Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8210566666

PHYSICS **0625/31**

Paper 3 Theory (Core) **October/November 2023**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m/s^2).

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

1 Fig. 1.1 shows a distance–time graph for a cyclist.

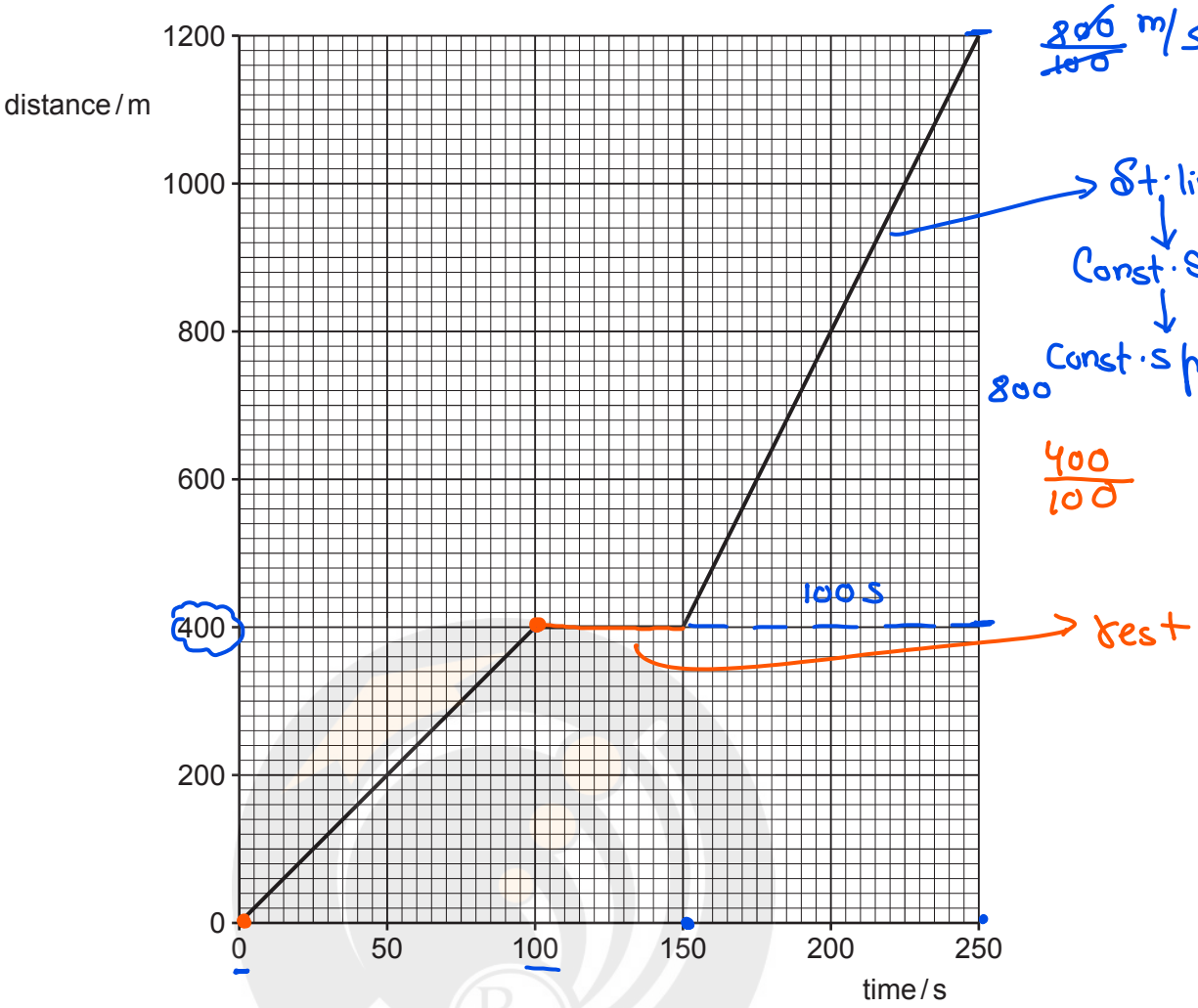


Fig. 1.1

(a) (i) Determine the distance travelled by the cyclist between time = 0 and time = 100 s.

distance travelled = 400 m ..... m [1]

(ii) Calculate the speed of the cyclist between time = 0 and time = 100 s.

Slope/gradient of speed time graph gives speed.

$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{400}{100}$

speed = 4 ..... m/s [3]

(iii) Describe the motion of the cyclist between time = 100 s and time = 250 s.

The cyclist is at rest from t = 100 to t = 150s as distance is not changing then till 300s it is moving with constant speed of 8 m/s ..... [2]

(b) Fig. 1.2 shows the cyclist riding along a long straight road.

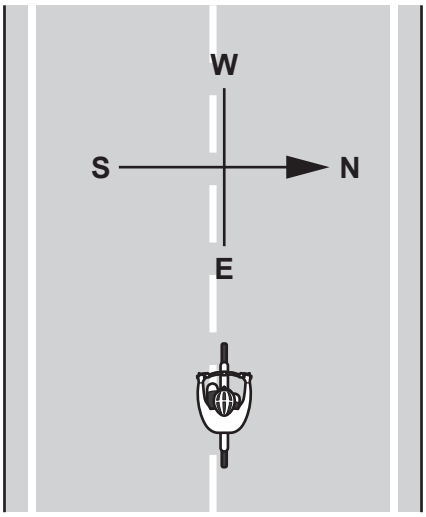


Fig. 1.2

The speed of the cyclist is 15 m/s. Determine the velocity of the cyclist.

velocity = 15 m/s due west ..... m/s

direction Towards west .....

[1]

[Total: 7]

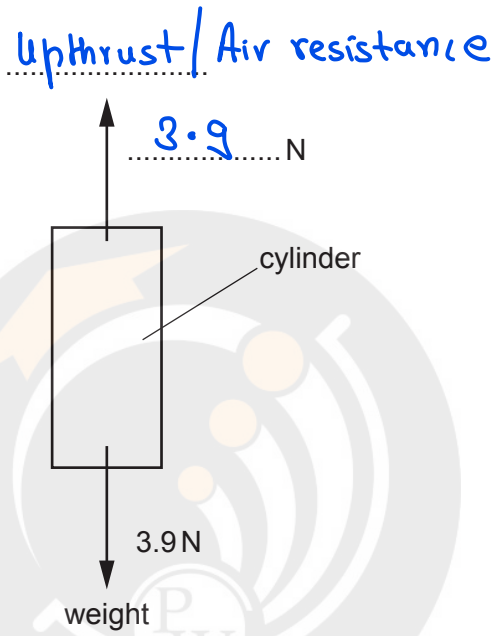
2 The mass of a solid metal cylinder is 400 g and its volume is 52 cm^3.

(a) Calculate the density of the metal. Include the unit.

$d = \frac{Mass}{Volume} = \frac{400}{52} = 7.69\ g/cm^3$

density = ... $7.7\ g\ cm^{-3}$ ..... [4]

(b) The cylinder is falling at constant speed through the air. Fig. 2.1 shows the vertical forces acting on the cylinder.



$a_{net} = 0$

Fig. 2.1 (not to scale)

On Fig. 2.1, write the name and the size of the upward force on the cylinder. [2]

(c) The student balances a beam on a pivot. On the beam, he positions the cylinder and a block so that the beam remains balanced. The arrangement is shown in Fig. 2.2.

$\hookrightarrow F_{net} = 0, \tau_{net} = 0$

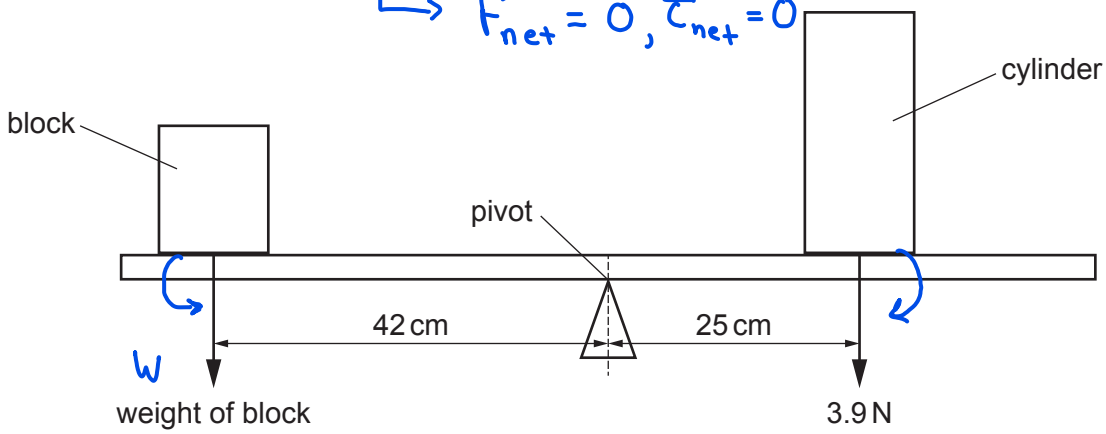


Fig. 2.2 (not to scale)

Calculate the weight of the block.

$W = 2.3\ N$

$W \times 42 = 3.9 \times 25$

$W = \frac{3.9 \times 25}{42} = 2.32$

weight of block = ... 2.3 ..... N [4]

[Total: 10]

3 Fig. 3.1 represents the arrangement and separation of particles in a liquid. Each circle represents a particle.

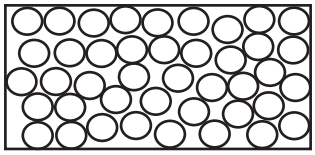


Fig. 3.1

(a) In the box in Fig. 3.2, draw at least **four** circles to show the arrangement and separation of particles in a **gas**.

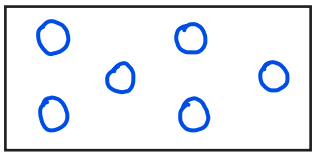


Fig. 3.2

[2]

(b) Describe the arrangement, separation and motion of particles in a **solid**.

In solid the intermolecular space between particles is very small and they are tightly packed. The particles can vibrate at their positions. [3]

(c) Fig. 3.3 shows a fire heating water in a metal pan.

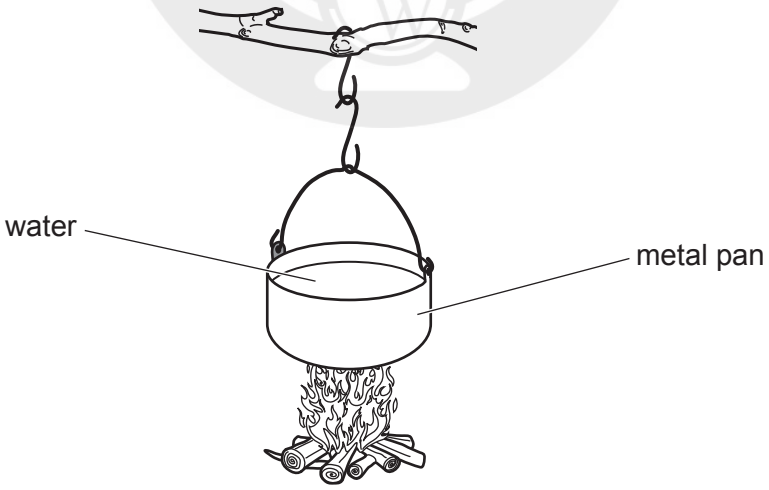
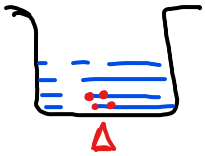


Fig. 3.3

(i) State the name of the process of thermal energy transfer through the metal of the pan.

Conduction → Between solids [1]



(ii) Describe how thermal energy is transferred through the water by convection.

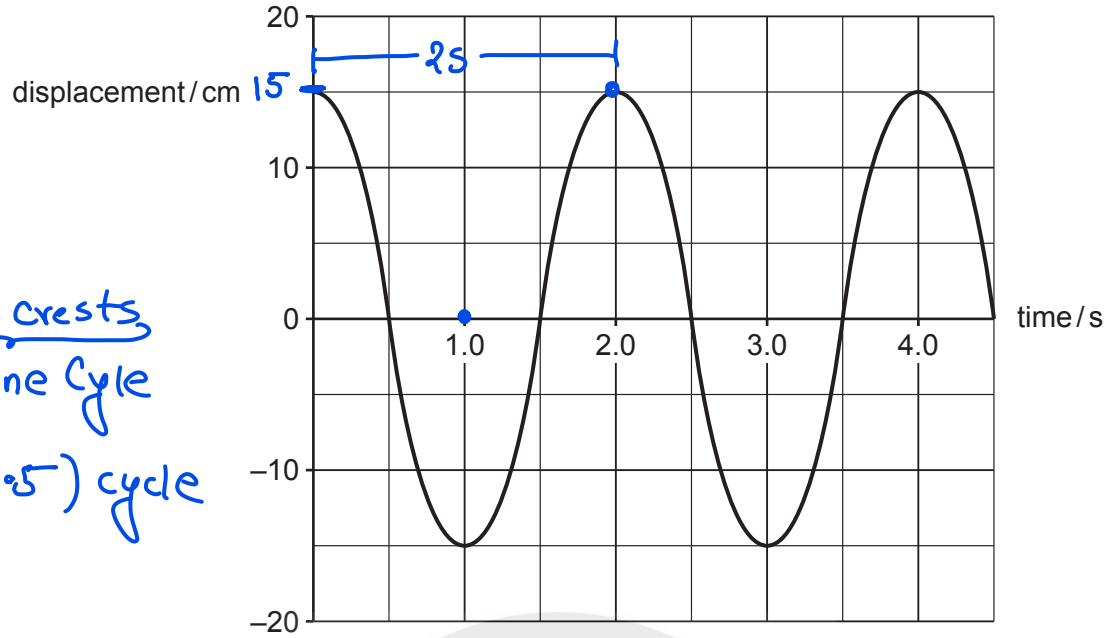
In convection when particle are heated they move away and due to which the density decreases and they are pushed upwards and colder water takes their place [3]

(iii) State the temperature at which the water boils at standard atmospheric pressure.

temperature = 100 °C [1]

[Total: 10]

4 Fig. 4.1 represents a wave on the surface of water.



2s → Two crests
one Cyle
1s → (0.5) cycle

Fig. 4.1

(a) (i) Determine the amplitude of the wave in Fig. 4.1.

amplitude = ... 15 ..... cm [1]

(ii) Determine the frequency of the wave in Fig. 4.1.

frequency = ... 0.5 ..... Hz [2]

(b) Fig. 4.2 shows wavefronts passing through a small gap in a barrier.
The arrows on the diagram show the directions of propagation of the wavefronts.

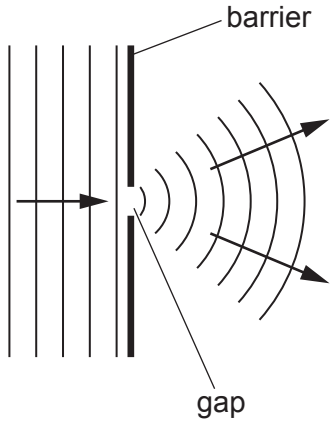


Fig. 4.2

State the name of the wave property shown in Fig. 4.2.

Diffraction ..... [1]

(c) Fig. 4.3 shows wavefronts changing direction as they pass from shallow water to deep water.
The arrows on the diagram show the directions of propagation of the wavefronts.

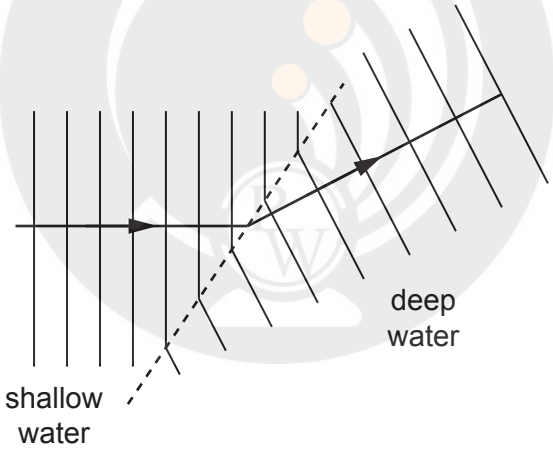


Fig. 4.3

(i) State the name of the wave property shown in Fig. 4.3.

Refraction ..... [1]

(ii) State **one** property of the water wave, other than direction, that changes as it moves from shallow water to deep water.

speed of wave / wavelength ..... [1]

[Total: 6]

* frequency never chayes

5 Fig. 5.1 shows the main regions of the electromagnetic spectrum in order of increasing frequency.

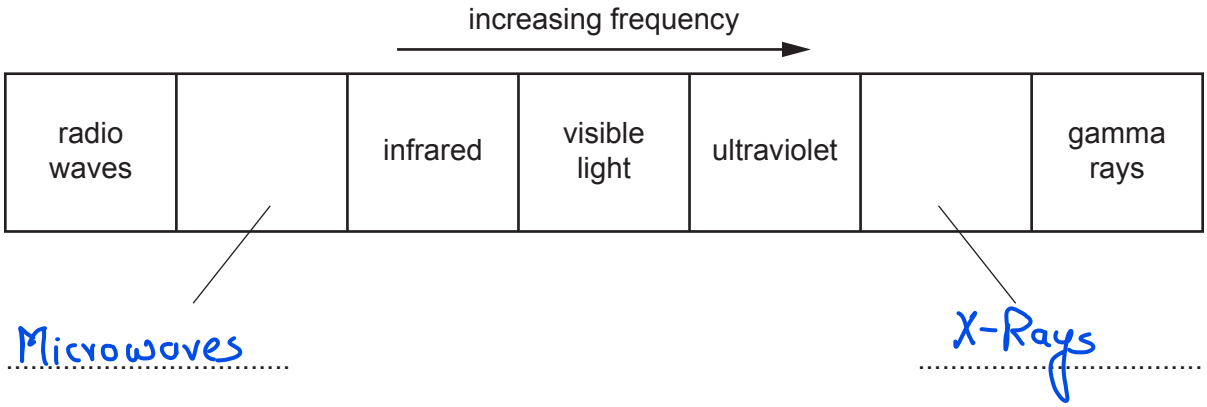


Fig. 5.1

(a) Two of the regions are unlabelled.

Add the correct label to each of the unlabelled regions in Fig. 5.1. [2]

(b) State **one** use of infrared radiation and **one** use of ultraviolet radiation.

infrared radiation

This is used in remotes for short rayge signalling

ultraviolet radiation

Sterilising of water / food

[2]

(c) Describe possible harmful effects of excessive exposure to:

infrared radiation

Skin burn

ultraviolet radiation

Skin Cancer

[2]

[Total: 6]

6 Fig. 6.1 shows four wind turbines.

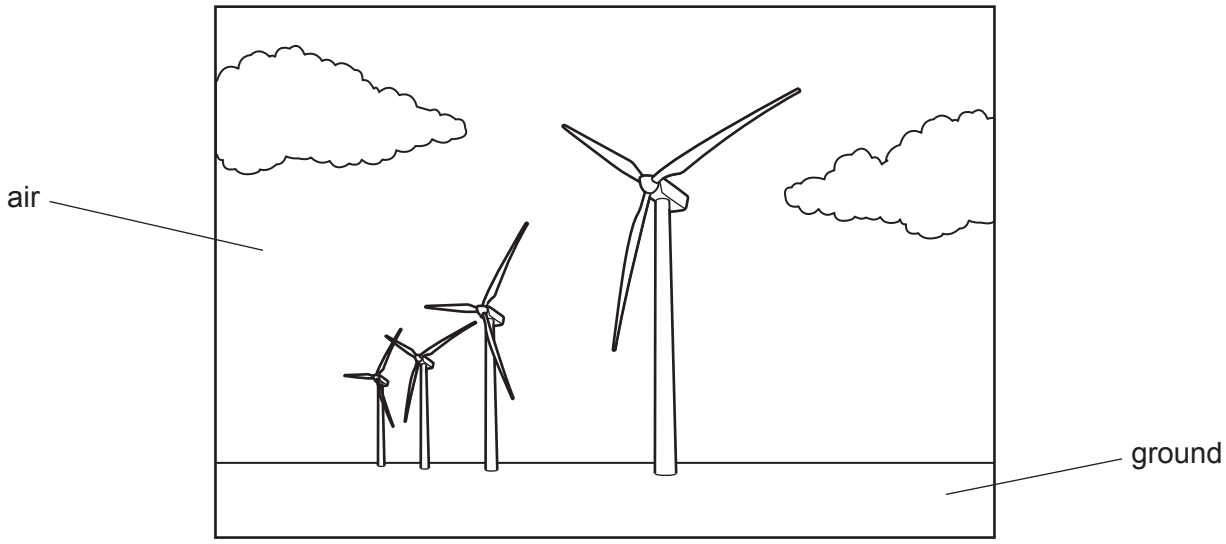


Fig. 6.1

(a) Describe how a wind turbine generates electrical power.

Because of moving air, kinetic energy is generated in moving blades of windmill further it is being connected with a generator which work on the principal of electromagnetic radiation. [3]

(b) The electrical power output of a wind turbine is 624 kW. The output current is 520 A.

Calculate the output voltage of the wind turbine.

$P = V i$

$i = \frac{P}{V} = \frac{624 kW}{520}$

output voltage = 1.2×10^3 V [4]

(c) For transmission, the output voltage is increased to 132 kV.

State **two** advantages of transmitting electrical power at high voltage.

1 low energy loss

2 Thinner wires can be used.

[2]

[Total: 9]

7 Fig. 7.1 shows a ray diagram for an object positioned on the principal axis of a thin converging lens.

F_1 and F_2 are the focal points of the lens and C is the centre of the converging lens.

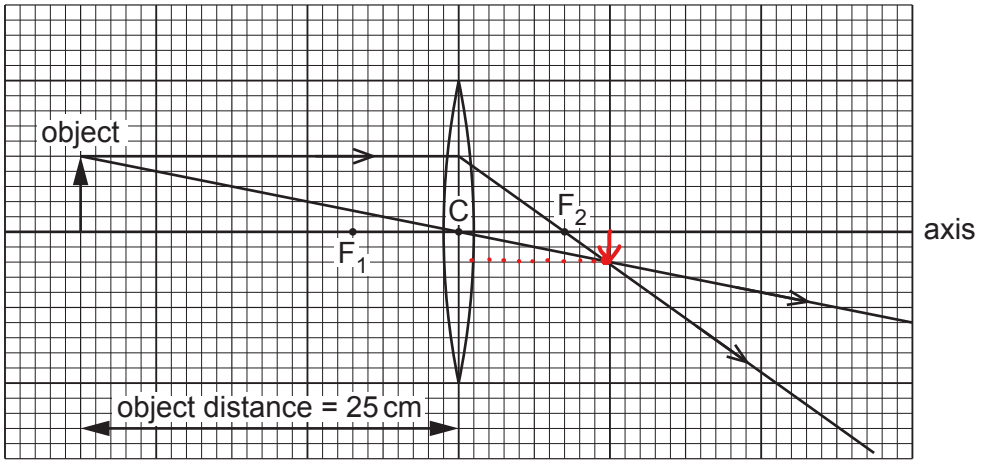


Fig. 7.1

(a) On Fig. 7.1, each small square of the grid represents 1.0 cm.

Determine the focal length of the converging lens.

focal length = ... 10 ..... cm [1]

(b) On Fig. 7.1, draw an arrow to show the position of the image formed by the converging lens. [1]

(c) State **three** characteristics of the image formed by the converging lens.

1 ..... Real image .....

2 ..... Inverted image .....

3 ..... Diminished image. .....

[3]

[Total: 5]

8 Fig. 8.1 shows a solenoid (long coil of wire) connected in a circuit. When the switch is closed, there is a large current in the circuit.

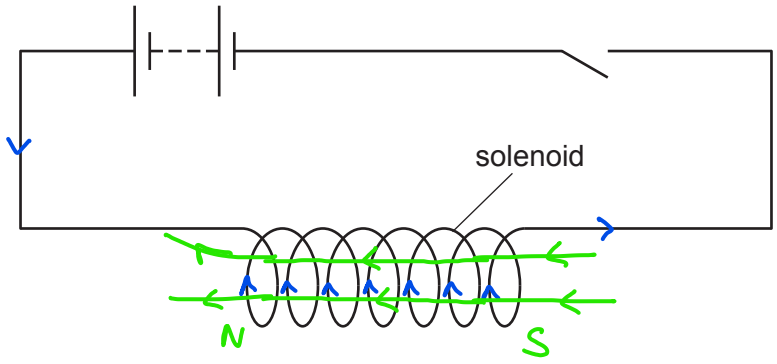


Fig. 8.1

(a) Describe an experiment to identify the pattern **and** direction of the magnetic field around the solenoid.

You may draw on Fig. 8.1 as part of your description.

Compass can be used to find direction of magnetic field, also iron fillings can be used and pattern of iron fillings can be observed. [3]

(b) A solenoid P is placed close to another solenoid Q. Solenoid Q is connected to a sensitive voltmeter.
The arrangement is shown in Fig. 8.2.

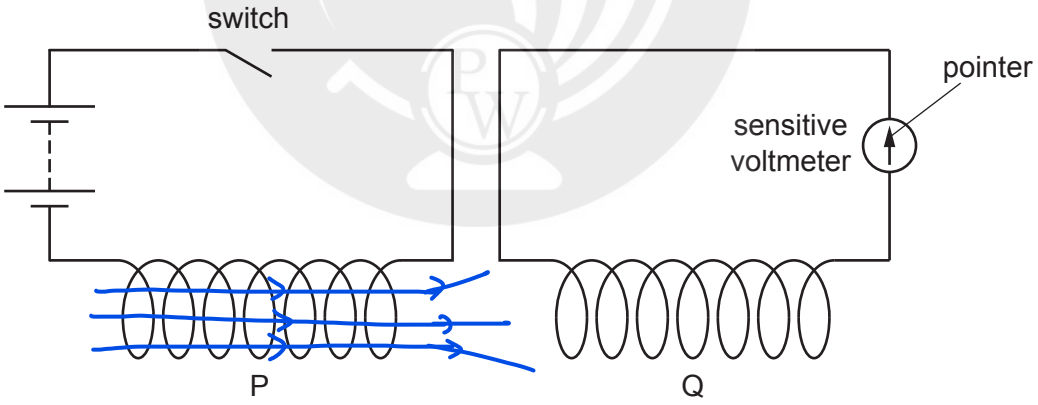


Fig. 8.2

Describe and explain what happens when the switch is closed.

When switch is closed, magnetic field is produced due to solenoid P and field cuts solenoid Q because of which induced EMF is generated and voltmeter will show deflection, after some time the current & $\vec{B}$ in coil P will be constant and there will no induced emf in the secord. [4]

[Total: 7]

9 A student investigates an electric circuit. Fig. 9.1 shows the student's circuit.

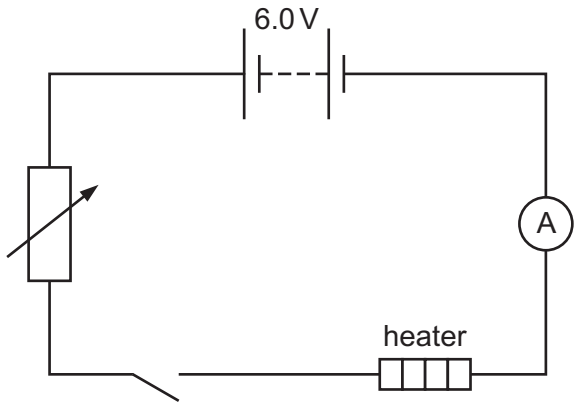


Fig. 9.1

(a) (i) Describe the purpose of the variable resistor in Fig. 9.1.

• Control the current by changing the value of resistance.

[1]

(ii) The student uses cells with an electromotive force (e.m.f.) of 1.5 V.

Determine the number of cells needed for the 6.0 V battery in Fig. 9.1.

$n = \frac{6}{1.5}$

number of cells needed = 4 [1]

(iii) The student connects another component to measure the potential difference (p.d.) across the heater.

On Fig. 9.1, draw the electrical symbol and connections for this component. [2]

(b) The p.d. across the heater is 4.0 V. The current in the heater is 1.6 A.

Calculate the energy transferred electrically by the heater in 40 s.

$V = 4V$

$I = 1.6A$

$H = V I t$

$H = 4 \times 1.6 \times 40$

energy transferred = 256 J [3]

[Total: 7]

10 A nucleus of an isotope of actinium contains 89 protons and 136 neutrons.
The chemical symbol for actinium is Ac.

(a) **(i)** Complete the nuclide notation for this isotope of actinium.

$^{225}_{89}Ac$

[1]

(ii) State the number of electrons orbiting the nucleus of a neutral atom of this isotope.

number of electrons = 89 [1]

(b) A sample contains 8.0 mg of this isotope of actinium.

The isotope of actinium has a half-life of 10.0 days.

The graph in Fig. 10.1 shows the original mass of the actinium in the sample and its mass after 10 days.

On Fig. 10.1, plot **two** more points for the mass remaining after 20 days and 30 days. Draw the decay curve for the sample over 30 days.

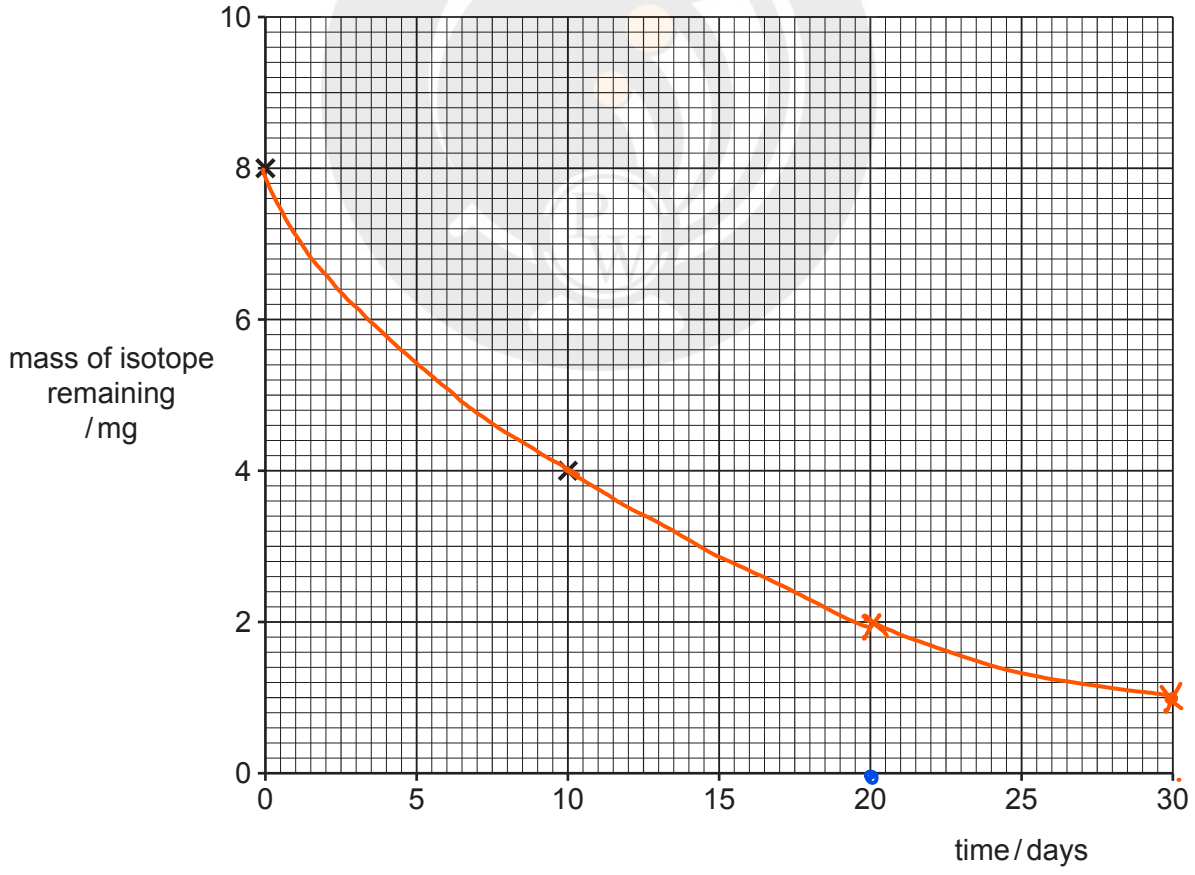


Fig. 10.1

[3]

[Total: 5]

11 Fig. 11.1 represents the Sun and part of the Solar System.

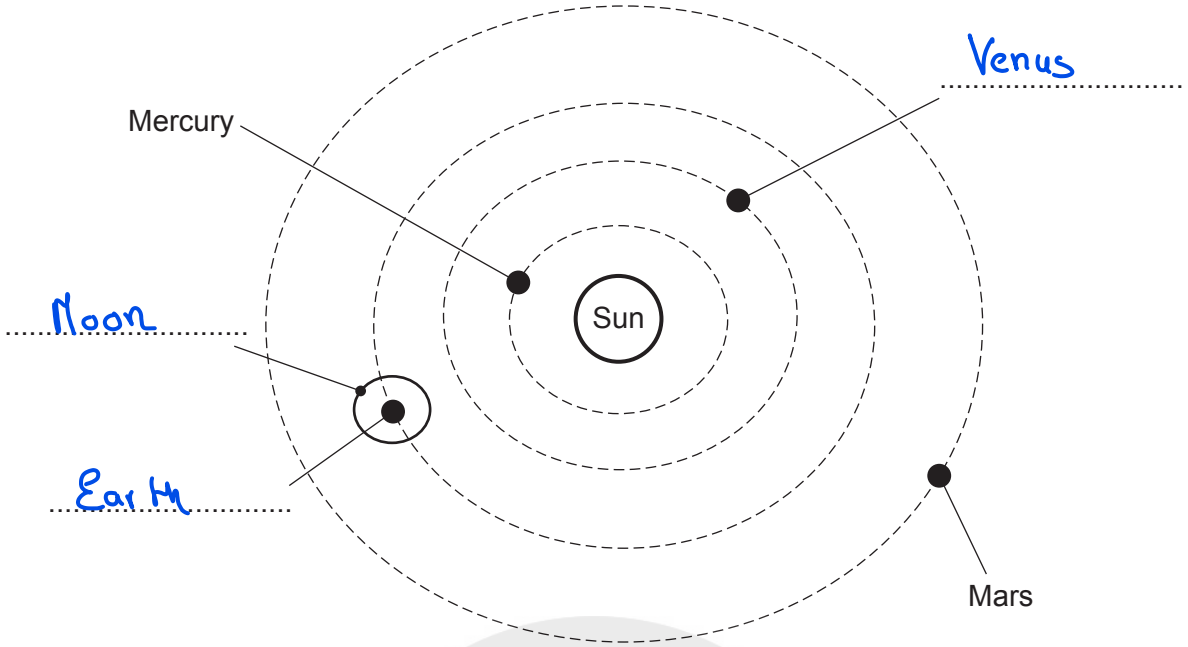


Fig. 11.1 (not to scale)

(a) Complete the labels on Fig. 11.1 by writing on the dotted lines. [3]

(b) Complete the sentences about the Sun.

The Sun consists mostly of the elements ..... Hydrogen ..... and ..... Helium ..... .

Most of the Sun's energy is radiated in the infrared, ... Visible .....

and ..... Ultraviolet ..... regions of the electromagnetic spectrum. [4]

(c) Give an estimate for the diameter of the Milky Way galaxy.

diameter = ... 100,000 ..... light-years [1]

[Total: 8]