UACE PHYSICS SEMINAR SLATED FOR 23^RD SEPTEMBER 2023 AT

UGANDA MARTYRS' S.S.S NAMUGONGO

Physics Paper one (P510/1)

SECTION A

1. (a) (i) Define momentum of a body and state its standard units.

(ii) State the law of conservation of linear momentum.

(b) Two bodies A and B of masses 2.0kg and 3.0kg respectively, moving at right angles to each other with respective velocities of $4.0ms^{-1}$ and $2.0ms^{-1}$ are involved in a perfectly inelastic collision. Find

(i) Their velocity after collision.

(ii) The loss in kinetic energy of the bodies.

(c) A man who can swim at $5ms^{-1}$ in still water wishes to cross from one point of a river bank to another directly opposite him. If the river is 400m wide and flows at a speed of $4ms^{-1}$, find

(i) The direction in which the man should swim

(ii) The time he will take to cross the river.

(d) Ship A is 10km south of ship B and is moving northwards at $100kmh^{-1}$. Ship B is moving eastwards at $120kmh^{-1}$. Find;

(i) The shortest distance between the two ships.

(ii) The time it takes to reach the point of shortest distance.

[NDEJJE S.S]

2. (a) (i) State Kepler's laws of planetary motion.

(ii) State Newton`s law of Universal gravitation.

(b) (i) Sketch a graph showing the variation of acceleration due to gravity with distance from the centre of the earth.

(ii) Derive an expression for the acceleration due to gravity g, inside the earth at a distance r, from the earth's surface given that the earth has a uniform density ρ.

(c) The orbital radius of Mars about the Sun is 1.53 times that of the earth about the sun. How many days does Mars take to move once round the Sun?

(d) (i) Define a parking orbit.

(ii) State any two uses of artificial satellites.

(e) A satellite of mass 100kg is in a circular orbit at a height of 3.59×10^7m above the earth's surface.

(i) Find the mechanical energy of the satellite.

(ii) Explain what would happen if the satellite encountered resistance to its forward motion.

[STANDARD HIGH SCHOOL, ZZANA]

3. (a) (i) Define *angular velocity* and *centripetal acceleration*.

(ii) Derive the expression for the centripetal acceleration of a body moving with angular velocity ω in a circular path of radius R.

(b) The period of a conical pendulum is 2.0 s. If the string makes an angle of 60° to the vertical at the point of suspension, calculate the:

(i) Vertical height of the point of suspension above the circle.

(ii) Length of the string,

(iii) Velocity of the mass attached to the string.

(c) (i) Define simple harmonic motion.

(ii) Show that a small mass, m attached to the free end of a helical spring of force constant K, suspended vertically executes simple harmonic motion when displaced through a small vertical distance x, and then released.

(iii) Explain briefly how you can use the experimental arrangement in (ii) above to determine acceleration due to gravity.

(d) A particle of mass 0.1kg is executing simple harmonic motion of amplitude 3.6×10^{-2}m between two points A and B about point O as the centre of oscillation. The maximum restoring force on the particle has a magnitude 3.52 N.

Calculate;

(i) The period of the motion

(ii) The kinetic energy of the particle when it is at a distance 4.5×10^{-2}m from A.

(iii) The total energy of the particle

[SEETA HIGH SCHOOL, GREEN CAMPUS]

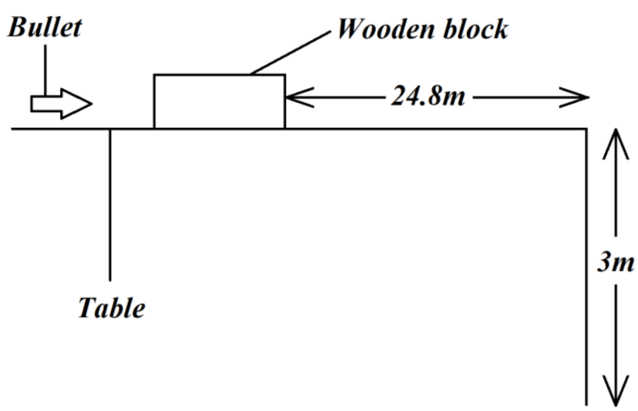
4. (a) (i) Define Friction

(ii) State the laws of solid friction

(iii) Use the molecular theory to explain the laws mentioned in (ii) above.

(b) Describe an experiment to measure the coefficient of dynamic friction between a wooden block and a plane surface.

(c) A block of wood of mass 950g rests on a horizontal table of height 3.0m at a distance of 24.8m from the edge of the table. A bullet of mass 50g moving with a horizontal velocity of $750ms^{-1}$ hits and gets imbedded in the block as shown in the diagram below.



If the coefficient of dynamic friction between the block and the table is 0.3, find

(i) the velocity of the block and bullet just after collision.

(ii) the horizontal distance from the table to the point where the block hits the ground.

[BUDDO S.S]

5. (a) (i) Define **Young's modulus**.

(ii) State Hooke`s law.

(b) (i) Show that when a wire is stretched, the energy E stored per unit volume is given by $\boldsymbol{E = \frac{1}{2} Stress \times Strain}$.

(ii) A copper wire of length 1.000 m is joined at one end to a steel wire of same length and diameter to form a composite wire of length 2.000 m. The composite wire is subjected to a tensile stress until its length becomes

2.002 m. Calculate the tensile stress applied to the wire.
[Young`s moduli for copper and steel are 1.2×10^{11} Pa and 2.0×10^{11} Pa respectively]

(c) (i) Describe an experiment to determine Young`s modulus for a wire.

(ii) State any two precautions taken in c (i) above to ensure accurate results.

(d) (i) Distinguish between ***ductile*** and ***brittle*** materials.

(ii) State the circumstance under which a brittle material can be used during construction.

[JINJA PROGRESSIVE ACADEMY]

6. (a) Define surface tension and derive its dimensions.

(b) (i) Calculate the amount of energy liberated when 1000 droplets of water, each of diameter 1.0×10^{6} cm coalesce to form a bigger drop.

(ii) Derive an expression for the pressure difference between the inside and outside of a soap bubble in air given that the radius of the bubble is r and surface tension of soap solution is γ

(iii) Two soap bubbles of diameters d_1 and d_2 respectively are attached to each other to form an interface of radius r, if $d_1 < d_2$, derive the expression for r in terms of d_1 and d_2.

(c) (i) Distinguish between streamline flow and turbulent flow of a liquid.

(ii) Describe an experiment to demonstrate streamline and turbulent flows.

[CRANE HIGH SCHOOL, ENTEBBE]

<u>SECTION B</u>

7. (a) (i) Define thermal conductivity.

(ii) Describe an experiment to determine thermal conductivity of a copper.

(b) The external wall of a brick house is of area $16m^2$ and thickness 0.3m. The indoor and outdoor temperatures are 20° C and 0° C respectively. Find;

(i) The rate at which heat is lost through the wall.

(ii) The amount of heat lost in one hour when the internal surface of the wall is covered with expanded polystyrene tiles of thickness 20mm.

(iii) The temperature of the brick-tile interface.

(Thermal conductivity of, brick = $0.5Wm^{-1}K^{-1}$, polystyrene = $0.03Wm^{-1}K^{-1}$)

(c) (i) Define a thermometric property.

(ii) State four examples of thermometric properties.

(d) The electrical resistance in ohms of a certain thermometer varies with temperature T kelvin according to the approximate law $R=R_0\,[1+5 \text{ x } 10^{-3}(T-T_0)]$. The resistance is 101.6 ohms at the triple point of water and 165.5 ohms at 600.5K. What is the temperature when the resistance is 123.4 ohms?

[GAYAZA HIGH SCHOOL]

8. (a) (i) What is meant by a **black body**?

(ii) State Stefan's law of black body radiation.

(iii) Draw a graph of relative intensity against wavelength for a black body at three different temperatures and use it to explain why the centre of a furnace appears white.

(b) A 150W electric light bulb has a filament which is 0.8m long and diameter 6.0×10^{-5}m. Estimate the working temperature of this filament if its total emissivity is 0.7.

(c) With aid of a labeled diagram, describe how a total radiation pyrometer is used to measure the temperature of a furnace.

[Mt. St. MARY'S COLLEGE, NAMAGUNGA]

9. (a) (i) What is the difference between an isothermal and an adiabatic change?

(ii) What are the conditions for a reversible adiabatic change to be archived?

(b) (i) State any three differences between real and ideal gases.

(ii) Draw sketches showing the P-V isothermals for a real gas above and below the critical temperature. Mark on the curve, the liquid, saturated vapour and gaseous states.

(c) One mole of a gas occupies $2.24 \times 10^{-2}m^3$ at a pressure of 1.01×10^5 Nm^{-2} and temperature 0°C. If the molar heat capacity at constant pressure is 28.5 $Jmol^{-1}$ K^{-1}, calculate the molar heat capacity at constant volume.

(d) 20g of the gas in (c) initially at 27°C is heated at constant pressure of 1.0×10^5 Nm^{-2} and its volume increased from 0.250 m^3 to 0 .375m^3.
Calculate,

(i) The external work done.

(ii) The increase in internal energy

[Relative molecular mass of the gas =2]

[KYAMBOGO COLLEGE SCHOOL]

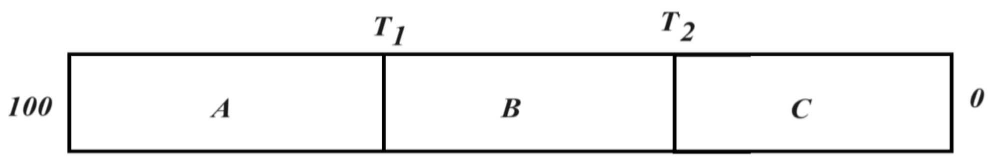
10. (a) (i) Define cooling correction.

(ii) State Newton's law of cooling.

(b) (i) Using a well labelled diagram, describe an experiment to determine the specific latent heat of vaporization of water by the method of mixtures.

(ii) State two advantages of the electrical method over the method of mixtures in determining the specific latent heat of vaporization of a liquid.

(c) Three metallic conductors A, B and C of equal lengths and cross section area are joined to form an insulated composite rod as show in the figure below.



The exposed end of A and C are maintained at 100^{o}C and 0^{o}C respectively. If the ratio of the thermal conductivities of A, B and C is 1.5:2:2.5 respectively,

(i) Find the steady temperatures of the interfaces T1 and T2.

(ii) Draw a sketch graph of temperature against length of the composite rod

(d) Explain why;

(i) One feels cool after sweating.

(ii) Greenhouse effect causes global warming.

[GREENHILL ACADEMY]

<u>SECTION C</u>

11. (a) (i) State the laws of photoelectric emission.

(ii) Define; **work function** and **threshold frequency**

(b) With use of a labeled diagram, describe Millikan's experiment to verify Einstein`s equation of photoelectric emission.

(c) Electrons are accelerated through a high potential difference and enter mid-way between two parallel plates with a velocity parallel to the plates. The plates are

15.0cm long and separated by 12.0mm. The electrons are deflected through 2.0cm on a screen placed 12.5cm beyond the plates when a potential difference of 960V is connected across the plates. Find;

(i) the velocity of the electrons as they emerge from the region between the plates.

(ii) the voltage used to accelerate the electrons before they enter the region between the plates.

(d) In Millikan's oil drop experiment an oil drop of radius 6.2×10^{-6}m and density 880kgm^{-3} was observed to fall through a distance of 6.25×10^{-1}cms^{-1}, when no potential difference was put across the plates. When a potential difference of 690V was applied between the plates, the same drop was seen to rise steadily at a speed of 7.25×10^{-2}cms^{-1}. If the distance between the plates is 1.5cm and the coefficient of viscosity of air is 1.8×10^{-7}Ns^{-1}kg^{2}, find the charge on the oil drop.

[NAALYA S.S, BWEYOGERERE CAMPUS]

12. (a) (i) Define mass defect of a nucleus.

(ii) Explain the observations of Rutherford's scattering of alpha particles by a gold foil.

(iii) Calculate the closest distance of approach when a 5.0MeV proton approaches a gold nucleus. (Atomic number of gold = 79)

(b) (i) Given that the radius of a hydrogen atom having an electron of mass **m** and charge **q** orbiting its nucleus is **r**. Derive the expression for the total energy of the electron. (Angular momentum of the electron = $\frac{nh}{2\pi}$)

(ii) Draw an energy level diagram for hydrogen to indicate emission of ultraviolet, visible and infra-red spectral lines.

(iii) A hydrogen atom is in an excited state of energy -10.6eV. It absorbs a photon of wavelength 1.2 x 10^{-7}m and is excited to a higher energy level. When it falls back to its ground state, a photon of wavelength 0.9 x 10^{-7}m is emitted. Find the energy of the ground state.

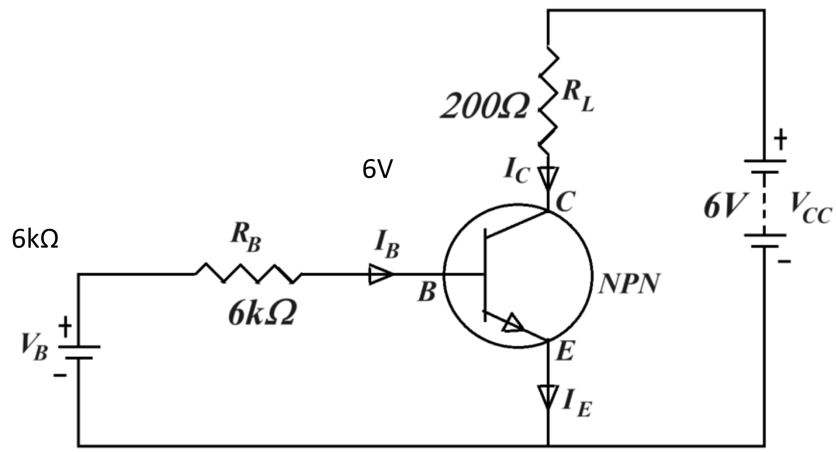
[NAMILYANGO COLLEGE]

13. (a) (i) Distinguish between an **intrinsic** and **extrinsic** semiconductor.

(ii) What is meant by a p-n junction?

(iii) Sketch the I_C-V_{CE} characteristic of a transistor in a common emitter connection for two different I_B current.

(b) The figure below shows a circuit incorporating an n-p-n transistor whose current amplification factor h_{fe} is 50.



With an input voltage V_B of 1.5V, find the;

(i) Base current I_B

(ii) Emitter Current I_E

(iii) Output Voltage V_O

(c) (i) With use of a labelled diagram, describe the use of the main feature of a cathode ray oscilloscope (C.R.O)

(ii) State any two uses of a C.R.O.

(d) With the time base switched off, an alternating voltage with root-mean-square value 2.82 V is connected across the Y-plates of a C.R.O. If a vertical trace of length 4.0 cm is formed on the screen, find the value at which the gain control of the C.R.O is set.

[KAKUNGULU MEMORIAL]

14. (a) When fast moving electrons strike a metal target in an X-ray tube, two types of X-ray spectra are produced.

(i) Draw a sketch graph of intensity against wavelength of the X-rays.

(ii) Account for the occurrence of the two types of spectra.

(b) (i) State Bragg's law of X-ray diffraction.

(ii) Derive Bragg's equation.

(c) (i) State the energy changes that take place in an X-ray tube during the production of X-rays.

(ii) A beam of X-rays of wavelength 2.0×10^{-10}m is incident on a set of cubic planes in a potassium Chloride crystal. First order diffraction maxima are observed at a glancing angle of 18.5°. Find the density of Potassium Chloride if its molecular weight is 74.55.

(Avogadro's number $N_A = 6.02 \times 10^{23}$)

(iii) Briefly explain any application of X-rays.

[NABISUNSA GIRLS SCHOOL]

15. (a) Define binding energy of a nuclide

(b) (i) Sketch a graph showing how binding energy per nucleon varies with mass number.

(ii) Describe the main features of the graph in b (i) above.

(c) Distinguish between **nuclear fission** and **nuclear fusion** and account for energy released.

(d) With the aid of a labelled diagram, describe the working of an ionization chamber.

(e) (i) What is meant by **half-life** and **decay constant** as applied to radioactivity?

(ii) A Geiger Muller (GM) tube placed **20cm** from a **2.0g** of Randon $^{222}_{86}Rn$ gives a count rate of **85** counts per second. If the entrance window of the GM tube has an area of **10cm²**, calculate the half-life of Randon.

[UGANDA MARTYRS' S.S. NAMUGONGO]

Physics Paper Two (P510/2)

SECTION A

1. (a) (i) What is meant by **refraction** of light? (1)

(ii) Describe an experiment to determine the refractive index of a liquid using an air cell. (5)

(b) (i) Explain why water in a glass, viewed from above, appears shallower than it actually is. (3)

(ii) A pin is mounted horizontally in a retort stand above a concave mirror, smeared with water. When the pin is adjusted vertically, it is found to coincide with its image at a height, h_w, above the water. When the experiment is repeated with another liquid, coincidence is achieved at a height of, h_l. If the refractive index of water is n_w, show that the refractive index of the liquid, n_l, is given by, $n_l = \frac{h_w n_w}{h_l}$. (4)

(c) A convex lens of focal length 12cm is arranged coaxially with a convex mirror of focal length 20cm, placed 8cm apart. An object is placed 40cm in front of the lens on the side remote from the mirror.

(i) Find the position of the final image. (5)

(ii) Using a point object, draw a sketch ray diagram to show the image formation. (2)

[St. HENRY'S COLLEGE, KITOVU]

2. (a) Define **magnifying power** and **exit pupil** as applied in optical instruments. (2)

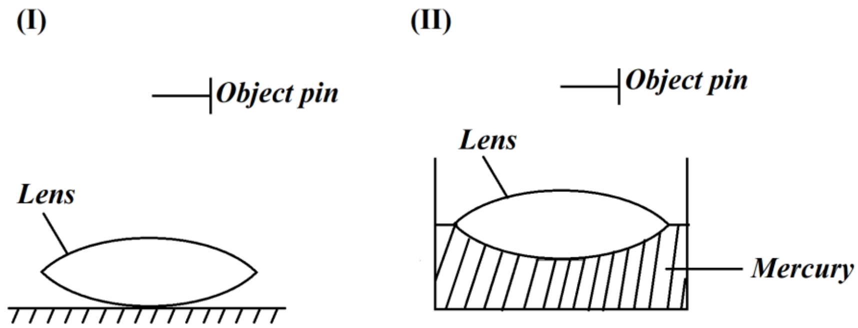
(b) (i) Draw a sketch ray diagram to show how a Galilean telescope forms the final image at the near point. (2)

(ii) Derive the expression for the magnifying power in this setting. (3)

(iii) Compare the magnifying power of the instrument with that of an astronomical telescope, with identical focal lengths when they form the final image at the near point. (2)

(c) Describe an experiment to determine the refractive index of the material of a prism of known refracting angle, using an optical spectrometer. (5)

(d)



A pin is arranged with a convex lens and plane mirror as in diagram above. The pin coincides with its image at a height of 16cm, above the mirror. When the lens is placed on mercury in a dish and again arranged with the pin as shown above, the pin coincides with its image at a height of 12cm above the mercury.

(i) Find the radius of curvature of the lens. (3)

(ii) Suppose the apparatus is again arranged as in figure (I) above, with liquid of refractive index 1.4 between the mirror and the lens, find the height at which the pin coincides with its image. (5)

[WAMPEEWO NTAKE]

SECTION B

3. (a) Define **frequency** and **amplitude** of a wave. (2)

(b) (i) What is a stationary wave? (1)

(ii) Show that when two progressive waves of equal wavelengths, equal frequencies and amplitude travelling in opposite directions superpose, they form a stationary wave. (4)

(c) (i) What is meant by **pitch** and **quality** of a sound note. (2)

(ii) Explain why a note produced by a closed pipe sounds different from when it is produced by an open pipe. (3)

(iii) Describe an experiment to demonstrate that a stretched wire plucked in the middle vibrates in more than one mode simultaneously. (5)

(d) An open pipe of length 130cm producing its fundamental note, resonates with a closed pipe three times as wide, producing its fundamental note. If the frequency is 120Hz, find the;

(i) end correction. (4)

(ii) length of the closed pipe. (3)

[UGANDA MARTYRS' S.S. NAMUGONGO]

4. (a) (i) What is **Doppler effect**? (1)

(ii) An ambulance sounding a siren at a frequency, f, passes a stationary observer with a velocity of u, towards a tall wall. If the velocity of sound in air at the time is, c, derive the expression for the frequency of beats heard by the observer. (3)

(i) Describe how the velocity of a star may be determined using Doppler effect. (3)

(b) A motorist moving at a velocity of $60kmh^{-1}$ hears a siren at a frequency of 540Hz, from a police car pursuing him. If the car is moving at a velocity of $90kmh^{-1}$, and the velocity of sound in air at the time $330ms^{-1}$,find the

(i) frequency of the siren. (3)

(ii) frequency received by the motorist after the police car mistakenly passed him. (3)

(c) (i) Define **beats**, in reference to sound notes. (1)

(ii) Explain how beats are used to determine the frequency of a given note. (3)

(d) Describe an experiment to demonstrate that sound waves undergo interference. (5)

[SEETA HIGH SCHOOL, MAIN CAMPUS]

5. (a) What are **coherent sources** of waves? (1)

(b) Explain how coherent sources are obtained;

(i) using a bi-prism (2)

(ii) using Lloyd's mirror (2)

(c) (i) Two coherent sources of waves a distance, d , apart produce light of wavelength, λ , which interfere on a screen, a distance, D, from the source forming an interference pattern. Show that the width, y, of each fringe is given by $y = \frac{\lambda D}{d}$. (4)

(ii) In an experiment to demonstrate interference by Young's double slit method, the slit separation was 0.3mm and the screen was 1.8m away from the slits. The distance between the 2nd bright fringe and the 5th dark fringe was measured and found to be 9.3mm. Determine the wavelength of the light used. (4)

(d) (i) Two glass slides in contact at one end are separated by a sheet of paper 15cm from the line of contact, to form an air wedge. When the air wedge is illuminated almost normally by light of wavelength 600nm, interference fringes of separation 1.8mm are formed. Find the thickness of the paper. (4)

(ii) Explain why the fringe along the line of contact of the slides in d(i) above is dark, yet the geometrical parth difference is zero. (2)

(e) (i) Describe how plane polarized light can be produced by double refraction. (4)

(ii) Describe how polarized light is used in determining the concentration of sugar in a solution. (3)

[KING'S COLLEGE, BUDDO]

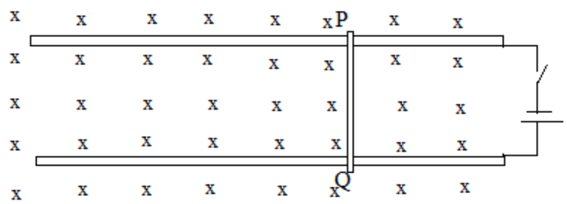
SECTION C

6. (a) (i) Define **one tesla**. (1)

(ii) Write the expression for the force acting on a straight conductor of length, l, carrying current of, I, at an angle,θ, to a magnetic field of flux density, B. (1)

(iii) From the expression in a(i) above, deduce the expression for the force acting on one free electron in the conductor. (3)

(b) (i)



The figure above shows a metal rod PQ of mass 24.1×10^{-3}g lying on two smooth horizontal rails connected in series with a battery of emf 1.5V and a resistor of 18Ω. The rails are parallel and placed 20.4cm apart, in a uniform magnetic field of flux density 5.6×10^{-2}T. Find the velocity of the rod 3seconds after switch K is closed. (5)

(ii) An aeroplane of wing span 40cm is flying in a straight horizontal coast westwards at a speed of $300 kmh^{-1}$. If the angle of dip at the location is 67^0, and the horizontal component of the earth's field intensity is $12.7 Am^{-1}$, Calculate the emf induced between the wing tips. (2)

(c) (i) Define magnetic meridian and magnetic variance. (2)

(ii) Describe an experiment to determine the horizontal component of the earth's magnetic flux density using a tangent galvanometer and a graphical analysis. (6)

[St. MARY'S COLLEGE, KISUBI]

7. (a) Define the terms **reactance** and **impedance** as applied to alternating current. (2)

(b) An alternating current of $I = I_0 \sin \omega t$ through a circuit containing a capacitor of capacitance, C.

(i) Derive the expression for the reactance of the capacitor. (3)

(ii) Compare the values of, V, and, I, at t=0, t=$\frac{\pi}{2\omega}$, and t=$\frac{\pi}{\omega}$, hence deduce the phase relationship between V and I. (2)

(c) Explain why a capacitor appears to conduct alternating current. (3)

(d) A capacitor of 16μF, a coil of inductance 0.5H and a resistor of 74Ωare connected across an a.c source of $V = 30 \sin 120\pi t$. Find the;

(i) average p.d across the capacitor. (4)

(ii) power dissipated in the circuit. (3)

(e) Describe how the attraction type of moving iron ammeter works. (5)

[UGANDA MARTYRS S.S, NAMUGONGO]

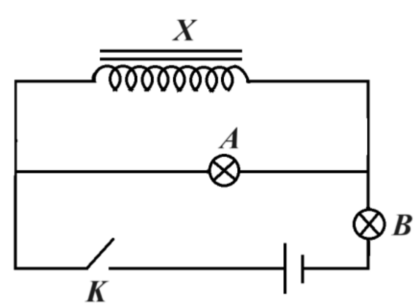
8. (a) State the laws of **electromagnetic induction**. (2)

(b) (i) Derive the expression for the charge, Q, induced in a coil of N turns when the magnetic flux through it changes. (4)

(ii) Describe how the magnetic flux density between pole pieces of a permanent magnet can be determined using a ballistic galvanometer of unknown charge sensitivity. (5)

(c) A copper disc of radius 8cm is placed in a uniform magnetic field of flux density 0.5T, with its plane perpendicular to the magnetic field. The disc is rotated about an axis through its centre at 2500revolutions per minute. If the centre of the disc is connected to the rim through a resistor of 3Ω and an ammeter, find the ammeter reading. (4)

(d)



Two identical bulbs A and B are connected to an inductor X, of large inductance as in circuit above across a strong voltage source. Explain what is observed when;

(i) switch K is first closed (4)

(ii) switch K is opened. (2)

[St. JOSEPH'S S.S, NAGALAMA]

SECTION D

9. (a) Define the following as applied to current electricity:

   (i) Electromotive force (1)

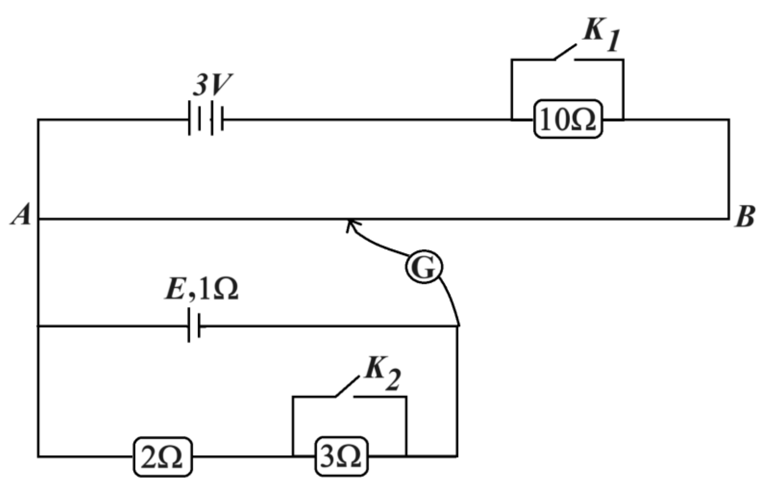
   (ii) Internal resistance. (1)

   (b) Explain the factors determining resistance of a conductor. (6)

   (c) (i) Describe an experiment to determine the *emf* of a thermocouple using a potentiometer. (4)

   (ii) Explain any special modification made to achieve the experiment in c(i) above. (3)

   (d)



In figure above, AB is a uniform wire of length 100cm and resistance30Ω. The driver battery has emf of 3V and negligible internal resistance. Battery E has internal resistance of 1Ω.

With both switches K_1 and K_2 open, the balance length is 92.6cm, when both switches are closed, the balance length is 55.6cm. Find the;

   (i) emf of battery E. (5)

   (ii) balance length when K_1 is open and K_2 is closed. (2)

[SEROMA CHRISTIAN HIGH SCHOOL]

10. (a) (i) Define electrical resistivity of a material. (1)

   (ii) Describe an experiment to determine the electrical resistivity of a material using a potentiometer. (6)

(iii) The conductivity of nichrome at room temperature is $9.1 \times 10^{5}\ \Omega^{-1}m^{-1}$. Find the resistance of a nichrome wire 20cm long and diameter 0.05mm. (3)

(b) (i) Define **voltage** across a conductor. (1)

(ii) Derive the expression for electrical energy dissipated in a conductor of resistance, R, when a current of, I, flows through it for, t, seconds. (3)

(iii) Explain why a wire heats up when current flows through it. (3)

(c) A resistance wire wound into a coil, is connected on the left hand gap of a metre bridge, and a standard resistor of 8.0Ωon the right hand gap. The coil is immersed in a water bath which is heated gently while stirring continuously.

When the temperature of the bath is $20^{0}C$, the balance point is 42.5cm from the left hand end of the slide wire. When the temperature is $80^{0}C$, the balance point is 55.4cm. Find the temperature coefficient of the material of the coil. (5)

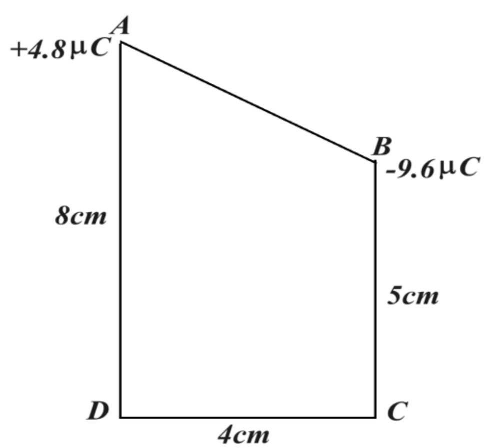
[KIBULI S.S]

11. (a) Define electric **field intensity** and **electric potential difference** between two points in an electric field. (2)

(b) (i) Describe an experiment to show that the surface of a charged, pear shaped conductor is equipotential. (3)

(ii) Explain why the electric field intensity from the surface in b(i) above must be perpendicular to the surface. (3)

(c)



Charges of +4.8μC, -9.6μC and -6.4μC are placed at the vertices A, B and C, of a trapezium in air, as in figure above. Find the;

(i) Electric field intensity at point D. (4)

(ii) Energy required to transfer the +4.8μC charge from A to D. (4)

(d) Describe how a large potential is built in a Van de Graff generator. (6)

[JINJA COLLEGE]

12. (a) Define;

(i) capacitance of a conductor. (1)

(ii) dielectric constant of a material. (1)

(b) (i) Describe an experiment to determine the relative permittivity of a material, using a vibrating reed switch circuit. (4)

(ii) Explain the theory of the experiment in b(i) above. (3)

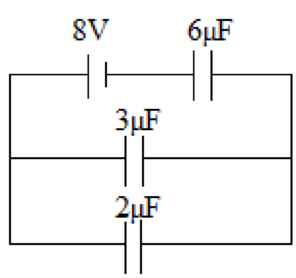
(c) (i) Two identical capacitors are connected in series across a d.c voltage source of, V, and a dielectric of relative permittivity, ε_r, is inserted in one of the capacitors. When they are fully charged, the capacitors are each isolated and then connected in parallel. Show that the final p.d, V', across the network becomes, (3)

$$V' = \frac{2\varepsilon_r V}{(\varepsilon_r + 1)^2}.$$

(ii) Explain why the capacitance of two identical capacitors reduces to half when connected in series and doubles when connected in parallel. (4)

(d) The total electric flux due to a charged spherical conductor of diameter 80cm is $8.14 \times 10^7 Nm^2C^{-1}$. Find the total charge on the conductor. (3)

(e)



Three capacitors of 6μF, 3μF and 2μF are connected across a voltage source of 8V as above. Find the;

(ii) energy stored in the network. (4)

(iii) p.d across the 3μF capacitor. (3)

[St. JOSEPH'S GIRLS S.S, NSAMBYA]