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

Combined Science

Paper 6
Higher Tier

Total Marks

Friday 12 June 2020 – Morning

Time: 1 hour 10 minutes plus your additional time allowance

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

Surname					
Other names					
Centre Number					
Candidate Number					

X62102A

Pearson

YOU MUST HAVE

Calculator, ruler, protractor

YOU WILL BE GIVEN

Equations Booklet

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided – 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.

An equations booklet is provided.

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.

Figure 1 shows a small piece of copper about 3 cm high.

A student wants to determine the density of copper.

The student uses a balance to measure the mass of the piece of copper.

(continued on the next page)

1 continued.

(i) Explain how the student could measure the volume of the piece of copper. (3 marks)

(continued on the next page)

1 continued.

(ii) The mass of the piece of copper is 0·058 kg.

The volume of the piece of copper is $6{\cdot}5 \times 10^{-6}\,m^3$.

Calculate the density of copper. (2 marks)

density of copper = _____ kg/m^3

(continued on the next page)

1 continued.

(b) A student wants to determine the specific heat capacity of copper.

Look at Figure 2 for Question 1(b) in the Diagram Booklet.

Figure 2 shows a piece of copper, with a thread tied around it, in a glass beaker of boiling water.

The student leaves the piece of copper in the boiling water so that the copper reaches a temperature of 100 °C.

The student uses the thread to take the piece of copper out of the boiling water.

The student puts the hot piece of copper into a different beaker of cold water at 20 °C.

Look at Figure 3 for Question 1(b) in the Diagram Booklet.

The apparatus is shown in Figure 3.

The student assumes that the thermal energy gained by the water equals the thermal energy lost by the piece of copper.

(continued on the next page)

1 continued.

The water and copper both reach a temperature of 22 °C.

The cold water gains 1050 J of energy.

The mass of the piece of copper is 0·058 kg.

(i) Calculate a value for the specific heat capacity of copper, using these results. (2 marks)

Use the equation

change in thermal energy =
mass × specific heat capacity × change in temperature

$$\Delta Q = m \times c \times \Delta\theta$$

specific heat capacity of
copper from these results = _____ J/kg °C

(continued on the next page)

1 continued.

(ii) The value for the specific heat capacity of copper obtained from the student's results is lower than the correct value.

State TWO ways that the experiment could be improved to give a value that is closer to the correct value. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(TOTAL FOR QUESTION 1 = 9 MARKS)

2 (a) Look at Figure 4 for Question 2(a) in the Diagram Booklet.

Figure 4 shows a drone.

The drone has four spinning blades.

The upward force produced enables the drone to rise in the air.

The speed at which the blades spin is measured in turns per minute.

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

Figure 5 shows how the upward force produced by the four blades depends on the speed at which the blades spin.

(continued on the next page)

2 continued.

Describe the relationship between upward force and speed shown by this graph. (2 marks)

(continued on the next page)

2 continued.

(b) A different drone has a mass of 4·5 kg.

This drone rises from the ground to a height of 20 m.

(i) Calculate the change in gravitational potential energy when the drone rises through a height of 20 m.

The gravitational field strength g = 10 N/kg.

(2 marks)

change in gravitational potential energy = _____ J

(continued on the next page)

2 continued.

(ii) State the amount of useful work done by the blades as the drone rises through 20 m. (1 mark)

useful work done = _____ J

(iii) It takes 4 s for the drone to rise through 20 m.

Calculate the useful power developed by the blades in this time of 4 s. (2 marks)

useful power developed = _____ W

(TOTAL FOR QUESTION 2 = 7 MARKS)

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

Figure 6 shows the magnetic field of a magnet.

(a) At which point is the magnetic field strongest? (1 mark)

☐ A

☐ B

☐ C

☐ D

(b) Look at Figure 7 for Question 3(b) in the Diagram Booklet.

Figure 7 shows a wire carrying a current.

Draw, on the card in Figure 7, the magnetic field that is produced by the current. (2 marks)

(continued on the next page)

3 continued.

(c) Look at Figure 8 for Question 3(c) in the Diagram Booklet.

Figure 8 shows two metal rods carrying a current.

A metal roller touches both rods and completes the circuit.
The roller is in the magnetic field produced by a magnet.

(continued on the next page)

3 continued.

(i) The magnetic flux density of the magnetic field at the roller is 1·2 T.

The current in the roller is 2·5 A.

The length of the roller carrying the current is 0·060 m.

Calculate the force on the roller. (2 marks)

Use the equation

$$F = B \times I \times l$$

force on the roller = _____ N

(continued on the next page)

3 continued.

(ii) Describe how Fleming's left-hand rule can be used to determine the direction of the force acting on the roller.

You may draw a diagram to help your answer. (3 marks)

(continued on the next page)

3 continued.

(iii) **Draw an arrow on Figure 8 in the Diagram Booklet to show the direction of the force acting on the roller. (1 mark)**

(TOTAL FOR QUESTION 3 = 9 MARKS)

4 **Look at Figure 9 for Question 4 in the Diagram Booklet.**

Figure 9 shows a spring standing on a table.

Weights are added to the spring as shown in Figures 9b and 9c.

(a) (i) Estimate the original length of the spring as shown in Figure 9a. (1 mark)

original length = _____ mm

(continued on the next page)

4 continued.

(ii) Describe how the reduction in the length of the spring when weights are added can be determined. (2 marks)

(continued on the next page)

4 continued.

(iii) State TWO ways that the experimental procedure could be improved. (2 marks)

1 _____

_____

_____

2 _____

_____

_____

(iv) Give ONE reason why the reduction in length eventually reaches a limit as more weights are added. (1 mark)

_____

_____

_____

(continued on the next page)

4 continued.

(b) A different spring is extended.

A force of 0·50 N gives an extension of 13 mm.

Calculate the spring constant k in N/m. (3 marks)

spring constant k = _____ N/m

(continued on the next page)

4 continued.

(c) Another spring is extended.

The work done to extend the spring is 0·14 J.

The spring constant of the spring is 175 N/m.

Calculate the extension of the spring.

Use an equation selected from the list of equations at the end of this paper. (3 marks)

extension of spring = _____ m

(TOTAL FOR QUESTION 4 = 12 MARKS)

5 (a) A student investigates resistors connected in parallel using a number of resistors. Each resistor has the same resistance.

Look at Figure 10 for Question 5(a) in the Diagram Booklet.

Figure 10 shows a circuit diagram with one resistor, R.

(i) Add to Figure 10:

- a voltmeter to find the potential difference across resistor R
- another resistor in parallel with resistor R.

(2 marks)

(continued on the next page)

5 continued.

(ii) State the measurements that the student must take to find the overall resistance of the resistors in parallel. (2 marks)

(continued on the next page)

5 continued.

(iii) The student investigates how the overall resistance of the circuit changes when additional resistors are added in parallel to R.

Each resistor has the same resistance.

Look at Figure 11 for Question 5(a)(iii) in the Diagram Booklet.

Figure 11 shows the results of the student's investigation.

State the resistance of a single resistor.
(1 mark)

resistance = _____ Ω

(continued on the next page)

5 continued.

(iv) Comment on the relationship between the overall resistance of the circuit and the number of resistors in parallel.

Use information from Figure 11 to support your answer. (3 marks)

(continued on the next page)

5 continued.

(b) Look at Figure 12 for Question 5(b) in the Diagram Booklet.

A different circuit is then set up with two resistors as shown in Figure 12.

(i) Calculate the potential difference across the 15 Ω resistor. (2 marks)

potential difference = _____ V

(continued on the next page)

5 continued.

(ii) Calculate the total power dissipated when there is a current of 0·20 A in the two resistors. (2 marks)

Use the equation

$$P = I^2 \times R$$

power produced = _____ W

(TOTAL FOR QUESTION 5 = 12 MARKS)

6 (a) Look at Figure 13 for Question 6(a) in the Diagram Booklet.

The magnitude and direction of a force can be represented by a vector. Figure 13 shows the forces acting on four identical trolleys. The arrows show the magnitude and direction of the forces.

Which diagram shows a pair of forces that will produce zero acceleration? (1 mark)

(b) Look at Figure 14 for Question 6(b) in the Diagram Booklet.

Figure 14 shows two small boats pulling a much larger ship.

The ship is connected to the boats with ropes.

The tension, T, in each of the ropes has a magnitude of 20 kN.

The ropes are at right angles to each other.

(continued on the next page)

6 continued.

Draw a vector diagram and use it to determine the resultant force that the boats exert on the ship. (4 marks)

magnitude of resultant force on the ship = _____ kN

(continued on the next page)

6 continued.

*(c) Look at Figure 15 for Question 6(c) in the Diagram Booklet.

Figure 15 shows a wooden block connected to a weight by a string. The string goes over a pulley.

The surfaces of the table and the wooden block are both rough.

The wooden block moves across the table at a constant horizontal velocity.

Several vertical and horizontal forces act on the wooden block as it moves.

Explain how the forces keep the wooden block moving across the table at a constant horizontal velocity.

Your answer should refer to all forces acting on the wooden block.

You may add to the diagram to help with your answer. (6 marks)

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(TOTAL FOR QUESTION 6 = 11 MARKS)

TOTAL FOR PAPER = 60 MARKS

END