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OCR
Oxford Cambridge and RSA

GCSE (9-1)

Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250

For first teaching in 2016

J250/11 Summer 2024 series

Version 1

ocr.org.uk/science

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Paper 11 series overview

J250/11 is one of six papers for the GCSE (9-1) Gateway Science Combined Science A Higher tier Qualification. It is the first of the two physics papers covering Topics P1 Matter, P2 Forces, P3 Electricity and magnetism and CS7 Practical skills. The other four papers in the suite assess biology and chemistry.

To do well in this paper candidates need to apply their knowledge and understanding to new situations and be familiar with a range of practical activities. In this paper the practical activities included measuring power by walking up steps, measuring resistance of a resistor in a simple electrical circuit, measuring specific latent heat of ice, measuring density and using an electromagnet.

It is important that candidates understand the command words used in the paper and know what is expected as a response for each different command word. For example, in Question 15 (b) (i) the question asks the candidate to 'Explain why a chain of iron nails is attracted to an electromagnet' however, some candidates only described how the iron nails were attached in a chain as each one is attracted to the next one. There was no explanation in terms of opposite poles attracting.

This year candidates performed better on questions involving calculations, including questions that required the candidate to convert power in W to power in kW, calculating resistance using information from a graph, giving the change in thermal energy to 2 significant figures and the force in mN.

There was no evidence to suggest that candidates were short of time in answering the questions on this paper and the omit rate was low.

Questions 1, 2 and 11 are overlap questions with the Foundation tier paper, J250/05.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• recalled the difference between vector and scalar quantities (Question 1), the different scientists who have contributed to the model of the atom (Question 2), how to calculate resistance from a graph (Question 13 (d) (i)) and the difference between specific latent heat and specific heat capacity (Question 14 (b)) • calculated momentum (Question 8), work done (Question 11 (a)), power in kW (Question 11 (b)), change in thermal energy to 2 significant figures (Question 14 (a) (i)), specific latent heat (Question 14 (a) (ii)) density (Question 14 (c) (iii)) and force in mN (Question 15 (c) (ii)) • used information in graphical form to describe motion and force (Question 12) and to calculate resistance (Question 13 (d) (i)) • used knowledge of practical techniques and the equipment needed to describe how to calculate power using a walking up steps method (Question 11 (c)) and suggested changes to a method which would give a more accurate value for the density of ice (Question 14 (c) (ii)).	• could not recall that electrons are negatively charged and can move (Question 3), the difference between precise and repeatable (Question 11 (d) (ii)) and the characteristics of a velocity-time graph (Question 12) • could not identify the object with the highest acceleration from simple force diagrams (Question 9) • Could calculate the change in thermal energy but could not give the answer to 2 significant figures (Question 14 (a) (i)) and could not rearrange equations to calculate the specific latent heat (Question 14 (a) (ii)) • could not explain the purpose of a variable resistor (Question 13 (a)) or explain why a chain of iron nails is attracted to the electromagnet (Question 15 (b) (ii)) • did not read the requirements of the question carefully, for example, in Question 15 (a), only one box was ticked rather than the two boxes requested in the question.

Section A overview

This section consists of ten multiple choice questions testing AO1 and AO2.

Assessment for learning

Candidates who did well on this section generally did the following:

- underlined pairs of key words, for example, vector and scalar, and mass and weight
- gave all the details for each calculation next to each option, A, B, C and D
- worked through distractors methodically, crossing out the letters as they were eliminated
- put each letter carefully in the box provided and ensured letters B and D were not confused by not using lower case letters, for example, a and d
- crossed out letters when changing the answer and wrote the new letter selected next to the box provided.

Questions that were most often answered correctly were 2, 7, 8, 9 and 10. The most challenging question was 5. Questions 3 and 6 discriminated well between candidates who achieved different grades.

Almost all candidates completed every question.

Question 1

1 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]**

Most candidates recognise that vectors and scalars have magnitude but only vectors have direction, option B. A few candidates selected option D, confusing the terms magnitude and direction.

Question 2

2 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]**

Most candidates know the order of each scientist's contribution to the model of the atom with D being the most common answer. The most common incorrect answer was C, with the order of the contributions from Bohr and Rutherford being in the incorrect order.

Question 3

3 An object is rubbed with a cloth and becomes **positively** charged.

Which sentence explains how the object becomes positively charged?

A Electrons move from the cloth to the object.

B Electrons move from the object to the cloth.

C Protons move from the cloth to the object.

D Protons move from the object to the cloth.

Your answer ☐ **[1]**

Most candidates know that electrons are negative and move and that protons are positive and do not move, giving option B as their answer. A few candidates selected option A, knowing that electrons move but confusing the direction of movement of the electrons to make the object positively charged.

Question 4

4 An astronaut has a mass of 70 kg on Earth.

The mass of the Moon is smaller than the mass of the Earth.

Which row describes the astronaut's mass and weight on the Moon compared to their mass and weight on Earth?

	Mass of astronaut	**Weight of astronaut**
A	smaller	larger
B	larger	stays the same
C	stays the same	smaller
D	stays the same	stays the same

Your answer **[1]**

Most candidates selected option C, knowing that mass stays the same and weight changes on the Moon compared to the Earth. The most common incorrect answer was D, where candidates thought that mass and weight remain constant on the Moon compared to the Earth.

Question 5

5 Which two units measure the same quantity?

A W and J

B N m and J

C kg and N

D V and A

Your answer **[1]**

Few candidates selected the correct answer, B, N m and J. These candidates usually named the quantities being measured next to the units: option A, W and J being power and energy, option C, kg and N being mass and weight and option D, V and A being voltage and current, leaving option B, N m and J as units with the same quantity.

Misconception

The most common answer to this question was option A, units W and J, with many candidates labelling units W and J both as units of energy rather than W as power and J as energy.

Question 6

6 A skydiver jumps from an airplane and reaches terminal velocity before the parachute opens.

Which statement describes what is happening when they reach terminal velocity?

A Air resistance equals the weight of skydiver.

B Air resistance has no effect on the skydiver.

C Air resistance is greater than the weight of skydiver.

D Air resistance is less than the weight of skydiver.

Your answer ☐ **[1]**

Most candidates knew that at terminal velocity the forces are balanced and so the air resistance equals the weight of the skydiver. The most common incorrect answer was option D, where candidates thought that the air resistance is less than the weight of the skydiver at terminal velocity.

Question 7

7 A sealed rigid container of air is in a room at 20 °C. The container is then placed in a refrigerator at 4 °C.

Which row explains what happens to the speed of the air molecules and the pressure inside the container?

	Air molecules inside the container	**Pressure on the inside of the container**
A	move faster	decreases
B	move faster	increases
C	move slower	decreases
D	move slower	increases

Your answer ☐ **[1]**

Most candidates selected the correct answer, C, understanding that air molecules move slower and the pressure decreases inside the rigid container when the temperature decreases. The most common incorrect answer was D, with these candidates appreciating that the speed of the air molecules decreases but thinking that the pressure inside the container would increase.

Question 8

8 Four cars are travelling along a road.

Which car has the **highest** momentum?

Use the equation: momentum = mass × velocity

	Mass of car (kg)	Velocity of car (m/s)
A	1000	5
B	1000	10
C	2000	5
D	2000	10

Your answer ☐ **[1]**

Most candidates selected the correct answer, option D.

Exemplar 1

Use the equation: momentum = mass × velocity

	Mass of car (kg)	Velocity of car (m/s)
A	1000	5
B	1000	10
C	2000	5
D	2000	10

Your answer D

A 1000 × 5
= 5000

B 1000 × 10
= 10000

C 2000 × 5
= 10 000

D 2000 × 10
= 20 000

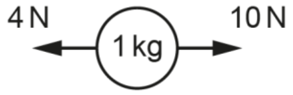
This candidate has underlined the important words in the question; 'highest momentum'. The candidate has then used the equation given in the question; momentum = mass × velocity, to calculate the momentum for options A, B, C and D. This candidate has carefully set out the complete calculations for each option. This minimises the possibility of errors and also allows the candidate to quickly recheck the calculations at the end if there is sufficient time.

Question 9

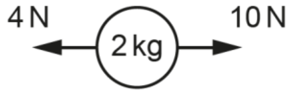
9 Four different objects are acted on by different forces.

Which object has the **highest** acceleration?

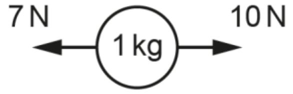
A



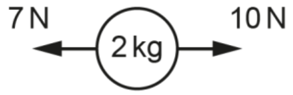
B



C



D



Your answer **[1]**

Most candidates selected option A as their answer. Many candidates calculated the difference in the size of the opposite forces and crossed out options C and D as the resultant force was 3 N compared to 6 N for options A and B. These candidates then used F = m × a to identify that A was the correct answer.

Question 10

10 A spring has a spring constant of 20 N / m.

What is the extension of the spring when it is stretched by a force of 6 N?

The spring is **not** stretched beyond its limit of proportionality.

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

A 0.3 m

B 0.3 mm

C 3.3 m

D 3.3 mm

Your answer ☐ **[1]**

Most candidates used the equation given in the question, to calculate the extension of the spring as 0.3 m. The most common incorrect answer was B, where candidates had calculated the value as 0.3 but then thought the measurement was in mm rather than m, although the value for the spring constant was given as 20 N / m.

Section B overview

This section includes short (1 mark) questions, questions requiring longer responses and one Level of Response question (Question 12). This section covers all the assessment objectives, AO1, AO2 and AO3.

Assessment for learning

Candidates who did well on this section generally did the following:

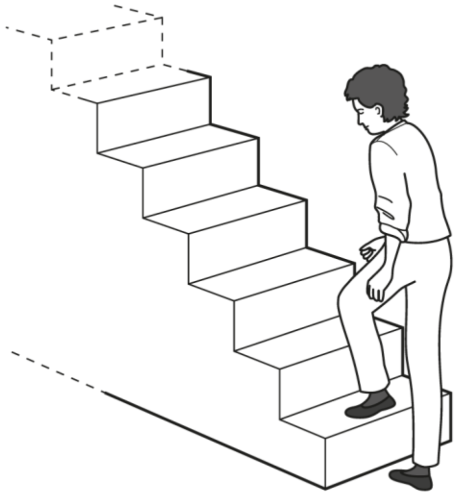
- identified equations from the Equation Sheet and wrote these in the answer space
- gave all steps involved in calculations so even if the final answer was incorrect some marks could still be awarded
- worked methodically through Question 11 (c) to describe the method and the equipment required for each part of the method
- used all the information in the velocity-time graph in Question 12, to describe the motion and forces between each of the points A-B, B-C, C-D, D-E, E-F and F-G
- accurately read values from the graph in Question 13 (d)
- carefully read the method used by the teacher to determine specific latent heat, in Question 14, to help them to suggest why the ice is dried and to suggest a change to the method to improve the accuracy of the density measurement.

Questions that were most often answered correctly were 11 (a) and 13 (d) (i). The most challenging questions were 13 (a), 13 (b), 13 (c), 14 (c) (ii), 15 (b) (ii) and 15 (c) (i). Questions 12 and 14 (a) (ii) discriminated well between candidates who achieved different grades.

Almost all candidates completed every question.

Question 11 (a)

11 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]**

Most candidates were given three marks for this question with the equation, work done = force × distance, quoted followed by the correct substitution of work done = 600 × (250 × 0.20) before the answer of 30 000 (J) on the answer line.

Question 11 (b)

(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]**

Most candidates were given three marks for this question. These candidates usually calculated the power in W and then converted this answer to kW. Candidates who were given just two marks usually either did not convert the answer of 150 W to kW or converted 150 W incorrectly to 150 000 kW.

Question 11 (c)

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

....

....

....

....

....

.... **[3]**

Most candidates were given two or three marks for this question. Candidates who performed well on this question linked the measurements made (time, weight, number of steps and height of each step) to the equipment required to make these measurements. Some candidates only listed the equipment used and so were limited to one mark.

Question 11 (d) (i)

(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]

Few candidates were given this mark. Many of these candidates thought the results were either described as not being precise or described as not being repeatable.

Question 11 (d) (ii)

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

....

....

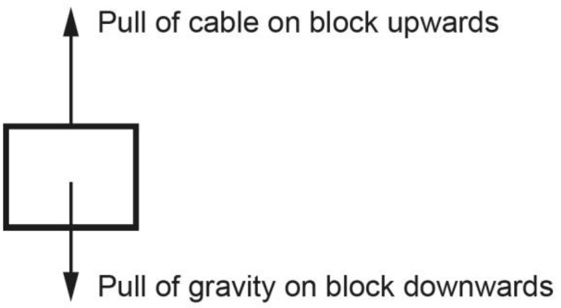
.... **[2]**

Most candidates were given at least one mark for their answer. This mark was usually for explaining that the results were precise as the results were close together. Fewer candidates were able to correctly describe the results as being repeatable, with many responses just being about the ability to do the experiment again or that 121 appears twice in the results or that there were no anomalies in the results.

Question 12*

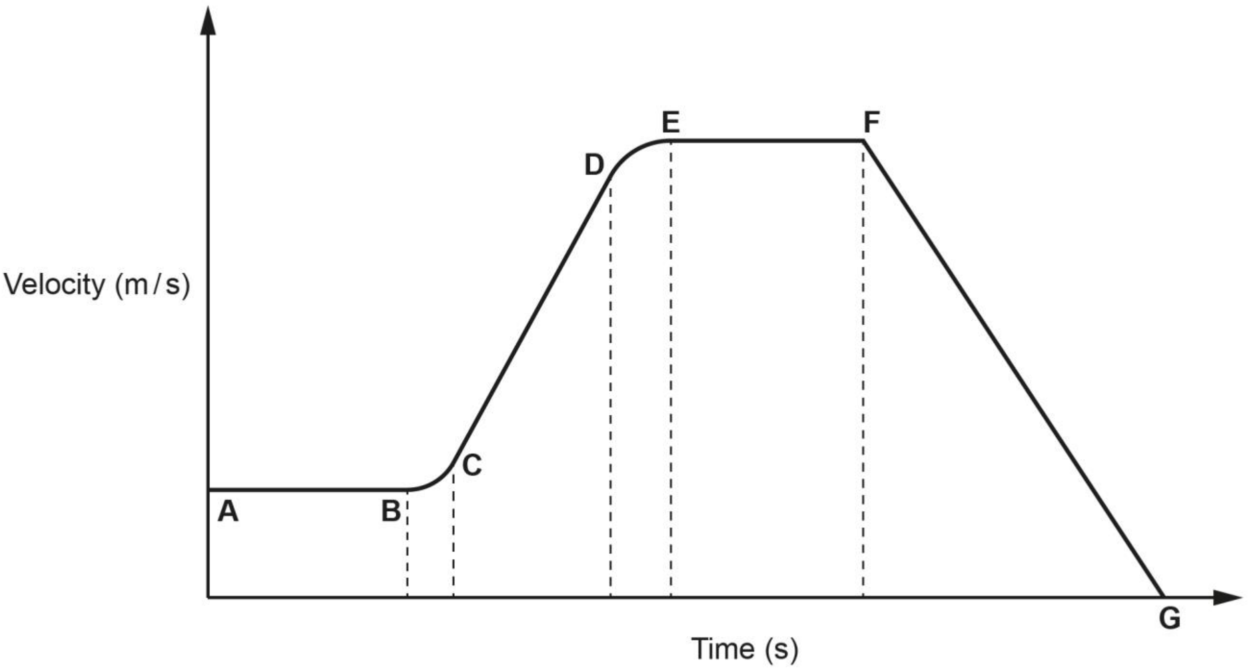
12* A cable is used to lift a block vertically upwards. **Fig. 12.1** shows the forces acting on the block.

Fig. 12.1



The size of the resultant force on the block changes as the block is lifted.
Fig. 12.2 shows the velocity-time graph for the block during the time it is being lifted.

Fig. 12.2



Describe how the motion of the block **and** resultant force on the block change as the block moves from point **A** to point **G**.

Use **Fig. 12.1** and **Fig. 12.2**

....

....

....

....

....

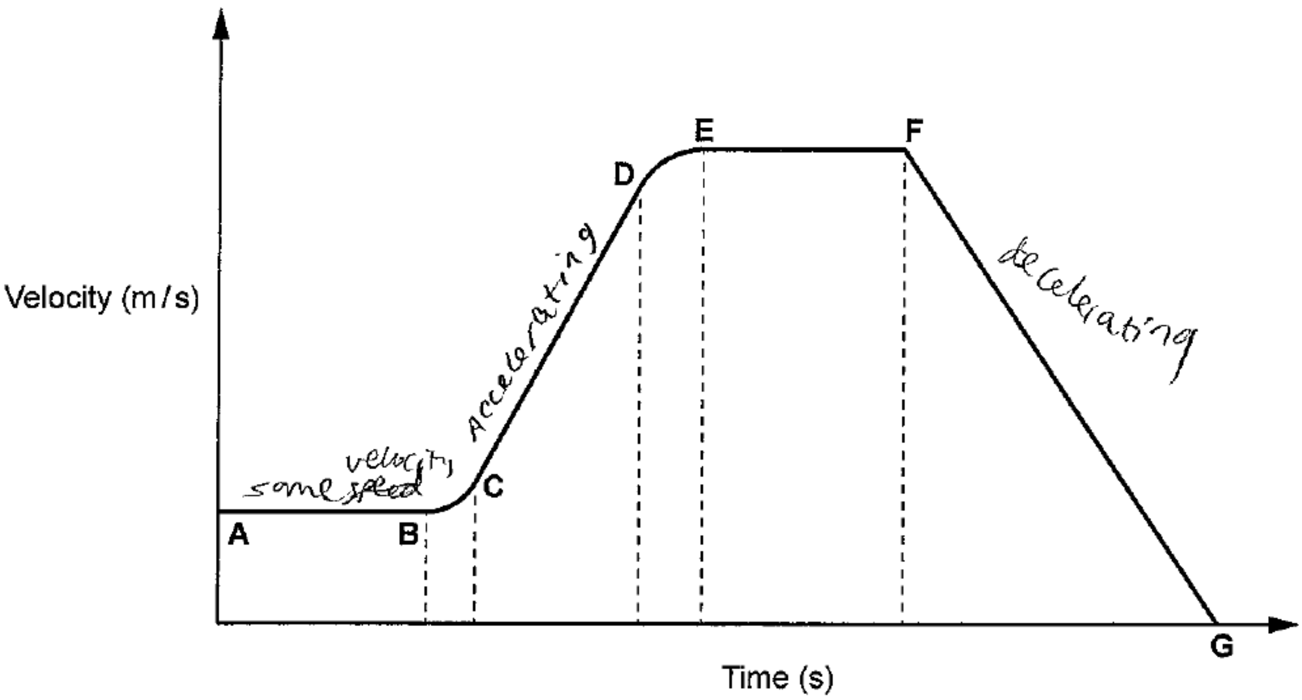
.... **[6]**

This is the Level of Response question. This question was attempted by the majority of candidates and the full range of the marks available were given. Many candidates gained credit for AO3 by analysing the information and ideas to interpret the graph and draw conclusions about forces, often writing the details about the size and direction of the forces on the graph as well as on the answer lines. Fewer candidates gained credit for AO2.2 by applying knowledge and understanding of velocity-time graphs in terms of acceleration, constant velocity and zero velocity. Many of these candidates did not mention acceleration in their answer and just wrote about velocity.

Exemplar 2

The size of the resultant force on the block changes as the block is lifted.
Fig. 12.2 shows the velocity-time graph for the block during the time it is being lifted.

Fig. 12.2



Describe how the motion of the block **and** resultant force on the block change as the block moves from point **A** to point **G**.

Use **Fig. 12.1** and **Fig. 12.2**

The cable will pull the block upwards as the force of the cable is greater than the pull of gravity. As the block is lifted upwards, air resistance will act on the block through friction with the air particles but this won't make much difference as the block isn't falling. As the block moves from A to B, the velocity is the same and is constant so doesn't change. As the block moves from B to C, there is a small acceleration shown by a curve. The points C to D show a steep acceleration as the motion of the object increases speed. This shows that the block is being pulled up faster from points* **[6]**

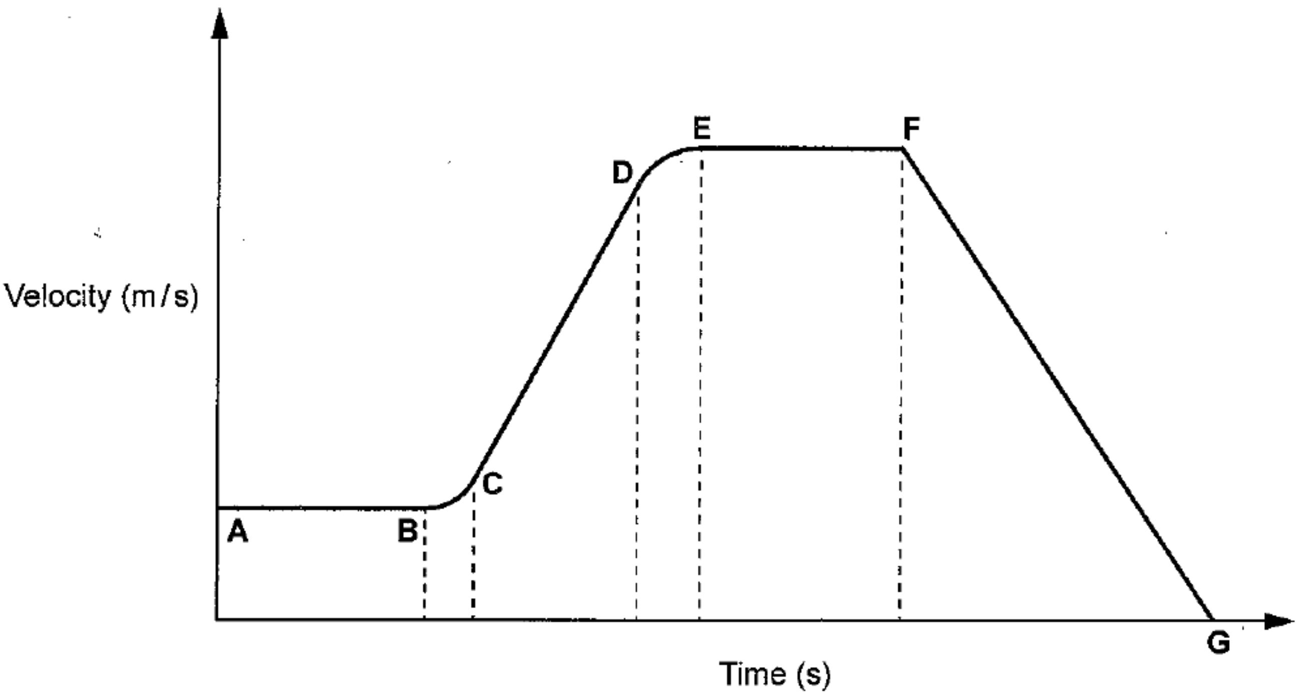
12 C to D. From points D to E, the ~~a~~ acceleration of the block moving upwards decreases and slows down. From E to F, the block returns to a constant velocity and then at F to G, the ~~a~~ block decelerates, shown by a steep decline, ~~perhaps~~ showing that the block has been released or dropped.

The information written on the graph has been considered as part of the candidate's response to this Level of Response question. The candidate starts their response with information about the pull of the cable upwards being greater than the pull of gravity. However, this is a general statement that has not been linked to the specific letters on the graph. If the candidate had linked the upward force being more than the downward force to section CD on the graph together with their information about acceleration, then the candidate would have been given Level 2 and four marks. The information given about acceleration is detailed and mostly correct. The candidate is given Level 2 and three marks. At the top of the mark scheme for this question is the statement 'If only detailed description about acceleration or about forces, then mark capped at L2 and three marks'.

As the candidate has not provided a basic linked description of the forces involved this would usually limit the candidate to Level 1. However, as the candidate has described the motion of the block in terms of acceleration and not just velocity, they have answered half the question, so this statement was added to award such responses three marks rather than two marks.

Exemplar 3

Fig. 12.2



Describe how the motion of the block **and** resultant force on the block change as the block moves from point **A** to point **G**.

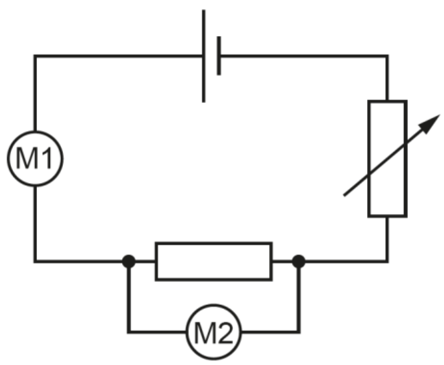
Use **Fig. 12.1** and **Fig. 12.2**

Between A and ~~B~~ B the block is moving at a constant speed as the resultant force is 0 as both forces are equal. Between B and C the block accelerates and gradually increases as there is a higher ~~result~~ force pulling the block up. Between B and C there is a constant acceleration as the resultant force stays the same. Between D and E there is still acceleration, however its gradually decreases coming to a constant speed between E and F as there is a resultant force of 0 again. From F to G the block is constantly decelerating as the gravity of the block downwards ~~exceeds~~ is grater than the pull of the cable upwards. **[6]**

The candidate has not written any information on the graph for this Level of Response question but has given a clear, well-structured and detailed response on the answer lines. The candidate starts their response with information about the forces and motion between A and B, then continues their response giving details about the forces and motion including acceleration for all the different sections of the graph. The candidate has made a slight slip by giving 'between B and C there is constant acceleration', but it is clear from the structure of their response that they mean between C and D, so Level 3 and six marks have been given.

Question 13 (a)

13 A student uses the circuit shown in the diagram to measure the resistance of a resistor.
M1 and M2 are meters.



(a) Explain the purpose of the variable resistor in the diagram.

....

.... **[1]**

Few candidates were given the mark for explaining the purpose of the variable resistor in the diagram. Most candidates just gave an answer about the variable resistor varying the resistance or that a variable resistor controls the direction of the current.

Question 13 (b)

(b) Explain why meter M1 in the diagram must be an ammeter.

....

.... **[1]**

Most candidates identified M1 in the diagram as being an ammeter because it is in series with the resistor.

Question 13 (c)

(c) When meter M1 in the diagram is replaced by a voltmeter, no current flows.

Suggest why.

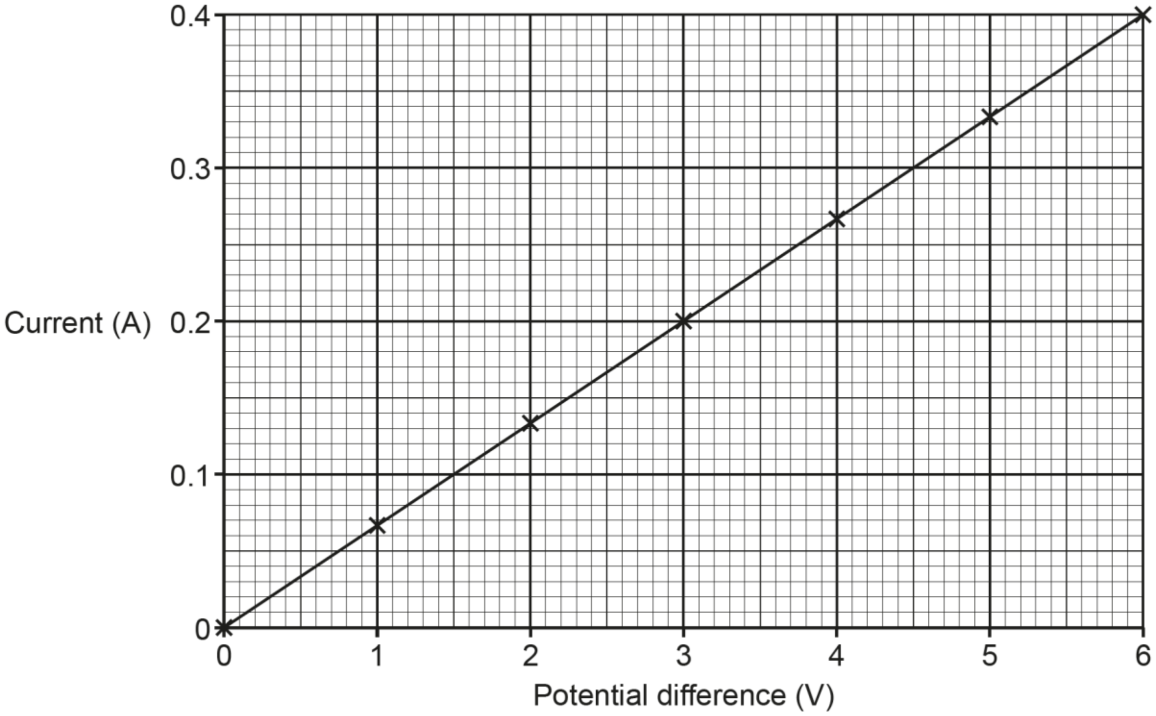
....

.... **[1]**

Few candidates were given this mark. Most candidates did not appreciate that a voltmeter has a high resistance so no current flows when it is placed in the position of M1. Many candidates just wrote that a voltmeter needs to be in parallel.

Question 13 (d) (i)

(d) The graph shows the student's results from using the circuit.



(i) Calculate the resistance of the resistor. Use the graph.

Resistance = ... Ω **[4]**

Most candidates were given four marks for this question. These candidates selected a pair of values from the graph for potential difference and current, usually 6 V and 0.4 A. These candidates then stated the equation; resistance = potential difference ÷ current, before substituting the values from the graph into this equation to calculate the resistance as 15 Ω.

Question 13 (d) (ii)

(ii) Complete the sentence about the graph to explain the relationship between potential difference and resistance.

Use words from the list.

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

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

Few candidates stated that as the potential difference increases, the resistance stays the same. Most candidates thought that as the potential differences increases, the resistance increases.

Question 14 (a) (i)

14

(a) A teacher measures the specific latent heat of ice using this method:

- Pour water at 30 °C into a beaker.
- Add the ice cube to the beaker of water.
- Measure the final temperature of the water after the ice cube melts.

(i) Here are the first set of results from the experiment.

Starting temperature of ice cube = 0 °C Mass of water = 0.2 kg Starting temperature of water = 30 °C Final temperature of water = 14 °C The specific heat capacity of water = 4200 J / kg °C

Calculate the change in thermal energy of the water.

Use the Equation Sheet.

Give your answer to **2** significant figures.

Change in thermal energy = ... J **[3]**

Most candidates were given two or three marks for this question. Some candidates did not calculate the change in temperature as 16 °C. Candidates who were given two marks usually gave the answer of 13 440 (J) and made no attempt to round this value to 2 significant figures.

OCR support

The Mathematical Skills Handbook provides guidance on the use of significant figures (Chapter 2: Handling Data).

Question 14 (a) (ii)

(ii) Here are the second set of results from the experiment.

Change in thermal energy of the water = 15 000 J Energy needed to raise temperature of melted ice = 12 600 J Mass of ice cube = 0.0075 kg

Use these results to calculate the specific latent heat of ice.

Use the Equation Sheet and this equation:

change in thermal energy of water = thermal energy needed to change ice to water + energy needed to raise the temperature of melted ice

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

Most candidates were given at least one mark for this question. Many candidates found it difficult to rearrange the equation to calculate the difference in energy, (15 000 – 12 600), with many candidates adding these values together.

Question 14 (a) (iii)

(iii) The ice must be dried with a paper towel before starting the experiment.

Suggest why.

....

.... **[1]**

Few candidates appreciated that the ice must be dried because the melted ice would be liquid water and so the mass of solid ice would be incorrect. Many candidates just stated that the measurement would be inaccurate without suggesting why.

Question 14 (b)

(b) Describe how the terms **specific latent heat** and **specific heat capacity** are different.

....

....

....

.... **[2]**

Most candidates were given two marks for this question. Most candidates were able to describe that specific heat capacity is the energy required to raise the temperature and that specific latent heat capacity is the energy required to change state. A few candidates did not explain their answers in terms of the energy required, a few candidates thought that both involved a change in temperature and a few candidates thought that specific heat capacity involved a change in state.

Question 14 (c) (i)

(c) The teacher then measures the density of an ice cube.

This is the method they use:

- Measure the mass of the ice cube.
- Place the ice cube in a measuring cylinder containing water.
- Measure the increase in volume of the water after the water has settled.
- Divide the mass by the increase in volume to measure density.

(i) The teacher's method does **not** give an accurate value for the density of ice.

Suggest why.

....

.... **[1]**

Candidates realised that the ice may melt in the water, but fewer candidates realised that ice would float in the water.

Question 14 (c) (ii)

(ii) Suggest a change to the method which would give a more accurate value for the density of ice.

....

.... **[1]**

Few candidates were awarded this mark. Many candidates thought that the ice needs to be melted to find the density or that using a Eureka can would give a more accurate value. A few candidates gave the response that the volume of a cube of ice can be determined by multiplying the dimensions of the height, width and depth together. Answers involving the idea of submerging the ice cube were rarely seen.

Question 14 (c) (iii)

(iii) An ice cube weighs 0.046 N.

The volume of the ice cube is $5.0 \times 10^{-6}\,m^3$.

Calculate the density of the ice cube.

Gravitational field strength = 10 N / kg

Use the equations: density $= \frac{\text{mass}}{\text{volume}}$

gravitational force = mass × gravitational field strength

Density = ... kg/m^3 **[3]**

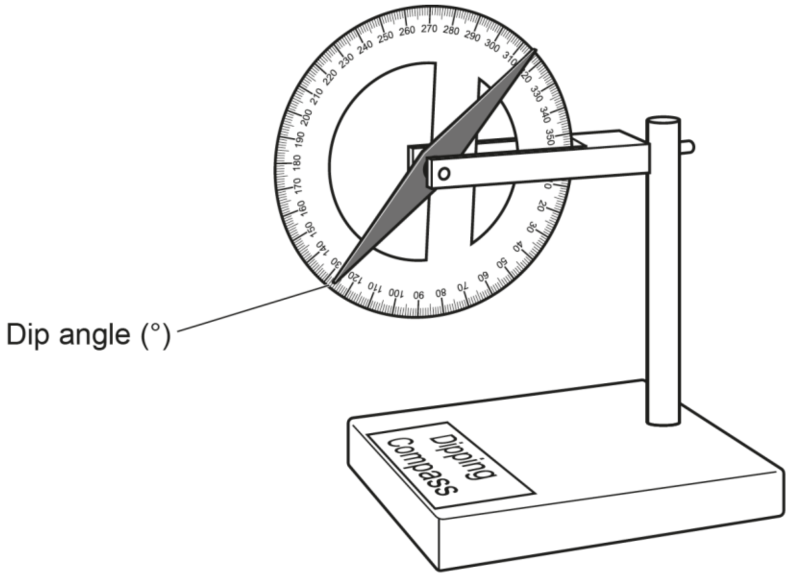
Most candidate were given two or three marks. Two marks were usually awarded when the candidate had the correct values of 4.6×10^{-3} divided by 5.0×10^{-6} but then were unable to successfully use the standard form numbers in the division to give the answer as 920 (kg/m^3). Some candidates did not convert the weight of the ice cube into the mass before substituting the numbers into the equation.

Question 15 (a)

15 This question is about magnetism.

(a) **Fig. 15.1** shows a dipping compass.

Fig. 15.1



In some places, a dipping compass shows a dip angle of 90°.

Where could the dipping compass be on Earth?

Tick (✓) **two** boxes.

At the equator ☐

At the North geographic pole ☐

At the North magnetic pole ☐

At the South magnetic pole ☐

In the United Kingdom ☐

[1]

Many candidates did not tick two boxes. Few candidates gave the correct answer of 'At the North magnetic pole' and 'At the South magnetic pole'. A common incorrect answer was 'At the North geographical pole'.

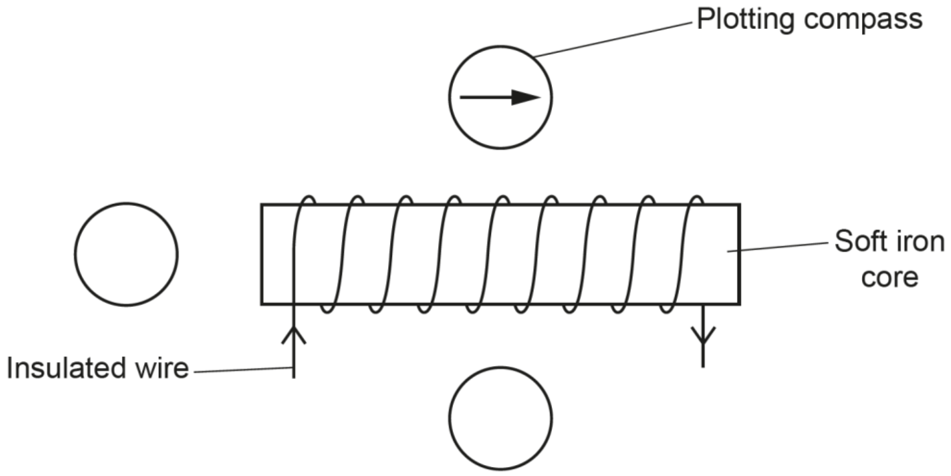
Question 15 (b) (i)

(b) A student uses a coil of insulated wire to construct an electromagnet.

(i) The student uses plotting compasses to show the magnetic field around the electromagnet.

Fig. 15.2 shows a diagram of the electromagnet. The circles show the position of three plotting compasses when the electromagnet is switched on.

Fig. 15.2



Complete **Fig. 15.2** by drawing arrows on the plotting compasses to show the direction they point.

One is already drawn for you. **[2]**

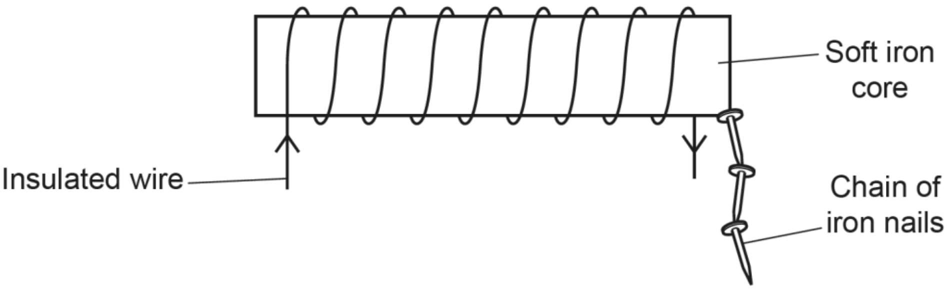
Few candidates were given any marks for this question. Many candidates drew vertical arrows or arrows in the opposite horizontal direction.

Question 15 (b) (ii)

(ii) The student uses the electromagnet to pick up some iron nails.

Fig. 15.3 shows what happens when the electromagnet is switched on.

Fig. 15.3



Explain why a chain of iron nails is attracted to the electromagnet.

You can label **Fig. 15.3** to help explain your answer.

....

....

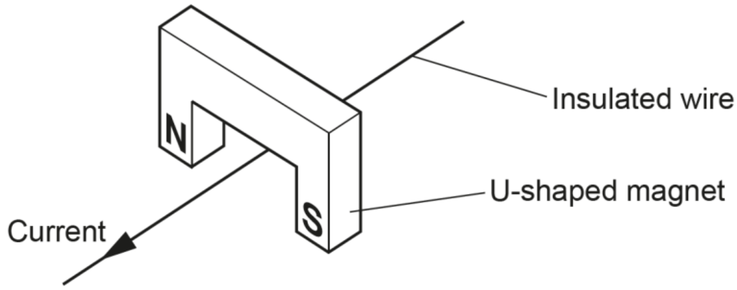
.... **[2]**

Few candidates gained any marks for this question and most of these candidates only gained one mark for stating that iron is easily magnetised. Many candidates thought that the chain of iron nails is attracted to the electromagnet because of unlike charges or that positive and negative charges attract.

Question 15 (c) (i)

(c) The student then places some insulated wire in a straight line between the poles of a U-shaped magnet as shown in **Fig. 15.4**.

Fig. 15.4



(i) Explain what happens when a current passes through the insulated wire.

....

....

.... **[2]**

Few candidates gained any marks for this question. Most candidates did not explain what happens to the wire but incorrectly thought that the current slows down, the current is made stronger by the magnetic field or the wire is insulated so the current cannot flow to the magnet.

Question 15 (c) (ii)

(ii) The magnetic flux density between the poles of the U-shaped magnet is 0.12 T.
The length of wire that lies between the poles is 0.04 m.

Calculate the force on this length of wire when a current of 0.25 A flows through it.

Use the Equation Sheet.

Give your answer in mN.

Force = ... mN **[3]**

Most candidates were given two or three marks for this question. The candidates given three marks usually calculated the force in N and then correctly converted this answer to mN. Candidates who were given just two marks usually either did not convert the answer of 0.0012 N to 1.2 mN or converted 0.0012 N incorrectly to 0.0000012 mN.

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