Q1. (2018)

0 5 Radioactive nuclei can emit alpha, beta or gamma radiation.

0 5 . 1 Which type of radiation is the most penetrating?

[1 mark]

Tick **one** box.

- Alpha (α) ☐
- Beta (β) ☐
- Gamma (γ) ☐

Q2. (2018)

0 5 . 2 Which type of radiation is the most ionising?

[1 mark]

Tick **one** box.

- Alpha (α) ☐
- Beta (β) ☐
- Gamma (γ) ☐

Q3. (2018)

0 5 . 3 Which type of radiation has the longest range in air?

[1 mark]

Tick **one** box.

- Alpha (α) ☐
- Beta (β) ☐
- Gamma (γ) ☐

Q4. (2019)

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

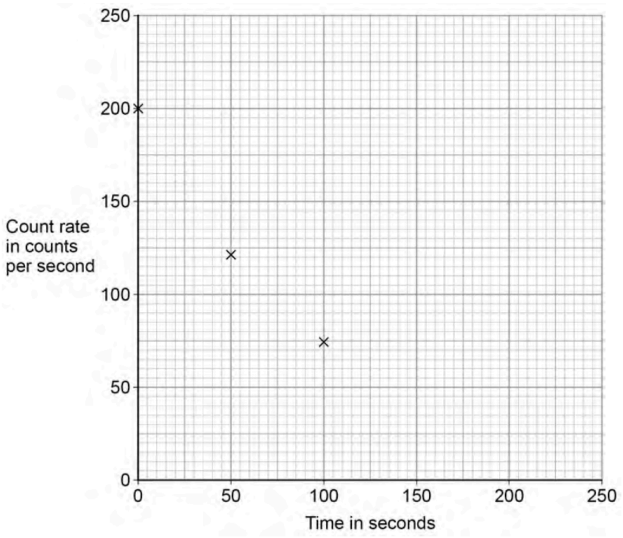
Table 2 shows the results.

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



A)

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

Use data from **Table 2**.

Draw the line of best fit.

[2 marks]

B)

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

C)

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

[1 mark]

Half-life = _____ s

D)

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 ☐

Q5. (2020)

0 6 Different radioactive isotopes emit different types of nuclear radiation.

A polonium-210 (Po) nucleus emits an alpha particle (α) and turns into a lead (Pb) nucleus.

This can be represented by the equation:

$$^{210}_{84}\text{Po} \longrightarrow {}^{A}_{Z}\text{Pb} + \alpha$$

A)

0 6 . 1 What is the value of A in the equation?

[1 mark]

Tick (✓) **one** box.

A = 206 ☐ A = 208 ☐ A = 210 ☐ A = 211 ☐

B)

0 6 . 2 What is the value of Z in the equation?

[1 mark]

Tick (✓) **one** box.

Z = 80 ☐ Z = 82 ☐ Z = 85 ☐ Z = 86 ☐

Q6. (2020)

0 6 . 3 A strontium-89 nucleus (Sr) emits a beta particle (β) and turns into an yttrium nucleus (Y).

This can be represented by the equation:

$$^{89}_{38}\text{Sr} \longrightarrow {}^{A}_{Z}\text{Y} + \beta$$

What are the values of A and Z in the equation?

[2 marks]

A = _____

Z = _____

Q7. (2020)

0 6 . 4 Gamma radiation is another type of nuclear radiation.

What does gamma radiation consist of?

[1 mark]

Tick (✓) **one** box.

High energy neutrons ☐

Electromagnetic waves ☐

Particles with no charge ☐

Positively charged ions ☐

Q8. (2020)

0 6 . 5 Explain the differences between the properties of alpha, beta and gamma radiations.

[6 marks]

Q9. (2021)

0 6 . 2 Alpha particles can ionise atoms in the air.

What happens to an atom when it is ionised by an alpha particle?

[2 marks]

Tick (✓) **two** boxes.

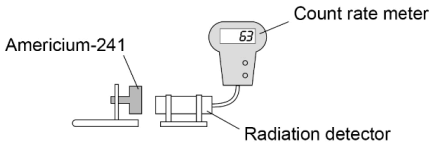
- A neutron in the atom becomes a proton. ☐
- The atom becomes a positive ion. ☐
- The atom gains a neutron. ☐
- The atom gains a proton. ☐
- The atom loses an electron. ☐

Q10. (2022)

0 3 A teacher demonstrated that the radioactive isotope americium-241 emits alpha particles.

Figure 4 shows the equipment used.

Figure 4



A)

0 3 . 1 An americium-241 nucleus (Am) emits an alpha particle and turns into a neptunium nucleus (Np).

Which is the correct nuclear equation for this decay?

Tick (✓) **one** box.

[1 mark]

- $^{241}_{95}Am \longrightarrow {}^{237}_{93}Np + {}^{4}_{2}He$ ☐
- $^{241}_{95}Am \longrightarrow {}^{245}_{93}Np + {}^{4}_{2}He$ ☐
- $^{241}_{95}Am \longrightarrow {}^{237}_{97}Np + {}^{4}_{2}He$ ☐

B)

The teacher replaced the americium-241 with a source of beta radiation.

0 3 . 4 Which symbol represents a beta particle?

[1 mark]

Tick (✓) **one** box.

- $^{0}_{-1}e$ ☐
- $^{0}_{0}e$ ☐
- $^{-1}_{-1}e$ ☐
- $^{-1}_{0}e$ ☐

Q11. (2023)

0 1 A scientist investigated the radiation emitted by different radioactive isotopes.

The scientist had a sample of polonium-210.

The radiation emitted by polonium-210 can be represented by the symbol $^{4}_{2}He$.

A)

0 1 . 1 Which type of radiation can be represented by the symbol $^{4}_{2}He$?

[1 mark]

Tick (✓) **one** box.

- Alpha ☐
- Beta ☐
- Gamma ☐

B)

0 1 . 3 A polonium-210 (Po) nucleus changes into a lead (Pb) nucleus by emitting a $^{4}_{2}He$ particle. This is shown by the following nuclear equation.

$$^{210}_{84}Po \rightarrow {}^{206}_{\mathbf{X}}Pb + {}^{4}_{2}He$$

What is the value of **X**?

[1 mark]

Tick (✓) **one** box.

80 ☐ 82 ☐ 84 ☐ 86 ☐

Q12. (2023)

0 1 . 8 Gamma radiation is emitted from the nucleus of an atom.

Complete the sentence.

Choose the answer from the box.

[1 mark]

electromagnetic waves	**high speed electrons**	
neutrons		**positively charged ions**

Gamma radiation consists of _____.

Q13. (2024)

0 7 Last century, scientists used evidence from the alpha particle scattering experiment to develop a new model of the atom.

In the experiment, alpha particles were directed towards a piece of gold foil.

0 7 . 1 What does an alpha particle consist of?

[1 mark]