Paper Reference(s) 1SC0/2PH
Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Combined Science

PAPER 6

Higher Tier

Total Marks

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						

Q74483RA

Pearson

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.

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.

There may be spare copies of some diagrams.

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.

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 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)

1 continued.

(b) Some students investigate resistors in parallel.

The students set up a circuit containing FOUR identical resistors.

Look at Figure 2 for Question 1(b) in the Diagram Booklet. It shows the circuit used.

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

(i) On Figure 2, draw a voltmeter connected to measure the voltage (p.d.) across the resistors. (1 mark)

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 3 for Question 1(b) in the Diagram Booklet. It is a table of their results.

(continued on the next page)

1(b) continued.

(ii) Using data from the table in Figure 3, predict the current from the power supply when there are 4 resistors in the circuit.
(1 mark)

current = _____ mA

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

resistance = _____ Ω

(continued on the next page)

1(b) continued.

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

(Total for Question 1 = 9 marks)

2 (a) A coil of copper wire has a mass of 14·1 g

The density, ρ, of copper is 8·96 g/cm^3

Calculate the volume of the copper wire.

Use the equation

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

(3 marks)

volume = _____ cm^3

(continued on the next page)

2 continued.

(b) Look at Figure 4 for Question 2(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)

(continued on the next page)

2 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 $2{\cdot}26 \times 10^6$ J/kg

Use the equation

$$Q = m \times L$$

(2 marks)

amount of thermal energy = _____ J

(continued on the next page)

2 continued.

(d) Look at Figure 5 for Question 2(d) in the Diagram Booklet.

Some students measure the volume of a lump of modelling clay using a measuring jug, as shown in Figure 5.

Using Figure 5, estimate the volume of the modelling clay in cm^3

You may assume that 1 litre = 1000 cm^3

(2 marks)

volume = _____ cm^3

(Total for Question 2 = 9 marks)

3 (a) Look at Figure 6 for Question 3(a) in the Diagram Booklet. It represents the Earth.

Figure 6 shows TWO magnetic compass needles placed near to the Earth's surface, at points Q and T.

Each magnetic compass needle can rotate about its central dot.

(i) A compass needle is placed at point P and another at point R, near to the Earth's surface.

On Figure 6, draw an arrow at point P and an arrow at point R to show the direction of the compass needle at each point.
(2 marks)

(continued on the next page)

3(a) continued.

(ii) Explain why the arrows point in the directions you have drawn in part (i).

You may draw on Figure 6 to help your answer.
(3 marks)

(continued on the next page)

3 continued.

(b) Look at Figure 7 for Question 3(b) in the Diagram Booklet. It shows a wire placed between the poles of a U-shaped magnet.

The wire is connected to a resistor and a battery.

The wire carries a current in the direction shown.

The wire is perpendicular to the magnetic field of the magnet.

(i) Draw an arrow on Figure 7 to show the direction of the force, F, acting on the wire.

Label this arrow 'F'.
(1 mark)

(ii) State ONE practical way of reversing the direction of force F.
(1 mark)

(continued on the next page)

3(b) continued.

(iii) In Figure 7

- current in the wire = 3·2 A
- length of wire in the magnetic field = 0·042 m
- magnetic force on the wire = 0·078 N

Calculate the magnitude of the magnetic flux density between the two poles of the magnet.
(2 marks)

magnetic flux density = _____ T

(Total for Question 3 = 9 marks)

4 (a) Look at Figure 8 for Question 4(a) in the Diagram Booklet. It shows an athlete training with a push sled.

The athlete pushes the sled with a force of 645 N.

Calculate the distance the sled moves when the force of 645 N does 7440 J of work on the sled.

Give your answer to an appropriate number of significant figures.
(3 marks)

distance moved = _____ m

(continued on the next page)

4 continued.

(b) Look at Figure 9 for Question 4(b) in the Diagram Booklet. It shows an electric motor lifting a set of masses.

(i) Describe an experiment, using the apparatus in Figure 9, to determine the gravitational potential energy gained by the masses as they are lifted.

Your description should include any measuring devices to be used.

You may add to the diagram in Figure 9 if it helps your answer.
(4 marks)

Answer space continues on the next page.

4(b)(i) continued.

(continued on the next page)

4(b) continued.

(ii) In one experiment, the change in gravitational potential energy of the masses was 5·8 J

The total mass lifted was 320 g

Calculate the vertical height the masses travelled through.

Use g = 10 N/kg

(2 marks)

height = _____ m

(continued on the next page)

4(b) continued.

(iii) The efficiency of the motor was 59%

State ONE reason why the motor was not 100% efficient.
(1 mark)

(Total for Question 4 = 10 marks)

5 (a) A student investigates how current varies with potential difference across a filament lamp.

The student uses a power supply, a variable resistor, the filament lamp and two meters.

Look at Figure 10 for Question 5(a) in the Diagram Booklet. Part of the circuit diagram is shown.

Complete the circuit diagram needed for this investigation.
(3 marks)

(b) Another student repeats the investigation in part (a) using a data logger.

The data logger records observations using sensors instead of meters. The sensors are connected to a computer to collect and display the observations.

The data logger collects 555 pairs of data in 2 minutes.

Look at Figure 11 for Question 5(b) in the Diagram Booklet. It shows the results.

(continued on the next page)

5(b) continued.

(i) Suggest ONE advantage of using a data logger instead of meters in this investigation.
(1 mark)

(ii) Describe how current varies with potential difference in the graph in Figure 11.
(2 marks)

(continued on the next page)

5(b) continued.

(iii) Use data from the graph in Figure 11 to show how the resistance changes with potential difference for the filament lamp.
(2 marks)

(c) Which of these equations is correct?
(1 mark)

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

☐ B $\text{time} = \text{charge} \times \text{current}$

☐ C $\text{time} = \frac{\text{power}}{\text{energy}}$

☐ D $\text{time} = \text{power} \times \text{energy}$

(continued on the next page)

5 continued.

(d) The unit of work is the joule.

Starting with the meaning of work, we may obtain an equivalent unit of work as Nm.

Using work = F × d

unit of work = unit of force × unit of distance = Nm

The unit of potential difference is the volt.

Explain how, starting with the meaning of potential difference, we may obtain an equivalent unit of potential difference.
(2 marks)

(Total for Question 5 = 11 marks)

6 (a) Which of these changes of state describes sublimation?
(1 mark)

☐ A from gas to liquid

☐ B from liquid to solid

☐ C from solid to gas

☐ D from solid to liquid

(b) Look at Figure 12 for Question 6(b) in the Diagram Booklet. It shows a sealed aerosol can.

The sealed can is taken from a cold room into a warm room.

If the volume of the can remains the same, which of these does NOT change?
(1 mark)

☐ A the pressure inside the can

☐ B the mean speed of the particles inside the can

☐ C the mean distance between the particles inside the can

☐ D the mean size of the momentum of the particles inside the can

(continued on the next page)

6 continued.

(c) Look at Figure 13 for Question 6(c) in the Diagram Booklet. It shows a storage heater.

The storage heater contains bricks.

The bricks are heated electrically.

The electrical heater supplies 210 kJ of energy to each brick in the storage heater.

One brick has a mass of 5·8 kg

The specific heat capacity for the brick is 860 J/kg K

(i) Use this data to calculate the increase in temperature of the brick.
(2 marks)

temperature increase = _____ °C

(continued on the next page)

6(c) continued.

(ii) The actual temperature increase will be smaller than you calculated in (i).

Explain why the actual temperature increase will be smaller than the value in (i).
(2 marks)

(continued on the next page)

6 continued.

*(d) Describe an investigation to determine the value for the specific heat capacity of water.

Your answer should include details of

- the apparatus needed
- the experimental procedure
- how the value may be calculated from the measurements taken.

Look at the blank page for Question 6(d) in the Diagram Booklet. You may draw a diagram to help your answer.
(6 marks)

Answer space continues on the next 2 pages.

6(d) continued.

6(d) continued.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

END OF PAPER