

**Combined Science**  
**PAPER 6**  
**Foundation Tier**

<b>Total Marks</b>
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**Time: 1 hour 10 minutes**

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

<b>Surname</b>					
<b>Other names</b>					
<b>Centre Number</b>					
<b>Candidate Number</b>					

**YOU MUST HAVE**

**Calculator, ruler, Equation Booklet**

**YOU WILL BE GIVEN**

**Diagram Booklet, Additional Equations Insert**

**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.**

## **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.**

**A list of equations is provided as a separate booklet and insert.**

**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.**

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**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 This question is about electrical circuits.**

**(a) Look at the diagram for Question 1(a) in the Diagram Booklet. Draw ONE straight line from each circuit symbol to its description.  
(3 marks)**

**(b) Look at Figure 1 for Question 1(b) in the Diagram Booklet. It shows a lamp in a circuit.**

**The lamp is switched on.**

**(i) The current in the lamp is a flow of  
(1 mark)**

☐ **A atoms**

☐ **B electrons**

☐ **C neutrons**

☐ **D protons**

**(continued on the next page)**

**1 continued.**

**(ii) The current in the lamp is 0.21 A.**

**Calculate the charge that flows through the lamp in a time of 300 s.**

**State the unit of charge.  
(3 marks)**

**Use the equation**

**charge = current  $\times$  time**

**charge = \_\_\_\_\_ unit \_\_\_\_\_**

**(Total for Question 1 = 7 marks)**

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- 2 (a) Look at Figure 2 for Question 2(a) in the Diagram Booklet. A teacher prepares some equipment to demonstrate electromagnetism. Figure 2 shows the equipment.

The teacher wants to show that iron filings

- are picked up by the metal rod when the switch is closed
- fall off the metal rod when the switch is opened again.

- (i) Suggest a suitable metal for the rod.  
(1 mark)

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(continued on the next page)

**2 continued.**

**(ii) Give TWO reasons for your choice.  
(2 marks)**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**



**2 continued.**

- (b) A student's mobile phone has an app to measure a magnetic field.**

**The student places the phone on a table and rotates the phone until it is pointing north.**

**There are no magnets near to the phone.**

**Look at Figure 3 for Question 2(b)(i) in the Diagram Booklet. It shows the display on the screen of the phone.**

- (i) State why the strength of the magnetic field shown is not zero.**  
**(1 mark)**

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**(continued on the next page)**

**2 continued.**

**The student places a magnet near to the phone on the table.**

**Look at Figure 4 for Question 2(b)(ii) in the Diagram Booklet. It shows the magnet and the new display on the screen.**

- (ii) State TWO changes in the magnetic field measured by the phone from Figure 3 to Figure 4.  
(2 marks)**

**1** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**2** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**(continued on the next page)**

**2 continued.**

- (iii) Describe how the student could use the mobile phone to investigate the strength of the magnetic field at different distances from the magnet.  
(3 marks)**

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

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- 3 (a) An electric water pump is powered by the 230 V mains supply.**

**Look at Figure 5 for Question 3(a) in the Diagram Booklet. It shows the inside of the plug on the cable to the pump.**

- (i) One wire in the plug is the earth wire.**

**The other two wires are  
(1 mark)**

- ☐ **A live and negative**
- ☐ **B live and neutral**
- ☐ **C positive and negative**
- ☐ **D positive and neutral**

**(continued on the next page)**

**3 continued.**

- (ii) Describe the purpose of the component labelled X.  
(2 marks)**

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**3 continued.**

- (b) The 230 V mains supply transfers 9000 J of energy to the pump motor in 1 minute.**

**Calculate the current in the pump motor.  
(3 marks)**

**Use the equation**

$$I = \frac{E}{V \times t}$$

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

**(continued on the next page)**

**3 continued.**

- (c) The system transfers 8400 J of useful kinetic energy to the water passing through the pump in 1 minute.**

**Look at Figure 6 for Question 3(c) in the Diagram Booklet. It shows a diagram of the energy transfers.**

- (i) Explain why the useful energy transferred to the water is different from the total energy supplied to the pump.  
(2 marks)**

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**(continued on the next page)**

**3 continued.**

- (ii) Calculate the efficiency of the pump.  
(2 marks)**

**Use the equation**

$$\text{efficiency} = \frac{\text{useful energy transferred by the pump}}{\text{total energy supplied to the pump}}$$

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

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

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**4 Three students carry out an investigation to determine their powers when running up stairs.**

**(a) Look at Figure 7 for Question 4(a) in the Diagram Booklet. It shows a diagram of the stairs with four distances, A, B, C and D, marked.**

**The students need to calculate the work done against gravity.**

**Which distance should be used in the calculation?  
(1 mark)**

☐ **A Distance A**

☐ **B Distance B**

☐ **C Distance C**

☐ **D Distance D**

**(continued on the next page)**

**4 continued.**

- (b) They take turns to run up the stairs and use a stopwatch to measure the time taken.**

**The students estimate their own weight.**

**Look at Figure 8 for Question 4(b) in the Diagram Booklet. It shows a table of their results.**

**The table is not complete.**

- (i) State the unit for work done.  
(1 mark)**

**unit for work done is \_\_\_\_\_**

- (ii) Use the data for student B to calculate his estimated weight.  
(2 marks)**

**weight = \_\_\_\_\_ N**

**(continued on the next page)**

**4 continued.**

- (iii) Use the data for student C to calculate the time she takes.  
(2 marks)**

**time taken = \_\_\_\_\_ s**

- (iv) Use the data for all three students to calculate the average power of the students.  
(2 marks)**

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

**(continued on the next page)**

**4 continued.**

- (c) Identify a significant source of error in the investigation and state how this error can be reduced.  
(2 marks)**

**source of error**

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**can be reduced by**

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**(Total for Question 4 = 10 marks)**

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- 5 (a) Look at Figure 9 for Question 5(a) in the Diagram Booklet. It shows a lamp connected to a d.c. power supply.

The power supply provides a potential difference (voltage) of 4.5 V.

The current in the lamp is 0.30 A.

- (i) Calculate the resistance of the lamp.  
(1 mark)

Use the equation

$$R = \frac{V}{I}$$

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

(continued on the next page)

**5 continued.**

- (ii) Calculate the power supplied to the lamp.  
(2 marks)**

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

**(continued on the next page)**

**5 continued.**

- (b) Look at Figure 10 for Question 5(b) in the Diagram Booklet. Another IDENTICAL lamp is added to the circuit, as shown in Figure 10.**

**The power supply provides the same potential difference as it provided in the circuit in Figure 9.**

**State and explain the difference between the brightness of the lamp in Figure 9 and the brightness of a lamp in Figure 10.**

**(3 marks)**

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**Turn over**

**5 continued.**

- (c) A student is given a low voltage power supply and 1 m of resistance wire.**

**The student uses these and other pieces of equipment to measure the resistance of just 50 cm of the resistance wire.**

**Draw a diagram of the circuit that the student should use.**

**Your circuit diagram should identify the pieces of equipment that the student uses.**

**(3 marks)**

**(continued on the next page)**

**Turn over**



**5 continued.**

- (d) Describe the difference between direct current (d.c.) and alternating current (a.c.) in electrical circuits.  
(2 marks)**

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

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- 6 (a) When water boils and turns into steam, there are changes in the arrangement of particles and the density.

Which of these shows the changes?  
(1 mark)

	<b>space between particles in steam</b>	<b>density of steam</b>
<input type="checkbox"/> A	bigger than in water	greater than water
<input type="checkbox"/> B	bigger than in water	less than water
<input type="checkbox"/> C	smaller than in water	greater than water
<input type="checkbox"/> D	smaller than in water	less than water

(continued on the next page)

**6 continued.**

- (b) Look at Figure 11 for Question 6(b) in the Diagram Booklet. It shows some water in a measuring cylinder and a lump of iron.**

**The lump of iron is lowered fully into the water.**

**The water level in the measuring cylinder rises to  $530 \text{ cm}^3$ .**

**The density of iron is  $7.9 \text{ g/cm}^3$ .**

**Calculate the mass of the lump of iron.**

**Use the equation**

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

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

**(continue your answer on the next page)**

**Turn over**

**6 continued.**

**mass = \_\_\_\_\_ g**

**(continued on the next page)**

**6 continued.**

- (c) A piece of wood has a similar shape and volume to the lump of iron.**

**The density of the wood is  $0.82 \text{ g/cm}^3$ .**

**The density of water is  $1.00 \text{ g/cm}^3$**

**Explain why the method used in part (b) cannot be used to determine the mass of the piece of wood.  
(2 marks)**

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**6 continued.**

- \*(d) A student needs to determine the specific heat capacity of water.**

**Look at Figure 12 for Question 6(d) in the Diagram Booklet. It shows some of the equipment the student uses.**

**Describe the method the student should use to determine the specific heat capacity of water.**

**Your description should include, with reasons,**

- any other equipment needed**
- the measurements needed.**

**You may draw a diagram if it helps your answer.  
(6 marks)**

**6 continued.**

**6 continued.**

[illegible]

**(continued on the next page)**

**Turn over**



**6 continued.**

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

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