

535/1
PHYSICS
Paper 1
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 **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 item(s) answered will not be scored.

*All answers **must** be written in the booklets provided.*

SECTION A

Answer **all** the items from this section

Item 1.

A brass band was invited to play during a celebration near a tall building, a distance slightly more than 17 m away. Two friends standing in the same direction and in line with the playing band, heard the sound from the band at different intervals of time which attracted them to go and attend the celebration. On arrival, the sound they heard was unclear, confused and indistinct. Later in the night during the celebration, coloured lights flashing red, blue and green made the colours of their clothes look different from the original colours which puzzled them.

Hint: Speed of sound in air = 330 ms^{-1} .

The two friends heard sound after 4 s and 5 s, respectively.

The friends were originally wearing yellow clothes.

Task:

As a physics student, help the two friends to understand why;

- (a) they heard the sound at different intervals.
- (b) the sound they heard was unclear, confused and indistinct.
- (c) the colour of their clothes kept changing when coloured lights flashed on them.

Item 2.

In a certain town, people are concerned about the waste disposal from the factory into the nearby lake which is their source of water for home use. They raised this issue to the chairperson Local Council 1 (LC1) who directed the management of the factory to stop disposing waste into the lake. A scientist was contacted to investigate the presence of radioactive material in the water. The scientist found out that the water was indeed radioactive as shown in Table 1.

Table 1

Time/days	0	5	10	15	20	25	30
Activity/counts per minute	1200	740	440	260	160	90	60

Although the water from the lake remains radioactive for a long time, the scientist recommended that water will be safe for use again when the activity is less than 38 counts per minutes.

Task:

As a student of physics;

- (a) Advise the chairperson LC1 about the time the community will wait for the water to be safe for use again.
- (b) Sensitise the members of the community about the risks associated with radioactive materials and how such materials should be handled.

Item 3.

In a certain country, a Television (TV) reporter was reporting live near the ocean about the high tides during night time. Viewers in another country were watching the live broadcast of the news bulletin during day time. The viewers wondered how it could be day and night at the same time, and how the event in one country could be watched live on TV in another country.

Task

Using your knowledge of physics to help the viewers to understand;

- (a) the possibility of it being day in one place and night in another place.
- (b) the occurrence of high ocean tides.
- (c) how an event in one place can be broadcast live in another country.

SECTION B**PART 1**

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

Item 4.

A certain home owner intends to put up a metallic tank of height 4 m with a maximum volume of 5000 l fitted with an electrical heater which supplies 20,000 kJ of heat energy as shown in figure 1.

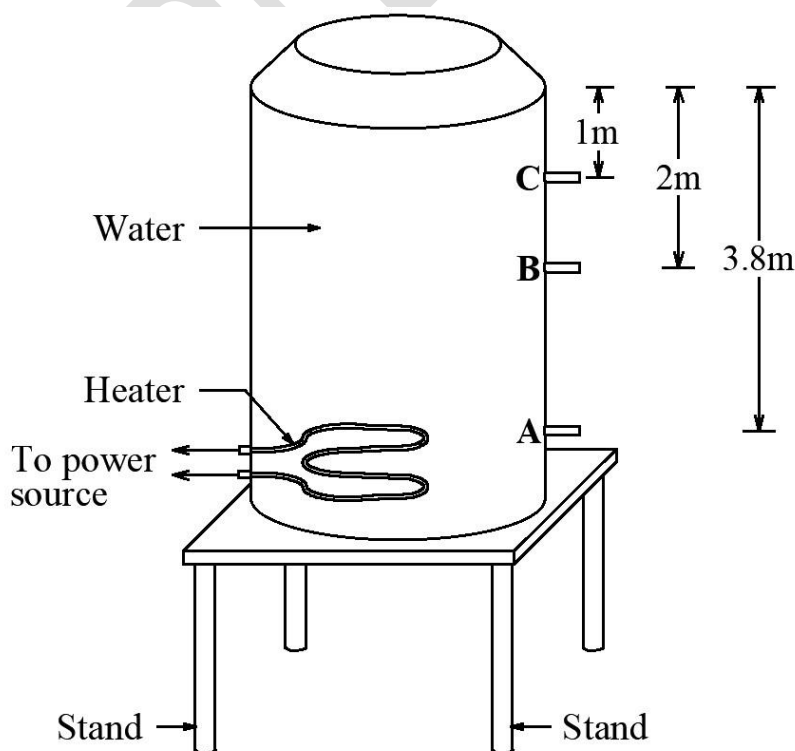


Fig. 1

The home owner found out that the heater was fitted at the lower part of the tank but he did not understand why it was done like that. Just before the hole for the outlet pipe was drilled at point **A**, the home owner told the person with the drill that the correct position was either **B** or **C**.

Task:

As a learner of Physics;

- (a) Explain to the home owner why;
 - (i) the electrical heater was fitted at the lower part of the tank and how eventually all the water gets hot.
 - (ii) the outlet pipe was drilled at point **A**.
- (b) If the initial temperature of the water in the tank is 20 °C, help the home owner to find out if the heater is working.
- (c) Advise the home owner on measures that can be taken to ensure that the tank stand can withstand the weight of the tank and water for a long time.

Use:

$$\begin{aligned} \text{Density of water} &= 1000 \text{ kgm}^{-3}. \\ \text{Specific heat capacity of water} &= 4200 \text{ J kg}^{-1} \text{ K}^{-1}. \\ \text{Acceleration due to gravity} &= 10 \text{ ms}^{-2} \end{aligned}$$

Item 5

A certain hotel has its bathrooms situated on the 3rd floor of a building. A customer of the hotel expects to bathe water at 32 °C. The hotel provides 10 litres of water at 20 °C to each customer. A boiler on ground floor heats water to 80 °C for the customers to use. The hotel management does not allow its workers to carry the hot water via the staircase.

Task:

Having studied physics;

- (a) help the hotel management to determine the quantity of hot water to be given to a customer for bathing.
- (b) advise the hotel management on how to keep the boiled water hot for a long period of time without keeping the boiler on.
- (c) explain to the management how the water from the boiler can reach the third floor safely.

Use:

$$\begin{aligned} \text{Density of water} &= 1000 \text{ kgm}^{-3}. \\ \text{Specific heat capacity of water} &= 4200 \text{ J kg}^{-1} \text{ K}^{-1}. \\ \text{Acceleration due to gravity} &= 10 \text{ ms}^{-2} \end{aligned}$$

PART II

Answer one item from this part.

Item 6.

Small pieces of metal which are unsafe to be eaten by chicken were found in feeds that had just been bought from a milling company by a poultry farmer. The small pieces of metal were later identified as iron. The farmer thought of disposing off the feeds but remembered that the pieces of metals could be sorted with a magnet which he did not have.

Hint:

A nail, connecting wires of resistance $0.5\ \Omega$, two dry cells each of $1.5\ \text{V}$ were available to the farmer.

Task:

As a student of physics;

- (a) Help the farmer to remove the pieces of iron from the feeds.
- (b) Comment on the effectiveness of what you have designed, given that current of $4\ \text{A}$ is enough to create a strong magnet.

Item 7.

In a certain place, electricity is transmitted at $120\ \text{V}$. A business person intends to connect 4 bulbs in a house rated $240\ \text{V}$, $60\ \text{W}$ each, and other domestic electrical appliances such that there is minimum power wastage. The business person has been advised to purchase a transformer of suitable specifications to achieve the objectives. The business person does not know what a transformer is, how it works and is bothered by the type of transformer that should be purchased.

Task:

As a student of physics, help the business person to solve the problems he/she is faced with.