

0 4

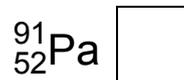
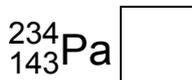
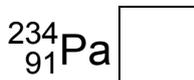
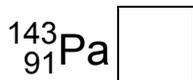
Protactinium (Pa) is radioactive.

0 4 . 1

An atom of one isotope of protactinium contains 91 protons and 143 neutrons.

What is the correct symbol for this atom?

[1 mark]

Tick (✓) **one** box.

A teacher investigated how the count rate from a sample of protactinium changed over time.

Table 2 shows the results.

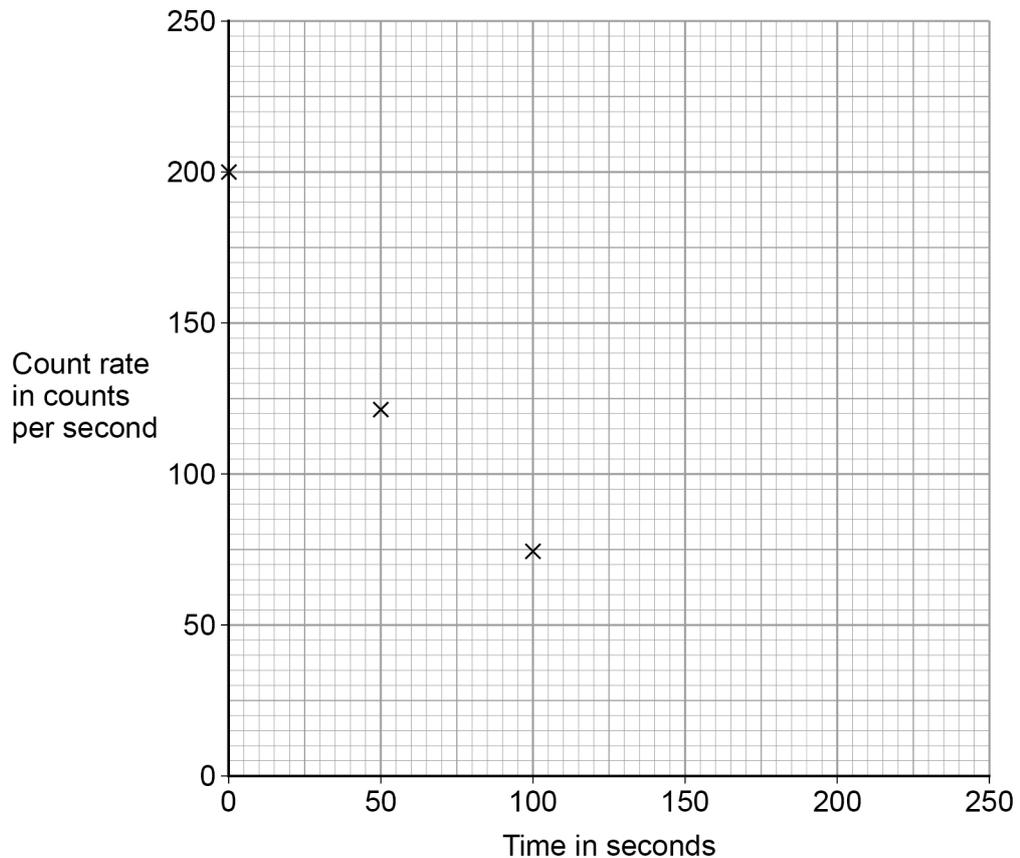
Table 2

| Time in seconds | Count rate in counts per second |
|-----------------|---------------------------------|
| 0 | 200 |
| 50 | 122 |
| 100 | 74 |
| 150 | 45 |
| 200 | 27 |



Figure 6 shows some of the teacher's results.

Figure 6



0 4 . 2 Complete the graph in **Figure 6**.

Use data from **Table 2**.

Draw the line of best fit.

[2 marks]

0 4 . 3 How much time did it take for the count rate to change from 200 counts per second to 100 counts per second?

[1 mark]

Time taken = _____ s

0 4 . 4 What is the half-life of protactinium?

[1 mark]

Half-life = _____ s

Turn over ►



0 4 . 5 The nuclear radiation from the protactinium can pass through paper.

This radiation can only be detected up to 1 metre away from the protactinium.

What type of radiation is emitted by the protactinium?

[1 mark]

Tick (✓) **one** box.

Alpha

Beta

Gamma

Neutron

0 4 . 6 The teacher read an article about the effects of radiation on the human body.

Why are articles in scientific journals generally more trustworthy than articles in newspapers?

[1 mark]

7



| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|--------------|--|--|------------|--------------------------------|----|
| 04.1 | ${}_{91}^{234}\text{Pa}$ | | 1 | AO1/1 6.4.1.2 | A |
| 04.2 | points correctly plotted to within 1 mm a curved line of best fit passing within 1 mm of all 5 points | ignore any line beyond 200 seconds | 1 1 | AO2.2 6.4.2.3 WS 3.2 | E |
| 04.3 | 70 (s) | allow an answer between 65 and 75 (s) allow an answer consistent with their drawn line | 1 | AO2/2 6.4.2.3 WS 3.5 | E |
| 04.4 | 70 (s) | allow an answer between 65 and 75 (s) allow their answer to question 04.3 | 1 | AO3/2b 6.4.2.3 | E |
| 04.5 | beta | | 1 | AO1.1 6.4.2.1 | A |
| 04.6 | articles in scientific journals are peer reviewed | allow articles in scientific journals are based on evidence/data allow newspaper articles may be oversimplified/inaccurate/biased | 1 | AO1.1 6.4.2.4 WS 1.6 | E |
| Total | | | 7 | | |