535/2
PHYSICS
Paper 2
3 August 2023
2 ¼ hours

ENTEBBE JOINT EXAMINATION BUREAU

Uganda Certificate of Education

PHYSICS

PAPER 2

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Attempt any **five** *questions.*

Any extra question **shall not** *be assessed*

Where necessary assume the following:

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

1. (a) (i) Define the terms **mass** and **weight**. *(02 marks)*

(ii) State **four** differences between mass and weight. *(02 marks)*

(b) (i) Define **volume** and state its S.I unit. *(03 marks)*

(ii) A plastic bottle of capacity $250cm^3$ has a mass of $3.5kg$ when filled completely with liquid x. It has a total mass of $1.46kg$ when it is two-fifth full of the same liquid. Determine the density of the liquid in kgm^{-3} and the mass of the empty bottle in grammes. *(06 marks)*

(c) Explain briefly why; *(02 marks)*

(i) liquids are almost incompressible.

(ii) solids have a definite shape and size while liquids assume the shape of the container. *(02 marks)*

2. (a) Define the terms;

(i) acceleration, *(01 mark)*

(ii) uniformly accelerated motion. *(01 mark)*

(b) Figure 1 shows a velocity-time graph of a certain body.

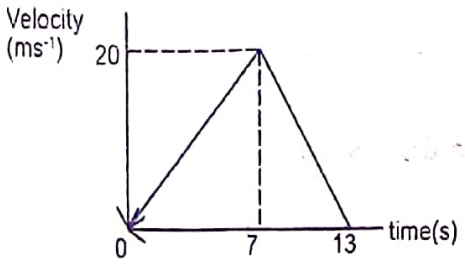

Fig 1

(i) Describe the motion of the body. *(03 marks)*

(ii) Calculate the deceleration of the body. *(02 marks)*

(c) (i) What is meant by **an inelastic collision**? Give **one** example. *(02 marks)*

(ii) A bullet fired at close range strikes a wooden wall of a house and passes through in a straight line. Explain why the bullet emerges out of the wall with reduced speed. *(02 marks)*

(d) (i) State **Newton's third law of motion**. *(01 mark)*

(ii) A spring balance carrying a mass of $4kg$ on its hook is hung on the ceiling of a lift which is accelerating upwards at $0.4ms^{-2}$. Determine the reading of the spring balance. *(03 marks)*

3. (a) Define the term **pressure** and state its S.I unit. *(02 marks)*

(b) You are provided with a light transparent plastic bottle, water, masking tape and a nail. Describe briefly a simple experiment you would perform using this apparatus to show that pressure acts equally in all directions. *(04 marks)*

(c) A diver dives to a depth of $20m$ below the surface of sea water of density $1.03 \times 10^3 kgm^{-3}$. If the atmospheric pressure is $1.013 \times 10^5 Nm^{-2}$, calculate the total pressure on the diver at the depth. *(04 marks)*

(d) State;

(i) Pascal's principle of transmission of pressure in fluids. *(01 mark)*

(ii) **two** applications of Pascal principles. *(01 mark)*

(e) (i) An empty plastic bottle of mineral water with a tightly fixed bottle top is placed in a refrigerator operating at a temperature of $-10°C$ for 1 hour. State what is observed when the bottle is pulled out of the refrigerator. *(01 mark)*

(ii) Explain your observation in e (i) above. *(03 marks)*

4. (a) Define the following terms;

(i) critical angle. *(01 mark)*

(ii) absolute refracting index of a material. *(01 mark)*

(b) State **two** applications of total internal reflection. *(02 marks)*

(c) A ray of light is incident from glass into air as shown in the diagram below.

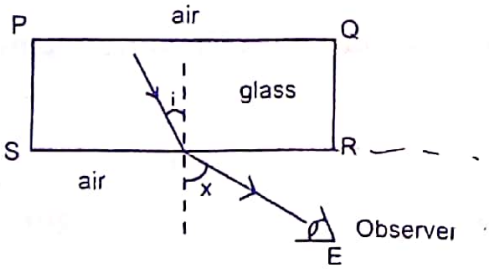

Fig 2

Given the refractive index of the material of the glass block $PQRS$ is 1.52 and that with observer in position, E angle x is 37.6°, Find;

(i) angle i *(03 marks)*

(ii) angle, i for which light will be observed along line SR. *(03 marks)*

(d) An object of height $1cm$ is placed perpendicular on the axis of convex lens of focal length $15cm$ at a distance of $10cm$ from the lens. By graphical method, and using a scale of $1cm$ to represent $5cm$ on the horizontal axis, determine the;

(i) position and nature of the image formed by the lens
(ii) magnification produced.

(06 marks)

5. (a) Define the terms;

(i) **wave length.** *(01 mark)*
(ii) **a ray.** *(01 mark)*
(iii) **wave front.** *(01 mark)*

(b) (i) What is meant by the terms **beats** and **reverberation**?

(02 marks)

(ii) State **one** way of minimising reverberation in a music studio.

(01 mark)

(c) Two men stand facing each other, $200m$ apart on the same side of a high wall and at the same perpendicular distance from it. When one fires a pistol the other hears the sound 0.60 seconds after the flash and a second sound 0.25 seconds after the first.

(i) Briefly explain these observations. *(02 marks)*
(ii) Determine the velocity of sound in air. *(02 marks)*
(iii) Find the perpendicular distance of the men from the wall. *(03 marks)*

(d) State **two** properties that distinguish electromagnetic waves from other forms of waves. *(02 marks)*

6. (a) Define the following terms as used in current electricity;

(i) potential difference. *(01 mark)*
(ii) an Ohm *(01 mark)*

(b) State **Ohm's law.** *(01 mark)*

(c) Figure 3 shows a resistor of resistance 3Ω connected to a set of three resistors of 4Ω, 5Ω and 20Ω.

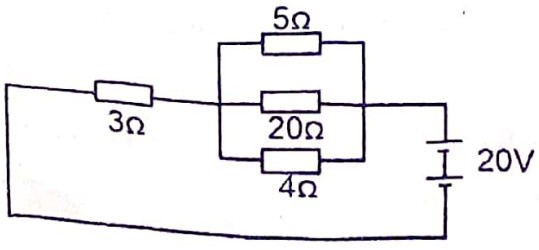

Fig 3

Calculate the;

(i) effective resistance in the circuit. *(02 marks)*
(ii) p.d. across the 3Ω resistor. *(02 marks)*
(iii) current passing through the 20Ω resistor. *(03 marks)*

(d) (i) Define term **internal resistance of a cell.** *(01 mark)*

(ii) You are provided with a voltmeter, a switch, a standard resistor and connecting wires. With the aid of a circuit diagram, describe how internal resistance of a dry cell can be determined using this apparatus. *(03 marks)*

(e) Why should the wire used in making a fuse be thin and of low melting point? *(02 marks)*

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

(ii) Sketch the magnetic field pattern due to two long straight conductors carrying current in opposite directions placed close to each other. *(02 marks)*

(b) State **two** factors on which the magnetic force on a conductor carrying current in a magnetic field depends. *(02 marks)*

(c) (i) With the aid of a labeled diagram, describe the structure and mode of action of a d.c. motor. *(06 marks)*

(ii) State **two** ways of improving the efficiency of a motor. *(02 marks)*

(d) Why does the brightness of a lamp of a bicycle connected to a dynamo increase with increase in speed of the bicycle and gives no light when the bicycle is stationary? *(03 marks)*

8. (a) Define the following terms;

(i) radioactivity *(01 mark)*

(ii) half-life *(01 mark)*

(b) A radioactive nuclide has a half-life of 4 hours. Calculate the mass that would decay after 4.8 hours if the original mass of the nuclide is 38.4g. *(03 marks)*

(c) (i) What are **x-rays**? *(01 mark)*

(ii) State **two** differences between x-rays and cathode rays. *(02 marks)*

(d) With reference to an x-ray tube, explain why the;

(i) tube has to be evacuated. *(02 marks)*

(ii) tungsten target is embedded in a copper block. *(02 marks)*

(iii) high voltage is connected across the tube. *(02 marks)*

(e) Why is;

(i) is radioactivity referred to as a spontaneous process? *(01 mark)*

(ii) are hard x-rays not used in x-ray photography? *(01 mark)*