Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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0501787989

PHYSICS **0625/31**

Paper 3 Theory (Core) **October/November 2016**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **17** printed pages and **3** blank pages.

DC (KN/SG) 115850/8

CAMBRIDGE International Examinations

[Turn over

1 Fig. 1.1 shows the speed-time graph for a cyclist travelling along a flat, straight road.

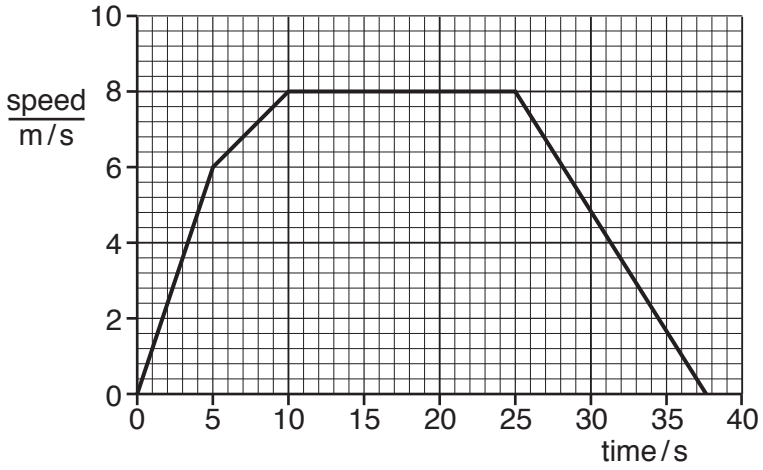

Fig. 1.1

(a) Complete the following sentence.

The cyclist has the greatest acceleration between ..... seconds

and ..... seconds. [1]

(b) Calculate the distance travelled by the cyclist between 10 s and 25 s.

distance = ... m [3]

(c) Fig. 1.2 shows the horizontal forces acting on the cyclist at three different times.

The length of each arrow represents the size of the force.

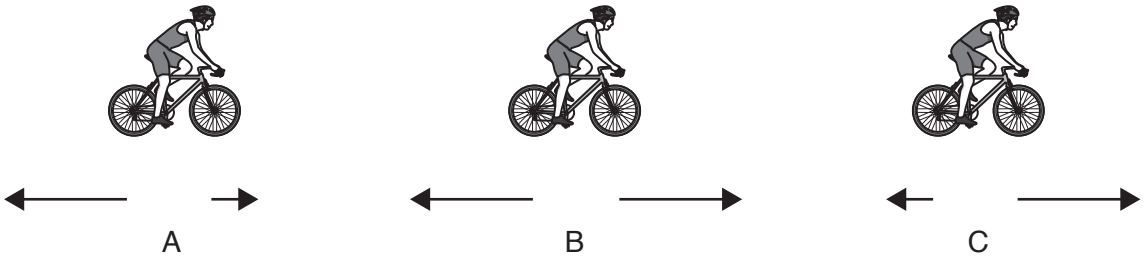

Fig. 1.2

(i) Which pair of forces, A, B or C, act on the cyclist when the time is 20 s? Tick **one** box.

A ☐

B ☐

C ☐ [1]

(ii) Explain your answer to **(c)(i)**.

.....

.....

.....

.....[2]

[Total: 7]

2 A student investigates the stretching of elastic bands.

Table 2.1 shows some of his results for elastic band A.

Table 2.1

load attached / N	elastic band A	
	length / cm	extension / cm
0	10.2	0.0
1	10.9	0.7
2	11.5	1.3
3	12.3	2.1
4	13.0	2.8
5	13.7	
6	14.5	

(a) Complete Table 2.1 by calculating the missing extensions. [2]

(b) The student repeats his experiment using elastic band B. Elastic band B is twice as long as elastic band A. It has the same thickness and is made of the same material.

Fig. 2.1 shows how he uses the apparatus.

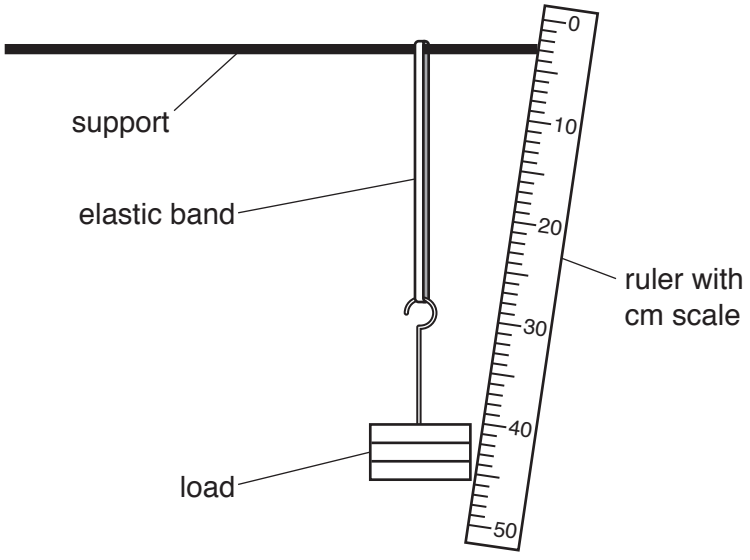

Fig. 2.1

Describe **two** changes the student could make to improve the accuracy of his measurements.

1. .....

.....

2. .....

.....

[2]

(c) The student draws a graph of extension against load for each elastic band.

The lines of best fit for elastic bands A and B are shown in Fig. 2.2.

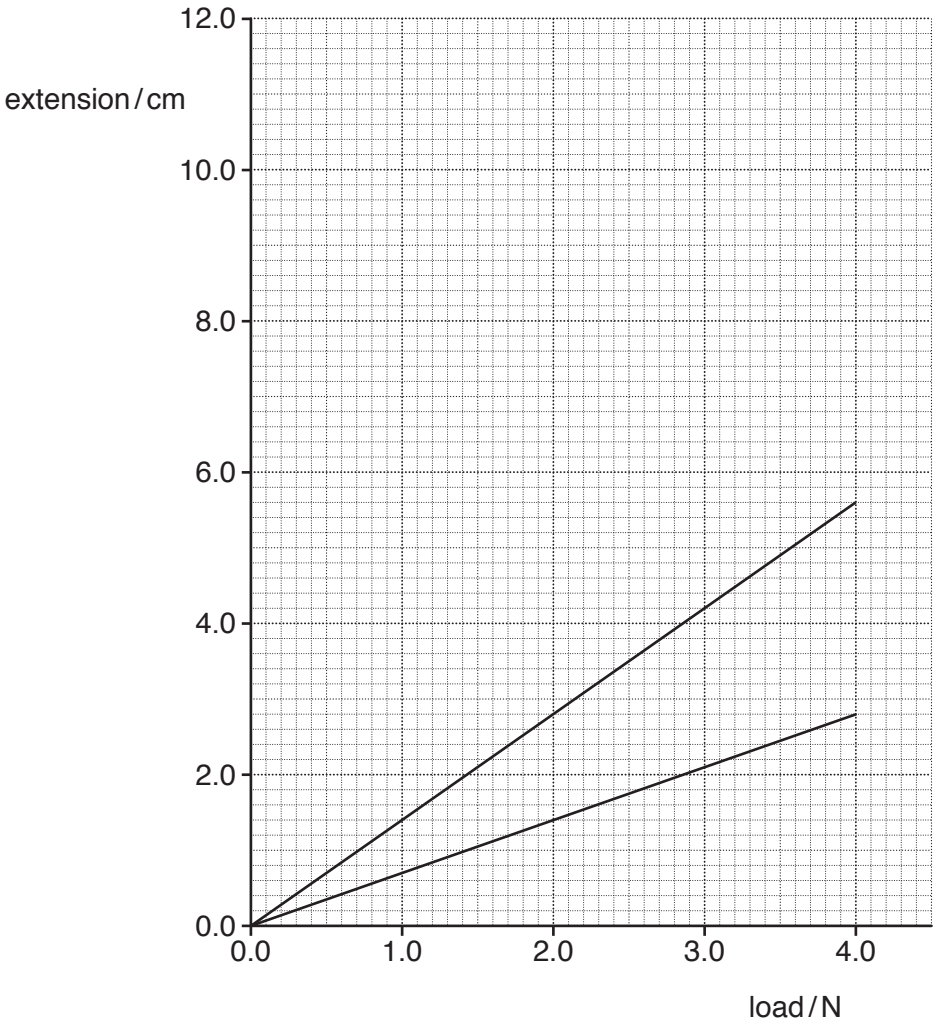

Fig. 2.2

(i) Use information from Table 2.1 to label each of the graph lines. Label the lines **band A** and **band B**. Explain how you decided on your answer.

.....

.....

.....[1]

(ii) The student repeats his experiment using elastic band C, which is three times as long as elastic band A. It has the same thickness and is made of the same material.

On Fig. 2.2, draw a line to suggest how extension would vary with load for elastic band C. Label the line **band C**. [1]

[Total: 6]

3 Fig. 3.1 shows a barrier pivoted near one end. The barrier is raised to allow cars to pass.

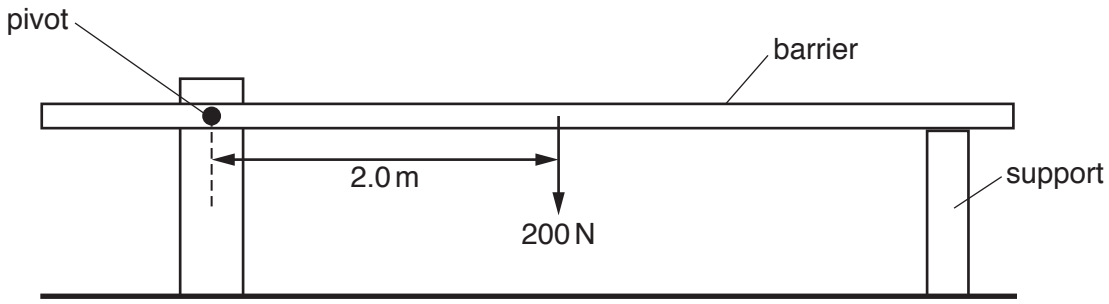

Fig. 3.1

(a) A force is used to raise the barrier off the support.

On Fig. 3.1, draw an arrow to show the position and direction of the smallest force that can be used to raise the barrier. [2]

(b) The barrier has a weight of 200 N. This acts at a distance of 2.0 m from the pivot, as shown in Fig. 3.1.

Calculate the moment of the weight of the barrier about the pivot.

moment = ... N m [2]

(c) To reduce the force needed to raise the barrier, a counterweight is added, as shown in Fig. 3.2.

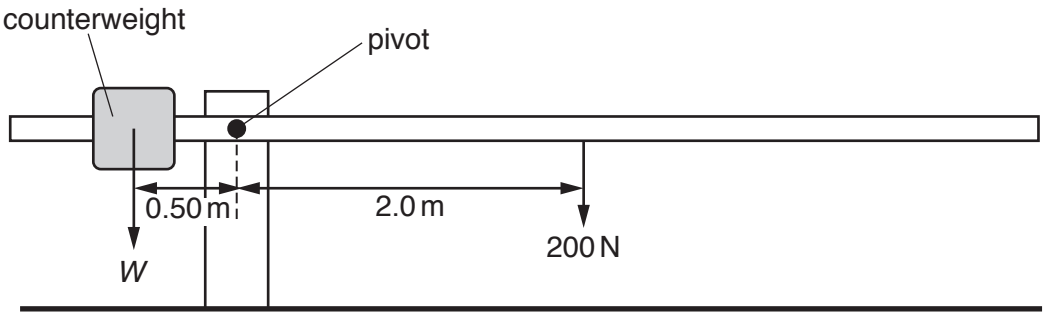

Fig. 3.2 (not to scale)

The weight *W* of the counterweight acts at a distance of 0.5 m from the pivot. The barrier is in equilibrium, without the support.

Calculate the weight *W* of the counterweight.

weight = ... N [2]

[Total: 6]

4 An electric motor is used to lift a load. The energy involved is shown in Fig. 4.1.

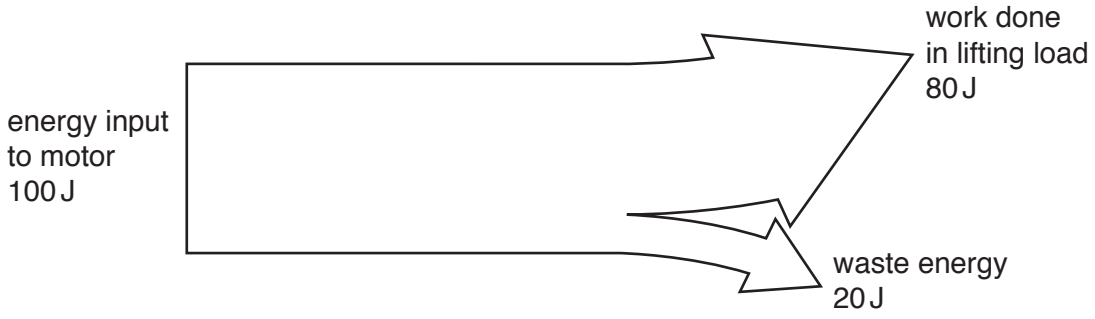

Fig. 4.1

(a) **(i)** State the term used to describe the energy gained by the load due to its increase in height.

.....[1]

(ii) What effect does the waste energy from the motor have on its surroundings?

.....[1]

(iii) State the principle of conservation of energy and explain how it applies to the working of the motor. Use information from Fig. 4.1 in your answer.

.....

.....

.....[2]

(b) The electrical power for the motor is generated in a coal-fired power station.

State **two** benefits of using coal-fired power stations and state **two** problems that arise from their use.

benefits

1. .....

.....

2. .....

.....

problems

1. .....

.....

2. .....

.....

[4]

[Total: 8]

5 **(a)** Fig. 5.1 shows a ray of red light passing through a semi-circular glass block.

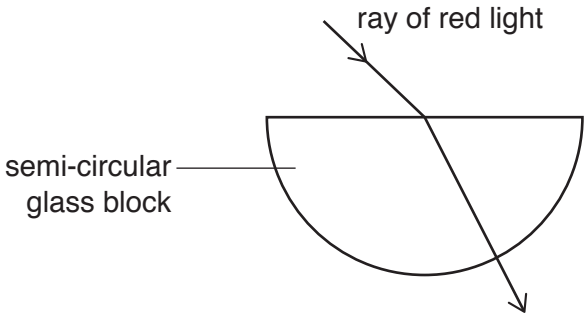

Fig. 5.1

(i) The ray of light changes direction as it travels into the block.

State the name that is given to this change of direction.

.....[1]

(ii) Fig. 5.2 shows another ray of red light travelling into the semi-circular glass block. It meets the curved surface at 90°.

Inside the block, the ray meets the flat surface of the block at an angle greater than the critical angle.

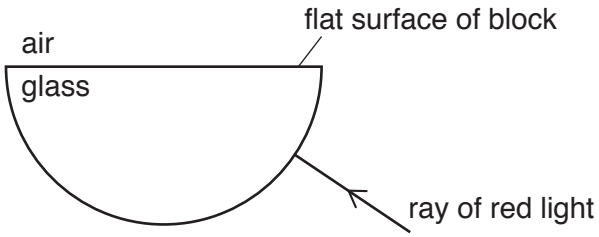

Fig. 5.2

On Fig. 5.2, complete the path of the ray of red light. [2]

(b) Fig. 5.3 shows the view from above of a car approaching an observer, marked with a cross (✖).

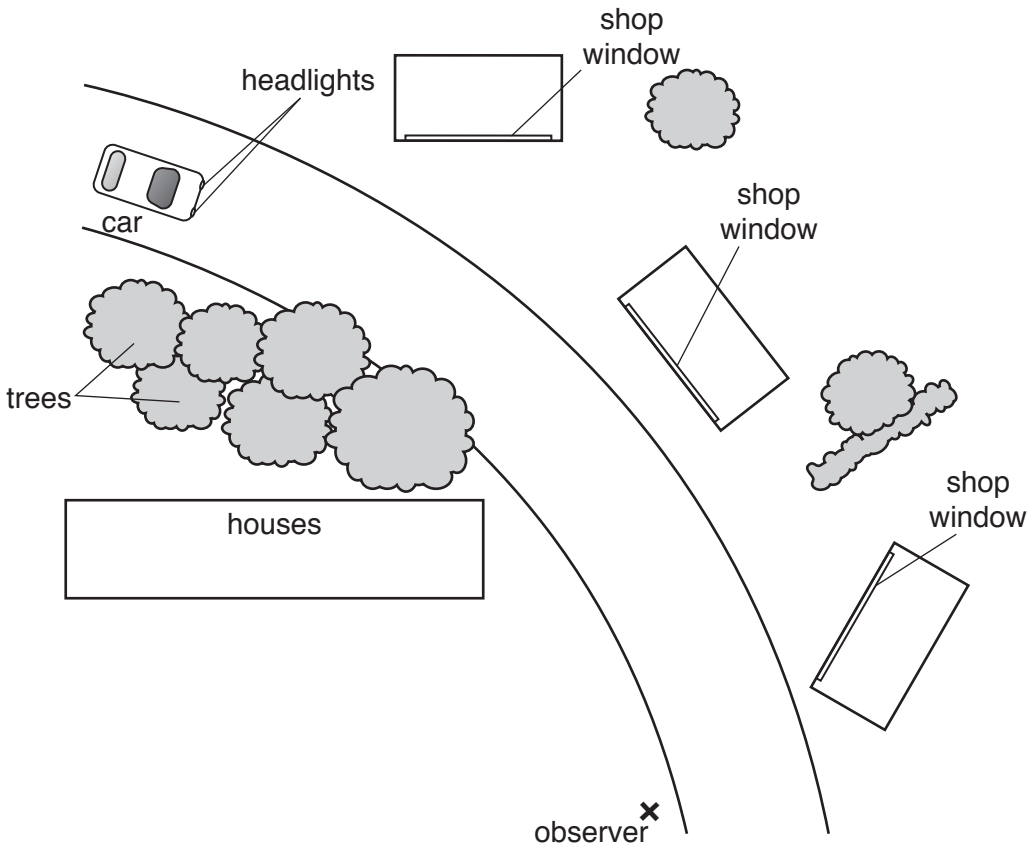

Fig. 5.3

(i) The observer sees the car's headlights reflected in one of the shop windows. The car's headlights are labelled.

In which shop window does the observer see the reflection? Show your answer by drawing, on Fig. 5.3, the path of a ray of light from a headlight to the observer. Use a ruler. [1]

(ii) State the law that you used to answer **(b)(i)**.

.....[1]

(iii) Add labels to Fig. 5.3 to show how the law stated in **(b)(ii)** applies. [2]

[Total: 7]

6 Fig. 6.1 shows a flask of hot water.

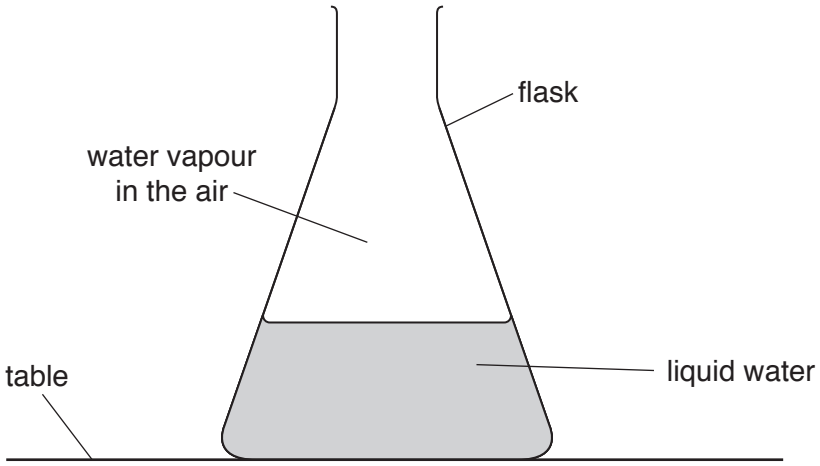

Fig. 6.1

(a) Describe the arrangement and movement of the molecules in the liquid water and in the water vapour.

.....

.....

.....

.....[3]

(b) Describe, in terms of molecules, how water in the flask becomes water vapour in the air. State the name of the process.

description .....

.....

.....

process .....

[3]

(c) The total weight of the flask and water is 5.6 N.

The area of the flask in contact with the table is 140 cm^2.

Calculate the pressure of the flask on the table.

pressure = ... N/cm^2 [3]

[Total: 9]

7 Fig. 7.1 represents the electromagnetic spectrum.

radio waves	micro-waves	infra-red waves	visible light		X-rays	gamma rays

Fig. 7.1

(a) One type of wave is missing from Fig. 7.1.

State its name.

.....[1]

(b) One type of electromagnetic wave is used to send signals to satellites.

State its name.

.....[1]

(c) Gamma rays and light waves travel through the vacuum of space to the Earth.

Which statement is correct? Tick **one** box.

☐ Gamma rays travel at a slower speed than light waves.

☐ Gamma rays travel at the same speed as light waves.

☐ Gamma rays travel at a faster speed than light waves. [1]

(d) State **one** way in which sound waves are different from electromagnetic waves.

.....[1]

[Total: 4]

[Turn over

8 A student measures the resistance of a sample of wire.

She plans to use the circuit shown in Fig. 8.1.

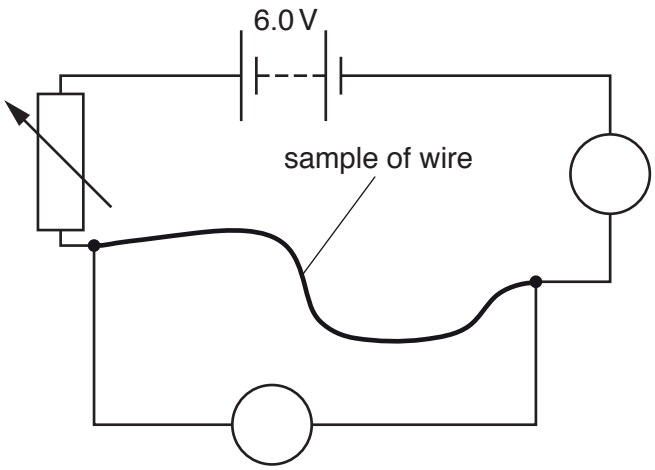

Fig. 8.1

Two circuit symbols are incomplete.

(a) Complete the symbols for the two meters on Fig. 8.1. [2]

(b) The current in the wire is 0.20 A. The potential difference across the wire is 6.0 V.

Calculate the resistance of the wire.

resistance = ... Ω [3]

(c) The student tests a thinner wire. It is the same length as the wire in **(b)** and is made of the same material. The potential difference across the wire is 6.0 V.

Explain how the current in this thinner wire compares with that in the first wire.

.....

.....

.....[2]

[Total: 7]

9 The charger for a mobile phone contains a transformer. Fig. 9.1 shows a simple transformer.

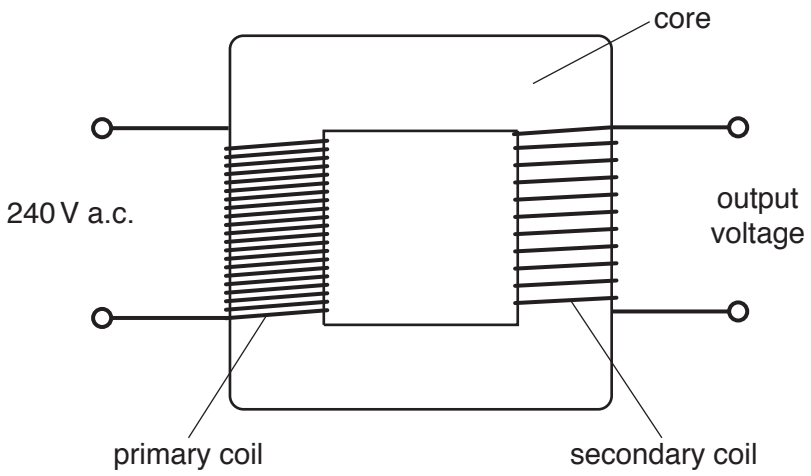

Fig. 9.1

(a) State the name of the material used in the core.

.....[1]

(b) **(i)** The transformer has 36 000 turns on the primary coil and 900 turns on the secondary coil. The input voltage is 240 V.

Calculate the output voltage.

output voltage = ... V [3]

(ii) State whether this transformer is *step-up* or *step-down*. Give a reason for your answer.

.....

.....[1]

(c) Transformers can produce high voltages for transmitting electricity from power stations to towns.

Describe the advantages of transmitting electricity at a high voltage.

.....

.....

.....[2]

[Total: 7]

10 **(a)** Fig. 10.1 shows two bar magnets.

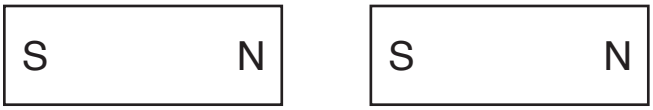

Fig. 10.1

Draw a ring around the correct description of the force between the magnets.

attractive force **repulsive force** **no force**

[1]

(b) Fig. 10.2 shows a current-carrying solenoid, wound on a piece of card.

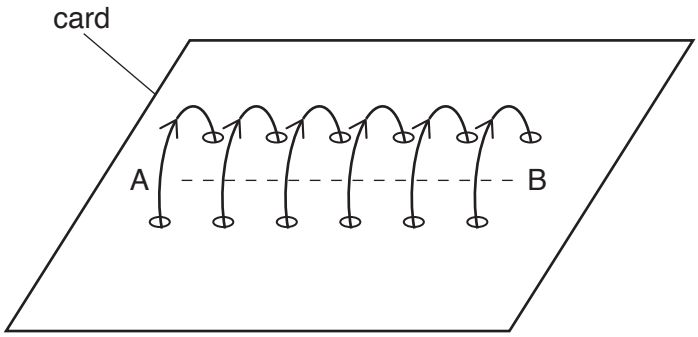

Fig. 10.2

The ends of the solenoid are labelled A and B. The arrows show the direction of the current in the solenoid.

(i) When there is a current in the solenoid, the ends of the solenoid act like the poles of a bar magnet.

Complete Table 10.1 by naming the pole produced at end A and at end B.

Table 10.1

position	pole
end A	
end B	

[1]

(ii) Fig. 10.3 shows the current-carrying solenoid viewed from above. The arrows show the direction of the current in the solenoid.

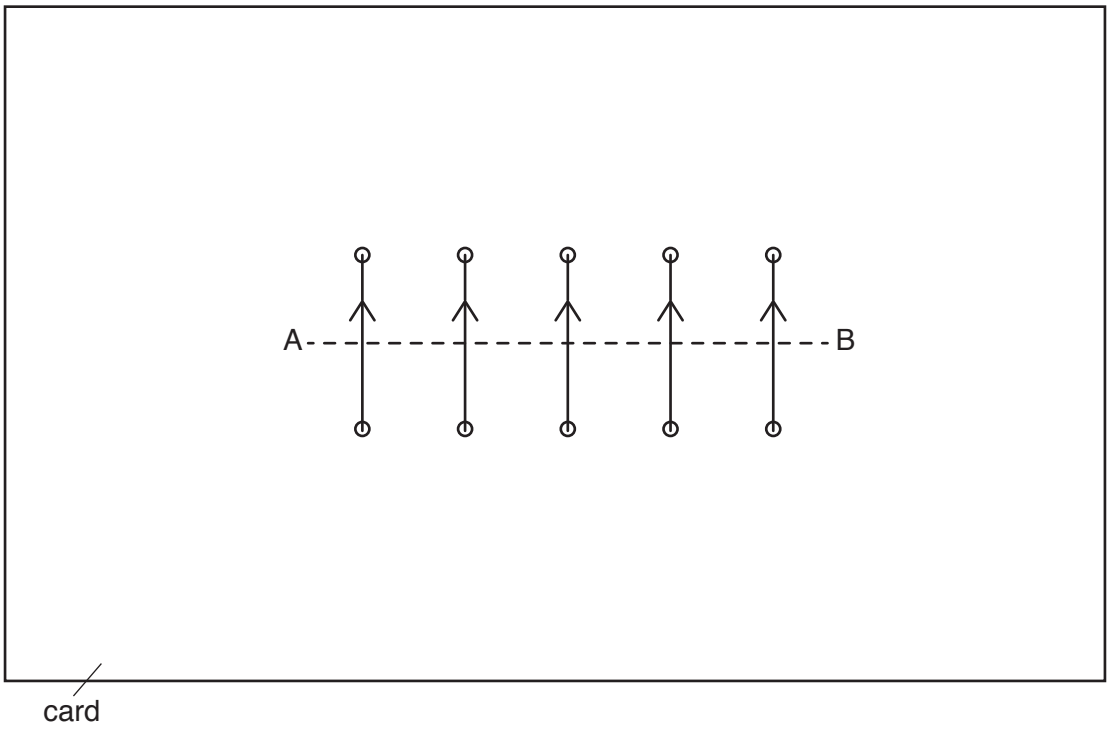

Fig. 10.3

On Fig. 10.3, draw the pattern of the magnetic field produced by the solenoid.
Draw at least **two** magnetic field lines above line AB and **two** below the line AB. [2]

(iii) Draw arrows on the field lines to show the direction of the magnetic field produced by the solenoid. [1]

(c) A current-carrying solenoid is wrapped around an iron rod to create an electromagnet.

State **two** reasons why an electromagnet can be more useful than a permanent magnet.

1. .....

2. .....
[2]

[Total: 7]

11 A student is given a length of wire, a sensitive voltmeter and two bar magnets.

(a) Describe how he could use the equipment to demonstrate the induction of an e.m.f. in the wire. You may include a diagram in your answer.

.....

.....

.....

.....[3]

(b) State how the student will know when an e.m.f. has been induced.

.....[1]

(c) Describe **two** ways the student could increase the size of the induced e.m.f.

1. .....

2. .....

[2]

[Total: 6]

12 Caesium-137 is formed in nuclear reactors.

The nucleus of caesium-137 can be represented as

$$^{137}_{55}Cs$$

(a) Complete Table 12.1 by stating the two types of particle in a nucleus of caesium-137, and the number of each particle present.

Table 12.1

type of particle	number of particles

[4]

(b) Caesium has more than one isotope.

Explain what is meant by the term *isotope*.

.....

.....

.....[2]

[Total: 6]

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