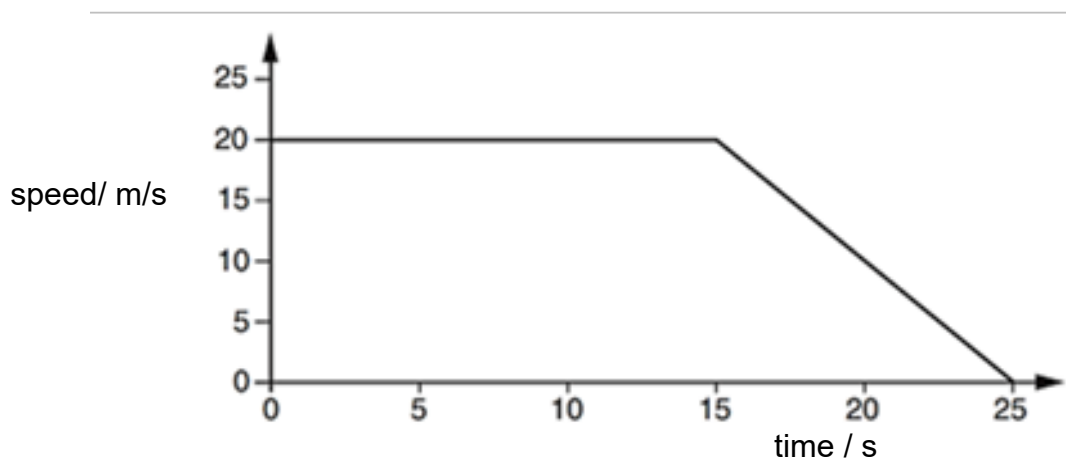


Section A [55 marks]

Answer **all** the questions in this section. Answer in the spaces provided.

- 1 A car with a mass of 2500 kg completes a journey with the speed-time graph shown below.



- (a) Describe the motion of the car during the entire journey.

.....
.....
.....[2]

- (b) Calculate the deceleration of the car.

deceleration =m/s² [2]

- (c) Determine the resistive force acting on the car.

resistive force =N [2]

- (d) Explain, in terms of forces, why speed of the car decreases from $t = 15$ s to $t = 25$ s.

.....
.....
.....[2]

- 2 A toy car, initially at rest, rolls down a smooth slope as shown in Fig. 2.1.

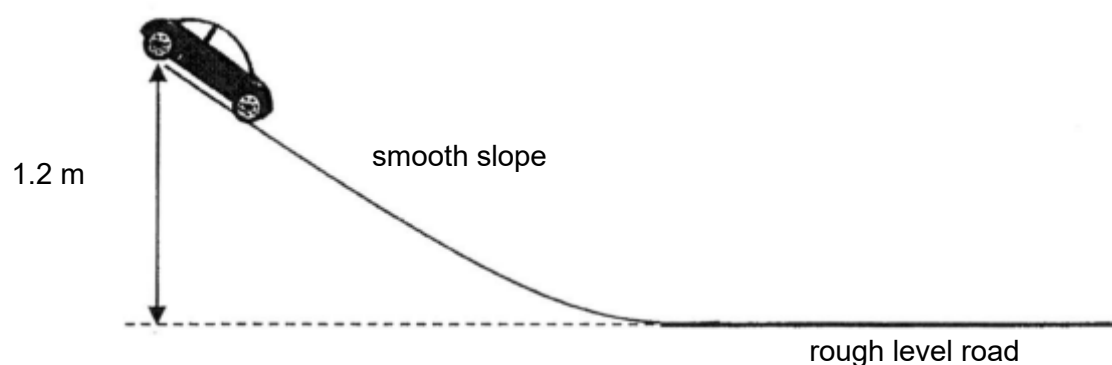


Fig. 2.1

The height of the slope is 1.2 m.

The mass of the car is 600 g.

The gravitational field strength is 10 N/kg.

- (a) Calculate the gravitational potential energy of the car.

gravitational potential energy = J [2]

- (b) Calculate the speed of the car when it hits the bottom of the slope.

speed = m/s [2]

[Turn over

-
- (c) If the friction along the level road is 3 N, calculate the distance moved by the car before it stops.

distance = m [1]

- 3 Fig. 3.1 shows a uniform metre rule of weight 10 N pivoted at end X. A block of weight 3 N is hung 30 cm from the pivot, while a spring balance is suspended at the 80 cm mark from the pivot and the rule is balanced.

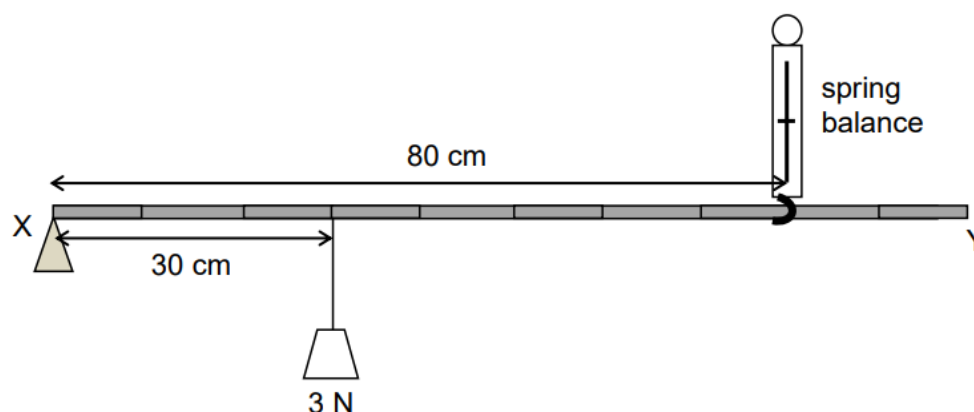


Fig. 3.1

- (a) State what is meant by the principle of moments.

.....

 [2]

- (b) (i) On Fig. 3.1, draw an arrow to represent the weight of the metre rule. Label it as W. [1]
- (ii) Hence, calculate the moment due to the weight of the metre rule about the pivot at end X.

moments =Ncm [2]

- (c) Calculate the upward force measured by the spring balance about the pivot at end X.

upward force =N [2]

[Turn over

- 4 A sphere of material X, weighing 3.5 N, is shown in Fig 4.1.

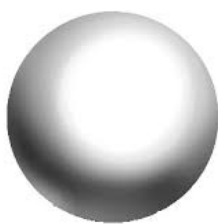


Fig 4.1

The gravitational field strength is 10 N/kg.

- (a) Calculate the mass of the sphere.

mass =kg [2]

- (b) The volume of a sphere is measured by dropping it into a container of oil, as shown in Fig 4.2.

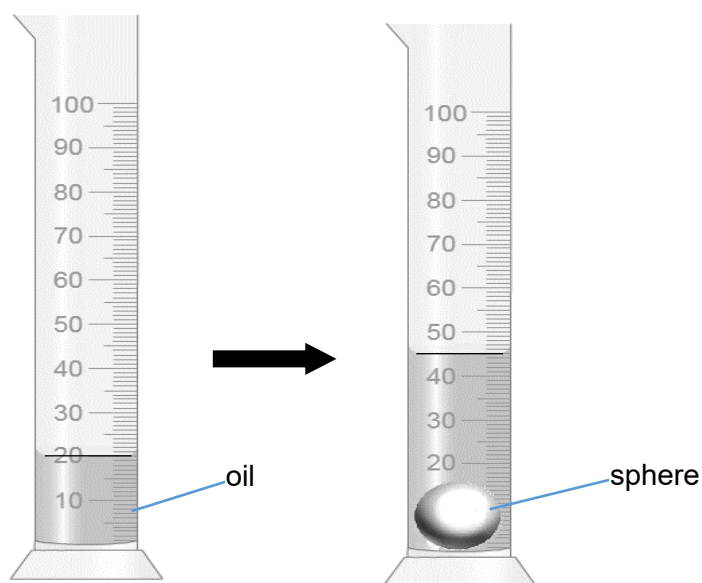


Fig 4.2

Determine the volume of the sphere.

volume = cm³ [1]

-
- (c) Use your answers in parts (a) and (b) to calculate the density of material X.

density = g/cm³ [2]

- 5 Fig. 5.1 shows a kettle containing water placed on the burner of a gas cooker.



Fig 5.1

The gas burner is lit at time $t = 0$. At $t = 250$ s the temperature of the water is 100°C , the boiling point of water.

- (a) State what is meant by *boiling point*.

.....
.....[1]

- (b) Fig. 5.2 shows how the temperature of the water changes with time t .

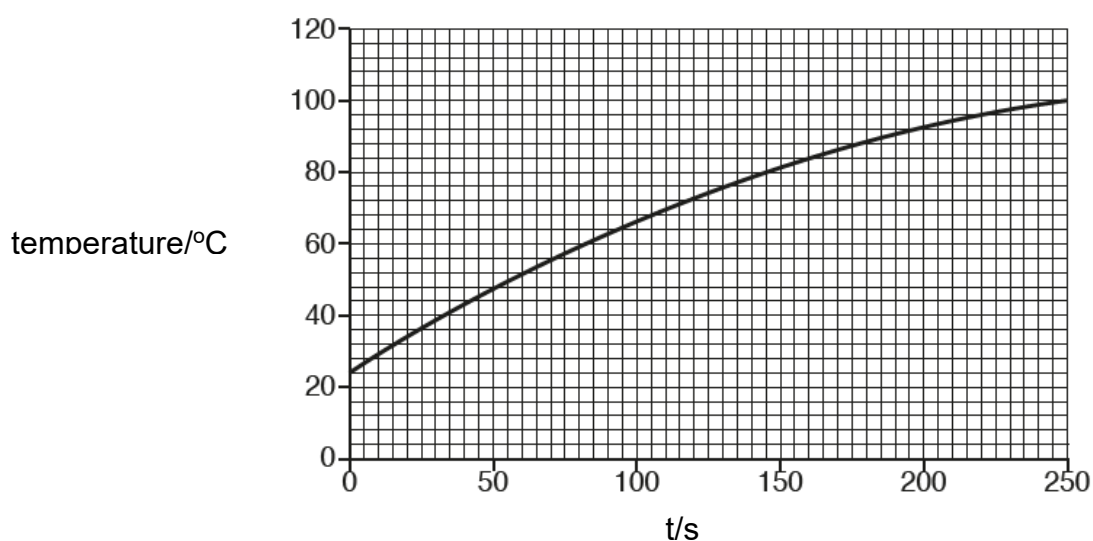


Fig 5.2

- (i) Thermal energy (heat) is transferred to the water at a constant rate but the temperature of the water increases at a rate that is not constant, as shown in Fig. 5.2. Explain why the temperature increases in this way.

.....
.....[1]

- (ii) When the temperature reaches 100 °C, the kettle is left on the burner. Thermal energy is still supplied to the water. The water boils as the molecules form bubbles and rise to the surface. Explain, in terms of the molecules, why it is necessary to supply thermal energy in order to keep the water boiling.

.....
.....
.....[2]

- 6 Fig. 6.1 shows the path of a ray of light as it enters a rectangular glass block at P. The light ray is refracted at P.

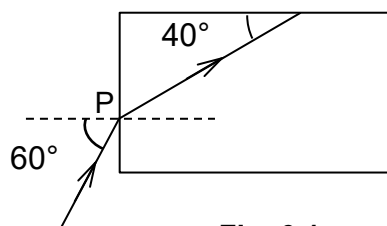


Fig. 6.1

- (a) Calculate the refractive index of the glass block.

refractive index =[2]

- (b) Given that the speed of light in the air is 3.0×10^8 m/s, find the speed of light in the glass block.

speed = m/s [2]

- 7 Fig 7.1 shows a girl standing a few hundred metres away from a large building.



Fig 7.1

The girl uses a signal generator and a loudspeaker to send a short pulse of sound towards the building. The sound has a frequency of 3700 Hz.

A short time later, the girl hears an echo.

- (a) State the two quantities to be measured so as to determine the speed of the echo.

.....
[1]

- (b) The pitch of the echo is the same as that of the original sound but the echo is not as loud.

State what has happened to

- (i) the amplitude of the sound wave,

.....[1]

- (ii) the frequency of the sound wave.

.....[1]

- (c) The speed of sound in air is 330 m / s.
 Calculate the wavelength of this sound.

wavelength =m [2]

[Turn over

- 8 Fig. 8.1 shows a plastic rod rubbed with a dry cloth.

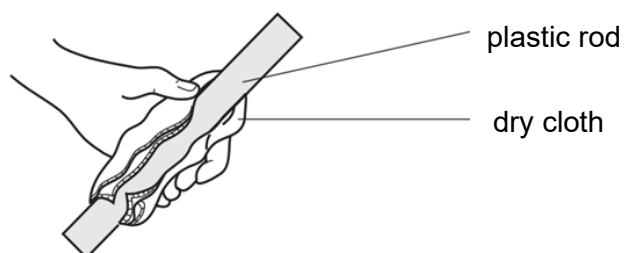


Fig. 8.1

The rod is then held close to a negatively charged sphere. Fig. 8.2 shows the movement of the sphere.

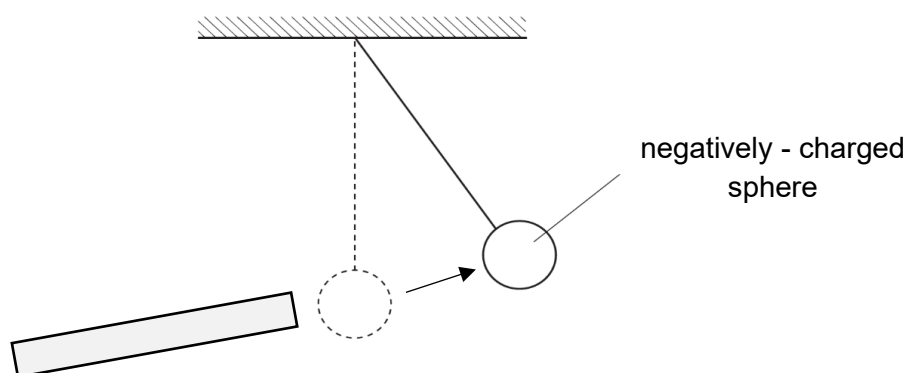


Fig. 8.2

Explain what happened to the charges in the plastic rod when it was rubbed with the dry cloth.

.....

.....

.....

.....

.....[2]

- 9 Carbon-12 is a stable isotope of carbon. Its nuclide notation is shown in Fig. 9.1. Carbon-14 is an unstable isotope of carbon. Its nuclide notation is shown in Fig. 9.2.



Fig 9.1

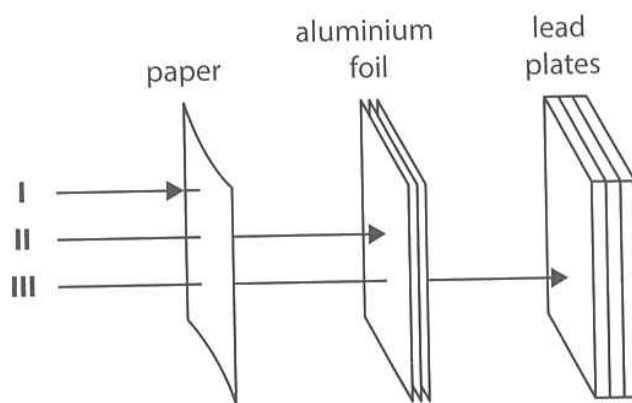


Fig 9.2

- (a) Determine the numbers of electrons, protons and neutrons in an atom of carbon-12 and the numbers of electrons, protons and neutrons in an atom of carbon-14. Complete the following table. [1]

	Carbon - 12	Carbon - 14
Number of electrons		
Number of protons		
Number of neutrons		

- (b) The penetrating power of a radioactive emission is defined by how easily it is stopped by matter. The below figure shows three radioactive emissions and whether they are stopped by materials of varying densities.



Identify the three radioactive emissions in the table below.

[2]

	Type of emissions
I	
II	
III	

(b) Fig. 9.3 shows the decay curve for a sample of carbon-14.

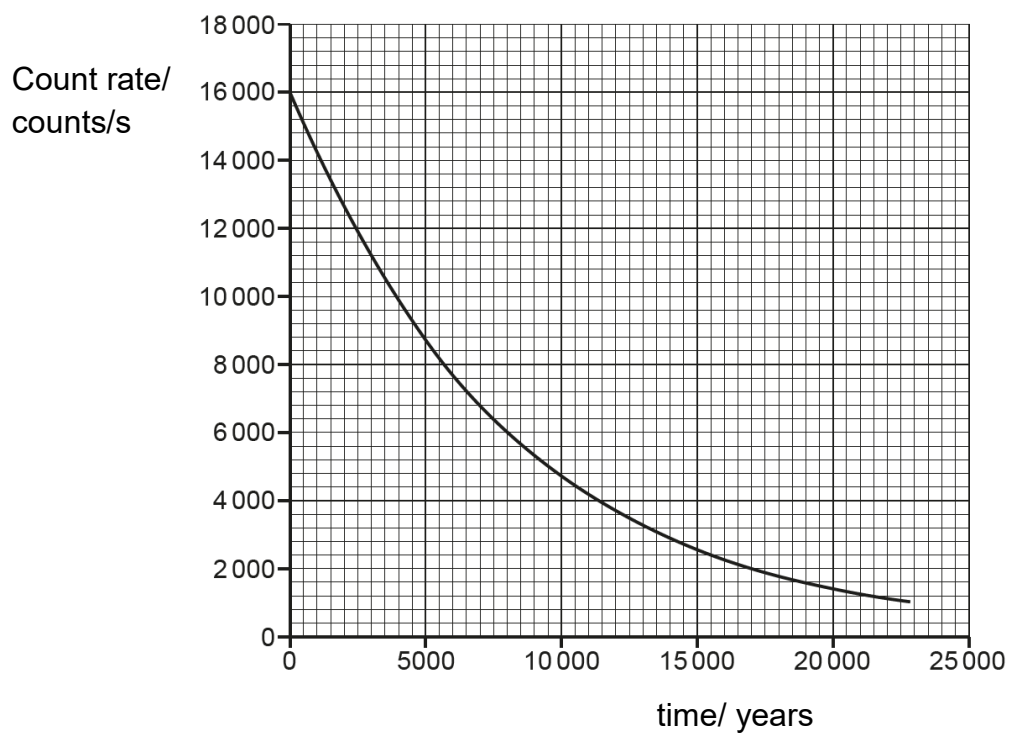


Fig 9.3

Use the graph to determine the half-life of carbon-14.

half-life = years [2]

10 Fig. 10.1 shows the electrical wiring in a table lamp.

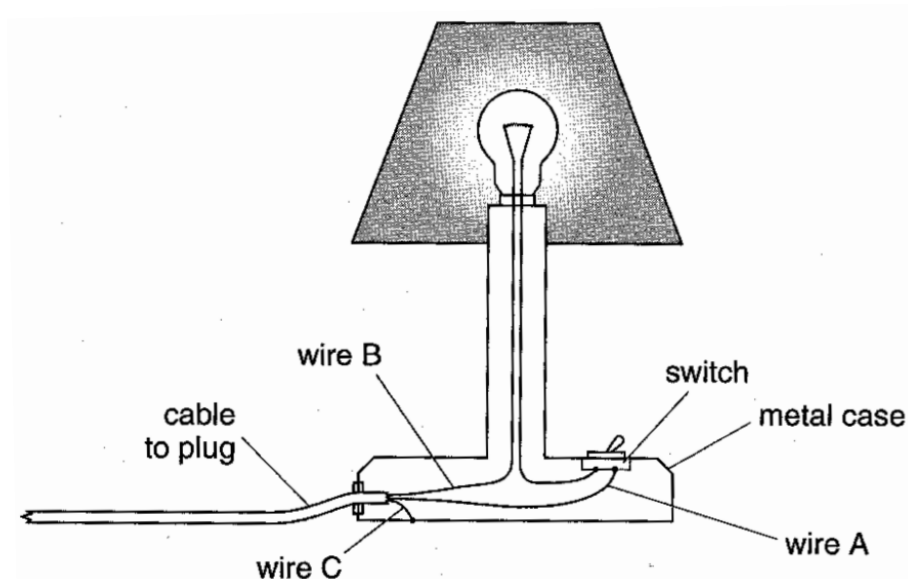


Fig. 10.1

(a) The lamp is marked “240 V, 60 W”.

(i) Calculate the current flowing the lamp when it is working normally.

current =A [2]

(ii) A fuse can be included in the circuit. Suggest a suitable fuse rating for the table lamp.

fuse rating =A [1]

(iii) The lamp is switched on for 12 hours daily. Calculate the cost for using the lamp for 7 days, given that the electrical consumption rate is \$0.28 per kWh.

cost = \$.....[2]

[Turn over

(b) Name the wires **A**, **B** and **C**. [2]

wire **A**:

wire **B**:

wire **C**:

(c) Wire **A** becomes loose and touches the metal case.
State and explain what would happen if a person accidentally touched the metal case.

.....

.....

.....

.....

..... [3]

Section B [10 marks]

Answer any 1 out of the 2 questions in the spaces provided.

- 11** Fig. 11.1 shows the I/V graph of a filament heating lamp.

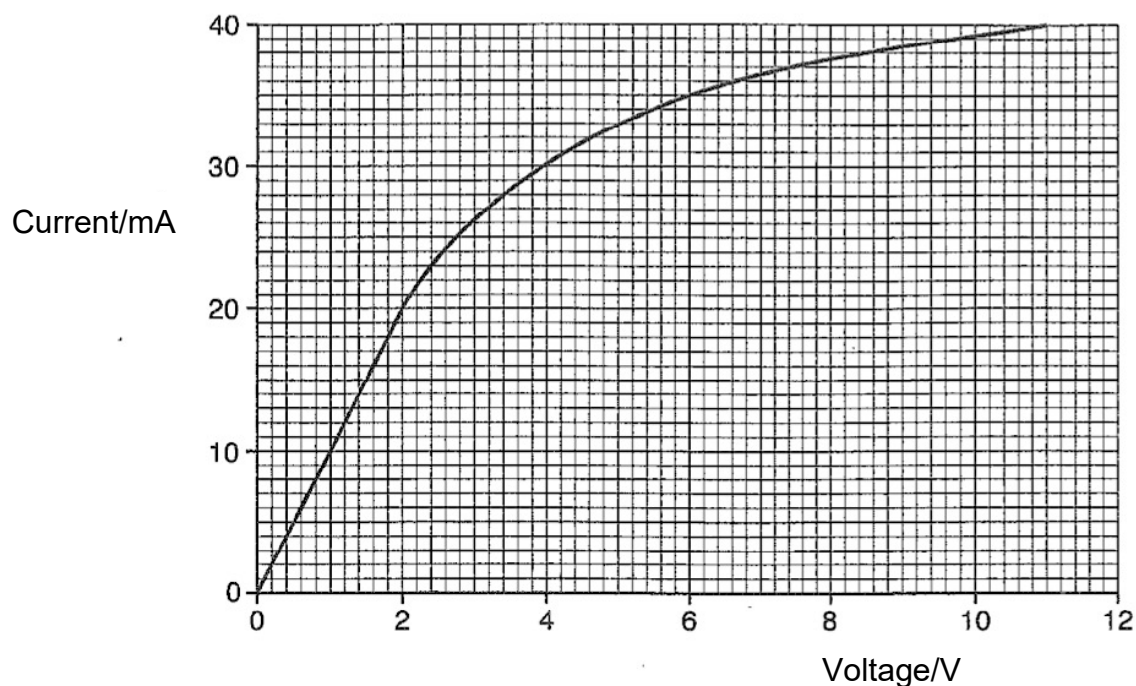


Fig. 11.1

- (a)** Calculate the resistance of the heating lamp when the current flowing through it is 10 mA.

resistance = Ω [2]

- (b)** Using the graph in Fig. 11.1, describe and explain how the resistance of the heating lamp changes as the voltage increases from zero.

.....
.....
.....
.....[2]

- (c) This diagram below shows how the heating lamp is being used in a restaurant to keep the food warm.



- (i) The owner used 11 V to power up this heating lamp. Calculate the amount of work done by a unit charge that flows through the heating lamp in 5 minutes.

work done =J [3]

- (ii) By using Kinetic particle model of matter, describe how the food is being heated up by the heating lamp.

.....

.....

.....

.....

.....

.....[3]

- 12 (a)** State what is meant by a magnetic field.

.....
.....
.....[1]

- (b)** Fig. 12.1 shows wire P carrying a current out of the plane of the paper.



Fig 12.1

- (i)** Draw the magnetic field around wire P. [1]
- (ii)** State the effect (if any) on the direction of the magnetic field if wire P carries a current into the plane of the paper.

.....
.....
.....[1]

- (c) Fig. 12.2 shows a coil of wire wound around a soft iron core. A current passes through the coils as shown by the arrows. A magnetic field is set up around this coil of wire.

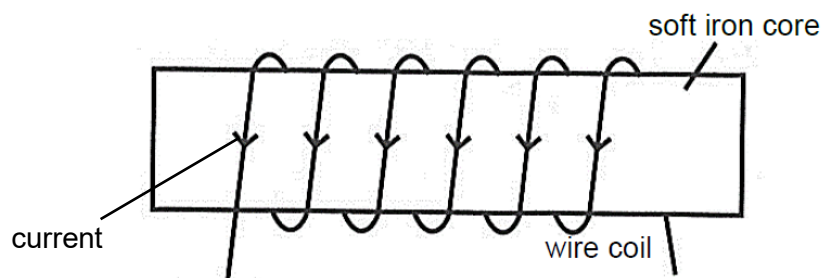


Fig. 12.1

- (i) On Fig. 12.2, draw the magnetic field around the coil of wire. [2]
 (ii) On Fig. 12.2, label with an 'N' the north pole produced by this coil of wire. [1]
 (iii) Suggest a way to increase the strength of this magnetic field.

.....

[1]

- (d) Wire P is placed beside the wire coil as shown in Fig. 12.3.

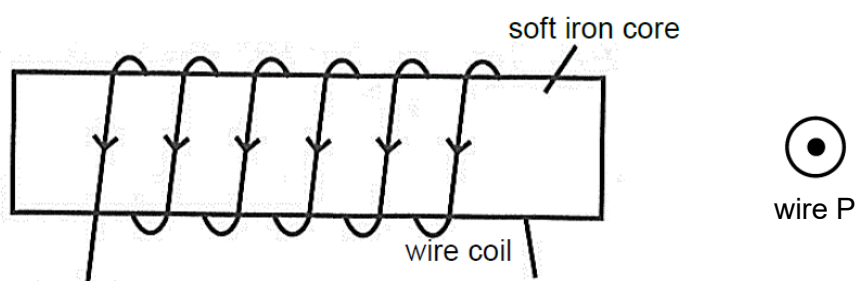


Fig. 12.3

- (i) State why a force acts on wire P when it is placed beside the wire coil.

.....
.....
.....[1]

- (ii) On Fig. 12.3, draw an arrow to indicate the direction of the force acting on wire P. [1]

- (iii) The current in the wire coil and the current in wire P are both reversed. State the effect of this (if any) on the direction of the force exerted on wire P.

.....
.....
.....[1]

END OF PAPER

[Turn over