OCR
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Tuesday 23 November 2021 – Morning

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

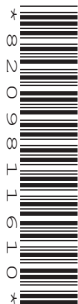**J250/11** Paper 11 (Higher Tier)

Time allowed: 1 hour 10 minutes

You must have:
- a ruler (cm/mm)
- the Data 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 pages 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.

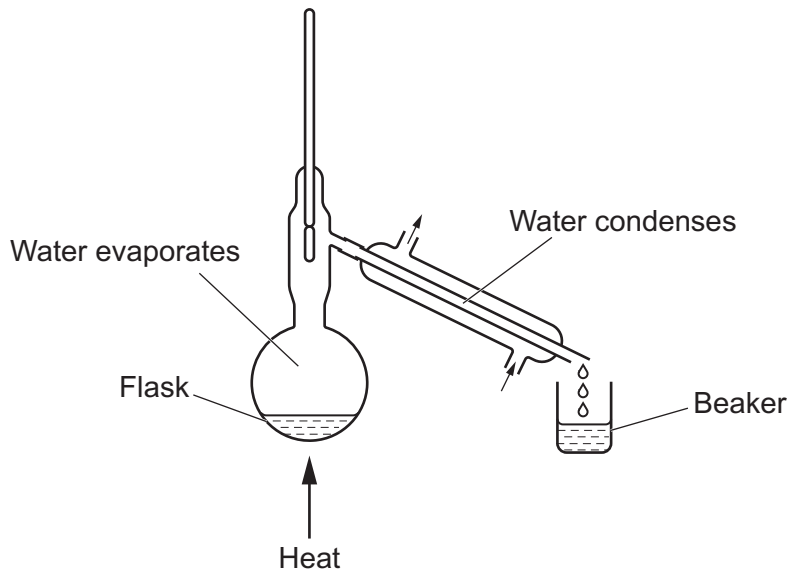OCR is an exempt Charity

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SECTION A

Answer **all** the questions.

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

Write your answer to each question in the box provided.

1   A teacher is distilling water using the equipment shown in the diagram.

Distillation involves evaporating and condensing the water.

When the teacher starts, there is 100 g of water in the flask, and the beaker is empty.

They stop when less than half of the water in the flask has been distilled.

Which statement is correct?

A   Mass of water in flask + Mass of water in beaker = 100 g

B   Mass of water in flask – Mass of water in beaker = 100 g

C   Mass of water in flask = Mass of water in beaker

D   There is twice as much water in the beaker than in the flask

Your answer [ ]   **[1]**

2   A magnetic field is produced around a current-carrying wire.
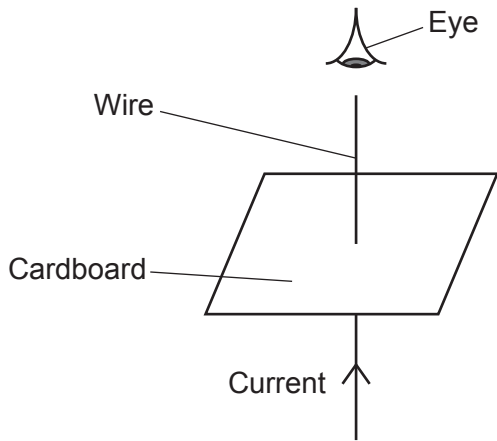
A student views the magnetic field from above, as shown by the eye in the diagram.

Which diagram shows the magnetic field around the wire?
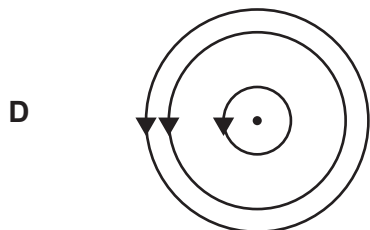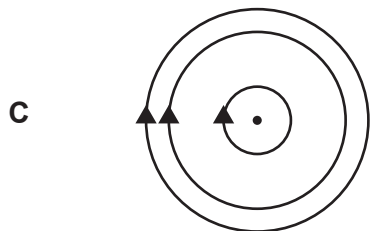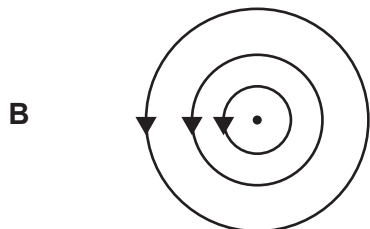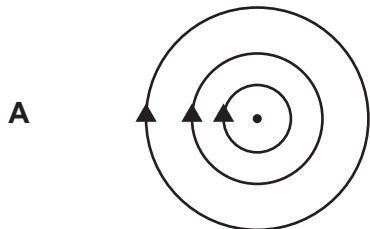
Your answer ☐   **[1]**

3 Which row of the table describes charge and current?

	Charge	Current
A	A property of all matter	The energy supplied per coulomb
B	A property of all matter	The rate of flow of charge
C	Resistance to current flow	The energy supplied per coulomb
D	Resistance to current flow	The rate of flow of charge

Your answer [   ] **[1]**

4 Circuits **X** and **Y** contain identical lamps.
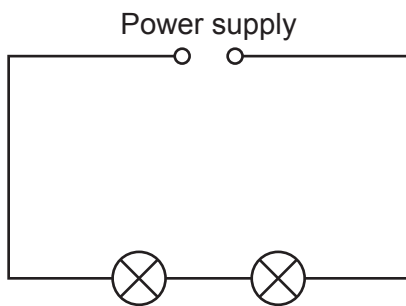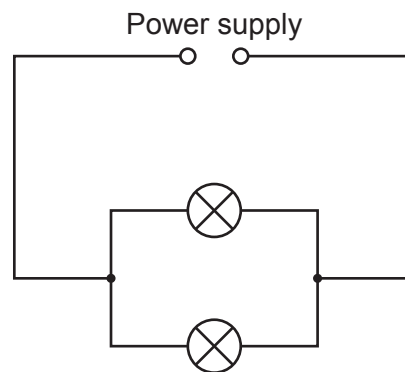
Circuit **X**   Circuit **Y**

Which statement explains why circuit **X** has a higher resistance than circuit **Y**?

A In circuit **X** each lamp has the full potential difference across it.

B In circuit **X** the current is the same at all points.

C In circuit **Y** the current is the same at all points.

D In circuit **Y** there are two pathways for current.

Your answer [   ] **[1]**

5 This is a force-extension graph for a spring.
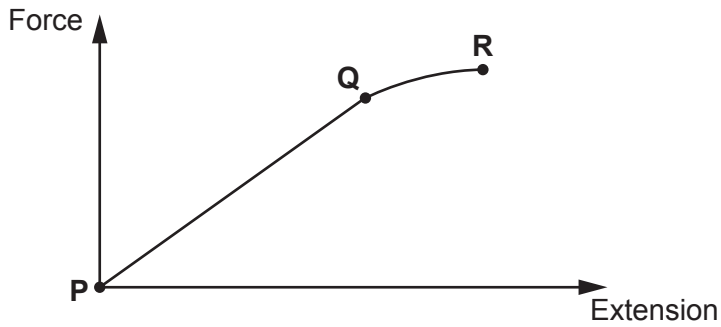
Which statement is correct?

A Between **P** and **Q**, the graph is linear and obeys Hooke's law.

B Between **Q** and **R**, the graph is linear and obeys Hooke's law.

C The spring obeys Hooke's law and the graph is linear.

D The spring only obeys Hooke's law between **Q** and **R**.

Your answer [1]

6 Electrical circuits can be used to transfer energy.

Which row of the table correctly shows the information needed to calculate the amount of energy transferred?

	Current	Potential difference	Time the circuit is used for
A	✓	✓	✗
B	✓	✗	✗
C	✓	✓	✓
D	✗	✓	✓

Your answer [1]

7   This apparatus is used to measure the pressure of a fixed volume of gas.
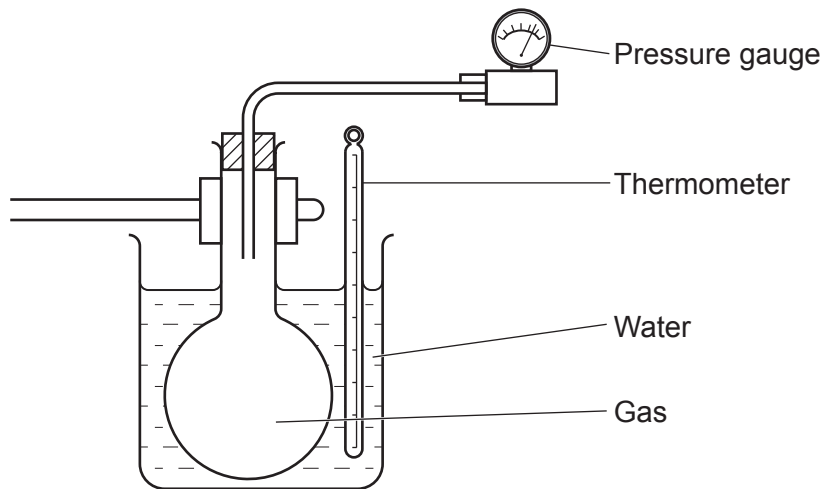
When the temperature of water increases what happens to the pressure and the speed of the gas particles?

	Pressure	Speed of gas particles
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

Your answer ☐   **[1]**

8 A current-carrying wire is placed in a magnetic field.
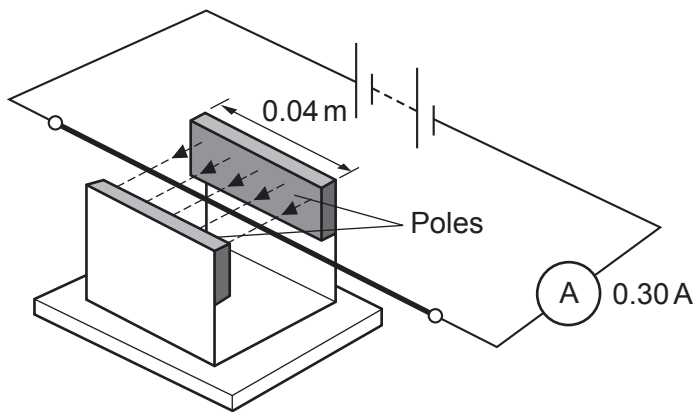
The magnetic flux density between the poles is 0.08 T.

Calculate the force acting on the wire.

Use values from the diagram and an equation from the Data Sheet to help you.

A 9.6×10^{-5} N

B 9.6×10^{-4} N

C 9.6×10^{-3} N

D 9.6×10^{-2} N

Your answer [ ] **[1]**

9 This is a diagram of a collision between two cars.

The cars stick together in the collision.

Before collision		**After collision**

| Mass = 1200 kg | Mass = 800 kg | Mass = 2000 kg |
| Velocity = 10 m/s | Velocity = 5 m/s | Velocity = ? m/s |

Which statement is correct?

A The total momentum after the collision = 8 m/s.

B The total momentum after the collision = 64 000 J.

C The total momentum before the collision = 8 000 kg m/s.

D The total momentum before the collision = 16 000 kg m/s.

Your answer [ ] **[1]**

10 This is a velocity-time graph for an object.
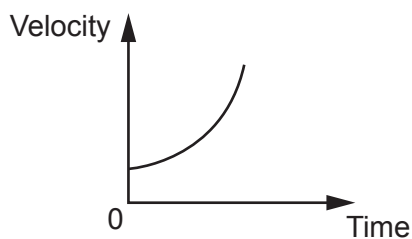
Which statement describes the motion of the object?

A The object has a constant acceleration.

B The object is accelerating at a decreasing rate.

C The object is accelerating at an increasing rate.

D The object is decelerating.

Your answer [ ] **[1]**

SECTION B

Answer **all** the questions.

11 (a) Here are some events in atomic theory:

1	Thomson	Discovered the electron. Published findings in a scientific journal.
2	Chadwick	Discovered the neutron.
3	Bohr	Suggested electron shells after a science conference.
4	Rutherford	Did experiments showing the atom had a nucleus.
5	Thomson	Published the 'plum pudding' model in a scientific journal.

(i) Place the events in the order they occurred.

Write the numbers in the boxes below. One has been done for you.

Year
1897

1932   **2**
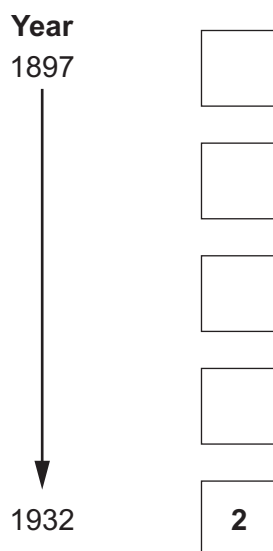
[2]

(ii) The events were peer reviewed **and** communicated to others.

Suggest why **both** are important in science.

Peer review ....

....

Communication ....

....

[2]

Turn over

(b) **Table 11.1** gives the density of different materials.

Material	State	Density (kg/m^3)
Argon	Gas	1.45
Copper	Solid	8960
Ethanol	Liquid	789
Iron	Solid	7870
Oxygen	Gas	1.31
Water	Liquid	998

Table 11.1

(i) Describe any trends in the data in **Table 11.1**.

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.... **[2]**

(ii) Explain the difference in density between solids and liquids.

You may draw diagrams to help your answer.

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.... **[2]**

(c) **Table 11.2** gives some information about ethanol and water.

Liquid	Specific heat capacity (J/kg°C)	Specific latent heat of vaporisation (J/kg)
Ethanol	2440	846 000
Water	4200	2 256 000

Table 11.2

(i) The specific latent heat of vaporisation is the energy transferred when 1 kg of a substance changes from liquid to gas.

Calculate the amount of energy needed to evaporate 0.2 kg of **ethanol**.

Use **Table 11.2** and an equation from the Data Sheet to help you.

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

(ii) The energy needed to heat 1 kg of water by 1 °C is 4200 J.

The energy needed to evaporate 1 kg of water is 2 256 000 J.

This is much **more** than 4200 J. Explain why.

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.... **[2]**

12 (a) Explain **in words** what is meant by **power**.

....

.... **[1]**

(b) (i) A weightlifter lifts a 200 pound (200 lb) mass.

1 lb = 0.454 kg.

Calculate the weight of the mass in Newtons.

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

Gravitational field strength = 10 N / kg.

Weight = ... N **[3]**

(ii) This is some data for a weightlifter.

Weight lifted   =   620 N
Height of the lift   =   1.6 m
Time taken to complete lift   =   4.0 s

Calculate the power generated by the weightlifter.

Use the equations: work done = force × distance
                              power = work done / time

Power = ...W **[4]**

13* This is the plan view of a corridor in a school building.

The arrow **XY** shows the path student **A** takes to walk around the corridor from **Room 1** to **Room 2**.

Student **A** takes 120 seconds to walk from point **X** to point **Y**. Student **B** describes the motion:

'The average velocity of student **A** is greater than their average speed.'

'This is because their displacement is greater than the distance they travel.'

Evaluate these statements.

Use calculations to help explain your answer.

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.... **[6]**

Turn over

14 This is a picture of a ball on a field.
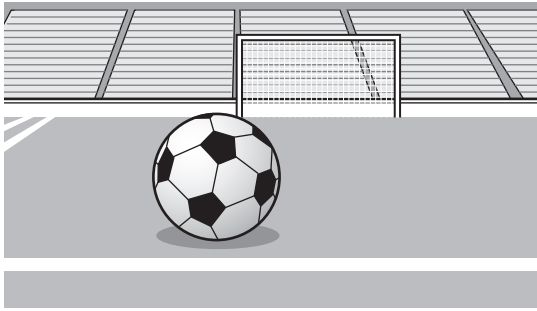
(a) Draw a free-body force diagram for the **ball**.

[2]

(b) (i) The ball is stationary on the field. Explain why using Newton's laws.

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.... [1]

(ii) Student **A** kicks the ball with their toes.

This hurts the student's toes. Explain why using Newton's laws.

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.... [3]

(c) (i) Student **A** kicks the ball.

Their boot is in contact with the ball for 0.05 s.

The velocity of the ball increases by 25 m/s.

Calculate the acceleration of the ball.

Use the equation: acceleration = change in velocity / time

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

(ii) Student **B** kicks the ball with a force of 216 N.

The mass of the ball is 0.45 kg.

Calculate the acceleration of the ball.

Use the equation: force = mass × acceleration

Acceleration = ... m/s^2 **[3]**

15 A student does an experiment to measure the resistance of a coil of wire.

The diagrams in **Fig. 15.1** show the meters used in this experiment:
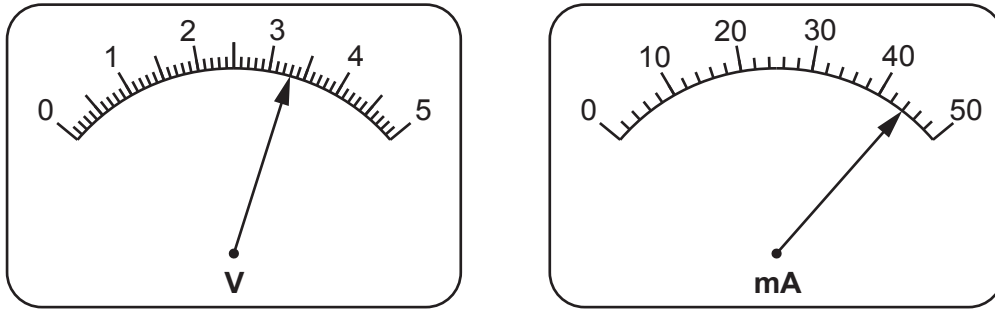
Fig. 15.1

 (a) Meter **V** measures potential difference.

Complete the table to describe meter **V**.

Name of meter **V**	
Smallest change in potential difference that can be measured on meter **V**	

[1]

 (b) Draw a circuit diagram for the experiment.

Use the symbol for a fixed resistor to represent the coil of wire that the student is testing.

[3]

(c) (i) Write down the values of potential difference and current shown by the meters in **Fig. 15.1**.

Potential difference = ... V

Current = ... mA

[2]

(ii) Calculate the resistance of the coil of wire.

Resistance = ... Ω **[3]**

(d) (i) To improve the experiment, the student places the coil of wire in a beaker of water, as shown in **Fig. 15.2**.

Fig. 15.2
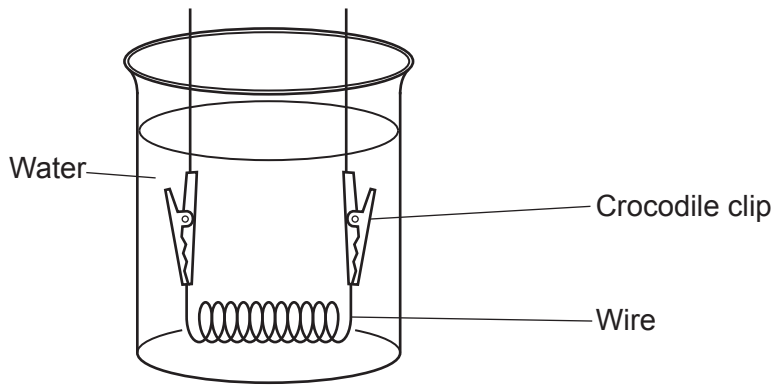
Suggest **two** reasons why this improves the experiment.

1 ....

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2 ....

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[2]

(ii) The student adds a variable resistor in series with the wire.

Suggest **two** reasons why this improves the method.

1 ....

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2 ....

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[2]

END OF QUESTION PAPER

19

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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