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Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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3507567167

PHYSICS **0625/31**

Paper 3 Theory (Core) **October/November 2019**

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.

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

This document consists of **20** printed pages.

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1 Fig. 1.1 shows a plastic water barrel. The barrel is full of water.

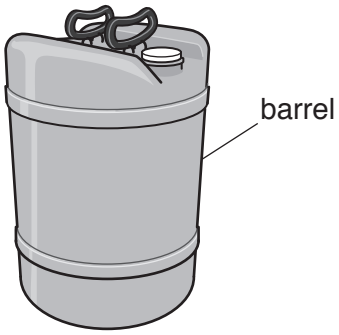

Fig. 1.1

(a) The water barrel contains 0.050 m^3 of pure water. The density of pure water is 1000 kg/m^3.

Calculate the mass of pure water in the barrel.

mass of water = ... kg [3]

(b) The density of sea water is 1030 kg/m^3. The density of the plastic is 1000 kg/m^3. Use this information and the information in **(a)** to state and explain whether the full barrel will float in sea water.

statement .....

explanation .....

.....

.....

[2]

[Total: 5]

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2 Four students P, Q, R and S each attempt to measure the time period (the time for one complete oscillation) of a pendulum. The arrows in Fig. 2.1 show the movements of the pendulum that each student times.

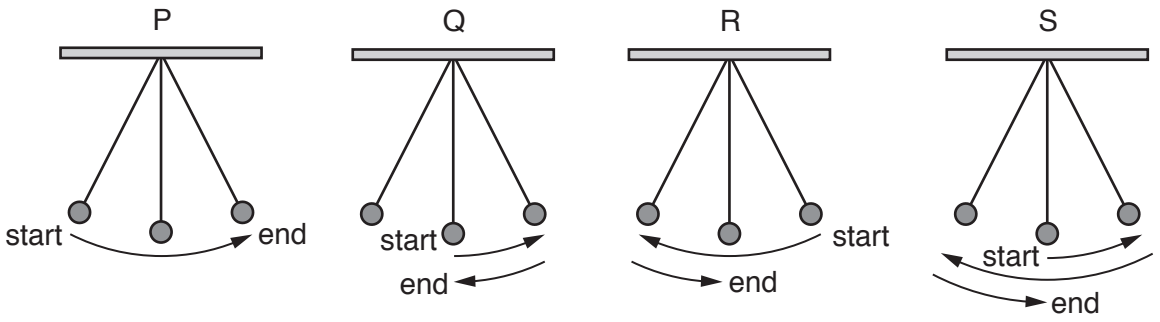

Fig. 2.1

(a) State the student who has chosen the correct movement for one period of a pendulum.

student ..... [1]

(b) Another student uses a stopwatch to measure the time taken for 50 periods of a pendulum. Fig. 2.2 shows the time taken on the stopwatch.

Fig. 2.2

Calculate the time for one period of the pendulum. Give your answer to 3 significant figures.

time for one period = ... s [3]

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(c) The student measures the displacement of the pendulum bob from its rest position. The displacement is 16.5 cm, as shown in Fig. 2.3.

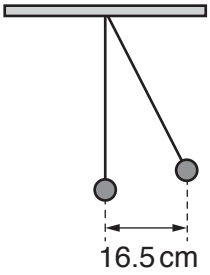

Fig. 2.3

State the displacement in millimetres.

displacement = ... mm [1]

[Total: 5]

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3 Fig. 3.1 shows a spring with no load attached. Fig. 3.2 shows the same spring with a load attached.

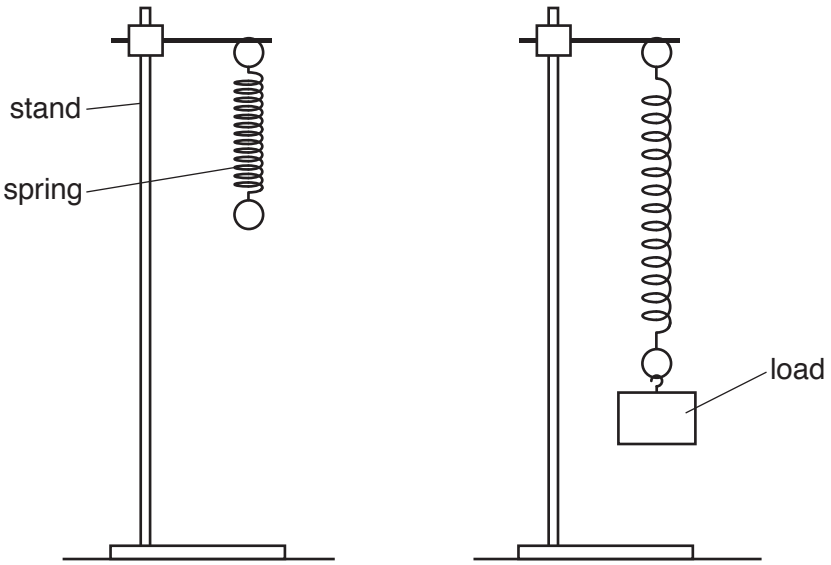

Fig. 3.1 **Fig. 3.2**

(a) Describe how a student can determine the extension of the spring. You may draw on Fig. 3.1 and Fig. 3.2 as part of your answer.

.....

.....

.....

.....

..... [3]

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(b) The student plots a graph of load against extension, as shown in Fig. 3.3.

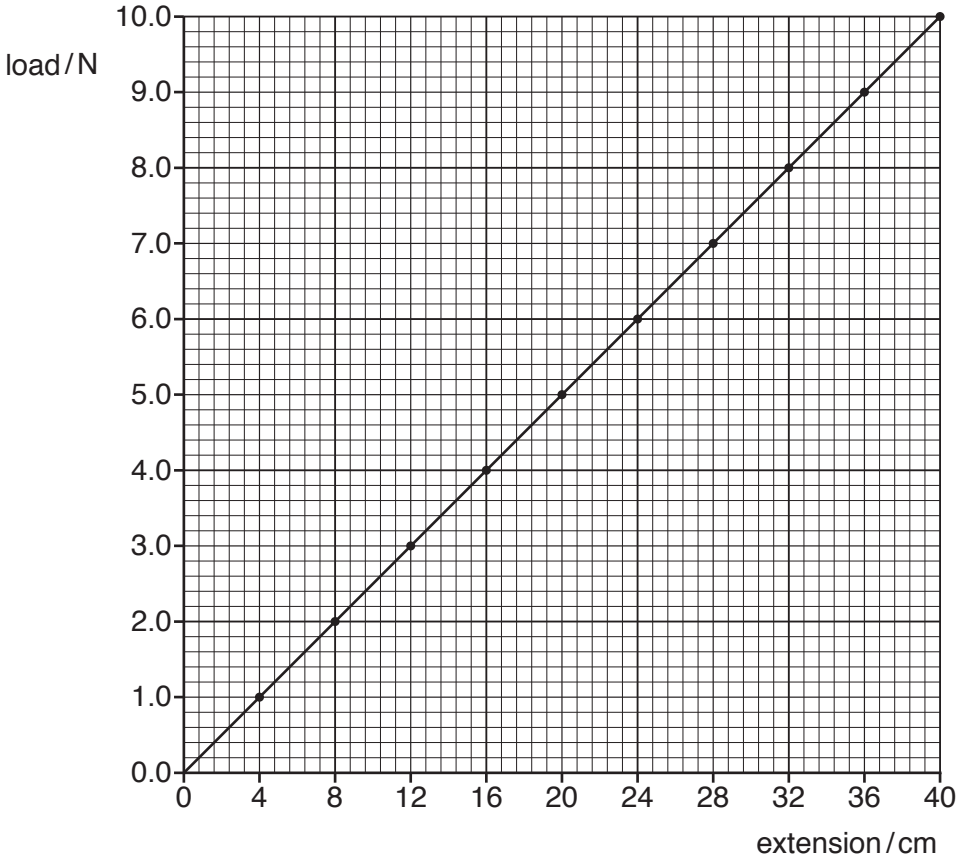

Fig. 3.3

(i) Determine the extension produced by a load of 7.5 N.

extension = ... cm [1]

(ii) Determine the load that would produce an extension of 10.0 cm.

load = ... N [1]

(c) Calculate the mass that has a weight of 6.0 N.

mass = ... kg [3]

[Total: 8]

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4 Fig. 4.1 shows a tractor fitted with a device for breaking up soil in a field.

Fig. 4.1

(a) (i) The tractor has a heavy weight at the front. Explain why the heavy weight is needed.

.....

..... [1]

(ii) Fig. 4.2 represents the weight of the device and its distance from the pivot.

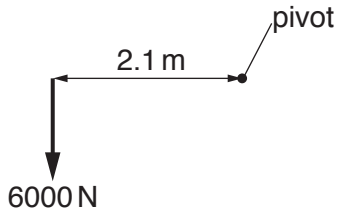

Fig. 4.2

Calculate the moment of the weight of the device about the pivot. State the unit.

moment = ... [4]

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(b) Fig. 4.3 shows a tractor fitted with narrow tyres and the same tractor fitted with wide tyres.

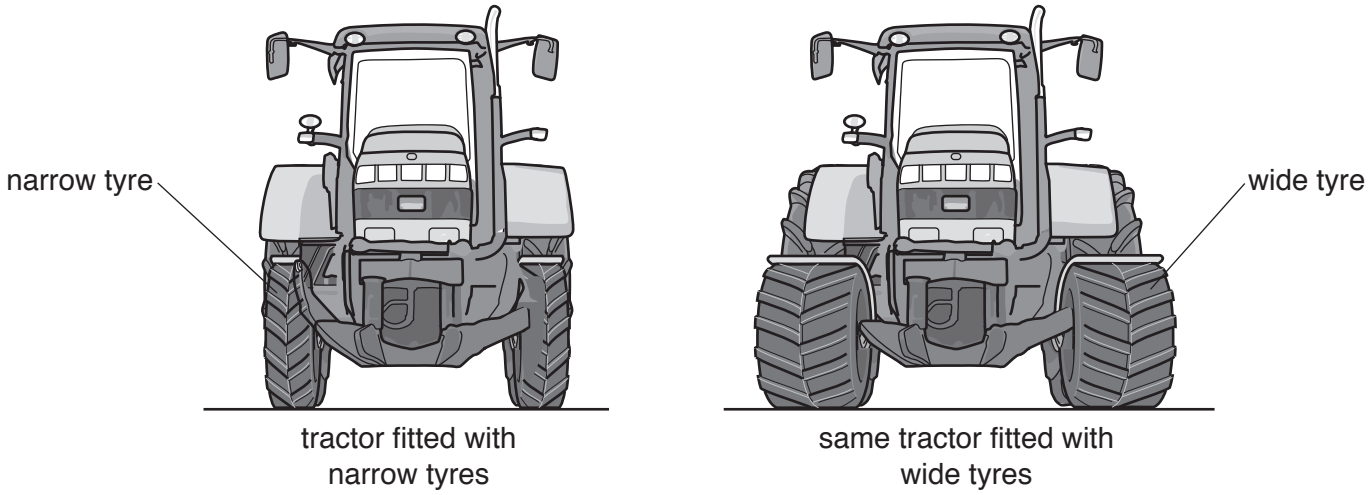

Fig. 4.3 (view from the front)

Explain why wide tyres are more suitable for the tractor on soft soil.

.....

.....

.....

..... [3]

[Total: 8]

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5 Here are some statements about energy and energy resources.

Some statements are correct. Put a tick (✓) in the box alongside each of these.

- ☐ Building hydroelectric power stations has an impact on the environment.
- ☐ Burning fossil fuels produces atmospheric pollution.
- ☐ Wind turbines are turned using gravitational potential energy.
- ☐ Coal and crude oil are sources of renewable energy.
- ☐ Geothermal energy is obtained from hot rocks below the ground.

[3]

[Total: 3]

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6 Fig. 6.1 shows a mirror periscope. The periscope is used to view a golfer over the heads of other people. The periscope has two plane mirrors each at an angle of 45° to the vertical.

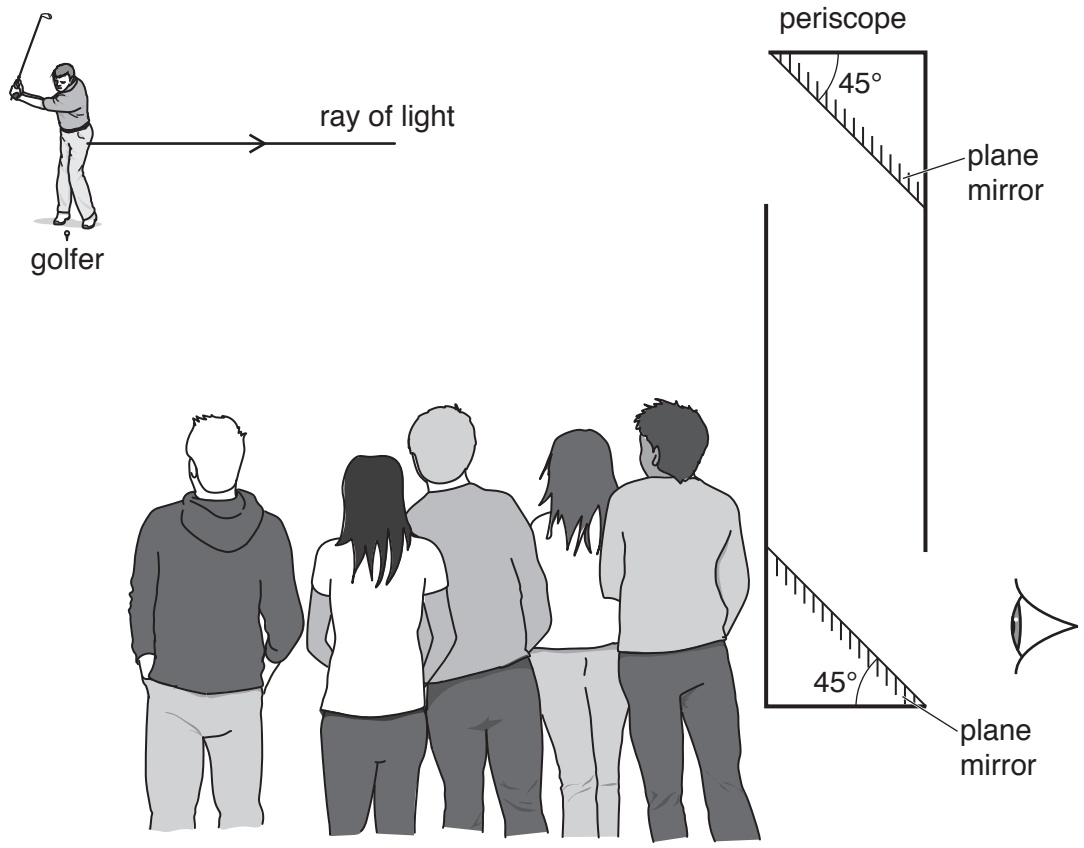

Fig. 6.1 (not to scale)

(a) (i) On Fig. 6.1:

1. Continue the ray of light from the golfer towards the upper mirror of the periscope

2. Draw and label the normal at the point where the ray strikes the mirror.

[1]

(ii) On Fig. 6.1, continue the ray of light after reflection at the upper mirror until it leaves the periscope. [1]

(iii) State the law of reflection used to deduce the position of the ray of light after striking the mirrors.

..... [1]

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(b) Fig. 6.2 shows three rays of red light each entering a semi-circular glass block.

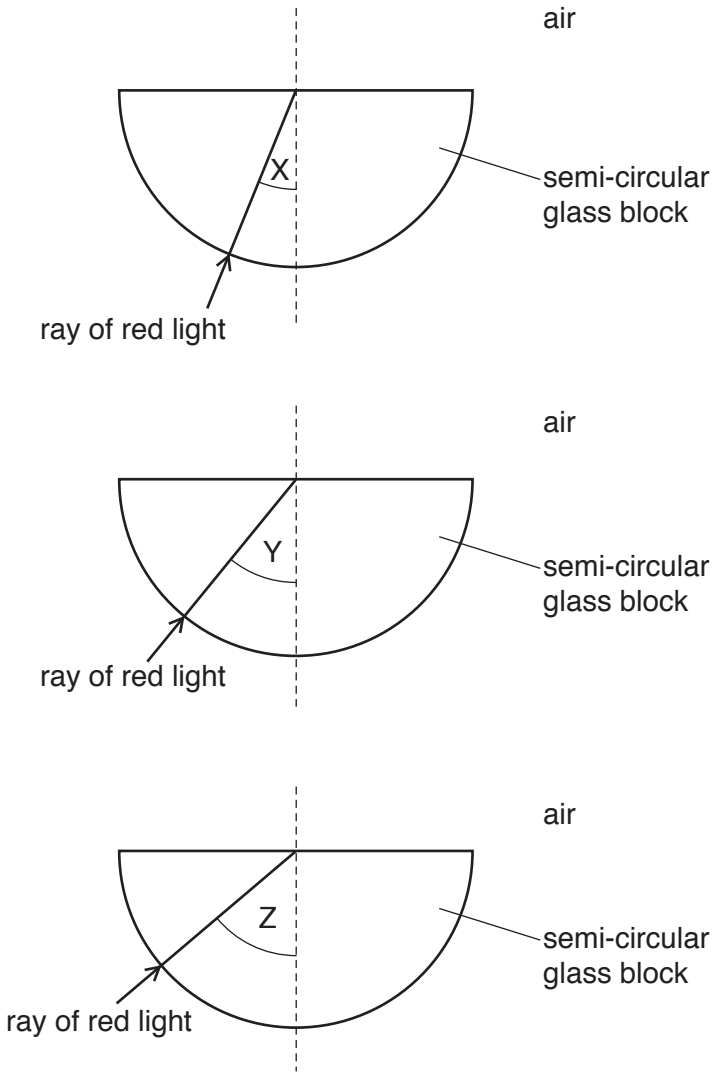

Fig. 6.2

Table 6.1

angle of incidence	description
X	less than the critical angle
Y	equal to the critical angle
Z	greater than the critical angle

Using the information in Table 6.1, draw on Fig. 6.2 to complete the path of each ray of red light. [3]

[Total: 6]

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7 An object, OX, is placed in front of a converging lens.

Fig. 7.1 shows a ray of light from the object passing through the lens.

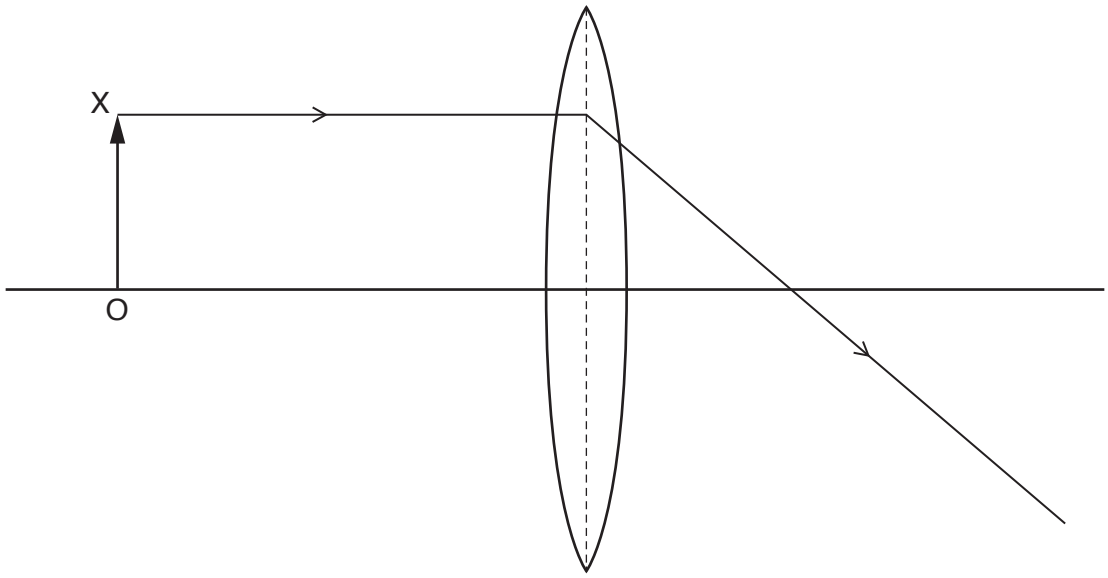

Fig. 7.1

(a) (i) The lens forms an image of object OX.

On Fig. 7.1, draw another ray from X to locate the position of the image. [1]

(ii) On Fig. 7.1, draw an arrow to represent the image of OX and label it I. [1]

(iii) On Fig. 7.1, mark a principal focus for the lens and label it F. [1]

(iv) On Fig. 7.1, measure and record the focal length of the lens.

focal length = ... cm [1]

(b) Describe the image I.

Choose words from the list. Tick (✓) **two** boxes.

- ☐ enlarged
- ☐ diminished
- ☐ same size
- ☐ inverted
- ☐ upright

[2]

[Total: 6]

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8 **(a)** Fig. 8.1 shows a student listening to the sound produced by a tuning fork.

Fig. 8.1

(i) State how the tuning fork produces the sound.

..... [1]

(ii) Complete the following sentence. Choose a word from the box.

electromagnetic	longitudinal	transverse

A sound wave is ..... [1]

(iii) A loudspeaker produces a sound with a frequency of 25 kHz.

A student with healthy ears cannot hear this sound. Explain why.

.....

..... [2]

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(b) Fig. 8.2 represents a sound wave travelling in air.

Fig. 8.2 (drawn full size)

(i) The air particles are moving. On Fig. 8.2, draw **two** arrows in opposite directions to show the movement of the air particles. [1]

(ii) Use Fig. 8.2 to determine the wavelength of the sound wave.

wavelength = ... cm [1]

(c) Describe a method of using water waves to demonstrate refraction.

.....

.....

.....

.....

.....

..... [4]

[Total: 10]

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9 A student is experimenting with magnets and electric charges.

(a) The student places a bar magnet on a piece of paper, as shown in Fig. 9.1.

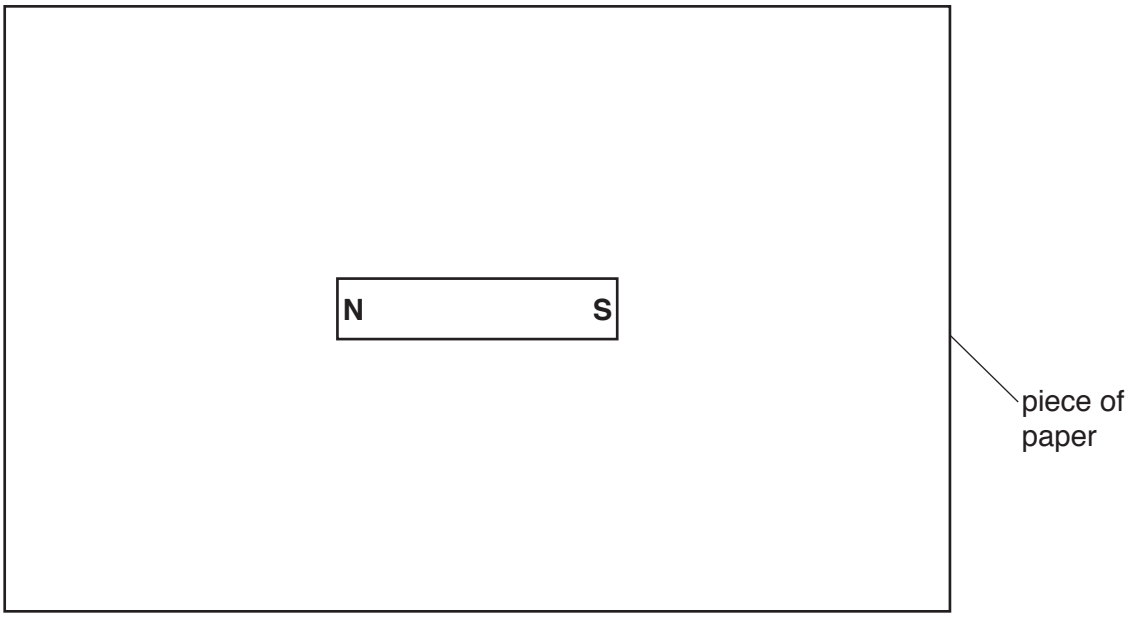

Fig. 9.1

Show the pattern of magnetic field lines around the bar magnet.

Draw **two** lines above the magnet and **two** lines below the magnet. Start and finish each line at a pole. Include **one** arrow to show the direction of the magnetic field. [3]

(b) The student rubs a plastic rod with a dry cloth. The plastic rod becomes positively charged.

Explain why the friction between the plastic and the cloth causes the plastic to become positively charged.

.....

.....

.....

..... [2]

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(c) The student investigates the forces between two pairs of objects.

Fig. 9.2 and Fig. 9.3 show the pairs of objects.

State whether there is a force of attraction, a force of repulsion, or no force between the pairs of objects. Draw a **ring** around **one** phrase for each pair of objects.

1. two positively charged spheres

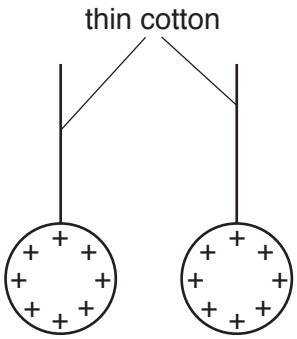

Fig. 9.2

force of attraction **force of repulsion** **no force**

2. a bar magnet and a bar of copper metal

Fig. 9.3

force of attraction **force of repulsion** **no force**

[2]

[Total: 7]

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10 A teacher is investigating the resistance of a lamp.

Fig. 10.1 shows part of the circuit she uses. The circuit is incomplete.

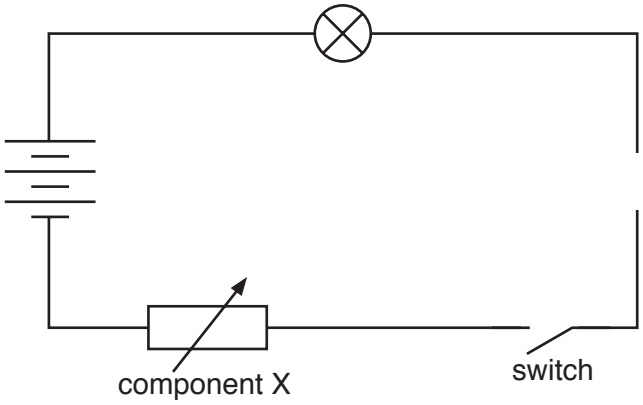

Fig. 10.1

(a) (i) To determine the resistance of the lamp, the teacher adds two meters to her circuit.

On Fig. 10.1, draw circuit symbols to show each meter correctly connected in the circuit. [3]

(ii) When the current in the lamp is 0.25 A, the potential difference (p.d.) across the lamp is 4.5 V. Calculate the resistance of the lamp.

resistance = ... Ω [3]

(b) (i) State the name of component X.

..... [1]

(ii) Describe and explain how the teacher uses component X to investigate the resistance of the lamp.

.....

.....

.....

..... [2]

[Total: 9]

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11 A student is experimenting with electromagnetic effects.

(a) Describe an experiment, using any standard laboratory equipment, to demonstrate electromagnetic induction. You may draw a diagram.

.....

.....

.....

..... [3]

(b) Fig. 11.1 shows a transformer connected to an input voltage of 12 V a.c.

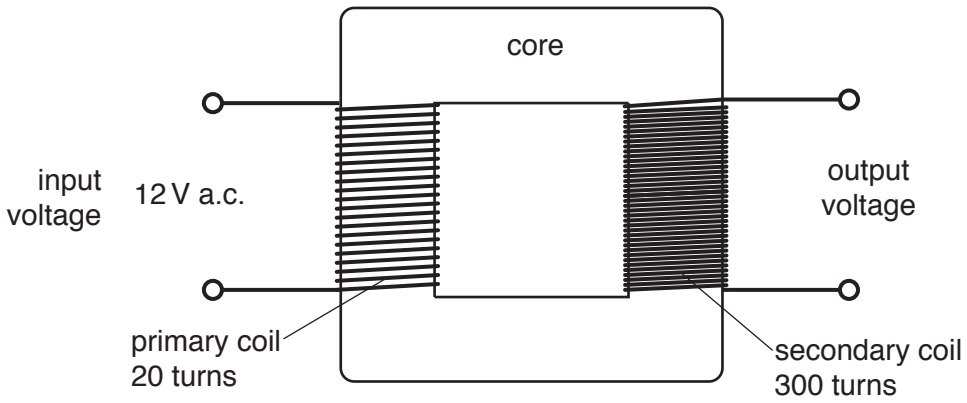

Fig. 11.1

(i) State the name of a suitable material for the core of the transformer.

..... [1]

(ii) Explain how the diagram in Fig. 11.1 shows a step-up transformer.

.....

..... [1]

(iii) Using the information in Fig. 11.1, calculate the output voltage of the transformer.

output voltage = ...V [3]

[Total: 8]

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12 A teacher carries out two experiments at the same time.

(a) In the first experiment the count rate for a sample of a radioactive isotope is measured every 30 seconds for 6 minutes.

The results are shown in Table 12.1.

Table 12.1

time / minutes	count rate counts / second
0.0	1246
0.5	1036
1.0	941
1.5	810
2.0	686
2.5	621
3.0	550
3.5	468
4.0	421
4.5	368
5.0	318
5.5	280
6.0	242

Estimate the half-life of the radioactive isotope. Use the information in the table.

half-life = ... minutes [1]

(b) In the second experiment the teacher repeats the procedure with another sample of the same radioactive isotope. The mass of the second sample is greater than that of the first sample.

Suggest a value for the count rate for this sample at the start of the experiment.

count rate = ... counts / second [1]

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[Turn over

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(c) One type of particle emitted during radioactive decay is an α-particle (alpha particle).

Describe:

(i) the nature of an α-particle

..... [1]

(ii) the ionising ability of an α-particle

..... [1]

(iii) the penetrating ability of an α-particle.

..... [1]

[Total: 5]

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