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Examiners' report

GCSE

COMBINED SCIENCE A (GATEWAY SCIENCE)

OCR Level 1/Level 2 GCSE (9-1) in Combined Science A (Gateway Science)

J250

For first teaching in 2016

J250/11 Summer 2025 series

Version 1

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 responses 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 Teach Cambridge.

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Paper 11 series overview

J250/11 is one of six papers for the GCSE (9-1) Combined Science A (Gateway Science) 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, to interpret graphs and diagrams and to be familiar with a range of practical activities. In this paper candidates were required to interpret a force-extension graph for two different springs, a graph showing the magnetic field strength at different locations around the Earth and a velocity-time graph to compare the motion of two different students. The practical activities included describing a change to make an experiment more accurate, the equipment used to measure charge transferred, building, using and adapting an electric motor, measuring the density of an irregular object, finding acceleration using a toy car and comparing resistance in electrical circuits.

It is important that candidates read the requirements of each question and know what to include in their answer. For example, in Question 13 the question asked the candidate to 'Compare the motion of Student A and Student B. Include acceleration and distance travelled.' Many candidates just described the motion of Student A and then described the motion of Student B without any comparison. Some candidates included information about velocity and acceleration but often did not mention the distance travelled. It is important to address all the requirements of a question.

This year many of the calculations were found in the multiple-choice questions, Questions 1 to 10. Candidates performed well on the calculations within Questions 1, 2, 5 and 10.

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 11 and 12 are overlap questions with the Foundation Paper, J250/05.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• recalled how to calculate acceleration and distance travelled from a velocity-time graph (Question 13), how a dipping compass works (Question 11 (c)) and the Thomson plum pudding model (Question 12 (a)) • calculated various quantities in the multiple-choice Questions 1, 2, 3, 5, 7, 9 and 10, acceleration and distance travelled (Question 13), force acting on a coil (Question 14 (b)) and current (Question 17 (b) • used information in graphical form, Questions 4, 11 (d) and 13 • used knowledge of practical techniques and the equipment needed to describe how to make results more accurate (Question 4), to measure charge transferred (Question 8), how to build and adapt an electric motor (Question 14), how to measure the density of an irregular object (Question 15), how to measure acceleration (Question 16) and how to compare resistance (Question 17).	• could not recall that iron filings and plotting compass are required to determine the shape of a magnetic field (Question 11 (b)), the position of an ammeter and a voltmeter in an electrical circuit (Question 17 (a)) • could not interpret a velocity-time graph (Question 13), could not change units from hours to seconds and from mA to A (Questions 3 and 14 (b) respectively), could not interpret data given in tables (Questions 15 (b), 16 (c) and 17 (b)) • could not draw electrical circuit diagrams (Questions 17 (a) and 17 (c)) • did not read the requirements of the question carefully, for example, in Question 12 (b) (ii), two lines drawn instead of one line.

Section A overview

This section consists of 10 multiple-choice questions testing AO1 and AO2.

Questions that were most often answered correctly were 1, 2, 5 and 10. The most challenging questions were 6 and 9. Questions 3 and 8 discriminated well between candidates who achieved different grades.

Almost all candidates completed every question.

Assessment for learning

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

- underlined key words and important quantities
- carefully set out the calculations required so they could be rechecked if time at the end of the examination
- converted any units required, for example, hours to seconds
- 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, ɑ and d
- crossed out letters when changing the answer and rewriting the new letter selected next to the box provided.

Question 1

1 A car travels 9000 m in 90 seconds.

What is the car's speed?

Use the equation: $\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$

A 0.01 m/s

B 0.1 m/s

C 10 m/s

D 100 m/s

Your answer ☐ **[1]**

The majority of candidates used the equation given to calculate the speed of the car as 100 m/s. Many of these candidates showed the working out as '9000 ÷ 90 = 100'.

Question 2

2 A lift is stationary 20 m above the ground.
The lift moves upwards until it is now 100 m above the ground.
The lift then remains stationary.
The mass of the lift is 450 kg.

What is the **increase** in gravitational potential energy of the lift?

Gravitational field strength = 10 N / kg

Use the equation: gravitational potential energy = mass × gravitational field strength × height

A 45.0 J

B 56.3 J

C 360 000 J

D 450 000 J

Your answer ☐ **[1]**

Most candidates selected the correct answer, option D.

Exemplar 1

A 45.0 J

B 56.3 J

C 360 000 J

D 450 000 J

Initial = 450 kg × 10 N / kg × 20 m
= 90,000 J

Final = 450 kg × 10 N / kg × 100 m
= 450,000 J

Your answer C **[1]**

This candidate has underlined the important numbers and words in the question; '20 m', '100 m', '450 kg' and the bold word in the question 'increase'. The candidate has then used the equation given in the question, gravitational potential energy = mass × gravitational field strength × height, to calculate the increase in gravitational potential energy. This candidate has carefully set out the complete calculations for the initial and final values. This minimises the possibility of errors and allows the candidate to quickly recheck the calculations at the end if there is sufficient time.

Question 3

3 A mobile phone is charged for 3 hours.
The mean charging current is 0.15 A.

What is the charge transferred to the mobile phone in this time?

Use the equation: charge flow = current × time

A 0.45 C

B 27 C

C 540 C

D 1620 C

Your answer ☐ **[1]**

Less than half the candidates selected the correct answer, 1620 C. Candidates that selected the correct answer usually converted the time in hours to time in seconds before using the equation charge flow = current × time.

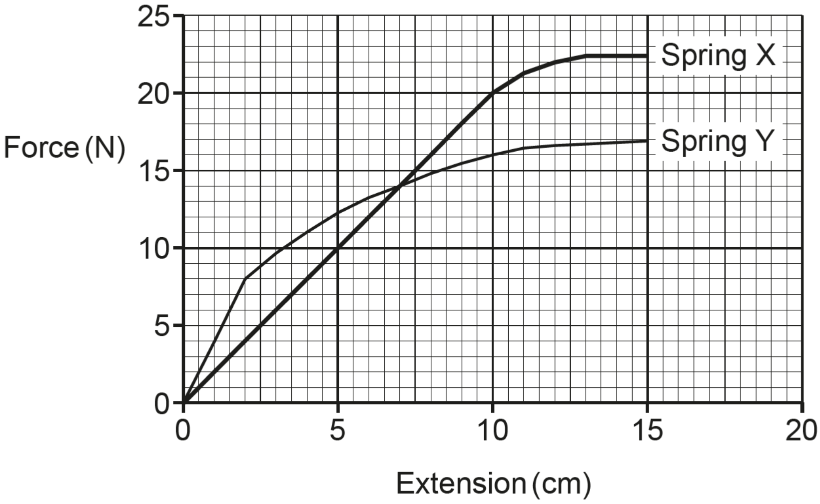
Misconception

?

The most common answer to this question was option A, 0.45 C. These candidates have used hours as the measurement of time rather than the unit of time being in seconds.

Question 4

4 The graph shows the results for two springs, Spring X and Spring Y, as they are stretched.



Which observation is correct?

	From 0 cm to 2 cm	From 0 N to 10 N
A	Spring X requires less force to stretch than Spring Y	Spring Y obeys Hooke's Law
B	Spring X requires less force to stretch than Spring Y	Spring Y does not obey Hooke's Law
C	Spring X requires more force to stretch than Spring Y	Spring Y obeys Hooke's Law
D	Spring X requires more force to stretch than Spring Y	Spring Y does not obey Hooke's Law

Your answer ☐ **[1]**

Few candidates selected option B. Most candidates placed an X next to the statement that from 0 N to 10 N Spring Y obeys Hooke's Law. These candidates identified that the line of the graph for spring Y curved. A few of these candidates then selected option B but the majority selected option D.

Question 5

5 A 2 V power supply is connected to a motor.
250 C passes in 50 s.

How much energy is transferred?

Use the equation: energy transferred = charge × potential difference

A 5 J

B 100 J

C 125 J

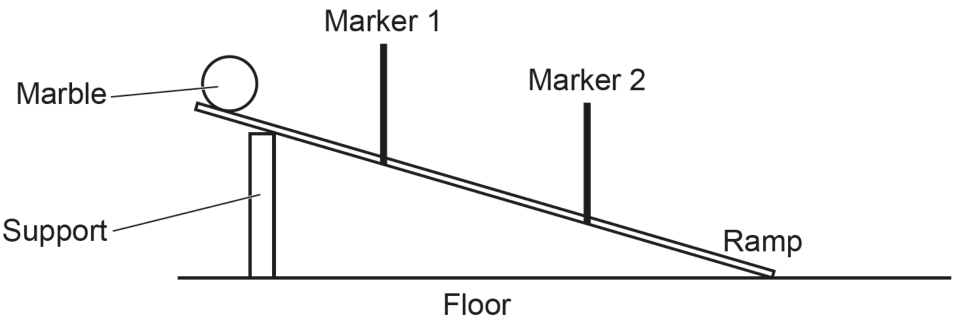
D 500 J

Your answer **[1]**

Most candidates selected option D, 500 J. These candidates usually showed their working out as 250 × 2. A few candidates tried to use the time of 50 s in their calculation.

Question 6

6 A student uses a stopwatch to measure the time it takes for a marble to travel down a ramp between two markers.



Which change will make the results more **accurate**?

A Asking a second student to operate the stopwatch

B Decreasing the height of the ramp

C Moving the markers closer together

D Starting the stopwatch as soon as the marble is released

Your answer **[1]**

This question was challenging for candidates. Few gave the correct answer of B, decreasing the height of the ramp. Candidates that did select option B realised that decreasing the height of the ramp would decreases the speed of the marble so the time difference between marker 1 and marker 2 would be greater. A common incorrect selection was option A, asking a second student to operate the stopwatch.

Question 7

7 A spring stores 100 J of elastic energy when it has an extension of 8 cm.

Its extension is reduced to 4 cm.

What is the elastic energy now stored?

Use the equation: energy transferred in stretching = $\frac{1}{2}$ × spring constant × (extension)^2

A 75 J

B 50 J

C 25 J

D 12.5 J

Your answer ☐ **[1]**

Few candidates selected the correct answer, option C, 25 J. These candidates first calculated the spring constant to be 3.125 using 100 = ½ × constant X× $(8)^2$. Then they used this value for the spring constant with the extension of 4 to calculate the elastic energy now stored. Other candidates just gave any of the other three options with no attempt at any calculation seen.

Question 8

8 A student does a practical investigation to find the charge transferred when a laptop is charged.

Which equipment must they use?

A Ammeter only

B Ammeter and stopwatch

C Voltmeter only

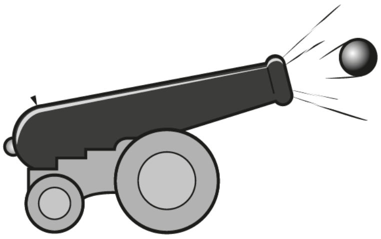
D Voltmeter and stopwatch

Your answer ☐ **[1]**

Approximately half of all candidates selected option B, ammeter and stopwatch. This answer was often accompanied by the equation 'charge flow = current × time', with an arrow from current to the word 'ammeter' and an arrow from time to the word 'stopwatch'. A popular incorrect answer was option A, ammeter only.

Question 9

9 A 5000 kg cannon fires a 10 kg cannonball.



Just after firing, the momentum of the cannonball is 50 kg m / s.

What is the velocity of the **cannon** just after firing?

Use the equation: momentum = mass × velocity

A –0.2 m / s

B –0.01 m / s

C 0.01 m / s

D 0.2 m / s

Your answer [ ] **[1]**

This question was challenging for candidates. Few candidates gave the correct answer of B, -0.01 m/s. The most common incorrect answer was option C, 0.01 m/s.

Question 10

10 A cyclist travels at 5 m/s and has a kinetic energy of 900 J.

They increase their speed to 10 m/s.

What is their kinetic energy now?

Use the equation: kinetic energy = $\frac{1}{2}$ × mass × (speed)^2

A 1273 J

B 1800 J

C 3600 J

D 9000 J

Your answer ☐ **[1]**

Most candidates selected option C, 3600 J. Common errors in the working out included not using the ½, not squaring the speed, not realising that the cyclist has the same mass at 5 m/s as at 10 m/s or just doubling the kinetic energy because the speed had doubled.

Section B overview

This Section includes short (1 mark) questions, questions requiring longer answers and one Level of Response question (Question 13). 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 Data Sheet and wrote these in the answer space
- gave all steps involved in calculations so even if the final answer were incorrect some marks could still be given
- worked methodically through Question 15 (a) to describe the method and linked each step to only the list of equipment given
- used all the information in the velocity-time graph in Question 13 to compare the acceleration and distance of Student A and Student B
- accurately read values from the graph in Questions 11 (d) and 13, and numbers from the table in Questions 14 (b) and 17 (b)
- carefully looking at the diagram of the apparatus and the setup of this apparatus in Question 15.

Questions that were most often answered correctly were 15 (b) (i), 16 (b) (i) and 17 (b). The most challenging questions were 11 (c), 12 (a) (i) and 17 (c). Questions 12 (b) (i) and 14 (a) discriminated well between candidates who achieved different grades.

Almost all candidates completed every question.

Question 11 (a)

11 An iron bar can be magnetised by placing it inside a magnetic field.

(a) What **type** of magnet is the iron bar?

.... **[1]**

Just less than half of all candidates described the magnet as induced or temporary. Many candidates gave answers of electromagnet, permanent, constant, positive or negative.

Question 11 (b)

(b) Complete this sentence about magnetic fields.

Use words from the list.

aluminium powder	**gold leaf**	**iron filings**	**plotting compasses**

The shape of the magnetic field around a bar magnet can be investigated using

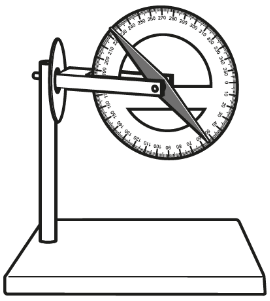
.... or ....

[2]

Most candidates were given 2 marks for this question with iron filings and plotting compass as the correct answers. A common incorrect answer was aluminium powder.

Question 11 (c)

(c) The diagram shows a **dipping compass**.



Describe how dipping compasses are used to find the shape of the Earth's magnetic field.

....

.... **[1]**

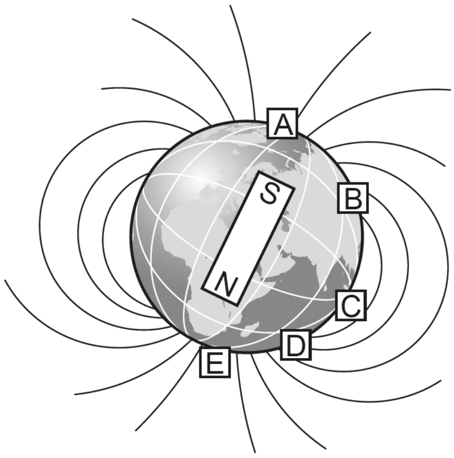
Candidates found this question challenging. The majority of candidates did not move the dipping compass to different parts of the Earth. These candidates just described the compass as pointing to the magnetic north, or that the compass follows the direction of the magnetic field or rotates to a certain angle depending on the angle of the Earth's magnetic field.

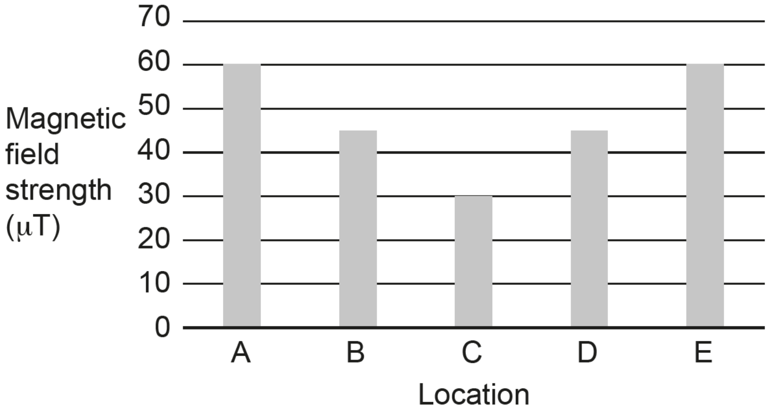
Question 11 (d)

(d) Scientists think that the Earth is surrounded by a magnetic field.

They measured the magnetic field strength at different locations around the Earth, **A**, **B**, **C**, **D** and **E**.

The graph shows the magnetic field strength at these different locations.





Describe the pattern in the results shown on the graph.

What does this pattern in results show about the magnetic field strength around the Earth?

....

....

....

.... **[2]**

Most candidates were given 1 mark by using the graph to describe the magnetic field being stronger or strongest at locations A and E. Fewer candidates then used the diagram of the Earth to relate this to the magnetic field being stronger at the poles, by the position of A and E on the diagram. Very few candidates stated the difference in the magnetic field strength as being 30 μT.

Question 12 (a) (i)

12 In the early part of the twentieth century, several scientists developed new ideas about what atoms look like.

(a) Thomson proposed the plum pudding model in 1904.

(i) What are the two main ideas about **electric charge** in this model?

1 ....

....

2 ....

....

[2]

Candidates found this question challenging with less than half of all candidates gaining a mark. Many candidates did not describe the plum pudding model but described the nucleus as being made of protons and neutrons surrounded by orbits of electrons. Some candidates did not write about charges and just concentrated on the overall model as being a large mass with dots inside. Candidates that answered this question well wrote about the large pudding being a ball of positive charge with the negative electrons dotted in the pudding like plums. These candidates often added a labelled diagram of the model to further describe their answer.

Question 12 (a) (ii)

(ii) Give **one** reason this model was not developed until 1904.

....

.... **[1]**

Approximately half of all candidates were given a mark for their answers. Many candidates just gave vague reasons. For example, electrons had not been discovered by him yet, he was working on other things when he discovered the model, many factors had not yet been discovered, there was not much evidence, he did not believe Dalton or nothing had been published yet.

Question 12 (b) (i)

(b) Rutherford fired alpha particles at gold foil. He published his results in a scientific journal.

(i) Suggest **two** reasons why he published his results in a scientific journal.

1 ....

....

2 ....

....

[2]

Most candidates were given 2 marks for this question. The most popular correct answers being able to share his findings with other scientists, so that his results can be checked by other scientists and so that other scientists can use his ideas to develop their ideas. A few candidates gave vague answers, for example, to get paid, to get awards, to be famous and so he knows he has done it.

Question 12 (b) (ii)

(ii) Draw **one** line from one of the physicists to show which **change** they made to Rutherford's model.

Physicist	**Change**
	neutrons
Bohr	
	electron orbits
Marsden	
	nucleus

[1]

Few candidates correctly drew one line from Bohr to electron orbits. Many candidates drew two lines with one from Bohr to electron orbits and one line from Marsden to neutrons.

Assessment for learning

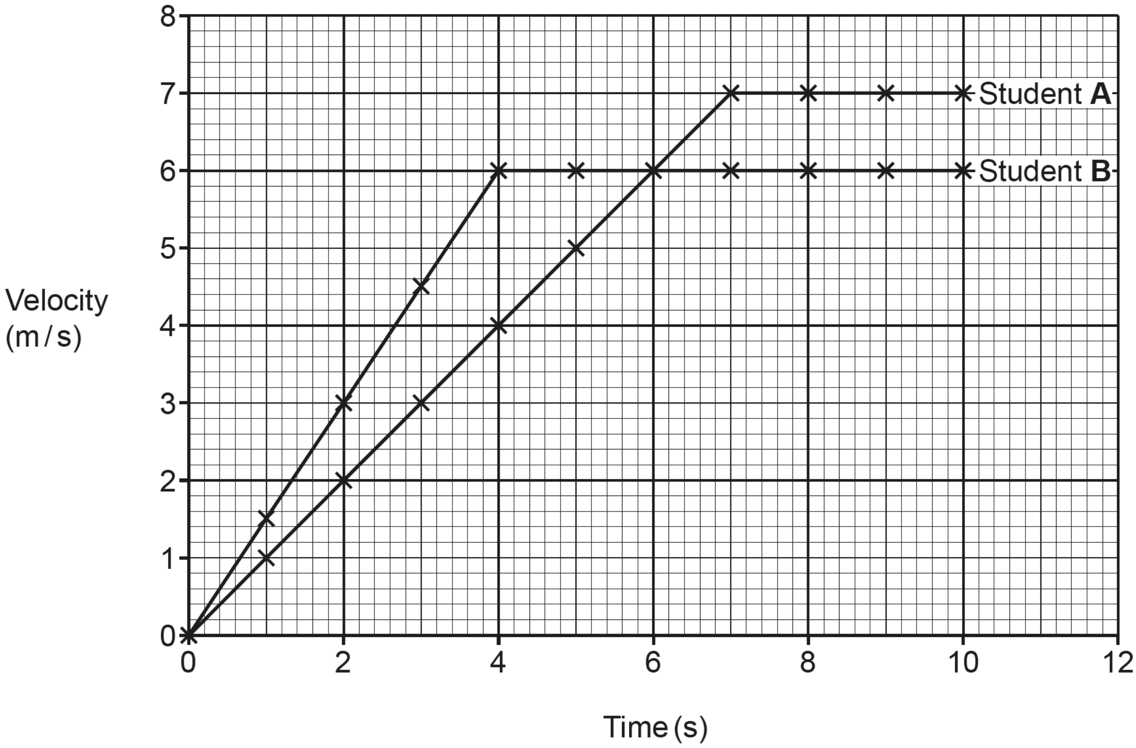
Many candidates drew two lines.

It is important that candidates read the question carefully and following the instructions given. Here, candidates were required to draw one line and not two lines.

Question 13*

13* Two students run for 10 seconds.

The graph shows their motion.



Compare the motion of Student **A** and Student **B**.

Include acceleration and distance travelled.

....

....

....

....

....

.... **[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. Candidates were required to compare the motion of Student A and Student B, specifically acceleration and distance travelled.

Many candidates gained credit for comparing the acceleration of Student A and Student B. These candidates recognised that the gradient of a velocity-time graph gives the acceleration and that B has a greater acceleration because the gradient is steeper.

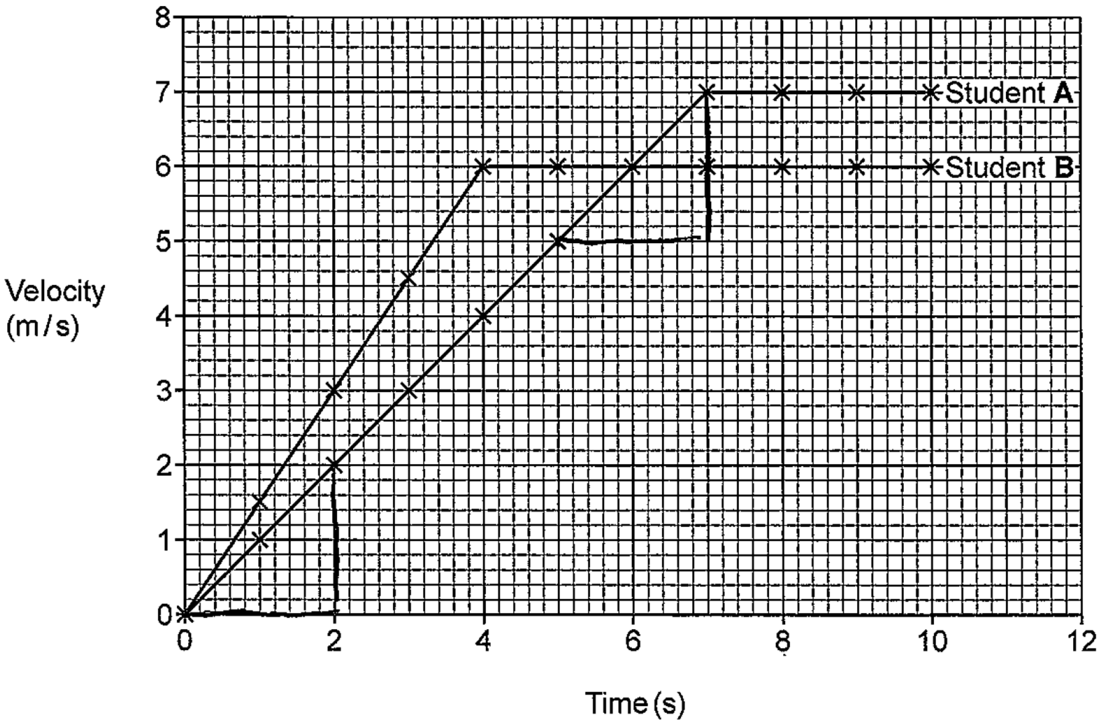
Fewer candidates gained credit for comparing the distance travelled by Student A and Student B. Many candidates did not appreciate that the distance travelled can be determined by the area under the graph. Many candidates tried to calculate the distance travelled using speed = distance ÷ time for the time of 10 seconds. Therefore incorrectly calculating, student A having a distance of $7 \times 10 = 70$ m and student B having a distance of $6 \times 10 = 60$ m.

As the two lines on the graph for Student A and Student B were identical, straight black solid lines, some candidates read the graph as student B being from (0,0) to (6,6) before the line became horizontal. This was considered correct in these candidate's answers.

Exemplar 2

13* Two students run for 10 seconds.

The graph shows their motion.



Compare the motion of Student **A** and Student **B**.

Include acceleration and distance travelled.

STUDENT A	STUDENT B
• Student A accellerated Slower He can See from his gradient.	• Student B Stayed at a constant Speed of 6 for 6 Seconds
• Student A ran for more distance as their line flattens out at 7s. And ran faster.	• Student be has a gradient of 1 = 2 ÷ 2 = 1. They both ran for 10 Seconds and Stopped.

[6]

The information written on the graph has been considered as part of the candidate's answer to this Level of Response question. The candidate has attempted to find the gradient of the line but has only considered student A. The candidate has divided their answer into two columns, one column for student A and one column for student B. This is useful when comparing the motion of Student A and Student B. This candidate has linked the gradient to the acceleration and given a comparison that student A has a smaller acceleration than student B, although these have been described in terms of slower acceleration for Student A and Student B having an acceleration of 1. The candidate has linked the distance that student A ran to the line flattening out at 7 which is not correct. Therefore, this candidate is awarded Level 1 and 2 marks for a basic comparison of accelerations.

Exemplar 3

11

$\frac{(\text{final})^2-(\text{initial})^2}{2(\text{distance})} = \text{acceleration}$

13* Two students run for 10 seconds.

The graph shows their motion.

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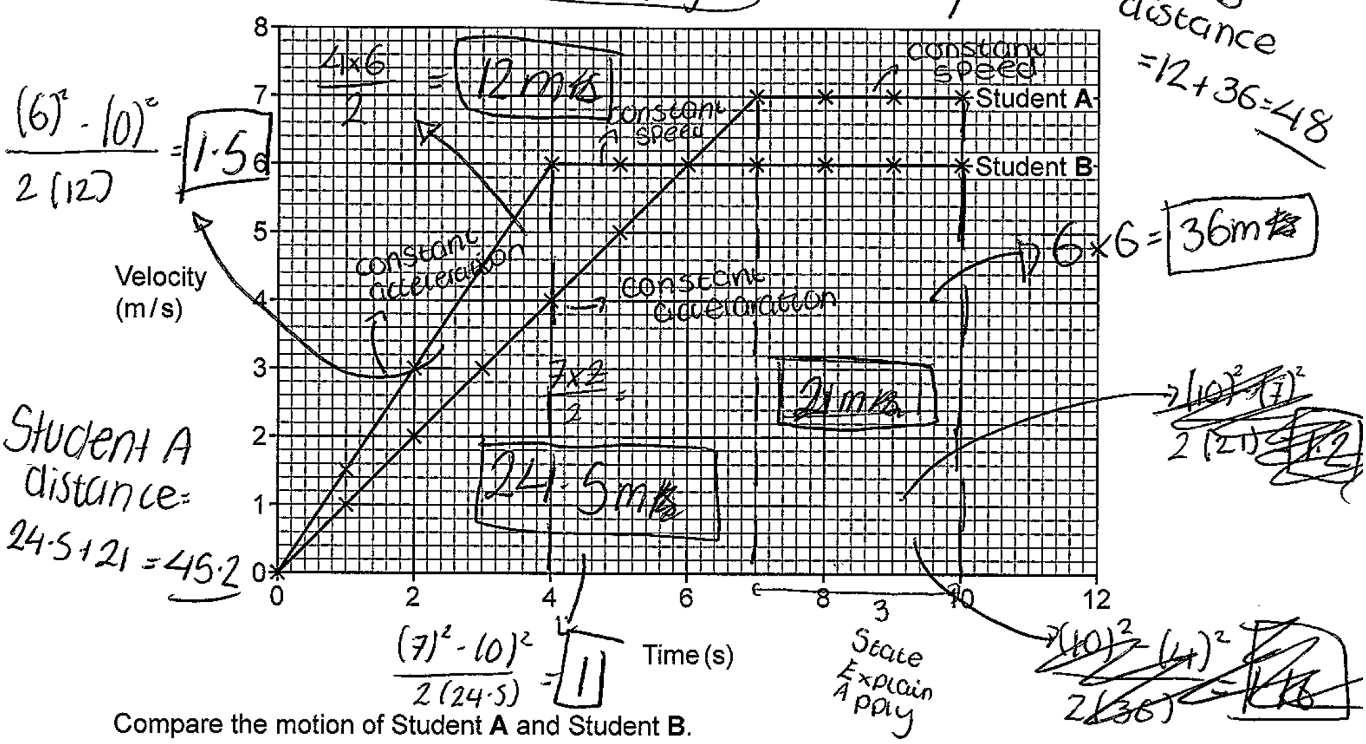


Compare the motion of Student **A** and Student **B**.

Include acceleration and distance travelled.

Student A overall travels at a higher velocity and travels 45.2 m in total, over student A's constant acceleration it travels 24.5m at an acceleration of 1, then when Student A reaches a constant speed it travels 21 m/s at 0 acceleration. Overall, Student B travels 48 m in total with an initial acceleration of 1.5 ~~but~~ and it travels at that acceleration for 12m, then when it reaches a constant speed, the acceleration is 0 due to it beong constant and it travels at that rate for 36m Overall, Student B travels further with a higher acceleration but student A has a higher velocity **[6]**

13. Student A acceleration

$a = \frac{v-u}{t}$

$a = \frac{final - initial}{time}$ $a = \frac{7-0}{7} = 1$

Student A again $a = \frac{7-7}{3} = \cancel{...} \; 0$

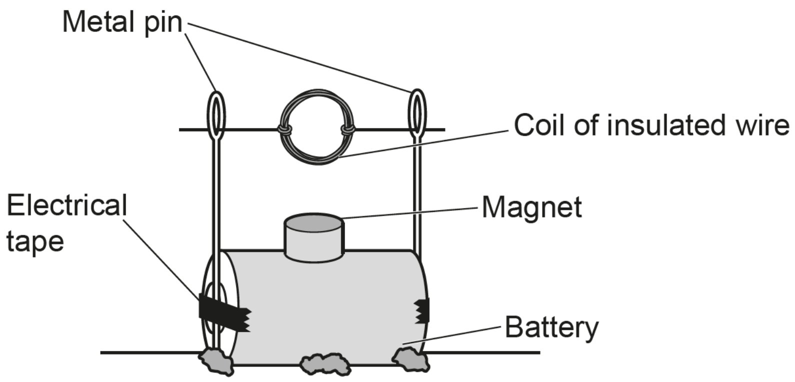
Student B $a = \frac{6-0}{4} = 1.5$

Student B again $= \frac{6-6}{6} = 0$

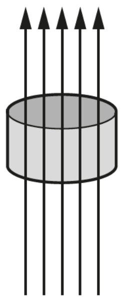
The information written on the graph has been considered as part of the candidate's answer to this Level of Response question. The candidate has fully annotated the graph to help them answer the question and although at first glance it appears a little disorganised there are clear references to acceleration and distance on the graph. The candidate's written answer then compares the acceleration of Student A and Student B by calculating the acceleration of A as 1 (m/s^2) and the acceleration of B as 1.5 (m/s^2), these are detailed comparisons of acceleration. The candidate has also calculated the distance, with student A 45.2 m and student B as 48 m. This is clearly a detailed answer and would be Level 3 and 6 marks but the candidate has made an error and given the distance of A as 45.2 m rather than 45.5 m. So, Level 3 and 5 marks were awarded.

Question 14 (a)

14 A student uses a small magnet to build an electric motor.



The magnetic field around the magnet can be shown like this:



(a) The battery is connected to the coil of insulated wire by the metal pins.

The current is clockwise around the coil of insulated wire and part of the coil is perpendicular to the magnetic field.

State the technique used to find the direction of the force acting on the coil.

.... **[1]**

The majority of candidates stated the technique as Fleming's left-hand rule. A few candidates gave the answer of Fleming's right-hand rule or magnetic field rules or plotting compass rules.

Question 14 (b)

(b) The table shows some data about the motor.

Magnetic flux density through the coil	1×10^{-6} T
Current in the coil	500 mA
Perpendicular length of coil wire inside the magnetic field	0.45 m

Calculate the force acting on the coil.

Use the Equation Sheet.

Force acting on the coil = ...N **[3]**

The majority of candidates were given 2 or 3 marks for this question. Two marks were given when the candidate did not convert 500 mA to 5 A.

Misconception

The most common answer to this question was 2.25 X 10^{-4} (N) rather than the correct answer of 2.3 X 10^{-7} (N). These candidates have used mA as the measurement of current rather than the unit of current being in A. Candidates should look carefully are the numerical information given in a question and check that each unit given is appropriate for their calculation.

Question 14 (c) (i)

(c) The student now doubles the number of coils in the motor.

They do this by using a piece of wire which is twice as long.

The battery, the wire diameter, the wire material and the coil size are unchanged.

(i) The current in the original coil was 500 mA.

State the current in the **new** coil.

Current = ... mA **[1]**

Candidates found this question challenging. Many candidates stated that the current has stayed the same at 500 mA or had doubled to 1000 mA, rather than halved to 250 mA.

Question 14 (c) (ii)

(ii) Explain whether the new motor turns faster, slower, or at the same speed as the original motor.

Consider the force acting on the **new** coil.

....

....

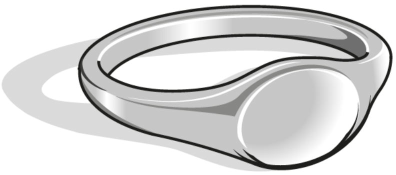
....

.... **[2]**

An error carried forward was considered for this question based on the answer provided for part (i). The majority of candidates were given 1 or 2 marks. Most of these candidates did explain whether the new motor turns faster, slower or the same speed. Fewer candidates considered the force acting on the new coil.

Question 15 (a)

15 A jeweller has a ring.



(a) They also have some water, a measuring cylinder, and a digital balance.

Explain how they could use these items to find the **density** of the ring.

....

....

....

....

....

.... **[4]**

The majority of candidates were given 3 or 4 marks for this question. There were many clear ordered answers seen. A few candidates tried to use a Eureka can rather than a measuring cylinder or tried to find the mass without mentioning the use of the balance.

Question 15 (b) (i)

(b) The jeweller knows that the ring is either made of copper or gold, or an alloy of copper and gold.

The table shows some data about copper and gold.

	Copper (solid)	Gold (solid)
Density (kg/m^3)	900	1800

The jeweller finds that the density of the ring is 1600 kg/m^3.

(i) What is the most likely composition of the ring?

Tick (✓) **one** box.

Pure copper ☐

Mostly copper ☐

Equal amounts of copper and gold ☐

Mostly gold ☐

Pure gold ☐

[1]

The majority of candidates ticked just one box, the mostly gold box.

Question 15 (b) (ii)

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

....

....

....

.... **[2]**

The majority of candidates were given 1 or 2 marks for this question. These candidates usually explained that the density was nearer to pure gold rather than pure copper but did not always explain that the density was different from pure gold. Many candidates illustrated their answer by using the data from the table.

Question 15 (c)

(c) The table shows some data about **liquid** copper and **liquid** gold.

	Copper (liquid)	**Gold (liquid)**
Density (kg/m^3)	800	1700

Explain why the densities of solids are greater than the densities of liquids.

Use ideas about particles and volume.

....

....

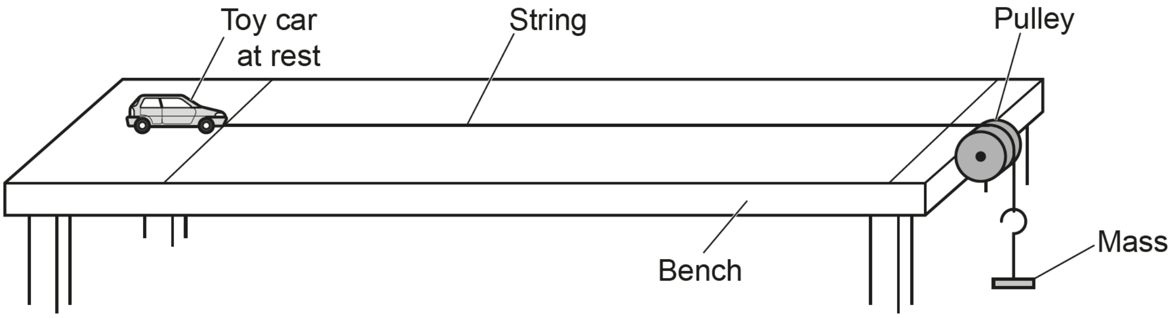
....

.... **[2]**

The majority of candidates were given 1 mark for this answer. These candidates usually explained that in a solid the particles are closer together than the particles in a liquid. Fewer candidates then explained that for a given volume there are more particles in a solid compared to the same volume of liquid.

Question 16 (a)

16 A student is investigating how force affects acceleration. They set up this apparatus.



(a) Explain how they should use this apparatus to find acceleration.

Include any extra equipment they need.

....

....

....

....

....

.... **[4]**

The majority of candidates were given 1 or 2 marks for this question. A number of different methods were given in the mark scheme but some candidates did not stick to just one method so the method that gave the candidate the highest mark was considered.

The majority of candidates chose the method of changing the mass and measuring the distance and the time using a ruler and a stopwatch. Many of these candidates did not include the idea that the mass needs to be released so that the car that is at rest starts to move or that the initial speed of the car is 0 (m/s). It was clear in the answers given by some candidates that they were unfamiliar with light gates or similar equipment to find acceleration in a practical situation.

Question 16 (b) (i)

(b)
(i) Two forces act to reduce the acceleration of the car.

One of these forces is air resistance.

Name the **other** force.

.... **[1]**

Most candidates named the other force as friction, although some candidates gave the answers of drag, gravity and gravitational potential energy.

Question 16 (b) (ii)

(ii) Suggest how the teacher can reduce the effect of this other force.

....

.... **[1]**

The majority of candidates were able to give a suggestion as to how the teacher can reduce the effect of friction. The most common answers were adding oil or using a smoother surface.

Question 16 (c)

(c) The table shows the student's results.

Force applied to car (N)	Acceleration of car (m/s^2)
0.30	0.51
0.60	1.02
0.90	1.53

Suggest **two** changes the student could make to improve the validity of their results.

1 ....

....

2 ....

....
[2]

The majority of candidates were given 1 or 2 marks for this question. The most common correct answer was to repeat the readings. The second most common answer was to use forces outside the range given in the table, for example use a force of 0.20 (N) or a force of 1.0 (N). Few candidates considered using a force within the range, for example, use a force of 0.40 (N) or use a force of 0.50 (N).

Question 16 (d)

(d) Predict the acceleration if a force of 1.2 N was applied to the car.

Use data from the table.

Acceleration = ... m/s^2 **[1]**

The majority of candidates gave the answer as 2.04 (m/s^2). A few candidates gave the answer of 2.4 (m/s^2).

Question 16 (e)

(e) Mass is an example of a quantity which has a magnitude, but **no** direction.

What scientific term is used for this type of quantity?

.... **[1]**

The majority of candidates gave the answer of scalar although a few candidates gave the answer of vector, displacement or speed.

Question 17 (a)

17 Some scientists are comparing the resistance of circuits.

Their first circuit contains **one** lamp, a cell, an ammeter, a voltmeter and some connecting leads.

(a) Draw a circuit diagram to show how they should connect these components.

Diagram

[2]

The diagram was generally well drawn by most candidates. These candidates usually placed the symbol for an ammeter in series with the lamp but fewer placed the symbol for a voltmeter in parallel with the lamp. A few candidates tried to add extra symbols, for example, a resistor or used the symbol for a battery rather than a cell. Some candidates did not know the symbol for a cell and just drew a square box or a diagram of a cell.

Question 17 (b)

(b) The scientists build more circuits, each time adding one more lamp to their circuit.

The table shows their results.

Number of lamps	Potential difference across each lamp (V)	Total resistance in the circuit (Ω)
1	6.0	5.0
2	6.0	3.8
3	6.0	3.3
4	6.0	2.9
5	6.0	2.6
6	6.0	2.4

Calculate the **largest** current through the cell observed by the scientists.

Use the equation: potential difference = current × resistance

Largest current = ... A **[2]**

The majority of candidates were given 2 marks for this question, for the largest current being 2.5 (A).

Question 17 (c)

(c) Explain how the scientists connected the additional five lamps.

Use their results from the table. You can use a diagram.

Optional diagram

....

....

....

.... **[2]**

Candidates found this question challenging with less than half of all candidates being given at least 1 mark. Often the candidate gave a written answer describing the additional lamps being added in parallel but then added the lamps in series in their diagram. Few candidates mentioned resistance in their answer.

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