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

Total Marks

Combined Science
PAPER 3
Foundation Tier

Wednesday 22 May 2024 – 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					

Y74479A

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.

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 you make are related or follow on from each other where appropriate.

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 the electromagnetic spectrum.

(a) X-rays and microwaves are both parts of the electromagnetic spectrum.

Look at the list of words for Question 1(a) in the Diagram Booklet. Use words from the list to complete the sentences.
(3 marks)

X-rays and microwaves are both

_____ waves.

In a vacuum, x-rays and microwaves always have the same

_____.

X-rays always have a higher

_____ than microwaves.

(continued on the next page)

1 continued.

(b) Look at Figure 1 for Question 1(b) in the Diagram Booklet. It shows the full electromagnetic spectrum.

Look at Figure 2 for Question 1(b) in the Diagram Booklet. It gives information about four of the types of electromagnetic radiation shown in Figure 1.

State the name of each type of radiation next to its information.
(4 marks)

(Total for Question 1 = 7 marks)

2 (a) A car is being driven at a constant velocity.

The driver sees an obstacle in the road ahead.

The driver uses the brakes to stop as quickly as possible.

Look at Figure 3 for Question 2(a) in the Diagram Booklet. It shows the velocity/time graph for the car from the time when the driver sees the obstacle.

(i) Which of these is the driver's reaction time shown in Figure 3? (1 mark)

☐ A 0 s

☐ B 1 s

☐ C 4 s

☐ D 22 s

(continued on the next page)

2(a) continued.

(ii) State ONE factor that might increase a driver's reaction time. (1 mark)

(continued on the next page)

2(a) continued.

(iii) Calculate the distance travelled between when the driver applies the brakes and when the car comes to rest in Figure 3.
(3 marks)

Use the equation

distance = area under the sloping line of the graph in Figure 3

distance = _____ m

(continued on the next page)

2 continued.

(b) The stopping distance of a car is the thinking distance plus the braking distance.

A car has a device that can detect an obstacle in the road ahead.

The device is linked to a computer that can apply the brakes.

It is claimed that, in an emergency, the computer-controlled car will have a shorter stopping distance than if the car is controlled by a human driver.

Explain why this claim could be true.
(2 marks)

Answer space continues on the next page.

2(b) continued.

(continued on the next page)

2 continued.

(c) A different car has a device that can detect rain.

This device is linked to a computer that can change the speed of the car.

In wet weather, the computer changes the speed of the car.

(i) State the change in speed that the computer should make when the road is wet.
(1 mark)

(continued on the next page)

2(c) continued.

(ii) Give a reason why this change in speed is necessary when the road is wet.
(1 mark)

(Total for Question 2 = 9 marks)

3 (a) A sound wave can transfer information across a room.

Which row of the table shows what else a sound wave can transfer? (1 mark)

	can transfer energy	can transfer air
☐ A	yes	yes
☐ B	yes	no
☐ C	no	yes
☐ D	no	no

(continued on the next page)

3 continued.

(b) Which of these always increases as a sound gets louder?
(1 mark)

☐ A amplitude

☐ B frequency

☐ C speed

☐ D wavelength

(continued on the next page)

3 continued.

(c) The speed of a sound wave in air is $330\,m/s$

The wavelength of this wave is $0{\cdot}75\,m$

Calculate the frequency of this wave.
(3 marks)

Use the equation

$$v = f \times \lambda$$

Answer space continues on the next page.

3(c) continued.

$$v = f \times \lambda$$

frequency = _____ Hz

(continued on the next page)

3 continued.

(d) Look at Figure 4 for Question 3(d) in the Diagram Booklet. It shows a water wave.

Which of these is the amplitude of the wave shown in Figure 4?
(1 mark)

☐ A 9 cm

☐ B 18 cm

☐ C 30 cm

☐ D 60 cm

(continued on the next page)

3 continued.

(e) Ripples travel out from the centre of a small circular pond to its edge.

(i) Describe how a student could determine the wave speed of the ripples.
(3 marks)

(continued on the next page)

3(e) continued.

(ii) Look at Figure 5 for Question 3(e)(ii) in the Diagram Booklet. It shows a duck floating on the pond.

The ripples cause the duck to move.

Draw arrows on Figure 5 to show how the duck moves due to the ripples.
(1 mark)

(Total for Question 3 = 10 marks)

4 Look at Figure 6 for Question 4 in the Diagram Booklet. It is a diagram representing an atom.

(a) Write the names of the particles **X**, **Y** and **Z** below.
(3 marks)

X _____

_____

Y _____

_____

Z _____

_____

(continued on the next page)

4 continued.

(b) The nucleus of a different atom emits a gamma ray.

What happens to the number of particles in the nucleus?
(1 mark)

☐ A it decreases by one

☐ B it decreases by two

☐ C it decreases by four

☐ D it does not change

(continued on the next page)

4 continued.

(c) A teacher demonstrates a radioactivity experiment to a class of students.

The teacher places a radioactive source in front of a radiation detector.

(i) State ONE safety precaution the teacher should take.
(1 mark)

(continued on the next page)

4(c) continued.

(ii) The teacher uses the detector to measure the activity of the source several times.

Look at Figure 7 for Question 4(c)(ii) in the Diagram Booklet. It shows the results.

The teacher tells the class that radioactive decay is random.

State how the data in Figure 7 supports this statement.
(1 mark)

(continued on the next page)

4(c) continued.

(iii) Calculate the mean of the FOUR measurements in Figure 7. (1 mark)

mean = _____ Bq

(continued on the next page)

4 continued.

(d) The teacher moves the radiation detector to different distances from the radioactive source.

The teacher determines the mean detector reading at each distance from the source.

Look at Figure 8 for Question 4(d) in the Diagram Booklet. The teacher plots the results on graph paper, as shown in Figure 8.

(i) The source emits alpha radiation ONLY.

Explain how the graph in Figure 8 shows that the source only emits alpha radiation.
(2 marks)

Answer space continues on the next page.

4(d)(i) continued.

(ii) Give a reason why the mean detector reading in Figure 8 does not fall to zero in this experiment. (1 mark)

(Total for Question 4 = 10 marks)

5 Look at Figure 9 for Question 5 in the Diagram Booklet. It shows a person on a skateboard at the top of a ramp.

At **P**, the person is not moving.

(a) The person rides the skateboard down the ramp from **P** to **Q**.

The gravitational potential energy of the person decreases by **980 J**

The mass of the person is **35 kg**

Calculate **h**, the height of the ramp. (2 marks)

Use **g = 10 N/kg**

Use the equation

change in gravitational potential energy = **m × g × h**

Answer space continues on the next page.

5(a) continued.

change in gravitational potential energy = $m \times g \times h$

$h =$ _____ m

(continued on the next page)

5 continued.

(b) The kinetic energy, KE, of the person at Q is 950 J

The mass of the person is 35 kg

Calculate the velocity of the person at Q.
(3 marks)

Use the equation

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

Answer space continues on the next page.

5(b) continued.

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

velocity = _____ m/s

(continued on the next page)

5 continued.

(c) Look at Figure 10 for Question 5(c) in the Diagram Booklet. It is a diagram that represents energy changes from **P** to **Q**.

(i) State what is represented by **X**. (1 mark)

(continued on the next page)

5(c) continued.

(ii) Calculate the value of **X**.
(1 mark)

value of **X** = _____ J

(continued on the next page)

5(c) continued.

(iii) Calculate the efficiency of the system represented in Figure 10. (2 marks)

efficiency = _____

(continued on the next page)

5 continued.

(d) The person would like to start from **P** again but have a greater velocity at **Q**.

Suggest TWO ways that this can be achieved.
(2 marks)

1 _____

_____

_____

2 _____

_____

_____

(Total for Question 5 = 11 marks)

6 (a) Two people, L and M, have a 100 m race.

L starts running before M.

Look at Figure 11 for Question 6(a) in the Diagram Booklet. It shows a distance / time graph of the race.

(i) State the DISTANCE that L has run when M overtakes.
(1 mark)

distance = _____ m

(continued on the next page)

6(a) continued.

(ii) Look again at Figure 11 for Question 6(a) in the Diagram Booklet. Calculate the velocity of **L** when running the **100 m** race. (2 marks)

velocity = _____ m/s

(continued on the next page)

6 continued.

(b) A motorcycle is travelling at a velocity of $6{\cdot}2\,m/s$

The motorcycle accelerates at $2{\cdot}5\,m/s^2$ until its velocity is $10\,m/s$

(i) Calculate the time taken for this acceleration.
(2 marks)

Use the equation

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

Answer space continues on the next page.

6(b)(i) continued.

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

time taken = _____ s

(continued on the next page)

6(b) continued.

(ii) The motorcycle now decelerates (slows down) from $10\,m/s$ to a stop.

The deceleration is at a constant rate of $4{\cdot}4\,m/s^2$

Calculate the distance the motorcycle travels as it slows down to a stop.
(2 marks)

Use the equation

$$v^2 - u^2 = 2 \times a \times x$$

Answer space continues on the next page.

6(b)(ii) continued.

$$v^2 - u^2 = 2 \times a \times x$$

distance = _____ m

(continued on the next page)

6 continued.

*(c) Look at Figure 12 for Question 6(c) in the Diagram Booklet. A student has a trolley and a ramp, as shown in Figure 12.

The height, H, of one end of the ramp can be adjusted.

The student investigates how the average speed of the trolley between X and Y depends on the height, H, of the ramp.

Describe

- the additional equipment that the student needs
- how that equipment is used to obtain the measurements needed.

(6 marks)

Answer space continues on the next 4 pages.

6(c) continued.

6(c) continued.

6(c) continued.

6(c) continued.

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER