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 scientific calculators may be used.

These values of physical quantities may be useful to you:

Acceleration due to gravity	$= 10 \ ms^{-2}$.
Specific heat capacity	$= 4200 \ Jkg^{-1}K^{-1}$.
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	$= 3.0 \times 10^8 \ ms^{-1}$.

Turn Over

1. (a) (i) State **three** fundamental quantities of measurements. (*03 marks*)
       (ii) State the S.I. unit of any one of the quantities in (a) (i) . (*01 mark*)

   (b) Describe a simple laboratory experiment to determine the density of a small piece of stone. (*04 marks*)

   (c) A spring balance reads 120 g when a metal block is suspended from it in air and reads 100 g when the block is completely immersed in water.

   Calculate the:
       (i) volume of the block. (*02 marks*)
       (ii) density of the block. (*02 marks*)

   (d) A rectangular block of dimensions 4 cm × 6 cm × 9 cm has a mass of 9.6 kg. Find the maximum pressure it can exert on its support. (*04 marks*)

2. (a) What is meant by **conduction** of heat? (*01 mark*)

   (b) Describe ways the fixed points of a thermometric scale can be determined. (*06 marks*)

   (c) The ice and steam points on an ungraduated thermometer are found to be 194 mm apart. What temperature is recorded in °C when the length of the mercury thread is 68 mm above the ice point mark? (*03 marks*)

   (d) Briefly explain the meaning of **greenhouse effect**. (*03 marks*)

   (e) Explain the fact that a dull surface feels hotter than a shiny surface when both are in the same environment. (*03 marks*)

3. (a) (i) State the principle of rectilinear propagation of light. (*01 mark*)
       (ii) An opaque object is placed between an extended source of light and a screen. Sketch a labelled diagram to show regions of the shadow formed when the screen is very far from the object. (*02 marks*)
       (iii) State any **two** properties of images formed by plane mirrors. (*01 mark*)

   (b) Describe the method of determining the focal length of a thin convex lens using a distant object. (*04 marks*)

   (c) (i) What is **critical angle** as applied to light? (*01 mark*)
       (ii) State the conditions for total internal reflection to occur. (*02 marks*)

2

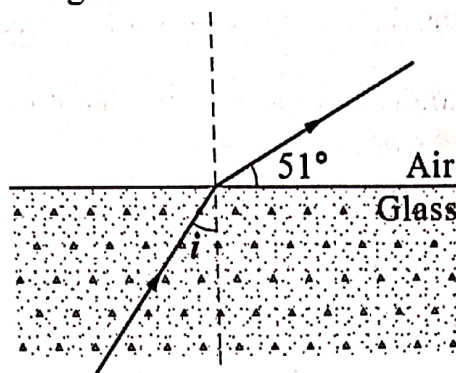(d) (i) A monochromatic light is incident at the air-glass boundary as shown in Figure **1**.

Fig.1

If the refractive index of glass is 1.5, find the value of angle i.
(*03 marks*)

(ii) State **two** reasons why convex mirrors are used as driving mirrors.
(*02 marks*)

4. (a) Define the following as applied to wave motion:
   (i) Nodes. (*01 mark*)
   (ii) Antinodes. (*01 mark*)

   (b) What are **progressive waves**? (*01 mark*)

   (c) A tuning fork making 200 vibrations in 2 s produces sound which travels at 320 ms^{-1} through air. Find the:
   (i) frequency of the sound. (*02 marks*)
   (ii) wavelength of the sound. (*02 marks*)

   (d) Figure **2** shows a pattern of straight water waves moving in direction **AB** incident to a barrier **CD**.
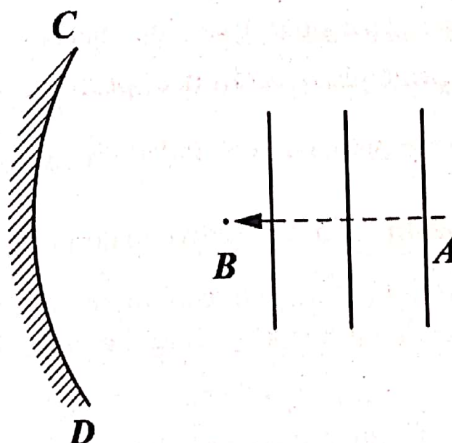

Fig. 2

Copy the diagram and show the pattern for the wave after hitting the barrier.
(*02 marks*)

Turn Over

(e)   (i)   State the condition for resonance to occur.   *(01 mark)*

       (ii)   With the aid of a labelled diagram, describe an experiment to demonstrate resonance due to sound waves.   *(05 marks)*

       (iii)   State **one** application of resonance.   *(01 mark)*

5.   (a)   Define the following:

       (i)   Adhesion.   *(01 mark)*

       (ii)   Cohesion.   *(01 mark)*

   (b)   State the factors that affect surface tension.   *(03 marks)*

   (c)   (i)   With the aid of a diagram describe an experiment to demonstrate how a siphon works.   *(04 marks)*

       (ii)   Give **one** use of siphon in everyday life.   *(01 mark)*

   (d)   Explain what happens to atmospheric pressure as one goes higher and higher from the ground.   *(03 marks)*

   (e)   The smaller piston of a hydraulic jack has an area 0.2 m². A force of 20 N is applied on the smaller piston to raise a car resting on the larger piston of area 2 m². Find the force that raises the car.   *(03 marks)*

6.   (a)   Describe the structure of an atom.   *(02 marks)*

   (b)   What are **radioisotopes**?   *(01 mark)*

   (c)   A nuclide P of mass number 214 and atomic number 82 decays to nuclide Q with the emission of two alpha particles and a beta particle.

       (i)   Write a nuclear equation for the decay process.   *(02 marks)*

       (ii)   Determine the mass number and atomic number of Q.   *(02 marks)*

   (d)   (i)   What is **half-life** of a radioactive material?   *(01 mark)*

       (ii)   The half-life of a radioactive element is 2 hours. If the initial mass of the element is 48 g, find the mass that decays after 8 hours.   *(03 marks)*

   (e)   State **two** industrial applications of radioactivity.   *(02 marks)*

(f) (i) What is **nuclear fission**? (*01 mark*)

(ii) State the condition necessary for nuclear fission reaction to take place. (*01 mark*)

(iii) State **one** condition for nuclear fusion to occur. (*01 mark*)

7. (a) (i) What is meant by **electrical resistance**? (*01 mark*)

(ii) Derive an expression for the effective resistance of two resistors connected in parallel. (*04 marks*)

(b) Resistors of resistances 3 Ω and 9 Ω are connected across a battery of emf 10 V and internal resistance of 2.75 Ω as shown in Figure 3.
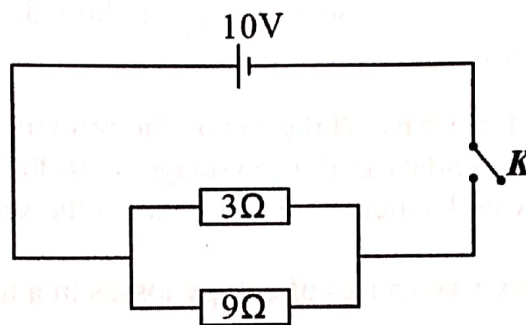

Fig.3

Calculate the:

(i) total resistance in the circuit. (*02 marks*)

(ii) power dissipated in the 3 Ω resistor. (*03 marks*)

(c) (i) What is the major cause of electrical power losses along the transmission line. (*01 mark*)

(ii) Explain how the power losses can be minimised. (*02 marks*)

(d) (i) Draw and label the structure of a dry cell. (*02 marks*)

(ii) Briefly explain how to charge a lead acid accumulator. (*01 mark*)

Turn Over

8. (a) (i) Differentiate between **ferromagnetic** and **non-ferromagnetic** materials. (*01 mark*)

(ii) State **two** examples of each of the materials in (a)(i). (*02 marks*)

(b) Sketch the magnetic field pattern of the following:

(i) Bar magnet. (*01 mark*)

(ii) Bar magnet in the earth's field with its south pole facing the earth's north. (*02 marks*)

(c) (i) State the **three** factors which affect the magnitude of the force on a current carrying conductor in a magnetic field. (*03 marks*)

(ii) Describe with the aid of a diagram, how the step down transformer works. (*04 marks*)

(iii) A transformer has 200 turns on the primary coil and 1000 turns on the secondary coil. If a voltage of 1600 V is fed to the primary coil, calculate the voltage on the secondary coil. (*02 marks*)

(iv) State any **two** causes of energy losses in a transformer. (*01 mark*)