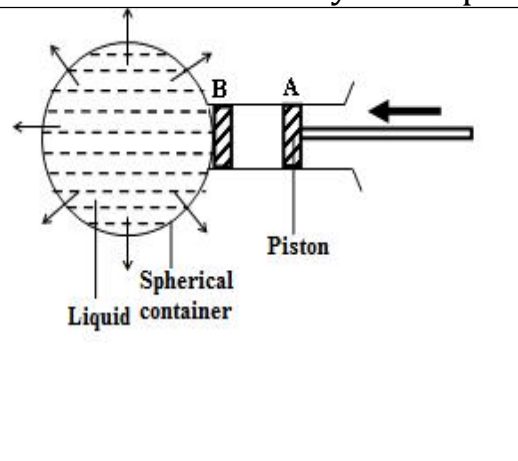
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(ii) State the assumption made in the principle of transmission of pressure in fluids.

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(iii) A spherical container pinched at different points around it. The piston is moved in such way that it pushes "B" to compress the liquid.

	Explain what is observed.

(g) (i) State any three applications of Pascal's principle

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(ii) A hydraulic press is made of two cylinders of cross-section areas 20cm^2 and 120cm^2 respectively fitted tightly with pistons A and B. A force of 10N applied on A is used to raise a load on piston B. Calculate the maximum possible force that can be raised on piston B.

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(iii) A hydraulic lift requires an effort of 100N acting on a piston A of area 20cm² to press a car placed on piston B of area 240cm². If the percentage efficiency of the press is 80%, calculate the force applied on the car.

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(h) The diagram below shows the major parts of a Hydraulic brake:

	i) Label the parts A: B..... C: D..... E: F..... (ii) Explain how the hydraulic brake works



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ATMOSPHERIC PRESSURE

1. (a) What is meant by **atmospheric pressure**?

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(b) Briefly describe an experiment to show existence of atmospheric pressure

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(c) Explain the variation of atmospheric pressure with altitude, hence explain why mountain climbers tend to nose bleed.

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(d) State any **five** applications of atmospheric pressure.

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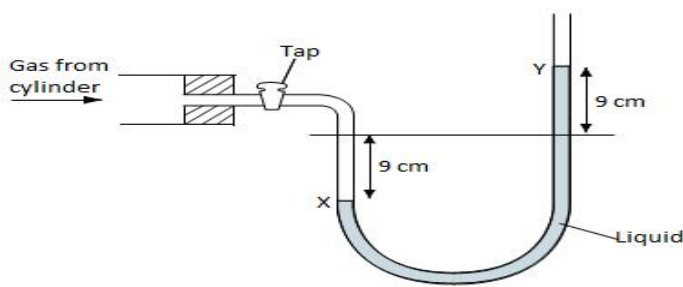
(d) Express a pressure of 75cmHg to pascals given that the density of mercury (Hg) is 13600kgm^{-3} .

(e)

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2. (a) The diagram shows the levels X and Y in a liquid manometer when the gas tap is opened.

	What is the pressure of the gas in the cylinder? A. 18 cm of liquid below atmospheric pressure B. 9 cm of liquid below atmospheric pressure C. 9 cm of liquid above atmospheric pressure

	D. 18 cm of liquid above atmospheric pressure

3. (a) In an experiment to compare density of two liquids, water and spirit were used. The height of water was found to be 8cm and that of spirit was 12cm. Given that the density of water is **1000kgm⁻³**. Find the density of the spirit.

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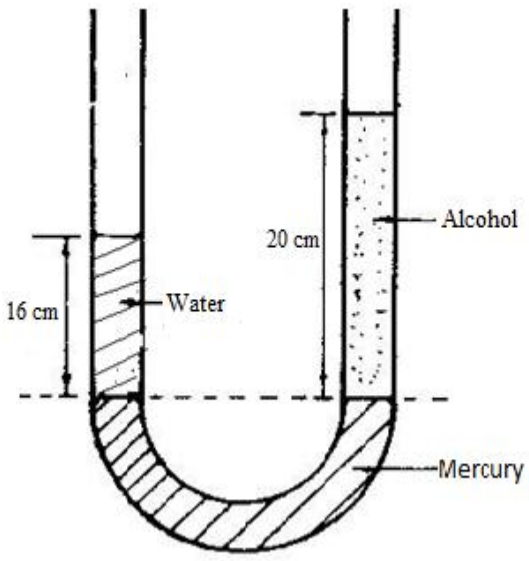
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(b) Mercury was poured in a U- tube such that it finds its own level. When a column of 20cm of alcohol was poured on one side of the tube, it was necessary to pour 16cm of water on the other side to maintain equal mercury levels on both sides as shown below. Find the density of alcohol.



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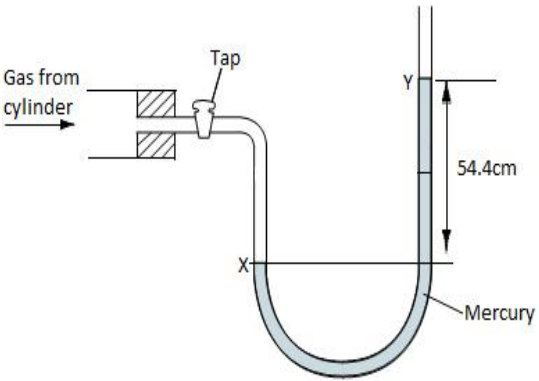
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(c) The manometer contains mercury so the atmospheric pressure is 76cm Hg.
Calculate the gas pressure in cm Hg and Nm^{-2} .



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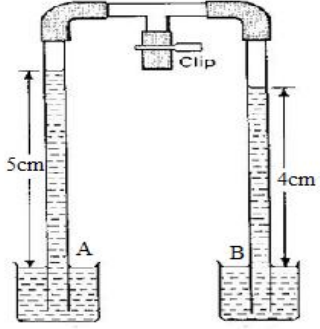
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(d) The diagram below shows heights to which liquids A and B have risen in an inverted U-tube (Hare's apparatus). When some air has been pumped at the clip. Find the density of liquid B if that of A is 800 kgm^{-3} .



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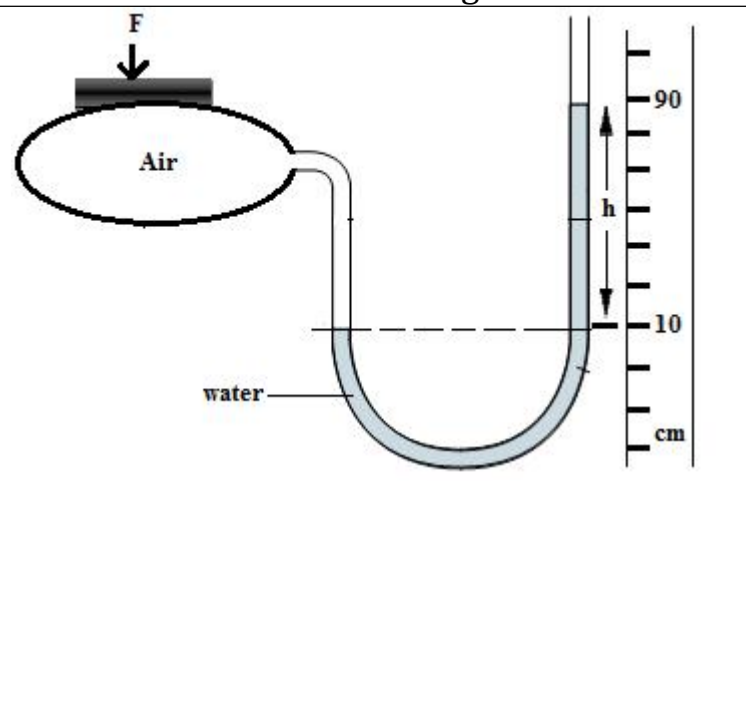
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1. The diagram below shows an air bag connected to a manometer and used to measure the force F acting on a wooden block of area 0.1m^2 placed on the air bag.

	How does h change when: (i) The manometer is made narrower. (ii) The liquid is denser than water (iii) Calculate the value of F

2. (a) Briefly describe how to set up a simple mercury barometer

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- (b) Explain why atmospheric pressure is low at a low altitude and high at a high altitude.

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(c) The atmospheric pressure at the bottom of a mountain is 100000Pa. If the mountain is 800m high, and the density of air is 1.25 kgm^{-3} . Find the pressure at the top of the mountain.

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(d) A mountain climber holding a barometer in his hands, climbs from a height of 200 of a mountain up to its top. If the level of mercury in the barometer falls from **75 cm** to **74 cm**, find the height of the top of the mountain from where he started.

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(e) State one advantage of the **aneroid barometer** over other barometers.

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3. Using Hare's apparatus, with water and another liquid A in a container, water rises to a height of 60cm and liquid A rises to a height of 48cm. If liquid A weighs 5g, determine the volume of liquid A.

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4. Water and kerosene are placed in U-tube containing mercury. Water rises to a height of 8cm above mercury while kerosene rises to 10cm. Determine the density of kerosene.

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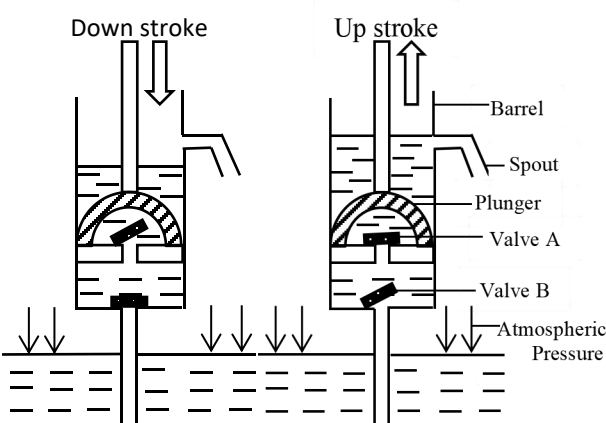
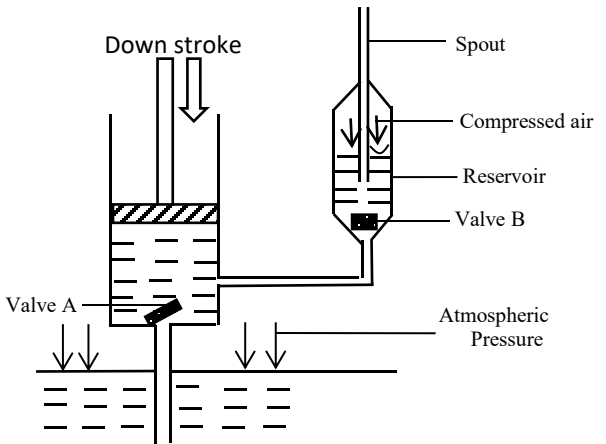
5. The pressure difference between the top and the bottom of a mountain is $1.0 \times 10^4 \text{ Nm}^{-2}$. If the density of air is 1.25 kgm^{-3} . Find the height of the mountain.

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6. A barometer reads 780mmHg at the foot of the mountain which is 450m high. What is the barometer reading at the top of the mountain? (Density of air is 1.25 kgm^{-3} and that of mercury is 13600 kgm^{-3}).

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7. The figures below show two pumps which are some of the applications of atmospheric pressure.

(i) Name the pump:  Describe the action of the pump. 	(ii) Name the pump:  Describe the action of the pump 		
(iii) State any four differences between the two pumps above <table border="1"><tr><td> </td><td> </td></tr></table>			
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1. A rubber balloon of mass 5g is inflated with hydrogen and held stationary by means of a string. If the volume of the inflated balloon is 0.005m^3 , find the tension in the string. (Assume hydrogen is a light gas, and density of air = 1.25kg^{-3}):

[Ans: $1.25 \times 10^{-2}\text{N}$]

2. A block of metal (density 2700kg/m^3) has volume 0.09m^3 . Calculate the up thrust force when

it is completely immersed in brine (density 1200kg/m^3)

- A. 600 N B. 1 080 N
C. 180 N D. 1200 N

3. An iron box of mass 90 g and density 0.9gcm^{-3} floats on brine (density 1200kg/m^3). What is the volume immersed in the brine?

- A. 40cm^3 B. 60cm^3
C. 90cm^3 D. 75cm^3

4. The envelope of a hot air balloon contains 1500 m^3 of hot air of density 0.8 kg/m^3 . The mass of the balloon (not including the hot air) is 420 kg . the density of surrounding air is 1.3 kg/m^3 . What is the lifting force?

A. $3\,300 \text{ N}$ B. $4\,400 \text{ N}$
C. $5\,500 \text{ N}$ D. $6\,600 \text{ N}$

5. What fraction of a wooden cube of one side 10cm will be below the water level if the cube is floating in water? ($d_{\text{water}} = 1\text{g/cm}^3$, $d_{\text{wood}} = 0.6 \text{ g/cm}^3$)

A. $\frac{3}{5}$ B. $\frac{2}{5}$
C. $\frac{1}{5}$ D. $\frac{1}{10}$

6. An ice cube of volume 600 cm^3 floats in water. What is the volume of the part above the water level? ($d_{\text{ice}} = 0.9 \text{ g/cm}^3$, $d_{\text{w}} = 1 \text{ g/cm}^3$)

A. 60 cm^3 B. 80 cm^3
C. 520 cm^3 D. 540 cm^3

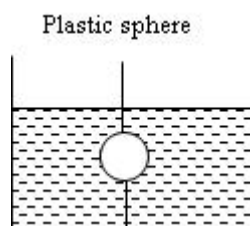
7. A cubical brass block floats in mercury. What fraction of the block lies above the mercury surface? (the densities of brass and mercury are $8\,600 \text{ kg/m}^3$ and $13\,600 \text{ kg/m}^3$ respectively)

A. $\frac{86}{136}$ B. $\frac{50}{86}$

C. $\frac{136}{86}$ D. $\frac{50}{136}$

8. A large, hollow plastic sphere is held below the surface of a fresh water pool by a cable attached to

the bottom of the pool. The sphere has a volume of 0.400 m^3 .



Calculate the buoyancy force exerted by the water on the sphere.

A. $4\,000 \text{ N}$ B. 800 N

C. $3\,200 \text{ N}$ D. $4\,800 \text{ N}$

9. A lead sphere has a total mass of 45.2 kg . If it is put into water, what will be the upthrust force on it? (Density of lead is $11\,300 \text{ kg/m}^3$)

A. 10 N B. 20 N

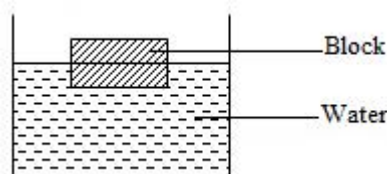
C. 30 N D. 40 N

10. A block of wood of volume 80cm^3 and density 0.5 g/cm^3 floats in water. What is the volume immersed in water (density of water = 1gcm^{-3})

A. 50 cm^3 B. 40 cm^3

C. 30 cm^3 D. 20 cm^3

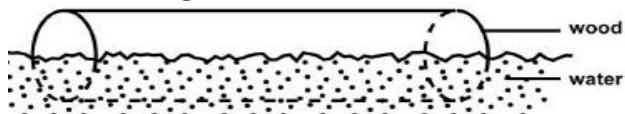
11. The Figure below shows a block of volume 40 cm^3 floating in water with only half of its volume submerged.



If the density of water is 1000kg m^{-3} , determine the mass of the wood.

- A. $40 \times 1000 \text{ kg}$. B. $20 \times 1000 \text{ kg}$.
C. $40 \times 10^{-6} \times 500 \text{ kg}$.
D. $20 \times 10^{-6} \times 500 \text{ kg}$.

12. The figure below shows a block of wood of volume 40 cm^3 floating in water with only half of its volume submerged.



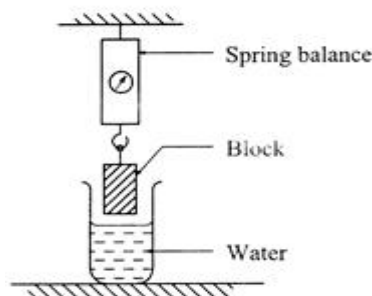
If the density of water is 1000 kgm^{-3} , determine the mass of the wood underwater.

- A. $40 \times 1000 \text{ kg}$. B. $20 \times 1000 \text{ kg}$.
C. $40 \times 10^{-6} \times 500 \text{ kg}$.
D. $20 \times 10^{-6} \times 500 \text{ kg}$

13. A balloon is filled with hydrogen and released in the open air. It will rise

- A. to a certain height and then float B. to a certain height and then drop
C. to a certain height and then burst D. indefinitely

14. The figure below shows a spring balance supporting a block being lowered into a beaker containing water.



When the block is immersed in water, the reading of the spring balance

- A. reduces B. increases
C. becomes zero.
D. remains constant.

15. The spring balance in the figure above reads 5N on suspending the block. When the block is completely submerged in water, the spring balance reads 1N.

- (i) State the forces acting on the block when fully immersed.
(ii) Determine the volume of the block.
(iii) Explain why the spring balance reading is likely to increase when the block is completely immersed in paraffin instead of water.

SECTION B

17. (a) State **Archimede's** Principle.
(b) Describe an experiment to verify Archimedes's Principle.
(c) A piece of iron weighs 355 N in air. When completely immersed in water, it weighs 305 N and weighs 315 when completely immersed in methylated spirit. Calculate the relative density of methylated spirit.
(d) State the application of Archimedes's principle.

18. (a) State the law of flotation.

(b) Describe an experiment to verify the law of flotation.

(c) A piece of wood of volume 40 cm^3 floats with only half of volume submerged. If the density of water is 1000 kg m^{-3} , calculate the density of wood.

19. A balloon has a capacity of 20 m^3 and is filled with hydrogen. The balloon's fabric and the container have a mass of 2.5 kg . Calculate the maximum mass load the balloon can lift. (Density of hydrogen = 0.089 kgm^{-3} and of air = 1.29 kgm^{-3} , gravity, $g = 10 \text{ ms}^{-2}$).

20. A hydrometer consists of a spherical bulb and a cylindrical stem of cross-sectional area 0.4 cm^2 . The total volume of the bulb and stem is 13.2 cm^3 . When immersed in water, the hydrometer floats with 8.0 cm of the stem above the water surface in alcohol it floats with 1.0 cm of the stem above the surface. Calculate the density of the alcohol. (0.78 gcm^{-3})

21. (a) Define terminal velocity.

(b) Explain with a help of velocity-time graph, what happens to a USA soldier parachuted from a war plane flying at a high altitude in an area free of enemies in Iraq from the time he leaves the plane till he lands to the ground.

22. A glass block weighs 25 N in air. When wholly immersed in water, the block weighs 15 N . Calculate the;
(k) up thrust on the block
[10 N]

(ii) Density of the glass kgm^{-3}
[2500 kgm^{-3}]

23. A piece of iron weighs 555 N in air. When completely immersed in water, it weighs 530 N and weighs 535 N when completely immersed in alcohol. Calculate the relative density of alcohol. [R.D=0.8]

24. A rubber balloon of mass 5 g is inflated with hydrogen and held stationary by means of a string. If the volume of the inflated balloon is 0.005 m^3 , find the tension in the string. (Assume hydrogen is a light gas, and density of air = 1.25 kg m^{-3}):[Ans: $1.25 \times 10^{-2} \text{ N}$]

25. When a metal is completely immersed in liquid A its apparent weight is 5 N . When immersed in another liquid B the apparent weight is 16 N if the density of B is times that of A. Calculate the mass of the metal. [= 5.2 kg].

26. The mass of a piece of cork (0.25 g/cm^3) is 20 g .
(i) What fraction of the cork is immersed when it floats in water?
(ii) Find the volume of the cork submerged

27. A solid of volume $1 \times 10 \text{ m}^3$ floats on water of density

$1 \times 10^3 \text{ kgm}^{-3}$ with $\frac{3}{5}$ of its volume submerged. Find the;

(iii) mass of solid [=0.06kg]

(iv) density of solid [= 600 kgm^{-3}]

28. A piece of wood that measures 2cm by 3cm at the bottom and 8cm in height floats in water with $\frac{1}{4}$ of its volume submerged. Calculate the:

(i) volume of water displaced

(ii) mass of the wood

29. A piece of marble of weight 14N and relative density 2.8 is supported by a light string from a spring balance and lowered into a vessel of water standing on a weighing machine. The weighing machine reads 57.5N before the marble enters water. What will be

the readings of both the spring balance and the weighing machine when the marble is completely immersed in water?

30. Sulphuric acid has a **specific gravity** of 1.8. This meant that a certain quantity of this acid is 1.8 times heavier than the same quantity of water. Find the weight in kg of two litres of sulphuric acid. [3.6kg].

31. An iron block of mass $3.2 \times 10^3 \text{ kg}$ and volume 0.6 m^3 is totally immersed in a liquid of density $1.56 \times 10^3 \text{ kg}$. Find the weight of the block in:

(ii) Air

(iii) liquid



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SECTION A

1. (a) State Archimedes’ principle.

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(b) Define the following;

(i) Up thrust

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(ii) Apparent weight

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(iii) Apparent loss of weight

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(c) Briefly describe an experiment to verify Archimedes’ principle.

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(d) (i) An iron cube, mass 480g and density 8g/cm³ is suspended by a string so that it is half immersed in oil of density 0.9g/cm³. Find the tension in string.

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(ii) A glass block weighs 25N. When wholly immersed in water the block appears to weigh 15N. Calculate the relative density.

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(iii) A metal weighs 25N in air. When completely immersed in liquid it weighs 15N and it weighs 20N when completely immersed in water. Calculate the relative density of the liquid.

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(iv) A glass block weighs 22N in air. If the density of the glass block is 2500 kgm^{-3} . Determine its apparent weight when completely immersed in a liquid of density 1200 kgm^{-3} .

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2. (a) State the **law of floatation**.

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(b) (i) Describe an experiment to verify the law of floatation

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(i) A balloon has a capacity 10m^3 and is filled with hydrogen. The balloon's fabric and the container have a mass of 1.25kg . Calculate the maximum mass the balloon can lift.

{Density of hydrogen = 0.089kgm^{-3} ; Density of air = 1.29kgm^{-3} }.

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(c) (i) A piece of cork of volume 100cm^3 is floating on water. If the density of the cork is 0.25gcm^{-3} . Calculate the volume of cork immersed in water.

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(ii) A solid of volume 10^{-5} m^3 floats in water of density 10^3 kgm^{-3} with four – fifth of its volume submerged. Find the mass of the solid.

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(d) A block of wood of volume 300 m^3 floats in water with $\frac{3}{4}$ of its volume immersed. Find the:

(i) mass of the wooden block.

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(ii) fraction of the block that would sink when placed in oil of density 0.842 gcm^{-3}

end



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1. (a) A ball bearing is gently dropped into a tall glass jar containing a transparent viscous liquid. Draw the ball bearing and show all the forces acting on the ball as it falls through the jar.

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(b) Describe the motion of the body as it falls through the liquid.

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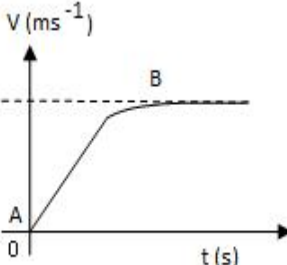
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2. Fig. (a) Shows a free-fall parachutist falling vertically downwards. Fig. (b) Shows how the speed of the parachutist varies with time.

Fig. (a) 	Fig. (b) 	(a) (i) State the forces acting on the parachutist. (ai) State the initial value of the acceleration of the parachutist.

(b) (i) Explain why the acceleration decreases from A to B.

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(i) Explain why the parachutist falls at a constant speed after B.

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3. (a) State **Bernoulli’s** principle

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4. (a) define the following terms as used in hydrodynamics

i) **Stream line/Laminar/Steady flow**

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ii) **Turbulent flow**

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(b) State any four differences between turbulent flow and Laminar flow.

Turbulent	Streamline
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LINEAR MOTION

1. An athlete of 80 kg moving at 5ms^{-1} , slides trough a distance of 10m before stopping in 4 seconds. Find the work done by friction on the athlete.
2. A car of mass 1500kg starts from rest and attains a velocity of 100ms^{-1} in 20 seconds. Find the power developed by the engine.
A. 750kW B. 3,000kW
C. 30, 000kW D. 750, 000kW

3. A ball of 3kg moves at 10ms^{-1} towards a volley ball player. If the player hits the ball and the ball moves back with a velocity of 5ms^{-1} . Find the change in momentum.

- A. $\frac{5 \times 3}{10}$ B. $\frac{10 \times 3}{5}$
C. $3(10 - 5)$ D. $3(10 + 5)$

4. A rubber bullet of mass 100g is fired from a gun of mass 5 kg at a speed of 200 ms^{-1} . Find the recoil velocity of the rifle.

- A. $\frac{5 \times 200}{100 \times 1000}$ B. $\frac{5 \times 1000}{100 \times 200}$
C. $\frac{100 \times 200}{5 \times 1000}$ D. $\frac{200 \times 1000}{5 \times 100}$

5. A body moves with uniform acceleration if

- A. its momentum remains constant
B. it covers equal distances in equal times
C. the velocity changes by equal amount in equal times.
D. the net force on the body is zero

6. A cyclist traveling at a constant acceleration of 2ms^{-2} passes through two points A and B in a straight line. If the speed at A is 10ms^{-1} and the points are 75m apart, find the speed at B.

- A. 15.8ms^{-1} B. 17.3ms^{-1}
C. 20.0ms^{-1} D. 400.0ms^{-1}

3. A body moves with a uniform acceleration of $P\text{ms}^{-2}$.

If its initial velocity is $x\text{ms}^{-1}$ and it travels for t s to attain a final velocity of $y\text{ms}^{-1}$, find the value of p in terms of x, y and t .

- A. $x + yt$ B. $\frac{y - x}{t}$
C. $\frac{y + x}{t}$ D. $y + xt$

7. A body is said to be moving with a constant velocity if;

(i) Its momentum remains constant

(ii) It covers equal distances in equal times

(iii) The velocity changes by equal amount in equal times.

(iv) The net force on the zero

- A. All B. (i), (ii) and (iv)
C. (i) and (ii) only D. (ii) only

8. A car of mass of mass 1200 kg moving with a constant velocity of 60 ms^{-1} is retarded uniformly to rest in 12 sec .Calculate the retarding force.

- A. $(1200 \times 12)\text{ N}$ B. $(1200 \times 5)\text{ N}$

- C. $(1200 \times 10)\text{ N}$ D. (1200×60)

N

9. The gradient of a velocity-time graph represents the

- A. Speed of the body
B. Velocity of the body
C. Acceleration of the body
D. The distance covered by the

body

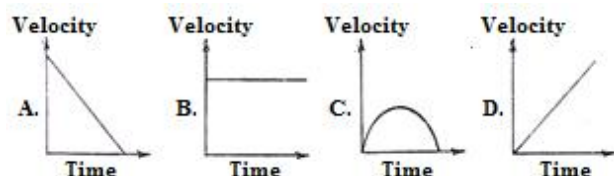
10. A body is said to be moving with uniform velocity when the rate of change of

- A. acceleration with time is constant
B. velocity with time is constant

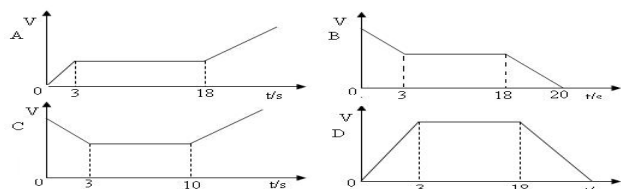
C. distance with time is constant

D. displacement with time is constant.

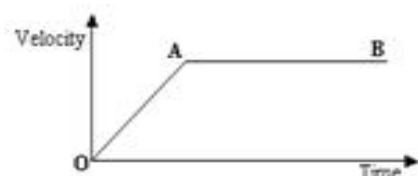
8. Which one of the above sketches represents uniformly accelerated motion?



9. A lift accelerates uniformly from rest for 3s. It then moves at uniform velocity for 15s then decelerates uniformly for 2s before coming to rest. Which of the following velocity-time graph represents the motion of the lift.



10. The Figure below shows a velocity-time graph for a moving body.

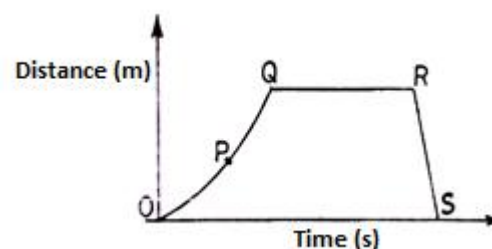


Which one of the following statements is true about the motion of the body?

- A. Velocity of the body is constant between O and B.
- B. Velocity of the body is constant between A and B.
- C. The body is accelerating between A and B.

D. The body is not accelerating between O and A

11. The graph in figure 1 describes the motion of particle. Between which points is the particle at rest?

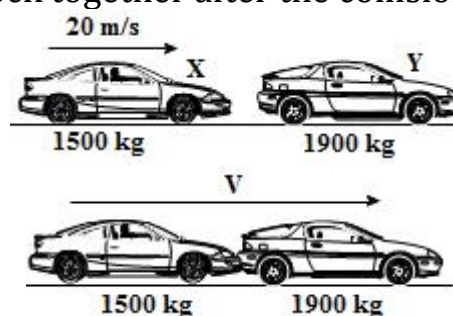


- A. O and P.
- B. P and Q.
- C. Q and R.
- D. R and S.

12. A car starts from rest and accelerates uniformly at the rate of 2ms^{-2} from $1/4$ of a minute. Find the velocity of the car after this time.

- A. 0.5ms^{-1}
- B. 12ms^{-1}
- C. 15ms^{-1}
- D. 30ms^{-1}

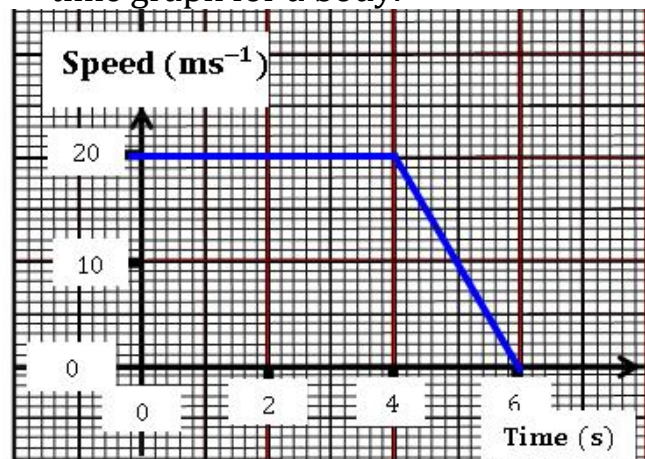
13. Car X of mass 1500 kg travels at 20 m/s along a straight, horizontal road. It collides with a stationary car Y of mass 1900 kg. The two cars lock together after the collision.



The speed of the cars after the collision is;

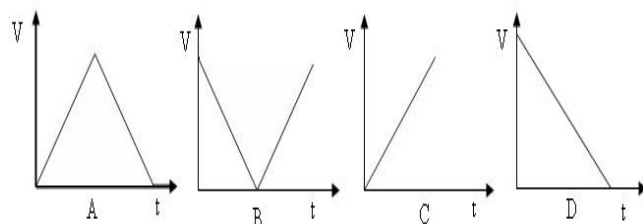
- A. $8\frac{1}{2}\text{ m/s}$
- B. $9\frac{1}{4}\text{ m/s}$
- C. 11 m/s
- D. 16 m/s

14. The in the figure shows a speed-time graph for a body.

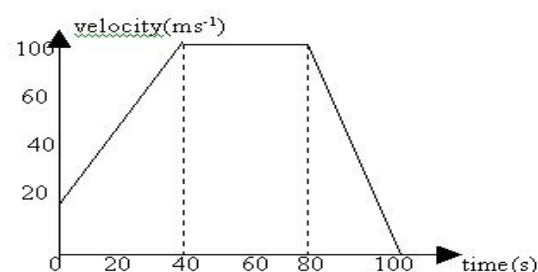


Calculate the distance traveled during retardation

- A. 20m B. 40m
C. 80m D. 100m
15. A boy throws a ball in the air and it goes up and falls back to his hand. Which one of the following sketches of velocity-time graph represents the motion of the ball up to the time it is received back?

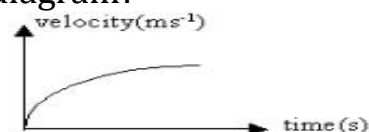


16. The velocity-time graph for a car is as shown in fig. Find the total distance the car travels.



- A. $2.08 \times 10^3 \text{m}$ B. $3.0 \times 10^3 \text{m}$
C. $4.0 \times 10^3 \text{m}$ D. $7.0 \times 10^3 \text{m}$

17. Which of the following best describes the motion represented by the velocity-time graph shown in the diagram?



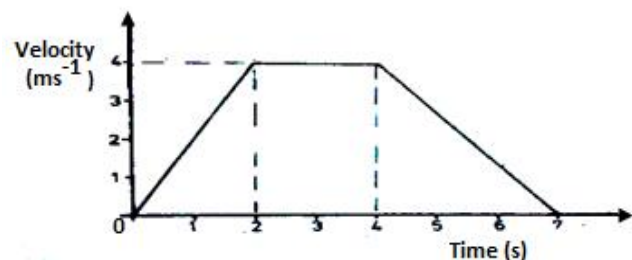
- A. Decelerated
B. Uniformly accelerated motion
C. Non-uniformly accelerated motion
D. Uniform velocity motion

18. A car is uniformly accelerated from rest and after 10s acquires a speed of 20ms^{-1} . How far does it move during the eleventh second?
A. 20m B. 21m
C. 100m D. 121m

18. Which one of the following is not true about a body moving with a constant velocity?
A. its acceleration is zero
B. Its momentum is constant
C. Its kinetic energy is constant
D. There is a resultant force on it

19. A car travelling at 20ms^{-1} is brought to rest in 10s. Find the distance it travels
A. 100m. B. 200m
C. 300m D. 400m

20. Use the velocity-time graph in the figure to find the distance over which there is deceleration.



- A. 4m. B. 8m
C. 6m D. 18m

21. When a car is suddenly brought to rest, a passenger jerks forward because of

- A. inertia B. friction
C. gravity D. momentum

22. A boxer while training noticed that a punch bag is difficult to set in motion and difficult to stop. What property accounts for this observation?

- A. Size. B. Inertia.
C. Friction. D. Weight of the bag.

22. Eggs packed in a soft, shock-absorbing box are placed in a car. When the car suddenly starts or stops moving, the eggs do not crack because.

- A. no force acts on them
B. the force acts on them for only a short time
C. the force is small and acts for a longer time
D. the force causes fast change of momentum.

23. A body of mass 20 kg moves with a uniform velocity

of 4 m/s from rest. Find its momentum.

- A. 5 kg m/s B. 80 kg m/s
C. 160 kg m/s D. 320 kg m/s

24. An object of mass 2 kg moving at 5 ms^{-1} , collides with another object of mass 3 kg which is at rest. Find the velocity of the two bodies if they stick together after collision

- A. 1.0 ms^{-1} B. 2.0 ms^{-1}
C. 2.5 ms^{-1} D. 5.0 ms^{-1}

25. A bullet of mass 0.1 kg is fired from a rifle of mass 5 kg. The rifle recoils at a velocity of 16 ms^{-1} . Calculate the velocity with which the bullet is fired.

- A. 66 ms^{-1} B. 110 ms^{-1}
C. 210 ms^{-1} D. 800 ms^{-1}

26. A body of mass 20 kg moves with a uniform velocity of 4 m/s from rest. Find its momentum.

- A. 5kgm/s B.80
C.160 D. 320

27. When a person steps forward from rest, one foot pushes backwards on the ground. The ground will as a result push that foot

- A. backwards with an equal force

B. forwards with an equal force
C. backwards with a smaller force
D. forwards with a smaller force

28. If the forces acting on a moving body cancel each other out (i.e. are in equilibrium) the body will

- A. Move in straight line to the steady speed
- B. Slow down to a steady slower speed
- C. Speed up a steady faster speed
- D. Be brought to a state of rest.

29. A rider on a horse back falls forward when the horse suddenly stops. This is due to

- A. Inertia of the horse
- B. inertia of the rider
- C. large weight of the horse.
- D. losing of the balance.

30. A mass is projected vertically upwards with a velocity of 10ms^{-1} . What is the maximum height reached by the mass?

- A: 1.0m B: 5.0m C: 10.0m D: 100.0m

31. A body of mass 20 kg, moving with uniform acceleration, has an initial momentum of 200kg m/s and after 10s, the momentum is 300 kg ms^{-1} . What is the acceleration of the body?

- A. 0.5 m/s^2
- B. 5 m/s^2
- C. 25 m/s^2
- D. 50 m/s^2



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1. (a) State Newton's laws of motion.
(b) Define:
 - (i) Inertia of a body
 - (ii) Momentum

(c) Explain why a passenger standing on the floor of a lorry jerks backwards when the lorry starts moving forwards.

(d) A 7-tonne truck initially moving at a velocity of 50m/s accelerates to 80m/s in 3 seconds. Calculate the force on the truck that caused the velocity change.

2. (a) (i) What is meant by **linear momentum**?

(ii) State the law of conservation of linear momentum.

(b) A bullet of mass 20g is fired into a block of wood of mass 400g lying on a smooth horizontal surface. If the bullet and the wood move together with the speed of 20ms^{-1} , calculate the;
(i) speed with which the bullet hits the wood,
(ii) kinetic energy lost.

(c) State the energy changes involved in (b) above.

3. (a) State the law of conservation of linear momentum.

(b) A water jet directed to a spot on the ground digs a hole in the ground after sometime. Explain.

(c) A moving ball P of mass 100g collides with a stationary ball Q of mass 200g. After collision, P moves backwards with a velocity of 2ms^{-1} while Q moves forwards with a velocity of 5ms^{-1} . Calculate the;

- Initial velocity of P.
- Force exerted by P on Q if the collision took 0.03s.

(d) Explain the principal of operation of a rocket engine

4. A sphere of mass 3 kg moving with velocity 4m/s collides head on with a stationary sphere of mass 2kg & imparts to it a velocity of 4.5 m/s . Calculate the velocity of the 3kg sphere after the collision.

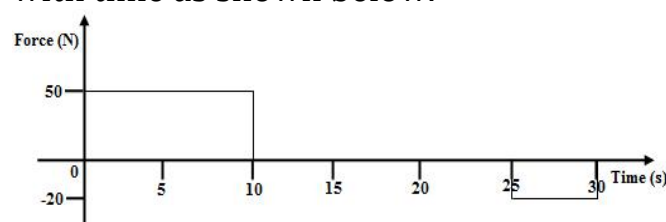
5. A railway track of mass $4 \times 10^4\text{ kg}$ moving at a velocity of 3m/s collides with another truck of mass $2 \times 10^4\text{ kg}$ which is at rest. The couplings join & the trucks move off together.

- State the type of collision.
- Calculate the common velocity after collision.

6.. A body accelerates uniformly from rest at 3ms^{-2} for 4 seconds. Its velocity then remains constant at the maximum value reached for 7 seconds before retarding uniformly to rest in the last 5 seconds. Calculate the:

- uniform velocity.
- total distance travelled.
- retardation
- average velocity for the journey.

8. A body of mass 5kg is at rest when a force is applied to it. The force varies with time as shown below.



- Using the graph, calculate the velocity of the body between 0 and 30 seconds.
- Sketch the velocity – time graph for the first 30 seconds of its motion.
- How far does it travel in the first 10 seconds?

9. A body moves from rest at a uniform acceleration of 2ms^{-2} .

- Sketch a velocity time graph for the motion of the body.
- Find:
 - its velocity after 5 seconds. ($v = 10\text{ms}^{-1}$)
 - how far it has gone in this time. ($s = 25\text{ m}$)
 - how long it will take the body to be 100 m from the starting point. ($t = 10\text{ s}$)

10. Two vehicles A and B accelerate uniformly from rest. Vehicle A attains a maximum velocity of 30ms^{-1} in 10s while B attains a maximum velocity of 40ms^{-1} in the same time. Both vehicles maintain these velocities for 6s before they are decelerated to rest in 6s and 4s respectively.

- (i) Sketch on the same axes, velocity time graphs for the motion of the vehicles.
- (ii) Calculate the velocity of each vehicle 18s after the start
- (iii) How far will the two vehicles be from one another during the moment in (ii) above?

11. A motorist P started from rest and accelerated uniformly to a velocity of

20ms^{-1} in 6s while motorist Q accelerates uniformly from 10ms^{-1} to 40ms^{-1} in the same time. Motorist P then comes to rest in the next 18s. Motorist Q first moves at constant speed for 100s, before it is uniformly brought to rest in 16s.

- (i) Sketch on the same axes, velocity time graphs for the motion of the vehicles.
- (ii) Calculate the total distance travelled by A, his acceleration and retardation.
- (iii) Calculate the total distance travelled by A, his acceleration and retardation.
- (iv) Calculate the average speed for each of the motorists, P and Q.



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1. (a) Define the following terms as used in motion. State the S.I unit in each case.

(i) Distance

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(ii) Displacement:

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(iii) Speed

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(iv) Velocity

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(v) Uniform velocity

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(vi) Acceleration

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(vii) Uniform acceleration

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(b) Write down the equations of uniformly accelerated motion.

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(c) A car traveling at 90km/hr is uniformly brought to rest in 40 seconds.

(i) Calculate the acceleration of the car.

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(ii) Explain the significance of the sign of your value in (b) (i) above.

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(iii) Find the distance moved in this time.

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(d) Sketch the following graphs.

(a)Velocity time graphs		(b) Displacement time graphs	
(i) Uniform velocity	(ii) Uniform acceleration	(ii)Uniform velocity	(ii) Uniform acceleration

(e) A cyclist starts from rest and accelerate uniformly at 1m/s^2 for 20s. Then he maintains the maximum speed so reached for 1 minute and finally decelerates to rest uniformly for 10s.

i) Draw a velocity against time graph for the body.	ii) Calculate the total distance travelled.

(f) A car traveling at 10m/s is uniformly accelerated for 4s at 2m/s^2 . It then moves with a constant speed for 5s after which it is uniformly brought to rest in another 3s.

i) Draw a velocity against time graph for the body.

ii) Calculate the total distance travelled.

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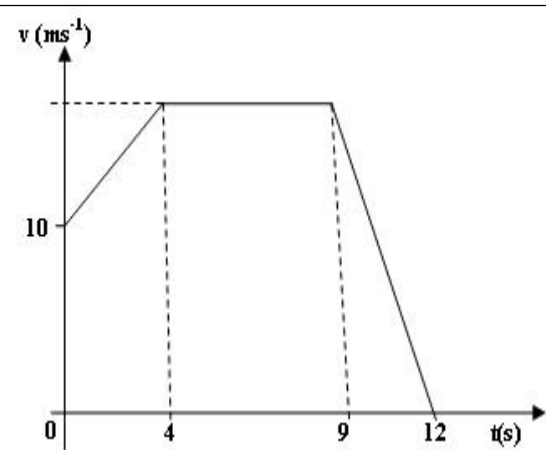
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(g)The graph below shows motion of a body of mass 2kg .



(a) Describe the motion of the body

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(b) Use the graph to calculate the:	
(iii) total distance covered	(ii) Distance covered when moving with uniform velocity.
(ii) acceleration	(iv) retardation
(v) average retarding force	

END



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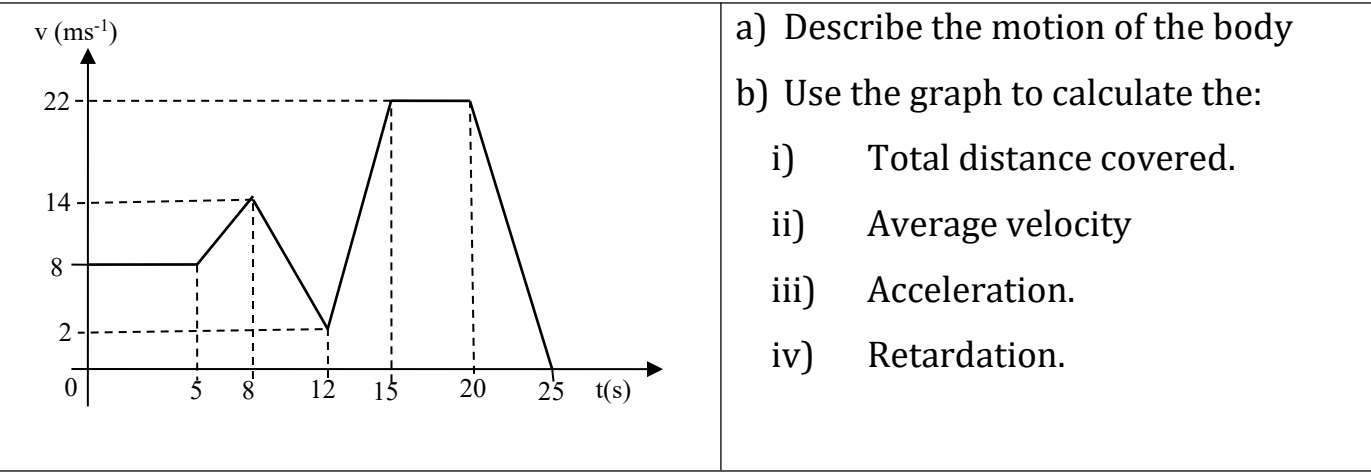
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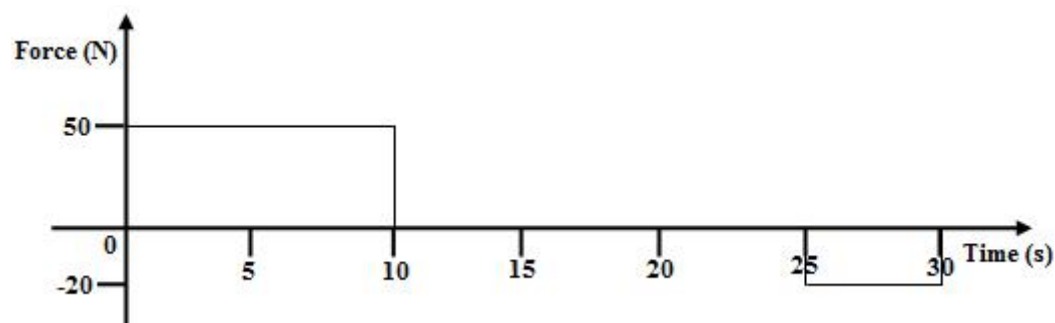
Qn1. The graph below shows motion of a body of mass 120g.



Qn2. A body accelerates uniformly from rest at 3ms^{-2} for 4 seconds. Its velocity then remains constant at the maximum value reached for 7 seconds before retarding uniformly to rest in the last 5 seconds. Calculate the:

- i) uniform velocity
- ii) total distance travelled
- iii) retardation
- iv) average velocity for the journey.

Qn3. A body of mass 5kg is at rest when a force is applied to it. The force varies with time as shown below.



- (iv) Using the graph, calculate the velocity of the body between 0 and 30 seconds.
- (v) Sketch the velocity – time graph for the first 30 seconds of its motion.
- (vi) How far does it travel in the first 10 seconds?

Qn4. A body moves from rest at a uniform acceleration of 2ms^{-2} .

c) Sketch a velocity time graph for the motion of the body.

d) Find:

- i) its velocity after 5 seconds.
- ii) how far it has gone in this time.
- iii) how long it will take the body to be 100 m from the starting point.

Qn.5;

Two vehicles A and B accelerate uniformly from rest. Vehicle A attains a maximum velocity of 30ms^{-1} in 10s while B attains a maximum velocity of 40ms^{-1} in the same time. Both vehicles maintain these velocities for 6s before they are decelerated to rest in 6s and 4s respectively.

- (i) Sketch on the same axes, velocity time graphs for the motion of the vehicles.
- (ii) Calculate the velocity of each vehicle 18s after the start.
- (iii) How far will the two vehicles be from one another during the moment in (ii) above?

Qn.6. A car of mass 1500 kilograms accelerates from rest to a speed of 18 metres per second in 6 seconds.

- (a) Calculate the acceleration of the car.
- (b) The car now travels at a constant speed of 18 metres per second for a time of 5 minutes. Calculate the distance travelled in this time.
- (c) The driver performs an emergency stop. Explain in terms of forces how the seatbelt protects the driver.



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MOTION UNDER GRAVITY (FALLING BODIES)

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1. (a) What is meant by **acceleration due to gravity**?

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(b) Explain why the acceleration due to gravity changes from place to place.

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2. An object is dropped from a helicopter. If the object hits the ground after 2s, calculate the height from which the object was dropped.

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3. An object is dropped from a helicopter at a height of 45m above the ground.

- a) If the helicopter is at rest, how long does the object take to reach the ground hence determine its velocity on arrival?

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- b) If the helicopter had a velocity of 1ms^{-1} when the object was released, what would be the final velocity of the object?

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4. An object is released from an aircraft traveling horizontally with a constant velocity of 200ms^{-1} at a height of 500m.

- a) Ignoring air resistance, how long it takes the object to reach the ground?

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b) Find the horizontal distance covered by the object between leaving the aircraft and reaching the ground.

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5. An object of 2kg is dropped from a helicopter at a height 45m above the ground. If the air resistance is 0.8N, calculate the:

i) acceleration of the body.

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ii) velocity with which the body hits the ground

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SECTION B

1. (a) The table below shows the variation of velocity with time for a body thrown vertically upwards from the surface of a planet.

Velocity (ms^{-1})	8	6	4	2	0	-2
Time (s)	0	1	2	3	4	5

(a) What does the negative velocity mean?

(b) Plot a graph of velocity against time.

(c) Use the graph in (b) above to find the

i) Acceleration due to gravity on the planet.

ii) Total distance travelled.

(c) If the body weighs 34N on earth, what is its weight on the planet?

2. An aero plane travelling at 200ms^{-1} at a height of 180m is about to drop an aid package of medical supplies onto an IDP camp in northern Uganda.

(a) At what horizontal distance before the target should the package be released?

(b) Find the time taken by the package to hit the target.

Free Fall

3. A stone is dropped a deep hole. If it takes 10 seconds to hit the bottom of the hole. Calculate:

(f) its velocity.

(g) the depth of the hole. (Take $g = 10\text{m/s}^2$)

4. A stone is dropped from a top of a cliff. If it takes 6 seconds to hit the ground, calculate:

(h) the height of the cliff.

(i) the velocity at impact. (Take $g = 10\text{ms}^{-2}$)

5. A tennis ball is thrown vertically upwards with an initial velocity of 40ms^{-1} . Calculate:

(j) the maximum height reached.

(k) the time taken to reach the maximum height. (Take $g = 10\text{ms}^{-2}$ and neglect air resistance)

6. A bullet is fired vertically upwards with an initial velocity of 300ms^{-1} . Neglecting air resistance, calculate:
(a) the maximum height reached.

(b) the time taken before it reaches the ground. (Take $g = 10\text{ms}^{-2}$)

7. A stone is thrown vertically upwards with an initial velocity of 20ms^{-1} from a tower 80 m high. Neglecting air resistance, calculate:

(a) the maximum height reached.

(b) the time taken to reach the maximum height.

(c) the total time which elapses before it just hits the ground
(Take $g = 10\text{ms}^{-2}$)



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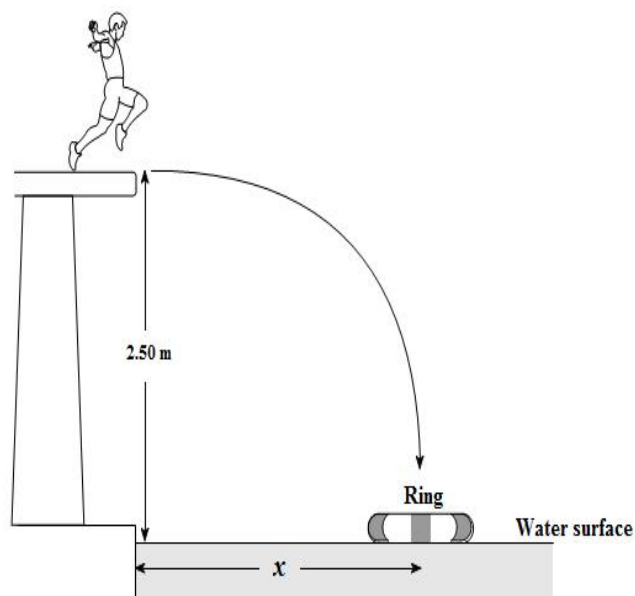
STUDENT'S No.

CLASS/STEAM

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MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

1. In a TV game show contestants are challenged to run off a horizontal platform and land in a rubber ring floating in a swimming pool. The platform is 2.50m above the water surface.



(a) A contestant has a mass of 60 kg. He runs off the platform with a horizontal velocity of 2 m/s. He takes 10s to reach the water surface in the centre of the ring.

(i) Calculate the horizontal distance X from the poolside to the centre of the ring.

(ii) Calculate the vertical velocity of the contestant as he reaches the water surface.

(b) Another contestant has a mass of 80 kg. Will she need to run faster, slower or at the same horizontal speed as the first contestant to land in the ring? You must explain your answer.

Deleted[KING]:

2. A stone is hit horizontally off a cliff with a velocity of 50 ms^{-1} . If it takes 10 seconds to reach the ground, calculate:

- (a) The height of the cliff.
- (b) The horizontal distance from the foot of the cliff to the point where the ball lands.
- (c) The velocity with which the ball hits the ground.

3. An Israel jet fighter plane moving with velocity of 300 ms^{-1} released a bomb to hit a Hezbollah base in Southern Lebanon. If the bomb took 20 seconds to hit the target, calculate:

- (a) The altitude at which the bomb was released.
- (b) The horizontal distance from the vertical point of the plane.
- (c) The velocity with which the bomb hits the target. (Take $g = 10 \text{ ms}^{-2}$)

4. Two vehicles A and B accelerate uniformly from rest. Vehicle A attains a maximum velocity of 30 ms^{-1} in 10 seconds while vehicle B attains a maximum velocity 40 ms^{-1} in the same time. Both vehicles maintain these velocities for 6 seconds. They are then decelerated such that A comes to rest after 6 seconds

while B comes to rest after 4 seconds.

- (i) Sketch on the same axes a velocity- time graph for the motion of the vehicles.
- (ii) Calculate the velocity of each vehicle 18 seconds after the start.
- (iii) How far will the vehicles be from one another during this moment?

5. (a) A stone A is released from the top of a tower of height 180m. At the same time another stone B is thrown horizontally at a speed of 15 ms^{-1} from the same point. Explain why the two stones hit the ground at the same time.

(b) Explain why when jumping, it is safer to flex the knees than keeping the legs stiff when landing at the instant when you touch the ground.

6. Two steel balls A and B of masses 2kg and 1kg are released from rest at the same time. From heights of 20m and 5m respectively.

- (a) Find the difference in the times taken for A and B to strike the ground.
- (b) Explain what would happen if the balls were released from the same height.



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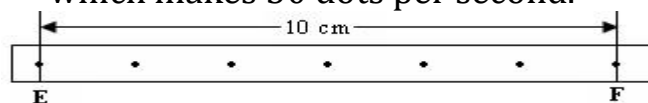
THE TICKER - TAPE TIMER

SECTION A

1. A ticker timer is connected to the mains supply of frequency 40Hz. Find the time it takes to print three consecutive dots.

- A. 0.08 s B. 0.25 s
C. 0.050 s D. 0.75 s

2. The ticker tape shown in the figure was pulled through a ticker timer, which makes 50 dots per second.



The speed at which the tape was pulled is

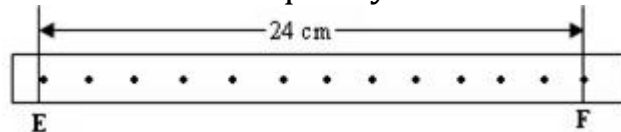
- A. 10cm s⁻¹ B. 25cm s⁻¹
C. 50cm s⁻¹ D. 100cm s⁻¹

3. A tape is pulled through a ticker-timer, which has a frequency of 50Hz. If the distance between successive dots is 2cm, calculate the speed of the body

A. 0.01cms^{-1} B. 50.33cms^{-1}

C. 83.330cms^{-1} D. 100.00cms^{-1}

4. The equally spaced dots on the ticker tape above are made by a vibrator of frequency 50 Hz.



The speed of the tape in m/s is

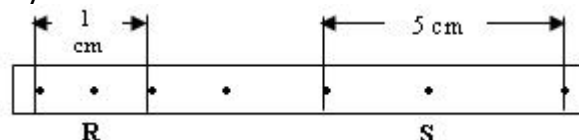
A. 0.1

B. 0.01

C. 0.001

D. 1

5. The tape shown in the diagram below was made by a trolley moving with a constant acceleration. If the frequency of the ticker-timer is 50 Hz, find the acceleration in m/s^2



A. 75 ms^{-2}

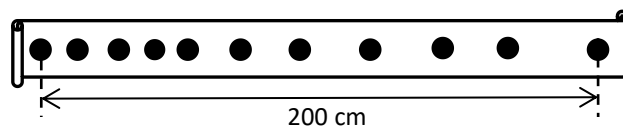
B. 2 ms^{-2}

C. 5 ms^{-2}

D. 12.5 ms^{-2}

SECTION B

1. Below is a tape printed by a ticker -tape timer vibrating at 50Hz. Calculate the average speed.



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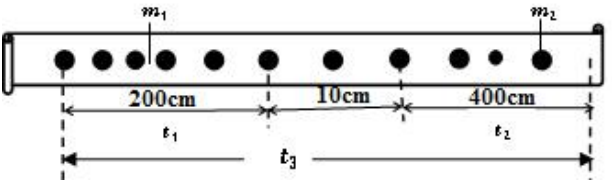
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2.

Below is a tape printed by a timer vibrating at 50Hz



Calculate the;

i) Initial velocity

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ii) Final velocity

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iii) Acceleration

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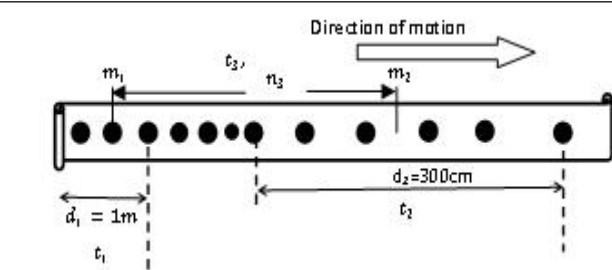
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3. Below is a tape printed by a ticker timer vibrating at 20Hz. Calculate the acceleration?



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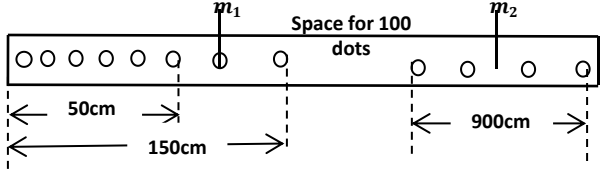
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4. The timer is vibrating at 20Hz. Calculate the acceleration.



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5. A ticker timer is vibrating at 10Hz. Calculate the time taken if the timer prints 21 dots.

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6. A ticker timer prints 11 dots at 20Hz in a space of 2m. Calculate the average speed.

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SECTION C

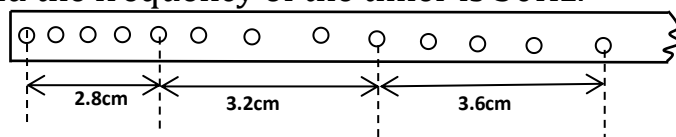
7. A trolley is pulled from rest with a constant force down an inclined plane. The trolley pulls a tape through a ticker timer vibrating at 50Hz. The following measurements were made from the tap.

Distance between 16th dot and 20th dot = d_1 = 20cm

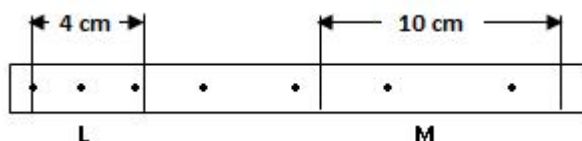
Distance between 20th dot and 30th dot = 34cm

Distance Q between 30th dots and 40th dot = 48cm
Distance between 40th dot and 50th dot = d_2 =62cm
Calculate the acceleration of the trolley.

8. A paper tape dragged through a ticker timer by a trolley has the first ten dots covering a distance of 4cm and the next ten dots covering a distance of 7cm. If the frequency of the ticker timer is 50Hz, calculate the acceleration of the trolley.
9. The ticker timer below was pulled by a decelerating trolley. The tape consists of 3 five dot spaces and the frequency of the timer is 50Hz.



10. Calculate the acceleration of the body. If the tape below is from ticker timer vibrating at a frequency of 40 Hz.





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CIRCULAR MOTION

1. (a) What is meant by **Circular motion**

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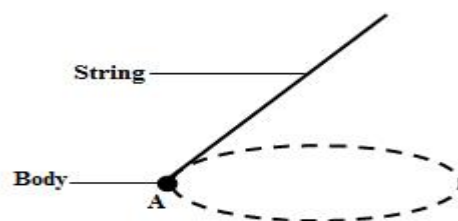
(b) State the factors that determine the magnitude of the centripetal force of a body.

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(c)A body is whirled in air in a horizontal circle by use of a string. As shown in the diagram below. Show and name all the forces acting on the body.



2. (a) Explain what happens when the string breaks at one point during the motion.

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(b) State two examples of circular motion

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(c) Explain why motorists and cyclists bend when negotiating a corner.

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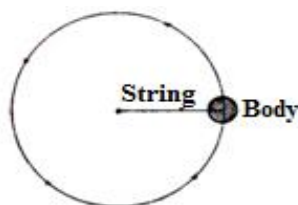
(d) State what provides the centripetal force when a car travels around a bend in a road.

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3. (a) Define the term **acceleration**.

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(b) A body attached to a string is swung in a vertical circular path in air as shown in figure 1.



Copy the above diagram and on it indicate and name all the forces acting on the body if the body is moving in an anti-clockwise direction.

(c) Explain why the weight of an object on the Earth's surface may vary from one place to another.

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(d) A ball of mass 0.25kg is dropped from rest at a height of 20 m above the ground.

(i) Calculate the time it takes to reach the ground.

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(ii) If the ball bounced once on hitting the ground and lost 20% of its original energy, calculate the maximum height the ball reached again.

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4. Explain what keeps the moon moving round the earth.

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5. A stone is tied on a string and then whirled in a horizontal circle. State the factors that determine the amount of centrifugal force acting on the stone.

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6. Explain the motion of the stone at the instant when the string breaks.

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1. (a) State **Newton’s laws** of motion

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(b) What is meant by the term **inertia**?

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(c) Explain why passengers in a taxi tend to jerk forward when the driver suddenly stops the taxi.

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2. Explain why a person in a lift feels heavier when the lift is ascending.

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3. A person of mass 78kg is standing inside an electric lift. What is the apparent weight of the person if the;

(i) Lift is moving upwards with an acceleration of 2ms^{-2} ?

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(ii) Lift is descending with an acceleration of 2ms^{-2} ?

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4. (a) define the following terms;

(i) Momentum of a body

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(ii) Impulse

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(b) State the principle of conservation of linear momentum

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(c) State any **four** (4) differences between elastic and inelastic collisions.

Elastic collision	Inelastic collision

(d) A body of mass 3kg traveling at 5ms^{-1} collides with a 2kg body moving at 8ms^{-1} in the same direction. If after collision the two bodies moved together, Calculate the velocity with which the two bodies move after collision.

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(e) A body of mass 8kg traveling at 20 ms^{-1} collides with a stationary body and they both move with velocity of 15 ms^{-1} . Calculate the mass of the stationary body.

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(f) A body of mass 20kg traveling at 5 ms^{-1} collides with another stationary body of mass 10kg and they move separately in the same direction. If the velocity of the 20kg mass after collision was 3 ms^{-1} . Calculate the velocity with which the 10kg mass moves.

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SECTION B

1. A particle of mass 200g moving at 30 ms^{-1} hits a stationary particle of mass 100g so that they stick and move together after impact. Calculate the velocity with which they move after collision.
2. A military tanker of mass 4 tonnes moving at 12 ms^{-1} collides head on with another of mass 3 tonnes moving at 20 ms^{-1} . After collision, they stick together and move as one body. Ignoring the effect of friction, find their common velocity.
3. A body of mass 10kg moving at 20 ms^{-1} hits another body of mass 5kg moving in the same direction at 10 ms^{-1} . After collision, the second body moves separately forward with a velocity of 30 ms^{-1} . Calculate the velocity of the first body after collision.
4. A car X of mass 1000kg travelling at a speed of 20 ms^{-1} in the direction due east collides head-on with another car Y of mass 1500kg, travelling at 15 ms^{-1} in the direction due west. If the two cars stick together, find their common velocity after collision.



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1 (a) A bullet of mass 8g is fired from a gun of mass 500g. If the missile velocity of the bullet is 500ms⁻¹. Calculate the recoil velocity of the gun.

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(b) A bullet of mass 200g is fired from a gun of mass 4kg. If the muzzle velocity of the bullet is 400ms^{-1} , calculate the recoil velocity.

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(c) A bullet of mass 12.0g travelling at 150ms^{-1} penetrates deeply into a fixed soft wood and is brought to rest in 0.015s. Calculate.

(i) How deep the bullet penetrates the wood

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(ii) Average retarding force exerted by the wood on the bullet.

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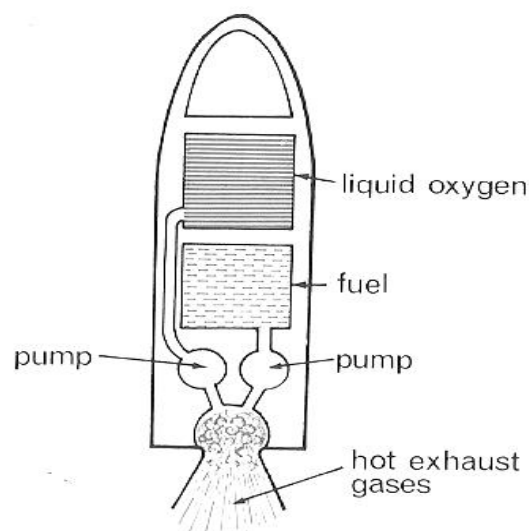
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-Exhaust hot gases at very high speed
-Hence a very high down ward momentum

[The figure above is a **rocket engine**]

(a)With the aid of a diagram at your left, describe the principle of operation of a rocket engine.

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(b) State any differences between a rocket and a jet engine.

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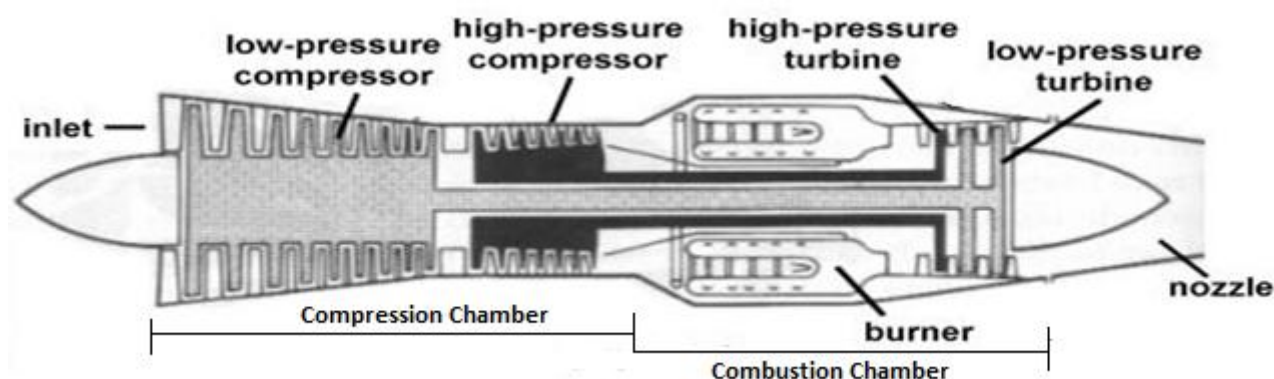
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(d) The figure below shows a **jet engine** taking off vertically and pushes out 25kg of exhaust gases every second at a speed of 100ms^{-1} . Find the upward force on the rocket.

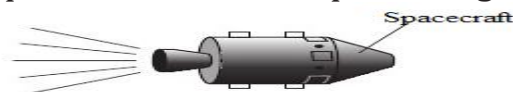


SECTION B

1. A body Q of mass 50g collides with a stationary body "P" of mass 4g. If a body "Q" moves backward with a velocity of 10ms^{-1} and a body "P", moves forward with a velocity of 6ms^{-1} . Calculate the initial velocity of a body Q.
2. A moving ball "P" of mass 100g collides with a stationary ball Q of mass 200g. After collision, P moves backward with a velocity of 2ms^{-1} while Q moves forward with a velocity of 5ms^{-1} . Calculate the initial velocity of P.
3. A body of mass 600g traveling at 10ms^{-1} is accelerated uniformly at 2ms^{-2} for four seconds. Calculate the;
 - (i) Change in momentum.
 - (ii) force acting on a body
4. A van of mass 1.5 tonnes travelling at 20ms^{-1} , hits a wall and is brought to rest as a result in 0.5seconds. Calculate the;
 - (i) Impulse.
 - (ii) Average force exerted on the wall.
5. A man of mass 60kg jumps from a high wall and lands on a hard floor at a velocity of 6ms^{-1} . Calculate the force exerted on the man's legs if;
 - (i) He bends his knees on landing so that it takes 1.2s for his motion to be stopped.

(ii) He does not bend his knees and it takes 0.06s to stop his motion.

6. The rocket engine in a spacecraft burns fuel producing exhaust gases.



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(a) Identify the Newton pair of forces involved.

(b) In deep space, the spacecraft approaches and docks with a stationary space station.



The spacecraft has a mass of 5800 kg and an initial velocity of 0.2 m/s. The space station has a mass of 8700 kg.

(a) Calculate the velocity of the spacecraft and space station after they have docked.

(b) Calculate the kinetic energy of the spacecraft and space station after they dock.

(c) The spacecraft returns to Earth and passes through the atmosphere. The spacecraft has a heat shield of mass 931kg. During the journey through the Earth's atmosphere the heat shield absorbs 1.25×10^9 J of energy and its temperature rises by 1300 °C. Find the density of the material of the heat shield.



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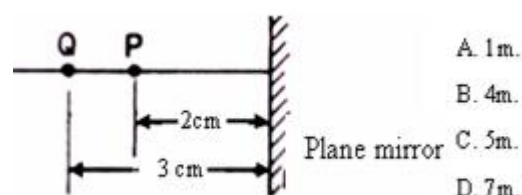
CLASS/STEAM

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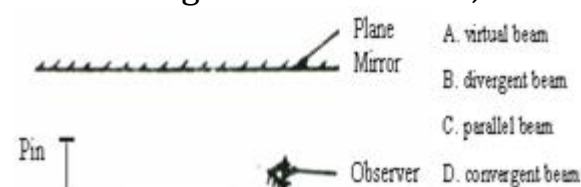
MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

SECTION A

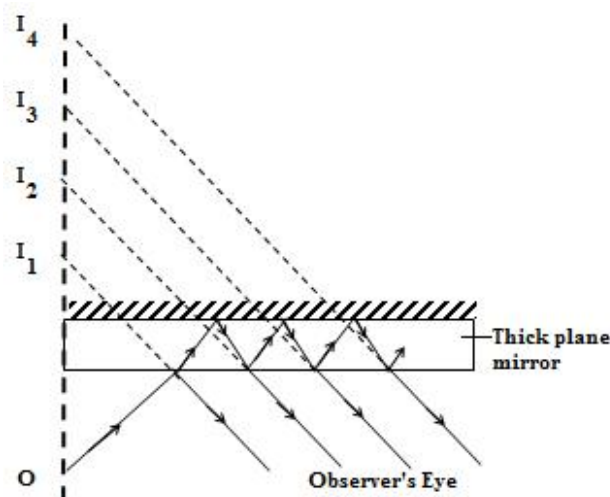
1. light energy is reflected when
 - A. angle of incidence is greater than angle of reflection
 - B. angle of incidence is equal to angle of refraction
 - C. angle of incidence is equal to angle of reflection
 - D. the normal at the point of incidence makes the same angle as the incident ray.
2. When reflection occurs in a plane mirror, the;
 - (i) image is real, erect and magnified
 - (ii) angle of reflection is equal to the angle of incidence
 - (iii) incident ray and reflected ray lie in different planes
 - (iv) object and the image are at the same distance from the mirror
 - A. (i), (ii) and (iii) only
 - B. (ii) and (iv) only
 - C. (i), (ii) and (iv) only
 - D. (iv) only
3. An object is placed 30 cm in front of a plane mirror. If the mirror is moved a distance of 6 cm towards the object, find the distance between the object and its image.
 - A. 24 cm
 - B. 36 cm
 - C. 48 cm
 - D. 60 cm
4. Objects P and Q are placed at distances of 2 m and 3 m respectively from a plane mirror as shown in the figure below. Find how far the image of P is from Q.



5. A person observes the image of a pin placed in front of a plane mirror as shown in the figure 14.2 below. The reflected beam from the pin reaching the observer is a;



6. Which of the following statements about eclipses is NOT correct?
- During the eclipse of the sun, the shadow of the moon falls on the earth.
 - During the eclipse of the moon, the earth is between the sun and the moon.
 - During the eclipse of the sun, the moon is between the sun and the earth.
 - During the eclipse of the moon, the shadow of the moon falls on the earth.
7. The diagram below shows a thick plane mirror forming multiple images of an object at O.



Which image is the sharpest?

- I_1
 - I_2
 - I_3
 - I_4
8. Parallel rays can be obtained practically from a point source of light if the source of light is placed at
- the principal focus of a concave mirror
 - the centre of curvature of a concave mirror
 - the principal focus of a convex mirror.
 - the centre of curvature of a convex mirror
9. The eclipse of the sun takes place when the shadow of the
- earth falls on the moon
 - sun falls on the moon
 - moon falls on the sun
 - moon falls on the earth
10. Two plane mirrors M_1 and M_2 are inclined to each other at an angle of 70° .

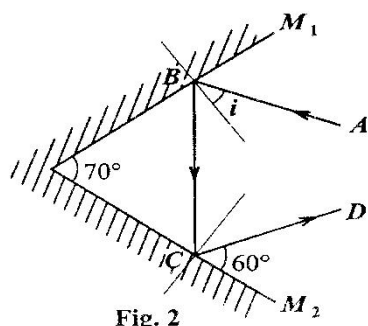


Fig. 2

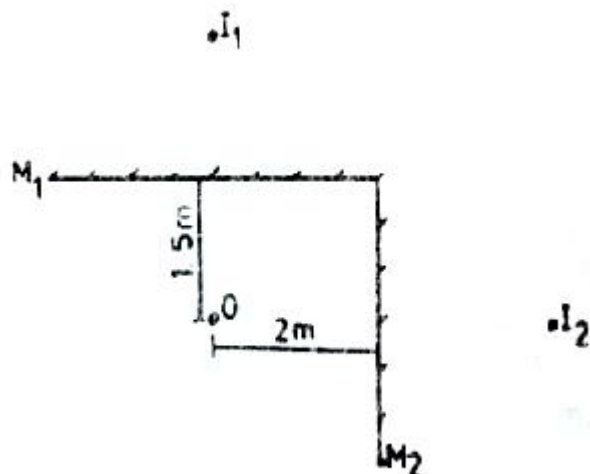
If the ray AB incident on M_1 is reflected as shown in figure 2, find the angle of incidence, i .

- A. 40° . B. 50° .
C. 60° . D. 70° .

11. Which of the following is the mirror image of the word "EXAMPLE" when it is placed facing the plane mirror?

- A. **EXAMPLE** B. **ELPMAXE**
C. **ELPMAXE** D. **EXMAYLE**

12. The images of an object O placed 2m and 1.5m from plane mirrors m_1 and m_2 respectively are I_1 and I_2 as shown in the figure below. Find the shortest distance between I_1 and I_2 .



- A. 2.5m B. 3.5m
C. 5m D. 7m

12. Two plane mirrors placed at angle θ to each other. If the number of images seen are 7. Find θ .

- A: 51.4° B: 60°
C: 45° D: 90°

13. A man looked into a plane mirror and saw the clock as shown below. What was the time then?

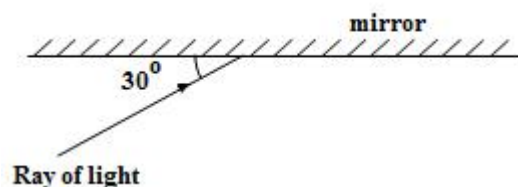


- A. 5:20 B. 6:40.
C. 11:50 D. 12:1

14. The image of a distant object formed by a pinhole camera is;

- (i) Real (ii) diminished (iii) erect
A. (i) only B. (i) and (ii) only
C. (ii) and (iii) only D. (i), (ii) and (iii)

15. A ray of light is incident on a plane mirror as shown.



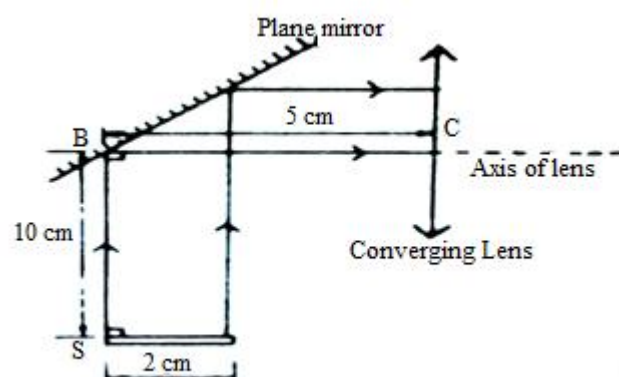
The ray of light reflects from the mirror. Which row in the table shows

the values of the angle of incidence and the angle of reflection?

Angle of incidence	Angle of reflection
A. 30	30
B. 30	60
C. 30	150
D. 60	30

SECTION B

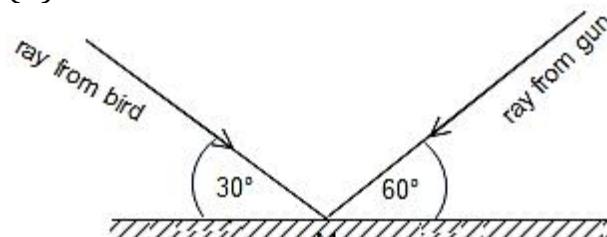
16. The figure below shows a stick, S, lying on a horizontal ground. Two parallel rays from the stick strike the mirror and are reflected on to the converging lens whose centre is C. The focal length of the lens is 10cm and the distance SB and BC are 10cm and 5cm respectively.



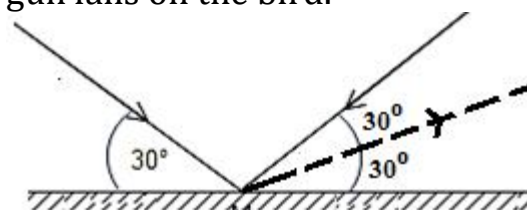
- State the nature of the image of the stick formed by the lens.
- Use the graphical method to locate the position of the two images of the stick.
- Find the magnification of the final image.

17. (a) With the aid of diagrams, distinguish between diffuse and regular reflection

(b)



A ray from a bird makes an angle of 30° with a plane reflector and a ray from the barrel of a gun makes an angle of 60° to the same reflector at the same point, M as shown in the figure. Find the angle through which the reflector must be rotated about M such that the ray from the barrel of the gun falls on the bird.



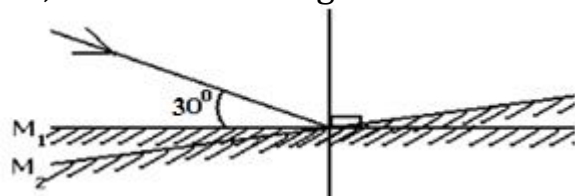
The reflected ray should be rotated through 30° .

- With the aid of the diagram explain why a parabolic mirror is most suitable for use in car head lights.
- List three uses of a concave mirror

18. (a) Describe a simple experiment to demonstrate the principle of reversibility of light. (05marks)

- (b) An object is released from a height of 10m above a plane mirror. What distance must it drop through in order to be 5m away from its image. (02marks)

(c) An incident ray makes an angle of 30° with the plane mirror in position M_1 , as show in the figure above.



What will be the angle of reflection, if the mirror is rotated through 15° to position M_2 while direction of the incident ray remains the same? (03marks)

(d) With the aid of a ray diagram, explain how a thick plane mirror forms multiple images of an object. (04marks)

18. (a) Define the following terms as used in optics;

- (i) Light
- (ii) Transparent material
- (iii) Translucent material
- (iv) Opaque material
- (v) A ray
- (vi) A beam of light

(b) (i) What is meant by **rectilinear propagation** of light?

(ii) With the aid of a labelled diagram, describe an experiment to show that light travels in a straight line.

(iii) State two evidences which prove that light travels in a straight line.

19. (a) What is meant by a **shadow**?

(c) Draw a ray diagram to show the formation of a shadow by;

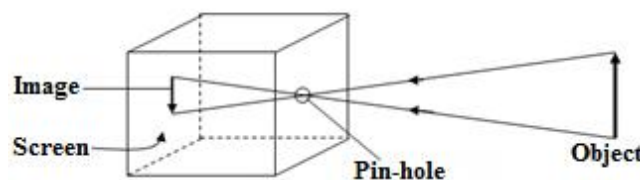
(i) A point source of light	(ii) An extended source of light

(c) Define an **eclipse**,

(d) With the aid of a clear ray diagram, describe the formation of the following eclipses;

- (i) Solar eclipse
- (ii) Annular eclipse
- (iii) Lunar eclipse

20. The diagram below shows a pin hole camera,



(a) State the characteristics of the image formed in the pin hole camera.

(b) Explain what happens when the pin hole is made wider.

- (c) Explain the effect of ;
- (i) adjusting the object distance
 - (ii) Increasing the length of the camera



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SECTION A

1. (a) define the following terms as used in optics;

(i) Light

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(ii) Transparent material

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(iii) Translucent material

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(iv) Opaque material

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(v) A ray

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(vi) A beam of light

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(b) (i) What is meant by **rectilinear propagation** of light?

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(ii) With the aid of a labelled diagram, describe an experiment to show that light travels in a straight line.

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(iii) State two evidences which prove that light travels in a straight line,

(c) (i) What is meant by a **shadow**?

(ii) In the space below, draw a ray diagram to show the formation of a shadow by;

❖ A point source of light	❖ An extended source of light

(d) (i) Define an **eclipse**,

(ii) With the aid of a clear ray diagram, describe the formation of the following eclipses;

❖ **Solar eclipse**

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❖ Annular eclipse

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❖ Lunar eclipse

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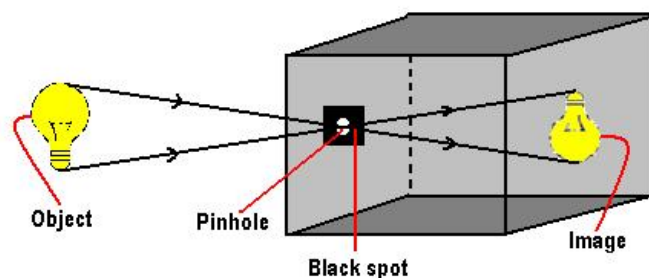
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(e)The diagram below shows a pin hole camera,



(d) State the characteristics of the image formed in the pin hole camera.

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(e) Explain what happens when the pin hole is made wider

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(f) Explain the effect of ;

(i) adjusting the object distance

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(ii) Increasing the length of the camera

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(f) (i) Define the term **magnification**.

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(ii) Calculate the height of a building which is 150m away from a pinhole camera of length 10cm, which produces an image 5cm high.

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(iii) An object 2m high placed 10m from the pin whole camera forms an inverted image 25cm from the pin hole. Find the size of the image and hence or otherwise determine the magnification of the image.

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(iv) An object of height 2.5m is placed at a distance of 150cm from the hole of a pin hole camera. Given that the screen is mounted at a distance of 7.2cm to receive the image of the object, calculate the image height.

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19. (a) Define **reflection** of light

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(b) With the aid of ray diagrams, explain the following terms as used in reflection of light;

[illegible]

(c)(i) State the laws of reflection of light.

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(ii) Briefly describe an experiment to verify the laws of reflection.

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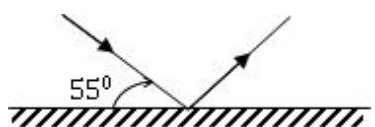
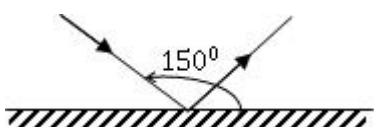
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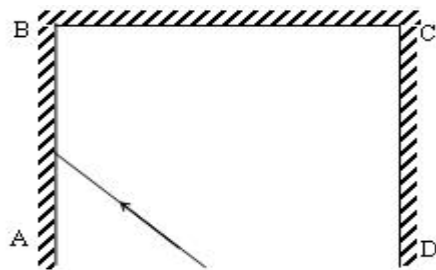
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(g) Determine the angles of incidence in the figures below.

	
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- (h) Three plane mirrors AB, BC, and CD are arranged such that a light ray is incident on AB at an angle of 40° as shown below. Complete the diagram and sketch the subsequent path of the light ray. Hence calculate the angle through which the ray is turned after three reflections.



- (iii) State the characteristics of the images formed in a plane mirror.

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- (iv) With the aid of a diagram, explain what is meant by **lateral inversion**

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(v) With the aid of a diagram, show the formation of all the images when two plane mirrors are inclined at;

(a) 90° to each other	(b) 180° to each other

(vii) State the applications of plane mirrors

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(viii) With the aid of a diagram, describe the action of the following instruments;

(a) Periscope	(b) Kaleidoscope

(i) Explain why lenses are normally fitted in periscopes

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(ii) State the **principle of reversibility of light**

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(iii) A ray from a bird makes an angle of 30° with a plane reflector and a ray from the barrel of the gun makes an angle of 60° to the same reflector. Find the angle through which the reflector must be rotated such that the ray from the barrel of the gun falls on the bird.

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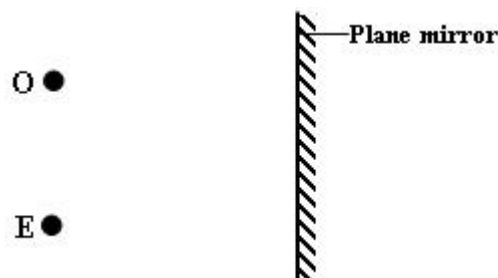
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(xii) By use of two rays from the object, O, show how an observer, E, is able to see the image of O in the figure below.



(xiii) Draw a ray diagram to show that a vertical mirror need not be 180cm long in order for a man 180 cm tall to see his full height in the mirror.

(xiv) If a man's eyes are 12 cm below the top of his head, find the shortest length of the mirror necessary and the height of its base above the floor level.

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(xv) Rachael runs towards a large mirror 10m away at a speed of 3ms^{-1} . With what speed does the image appear to move and in which direction? What is the distance between Rachael and her image after 5 seconds?

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1. An object 10cm high is placed at a distance of 25cm from a convex mirror of focal length 10cm.
 - (i) Draw a ray diagram to locate the position of the image.
 - (ii) Calculate the magnification.(b) State the reasons for use of convex mirrors in vehicles.
2. With the aid of a diagram, explain why a parabolic mirror is most suitable for use in car head lights.
 - (a) List **three** uses of concave mirrors
3. (a) With the aid of the diagram explain why a parabolic mirror is most suitable for use in car head lights.
 - (a) List three uses of a concave mirror.
4. (a) Draw a ray diagram to show the formation of an image of an object O placed in front of a convex mirror shown in the figure below. F is the principal focus of the mirror.
 - (a) A convex mirror whose radius of curvature is 30 cm forms an image of a real object which has been 20 cm from the mirror. Calculate the:
 - (i) position of the image
 - (ii) Magnification produced.
 - (c) State any **two** reasons for use of convex mirrors in vehicles.

5. (a) An object 10cm high is placed 20cm in front of a convex mirror of focal length 10cm. Use an accurate ray diagram to determine the, position, size, nature and Magnification of the image.
6. An object of 3cm tall stands 30cm in front of a concave mirror of focal length 12 cm. By scale drawing, determine the nature, position, size and magnification of the image formed.
7. An object of height 5cm is placed 12cm in front of a converging mirror whose radius of curvature is 36 cm. By construction of a ray diagram, find the nature, position, size and magnification of the image formed.
8. A tree 1.5m tall is focused using a concave mirror placed 40cm away from the tree. The mirror forms an image which is 4.5cm tall on a screen placed 120cm from the mirror. By graphical method, determine the focal length of the mirror used.
9. An object is placed 15cm in front of a concave mirror. An upright image of magnification 4 is produced. By graphical method; determine the nature of the image, focal length of the mirror and distance of the image from the mirror.
10. An erect image 3 times the size of the of the object is obtained with a concave mirror of radius of curvature 36cm. Find the object distance [24 cm]
11. (i) Explain the applications of spherical mirrors giving a reason for each application.
(ii) Briefly describe an experiment to determine the focal length of a concave mirror using an illuminated object.
12. Define the following term as used in curved mirrors;
 - (i) Pole, **P** of a mirror
 - (ii) Aperture of a mirror
 - (iii) Principle axis, **P.a**
 - (iv) Principle Focus, **F** and Focal length, **f**.
 - (v) Centre of curvature, **C** and Radius of curvature, **r**



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1. (a) Define the following term as used in curved mirrors;

(i) Pole, P of a mirror

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(ii) Aperture of a mirror

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(iii) Principle axis

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(iv) Principle Focus, F

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(v) Focal length, f

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(vi) Centre of curvature, C

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(vii) Radius of curvature

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2. State the **major differences** between a concave mirror and a convex mirror

Concave mirror	Convex mirror

3. With the help of a ray diagram, state the **useful rays** necessary in the construction of a ray diagram to locate the position of an image.

4. Briefly describe an experiment to determine the focal length of a concave mirror using an illuminated object.

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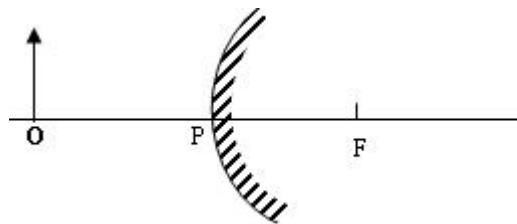
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5. Explain the applications of spherical mirrors giving a reason for each application.

(i) Concave	(ii) Convex

6. (a) The figure below shows an object, O placed in front of a mirror. If F is the principle focus of the mirror. Complete the diagram to show the formation of the image.



(c) State two applications of convex mirrors.

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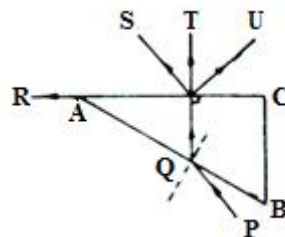
MARKS SCORED	PERCENTAGE MARK	TEACHER'S COMMENT

SECTION A:

1. A stick with one end immersed in water appears bent on the water surface because

A. diffraction B. reflection
C. interference D. refraction

2. A ray of light PQ is incident on the face AB of a glass prism ABC as shown in the diagram in the figure below.



Which one of the rays R, S, T, and U indicates the correct direction of the emergent ray?

A. R B. S C. T D. U

3. Which one of the following is a wrong formula in the study of optics?

A. $M = \frac{u}{v}$ B. $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

C. $\sin C = \frac{1}{n}$ D. $M = \frac{v}{u}$

4. A ray of light is incident on a glass block at an angle of incidence of 45° and the angle of refraction 21° . Find the critical angle of the glass

- A. 42.0° B. 40.0°
C. 33.8° D. 35.0°

5. Total internal reflection occurs when

- (i) the incident angle is equal to the critical angle
- (ii) light travels from a dense to a less dense medium
- (iii) light travels from a less dense to a dense medium
- (iv) the incident angle in a dense medium is greater than the critical angle.

- A. (i), (ii) and (iii) only
B. (ii) only
C. (iv) only
D. (ii) and (iv) only

6. A pin is placed in front of convex lens at a distance less than the focal length of the lens. What type of image is formed?

- A. Real, inverted diminished.
B. Virtual, erect, magnified
C. Real, erect, diminished.
D. Virtual, inverted, magnified.

7. An object 2 cm tall is placed 5 cm in front of a convex lens. A real image is produced 20 cm from the lens. Calculate the magnification of the lens.

- A. 4 B. 2 C. 0.5 D. 0.25

8. An object is placed between a converging lens and its principal focus. The image formed is

- A. real, magnified, upright
B. real, magnified, inverted
C. virtual, diminished, upright
D. virtual, magnified, upright

9. An image 5 cm high is formed by a converging lens. If the magnification is 0.4, find the height of the object

- A. 2.0cm B. 4.6cm
B. C. 5.4cm D. 12.5cm

10. An object is placed at a distance of 20 m from a convex lens of focal length 15cm. the type of image formed is

- A. inverted and magnified
B. B. Inverted & diminished
C. upright and diminished
D. upright and magnified

11. A lens of power 4 dioptries is used to focus an object at infinity. How far the screen must be placed from the lens so that a clearly focused image is seen.

- A. 0.20cm B. 0.25cm
C. 20cm D. 25cm

12. The velocity of light in air is $3 \times 10^8 \text{ ms}^{-1}$ and the velocity of light in water is $2.25 \times 10^8 \text{ ms}^{-1}$. The refractive index of water is;

A. $\frac{4}{3}$ B. $\frac{3}{4}$ C. 3×2.25

D: $3 + 2.25$

13. The ability of the eye to vary its focal length in order to focus light from different objects is referred to as

A: long sightedness

B: short sightedness

C: Astigmatism

D: Accommodation

14. An explosion emits light, infrared and sound waves. What waves will be received first by the person some distance away?

A: infra-red and sound

B: all the three together

C: infra red and light

D: light and sound

SECTION B

2. (a) (i) Define **refraction** of light.

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(ii) Explain what **causes** refraction of light

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(b) (i) State the **laws** of refraction of light

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(ii) Briefly describe an experiment to verify the laws of refraction.

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(iii) Explain any **three effects** of refraction of light.

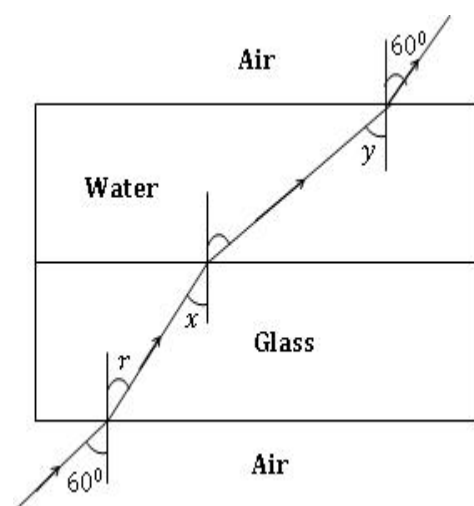
(iv) Define the term **refractive index**.

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(v) The figure below shows a slab of glass of uniform thickness lying horizontally and above it is a layer of water. A ray of light PQ is incident upwards on the lower surface of the glass and is refracted successively at A, B and C, the points where it crosses the air-glass, glass-water and water-air interfaces respectively. Given that the refractive index of glass and water are $\frac{3}{2}$ and $\frac{4}{3}$ respectively.



(a) Calculate the angles r , x and y .

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(a) Find the refractive index of glass for a ray of light moving from water to glass.

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(iv) Distinguish between **real** and **apparent depths**.

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(v). A coin rests at the bottom of a glass filled with ethanol. The coin appears to be raised up by a distance of the total depth of ethanol. Calculate the refractive index of ethanol.

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(vi). Explain why a king fisher bird has to dive at an angle normal to the water surface to be able to catch the fish under water.

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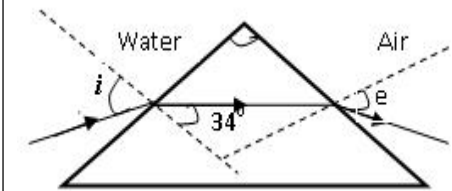
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c) A light ray is incident at various angles at an air-glass boundary. The corresponding angles of incidence and refraction are given below .

Angle of incidence i (degrees)	0	20	40	60	80
Angle of refraction r (degrees)	0	13	25	35	41

- (i) Using the information above draw a graph of $\sin i$ (along vertical axis) against $\sin r$ (along horizontal axis)
- (ii) Use your graph to determine the refractive index of glass.

d) A ray of light travels from water and is incident on an equilateral glass prism at an angle i as shown in the figure above. If the refractive index of water and glass is 1.33 and 1.52, find the value of i and e .



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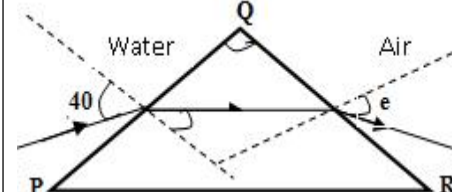
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e) The figure below shows a ray of light incident on an equilateral a triangular glass prism from Water.



Find;

i) the angle of refraction at PQ.

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ii) the angle of emergence at QR.

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d) .i) Explain why prisms are preferred to plane mirrors in manufacture of periscopes.

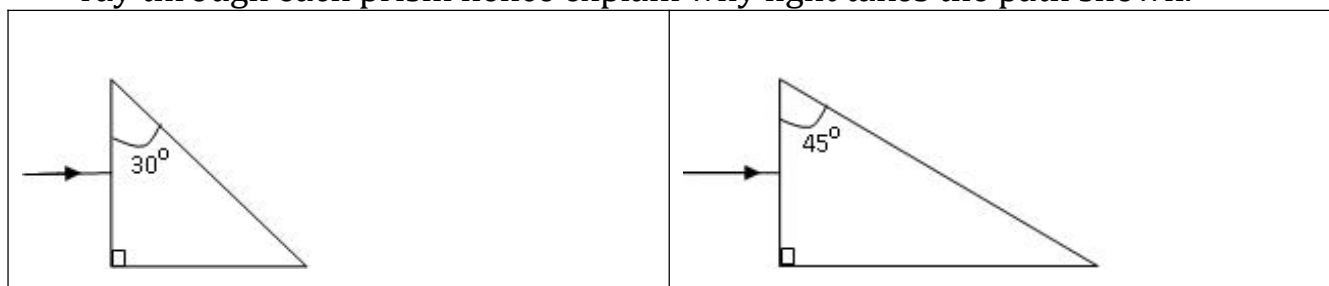
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ii)The figures below show two right angled prisms of refracting angles 30° and 45° respectively. Rays of light are incident normally on the faces of the prisms below. Complete the diagrams to show the path taken by the incident ray through each prism hence explain why light takes the path shown.



e) i). Define a **critical angle**.

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ii). with the aid of a ray diagram, explain what is meant by the term “**Total internal reflection**”.

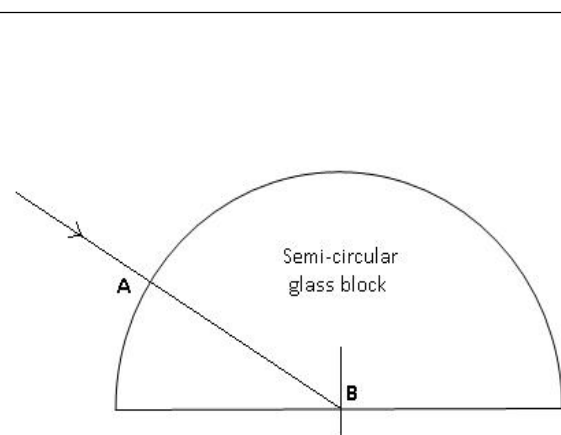
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iii) State any two factors necessary for total internal reflection to occur.

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iv).The critical angle of a certain precious stone is 27° . Calculate the refractive index of the stone.

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v) The figure below shows light incident on a semi-circular glass block of refractive index 1.62.



(a) Explain why light is not deviated at A.

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(b) Calculate the critical angle of the material of the glass block.

iv) State the application of total internal reflection.

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v) Briefly describe the formation of a mirage.

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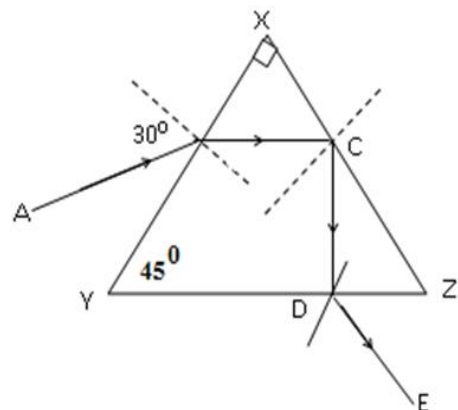
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(a) The figure below shows the path of a ray AB incident on the glass prism XYZ with angles of 90° and 45° and finally emerging along DE.



Explain the statement "The refractive index of the glass is 1.5"

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Why does the ray AC not emerge into the air at C?

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(i) Why does the ray CD refracted away from the normal at D to the side YZ?

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(ii) When the angle of incidence the ray AB makes with the normal at point B is 30° . What is the value of angle r and angle BCP.

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REFRACTION IN LENSES

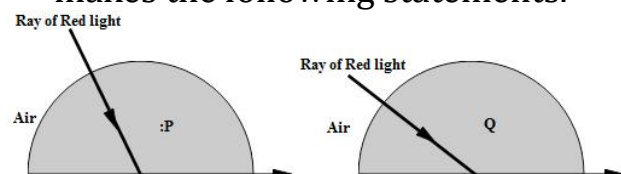
SECTION A

1. A pin is placed in front of convex lens at a distance less than the focal length of the lens. What type of image is formed?
A. Real, inverted diminished.
B. Virtual, erect, magnified
C. Real, erect, diminished.
D. Virtual, inverted, magnified.
2. An object 2 cm tall is placed 5 cm in front of a convex lens. A real image is produced 20 cm from the lens. Calculate the magnification of the lens.
A. 4. B. 2 C. 0.5 D. 0.25
3. An object is placed between a converging lens and its principal focus. The image formed is
A. real, magnified, upright
B. real, magnified, inverted

- C. virtual, diminished, upright
- D. virtual, magnified, upright

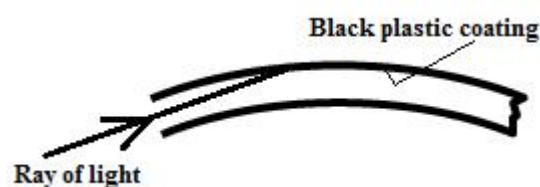
4. An image 5 cm high is formed by a converging lens. If the magnification is 0.4, find the height of the object
- A. 2.0cm
 - B. 4.6cm
 - C. 5.4cm
 - D. 12.5cm
5. An object is placed at a distance of 20 m from a convex lens of focal length 15cm. the type of image formed is
- A. inverted and magnified
 - B. inverted and diminished
 - C. upright and diminished
 - D. upright and magnified

6. From the figures below, a student makes the following statements.



- (I) Material P has a higher refractive index than material Q.
- (II) The wavelength of the red light is longer inside material P than inside material Q.
- (III) The red light travels at the same speed inside materials P and Q.
- Which of these statements is/are correct?
- A. I only
 - B. II only
 - C. III only
 - D. I and II only
 - E. I, II and III

7. The diagram shows a ray of light in an optical fibre.



A student makes the following statements about light transmitted along the optical fibre.

- I. The light is totally internally reflected inside the glass.
 - II. The light is reflected by the black plastic coating.
 - III. The angle of incidence in the glass is greater than the critical angle for this glass.
- Which of the statements is/are correct?
- A. I only
 - B. III only
 - C. I and II only
 - D. I and III only
 - E. I, II and III

SECTION B

3. (i) Draw a clear ray diagram to show how converging lens can be used as magnifying glass.

(ii) An object is placed 10 cm in front of a concave lens of focal length 20 cm to form an image. Determine the position, nature and magnification of the image using a ray diagram.

(iii) An object 5cm tall is placed 15 cm away from a convex lens of focal length 10cm. By construction, determine the position size and nature of the final image. [Use the graph paper provided]

(iv) An object 5cm high is placed 20cm in front of a converging lens of focal length 15cm. Find the power of the lens and the magnification of the lens. [Use the graph paper provided]

(v) An object of height 20cm is placed vertically on the axis of a convex lens of focal length 10cm at a distance of 30cm from the lens. Use the graphical method to find the position, nature and magnification of the image. [Use the graph paper provided].

4. (a) State the types of the two common lenses.

(b) Define the following terms as used in the study of lenses.

(i) principal focus.

(ii) focal length of a converging lens.

(c) With the help of a ray diagram show how a converging lens can be used as a magnifying glass.

5. (a) Define:

(i) real image.

(ii) Virtual image.

(b) State any two properties of an image of a real object formed in a diverging lens.

(c) An object 8 cm high is placed perpendicularly on the principal axis 12 cm away from the diverging lens. With the aid of a ray diagram, find the focal length of the lens, if the height of the image formed is 2 cm

6. The focal length of a converging 10.0 cm. What is its power?

(b) State two applications of converging lenses

(c) An object of height 4 cm is placed perpendicularly on the principal axis at a distance of 45 cm from a converging lens of focal length of 15 cm. By graphical construction, determine

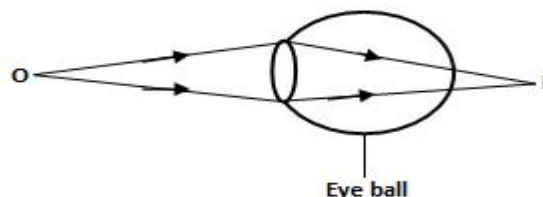
(i) the position of the image. (ii) the magnification.

7. (a) Define **focal length** of a converging lens.

(b) With the aid of a labelled diagram, describe a simple experiment to determine the focal length of a converging lens.

(c) Give one use of converging lenses

8. The diagram in figure below shows one of the eye defects in human.



(a) (i) State the type of eye defect shown in the diagram.

(ii) Explain with a help of diagram how the defect can be corrected.

(b) What is meant by **accommodation**?

(c) With a help of ray diagram, describe how a projector is used to project a magnified image on to a giant screen.

(d) With the aid of a labelled diagram, describe how a lens camera works.



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MARKS SCORED	PERCENTAGE MARK	TEACHER’S COMMENT

9. (a) Define the following terms as used in lenses.

(i) Power of a lens

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(ii) Optical centre.

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(iii) Principle focus

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(iv) Radius of curvature

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b) (i) State the difference between a convex mirror and a convex lens

Convex mirror	Convex lens

(iii) With the aid of a labelled diagram describe an experiment to determine the focal Length of a convex lens.

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c) (i) State any three applications of a converging lens.

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(iii) With the aid of a diagram, describe how a **slide projector** works.

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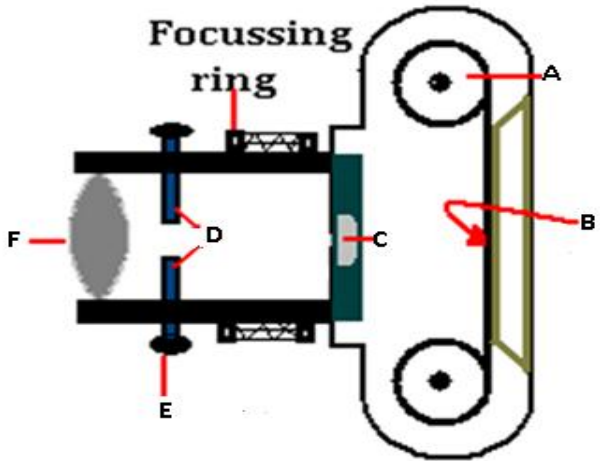
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(iii) The diagram below shows a lens camera. Use it to answer the following questions



(a) State the characteristics of the image formed in the camera in (e) (ii).

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(a) Name and state the function of the parts labelled ;

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C.....

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D.....

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F.....

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(j) State any **four** differences between a **lens camera** and the **human eye**

Lens camera	Human eye
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SECTION A

1. A piece of white cloth viewed through a blue glass appears blue because
 - A. Blue light is absorbed by the glass
 - B. the glass adds blue light to the light coming from the cloth
 - C. the glass transmits only blue light and absorbs all other colours
 - D. the colour of the glass is reflected onto the cloth.

2. A student is holding a white paper with green printing on it. If she enters a room with red lights, she will see
 - A. black printing on a red paper
 - B. blue printing on a red paper
 - C. yellow printing on a red paper
 - D. red printing on a white paper.

3. When a green plant with white flowers is placed in a yellow light, the plant will appear
 - A: green leaves, yellow flowers
 - B: yellow leaves, green flowers
 - C: green leaves, red flowers
 - D: red leaves, green flowers.

4. Which one of the following is correct?
 - (i) green light shone on the green surface is all absorbed
 - (ii) green light added equally to red light appears yellow
 - (iii) green light passes through a red filter
 - A. (ii) only B. (i) and (ii) only
 - C. (ii) and (iii) only
 - D. (i), (ii) and (iii)

5. White light is separated into its component colours due to;
 - A. absorption B. dispersion
 - C. reflection D. Transmission

6. Which of the following are secondary colours only?
 - A. Red, green and yellow.
 - B. Blue, yellow and magenta.
 - C. Yellow, cyan and magenta.
 - D. Red, green and blue.

7. Which of the following statements are true?
 - (i) Surfaces which reflect all colours of light appear white
 - (ii) Red surfaces absorb all colours and reflect only red light
 - (iii) black surfaces appear black because they reflect all colours

- A. (i) only B. (i) and (ii) only
C. (i) and (iii) only D. (ii) and (iii) only

8. The secondary colours of light are cyan, magenta and yellow. Which of the following sets of addition of colours of light will produce white light

- (i) cyan + blue and magenta + red
(ii) cyan + red and magenta + green
(iii) yellow + red and magenta + blue
(iv) cyan + green and yellow + blue

- A. (i) only B. (ii) only
C. (iii) only D. (iv) only

9. Which of the following statements are **true**?

- (i) A magenta filter absorbs green light and transmits red and blue lights.
(ii) A magenta filter absorbs blue light and transmits red and green lights
(iii) A cyan filter absorbs red light and transmits blue and green lights
(iv) A cyan filter absorbs blue light and transmits red and green lights

- A. (i) only B. (ii) only
C. (ii) and (iv) only D. (i) and (iii) only

10. Dispersion of light is:

- A. the rectilinear propagation of light.
B. the spreading of light around an obstacle.
C. the splitting of white light into its constituent colours.
D. the changing of direction by light when it moves from one media to another.

11. When a yellow dress with blue dots is placed in a room lit with pure red light, the dress appears

- A. red with black dots
B. yellow with blue dots
C. green with red dots
D. black with yellow dots

12. A piece of white cloth viewed through a blue glass appears blue because

- A. Blue light is absorbed by the glass
B. the glass adds blue light to the light coming from the cloth
C. the glass transmits only blue light and absorbs all other colours
D. the colour of the glass is reflected onto the cloth.

13. What is the appearance of a blue curtain with red flowers in green light?

	Appearance of curtain	Appearance of Flower

A	Blue	Red
B	Black	Green
C	Black	Black
D	Red	Black

14. A student is holding a white paper with green printing on it. If she enters a room with red lights, she will see

- A. black printing on a red paper
- B. blue printing on a red paper
- C. yellow printing on a red paper
- D. red printing on a white paper.

15. Which one of the following is correct?

- (i) Green light shone on the green surface is all absorbed
 - (ii) Green light added equally to red light appears yellow
 - (iii) Green light passes through a red filter
- A. (ii) only
 - B. (i) and (ii) only
 - C. (ii) and (iii) only.
 - D. (i), (ii) and (iii)

16. White light is separated into its component colours due to:

- A. absorption
- B. dispersion
- C. reflection
- D. Transmission

17. Which of the following are secondary colours only?

- A. Red, green and yellow.
- B. Blue, yellow and magenta.
- C. Yellow, cyan and magenta.
- D. Red, green and blue.

18. Which of the following statements are true?

- (i) surfaces which reflect all colours of light appear white
 - (ii) red surfaces absorb all colours and reflect only red light
 - (iii) black surfaces appear black because they reflect all colours
- A. (i) only
 - B. (i) and (ii) only
 - C. (i) and (iii) only
 - D. (ii) and (iii) only

19. Which of the following statements are true?

- (i) A magenta filter absorbs green light and transmits red and blue lights
- (ii) A magenta filter absorbs blue light and transmits red and green lights

- (iii) A cyan filter absorbs red light and transmits blue and green lights
(iv) A cyan filter absorbs blue light and transmits red and green lights
A. (i) only B. (ii) only
C. (ii) and (iv) only
D. (i) and (iii) only

20. Dispersion of light is

- A. the rectilinear propagation of light.
B. the spreading of light around an obstacle.
C. the splitting of white light into its constituent colours.
D. the changing of direction by light when it moves from one media to another.

21. When a yellow dress with blue dots is placed in a room lit with pure red light, the dress appears

- A. red with black dots B. yellow with blue dots
C. green with red dots D. black with yellow dots.

SECTION B

22. (a) Explain the phenomenon of dispersion applied to white light.

(b) Draw a ray diagram to show the dispersion of white light by a glass prism

(c) With the aid of a diagram, explain briefly how a pure spectrum may be produced.

(d) Explain briefly what happens when white light falls on a green body.

23. (a) Distinguish between secondary and primary colours. Give one example of each.

(b) Name the colour that would be obtained when the following coloured lights are mixed.

(i) Green and red.

(ii) cyan and red.

(b) Explain why an object illuminated by white light appears.

(i) coloured (ii) black

(d) State why most hind car registration number plates are printed black on a yellow background.

(e) Explain the appearance of a blue dress with red stripes in, yellow light, and when in blue light.

(f) Explain why **the hind car registration number plates** are printed **black** on a **yellow** back ground.

(g) (i) With the aid of a labelled diagram, explain how a pure spectrum of visible light can be produced.

(ii) Explain why a glass prism is capable of dispersing white light.

(iii) Explain why the sun appears red at sunrise and sunset.