Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | Candidate Number

Time 1 hour 10 minutes

Paper reference **1SC0/1PH**

Combined Science
PAPER 3
Higher Tier

You must have:
Calculator, ruler

Total Marks

Instructions
- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- 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.
- A list of equations is included at the end of this exam paper.

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.
- Good luck with your examination.

Turn over

Pearson

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) Figure 1 shows part of a wave.

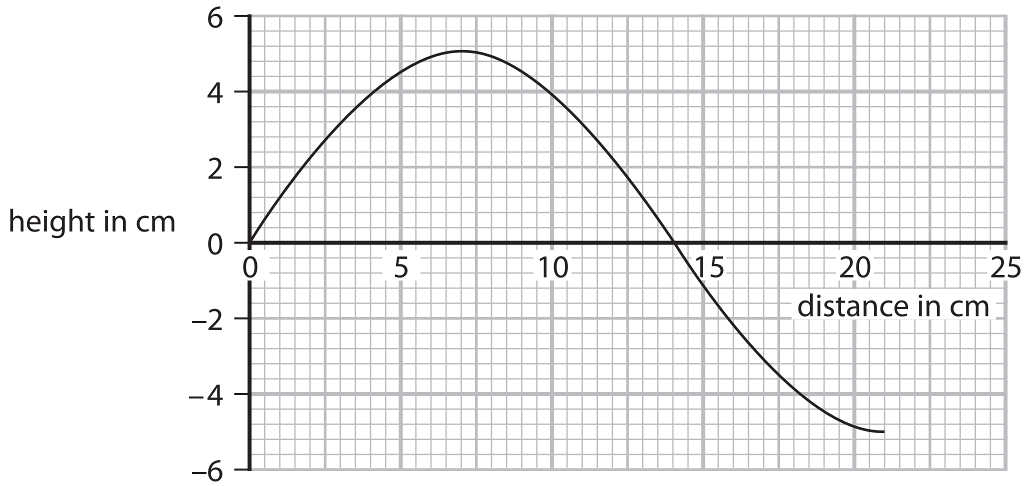


Figure 1

Use data from Figure 1 to calculate the wavelength of the wave.

(2)

wavelength = ... cm

(b) (i) Figure 2 shows a student sitting on the shore of a lake watching ripples on the surface of the water moving past a toy boat.

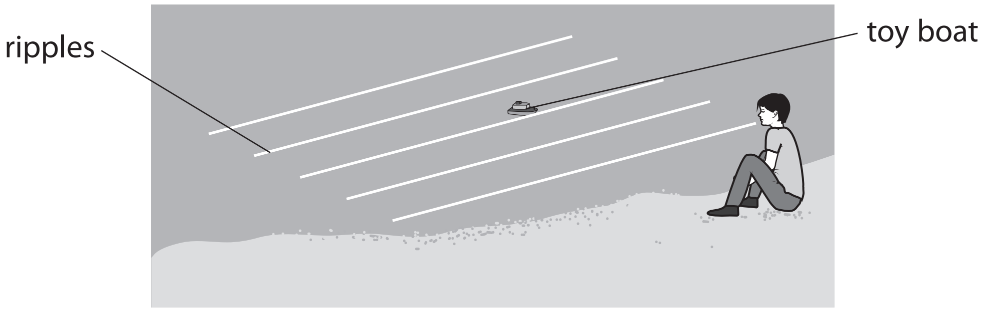


Figure 2

The student has a stopwatch.

Describe how the student could determine the frequency of the ripples on the lake.

(3)

....

....

....

....

....

....

(ii) The speed of a water wave is 1.5 m/s.

The frequency of the wave is 0.70 Hz.

Calculate the wavelength of this wave.

Use the equation

$$v = f \times \lambda$$

(2)

wavelength = ... m

(iii) Water waves are transverse waves.

Describe the difference between transverse waves and longitudinal waves.

(2)

....

....

....

....

(Total for Question 1 = 9 marks)

2 This question is about radioactivity.

(a) Alpha (α), beta (β) and gamma (γ) are three types of radioactive emissions.

Which statement describes **all** of these radioactive emissions?

(1)

☒ **A** ionising and emitted by stable nuclei

☒ **B** ionising and emitted by unstable nuclei

☒ **C** neutral and emitted by stable nuclei

☒ **D** neutral and emitted by unstable nuclei

(b) Fluorine-19 is a stable isotope of the element fluorine.

The element fluorine also has several radioactive isotopes.

Describe **one** similarity and **one** difference between the numbers of particles in one nucleus of fluorine-19 and one nucleus of a radioactive isotope of fluorine.

(2)

similarity ....

....

difference ....

....

(c) Figure 3 shows a Geiger–Muller (G–M) tube attached to a counter.
The G–M tube is used to measure the activity of a source of beta (β) radiation.
There is an aluminium sheet between the beta source and the G–M tube.
The counter is switched on and after 1 minute shows a count of 268.

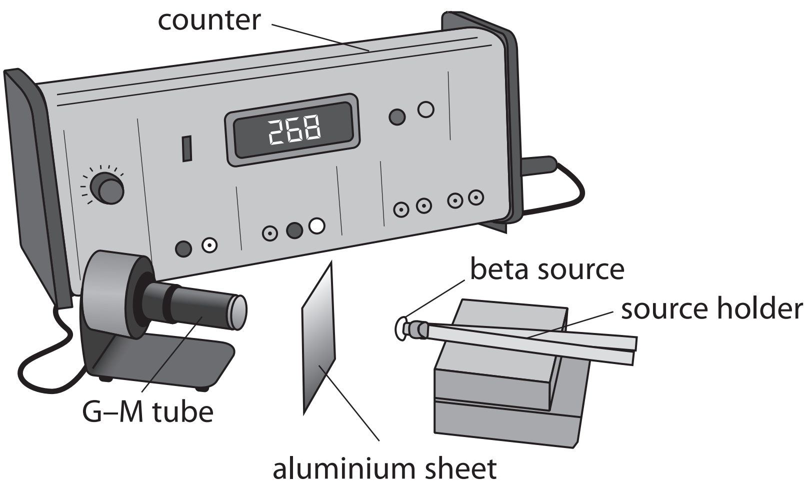


Figure 3

(i) The aluminium sheet is taken away.
The counter is reset to zero and then switched on again.
A new count is taken for 1 minute.

Explain why the new count is greater than 268.

(2)

....

....

....

....

(ii) The beta source is then also taken away.
The counter is reset to zero and switched on again.
A new count is taken for 1 minute.

Give a reason why there would now be a reading on the counter.

(1)

....

....

(iii) State the SI unit for the activity of a radioactive source.

(1)

....

(d) Radium-223 is a radioactive substance.

Radium-223 is an alpha emitter.

The half-life of radium-223 is 11 days.

A radioactive source contains 1.7×10^{23} nuclei of radium-223.

Calculate the number of radium-223 nuclei remaining in the source after a time of 33 days.

(2)

number of radium-223 nuclei remaining = ...

(Total for Question 2 = 9 marks)

3 A student is investigating the refraction of light.

Figure 4 shows part of the apparatus and the angles to be measured.

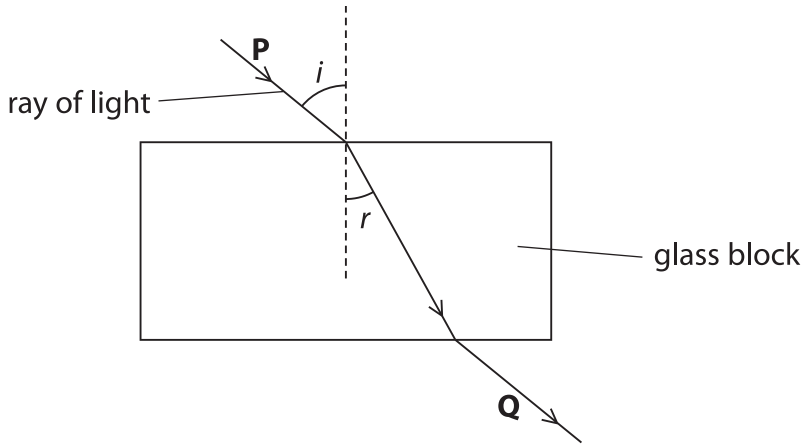


Figure 4

The student measures angle *r* for several different values of angle *i*.

Figure 5 shows the student's results.

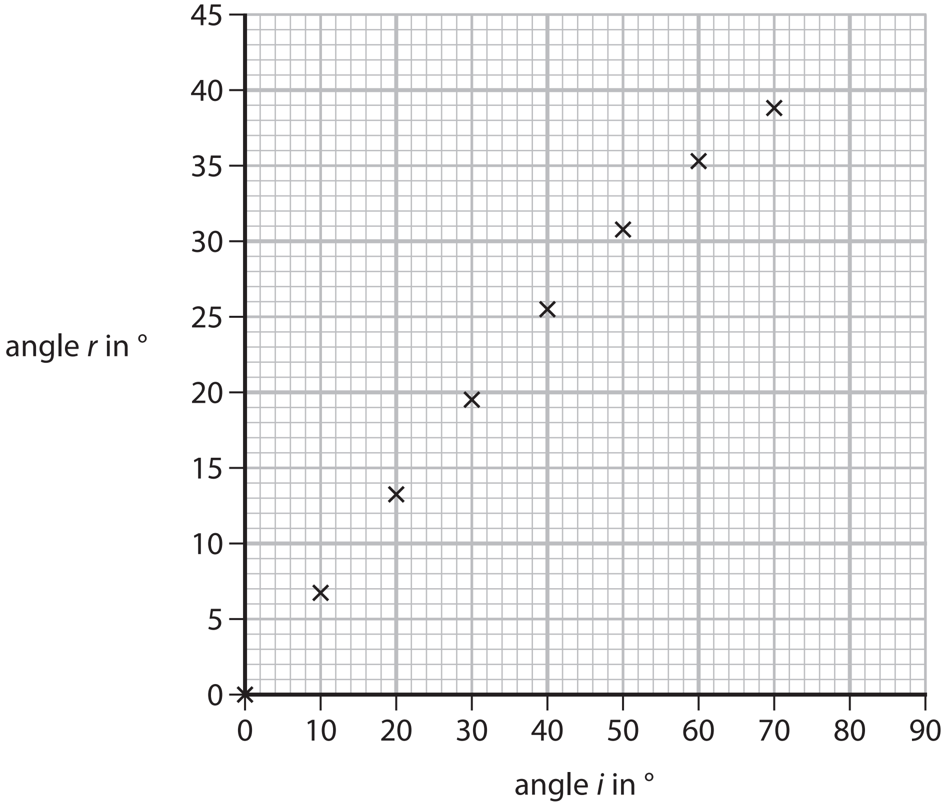


Figure 5

(a) (i) On the graph in Figure 5, draw the best fit curve.

(1)

(ii) Use the graph in Figure 5 to estimate the value of angle *r* when angle *i* is 80°.

(1)

angle *r* = ... °

(iii) Describe how angle *r* changes with angle *i* for the results shown on the graph in Figure 5.

(2)

....

....

....

....

(b) In Figure 4, the frequency of the light remains the same in glass as in air.

Which row of the table describes what happens to the wave velocity and to the wavelength of the light when the light travels from air to glass?

(1)

		wave velocity	wavelength
☒	**A**	decreases	decreases
☒	**B**	decreases	increases
☒	**C**	increases	decreases
☒	**D**	increases	increases

(c) In Figure 6, only refraction of light is shown.

Other things happen to the light as it travels from **P** to **Q**.

The intensity (brightness) of the light at **Q** is less than the intensity of the light at **P**.

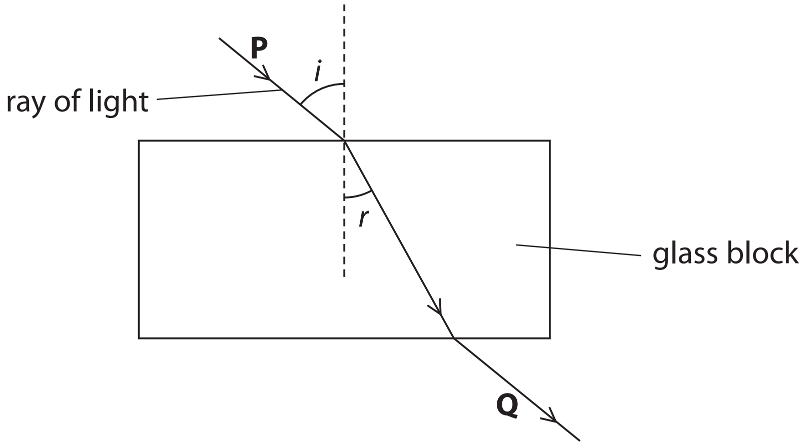


Figure 6

Explain the decrease in intensity as the light travels from **P** to **Q**.

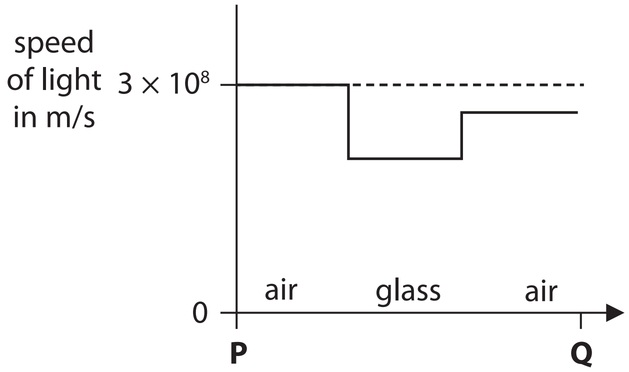
You may add to Figure 6 to help your answer.

(3)

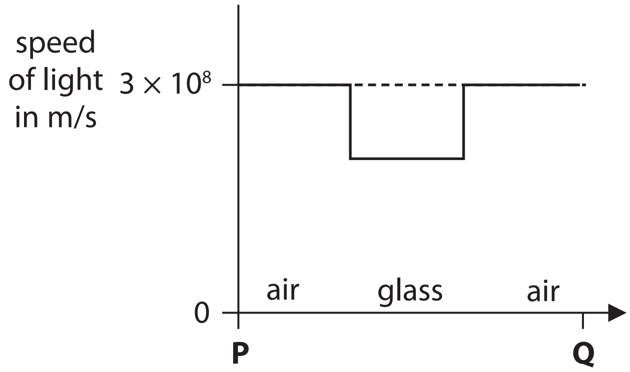
(d) Which of these sketch graphs represents the speed of light as it travels from **P** to **Q**?

(1)

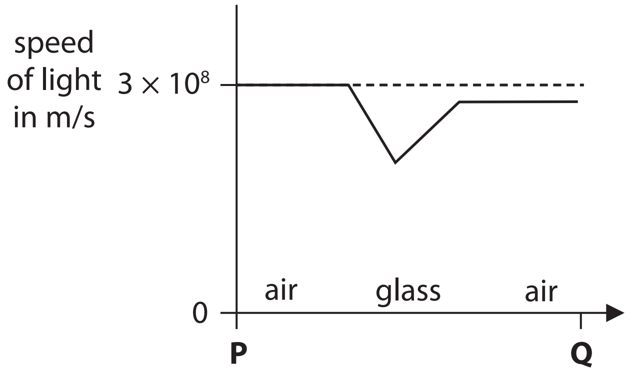
☐ **A**



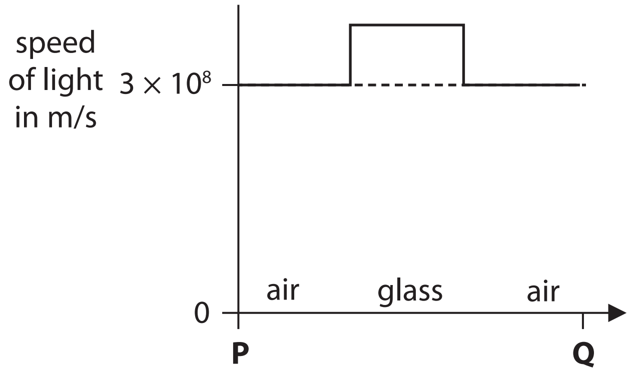
☐ **B**



☐ **C**

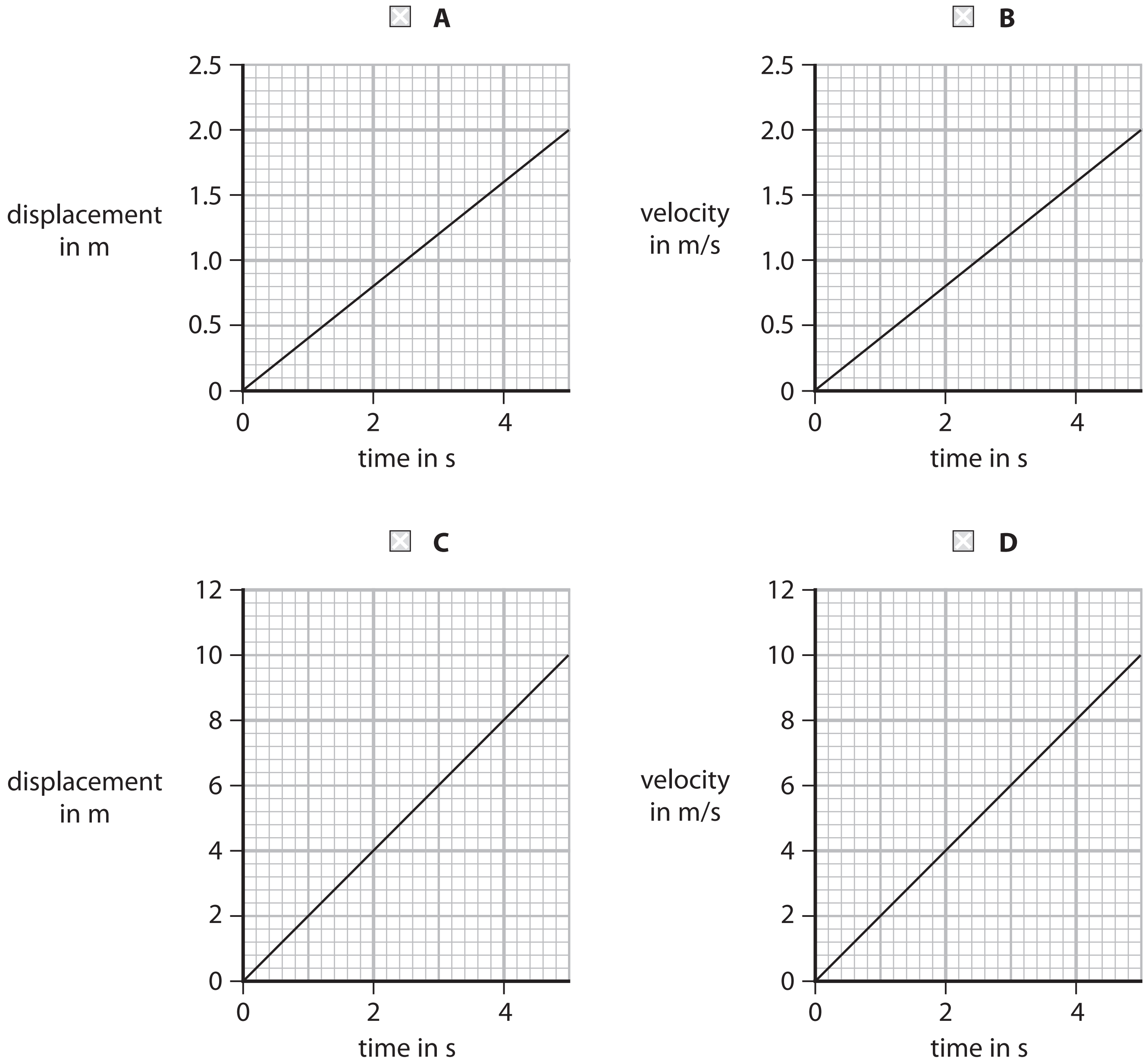


☐ **D**



(Total for Question 3 = 9 marks)

4 (a) Which of these graphs represents an object moving with a constant velocity of 2 m/s?
(1)



(b) Figure 7 is a velocity/time graph showing a 34 s part of a train's journey.

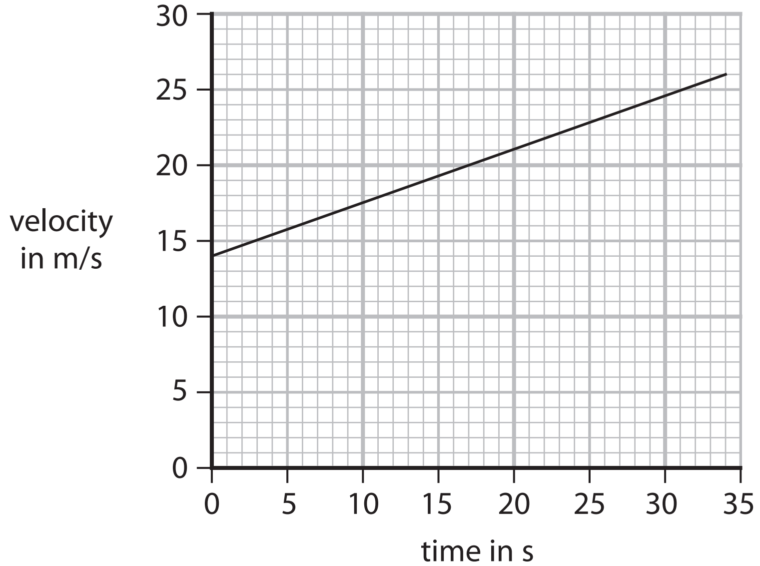


Figure 7

(i) Calculate the acceleration of the train in the 34 s.

Give your answer to an appropriate number of significant figures.

(3)

acceleration = ... m/s^2

(ii) Calculate the distance the train travels in the 34 s.

(3)

distance .... m

(c) Figure 8 shows a rocket soon after it takes off from the ground.

(Source: © Alones/Shutterstock)

Figure 8

The force that the rocket engines produce remains constant during the first few seconds after take-off.

Explain what happens to the acceleration during the first few seconds.

(3)

....

....

....

....

....

....

(Total for Question 4 = 10 marks)

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5 (a) Figure 9 shows a small steel ball held at a height, *h*, above the ground.

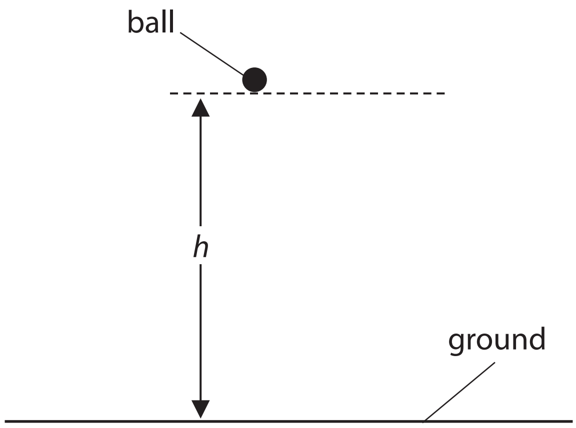

Figure 9

The ball is released and allowed to fall to the ground.

The height *h* is 1.4 m.

Calculate the time, *t*, for the ball to reach the ground.

Use the equation

$$t^2 = \frac{2h}{g}$$

$g = 10\,m/s^2$

(2)

t = ... s

(b) Two students use the arrangement shown in Figure 9.

They use a stopwatch to time the ball falling through the height of 1.4 m.

The students repeat the measurement many times, but their average value for *t* is different from the calculated value.

(i) Suggest a reason why the students' value for *t* is different from the calculated value.

(1)

....

....

(ii) Suggest **one** improvement the students could make to their procedure so that their value for *t* is closer to the calculated value.

(1)

....

....

(c) Figure 10a shows a box falling towards a hard floor.

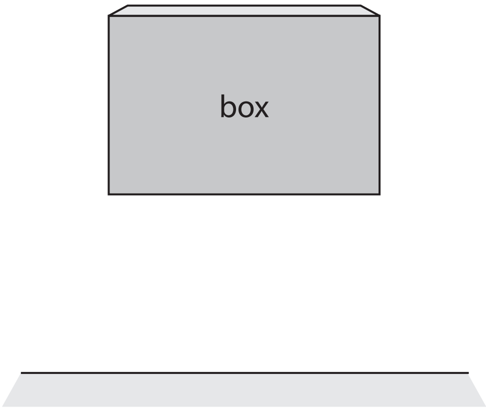

Figure 10a

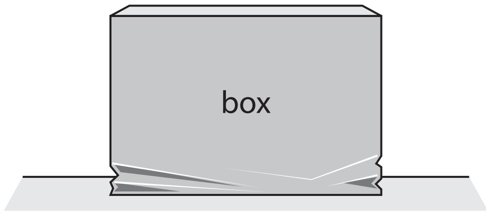

Figure 10b

The box hits the floor and crumples a little before it comes to rest as shown in Figure 10b.

The momentum of the box just before it hits the floor is 8.7 kg m/s.

The box comes to rest 0.35 s after it first hits the floor.

(i) Calculate the magnitude of the force exerted by the floor on the box.

Use an equation selected from the list of equations at the end of this paper.

(2)

force exerted by the floor on the box = ... N

(ii) State the magnitude and direction of the force exerted by the box on the floor.

(2)

magnitude ....

direction ....

(d) Figure 11 shows a ball held in a clamp at **R**, above the ground.

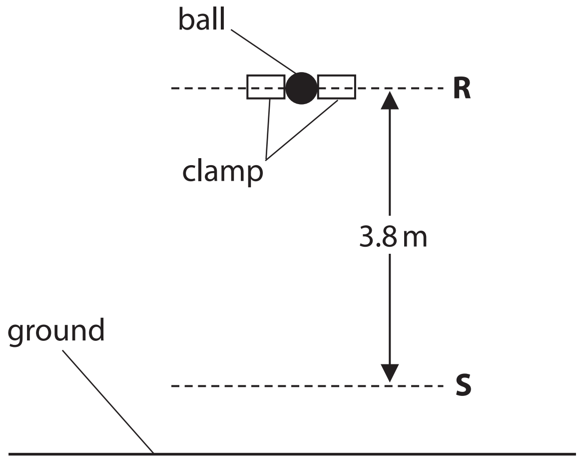

Figure 11

The ball is released from the clamp and falls.

S is 3.8 m below **R**.

At **S** the momentum of the ball is 0.40 kg m/s.

Calculate the mass of the ball.

Acceleration due to gravity, g, = 10 m / s^2

(4)

mass of the ball .... kg

(Total for Question 5 = 12 marks)

6 (a) Sometimes food can become contaminated with radioactive substances.

Describe the harmful effects of eating food contaminated with radioactive substances.

(2)

....

....

....

....

(b) Gamma radiation can be used in food processing to irradiate food.

Explain why some food is irradiated with gamma radiation.

(2)

....

....

....

....

(c) Gamma radiation is part of the electromagnetic spectrum.

When the nucleus of an atom emits a gamma ray, the number of protons in the nucleus and the number of neutrons in the nucleus **do not** change.

State how the nucleus **does** change when it emits a gamma ray.

(1)

....

....

*(d) Gamma radiation is produced by radioactive decay.

Alpha radiation and beta radiation are also produced by radioactive decay.

Compare the processes of alpha decay and beta decay.

Your answer should include what each radiation is and what effect each decay has on the original nucleus.

(6)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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Equations

(final velocity)^2 − (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
force = change in momentum ÷ time $F = \frac{(mv - mu)}{t}$
energy transferred = current × potential difference × time $E = I \times V \times t$
force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length $F = B \times I \times l$
$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil $V_p \times I_p = V_s \times I_s$
change in thermal energy = mass × specific heat capacity × change in temperature $\Delta Q = m \times c \times \Delta\theta$
thermal energy for a change of state = mass × specific latent heat $Q = m \times L$
to calculate pressure or volume for gases of fixed mass at constant temperature $P_1 V_1 = P_2 V_2$
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = ½ \times k \times x^2$
pressure due to a column of liquid = height of column × density of liquid × gravitational field strength $P = h \times \rho \times g$