535/1
PHYSICS
Paper 1
2024
2½ hours

ST. MARYS SECONDARY SCHOOL MASESE III

Uganda Certificate of Education

INTERNAL MOCKS

PHYSICS

Paper 1
Theory

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of **seven** *examination items. It has two sections;* **A** *and* **B**.*Section* **A** *has* **three** *compulsory items.*

Section **B** *has two Parts;* **I** *and* **II**. *Answer* **one** *item from each part.Answer* ***five*** *items in all.*

Any additional item(s) answered will not be scored.

SECTION A

WAVES AND OPTICS

1. The students in a particular class visited a laboratory with a white bulb and a red one, to observe a glass tank filled with water with a white base at the bottom. Modifications were made to create a shallow end on one side of the tank using glass material. To their surprise, when they struck the water's surface at the shallow end with a long rectangular rod at a frequency of 80 Hz, they noticed that the spacing between successive crests changed from 2.5cm to 5cm. Additionally, they were disturbed by the distortion of ripples as they struck the tank walls. They were also surprised to see the base turning black when it was replaced with a yellow sheet and the red lights switched on.

Hint; the glass tank would break if the velocity of the waves that hit it is greater than 20 ms^{-1}

Use your knowledge of physics to:

a. Determine if the ripple tank will break.
b. Explain the reason for the change in the distance between the ripples and its impact on the velocity of the ripples.
c. Explain what distorted the waves and how it could have been reduced.
d. Explain why the yellow sheet changed color when the red lights were switched on.

SATTELLITES AND COMMUNICATION

2. An article in the newspaper gave information that on 2nd December 2022, Ugandan engineers with the help of Japanese engineers launched a satellite. The literature teacher who picked interest in the article found new words like artificial and natural satellites. He developed a number of unanswered questions which could be answered by a physics learner like you.

(a) Explain the difference between the two types of satellites in the article.
(b) With reasons, justify why Uganda should spend all that much money to launch its own satellite.
(c) Incase Uganda is to develop a super rocket capable of reaching different planets. List with reasons the planets it can land on and planets it cannot land on.

MODERN PHYSICS

3. The government has discovered a precious and rare mineral in a certain part of the country. A team of men picked samples and kept them in a store of one of the hospitals where photographic plates are also stored. The mineral was checked on regularly and they made the following observations;

- All photographic plates had darkened.
- Its mass reduced spontaneously with time as shown below

Mass (g)	200	150	70	35	25
Time (days)	0	4	16	28	30

As a physics learner,

(a) Support the view that the mineral is radioactive.
(b) Use the graph to estimate its half-life
(c) Explain the best way of storing this rare mineral.
(d) What are the dangers of exposing this mineral to the public

SECTION B
Part I
MECHANICS AND HEAT

4. Workers at a construction site are meant to raise pieces of scrap of mass 6 kg through a height of 15m. Their boss always complains that the workers who carry the pieces of metal 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. One of the workers suggested they use a pulley of velocity ratio 4 and an efficiency of 80%.

   Use your knowledge of physics to;

a. Explain why the metals are very cold in the morning and hot in the afternoon.
b. Draw a design of the required pulley and explain how it can be used to solve their problem.
c. Determine the minimum force required to ensure an 80% is achieved.

   The string they used had a mass of 120g and a specific heat capacity of 2510 $JKg^{-1}K^{-1}$, and the work done to lift the load would be converted to heat energy in the string at the contact point of the pulley.

   Hint; The string would break if its temperature reaches by 28ºC.

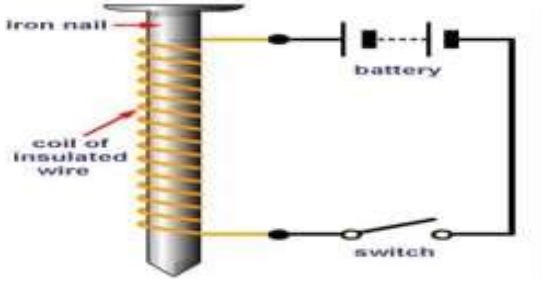
d. Determine if the string suggested above would be suitable for the purpose.
e. Suggest ways in which the efficiency of the pulley system can be improved.

5. During a party, 2 liters of water at 24 ^oC were served to a man and a woman. They complained that it was warm and were given 50g of ice at -10 ^oC blocks. They mixed the water and blocks in a wooden container with a negligible specific heat capacity. They were surprised by the ice cubes disappearing in the water. The man put his mixture in a plastic container **(shc = 2800 $JKg^{-1}K^{-1}$)** while the woman put her mixture in a metallic container **(shc = 800 $JKg^{-1}K^{-1}$)**. They were surprised to find their water at different temperatures after some time.
   Specific Heat capacity of water = 4200 $JKg^{-1}K^{-1}$
   Latent heat of fusion of ice = 340000 JKg^{-1}
   Use your knowledge of Physics to;

a. Determine if the water cooled when mixed with ice.
b. Why do the ice cubes disappear when mixed with water?
c. Explain why there was a difference in temperatures in the water kept in the plastic and the metallic container.

Part II
ELECTRICITY AND MAGNETISM.

6. An electromagnet as shown in Figure below is constructed by winding a wire around an iron nail of resistance 0.5Ω, connecting it to a battery of four cells of EMF 1.5V each, and then placing it above a tin containing iron fillings, some of which are attracted to the nail. Upon disconnecting the battery, most iron fillings fall off. However, when the iron nail is replaced with an identical steel nail of the same size, the pins are attracted slower. Surprisingly, when the EMF source is disconnected, just a few of the iron fillings fall off.



Use your physics knowledge to:

a. Explain how the electromagnet operates.
b. Use domain theory to explain how the nail becomes a magnet.
c. Elaborate on the difference in the time taken before the steel and iron nails start attracting small pins.
d. Explain what would happen if a battery of 2 cells of the same EMF was used instead of one of 4 cells.
e. Identify other factors that could contribute to an increase in the number of nails being attracted.
f. Suggest ways in which the magnetized nails can be made to lose their magnetism.

7. A certain household has a set of appliances as listed in the table below.

Appliance	**Power rating**	**Time of use**
4 bulbs	20 W each	13 hours every day
Cooker	2500 W	4 hours every day
Flat iron	1500 W	5 hours each week
Electric fence of low resistance wire	2200 W	10 hours every day

The owner of the household while making a budget for how much money would be required every week to cater for the electricity bill. He also wondered how the sockets for those appliances should be connected to ensure high current flows and why low resistance instead of high resistance wire is used.

Hint; The owner only intends to spend sh.50000 on electricity every week.

Use your knowledge of Physics to;

a. Determine if sh. 50000 would be enough to cater for the electricity bill for a week.
b. Explain how the sockets of the appliances should be connected to ensure maximum current flows
c. Explain why low-resistance wires are used for the electric fence.
d. Suggest measures on how to reduce the electricity bill.

END