535/1
PHYSICS
PAPER 3
November 2023
$2^{1}/_{4}$ hours

WAKISSHA JOINT EXAMINATIONS

Uganda Certificate of Education

PHYSICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS

- *This paper consists of six items. Attempt any 5 items.*

  Where necessary, the following values of physical constants may be assumed.

  - *Acceleration due to gravity* — $10\ ms^{-2}$
  - *Density of water* — $1000\ kgm^{-3}$
  - *Density of mercury* — $13600\ kgm^{-3}$
  - *Refractive index of air* — 1.00
  - *Speed of sound in air* — $340\ ms^{-2}$
  - *Speed of light in a vacuum* — $3.0 \times 10^{8}\ ms^{-1}$

1. Figure 1 below shows a uniform metallic rod of length 4.0 m pivoted at its centre that is used at a children's play resort.

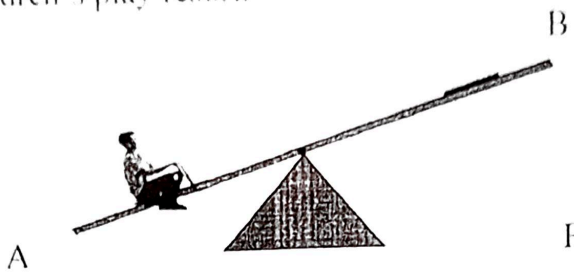


Figure 1

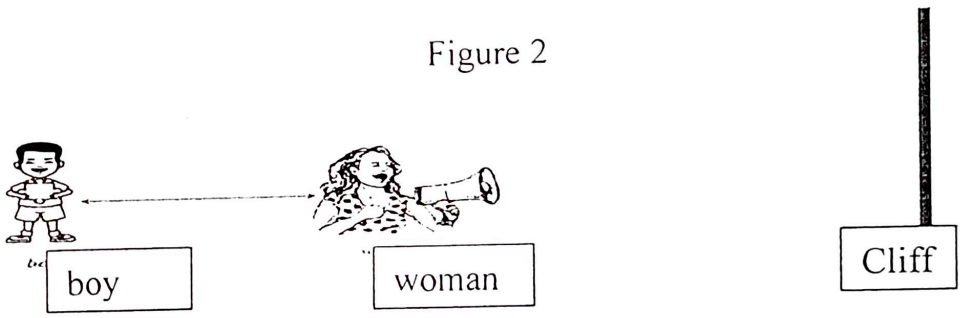
Given that a boy of mass 48 kg sits 1.5 m from end A. Help the guide at the play resort to determine if another boy of mass 40 kg will restore equilibrium in the beam if he sits at a distance of 0.6 m from the centre.
Identify two other instances in which the knowledge in this scenario would be applicable in real life.
With the boys off the rod, explain what would happen to the beam if the end B was heated by a considerably hot flame. *(12 scores)*

2. During a Science project, learners are given two devices; a pinhole camera of length 50 cm and a concave mirror of focal length 50 cm. As a learner of Physics, help the students to determine which instrument forms a bigger image of a man of height 1.8 m standing 2 m away from each of the instruments.

Write a report about the nature of the images formed by each of the devices and what would happen if the size of the pinhole was enlarged. *(12 scores)*

3. Two people stand in front of a cliff at an unknown distance between them as in figure 2 below.

Figure 2



The woman calls out to the boy and she hears an echo of the sound she made after 4 seconds while the boy hears the same echo 3.5 seconds later. As a learner of Physics, help these people to determine the distance between them.
Write a report about the factors that increase the rate of movement of sound and why it would be easier for the sound to travel from the girl to the cliff at night than during the day. *(12 scores)*

4. Conrad is required to prepare a bath for his younger brother Alex. According to the advice got from his mother, the bath should be between 40° C and 42°C. He (Conrad), however, has 2 litres of hot water at 100° C and 6 litres of cold water at 20° C. All that Conrad has to do is mixing in an aluminium pan of mass 3.5 kg and specific heat capacity 650 J kg^{-1} K^{-1}. As a learner of Physics, help Conrad to establish and inform his mother whether the water is warm enough for Alex to bathe. In what ways would you prevent the water from cooling very fast and why would water be used as a coolant in engines. *(12 scores)*

5. On November 7th, 2022, Uganda launched its first satellite named ***PearlAfricaSat-1*** into space with the help of National Aeronautics and Space Administration (NASA). The purpose of this mission was to study weather patterns. Students of Physics were availed with data collected over a certain period of time and they noticed the following. While some places were having day time, other places were having night time. Various places were having different seasons. As a learner of Physics explain; why some places had daytime while it was night time at other places, why different places had different weather patterns and how world-wide communication is made possible through satellites.

(12 scores)

6. In a certain town, it is a must for drivers to be tested together with their vehicles for road-worthiness. On a certain day, a car started from rest and accelerated to 50 ms^{-1} in 10 s. The driver maintained that velocity for 20 s and suddenly decelerated to rest in 2 s making him to crash into the windscreen. As a learner of Physics, draw a graph to show the relationship between the velocity and time for the car. State whether the driver's average velocity does not exceed the town's speed limit of 8 ms^{-1}. Find the rate at which the car's velocity reduces and explain why the driver crashed into the windscreen and how this can be prevented. ***(12 scores)***

END