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

Total Marks

Combined Science
PAPER 6
Higher Tier

Friday 16 June 2023 – Morning

Time: 1 hour 10 minutes

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

Surname						
Other names						
Centre Number						
Candidate Number						

V72565A

Pearson

YOU MUST HAVE

Calculator, ruler, Equation Booklet (enclosed)

YOU WILL BE GIVEN

Diagram Booklet, Formulae 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.

In questions labelled 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 in the separate Formulae Booklet and Equation Booklet.

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 some of the apparatus that students use to determine the resistance of a piece of iron wire.

Add connecting wires, a voltmeter and an ammeter to complete the circuit in Figure 1 so that the students can determine the resistance of the piece of iron wire.
(2 marks)

(continued on the next page)

1 continued.

(b) The students extend the investigation to determine how the resistance of the iron wire changes with its length.

(i) Give the name of ONE additional piece of apparatus the students would need.
(1 mark)

_____

_____

(ii) Look at Figure 2 for Question 1(b)(ii) in the Diagram Booklet. It shows a graph of the results.

Draw a straight line of best fit on Figure 2.
(1 mark)

(continued on the next page)

1(b) continued.

(iii) Use Figure 2 to estimate the resistance of a 100 cm length of the iron wire.
(1 mark)

resistance = _____ Ω

(continued on the next page)

1(b) continued.

(iv) The variable resistor shown in Figure 1 is used to prevent the iron wire from becoming too hot.

Explain how the variable resistor is used to prevent the iron wire from becoming too hot.
(2 marks)

(continued on the next page)

1 continued.

(c) The potential difference (voltage) across another piece of wire is 1·56 V.

The current in the wire is 0·45 A.

Calculate the resistance of this piece of wire.
(2 marks)

Use the equation

$V = I \times R$

resistance =

_____ Ω

(Total for Question 1 = 9 marks)

2 (a) Which of these means changing state from solid directly to gas? (1 mark)

☐ A condensing

☐ B freezing

☐ C melting

☐ D sublimating

(b) An object has a mass of $7{\cdot}22 \times 10^{-2}$ kg and a volume of $2{\cdot}69 \times 10^{-5} m^3$.

Calculate the density, ρ, of the object. (3 marks)

(continued on the next page)

2(b) continued.

Use the equation

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

State the unit.

density = _____

unit _____

(continued on the next page)

2 continued.

(c) Aluminium has a melting point of 660 °C.

The absolute zero of temperature is –273 °C.

(i) Calculate the melting point of aluminium in kelvin.
(1 mark)

melting point of aluminium =

_____ K

(continued on the next page)

2(c) continued.

(ii) Describe the motion of particles in liquid aluminium (above 660 °C).
(2 marks)

(continued on the next page)

2 continued.

(d) A student determines the volume of a piece of metal by measuring the volume of water that it displaces.

The student wrote the following in his notebook.

I put some water into a measuring cylinder.

I put the piece of metal into the water in the measuring cylinder.

I took the reading of the new water level in the measuring cylinder.

This was the volume of the piece of metal.

(continued on the next page)

2(d) continued.

The student's description is incomplete.

Suggest TWO sentences that the student could have included to provide a more complete description of the correct procedure.
(2 marks)

Answer space continues on the next page.

1 _____

_____

2 _____

2(d) continued.

(Total for Question 2 = 9 marks)

3 (a) Look at Figure 3 for Question 3(a) in the Diagram Booklet. It shows two magnets with their N poles facing each other.

On Figure 3, draw the shape and direction of the magnetic field between the two magnets.
(2 marks)

(b) Look at Figure 4 for Question 3(b) in the Diagram Booklet. It shows a toy that has a plastic cylinder, a plastic base and two similar magnets. Each of the two magnets is in the shape of a ring.

The upper magnet seems to float in the air above the lower magnet.

Describe the forces acting on the upper magnet.

(continued on the next page)

3(b) continued.

Use the idea of magnetic fields in your answer.
(3 marks)

(continued on the next page)

3 continued.

(c) Look at Figure 5 for Question 3(c) in the Diagram Booklet. It shows a current-carrying wire between the poles of a magnet.

(i) The magnet and the wire each experience a force when there is a current in the wire.
(2 marks)

1 State the direction of the force on the wire.

2 State the direction of the force on the magnet.

3(c) continued.

(ii) The force on the wire is 0·15 N.

The current in the wire is 2·7 A.

The magnet produces a field with a magnetic flux density of 0·50 T.

Calculate the length of the wire in the magnetic field.

(continued on the next page)

3(c)(ii) continued.

Use an equation selected from the list of equations given in the Formulae Booklet or Equation Booklet.
(2 marks)

length of the wire in the magnetic field = _____ **m**

(Total for Question 3 = 9 marks)

4 (a) Look at Figure 6 for Question 4(a) in the Diagram Booklet. It shows part of the inside of a pen.

The pen contains a spring that can be compressed.

The spring constant of the spring is 260 N / m.

(i) Calculate the force needed to compress the spring by the amount shown in Figure 6.

(continued on the next page)

4(a)(i) continued.

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

force = _____ N

(continued on the next page)

4(a) continued.

(ii) A student removes the spring from the pen and investigates the compression of the spring.

Look at Figure 7 for Question 4(a)(ii) in the Diagram Booklet.

It shows the equipment and the procedure that the student uses.

The student presses down on the spring to change its length.

The electronic balance measures the force applied to the spring.

Describe how the student can determine the change in length of the spring. You may add to Figure 7 to help your answer.
(3 marks)

Answer space continues on the next page.

4(a)(ii) continued.

(continued on the next page)

4(a) continued.

(iii) The student finds it difficult to make an accurate measurement of the change in length of the spring using the equipment as shown.

Describe ONE way that the student could improve the procedure.
(2 marks)

(continued on the next page)

4 continued.

(b) Look at Figure 8 for Question 4(b) in the Diagram Booklet. It shows a different spring hanging from a hook fixed to the ceiling.

A block hangs from the other end of the spring.

The weight of the spring is 1 N.
The weight of the block is 5 N.

The force exerted on the top of the spring by the hook is
(1 mark)

☐ A 4 N down

☐ B 4 N up

☐ C 6 N down

☐ D 6 N up

(continued on the next page)

4 continued.

(c) Look at Figure 9 for Question 4(c) in the Diagram Booklet. It shows two forces, P and Q, acting at point X.

Complete the diagram in Figure 9 to show the size and direction of the resultant force, R, on point X.
(2 marks)

(Total for Question 4 = 11 marks)

5 (a) An electric car is travelling at a speed of 16·0 m/s

The total mass of the car is 1200 kg.

(i) Calculate the kinetic energy, in kJ, of the car
(2 marks)

kinetic energy =

_____ kJ

(continued on the next page)

5(a) continued.

(ii) On a journey, the car transfers energy from the battery at an average rate of 17·5 kW.

The battery in the car transfers a total of 126 MJ of energy before it becomes discharged.

Calculate the time taken for the battery to become discharged on this journey.

Give your answer in hours.
(2 marks)

time taken = _____ hours

(continued on the next page)

5(a) continued.

(iii) Look at Figure 10 for Question 5(a)(iii) in the Diagram Booklet. It shows an electrical device connected to the wheels of an electric car.

The electrical device is used as a motor when the car accelerates and as a dynamo when the car decelerates.

Explain how using the device can help to increase the time that the car can be driven before the battery becomes discharged.
(2 marks)

Answer space continues on the next page.

5(a)(iii) continued.

(continued on the next page)

5 continued.

(b) The battery can be recharged at a charging point.

The charging point provides an average current of 15·0 A to the battery, at a potential difference (voltage) of 400 V.

It is claimed that 126 MJ of energy can be transferred to the battery in less than 6 hours.

(continued on the next page)

5(b) continued.

(i) Comment on this claim.
(3 marks)

Use this equation to support your answer

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

(continued on the next page)

5(b) continued.

(ii) Calculate the total charge that moves into the battery while it is being recharged.
(2 marks)

Use the equation

$$E = Q \times V$$

charge = _____ C

(Total for Question 5 = 11 marks)

6 (a) Look at Figure 11 for Question 6(a) in the Diagram Booklet. It shows a pulley system that enables a person to lift a heavy barrel.

The person pulls down on the rope to make the barrel rise through 1·2 m.

The work done against gravity on the barrel is 1800 J.

(continued on the next page)

6(a) continued.

(i) Calculate the weight of the barrel. (2 marks)

Use the equation

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

weight of the barrel =

_____ N

(continued on the next page)

6(a) continued.

(ii) The efficiency of the system is 64%.

Calculate the total work done by the person.
(2 marks)

Use the equation

$$\text{efficiency} = \frac{\text{(work done against gravity on the barrel)}}{\text{(total work done by the person)}} \times 100\%$$

work done = _____ J

(continued on the next page)

6(a) continued.

(iii) Some energy is wasted due to friction.

Suggest ANOTHER reason why some energy is wasted in using this pulley system.

(1 mark)

(continued on the next page)

6 continued.

*(b) Look at Figure 12 for Question 6(b) in the Diagram Booklet. A student has the equipment shown in Figure 12.

Devise an experiment to investigate how the efficiency of the pulley system varies with the weight of metal being lifted.

Your answer should include how you will use your measurements.
(6 marks)

Answer space continues on the next page.

6(b) continued.

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER