535/1
PHYSICS
Paper 1
(Theory)
Oct./Nov. 2024
2½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 1
(Theory)

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of **two** *sections;* **A** *and* **B**. *It has a total of* **seven** *examination items.*

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 items answered will **not** *be scored.*

Answers to all items must be written in the answer booklet(s) provided.

Graph paper is provided.

Turn Over

SECTION A

Answer **all** *the items in this section.*

Item 1.

In a classroom activity, senior three students of your school are presented with the learning aids shown in figures 1(a), 1(b) and 1(c).

Fig. 1(a).

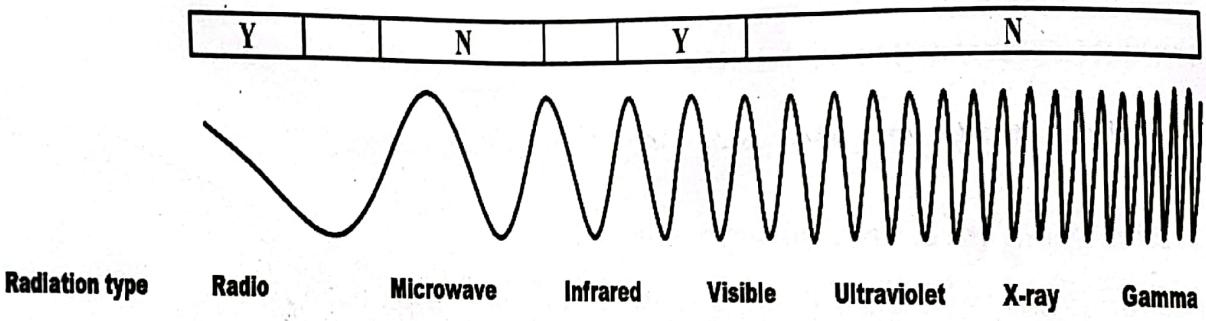

Fig. 1(b)

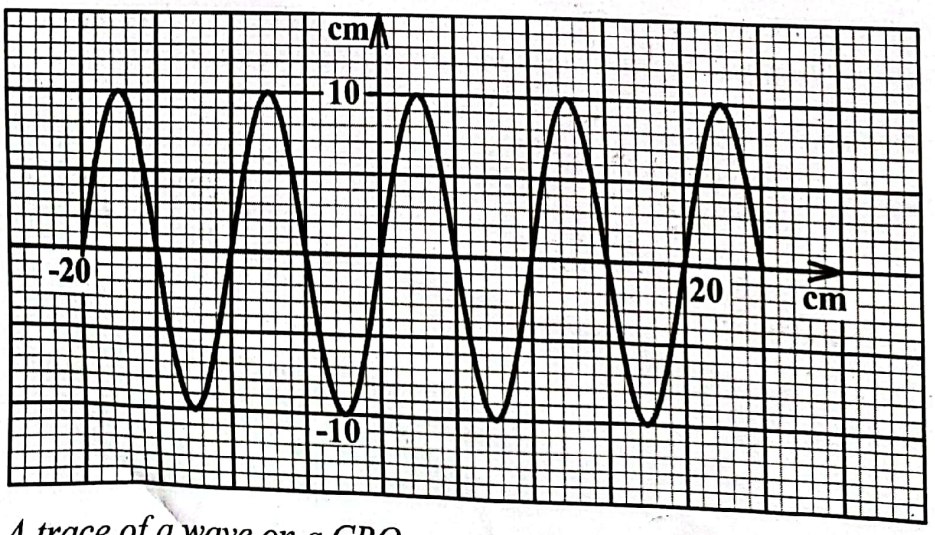

Fig. 1(c): *A trace of a wave on a CRO, generated from a loud speaker*

The students are required to;

(a) (i) describe the formation of the phenomenon shown in figure **1(a)** in a classroom setting.

(ii) explain why the physical rainbow appears curved as shown in figure **1(a)** and why it is in the position opposite to where the sun is.

(b) (i) state the general name of the waves shown in figure **1(b)**.

(ii) explain the effect of the two radiations at the extreme ends of figure **1(b)** on a photographic plate.

(iii) explain the usefulness of visible radiation.

(iv) explain the pattern of the waves shown in figure **1(b)**.

(c) use figure **1(c)** to determine the;

(i) amplitude of the sound waves,

(ii) frequency of the sound waves.

The senior three students are unable to do the classroom activity due to lack of knowledge and have approached you for help.

Task:

Assist the senior three students do the classroom activity.

(***Hint***: *Velocity of sound in air is 330 ms^{-1}.*)

Item 2.

A patient has been taken by relatives to a hospital, complaining of severe pain in the neck. A doctor has admitted the patient in an isolated room and decided to examine the functioning of the thyroid gland. In the process of the examination, a radioactive isotope has been injected into the patient to be used to diagnose the thyroid disorder.

The activity of the radioactive isotope from the thyroid gland is detected and recorded as shown in table **1**.

Table 1

Activity (counts per minute)	480	280	170	100	60	35
Time (hours)	0	10	20	30	40	50

Whenever the relatives of the patient want to check on him in the isolated room, the doctor tells them to wait for the right time (when the activity is equal to the background count rate of 40).

The doctor has also informed the relatives that if the right time for them to check on the patient comes, they must observe precautions in the isolated room.

The relatives have demanded to know the period they should wait before they can check on their patient but no one answers them. They have also been left wondering what the precautions are and why they should observe them.

You have heard the doctor talking to the relatives and they have contacted you to address their concerns.

Task:

(a) (i) Use the data in Table **1** to determine how long the relatives should wait before they are allowed to check on their patient.

(ii) Explain to the relatives why they need to wait for that time before they enter the isolated room.

(b) (i) State the precautions the relatives have to observe inside the isolated room.

(ii) Explain why the relatives should observe the precautions when inside the isolated room.

Item 3.

Some regions in Uganda are affected by the changes in seasons that sometimes may lead to famine. Accordingly, the people in Uganda have been demanding for solutions from the government to ensure that famine does not occur any more.

In November 2022, the government launched a satellite into the lower Earth orbit through the support of the International Space Station (ISS). A number of people criticised the move by the government to launch the satellite into space, claiming that the satellite will not solve the problem of famine in Uganda.

Task:

As a student of physics;

(a) help the public to understand the occurrence of seasons.

(b) make the people understand and appreciate the reason why the government of Uganda took the move.

Part I

Answer **one** *item from this part.*

Item 4

Your sister leaves home for work at 7:20 a.m. and as a must carries tea in a f
One morning she needed to prepare the tea she carries but remembered that the
water she had in the house was 5 litres in a sauce pan of 0.2 kg in a deep freeze

On removing the sauce pan from the deep freezer, she realised that all the water
turned into a block of ice. It was 7:00 a.m. and she was worried about leaving h
late, but decided to heat the sauce pan containing the block of ice with her he
rated 4.22 kW, until all the ice turned into water and the water boiled ready for

Hint:

Specific heat capacity of the saucepan	$= 900\ J\ kg^{-1}K^{-1}$
Specific heat capacity of water	$= 4{,}200\ J\ kg^{-1}K^{-1}$
Specific latent heat of fusion of ice	$= 336{,}000\ J\ kg^{-1}$
Density of water	$= 1000\ kg\ m^{-3}$
Boiling point of water	$= 100\ ^{\circ}C$
Temperature of ice in the sauce pan	$= 0\ ^{\circ}C$

Task:

(a) Determine how long it took your sister to boil the tea.

(b) Explain whether or not your sister was able to leave home for work at 7:20 a.m.

Item 5

Your father has hired a taxi to take the whole family to the village but is not the total distance from your home to the village. The taxi driver has informe father that he charges Shs2,500 per km moved and that your father should n worry about the distance since he installed a machine in his taxi that shows motion of the taxi in form of a velocity time graph.

The taxi has set off from your home to the village and the velocity time graph for the whole journey is as shown in figure **2**.

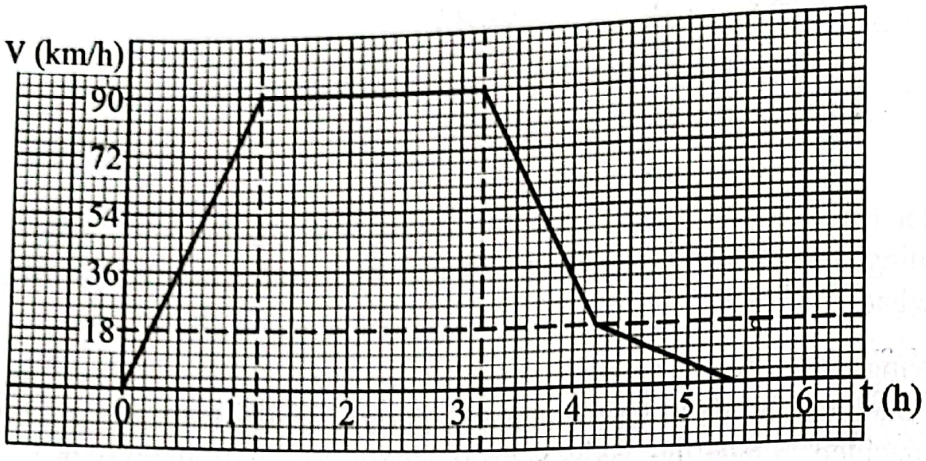

Fig. 2

On reaching the village, the taxi driver has requested for his payment. However, your father has refused to pay until he is helped to understand how the graph drawn by the machine is related to the distance travelled.

Task:

Help your father to;

(a) understand the motion of the taxi from your home to the village.
(b) determine the amount of money he has to pay to the taxi driver.

Part II

Answer **one** *item from this part.*

Item 6.

The school scouts planned to go for a camp where they would stay for seven days. The tent they were to use had no electrical wiring. The camp site was near a meter box from which they could access electric power which they would pay for. They intended to wire the tent so as to have electricity.

They planned to carry along with them components which they would use to make an electromagnetic device for alerting members of the different activities.

The scouts intended to use a bulb rated 240 V, 5 W for five hours every day and an electric kettle rated 240 V, 2 kW for 3 minutes a day. However, on the day of departure, the lead scout they were relying on to draw the wiring plan for the tent, design the electromagnetic device, as well as to determine the amount of money to pay for using the bulb and kettle, could not be accessed.

One of the scouts is your friend and has approached you for help.

Task:

Perform the duties of the lead scout.
(Hint: each unit of electric power costs Shs1000.)

Item. 7

Your friend, a carpenter, uses an electric drill to drive screws when making furniture. One day the drill he was using suddenly stopped working. He took the drill to a technician who informed him that the coil in the d.c. motor had got burnt and therefore the motor had to be repaired.

The technician assured your friend that he could repair the motor and make it even more efficient if your friend bought the required materials. However, your friend could not understand what the technician was saying and has therefore approached you for more information about the structure, mode of operation of the electric motor and how it can be made more efficient.

Task:

Provide the information needed by your friend.