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GCSE (9–1) Combined Science A (Physics) (Gateway Science)
J250/11 Paper 11, P1–P3 and CS7 (PAGs P1–P6) (Higher Tier)

Wednesday 23 May 2018 – Afternoon
Time allowed: 1 hour 10 minutes

First name	
Last name	

Centre number					Candidate number				

INSTRUCTIONS
• The Data Sheet will be found inside this document.
• Use black ink. You may use an HB pencil for graphs and diagrams.
• Complete the boxes above with your name, centre number and candidate number.
• Answer **all** the questions.
• Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
• Do **not** write in the barcodes.

## INFORMATION
• The total mark for this paper is **60**.
• The marks for each question are shown in brackets **[ ]**.
• Quality of extended responses will be assessed in questions marked with an asterisk (*).
• This document consists of **16** pages.

SECTION A

Answer **all** the questions.

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

1 Four compasses are each placed near to a wire at points **A**, **B**, **C** and **D**. Each wire has a current flowing through it. The distance of each compass from its wire is shown.
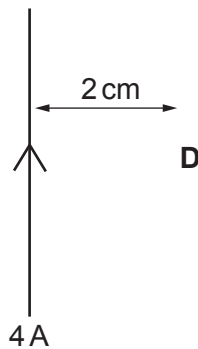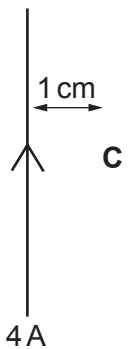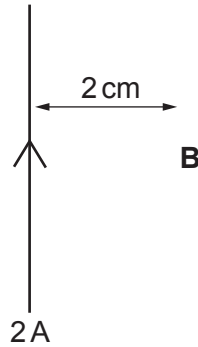
Which compass experiences the **greatest** magnetic field strength?

Your answer [ ] **[1]**

2 Which of the following is a definition for specific heat capacity in physics?

A Energy needed to increase the temperature of 1 g of material by 1 °C.

B Energy needed to increase the temperature of 1 kg of material by 1 °C.

C Energy needed to increase the temperature of 1 g of material by 10 °C.

D Energy needed to increase the temperature of 1 kg of material by 10 °C.

Your answer [ ] **[1]**

3 A student wishes to draw a diagram of a circuit she has created.
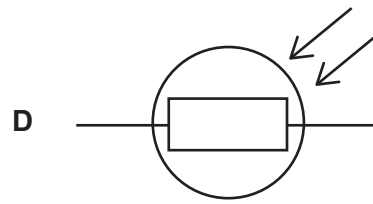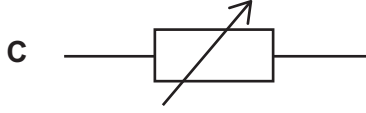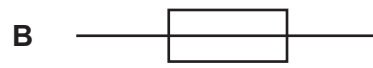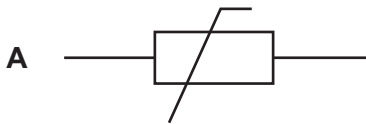
Which diagram **A**, **B**, **C** or **D** shows the circuit symbol for a variable resistor?

Your answer [   ] **[1]**

4 Which of the following forces is a non-contact force?

A Drag

B Electrostatic

C Tension

D Upthrust

Your answer [   ] **[1]**

5 In which circuit would a current flow?
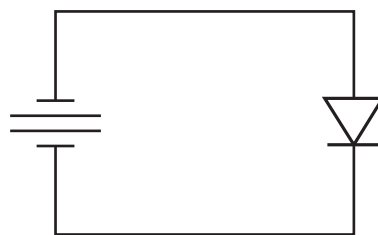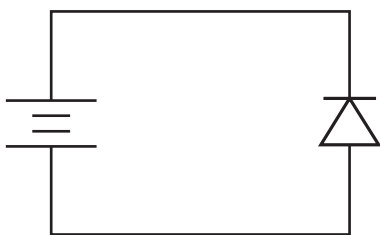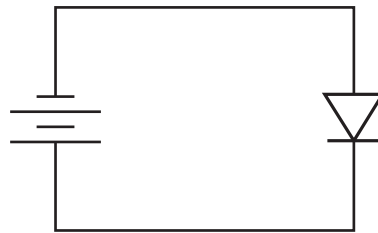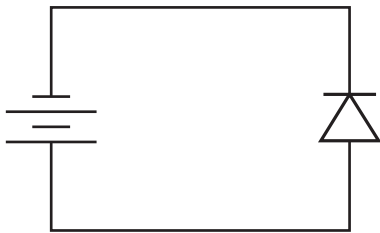
Your answer [   ] **[1]**

6   Which of the following is the same speed as 7.2 km/h?

    A   2.0 m/s

    B   20.0 m/s

    C   25.9 m/s

    D   120.0 m/s

    Your answer ☐   **[1]**

7   A student is heating substances in four identical beakers **A**, **B**, **C** and **D**. Some information about the contents of the beakers is shown below.
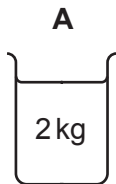
A

2 kg

Specific heat capacity
= 4200 J/kg °C

B

1 kg

Specific heat capacity
= 4200 J/kg °C

C

2 kg

Specific heat capacity
= 2000 J/kg °C

D

4 kg

Specific heat capacity
= 2000 J/kg °C

Which beaker requires the **greatest** amount of energy to raise the temperature of its contents by 1 °C?

Your answer ☐   **[1]**

8 Look at the graph below.
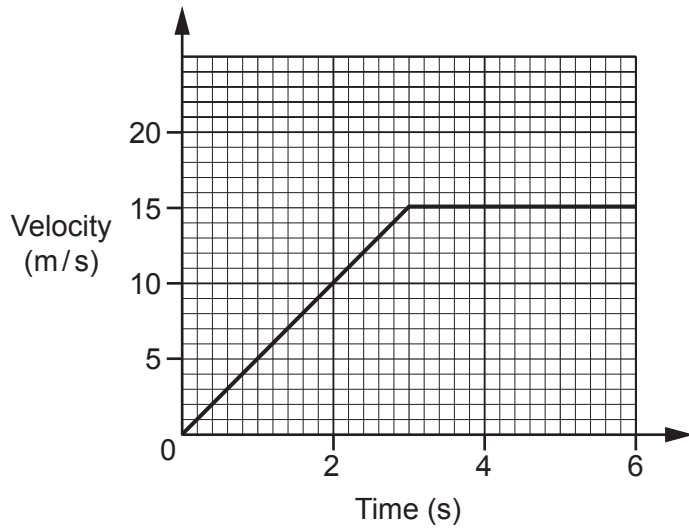
Which of the following is the distance travelled between 0 and 6 seconds?

A 22.5 m

B 45.0 m

C 67.5 m

D 90.0 m

Your answer [___]   **[1]**

9 How can mass be calculated?

A Acceleration divided by force

B Force divided by acceleration

C Gravity divided by weight

D Weight divided by force

Your answer [___]   **[1]**

Turn over

10 A student lifts four different objects onto a set of shelves.

Object	Mass (kg)	Height lifted (m)
A	0.1	2.2
B	0.3	1.5
C	0.4	1.7
D	0.5	2.0

Which object gains the **most** gravitational potential energy?

Your answer ⬜ **[1]**

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SECTION B

Answer **all** the questions.

11 (a) A student uses a small motor to lift a toy car through a vertical distance of 1.0 m.

Motor

1.0 m
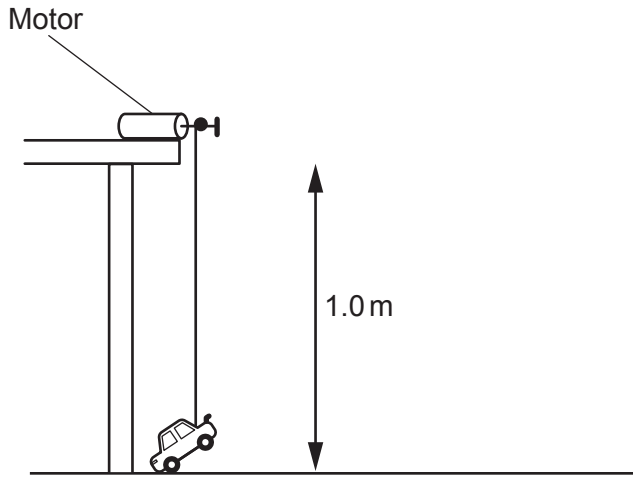
The car has a weight of 0.05 N.

(i) Calculate the work done when lifting the car through this distance.

Answer = ... J **[3]**

(ii) Calculate the power of the motor if the car takes 5.0 seconds to travel the 1.0 m distance.

State the unit.

Answer = ... Unit .... **[4]**

(b) The motor uses 2 cells in series.

Each cell has a potential difference of 1.5 V.

(i) Write down the total potential difference of the cells.

Answer = ... V **[1]**

(ii) The motor has a resistance of 6.0 Ω.

Calculate the current in the circuit when the motor is in use.

Use the equation: Potential difference = Current × Resistance

Answer = ... A **[3]**

(c) The student wishes to increase the time taken to lift this toy car vertically through the 1.0 m distance shown.

Suggest a change he could make to this experiment to achieve this.

....

.... **[1]**

12 A teacher demonstrates static electricity using a Van de Graaff generator.

She places 3 metal foil containers on top of the dome of the Van de Graaff generator. When the Van de Graaff generator is turned on, the foil containers fly off the dome one by one.

Foil containers

Dome

Belt
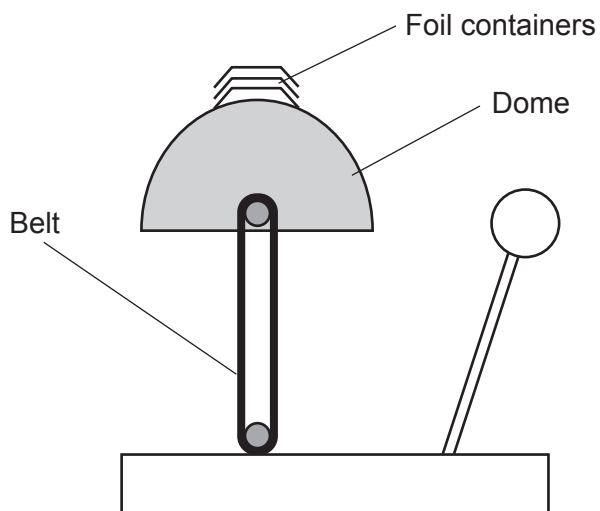
(a) Explain why this happens.

Use ideas about charge in your answer.

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.... **[4]**

(b) Calculate how long it would take for a charge of 5.0 C to flow with a current of 25 mA.

Use the equation: Charge flow = Current × Time

Answer = ... s **[4]**

13* A student removes a material from a freezer and heats it up.

He uses a heater with a constant power output. He then plots a heating curve of the material as its temperature rises.
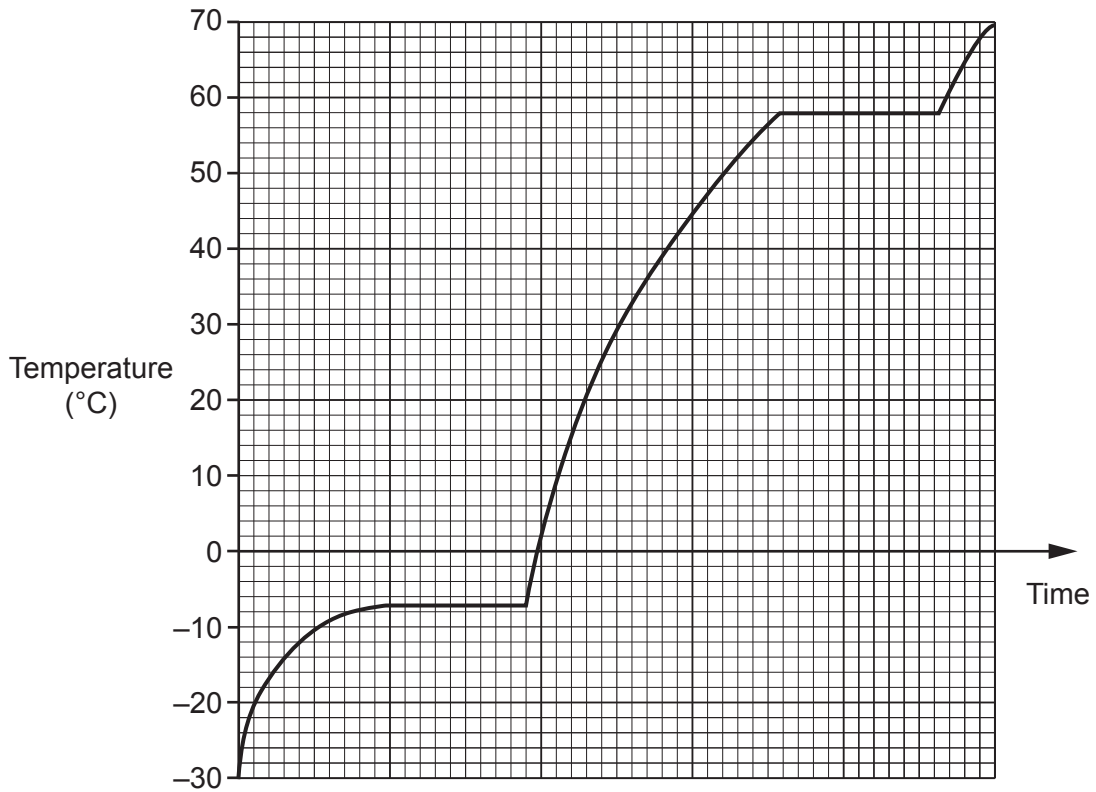
Describe and explain what the graph tells us about the material being heated.

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.... **[6]**

Turn over

14 (a) Objects in freefall eventually reach terminal velocity.

Draw a labelled diagram to show the forces acting on an object when it is falling at terminal velocity.

[3]

(b) A student measures two forces.

The forces are 5.0 N and 3.0 N. The forces act at 90° to each other.

Draw a scale drawing to determine the resultant force.

Answer = ... N **[3]**

(c) An object travelling in a circle at a constant speed has a changing velocity.

State why.

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.... **[1]**

15 (a) (i) Fleming's left-hand rule is used to show the direction of the force produced when a current flows in a magnetic field.

Explain how.

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.... **[3]**

(ii) A simple motor is shown in the diagram.
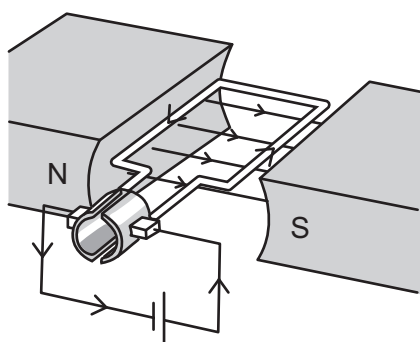
Use the diagram to explain how rotation is caused in the motor.

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.... **[3]**

(b) Calculate the magnetic flux density on a 0.5 m long conductor when a current of 0.8 A flows.

The force produced is 0.6 N.

Answer = ... T **[3]**

Turn over

16 Two students investigate how the resistance of a thermistor varies with temperature.

The students place the thermistor in a beaker of water and measure the resistance of the thermistor for 5 different temperatures. They repeat the experiment three times at each temperature in order to calculate a mean.

Temperature (°C)	Resistance (Ω)			
	1	2	3	Mean
10	1900	1870	1930	1900
15	980	1000	990	990
20	770	760	760	763.3
25	610	720	610	647
30	540	540	530	536

(a) (i) Describe the pattern shown by these results.

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.... **[2]**
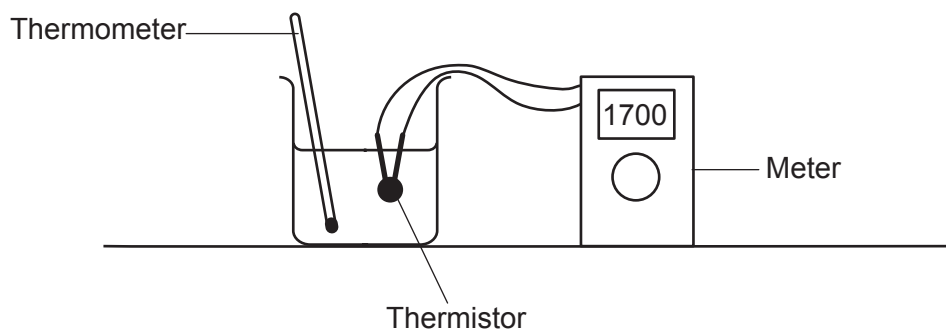
(ii) The students have made mistakes when recording their results.

Identify **two** mistakes **and** explain what they should have done.

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.... **[2]**

(b) Suggest **one** way the experiment could be improved.

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.... **[1]**

(c) At 10 °C the thermistor had a resistance of 1900 Ω. The thermistor has a power rating of 75 × 10^{-3} W.

Calculate the maximum current in this thermistor at 10 °C.

Use the equation: Power = Current^2 × Resistance

Answer = ... A **[3]**

END OF QUESTION PAPER

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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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