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

Total Marks

Combined Science
PAPER 3
Foundation Tier

Thursday 25 May 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					

Y72558A

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.

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.

(continued on the next page)

INFORMATION continued.

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.

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 waves in the electromagnetic (e-m) spectrum.

(a) (i) Look at Figure 1 for Question 1(a) in the Diagram Booklet. It shows some types of radiation that form part of the e-m spectrum and some uses of e-m radiation.

Draw ONE straight line from each type of e-m radiation to its use.

ONE line has been drawn for you.
(3 marks)

(continued on the next page)

1(a) continued.

(ii) Which of these waves has the highest frequency?
(1 mark)

☐ A infrared

☐ B microwaves

☐ C ultraviolet

☐ D visible light

(continued on the next page)

1 continued.

(b) X-rays are also part of the e-m spectrum.

Look at Figure 2 for Question 1(b) in the Diagram Booklet. It shows an airport security scanner using X-rays to scan passengers' bags.

(i) Explain why X-rays are used to scan passengers' bags.
(2 marks)

(continued on the next page)

1(b) continued.

(ii) Explain why passengers are NOT scanned with X-rays.
(2 marks)

(Total for Question 1 = 8 marks)

2 (a) Look at Figure 3 for Question 2(a) in the Diagram Booklet. The graph shows how the velocity of a car changes with time.

The car starts from rest and travels along a level, straight road for 50 s.

(i) Which part of the graph shows when the car has constant velocity?
(1 mark)

☐ A PQ

☐ B QR

☐ C RS

☐ D ST

(continued on the next page)

2(a) continued.

(ii) Which part of the graph shows when the car has the greatest acceleration?
(1 mark)

☐ A PQ

☐ B QR

☐ C RS

☐ D ST

(continued on the next page)

2(a) continued.

(iii) Calculate the acceleration of the car in the first 10 s shown on the graph.
(2 marks)

Use the equation

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

acceleration =

_____ m/s^2

(continued on the next page)

2(a) continued.

(iv) Calculate the distance the car travels in part QR shown on the velocity / time graph in Figure 3. (3 marks)

distance = _____ m

(continued on the next page)

2 continued.

(b) A different car has a mass of 1200 kg.

Calculate the force needed to give this car an acceleration of $2{\cdot}4\,m/s^2$
(2 marks)

Use the equation

$F = m \times a$

force = _____ N

(Total for Question 2 = 9 marks)

3 An atom has a central nucleus containing neutrons and protons.

Electrons orbit the nucleus.

(a) (i) Which row of the table gives the relative mass and charge of a proton?
(1 mark)

	relative mass	charge
☐ A	0	+1
☐ B	0	–1
☐ C	1	+1
☐ D	1	–1

(continued on the next page)

3(a) continued.

(ii) An atom has a radius of $1{\cdot}0 \times 10^{-10}$ m.

A nucleus has a radius of $1{\cdot}0 \times 10^{-15}$ m.

Calculate the ratio of the radius of the atom to the radius of the nucleus.
(2 marks)

Answer space continues on the next page.

3(a)(ii) continued.

ratio of radius of atom to radius of nucleus =

(continued on the next page)

3(a) continued.

(iii) Explain why an atom has no charge overall.
(2 marks)

(continued on the next page)

3 continued.

(b) One isotope of carbon is carbon-14.

$$^{14}_{6}C$$

(i) State the number of protons in one atom of carbon-14.
(1 mark)

number of protons =

_____

(ii) State the number of neutrons in one atom of carbon-14.
(1 mark)

number of neutrons =

_____

(continued on the next page)

3(b) continued.

(iii) Look at Figure 4 for Question 3(b) (iii) in the Diagram Booklet. It shows a graph for the decay of the radioactive isotope carbon-14.

Use the graph to estimate the half-life of carbon-14.
(2 marks)

half-life = _____ years

(Total for Question 3 = 9 marks)

4 (a) Look at Figure 5 for Question 4(a) in the Diagram Booklet. It shows a wave on the surface of water.

(i) Which of the arrowed lines shows the amplitude of the wave?
(1 mark)

☐ A

☐ B

☐ C

☐ D

(ii) Explain why the wave shown in Figure 5 is a transverse wave.
(2 marks)

Answer space continues on the next page.

4(a)(ii) continued.

_____

_____

(b) Look at Figure 6 for Question 4(b) in the Diagram Booklet. It shows the top view of the wave pattern on screen and the side view of a ripple tank.

A screen is placed below the ripple tank.

The wave pattern produced by the ripples can be seen on the screen.

A student has a stop clock and a ruler.

(continued on the next page)

4(b) continued.

(i) Describe how the student could measure the frequency of the ripples.
(2 marks)

(continued on the next page)

4(b) continued.

(ii) Describe how the student could measure the wavelength of the ripples.
(2 marks)

(continued on the next page)

4 continued.

(c) In a swimming pool, a wave is produced with a wavelength of 4·0 m and a velocity of 0·8 m/s.

Calculate the frequency of the wave.

State the unit of frequency.
(3 marks)

Use the equation

$v = f \times \lambda$

Answer space continues on the next page.

4(c) continued.

frequency of wave

_____

unit _____

(Total for Question 4 = 10 marks)

5 (a) Which of these is a scalar quantity? (1 mark)

☐ A acceleration

☐ B distance

☐ C force

☐ D weight

(b) A student has some cupcake cases.

Look at the diagrams for Question 5(b) in the Diagram Booklet. One cupcake case is shown in Figure 7.

The student drops a stack of cupcake cases with the base facing downwards, as shown in Figure 8.

The speed of the falling stack of cupcake cases depends on the number of cupcake cases in the stack.

(continued on the next page)

5(b) continued.

(i) The student also has a stop clock and a metre rule.

Describe an investigation to show how the speed of the falling stack of cupcake cases depends on the number of cupcake cases in the stack.
(4 marks)

Answer space continues on the next page.

5(b)(i) continued.

(ii) A stack of cupcake cases has a mass of 0·005 kg.

Calculate the weight, in newtons, of the stack of cupcake cases.

Gravitational field strength = 10 N / kg
(2 marks)

(continued on the next page)

5(b)(ii) continued.

Use the equation

$$W = mg$$

weight = _____ N

(continued on the next page)

5(b) continued.

Look at Figure 9 for Question 5(b) (iii) in the Diagram Booklet. It shows a cupcake case that is falling at a constant velocity.

(iii) Draw an arrow on Figure 9 to show the force due to air resistance on the cupcake case. (1 mark)

(iv) State the value of the acceleration of the cupcake case when it is falling at a constant velocity. (1 mark)

_____

_____

(c) A car travels along a straight road.

The car accelerates at $3\,m/s^2$ for a time of 7 s.

(continued on the next page)

5(c) continued.

Calculate the change in velocity of the car.
(2 marks)

Use the equation

change in velocity = acceleration × time taken

change in velocity =

_____ m/s

(Total for Question 5 = 11 marks)

6 (a) Look at Figure 10 for Question 6(a) in the Diagram Booklet. It shows a football kicked against a wall.

The football has a mass of 0·42 kg.

(i) The football gains 11 J of gravitational potential energy as it moves from the ground to the wall.

Calculate the height at which the ball hits the wall.
(3 marks)

Gravitational field strength = 10 N / kg

(continued on the next page)

6(a)(i) continued.

Use the equation

$\Delta GPE = m \times g \times \Delta h$

height = _____ m

6(a) continued.

(ii) Calculate the kinetic energy of the football when it is moving at a velocity of 12 m/s.
(2 marks)

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

kinetic energy =

_____ J

(continued on the next page)

6(a) continued.

(iii) Describe the energy transfers that happen when the ball hits the wall. (2 marks)

*(b) In the UK, electricity is generated using non-renewable and renewable energy resources.

Look at Figure 11 for Question 6(b) in the Diagram Booklet. The graph shows how the amount of electricity generated by these resources changed from 2012 to 2020.

(continued on the next page)

6(b) continued.

Explain how and why the amount of electricity generated by renewable and non-renewable energy resources has changed from 2012 to 2020.

Your answer should include

- the trends shown in Figure 11
- the change in the amount of electricity generated by at least one renewable resource
- the change in the amount of electricity generated by at least one non-renewable resource.

(6 marks)

Answer space on the next 2 pages.

6(b) continued.

6(b) continued.

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER