535/2
PHYSICS
Paper 2
Oct. /Nov. 2020
2¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer any **five** *questions.*

Any additional question(s) answered will **not** *be marked.*

Mathematical tables and silent non-programmable calculators may be used.

These values of physical quantities may be useful to you:

Acceleration due to gravity	=	$10\ ms^{-2}$.
Specific heat capacity of water	=	$4200\ Jkg^{-1}K^{-1}$.
Specific heat capacity of copper	=	$400\ Jkg^{-1}K^{-1}$.
Specific latent heat of fusion of water	=	$340000\ Jkg^{-1}$.
Speed of sound in air	=	$320\ ms^{-1}$.
Velocity of electromagnetic waves	=	$3.0 \times 10^{8} ms^{-1}$.

© 2020 Uganda National Examinations Board

Scanned with CamScanner

1. (a) State **two** differences between mass and weight. *(02 marks)*

(b) Explain why the variation of weight of a body in two different places on earth's surface can be detected by a sensitive spring balance but not a beam balance. *(04 marks)*

(c) A metal block of mass 20 kg comes to rest in 3 s after sliding through a distance of 9 m along a horizontal floor. Assuming that the block is retarded uniformly, find the;

(i) retardation. *(04 marks)*

(ii) initial kinetic energy. *(04 marks)*

(d) State **two** ways by which friction in (c) above can be reduced. *(02 marks)*

2. (a) State **Snell's law** of refraction of light. *(01 mark)*

(b) A ray of red light is incident onto a liquid-air boundary as shown in figure **1**.

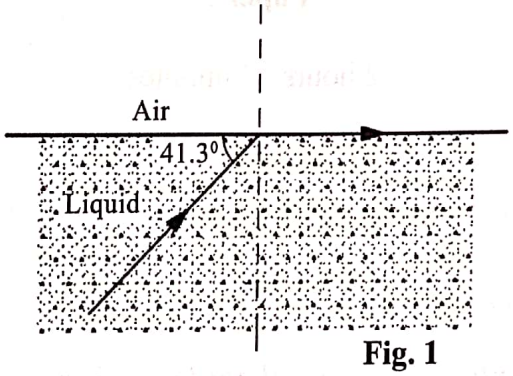

Fig. 1

(i) Find the critical angle for the liquid. *(01 mark)*

(ii) Calculate the refractive index of the liquid. *(02 marks)*

(c) An object 12 cm tall is placed perpendicularly on the principal axis of a convex mirror of a focal length 10 cm. If the object is 16 cm away from the pole of the mirror, find the position and magnification of the image formed by graphical method. *(06 marks)*

(d) (i) What is meant by **dispersion** of light? *(01 mark)*

(ii) A ray of white light is directed towards red (***R***) and blue (***B***) filters arranged as shown in figure **2**.

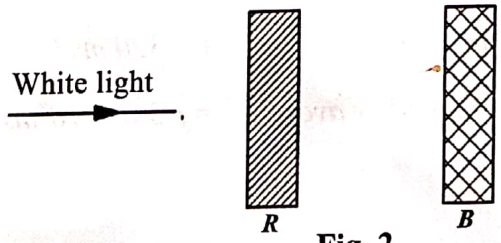

Fig. 2

State the colours between R and B, and after B. *(02 marks)*

Scanned with CamScanner

(c) State **three** differences between a lens camera and a human eye. (*03 marks*)

3. (a) A capillary tube is dipped into water in a container and another identical capillary tube is also dipped in mercury in a container.

(i) Draw diagrams to show the heights and shapes of each liquid meniscus in the respective tubes. (*02 marks*)

(ii) Use the molecular theory to explain the behaviour in (a) (i). (*02 marks*)

(b) Describe an experiment to demonstrate diffusion in gases. (*04 marks*)

(c) A 10 kg mass of iron at 70 °C is dropped into water in a container. If the mass of water is 20 kg and its temperature is 10 °C before the iron is added, calculate the final temperature of the mixture.
(*Specific heat capacity of water = 4200 $Jkg^{-1}K^{-1}$, Specific heat capacity of iron = 450 $Jkg^{-1}K^{-1}$*) (*04 marks*)

(d) (i) Sketch and describe the shape of a graph of volume against temperature for an ideal gas. (*02 marks*)

(ii) Using your sketch graph in (d) (i), explain the concept of **absolute zero** of temperature. (*02 marks*)

4. (a) Define the following:

(i) Magnetic meridian, (*01 mark*)
(ii) Angle of declination. (*01 mark*)

(b) (i) What is a **magnetic field**? (*01 mark*)

(ii) Sketch the magnetic field pattern around a bar magnet in the earth's field with its north pole facing the geographic south. (*02 marks*)

(c) (i) Using the domain theory, explain the meaning of magnetic saturation. (*02 marks*)

(ii) State **one** disadvantage of magnetising a material by the single touch method. (*01 mark*)

(d) With aid of a diagram, explain how an iron watch between two opposite poles can be kept unmagnetised. (*03 marks*)

(e) (i) What is meant by **rectification**? (*01 mark*)
(ii) With the aid of a circuit diagram, explain how alternating current can be fully rectified using four semiconductor diodes. (*04 marks*)

Scanned with CamScanner

5. (a) Name the radiations from a radioactive process which;

(i) behaves as electrons. *(01 mark)*

(ii) have the highest penetrating power. *(01 mark)*

(b) What is meant by **nuclear fusion**? *(01 mark)*

(c) Uranium U- 236 undergoes nuclear decay to produce barium, krypton and 2 neutrons according to the following equation.

$$^{236}_{92}U \longrightarrow {}^{144}_{56}Ba + {}^{b}_{a}Kr + 2\,{}^{1}_{0}n + \text{energy}.$$

(i) Find the value of a and b. *(02 marks)*

(ii) State **two** practical applications of nuclear fission. *(02 marks)*

(d) With reference to a cathode ray oscilloscope (CRO);

(i) State the effect of increasing the heating voltage. *(01 mark)*

(ii) State **two** uses of a control grid. *(02 marks)*

(e) An alternating voltage is applied to the Y- plate of a CRO and a section of the waveform produced on the screen is as shown in figure **3**.

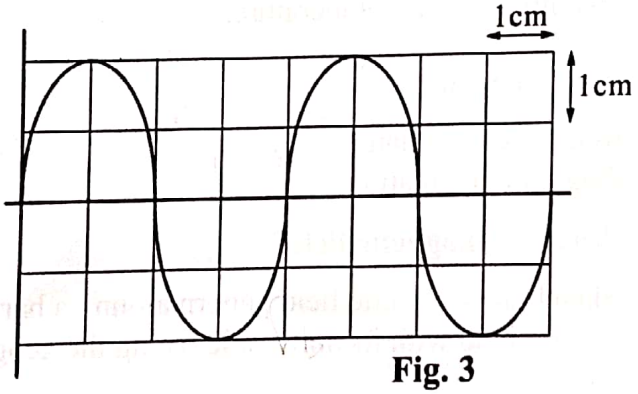

Fig. 3

The time base is set at 0.002 scm^{-1} and Y- gain at 5 V cm^{-1}. Find the

(i) amplitude of the wave. *(02 marks)*

(ii) frequency. *(02 marks)*

(f) State **two** uses of the CRO. *(02 marks)*

6. (a) (i) Differentiate between **polarisation** and **local action** as applied to a simple cell. *(02 marks)*

(ii) Describe briefly, how polarisation and local action can be minimised. *(02 marks)*

(iii) State **two** advantages of a lead-acid accumulator over a dry cell. *(02 marks)*

Scanned with CamScanner

(b) (i) What is meant by **internal resistance** of a cell? (*01 mark*)

(ii) Describe, with the aid of a diagram, a simple experiment to measure the resistance of a resistor. (*04 marks*)

(c) A cell has an e.m.f, E, and internal resistance, r. When resistors of resistances 2 Ω and 5 Ω are connected in turn across the cell, current of 0.5 A and 0.25 A are respectively obtained in the circuit.

Calculate the;

(i) e.m.f, E of the cell. (*03 marks*)

(ii) internal resistance, r, of the cell. (*02 marks*)

7. (a) State the **principle of moments**. (*01 mark*)

(b) Figure **4** represents a uniform bar ***AB*** of negligible weight pivoted at point ***P***.

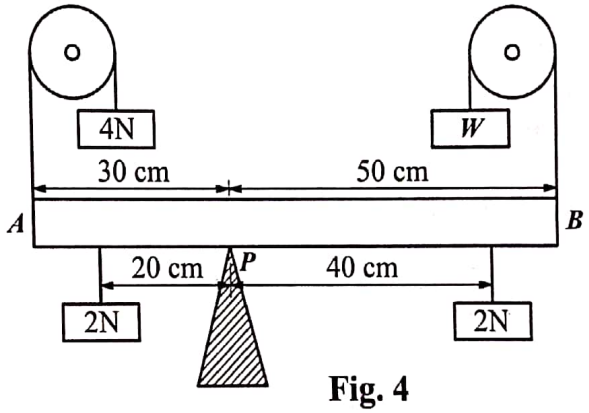

Fig. 4

The bar is in equilibrium under the action of the forces shown. Find the force *W*. (*03 marks*)

(c) An inclined plane of length 4 m is used to raise a load of mass 20 kg through a vertical height 1 m. It is found that an effort of 80 N is needed to move the mass up the slope at a constant speed.

(i) Explain how the 80 N force may be applied. (*01 mark*)

(ii) What is the velocity ratio of the system? (*03 marks*)

(iii) Calculate the efficiency of the system. (*03 marks*)

(d) Given a metre rule, 100 g mass, a piece of thread and a knife edge, describe how they can be used to determine the mass of a banana. (*05 marks*)

Scanned with CamScanner

8. (a) (i) What are **electromagnetic waves**? (*01 mark*)

(ii) State **three** ways in which electromagnetic waves differ from sound waves. (*03 marks*)

(b) (i) Derive an equation that relates wavelength, frequency and velocity of a wave. (*03 marks*)

(ii) The distance between two successive crests of ripples traveling across water surface is 30 mm. If the waves travel 252 mm in 1.5 s, calculate the frequency of the source producing the ripples. (*03 marks*)

(c) (i) What is meant by **pitch** of a sound wave? (*01 mark*)

(ii) State **two** factors on which frequency of a sound note of a vibrating string depends. (*02 marks*)

(d) Explain why sound is fainter at high mountains than at sea level assuming temperature is constant at both places. (*03 marks*)

END

Scanned with CamScanner