Paper Reference(s) **1SC0 / 1PF**

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

Combined Science

Paper 3: Physics 1

Foundation Tier

Wednesday 22 May 2019 – Afternoon

Time: 1 hour 10 minutes plus your additional time allowance

INSTRUCTIONS TO CANDIDATES

Write your centre number, candidate number, surname, other names and your signature in the boxes below. Check that you have the correct question paper.

Centre No.							
Candidate No.							
Surname							
Other names							
Signature							
Paper Reference	1	S	C	0	/	1	P	F

- Use BLACK ink or ball-point pen.
- 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.

MATERIALS REQUIRED FOR EXAMINATION
Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS
Equations booklet

INFORMATION FOR CANDIDATES

- 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.

(Instructions continue on next page)

ADVICE TO CANDIDATES

- 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.

(Turn over)

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 a speed/time graph for a car.

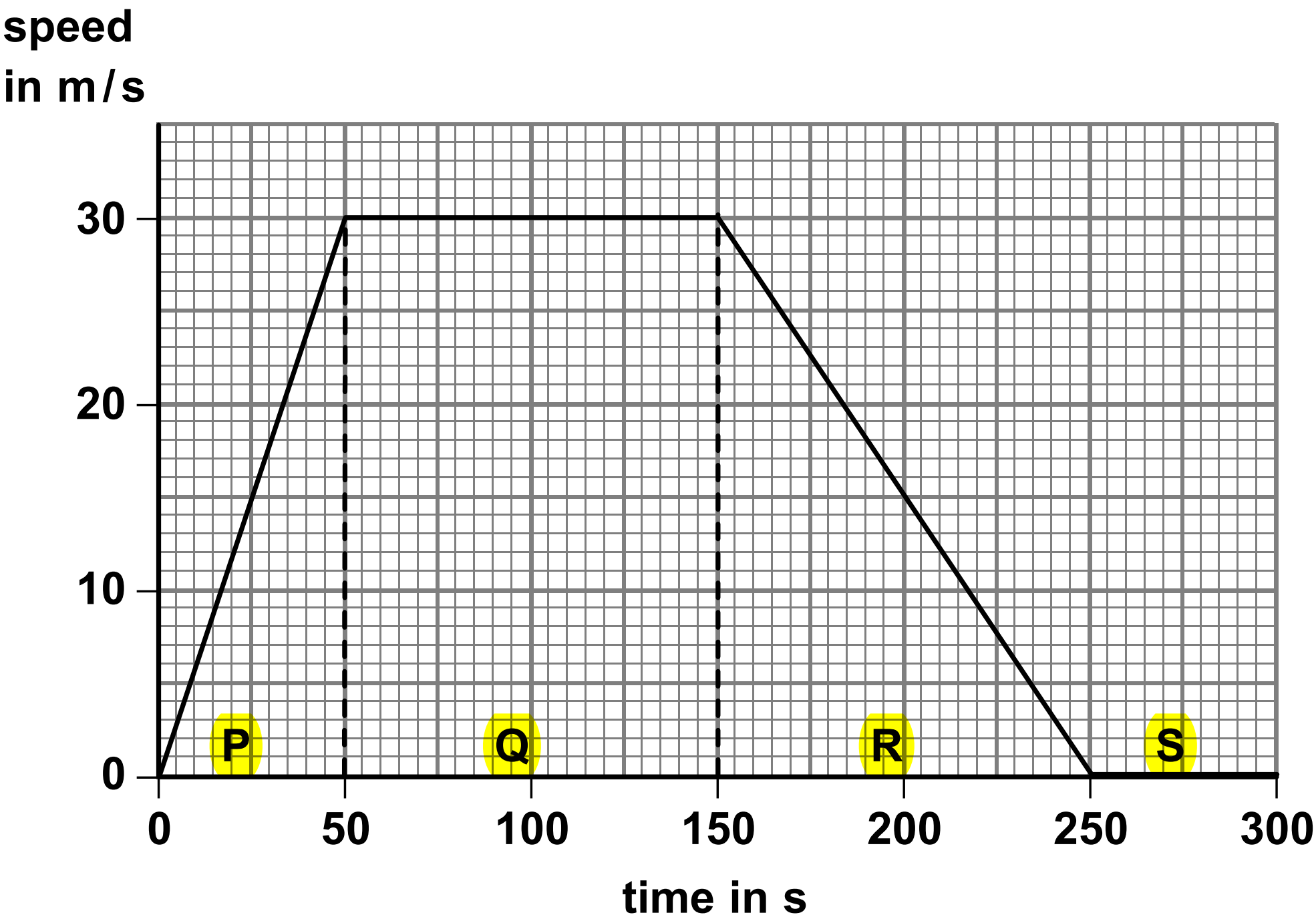


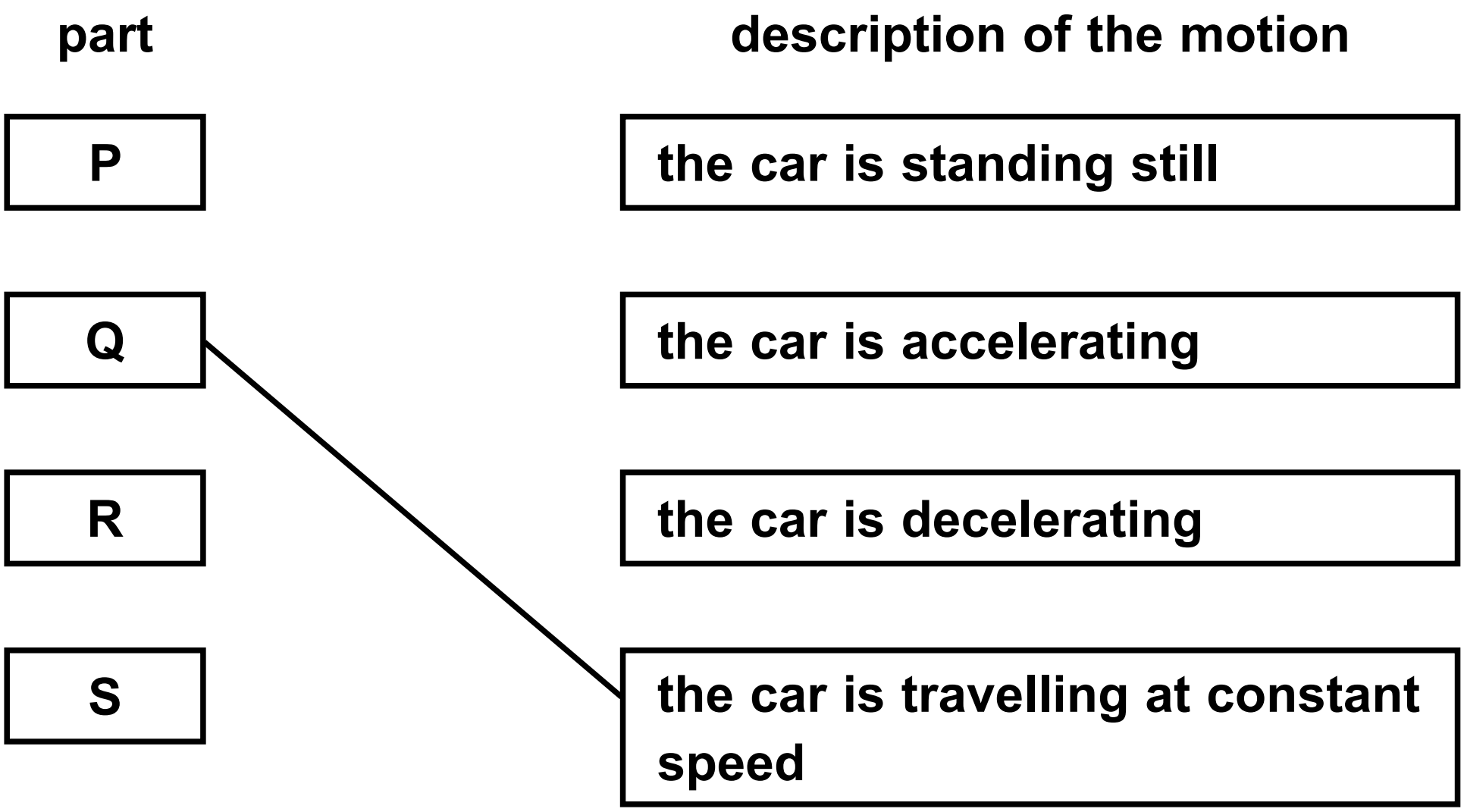
Figure 1

(Question continues on next page)

(i) The graph in Figure 1 is divided into four parts, P, Q, R and S.

Draw a line from the letter for each PART to the correct DESCRIPTION OF THE MOTION during that part.

One line has been drawn for you. (2 marks)



(Question continues on next page)

(ii) In two parts of the graph in Figure 1 the forces are balanced.

State the letters of the two parts of the graph where the horizontal forces acting on the car are balanced. (2 marks)

part _____ and part _____

(iii) Calculate the distance travelled by the car in part Q. (2 marks)

Use the equation

distance travelled = average speed × time

distance travelled = _____ m

(Question continues on next page)

(b) A car with a mass of 1800 kg is accelerating at 1·2 m/s^2.

Calculate the force used to accelerate the car.
(2 marks)

Use the equation

force = mass × acceleration

force = _____ N

(TOTAL FOR QUESTION 1 = 8 MARKS)

(Questions continue on next page)

2 (a) Figure 2 shows an energy transfer diagram for a steam engine.

The diagram shows the amounts of energy transferred each second by the steam engine.

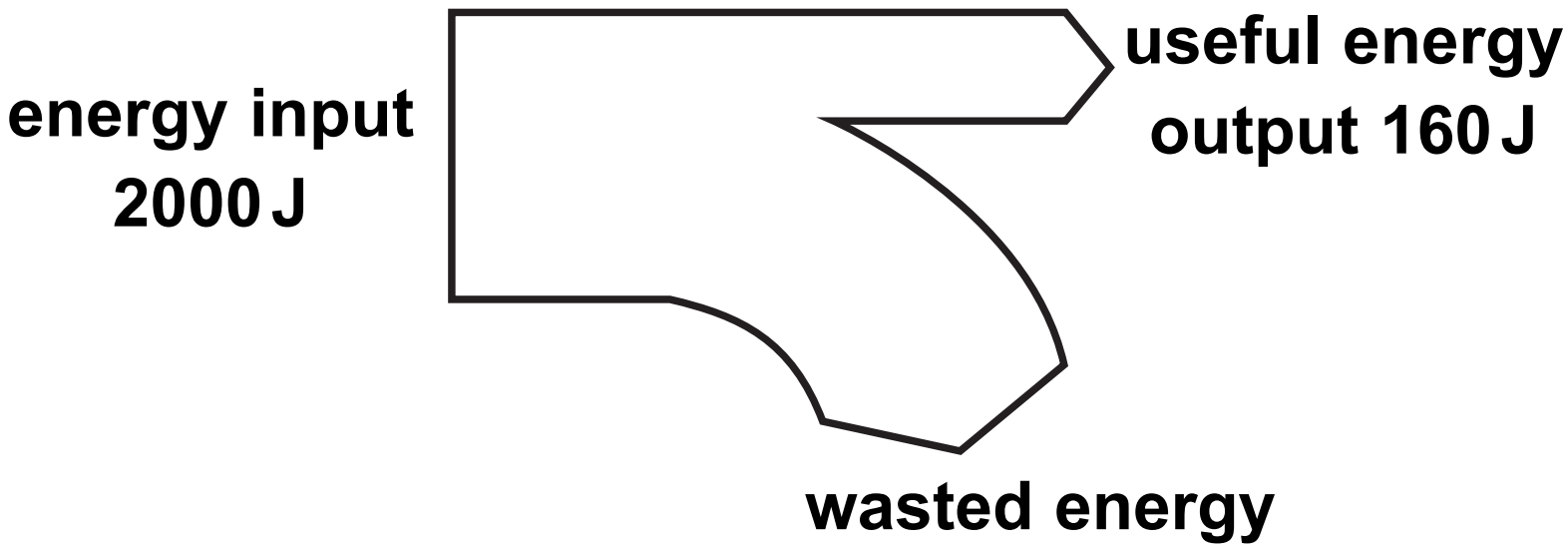


Figure 2

(i) Calculate the amount of wasted energy.
(1 mark)

wasted energy = _____ J

(Question continues on next page)

(ii) Calculate the efficiency of the steam engine.
(2 marks)

Use the equation

$$\text{efficiency} = \frac{\text{(useful energy transferred by the steam engine)}}{\text{(total energy supplied to the steam engine)}}$$

efficiency = _____

(Question continues on next page)

(iii) State what happens to the wasted energy. (1 mark)

(iv) Coal is a fossil fuel that is burnt in some steam engines.

State TWO ways that the use of coal might be harmful to the environment. (2 marks)

1 _____

_____

2 _____

_____

_____

(Question continues on next page)

(b) A model train has a mass of 8·0 kg.
It travels at a speed of 1·5 m/s.

Calculate the kinetic energy of the model train.
(3 marks)

Use the equation

$$\text{kinetic energy} = \tfrac{1}{2} \times \text{mass} \times (\text{speed})^2$$

kinetic energy = _____ J

(TOTAL FOR QUESTION 2 = 9 MARKS)

(Questions continue on next page)

3 (a) (i) Use words from the box to complete the sentences below about ions. (2 marks)

absorbing		gaining
inner	losing	outer

Atoms may form positive ions by

_____ electrons.

The electrons involved in forming positive

ions are the _____ electrons.

(ii) Which of these radiations is both electromagnetic and ionising? (1 mark)

☐ A alpha

☐ B beta minus

☐ C gamma

☐ D neutron

(Question continues on next page)

(iii) Which type of radiation will travel the shortest distance in air? (1 mark)

☐ A alpha

☐ B beta minus

☐ C beta plus

☐ D gamma

(b) Lead-214 is a radioactive isotope.

(i) State ONE way in which radioactive isotopes can be harmful to people. (1 mark)

(Question continues on next page)

(ii) Lead-214 emits β^- particles.

Describe what happens to the nucleus of a lead-214 atom when it emits a β^- particle.
(2 marks)

(c) The typical size of an atom is (1 mark)

- ☐ A 10^{-5} m
- ☐ B 10^{-10} m
- ☐ C 10^{-15} m
- ☐ D 10^{-20} m

(Question continues on next page)

(d) The mass of a proton is $1{\cdot}6726 \times 10^{-27}$ kg.
The mass of an electron is $9{\cdot}1094 \times 10^{-31}$ kg.

Calculate how many times the mass of a proton is greater than the mass of an electron.

Give your answer to two significant figures.
(3 marks)

_____ times

(TOTAL FOR QUESTION 3 = 11 MARKS)

(Questions continue on next page)

4 (a) (i) Which of these would be a typical speed for a racing cyclist travelling down a steep straight slope? (1 mark)

☐ A 0·2 m/s

☐ B 2 m/s

☐ C 20 m/s

☐ D 200 m/s

(Question continues on next page)

(ii) A cyclist travels down a slope.
The top of the slope is 20 m vertically above the bottom of the slope.
The cyclist has a mass of 75 kg.

Calculate the change in gravitational potential energy of the cyclist between the top and the bottom of the slope.
The gravitational field strength, g, is 10 N / kg.
(3 marks)

change in gravitational potential energy = _____ J

(Question continues on next page)

(b) An aircraft waits at the start of a runway.
The aircraft accelerates from a speed of 0 m/s to a speed of 80 m/s.
The acceleration of the aircraft is 4 m/s^2.

Calculate the distance, x, travelled by the aircraft while it is accelerating. (2 marks)

Use the equation

$$x = \frac{v^2 - u^2}{2a}$$

x = _____ m

(Question continues on next page)

(c) A student needs to measure the average speed of an accelerating trolley between two marks on a bench.

Figure 3 shows the arrangement of some apparatus that the student can use.

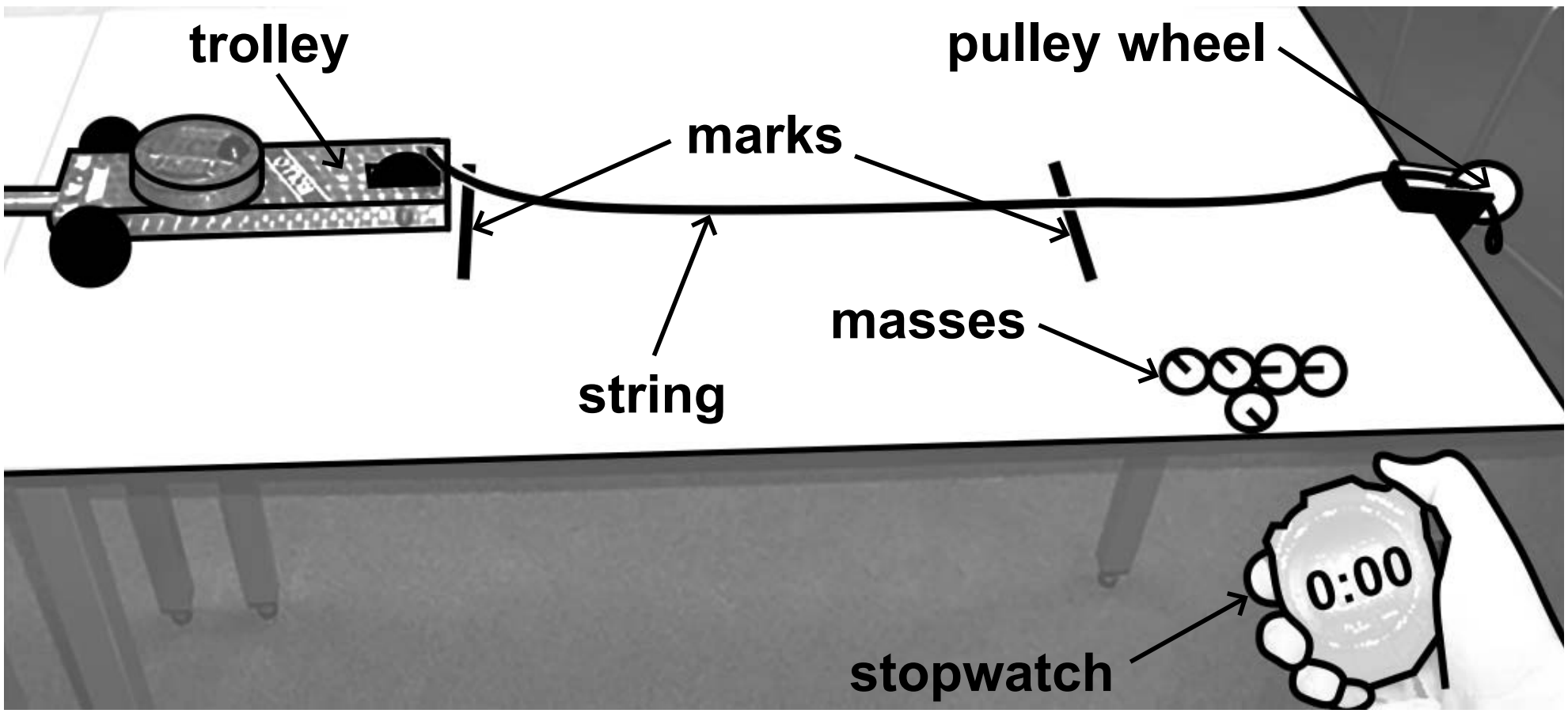


Figure 3

(i) One piece of apparatus is missing from the diagram.
This piece of apparatus is needed to determine the average speed.

State the extra piece of apparatus needed to determine the average speed. (1 mark)

(Question continues on next page)

(ii) Describe how the student can make the trolley accelerate along the bench. (2 marks)

(Question continues on next page)

(iii) The student wishes to develop the experiment to determine the acceleration of the trolley.

State ONE OTHER measurement that the student must make to determine the acceleration of the trolley. (1 mark)

(TOTAL FOR QUESTION 4 = 10 MARKS)

(Questions continue on next page)

5 (a) Which colour of visible light has the longest wavelength? (1 mark)

☐ A blue

☐ B green

☐ C red

☐ D yellow

(b) Some television remote controls use infrared radiation and other remote controls use radio waves.

Explain why an infrared remote control may not switch on the television from behind an armchair but a radio wave remote control always will. (2 marks)

(Question continues on next page)

(c) Figure 4 is a diagram of a water wave.

A cork is floating on the water.

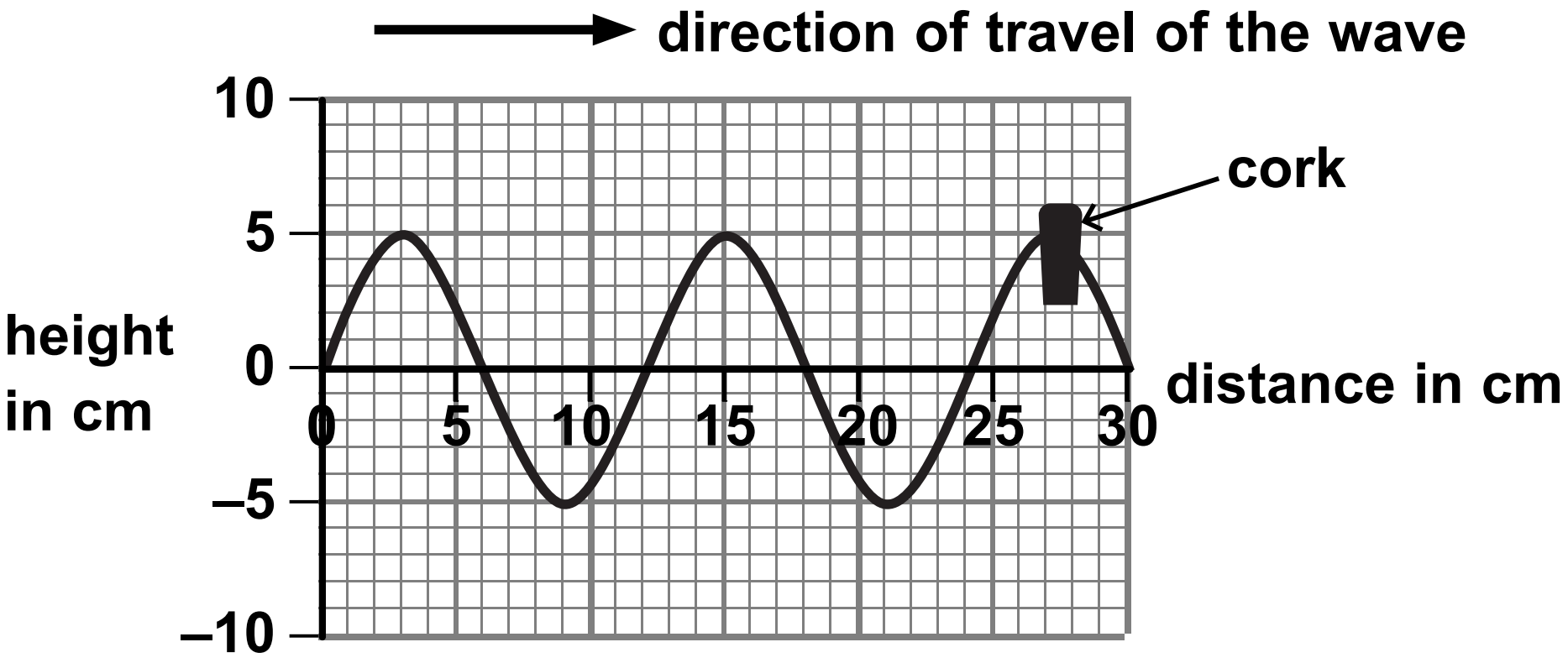


Figure 4

(i) Use the scale on the diagram to measure the wavelength of the wave. (2 marks)

wavelength = _____ cm

(Question continues on next page)

(ii) Describe the motion of the cork.

You should include how the cork moves relative to the direction of travel of the wave.
(2 marks)

(Question continues on next page)

(d) A different water wave has a wavelength of 0·25 m and a frequency of 1·5 Hz.

Calculate the wave speed. (2 marks)

wave speed = _____ m/s

(TOTAL FOR QUESTION 5 = 9 MARKS)

(Questions continue on next page)

6 (a) Carbon-13 and carbon-14 are isotopes of carbon.

Nuclei of carbon-13 and carbon-14 can be represented by these symbols

$$^{13}_{6}C \quad \text{and} \quad ^{14}_{6}C$$

Complete the table for an atom of carbon-13 and an atom of carbon-14. (2 marks)

	number of neutrons in the nucleus	number of electrons in orbit around the nucleus
carbon-13		
carbon-14		

(b) (i) State the name of an instrument that can be used to measure radioactivity. (1 mark)

(Question continues on next page)

(ii) State TWO sources of background radiation. (2 marks)

1 _____

2 _____

(c) Carbon-14 is radioactive and has a half-life of 5 700 years.

The number of radioactive carbon-14 atoms in a very old piece of wood is found to have decreased from 1 000 000 to 125 000.

Determine the age of the piece of wood. (2 marks)

age of wood = _____ years

(Question continues on next page)

*(d) In 1908 a scientist called Rutherford was investigating ideas about atoms.

His students fired a beam of alpha particles at a thin piece of gold foil.

Figure 5 shows the arrangement of the experiment.

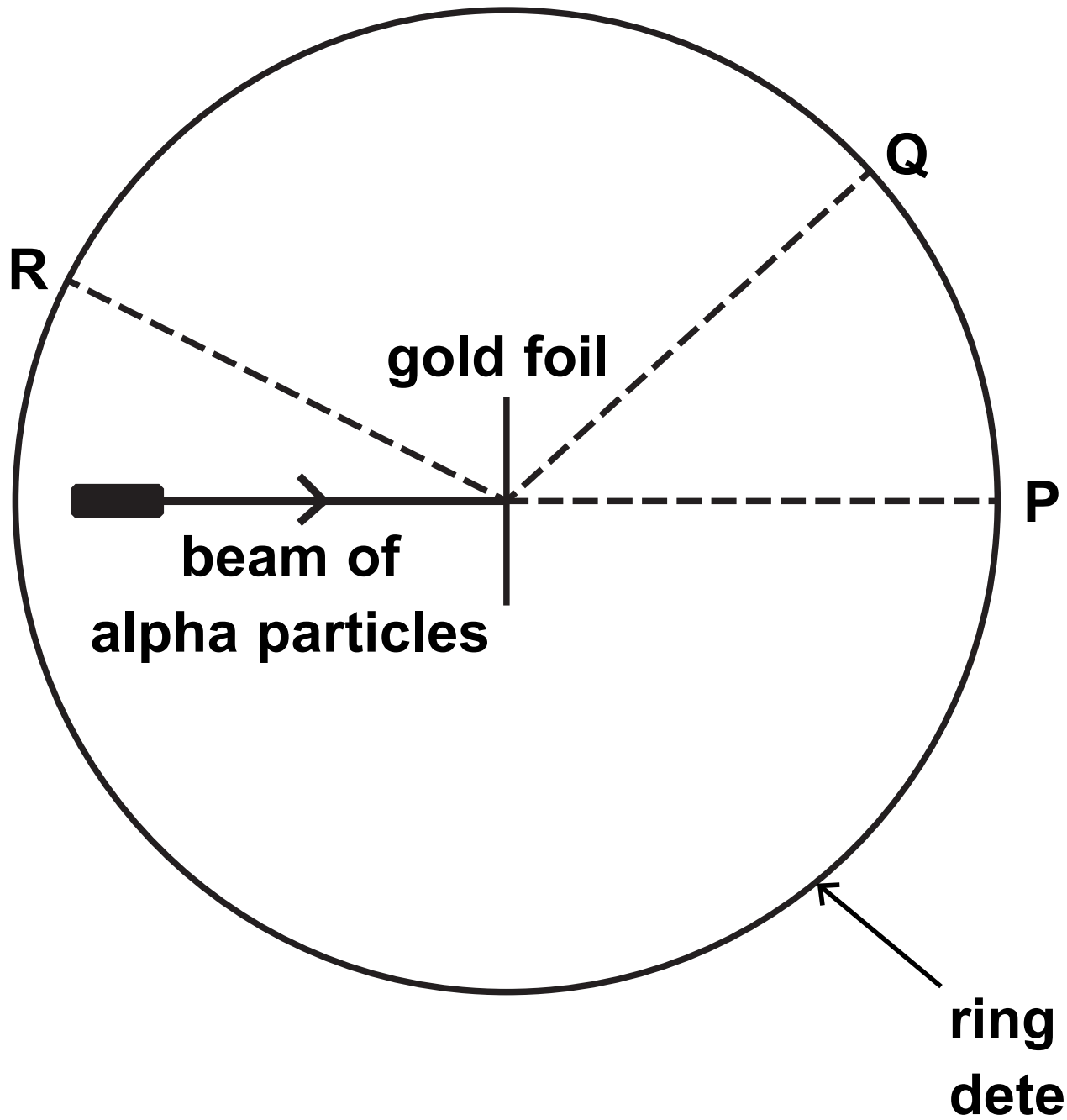


Figure 5

Some alpha particles were found at all parts of the ring of detectors.

(Question continues on next page)

The table in Figure 6 shows how many alpha particles were detected at P, at Q and at R, in one experiment.

position	number of alpha particles detected
P	72340
Q	25
R	2

Figure 6

Explain what the information in Figure 5 and Figure 6 shows about the structure of an atom. (6 marks)

(Continue your answer on next page)

(Continue your answer on next page)

(Turn over)

(TOTAL FOR QUESTION 6 = 13 MARKS)

TOTAL FOR PAPER = 60 MARKS

END