Cambridge Assessment International Education

# Cambridge IGCSE™ (9–1)

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| CANDIDATE NAME | | | | | | | | | |
| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | |

*3847682478*

**PHYSICS** **0972/32**

Paper 3 Theory (Core) **May/June 2020**

**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 10 N (acceleration of free fall = 10 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. Blank pages are indicated.


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**1** Some students observe drops of water falling from a tap that leaks, as shown in Fig. 1.1.

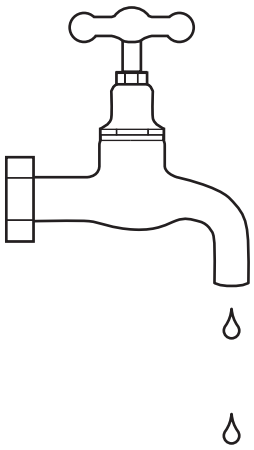

**Fig. 1.1**

**(a)** The students measure the time for 50 drops to fall from the tap. The time for 50 drops to fall is 20 s.

Calculate the average time between two drops falling.

average time = ..... s [2]

**(b)** The students collect some drops of water.

**(i)** The students measure the volume of the water they collect.

State the term for the equipment that is suitable for measuring the volume accurately.

..... [1]

**(ii)** In a similar experiment, another student collects 0.21 kg of water.

Calculate the weight of this water.

weight of water = ..... N [3]

[Total: 6]

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**2** **(a)** Some students determine the speed of a car on a road. The students measure the time for the car to travel 30 m along the road. The time is 5.4 s.

Calculate the average speed of the car.

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

**(b)** Another car moves at a constant speed of 16 m / s for 4.0 seconds. During the next 2.0 seconds, the car decelerates from a speed of 16 m / s to a speed of 13 m / s. It then continues at a constant speed of 13 m / s for 3.0 seconds.

On Fig. 2.1, plot the speed–time graph for the motion of the car during these 9.0 s.

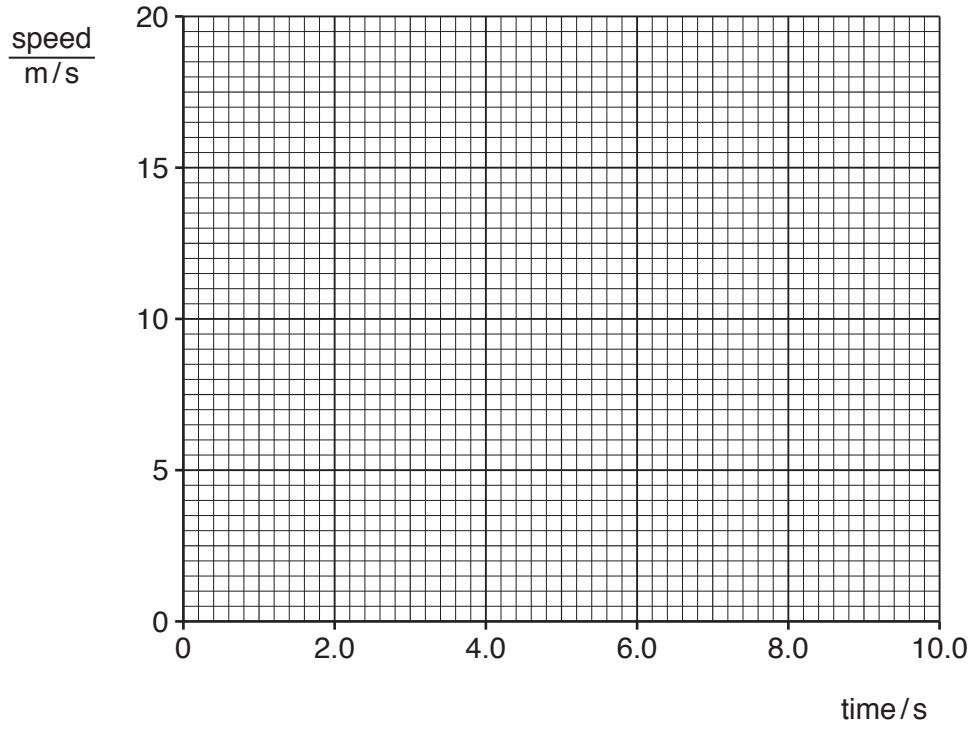


**Fig. 2.1**

[3]

**(c)** A motorcycle accelerates as shown in Fig. 2.2. Calculate the distance the motorcycle travels while it is accelerating. Use information from Fig. 2.2.

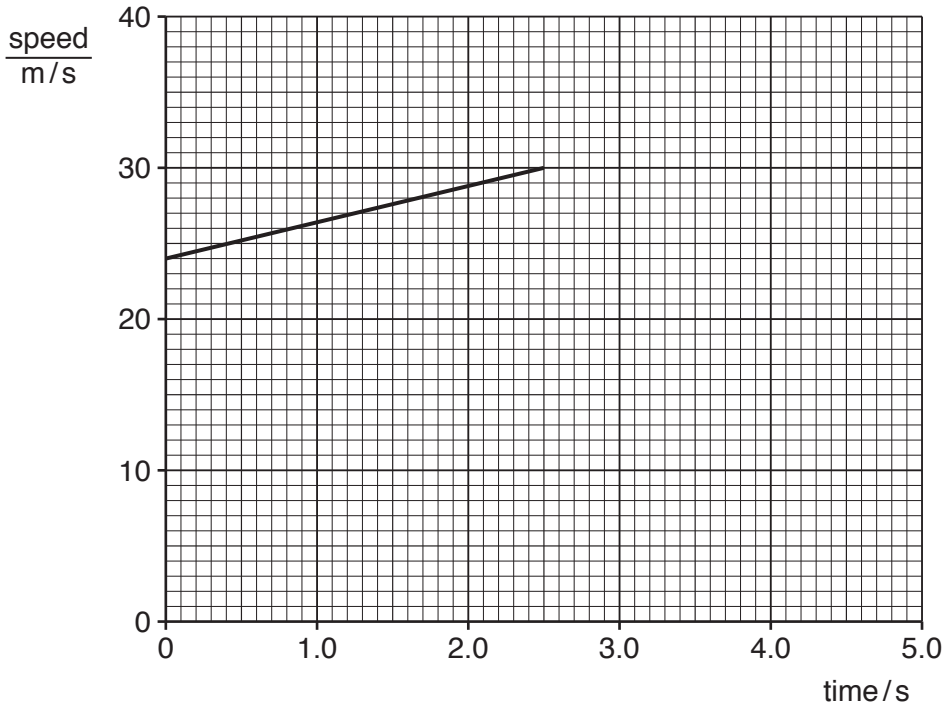


**Fig. 2.2**

distance travelled = ..... m [3]

[Total: 9]

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**3** Fig. 3.1 shows an archer pulling the string of a bow.

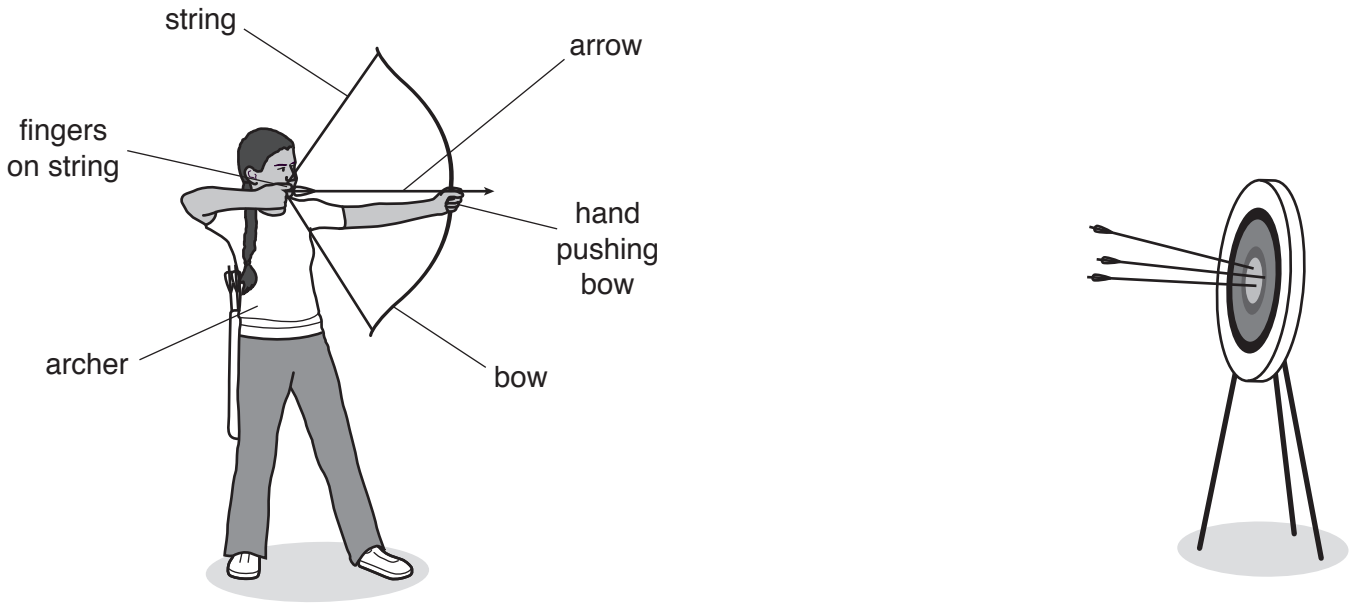


**Fig. 3.1**

**(a)** The archer uses a force of 120 N. The force acts on an area of 0.5 $cm^2$ on the archer's fingers.

Calculate the pressure on the archer's fingers.

pressure on fingers = ..... $N/cm^2$ [3]

**(b)** The archer's other hand is pushing the bow with the same force of 120 N. This force acts on a larger area than the force in **(a)**.

State whether the pressure on this hand is greater than, the same as or less than the pressure on the fingers holding the string.

..... [1]

**(c)** State the type of energy stored in the bow when the archer bends it as shown in Fig. 3.1.

..... [1]

[Total: 5]

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**4** **(a)** Match each description with the correct state of matter in Table 4.1.

Write the correct letter in Table 4.1.

A – Molecules move around freely and are far apart from each other.

B – Molecules vibrate about fixed positions.

C – Molecules move around randomly and are close to each other.

**Table 4.1**

| state of matter | description |
|---|---|
| solids | |
| liquids | |
| gases | |

[2]

**(b)** Some students heat water in a beaker. They measure the temperature every minute. They heat the water for 8 minutes until it boils, and then continue to heat it for a further 5 minutes.

Describe and explain how the temperature of the water changes during the 13 minutes.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 5]

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**5** Fig. 5.1 shows a ray of red light passing through a semicircular glass block.

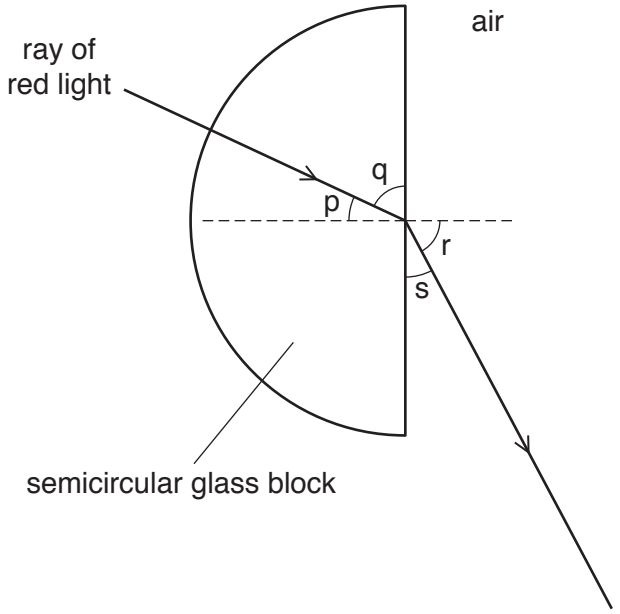


**Fig. 5.1**

**(a) (i)** State the term for the dotted line shown in Fig. 5.1.

..... [1]

**(ii)** State which angle p, q, r or s is the angle of incidence for the ray of red light.

..... [1]

**(iii)** State which angle p, q, r or s is the angle of refraction.

..... [1]

**(iv)** State what happens to the speed of the red light as it enters the semicircular glass block from the air.

..... [1]

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**(b)** Fig. 5.2 shows the path of a ray of light entering a semicircular glass block. The critical angle for the glass block is 42°.

On Fig. 5.2, continue the path of the ray. Show clearly its direction on leaving the glass block.

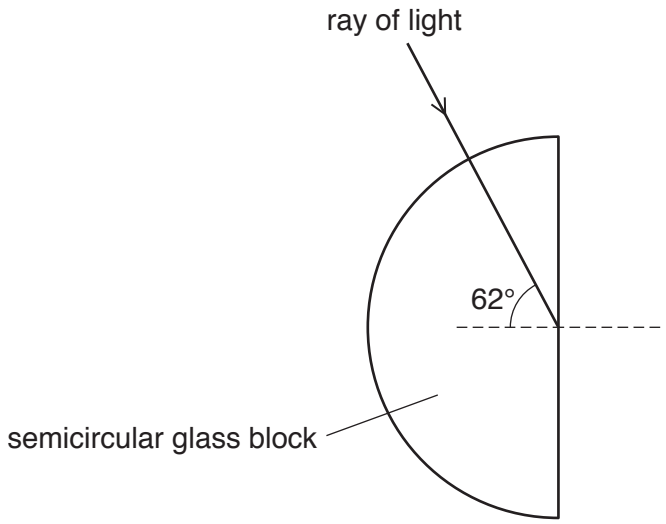



**Fig. 5.2**

[2]

**(c)** A ray of white light passes through two prisms as shown in Fig. 5.3.

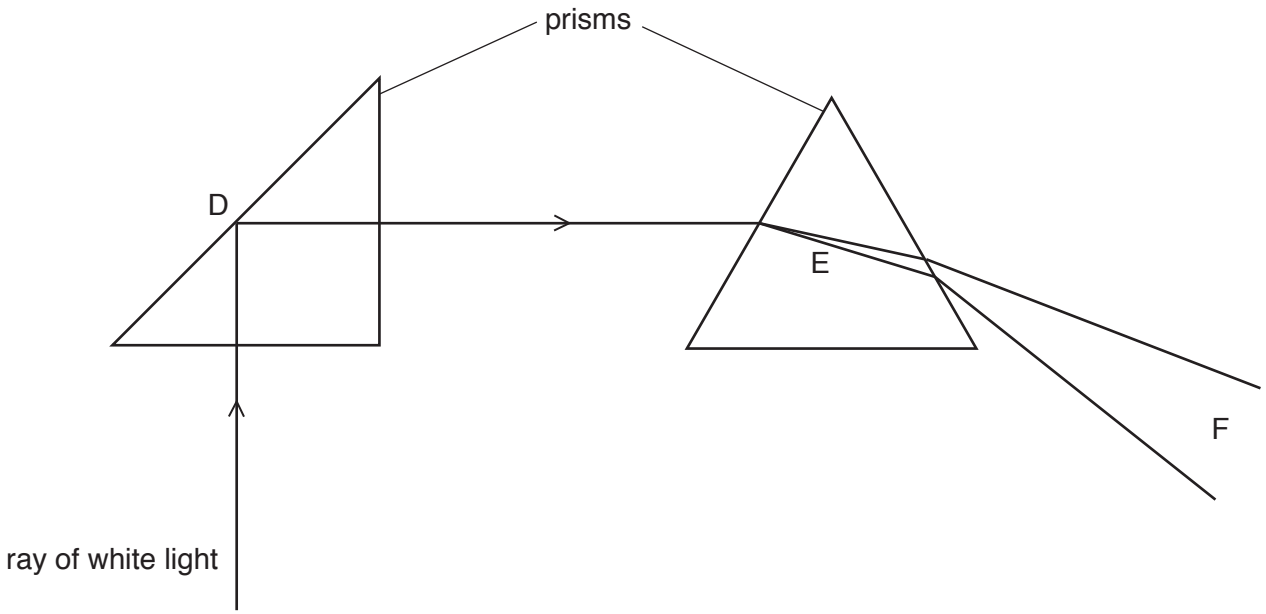



**Fig. 5.3**

Draw **one** line to link the letter for each position to the correct effect at that position.

| position | effect |
|---|---|
| | refraction |
| D | diffraction |
| | total internal reflection |

**(i)** [1]

| position | effect |
|---|---|
| | reflection |
| E | dispersion |
| | diffraction |

**(ii)** [1]

| position | effect |
|---|---|
| | red, green and blue light only produced |
| F | white light produced |
| | spectrum of visible light produced |

**(iii)** [1]

[Total: 9]

**6** Fig. 6.1 shows a hot liquid in a vacuum flask. The vacuum flask keeps the temperature of the liquid in the flask constant for a long time.

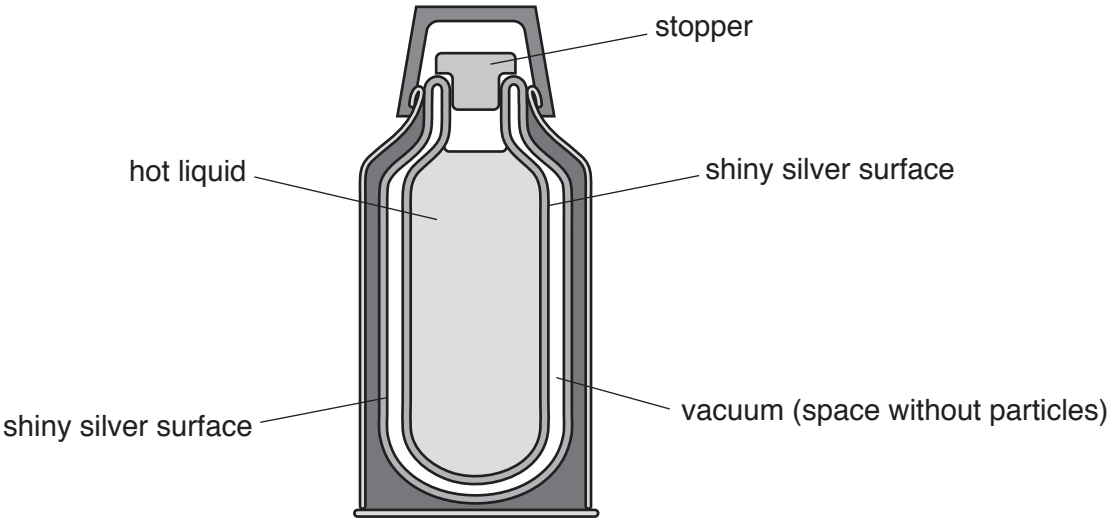



**Fig. 6.1**

**(a)** Describe how each feature helps to keep the liquid hot for longer.

**(i)** shiny silver surface

.....

..... [2]

**(ii)** the vacuum between the silvered surfaces

.....

.....

..... [3]

**(b) (i)** Suggest a material for the stopper that will help to keep the liquid hot for longer.

material ..... [1]

**(ii)** Give a reason for your answer.

reason .....

..... [1]

[Total: 7]

**7** Fig. 7.1 shows a diagram of the main regions of the electromagnetic spectrum. Two labels are missing.

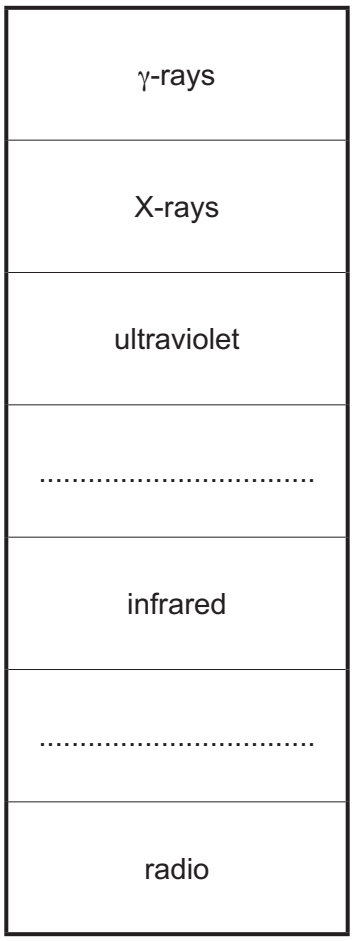



**Fig. 7.1**

**(a) (i)** Complete the labels on Fig. 7.1. [2]

**(ii)** State **two** properties that are the same for all waves in the electromagnetic spectrum.

1. .....

2. .....

[2]

**(b)** State which region of the electromagnetic spectrum is used in each situation.

**(i)** detecting objects without opening baggage at a security check

..... [1]

**(ii)** television remote control

..... [1]

**(iii)** satellite television transmissions

..... [1]

[Total: 7]

**8** Sound travels as a wave.

**(a)** Complete each sentence.

Sound is produced when an object ..... .

An echo is produced when sound is ..... from a hard surface.

Compared with a quiet sound, a loud sound always has a greater ..... .

Compared with a high pitched sound, a low pitched sound always has a smaller ..... .

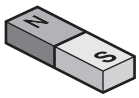
Waves transfer energy without transferring ..... .
[5]

**(b)** State the meaning of the term ultrasound.

..... [1]

[Total: 6]

**9** Some students plot the magnetic field lines around a bar magnet. They have the apparatus shown in Fig. 9.1 and a large sheet of paper.



bar magnet


plotting compass

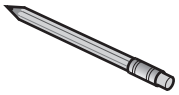

pencil

**Fig. 9.1**

**(a)** Describe how the students use the apparatus in Fig. 9.1 to show the pattern of the magnetic field lines around the bar magnet.

You may draw a diagram to assist with your description.

.....

.....

.....

.....

.....

..... [3]

**(b)** Draw at least **four** lines above and below the bar magnet in Fig. 9.2 to show the magnetic field around the bar magnet. Draw an arrow on the field lines to show the direction of the magnetic field.


**Fig. 9.2**

[3]

[Total: 6]

**10** A student connects three identical lamps J, K and L in a circuit, as shown in Fig. 10.1.

Switch $S_1$ is open and the current in ammeter $A_1$ = 0.2 A.

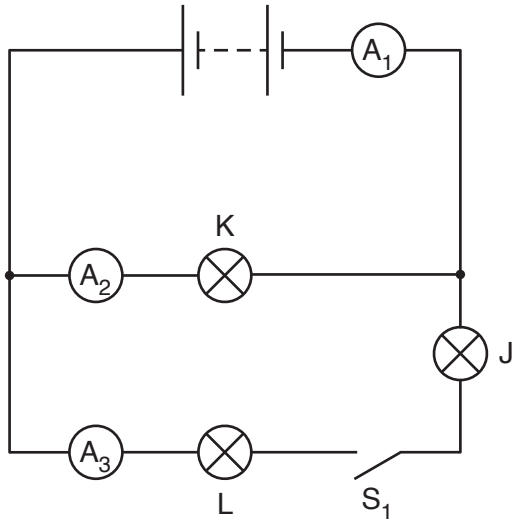



**Fig. 10.1**

Use words from the box to complete the sentences.

Each word may be used once, more than once, or not at all.

| | | |
|---|---|---|
| the same | increased | decreased |

**(a)** The switch $S_1$ in Fig. 10.1 is closed. State and explain the effect on the circuit.

**(i)** The current in ammeter $A_1$ is ..... because the resistance of the whole circuit is ..... . [2]

**(ii)** The current in ammeter $A_2$ is ..... . [1]

**(b)** A student measures the potential difference (p.d.) across lamp J by using a voltmeter.

On Fig. 10.1, draw the correct electrical symbol for the voltmeter with the correct connections. [2]

**(c)** The p.d. across lamp J is 3.0 V and the current shown by ammeter $A_3$ is 0.15 A.

Calculate the resistance of lamp J. Include the unit in your answer.

resistance of lamp J = ..... unit..... [4]

[Total: 9]

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**11** A model train uses an electric motor. The motor has a coil of wire in a magnetic field.

**(a)** Fig. 11.1 shows a coil of wire in a magnetic field.

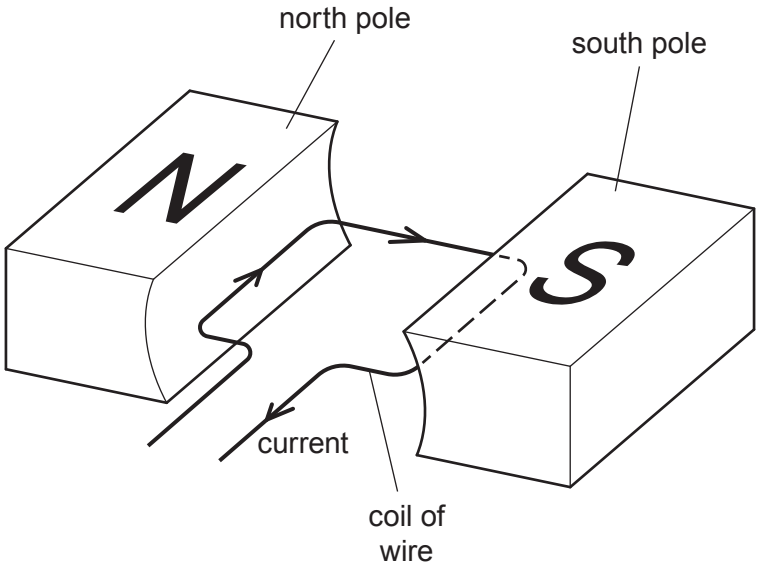


**Fig. 11.1**

Describe **two** ways of increasing the turning effect on the coil.

.....

..... [2]

**(b)** The motor for the model train uses an alternating voltage of 12 V. This is supplied by the secondary coil of a transformer.

The primary coil of the transformer is connected to a mains voltage of 240 V.

The primary coil has 900 turns.

Calculate the number of turns on the secondary coil.

number of turns on the secondary coil = ..... [3]

[Total: 5]

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**12** **(a)** Carbon-14 is a radioactive isotope of carbon. An atom of carbon-14 has 6 protons in its nucleus.

Another isotope of carbon is carbon-12.

**(i)** Determine the number of protons in a carbon-12 nucleus.

..... [1]

**(ii)** Determine the number of neutrons in a carbon-14 nucleus.

..... [1]

**(iii)** Determine the number of electrons orbiting the nucleus of a single carbon-14 atom.

..... [1]

**(b)** Carbon-14 decays by emitting a $\beta$-particle.

State what happens to a nucleus of carbon-14 when it emits a $\beta$-particle.

..... [1]

**(c)** People working with radioactive sources need to take safety precautions.

**(i)** A shielding material can absorb ionising radiation and reduce the damage to living tissue.

State a suitable material that will absorb all types of naturally occurring nuclear radiation.

..... [1]

**(ii)** Apart from using shielding, state how a person can reduce the amount of ionising radiation they absorb when they handle samples of radioactive substances.

..... [1]

[Total: 6]

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