

Combined Science
PAPER 6
Foundation Tier

Total Marks

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

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.

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)

- 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)**

(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)**

(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)**

(Total for Question 2 = 9 marks)

- 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)**

(continued on the next page)

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)**

(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)

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

can be reduced by

(Total for Question 4 = 10 marks)

- 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 = _____ Ω

(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)

(continued on the next page)

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)**

(Total for Question 5 = 11 marks)

- 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)

	space between particles in steam	density of steam
<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

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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 cm^3 .

The density of iron is 7.9 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 g/cm^3 .

The density of water is 1.00 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)**

(continued on the next page)

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.

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6 continued.

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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER