OCR
Oxford Cambridge and RSA

Wednesday 22 May 2024 – Morning

GCSE (9–1) Combined Science A (Gateway Science)

J250/05 Physics (Foundation Tier)

Time allowed: 1 hour 10 minutes

F

You must have:
- a ruler (cm/mm)
- the Equation Sheet for GCSE (9–1) Combined Science A (Physics) (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined page at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*****).
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

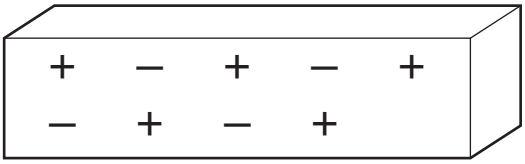
Section A

You should spend a **maximum** of **20 minutes** on this section.

Write your answer to each question in the box provided.

1 Objects can be charged by rubbing them with a cloth.

The diagram shows a plastic rod which has become charged.



Which statement correctly describes the plastic rod?

A The rod has an overall negative charge.

B The rod has an overall positive charge.

C The rod has gained neutrons.

D The rod has gained protons.

Your answer ☐ **[1]**

2 A spring has a spring constant of 20 N/m and its extension is 0.4 m.

What is the force exerted on the spring?

Use the equation: force exerted by a spring = extension × spring constant

A 0.8 N

B 5.0 N

C 8.0 N

D 20.4 N

Your answer ☐ **[1]**

3 Which two instruments are used to measure the **density** of a rectangular glass block?

A A measuring cylinder and a ruler

B A protractor and a ruler

C A protractor and an electronic balance

D A ruler and an electronic balance

Your answer ☐ **[1]**

4 A car changes velocity by 14 m/s in 3.5 s.

What is the acceleration of the car?

Use the equation: acceleration = $\frac{\text{change in velocity}}{\text{time}}$

A 0.25 m/s^2

B 4.0 m/s^2

C 10.5 m/s^2

D 17.5 m/s^2

Your answer ☐ **[1]**

5 An object of mass 2.0 kg accelerates. The force acting on the object is 5.0 N.

Calculate the acceleration of the object.

Use the equation: force = mass × acceleration

A 0.4 m/s^2

B 2.5 m/s^2

C 3.0 m/s^2

D 10.0 m/s^2

Your answer ☐ **[1]**

6 A student stretches four different springs as shown in the table.

The student measures the length of each spring:

- before the stretching force is applied
- during the time that the stretching force is applied
- after the stretching force has been removed.

Which spring shows **plastic** deformation?

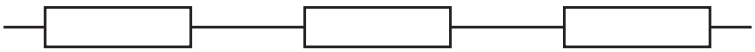
	Length before (cm)	Length during (cm)	Length after (cm)
A	2.4	2.9	2.4
B	2.5	5.0	2.5
C	2.5	2.9	2.9
D	2.6	2.6	2.6

Your answer ☐ **[1]**

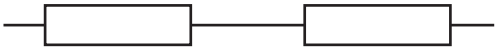
7 The resistors shown in **A**, **B**, **C** and **D** are identical.

Which arrangement has the **smallest** resistance?

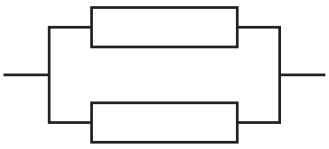
A



B



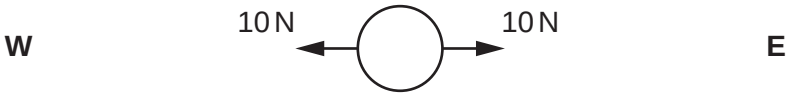
C



D

Your answer ☐ **[1]**

8 The diagram shows some forces acting on a moving object.



Which statement describes the motion of the object?

A The object accelerates towards E.

B The object accelerates towards W.

C The object changes direction.

D The object moves at constant velocity.

Your answer ☐ **[1]**

9 Which row describes the difference between a vector quantity and a scalar quantity?

	Has magnitude	**Has direction**
A	scalar only	vector only
B	vector and scalar	vector only
C	vector and scalar	scalar only
D	vector only	vector and scalar

Your answer ☐ **[1]**

10 Different scientists have contributed to the model of the atom.

What is the order of each scientist's contribution from the oldest to the newest?

Oldest ⟶ Newest

A Bohr, Rutherford, Thomson

B Rutherford, Bohr, Thomson

C Thomson, Bohr, Rutherford

D Thomson, Rutherford, Bohr

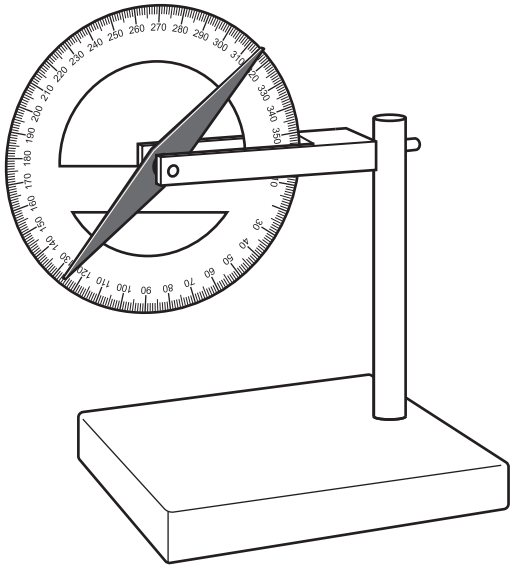
Your answer ☐ **[1]**

Section B

11 This question is about magnetic fields.

(a) **Fig. 11.1** shows a diagram of a measuring instrument.

Fig. 11.1



(i) Name this measuring instrument.

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

(ii) What information does the instrument in **Fig. 11.1** give us about the core of the Earth?

.....

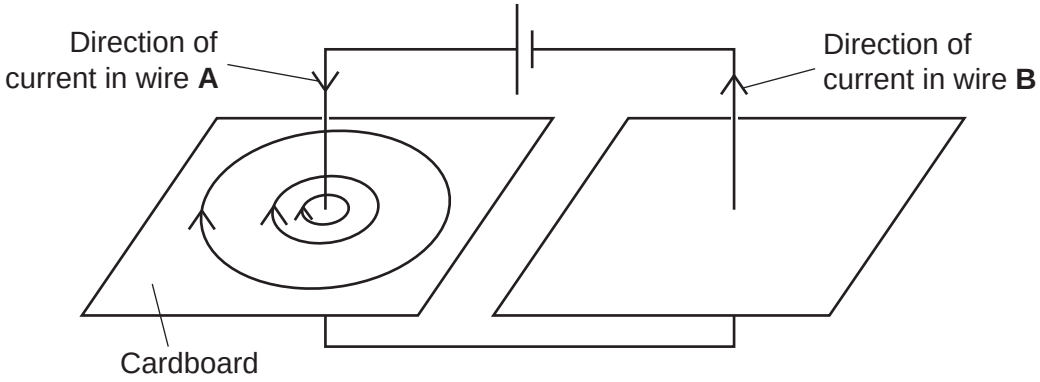
..... **[1]**

(b) **Fig. 11.2** shows a diagram of an electrical circuit containing two straight wires, **A** and **B**.

Each wire passes through a piece of cardboard.

The magnetic field is shown around wire **A**.

Fig. 11.2



(i) Describe how you can use iron filings to show the shape of the magnetic field pattern around wire **B**.

.....

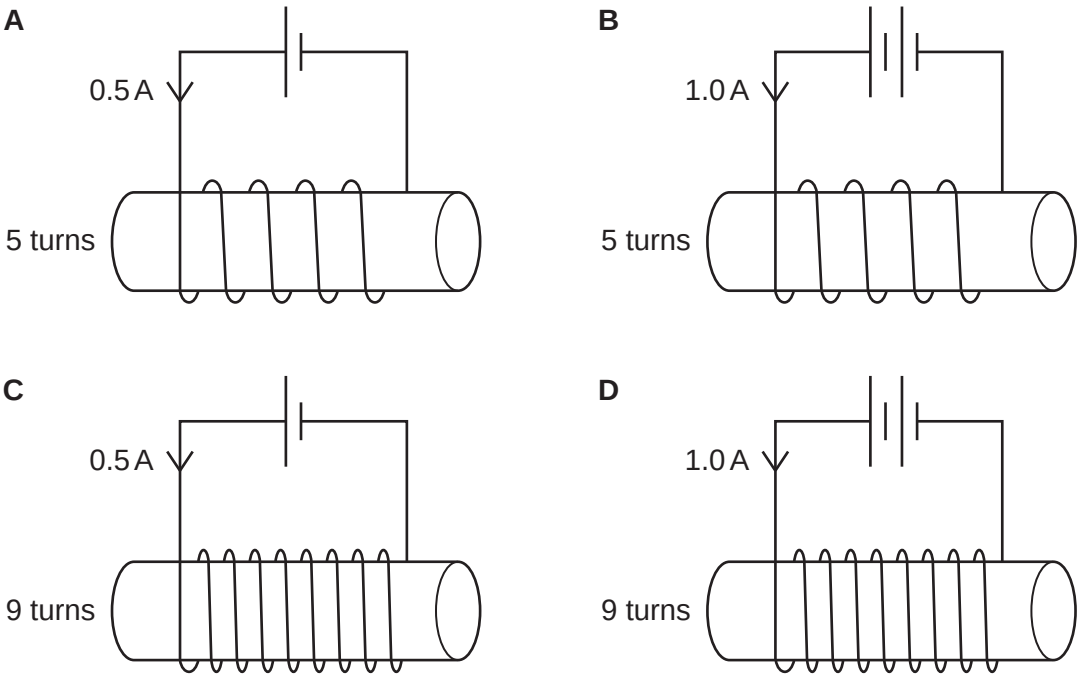
..... **[2]**

(ii) Draw the shape and direction of the magnetic field pattern around wire **B** on **Fig. 11.2**. **[3]**

(c) Solenoids can be used to produce magnetic fields.

Fig. 11.3 shows the current and the number of turns of wire in four different solenoids **A**, **B**, **C** and **D**.

Fig. 11.3



The solenoids are all made of the same material using wires of equal thickness.

Which solenoid has the strongest magnetic field?

Give a reason for your answer.

Solenoid .....

Reason .....

.....

.....

[2]

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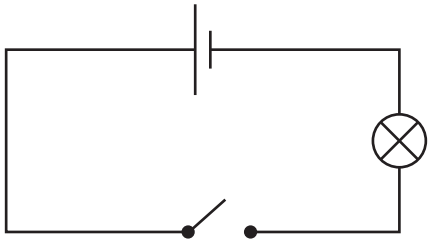
12 This question is about how electrical circuits work.

(a) A student builds three different electrical circuits.

Explain why the lamp does **not** light in each circuit.

(i) **Fig. 12.1** shows the first circuit.

Fig. 12.1

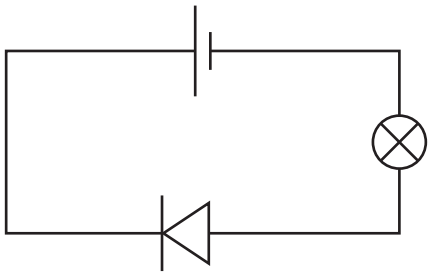


The lamp does **not** light because .....

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

(ii) **Fig. 12.2** shows the second circuit.

Fig. 12.2



The lamp does **not** light because .....

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

(iii) **Fig. 12.3** shows the third circuit.

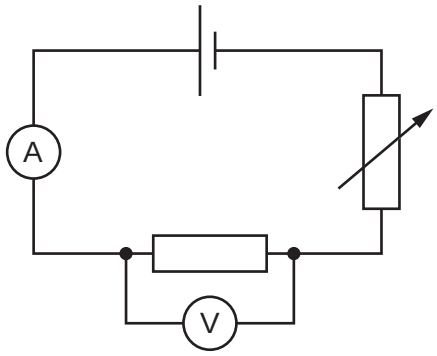
Fig. 12.3

The lamp does **not** light because .....

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

(b) The student uses the meters in the circuit in **Fig. 12.4** to determine the resistance of a resistor.

Fig. 12.4



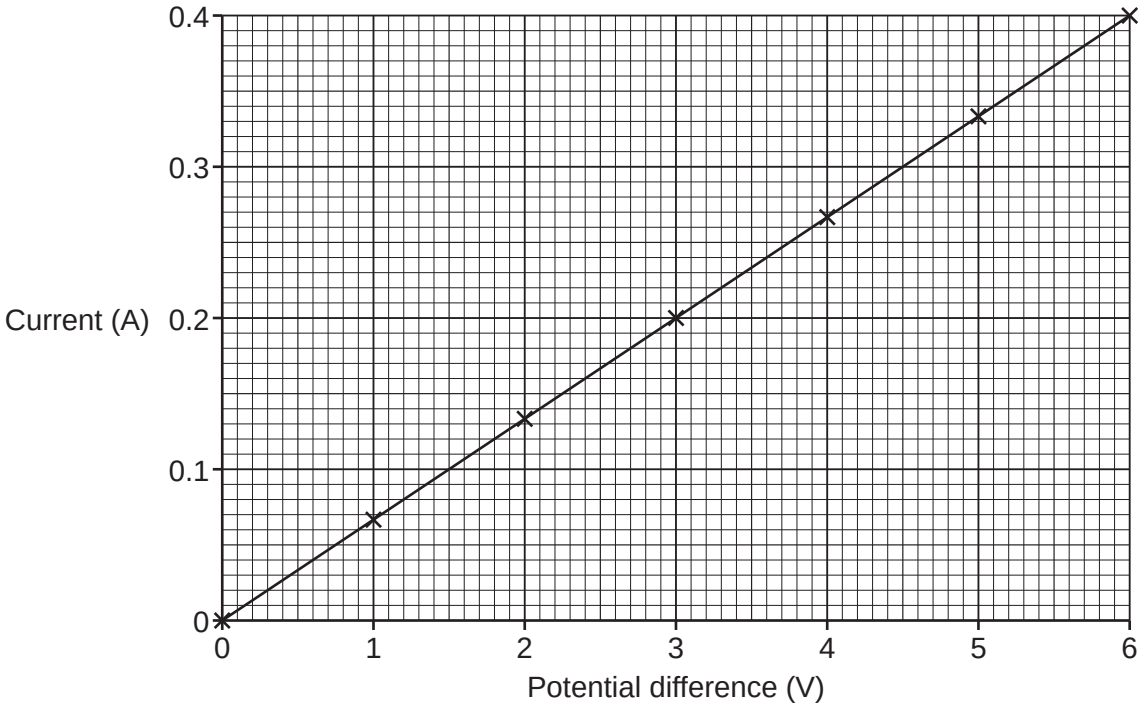
(i) Draw lines to connect each meter name with:

- the way the meter is connected and
- the quantity it measures.

Meter name	The way the meter is connected	The quantity it measures
Ammeter	In parallel	Potential difference
Voltmeter	In series	Resistance
		Current

[2]

(ii) The student uses the circuit to take several readings of current and potential difference.
The graph shows the student's results.



Complete the sentence about the graph to explain the relationship between potential difference and current.
Use words from the list.

decreases	**increases**	**stays the same**

As the potential difference increases, the current ..... . **[1]**

(iii) The ratio of potential difference : current at 3 V is 15 : 1.

Calculate the ratio of potential difference : current at 6 V.
Use the graph.

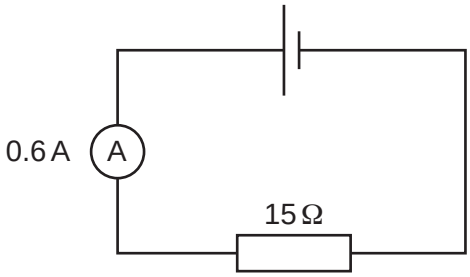
Ratio = ... **[1]**

(iv) Complete the sentence about the graph.
Use a word from the list.

elastic	**linear**	**non-linear**	**plastic**

The graph of current against potential difference for the resistor is ..... . **[1]**

(c) This diagram shows a cell connected in series with a resistor.



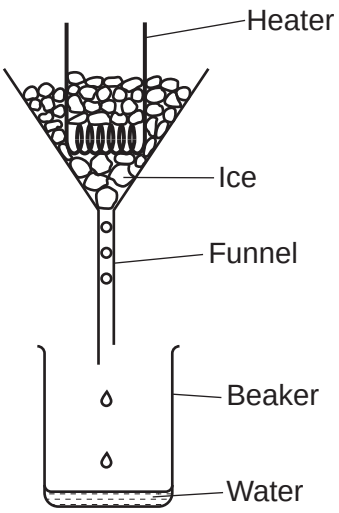
Calculate the potential difference of the cell in the diagram.

Use the equation: potential difference = current × resistance

Potential difference = ... V **[2]**

13 A teacher wants to measure the specific latent heat of ice.

The diagram shows the equipment the teacher uses.



(a) Which statement describes how to get accurate results?

Tick (✓) **one** box.

Add some ice to the beaker. ☐

Use the heater for a very short time. ☐

Wrap insulation around the funnel. ☐

Wrap insulation around the heater. ☐

[1]

(b) Here are some steps in the method for this experiment. The steps are **not** in the correct order.

Write numbers in the boxes next to each step to show the correct order.
One is already done for you.

Measure the mass of the beaker. **1**

Measure the mass of the beaker and water. ☐

Turn off the heater and stop timing. ☐

Turn on the heater and start timing. ☐

[1]

(c) In one set of results 0.006 kg of ice melts.

Calculate the weight of the ice that melts.

Gravitational field strength = 10 N / kg

Use the equation: gravitational force = mass × gravitational field strength

Weight of ice = ... N **[2]**

(d) The heater is turned on for 150 seconds.

The power of the heater is 15 W.

Calculate the energy transferred by the heater.

Use the equation: energy transferred = power × time

Energy transferred = ... J **[2]**

(e) In another set of results 0.015 kg of ice melts.

The energy transferred by the heater is 5010 J.

Calculate the specific latent heat of ice.

Use the Equation Sheet.

Specific latent heat of ice = ... J / kg **[3]**

14* A crane lifts a block straight upwards. **Fig. 14.1** shows the forces acting on the block. The size of these forces may change during its journey.

Fig. 14.1

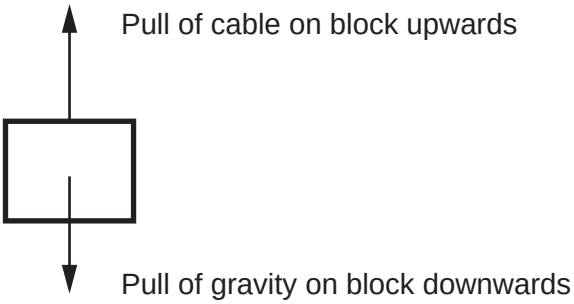
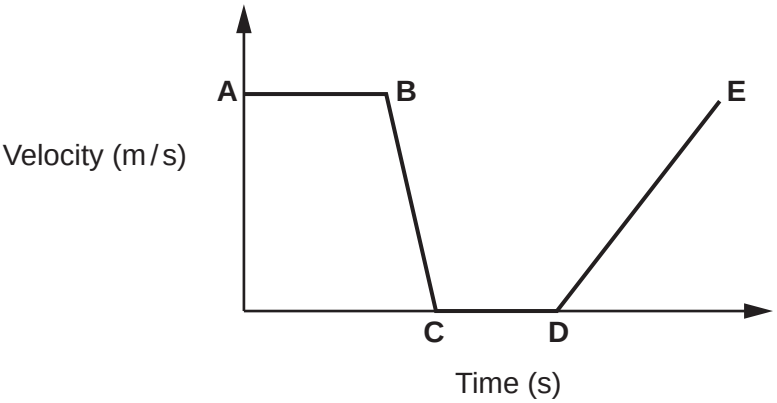


Fig. 14.2 shows the velocity-time graph for the block during a part of its journey.

Fig. 14.2



Use **Fig. 14.1** and **Fig. 14.2** to:

- Describe how the velocity of the block changes from point **A** to point **E**.
- Describe how the resultant force on the block changes from point **A** to point **E**.

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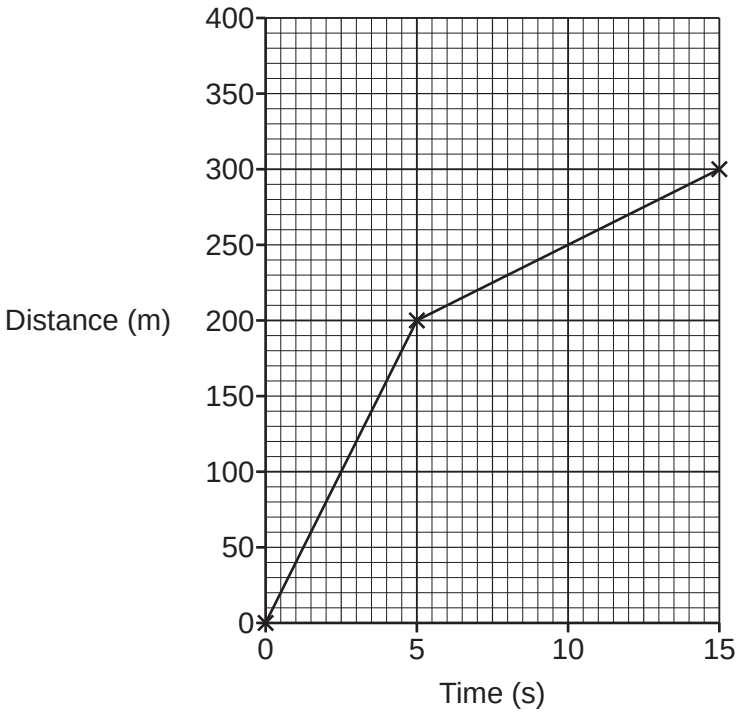
..... **[6]**

15 The distance-time graph shows the journey of a car.

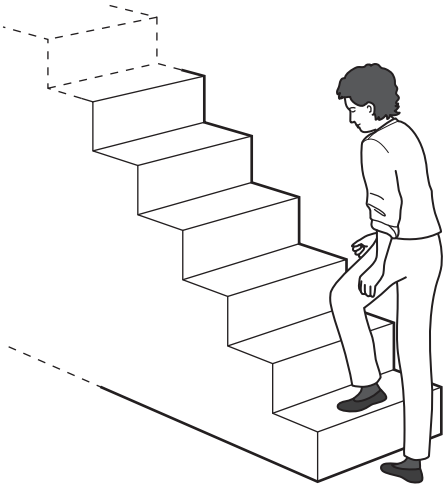


Calculate the average speed of the car.

Use the graph **and** the equation: distance travelled = speed × time

Average speed = ... m/s **[4]**

16 Two students do an experiment to measure their power by walking up steps.



(a) This is the data from student **P**:

- Weight = 600 N
- Number of steps = 250
- Height of each step = 0.20 m

Calculate the work done by student **P**.

Work done = ... J **[3]**

(b) This is the data from student **Q**:

- Work done = 36 000 J
- Time taken = 240 s

Calculate the power of student **Q**.

Use the equation: power = $\frac{\text{work done}}{\text{time}}$

Give your answer in kW.

Power = ... kW **[3]**

(c) Describe how the students carry out this experiment. Include any equipment they use.

.....

.....

.....

.....

.....

..... **[3]**

(d) Student **P** carries out the experiment five more times and calculates their power.

Here are student **P**'s results.

	Try 1	**Try 2**	**Try 3**	**Try 4**	**Try 5**
Power (W)	120	121	122	121	123

(i) How can student **P**'s results be described?

Tick **one** (✓) box in each row.

	Yes	**No**
Precise		
Repeatable		

[1]

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

.....

.....

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

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use this lined page. You must write the question numbers clearly in the margin.