Oxford Cambridge and RSA

Thursday 22 May 2025 – Morning

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

J250/11 Physics (Higher Tier)

Time allowed: 1 hour 10 minutes

H

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.

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Section A

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

Write your answer to each question in the box provided.

1 A car travels 9000 m in 90 seconds.

What is the car's speed?

Use the equation: 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]**

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]**

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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

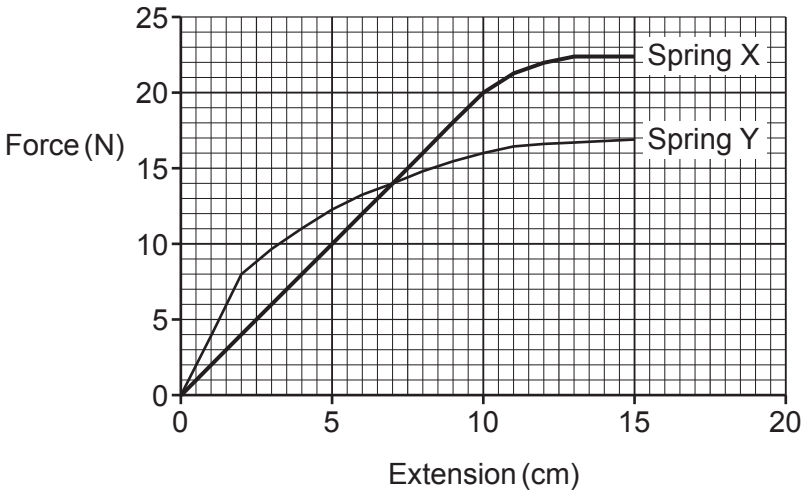
B 27 C

C 540 C

D 1620 C

Your answer ☐ **[1]**

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]**

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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

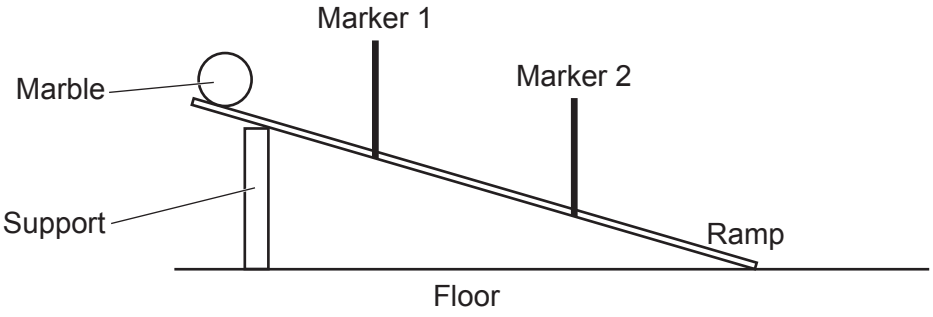
B 100 J

C 125 J

D 500 J

Your answer ☐ **[1]**

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]**

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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]**

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]**

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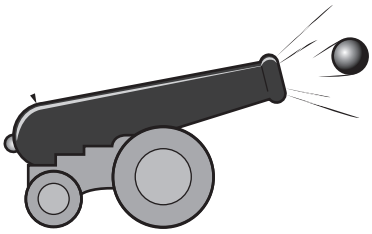
9 A 5000 kg cannon fires a 10 kg cannonball.



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]**

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]**

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Section B

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

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

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

(b) Complete this sentence about magnetic fields.

Use words from the list.

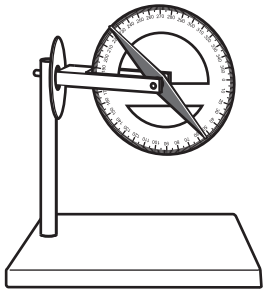
aluminium powder	**gold leaf**	**iron filings**	**plotting compasses**

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

..... or ..... .

[2]

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



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

.....

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

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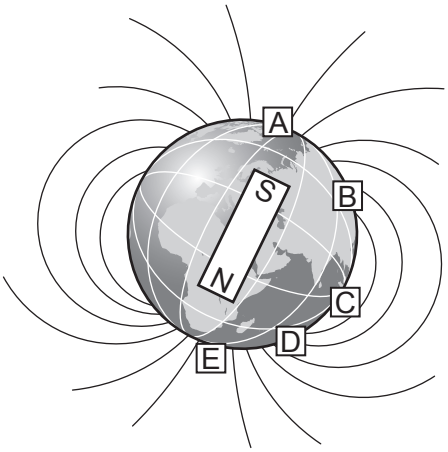
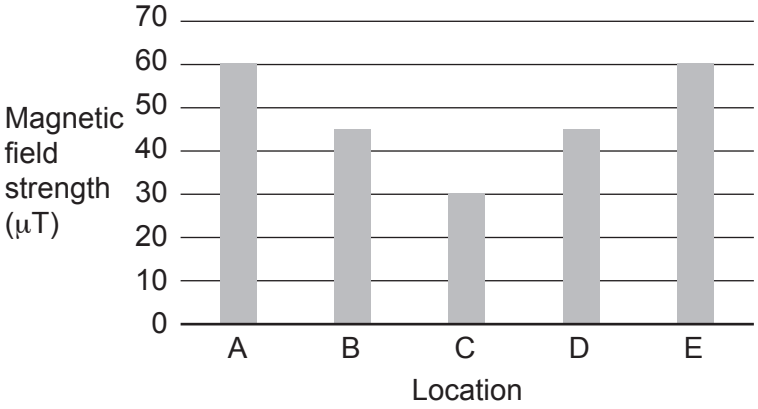
(d) Scientists think that the Earth is surrounded by a magnetic field.

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?

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

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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]

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

.....

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

(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]

(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]

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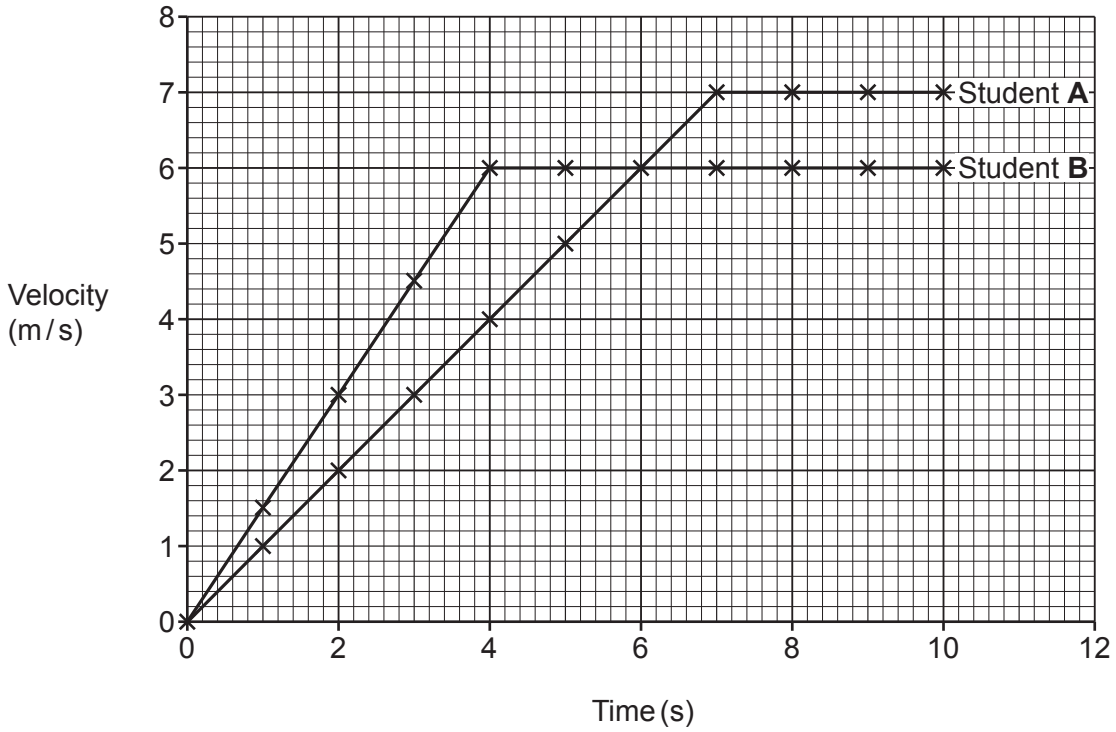
13* Two students run for 10 seconds.

The graph shows their motion.



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

Include acceleration and distance travelled.

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

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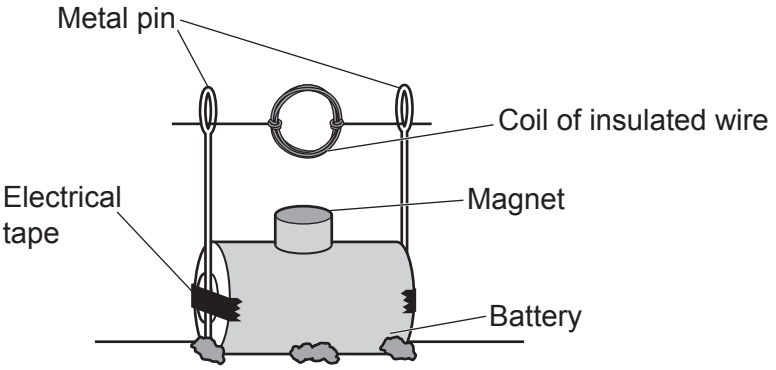
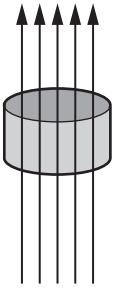
14 A student uses a small magnet to build an electric motor.



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]**

(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]**

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(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]**

(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.

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

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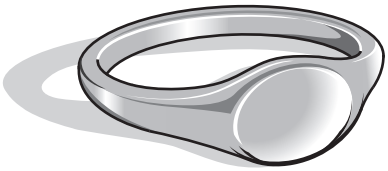
15 A jeweller has a ring.



(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.

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..... **[4]**

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(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]

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

.....

.....

.....

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

(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.

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

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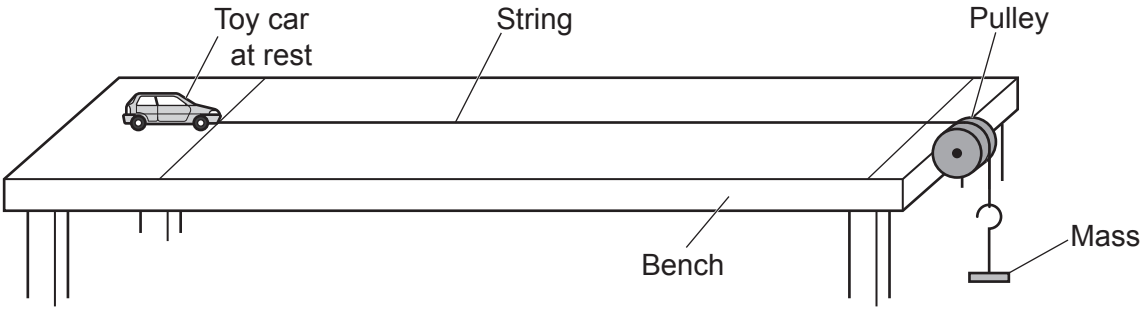
16 A student is investigating how force affects acceleration. They set up this apparatus.



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

Include any extra equipment they need.

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..... **[4]**

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

One of these forces is air resistance.

Name the **other** force.

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

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

.....

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

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(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]

(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]**

(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]**

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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]

(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]**

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

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

Optional diagram

.....

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.....

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

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

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

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