WUNNA EDUCATIONAL SERVICES

LOWER SECONDARY LEARNER'S HOLIDAY PACKAGE

MATHEMATICS AND PHYSICS

SCHOOL NAME:

_____

STUDENT'S NAME:

_____

CLASS AND STREAM:

_____

INSTRUCTIONS:

- Complete all the exercises in this Package.
- Submit your work on the first day back after the holiday.
- Ensure all your work is neat and well-organized.
- Make Research but when answering the package ensure that you work independently to ensure that your understanding is reflected.

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MATHEMATICS

1) Your mathematics teacher has promised to award his best three students Maria, Monica and Mariam with 126 counter books. Each counter book costs UGX12000 in the market. Maria will receive 42 counter books in base 6. Monica will receive 36 counter books in base 8. Mariam will receive the share of her counter books in base 10. To provide accountability to the school head teacher, the mathematics teacher intends to present the data on appropriate chart to the head teacher.

a) Determine how much money was spent in buying Mariam's Counter books.

b) Help the teacher to present the data to the school head teacher.

2) Kauta and Lukonge are students of the same school. They are working on a mathematics assignment that involves number bases. Wilson is working in base 6 while Lukonge is working in base 8. Kauta number is 24 written on a white cardboard while Ronald's number is 32 written on a blue cardboard. They are all aiming at find the least number that can divide all the two numbers. Kauta's class has 5 streams with 15 students each while Lukonge's class has 2 streams with 24 students each. The school wishes to determine the minimum number of students each stream should have so that they contain the same number of students.

a) Help Kauta and Lukonge to determine the least number that can divide all the two numbers.

b) Help the school to determine the number of students each stream should have?

3) Your school has received a new set of mathematics books for the lower secondary school curriculum from the ministry of education and sports. The school is arranging the books into boxes to hand them over to the school librarian. The school decides to arrange the books in rows on different number bases. The first box is arranged in base 2, the second box in base 3 and the third in base 5. Each box has equal number of books in each row. The first box contains 5 rows of books. The second box contains 9 rows of books and the third box contains 8 rows of books. The librarian is creating selves and each self will contain equal number of books. Each book costs UGX25000

a) Determine the total number of books that the school received from the ministry of education and sports.

b) How many books will the librarian arrange in each shelf?

c) Determine the amount of money spent in buying each box of books.

4) Scovia locks her phone with a password “MATH” after using it. Each letter in the password represents a number in base five. M represents 13, A represents 1, T represents 20 and H represents 8. Ruth wants to use the phone but needs to combine the numbers in base 10 to unlock the phone. Scovia bought the phone at UGX780000. She plans to sell the phone to Ruth at UGX1080000. Scovia plans to use part of the money to buy a crate of soda that has 24 bottles for her birthday and save the rest. Each bottle of soda costsUGX12000.

a) What number should Ruth use to unlock the phone?

b) Determine Scovia’s percentage profit.

c) Express the amount of money that will be used to buy the crate of soda as a percentage of the amount of money that will be save.

5) A telecommunication company in Uganda offers a special promotion to all customers having their brand smartphone. The promotion allows customers to convert their loyalty points to a specific amount of money in US dollars and finally to Ugandan shillings (UGX) basing on a unique number base system. In this system, the digit 3 in the loyalty points is equivalent to the digit 5 in the decimal system. Joshua accumulates 243 loyalty points every week. Each loyalty point can be converted to UGX 11400. The company sells each phone at a profit of 5%. They sell each phone at UGX 585000.

a) Determine the amount of money Joshua received for his loyalty points in US dollars for last week. Hence determine the total amount of money he will receive within 6 weeks.

b) Determine the cost price of each phone.

6. A football team gains 3 points on the first tournament, loses 6 points on the second tournament, loses 3 points on the third tournament and gains 4 points on the fourth tournament. Each point gained is awarded UGX54500 and each point lost is deducted UGX12500. The team has 40 players who are either left footed or right footed. 28 players are right footed while 17 players are left footed. A player who is both left and right footed is awarded UGX 258000 by the football association.

a) Determine the total amount of money the football team obtained from the four tournaments

b) How much money did the football management spend in awarding the players who are both right and left footed? (write your answer in words)

6) James bought three bags at UGX 45000 each after being given a discount of 5% on the original price of each of the bags from a shop in Kampala. He bought oranges at UGX500 each and put in the bags. Each bag contained 8 oranges. James then decided to share them with his four friend Joshua, Jakin, Jack and Jadon by dividing them equally in to four groups. He bought 10 more oranges later on and added them to the total number of oranges he had. James realized that he had to multiply the sum of the oranges by 2 to determine the final count. Joshua being the oldest of the other four friends by 2 years claims that he

should be given more oranges. The sum of the ages of the five people when pressed on a calculator was found to be 77.

a) Determine the total amount of money of the final count.

b) What is total original cost of the three bags

c) Determine the ages of the five people.

7) Oscar wants to design a triangular garden in her backyard. The base of the triangular garden is 12 metres long and the height is 8 metres. He plans to divide the garden in to three equal sections to plant different flowers. Oscar decides to allocate $\frac{1}{3}$ of the garden to roses, $\frac{1}{4}$ to tulips and the remaining section to sunflowers. Oscar realizes that the roses need 40% of their section to grow properly, the tulips need 25% and the sunflowers require 35%. Oscar decides to install a decorative border around the perimeter so that it just touches the edges of the garden and the border costs UGX50000 per metre.

a) What is the total cost of installing the decorative border?

b) What is the area in square meters allocated to each type of flower?

c) Find out how many square metres of each flower bed should be allocated for optimal growth.

8) Your sister, Mercy works in one of the non-governmental organizations in Uganda. She is paid a monthly salary of UGX8800000. Your sister decides to invest a portion of her total savings in a fixed deposit account that offers a simple interest rate of 5% per month. She invests $\frac{1}{3}$ of her total savings which amounts to UGX1400000. Mercy saves 30% of her monthly salary and uses the remainder to pay school fees.

a) Determine the amount of money she withdraws from the fixed deposit account after 4 years.

b) Work out her total savings in 2 years.

9) Your school is located at (2, −1), which is 2 blocks east and 1 block south of the centre of town. To get from your house to the school, you walk 5 blocks west and 2 blocks north. The school is near the houses of four of your friends Alex, Bernard, Cathy and Dalton. Alex's house is 600 meters north of the school, Bernard's house is 300 metres on 60° east of north of the school. Cathy's house is half kilometer on south of east of the school while Dalton's house is south west of the school. Dalton's house is 400 metres from the school.

a) Is your school or your school closer to the centre of town? use a suitable graph

b) Show accurately the position of the houses of the four friends and determine how far Dalton's house is from Alex's house.

10) A new football coach of an English premier club is designing a new style of play for his team on a coordinate plane that represents a football pitch. The goalposts are located at points A(2,4) and $B(2, -4)$. The football coach wants the team to practice running a play to facilitate counter attack against the opponent where the centre back starts the ball at point $Q(-3,1)$ and throws the ball in a straight line to the wide midfielder at point R(4, −2).The football club has a total of 40 players. 28 of the players can defend, 14 can attack while 2 of the players can neither attack nor defend. A player who can both defend and attack receives a weekly bonus.

Task

a) The football coach would like to present his new style to the board of directors of the club, help him to address this challenge.

b) Write an equation that represents the path of the ball. How many players receive the weekly bonus?

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11) There is a quarantine of all cattle and goats in some parts of Western Uganda especially Mbarara District. The area honorable Member of Parliament (M.P) wants to throw for his constituents a celebration party for the success of the Parish Development Model (PDM) and he has invited a lot of guests. However due t the quarantine he cannot buy any animals from Mbarara and he has been advised to go to Kayunga where cheap cattle and good Yoghurt can be found. He moves from Mbarara to Masaka which is **160km** North of Mbarara. From Masaka he moves west wards **150km** to Kampala. From Kampala he heads to Mukono which is in the direction $\boldsymbol{S75^{o}W}$ which is **90km** from Kampala. From Mukono he heads to Kayunga which is **148km** and south of Mukono.

When he reached Kayunga he bought **400** cows and each costs **UGX850**, per cow. The farmer and owner of the cow first gives a **5**% discount on each cow plus an additional **10**% discount for any number of cows bought in excess of **250**.

In order to package the yoghurt, he bought two identical types of buckets. A smaller bucket with a base radius of **30cm** and a larger bucket with a base radius of **50cm**. He intends to use the buckets to keep the Yoghurt for his guests. The capacity of the smaller bucket is **45 litres** and he is to buy **4** smaller buckets and **2** larger buckets. **.**

(a) Direct the honorable MP on the shortest route he should take and the shortest distance between Mbarara and Kayunga.

(b) Find the total cost he incurred in purchasing the cows.

(c) What is the maximum amount of Yoghurt be bought for his guests.

12) Holistic Prayers Ministries International for a long time has been soliciting money to construct a church which can congregate all the church members. The Senior Pastor has a vision of a Hexagonal church which can fit exactly in the plot of land available. He wants to know the actual cost of constructing the church. He also has to buy a Sino Truck to transport all building materials and requirements. The contractor informs him that the area of each triangle that can be formed from the hexagonal church will cost him **UGX 128**,**000**,**000**.
He then proceeded to Nina Motors to buy the Sino truck. A brand new Sino Truck costs four hundred eighty millions on cash. It can also be bought by paying a deposit of a quarter of the Cash price value and either pay **UGX7**. **5 millions** weekly for **50 weeks** or pay **24**. **5 millions** monthly for **15 months**. The pastor does not have the required money to obtain the Sino Truck on cash.
(a) Help the pastor determine the cost of the church.
(b) How much extra will he pay for the Sino Truck and explain why. *(25 scores)*

13) A certain tourist in USA is planning to visit the following places in Africa next month. The tourist has highlighted the following places on the map of Africa. These include; South Africa, Burundi, Kampala, Dodoma, Accra, Bujumbura, Nairobi , Ghana, Johannesburg, Tanzania, Uganda, Kenya, Cairo, Kigali, Egypt and Rwanda. Mr. Apeku Elias is an agent for three companies of soda: Coca cola. Pepsi and Riham beverages. He earns 10% commission on every carton of soda sold. He sells each carton of Coca cola at UGx.1 1,000, Pepsi at UGx.11,000 and Riham at UGx.10.000 On a good day, he sells 30 cartons of coca cola, 20 cartons of Pepsi and 10 cartons of Riham.

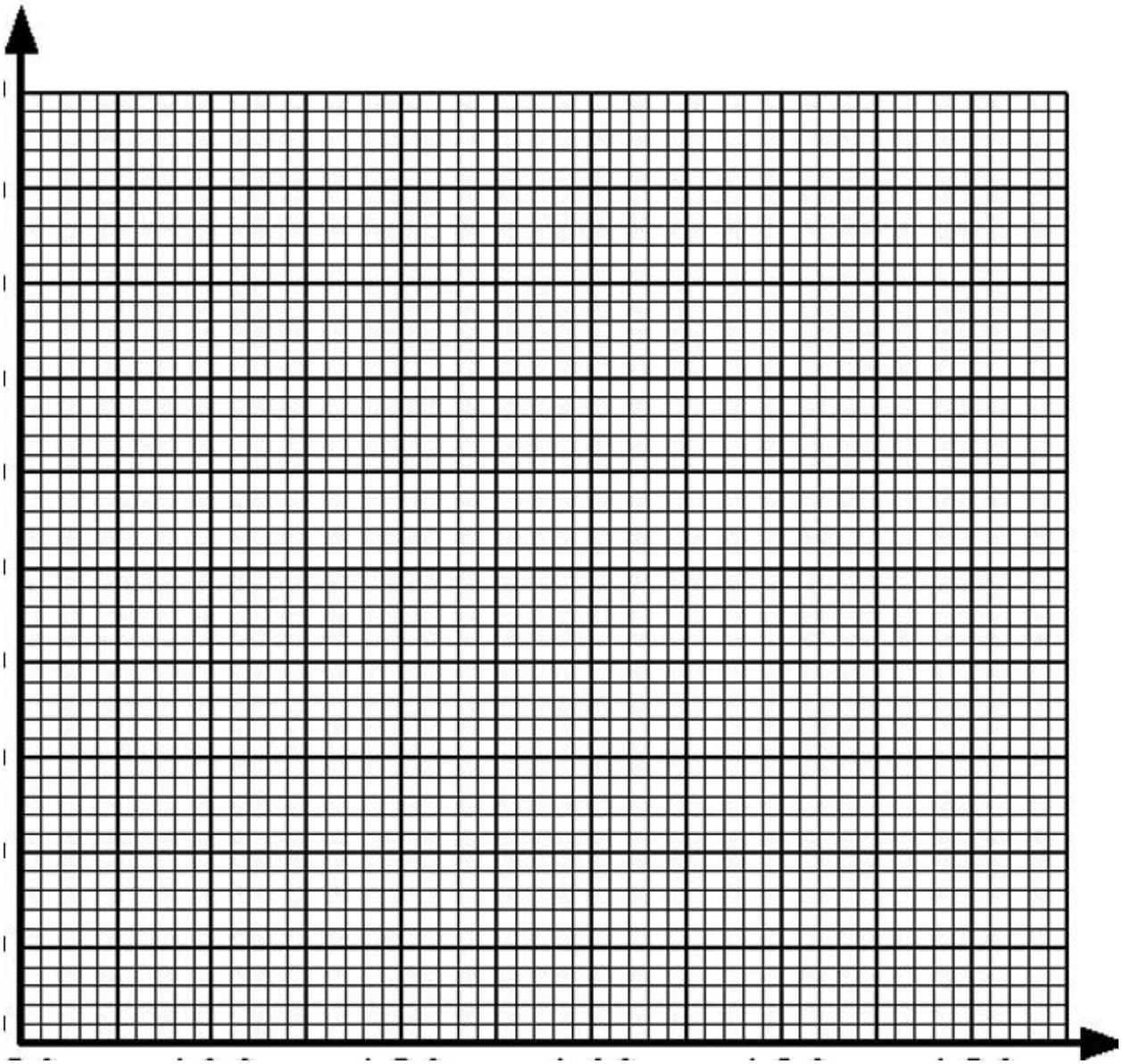
a) Help the tourist to sort the places by use of an arrow diagram.
b) i. List the places in the Domain set.
ii. List the members of the range
iii. What is the relationship between the domain and the range?
Iv. Describe the type of mapping in the arrow diagram in (a) above
c) Help Apeku to know the commission earned on a good day from all the sales.

14) Mr. Lwanyaga the head of mathematics department organized a mathematics study trip to Namanve where assembling of Toyota vehicle and manufacturing of Coca-Cola products are done, and in his report to the members of mathematics department shows the cost of hiring a school bus is constant for any a bus and other varies as the distance covered by the bus. He later reviled that if a bus covers 100km then charged kshs.4500 and kshs.4000 for a distance of 60km. The distance between the school and Namanve is 480km and they expected to live the school at 8:00am at an average speed of $100km/hr$ according to the school's study trip rules and procedures and after the trip they students would rest for forty-five minutes and then proceed back to school.

Tasks:

a) As the treasure of the mathematics department help Mr. Lwanyaga to know total expenses for the total journey.

b) By representing the journeys on a suitable graph explain the motion of the bus to the school administrators.



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15) Kalumba and his father Katamba have an age difference of 20 years and the product of their ages is 800 years. One day during a mathematics lesson Kalumba borrows a calculator from his neighbor and on the screen he finds a number 840 which made him wonder which two numbers he could have entered to get the as a product of the figure. Later on during the festive season Kalumba and his elder brother David were visited by their uncle and were each given shs.42000 and shs.53500 respectively. Kalumba used all his money to buy 4 shirts and 3 vests while David used all his money to buy 5 shirts and 4 vests.

(a) How old do you think is Kalumba and his father Katamba?

(b) Help Kalumba figure out all the possible values that his neighbor could have typed in the in the calculator to get the number on the screen.

(c) Help the two brothers explain to their father how much he would spend if he wanted to buy three vests and five shirts for their cousin brother Isaac.

16) Uganda National Road Authority is planning to construct a roundabout at mile mbiri along Kampala-Gulu Road. The area identified has a triangular flower garden with a base of 10m and other two sides making an angle of 60^0 and 45^0 with the base. By constructing a roundabout, the flower garden must not be destroyed. WUNNA CONSTRUCTIONS LTD a Construction company charges 1,000,000 per meter constructed.

TASK

As an engineer help UNRA to know how much money it should prepare for the company to complete this work.

HINT: The roundabout should not go beyond the vertices of the flower garden.

PHYSICS

1. During holidays, a boy of mass $50kg$ went to a play resort near the lake shores on a certain beach and sat on one side of the see-saw at a distance of $2.4m$ from its pivot. It was very hot that day and the diurnal temperatures were above 42℃; afterwards he decided to enter the lake and swim to cool himself. He was wearing heavy black shorts and a white vest. After swimming, he was left puzzled and wondering why his heavy black shorts dried quicker than the white vest and the beach cottages roofed with grass were cooler than those roofed with iron sheets.

Hint: specific heat capacity of human body is $\mathbf{3.5 kJkg^{-1}K^{-1}}$**.**

As a physics student;

a) Help the guide at the play resort to determine if another boy of mass $40kg$ will restore equilibrium in the see-saw if he sits at a distance $3m$ from the pivot.

b) Assist the boy to understand what has made him puzzled.

c) Determine the quantity of heat lost by the boy if his temperature in the lake was 22℃.

2. Jordan was confused about which material to use as a line for hanging clothes. He decided to obtain materials of the same thickness, made of copper and nylon each of length 200cm, and loaded them in turn, with clothes of 20N which stretched to 201.5cm and 205.5cm respectively.
He washed the other clothes the next morning and hung them on a cloudy day, as his friend cooked some milk in the kettle using a charcoal stove. To his surprise the clothes were not fully dry by evening.

Task

As a Physics student,

a) Help Jordan eliminate the confusions with reasons, on the best material to use for hanging clothes. (03 marks).

b) Calculate the extension created in each of the materials after loading it with blankets each of mass 3kg. (07 marks)

c) Explain to Jordan why clothes were not dry by evening. (04 marks).

Using the knowledge of heat transfer, explain to Jordan's friend how heat from the charcoal stove made the milk ready. (06 marks)

3. During the midday heat of an extremely hot day, district engineers made a visit to a construction site situated near a primary school. However, one of the engineers expressed concern about a foul odor coming from the primary school latrines. This prompted him to approach the school administrators, who admitted their lack of knowledge regarding the cause of the odor spread, attributing it to hot weather conditions beyond their control. A week later the engineers presented their findings:

- Some construction materials lacked sufficient mechanical properties.
- Carrying concrete on their heads posed a risk to the builder's safety. They urged them to continue using concrete however recommended reinforcing concrete for increased strength.
- A small material of the same type as the iron bars used at the site measuring $14cm$ in length, exhibited an extension of $0.3cm$ when subjected to a load of $20kg$. This information caused confusion among the builders.

Hint: *the diameter of the iron sample material (having the same properties as the iron bars used at the site) was* $7 \times 10^{-2}mm$ **,***the recommended iron bars should have a Young's modulus of at least* $4.0 \times 10^{9}Nm^{-1}$*, acceleration due to gravity,* $g = 10ms^{-2}$

Task:

Having acquired some physics knowledge, help

a) The builders understand;

i) The emphasized mechanical properties highlighted in the report.

ii) Why they urged them to continue using concrete, what it means by reinforcing concrete and suggest alternative methods for transporting concrete to higher floors.

b) Help The builders evaluate whether the iron bars used were suitable for construction of such structures.

c) Help the school administrators understand why the odor could spread much during hot days and provide strategies to minimize the odor spread.

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4. At a certain construction site in a given town casual laborers were required to raise construction materials to the 3rd level which was 2400m from the ground, they requested for a crane consisting of a pulley system of velocity ratio 7. The operator raised a total load of 40,000N using an effort of 8,000N. Their boss always complains that the workers who carry the construction materials do the work slowly, especially in the afternoon when the temperatures are high and in the morning when it is cold. In response, the workers claim their hands are burnt by the hot metals which slows them down. Later, when doing their work they noticed something unusual about their flag at the lake shore near the construction site. During hot days, the flag flew towards land and at night, it flew toward the sea, even though there was no wind

Task:

As a learner of physics;

a) Explain why the metals are very cold in the morning and hot in the afternoon
b) Draw a diagram to illustrate the pulley system contained in the crane.
c) Determine the efficiency of the pulley system.
d) Explain why the efficiency of the machines is always less than 100% and state how it can be improved.
e) State the applications of pulleys in our daily life.
f) Explain to the scouts why the flag behaved that way

5. A breakdown truck is used to rescue a car from an accident given that the car is of mass 1200kg and the break down is supposed to take it to the police station 1.5km away from the accident point. The breakdown truck uses an electrical system working at a rate of **50kJ per second** for 10 minutes to perform the task.

Task

a)Comment on the breakdown is effective in using energy from its batteries giving Reasons why the value is not the maximum it can be. [7 marks]

b) A man carries a bag of cement of mass 50kg from the ground floor to the first floor using stairs of height 0.01m each.

Determine the work done by this man to move the bag of cement from the ground floor to the first floor after climbing 20 stairs. [3 marks]

(c) Today in the morning at St. Maphia primary school, 2 pupils were found dead in a down tank which is 10 metres long below the ground. The head teacher was arrested immediately and the vision group interacted with him and says that the pupils were fetching water from the tank using a rope tied on the jerrycan which had a capacity of containing water up to the weight of 5kg.

Task

(i) Help the school **step by step** to come up with a simple machine they can use at the moment to help the school from being closed. [8 marks]

(Include illustrations where necessary).

(ii) Guide the pupils on how to use the machine using the least possible energy

6. A group of scouts on a camping trip noticed something unusual about their flag at the lake shore. During hot days, the flag flew towards land and at night, it flew toward the sea, even though there was no wind. They were puzzled by this observation. Later, they met a local farmer who had recently built a dam on his farm. He was unsure about whether it was safe to fill the dam to its full capacity and why the walls of the dam were so thick at the bottom of the dam. Additionally, the farmer was concerned about the quality of milk produced on his farm and suspected that his employees might be diluting it.

Hint: *the dam is 8m deep and can support a maximum pressure of* 70000 Pa.

Task:

As a student of physics;

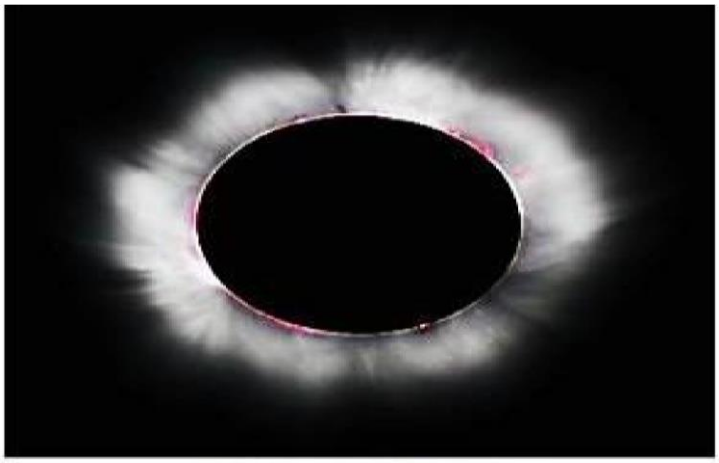
a. Explain to the scouts why the flag behaved that way.

b. Help the farmer understand the purpose of thick walls at the bottom of the dam and advise him on whether to fill the dam to capacity.

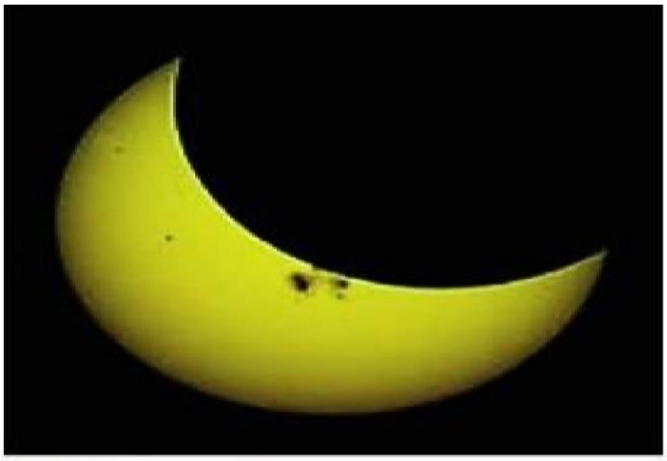
c. Suggest a way for the farmer to determine if his milk was being diluted or if there were other factors affecting it.

Use: *density of water* = $1000 kgm^{-3}$, *acceleration due to gravity, g* = $10 ms^{-2}$

7. A long time ago, solar eclipses were considered as a message from the gods since the people in that age dwelt so much in the spiritual realm than the scientific world. However, with the development of science and technology, eclipses can now easily be explained scientifically instead of spiritually. Whenever eclipses occur, many people gather out in open places to watch the beautiful view of the heavenly bodies as they align themselves in a beautiful display.



(a) Total eclipse



(b)Partial eclipse

However, in most remote areas of Uganda some people still observe the eclipse directly using naked eyes not aware of the risk they are exposing their eyes to in the long run. The science club of your school has taken an initiative to always once in a while go out into the community and teach the community members about scientific facts. This year you are expected to go out during the day an eclipse is expected to occur to. You are expected to organize for the presentation about eclipses.

8. Some bottles of colourless liquids were being labelled by the lab technician and accidentally mixed them up and lost a track of the content. 15.0cm^3 of the sample of the liquid weighing 22.3g was withdrawn from one bottle which the technician suspect to be either acetone, benzene, chloroform or carbon tetrachloride.

He however has a challenge of identifying the right chemical so that he can label all the bottles correctly.

Support material:

LIQUID	Acetone	Benzene	Chloroform	Water	Carbon tetrachloride
DENSITY (gcm^3)	0.792	0.899	1.487	1.000	1.595

Task:

(a)What was the identity of the liquid? Clearly show your working.
(b)With a reason which of the liquids shown in the table above can float on water? And identify the liquids on which water floats
Give any two practical applications of the knowledge of density

9. A newly recruited dentist was supposed to examine the tooth of the patient. The dentist wants to use a curved mirror of focal length 10cm but he is not so sure of the position of the patient's from the mirror. The possible positions of the tooth from the mirror are A, B, C, D and E.

Support material;

Position	A	B	C	D	E
Distance from the mirror.	10cm	5cm	15cm	20cm	25cm

Task:

(a)Which type of the curved mirror is the dentist supposed to use?

(b)As a physics learner, explain how you would help the dentist to select the best position of the patient's tooth and give a reason why you have not selected the other positions.

Draw a ray diagram to illustrate the image of the tooth in the mirror when the tooth is at a position you have selected in (b) above and give atleast two features of image formed.

RAY DIAGRAM

Features of the image

_____

_____

_____

_____

10. A certain man built a three storied apartment. Because he wanted to cut costs, he constructed an underground water tank and installed pipes from the tank to all the apartments including those on upper floors. When he got tenants, those especially on the upper floors complained about the slow rate at which water flows out of the pipes. He called an engineer who advised him to construct a tank stand and water be pumped to the tanks instead of directly to the taps.

As a physics student, assume you have been chosen to provide expert advice to the land lord;

a. Help him understand what caused slow water rate in the houses
b. Convince him on how the raised tank will solve the problem.
c. Draw for him a sketch of the raised water tank next to/on the house.
d. Advise him on the type of materials to use while constructing the water tank.

Additional information

(The available tank has a capacity of 1000L, density of water is $1000kgm^{-3}$, and the cross section area of the tank is $7854cm^2$)

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11. (a) During covid-19 lock down, temperature guns were introduced to tell people's temperature even when there were thermometers in medical facilities. Some politicians complained that it was a waste of tax payer's money

(i) Assist such politicians to appreciate that such a government strategy was necessary in handling the pandemic

(ii) What **two (2)** limitations can you point out in relation to using temperature guns to tell temperature of a person

(b) Having taken your sister to a nearby clinic suspecting that she has Malaria, you see the nurse touching her cheek to tell her temperature. You realize the readings on their clinical thermometer are faded due to overuse

(i) What **two** common liquids are used in the thermometer they have?

(ii) Identify **any two** reasons for the choice of each liquid stated in b(i) above

What steps would you advise the makers of the thermometer to follow to put the readings back on the thermometer

12. In your community some of the roads are murram. During the rainy season Lorries and pickup trucks usually skid, slide or get stuck in the mud.

If you found a driver stuck in the mud (soft and slippery situation).
Tasks

a) Suggest possible ways to remove the truck from this position.
b) Advise the driver on how to avoid the above situation

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13) Mr. Asiimwe sells milk at his shop. One day he received a customer who bought 2 liters of milk. On reaching his home, the customer came back to the shop saying that Mr. Asiimwe's milk was so dilute and not pure so he wanted Mr. Asiimwe to refund his money. The biggest problem was that Mr. Asiimwe had no lactometer to prove to the customer that the milk was not dilute. The customer placed the milk on the electric balance that was near and insisted that on being refunded. On looking at the electric balance, it had reading of 4kg.

Support: The density of pure concentrated milk is $2gcm^{-3}$.

Task: as a learner who has studied physics help Mr. Asiimwe to see whether his milk is pure or not.
Should Mr. Asiimwe refund the money or not? Give reasons to your answer.

14) In a Bukonte village, Kaswabuli is a resident near Bukonte primary school who complains about the bad smell that comes from the pit latrines at the school, the L.C 1 chairperson wanted to resolve the issue and he decided to visit his home but, on his way, it started raining with thunderstorm and lightning that made him reach when it had just stopped raining. Kaswabuli was disappointed to smell nothing during the times he thought that he will be helped and he kept on wondering the magic a person can use to send away the smell which was intense when was shining before the rain.

Task.

a) State the properties of the states of matter reflected in the scenario.
b) Make a write up to Kaswabuli to explain how the smell reaches his home and to clear his confusion on that day.
c) Does the phenomenon in the scenario occur in liquids? If yes, describe how it can be shown.

14) Mr.Wuuna, a Divinity/History teacher wishes to set up a hair saloon during the third term holiday. When he shared his plan with Tr.Ivan, a physics teacher, he was advised to first consider buying a curved mirror of focal length 30 cm so that he could use it as a shaving mirror in his saloon. Mr. Wuuna didn't know which type of curved mirror to buy and how to determine its focal length.

Task:

a) As a learner of physics, help Mr. Wuuna to dentify the type of curved mirror to be bought.

b) Use a ray diagram to illustrate the use of the selected curved mirror as a shaving mirror.

c) (i) What are the properties of the image formed above?

(ii) Describe a simple experiment to show that light travels in a straight line.

d) An object of height 4 cm is placed 35 cm away from a pin-hole camera. The screen is 7 cm from the pin-hole camera.

i) Draw a ray diagram to show the formation of the image by a pin-hole camera.

ii) What is the nature of the image formed?

iii) Find the height of the image

iv) Find the magnification

(v) Explain what happens to the image if the pin-hole is made larger.

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15) **New vision**

Sad news!!! Sad news!!! Sad news!!!

Today in the morning at Namutumba primary school, 2 pupils were found dead in a down tank which is 10 metres long below the ground. The head teacher was arrested immediately and the vision group interacted with him and says that the pupils were fetching water from the tank using a rope tied on the jerrycan which had a capacity of containing water up to the weight of 10kg. The government is taking a step of closing the school tomorrow and to arrest all the teachers.

Support materials

A rope, the same jerrycan, a metallic bar OR a long moderate piece of wood **and** a wheel of the bicycle.

Task

a) Help the school come up with a simple machine they can use at the moment to protect it from being closed. Show all the necessary steps and illustration of this machine. Also guide the pupils on how to operate the machine using the least possible energy. (**10 scores**)

b) Use the knowledge of application of atmospheric pressure, write a simple report to L.C.V of Namutumba district, and include a machine you would recommend the government to install at the school to solve the problem completely. Give the reason(s) for the choice of the machine. (**10 scores**)

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NEW LOWER SECONDARY CURRICULUM PHYSICS PRACTICAL

INTRODUCTION

1. The new curriculum physics practical assessment consists of only two (2) scenario questions, from either Mechanics, light or electricity and a learner attempts only one question.

2. The duration for this exam is strictly 2 hours.

3. The steps in a scientific investigation are;

- observing a situation,
- identifying a problem or question,
- identifying variables involved,
- formulating a hypothesis,
- designing and carrying out an experiment,
- collecting and tabulating data,
- writing a report for the investigation.

INDICATORS FOR PHYSICS SCIENTIFIC INVESTIGATION

The learner must write a practical work report which will include the following;

(a) Aim of the scientific investigation (experiment).

(b) Variables of the experiment

- Independent variable
- Dependent variable
- Controlled variable

(c) Hypothesis

(d) List of apparatus and materials

(e) Procedure of the experiment and setup

(f) Presentation of data

- Table of results
- Graphs
- Calculation of the slope

(g) Sources of errors

(h) Precautions

(i) Conclusion; conclusions can come from the value of the graph, the value of the slope or intercepts etc.

Note:
The conclusion will either qualify or disqualify the hypothesis. It is the conclusion that shows that whether the hypothesis is correct or not.

FORMULATING A HYPOTHESIS

The hypothesis is a concept or an idea that is to be tested through research and experiments.

OR: A hypothesis is the prediction about what the scientific investigation will find.
OR: It's simply a statement that is to be proven at the end of the scientific experiment or investigation.
It shows the relationship between one dependent variable and a single independent variable.

IDENTIFYING VARIABLES INVOLVED

There are three (3) basic types of experimental variables that a learner must identify and note down while performing a scientific investigation in physics practicals. And these include;

Independent/Manipulated Variable

- This is a variable that we can change or control in a scientific experiment or investigation.

OR: This is a variable which the experimenter (or investigator) changes to test its dependence on other variables.

Dependent variable/Responding variable

- This is the one which we can test in a scientific investigation in order to get results.
- The dependent variable depends on the independent variable.
- When taking data during a scientific investigation, the dependent variable is the one being measured.

Controlled/Fixed/Control variable

✦ This is the one the investigator/experimenter holds constant during a scientific investigation.

✦ The control variable is not part of an experiment, but it is important because it has an effect on the results.

✦ One of the most common control variables is ***temperature***, and if not taken account of it might nullify the correlation between the dependent and independent variable. Other control variables include; ***amount of light***, ***humidity***, ***wind speed***, ***duration of an experiment*** etc.

✦ Whenever it is possible, control variables should be identified, measured and recorded.

PRACTICAL QUESTION ONE

An old man and his grandson, who had grown up with his parents in the city, were very hungry after working in a garden. While resting under a mango tree, a ripe mango fell from the tree. The grandson got excited and wanted to get more mangoes to eat before proceeding home for lunch, but he was not sure of a quick way to harvest the ripe mangoes from the tree. The grandfather advised that if he could climb up the tree and shake the branches, the ripe mangoes would fall to the ground. The grandson did exactly that and many ripe mangoes fell to the ground, which he ate with his grandfather. The grandson then told his grandfather that their physics teacher told them that mangoes fall from trees because of the force of gravity acting on them. He added that the teacher had also told them that bodies fall freely at the rate of 10 $ms{-}2$. The old man, being curious, wanted to know how the teacher arrived at his rate. He challenged the grandson to prove to him that indeed bodies fall freely at the rate of 10 $ms{-}2$. However, the grandson did not know how to prove this to his father.

Task

As a physics learner and using the set up above, help the grandson to practically verify and show the grandfather that bodies fall freely at a rate of 10 $ms{-}2$.

Hint

The relationship between the period, T, of oscillation and the length, l, of a pendulum is given by $\mathrm{T}^2=\left(4\pi^2/g\right)l.$

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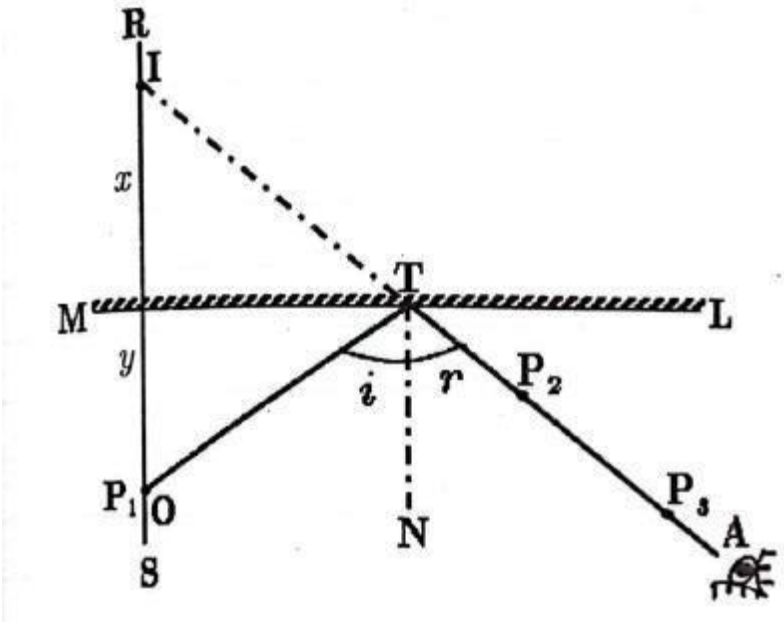
PRACTICAL QUESTION TWO

1. Jane and her mother were dressing up to go for a wedding party. They went in front of a plane mirror while dressing up. Jane who is in S.3 told her mother that the distances of their images from the plane mirror was equal to the distance between them and the plane mirror. However, her mother disagreed claiming that their images were closer to the plane mirror than they are. Jane told her mother that their physics teacher told them that the distance of any object placed in front of a plane mirror forms its image at the same distance behind the plane mirror as the object is in front of the mirror. Jane's mother challenged Jane to prove it.

Experimental setup



Task

As a learner of physics and using the arrangement of the apparatus shown above, carry out a scientific investigation to show the relationship between the object distance and the distance of its image from the plane mirror.

Hint:

Laws of reflection apply

Apparatus

1 plane mirror, 1 white sheet of paper, 1 soft board, 4 optical pins, 4 drawing pins and a complete geometry set.

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PRACTICAL QUESTION THREE

While in his village, John has been using a plane mirror to aid him in shaving. One day, when he had gone on a visit to his elder brother in Kampala, he found out that his brother uses a concave mirror as a shaving mirror. When his brother wasn't at home, he picked that concave mirror and had a keen look through it. It surprised him that his image was bigger, nearer and upright. He then noticed that it would be easier to do shaving using a concave mirror. When he returned back to the village, he decided that he must buy a concave mirror for his shaving. The following day, John went to the nearby town to look for a concave mirror. After moving through several shops, he chanced one shop selling the mirrors. The shop attendant asked him for the focal length of the mirror he was looking for, but John could not tell. To help him get a suitable mirror, the shop attendant asked him what purpose he wanted the mirror for and he said it is for shaving. The shop attendant recommended that he must buy a concave mirror of focal length 10 cm. Unfortunately, there were two mirrors in the shop which had remained for which it was of 10 cm and 15 cm focal length. Since John badly wanted to back with the mirror having looked for it from several shops and also the fact that the attendant had not made any sales, they both decided that they find out the focal length of the mirrors in question, but they failed in the process.

Task:

As a physics learner, carry out a scientific investigation to determine the focal length of the mirror in question so as to help John and the attendant.

Hint:

Take use of the equation; $\frac{V}{U} = \frac{1}{f}(V-1)$

Apparatus:

2 dry cells, a double cell holder, 1 torch bulb, 1 bulb holder, 1 switch, 1 concave mirror, 1 screen with a wire gauze, connecting wires, 1 metre rule and 1 screen.

END

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