

Combined Science  
PAPER 6  
Foundation Tier

Total Marks
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Friday 14 June 2024 – Afternoon

Time: 1 hour 10 minutes

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

**YOU MUST HAVE**

**Calculator, ruler, Equation Booklet (enclosed)**

**YOU WILL BE GIVEN**

**Diagram Booklet**

**INSTRUCTIONS**

**Answer ALL questions.**

**Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – there may be more space than you need.**

**Calculators may be used.**

**Any diagrams may NOT be accurately drawn, unless otherwise indicated.**

**You must show all your working out with your answer clearly identified at the end of your solution.**

**Turn over**

## **INFORMATION**

**The total mark for this paper is 60.**

**The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.**

**In questions marked with an ASTERISK (\*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.**

**There may be spare copies of some diagrams.**

## **ADVICE**

**Read each question carefully before you start to answer it.**

**Try to answer every question.**

**Check your answers if you have time at the end.**

**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.**

- 1 (a) Look at Figure 1 for Question 1(a) in the Diagram Booklet. It shows a circuit containing a battery and FOUR other components.**

**Label the FOUR components in Figure 1, using words from the list below.  
(4 marks)**

**ammeter**

**lamp**

**LDR**

**switch**

**thermistor**

**variable resistor**

**(continued on the next page)**

**1 continued.**

**(b) The circuit in Figure 1 is switched on.**

**A charge of  $1.2\text{ C}$  leaves the battery  
in a time of  $4.0\text{ s}$**

**Calculate the current in the circuit.**

**Use the equation**

$$\text{current} = \frac{\text{charge}}{\text{time}}$$

**(2 marks)**

**current = \_\_\_\_\_ A**

**(Total for Question 1 = 6 marks)**

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**Turn over**

- 2 (a) Look at Figure 2 for Question 2(a) in the Diagram Booklet. It shows the shape of the magnetic field lines around a bar magnet.**
- (i) Draw ONE arrow on a magnetic field line in Figure 2 to show the direction of that magnetic field line. (1 mark)**
- (ii) Draw an X on Figure 2 to show where the magnetic field is strongest. (1 mark)**
- (iii) Give a reason why Figure 2 shows the magnetic field is strongest at point X. (1 mark)**
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**2 continued.**

**(b) A student places two magnets on a smooth bench.**

**Look at Figure 3 for Question 2(b) in the Diagram Booklet. The student holds the magnets close to each other, as shown in Figure 3.**

- (i) Draw some magnetic field lines on Figure 3 to show the shape of the magnetic field BETWEEN the two magnets.  
(2 marks)**

**(continued on the next page)**



**2(b) continued.**

**(ii) The student is holding the two magnets on the smooth bench.**

**State what would happen if the student let go of one of the magnets.  
(1 mark)**

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**(continued on the next page)**

**2 continued.**

**(c) Look at Figure 4 for Question 2(c) in the Diagram Booklet. A student is given two permanent magnets and some paper clips, as shown in Figure 4.**

**The paper clips are NOT magnets, but they are made from a magnetic material.**

**(i) Which of these is a magnetic material?  
(1 mark)**

☐ **A aluminium**

☐ **B iron**

☐ **C plastic**

☐ **D wood**

**(continued on the next page)**

**Turn over**

**2(c) continued.**

- (ii) Describe how the student could use the paper clips to find out which of the two permanent magnets is the stronger magnet. (2 marks)**

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**(Total for Question 2 = 9 marks)**

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**Turn over**

- 3 (a) Look at Figure 5 for Question 3(a) in the Diagram Booklet. It shows a truck on a horizontal road.**
- (i) A force of 1200 N pulls the truck along the road for a distance of 8.0 m**

**Calculate the work done by the 1200 N force.**

**Use the equation**

**work done = force ×  
distance moved in the direction of the force**

**State the unit of work done.  
(3 marks)**

**Answer space continues on the next page.**

**3(a)(i) continued.**

**work**  
**done =** \_\_\_\_\_  
**unit** \_\_\_\_\_

**(continued on the next page)**

**Turn over**

**3(a) continued.**

- (ii) At 8.0 m the force is removed and the truck slows down until it stops.**

**Describe the energy transfers as the truck slows down.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**3 continued.**

**(b) A box has a mass of 90 kg**

**Which of these is the weight of the box?**

**(1 mark)**

☐ **A 9 N**

☐ **B 90 N**

☐ **C 900 N**

☐ **D 9000 N**

**(continued on the next page)**

**3 continued.**

**(c) Look at Figure 6 for Question 3(c) in the Diagram Booklet. It shows a truck lifting a different box.**

**A student calculates the change in gravitational potential energy,  $\Delta GPE$ , for the box at different heights.**

**Look at Figure 7 for Question 3(c) in the Diagram Booklet. It shows the results of the student's calculations.**

**(i) The student has made one incorrect calculation.**

**On Figure 7, draw a circle round the ● for this incorrect calculation.  
(1 mark)**

**(continued on the next page)**

**Turn over**



**3(c) continued.**

**(ii) The truck lifts the box from the ground to a height of 2.0 m**

**This takes a time of 5.0 s**

**Using data from the graph in Figure 7, calculate the power needed to lift the box.  
(3 marks)**

**Use the equation**

$$\text{power} = \frac{\Delta \text{GPE}}{\text{time}}$$

**Answer space continues on the next page.**

**3(c)(ii) continued.**

**power = \_\_\_\_\_ W**

**(Total for Question 3 = 10 marks)**

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**Turn over**

**4 Look at Figure 8 for Question 4 in the Diagram Booklet. It shows a saucepan of milk being heated on an electric cooker.**

**(a) Look at Figure 9 for Question 4(a) in the Diagram Booklet. It is a table of data about the milk being heated.**

**(i) Using data from the table in Figure 9, calculate the increase in temperature of the milk.  
(1 mark)**

**increase in  
temperature = \_\_\_\_\_ °C**

**4(a) continued.**

- (ii) Using data from the table in Figure 9, calculate the specific heat capacity of the milk.**

**Use the equation**

$$\text{specific heat capacity} = \frac{\text{change in thermal energy}}{\text{mass} \times \text{increase in temperature}}$$

**(2 marks)**

**specific heat  
capacity = \_\_\_\_\_ J/kg °C**

**(continued on the next page)**

**Turn over**

**4 continued.**

**(b) The cooker supplies 130 000 J of energy in a time of 87 s.**

**(i) Calculate the power supplied by the cooker.**

**Use the equation**

$$P = \frac{E}{t}$$

**Give your answer to  
2 significant figures.  
(3 marks)**

**Answer space continues on the next page.**

**4(b)(i) continued.**

**power = \_\_\_\_\_ W**

**(continued on the next page)**

**Turn over**

**4(b) continued.**

- (ii) The cooker supplies 130 000 J of energy but only 96 000 J of this energy is used to heat the milk.**

**Calculate the efficiency of heating the milk using this cooker.**

**Use the equation**

$$\text{efficiency} = \frac{\text{useful energy transferred}}{\text{total energy supplied}}$$

**(2 marks)**

**Answer space continues on the next page.**

**4(b)(ii) continued.**

**efficiency = \_\_\_\_\_**

**(continued on the next page)**

**Turn over**



**4 continued.**

**(c) The wiring for the cooker has safety features.**

**(i) Which of these wires would help to protect a person from getting an electric shock if a fault developed in the cooker?  
(1 mark)**

- ☐ **A earth**
- ☐ **B live**
- ☐ **C negative**
- ☐ **D positive**

**(continued on the next page)**

**Turn over**

**4(c) continued.**

- (ii) Explain how a fuse can prevent overheating of the wiring for the cooker.  
(2 marks)**

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**(Total for Question 4 = 11 marks)**

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- 5 (a) Look at Figure 10 for Question 5(a) in the Diagram Booklet. It is a circuit diagram.**

**The current at P is  
(1 mark)**

☐ **A 0.05 A**

☐ **B 0.10 A**

☐ **C 0.15 A**

☐ **D 0.20 A**

**(continued on the next page)**

**5 continued.**

**(b) Some students investigate resistors in parallel.**

**The students set up a circuit containing FOUR identical resistors.**

**Look at Figure 11 for Question 5(b) in the Diagram Booklet. The circuit used is shown in Figure 11.**

**The students measure the current from the power supply and the voltage (p.d.) across the resistors.**

**(i) On Figure 11, draw a voltmeter connected to measure the voltage (p.d.) across the resistors.  
(1 mark)**

**(continued on the next page)**

**Turn over**

**5(b) continued.**

**The students remove one resistor and measure the current and voltage again with only 3 resistors in the circuit.**

**They repeat the measurements of current and voltage with only 2 resistors in the circuit and then with only 1 resistor in the circuit.**

**Look at Figure 12 for Question 5(b)(ii) in the Diagram Booklet. It is a table of their results.**

**(continued on the next page)**

**5(b) continued.**

- (ii) Using data from the table in Figure 12, predict the current from the power supply when there are 4 resistors in the circuit.  
(1 mark)**

**current = \_\_\_\_\_ mA**

**(continued on the next page)**

**Turn over**

**5(b) continued.**

**(iii) Using data from the table in Figure 12, calculate the resistance of ONLY 1 resistor.  
(3 marks)**

**resistance = \_\_\_\_\_  $\Omega$**

**(continued on the next page)**

**Turn over**

**5(b) continued.**

- (iv) Using data from the table in Figure 12, explain what happens to the total resistance of the circuit as the number of resistors in parallel decreases. (3 marks)**

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**5 continued.**

**(c) An electric fire is connected to a 230 V mains supply.**

**A current of 9.0 A is supplied to the fire.**

**Calculate the power supplied to the fire.**

**Use the equation**

**power = current  $\times$  voltage**

**(2 marks)**

**Answer space continues on the next page.**

**5(c) continued.**

**power = \_\_\_\_\_ W**

**(Total for Question 5 = 11 marks)**

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**Turn over**

- 6 (a) A coil of copper wire has a mass of  $14.1 \text{ g}$

The density,  $\rho$ , of copper is  $8.96 \text{ g/cm}^3$

Calculate the volume of the copper wire.

Use the equation

$$\rho = \frac{m}{V}$$

(3 marks)

Answer space continues on the next page.

**6(a) continued.**

**volume = \_\_\_\_\_ cm<sup>3</sup>**

**(continued on the next page)**

**Turn over**

**6 continued.**

**(b) Look at Figure 13 for Question 6(b) in the Diagram Booklet. It gives information about the density of aluminium.**

**Explain the difference between the density of solid aluminium and the density of liquid aluminium in terms of the arrangement of particles.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**6 continued.**

**(c) A student boils some water.**

**Calculate the amount of thermal energy needed to change 60·0 g of water to steam at its boiling point.**

**The specific latent heat of vaporisation of water,  $L$ , is  $2\cdot26 \times 10^6 \text{ J/kg}$**

**Use the equation**

$$Q = m \times L$$

**(2 marks)**

**Answer space continues on the next page.**

**Turn over**

**6(c) continued.**

**amount of  
thermal energy = \_\_\_\_\_ J**

**(continued on the next page)**

**Turn over**

**6 continued.**

**\*(d) A student is investigating the melting of ice.**

**The student has some crushed ice in a beaker at a temperature of  $-20^{\circ}\text{C}$**

**The student heats the beaker and its contents for 20 minutes.**

**Look at Figure 14 for Question 6(d) in the Diagram Booklet. It is a graph of the student's results.**

**Using information from the graph, describe the changes that take place in the 20 minutes shown on the graph.**

**(continued on the next page)**



**6(d) continued.**

**Your answer should refer to**

- **data from the graph**
- **the state (solid, liquid or gas) of the contents of the beaker.**

**(6 marks)**

**Answer space continues on the next 2 pages.**

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**Turn over**

**6(d) continued.**

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**Turn over**

**6(d) continued.**

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**(Total for Question 6 = 13 marks)**

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**TOTAL FOR PAPER = 60 MARKS**  
**END OF PAPER**