**Year 9 Physics Contingency plan 2 weeks Unity Academy: Atomic Structure (Radioactivity)**

Sign into SENECA and use the class code: (Year 9 Physics) **x8bckcedz7**

**or use the url:** https://app.senecalearning.com/dashboard/join-class/x8bckcedz7

Complete the assignments and then use the knowledge organiser to answer the self-quizzing questions. Finally, attempt the following questions:

| | What is it? | Symbol | Charge | Ionising power | Penetrating power | Stopped by… |
|---|---|---|---|---|---|---|
| Alpha | | | | | | |
| Beta | | | | | | |
| Gamma | | | | | | |

**Key points**

- Rutherford used the measurements from alpha-scattering experiments to prove that an atom has a small positively charged central nucleus where most of the mass of the atom is located.
- The plum pudding model could not explain why some alpha particles were scattered through large angles.
- The nuclear model of the atom correctly explained why the alpha particles are scattered and why some are scattered through large angles.

**2 a** Figure 5 shows four possible paths, labelled A, B, C and D, of an alpha particle deflected by a nucleus. Which path would the alpha particle travel along?

**b** Explain why each of the other paths in part **a** is not possible.

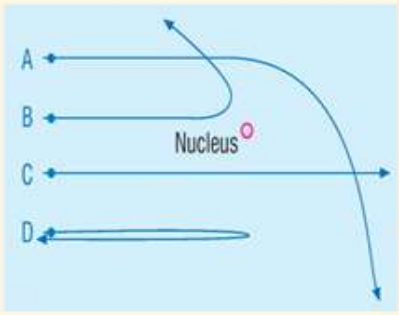


Figure 5

**3 a** Describe two differences between the nuclear model of the atom and the plum pudding model.

**b** Explain why the alpha-scattering experiment led to the acceptance of the nuclear model of the atom and the rejection of the plum pudding model.

| Use | Type of Radiation | How it works |
|---|---|---|
| **Smoke detector (Sounds an alarm when smoke is present in the air)** | | |
| **Tracers in industry (Also used in medicine to find blockages without cutting into the body)** | | |
| **Quality control (Controlling the thickness of a sheet of material to within a few nm)** | | |

**1** How many protons and how many neutrons are there in the nucleus of each of the following isotopes:

**a** $^{12}_{6}C$ [1 mark] **b** $^{60}_{27}Co$ [1 mark] **c** $^{235}_{92}U$? [1 mark]

**d** How many more protons and how many more neutrons are in $^{238}_{92}U$ compared with $^{224}_{88}Ra$? [2 marks]

**2** A substance contains the radioactive isotope $^{238}_{92}U$, which emits alpha radiation. The product nucleus X emits beta radiation and forms a nucleus Y. Determine how many protons and how many neutrons are present in:

**a** a nucleus of $^{238}_{92}U$ [1 mark] **b** a nucleus of X [2 marks]

**c** a nucleus of Y [2 marks]

## Half-life

The time it takes a sample of material for radioactivity to fall to ½ its original level.

E.g. 450 Bq → 225 Bq
100 Bq → 50 Bq
6 Bq → 3 Bq

**A sample of radioisotopes has a half-life of 4 hours. If the activity of the sample is 240Bq, how long does it take to fall to 15Bq?**

**240Bq → 120Bq 4 hours**
**120Bq → 60Bq 4 hours**
**60Bq → 30Bq 4 hours**
**30Bq → 15Bq 4 hours**

**Total = 16 Hours**

## "The time it takes for activity to fall to ½ the original level"

1. A sample has a half life of 2 hours. How long does it take to drop from 100Bq to 25Bq?

2. A sample has a half life of 250 years. How long does it take for activity to fall from 64Bq to 4Bq?

- Radioactive decay is random.
- We cannot predict the outcome of one atom.
- We can predict the outcome of a large number of atoms.

1) A radioactive material has an activity of 40Bq. If it takes 18weeks to fall to 5Bq, calculate the half-life of the sample.

2a) A sample has a half-life of 10 days. How long does it take to fall from an activity of 4,800Bq to 300Bq?

**2b) How long does it take to fall to 0Bq?**

## Half-life

The time it takes a sample of material for radioactivity to fall to ½ its original level.

E.g. 450 Bq → 225 Bq
100 Bq → 50 Bq
6 Bq → 3 Bq

**A sample of radioisotopes takes 16 hours to drop from 240Bq to 15Bq. What is the half life?**

**240Bq → 120Bq**
**120Bq → 60Bq**
**60Bq → 30Bq**
**30Bq → 15Bq**

**Total = 16 Hours**
**16h = 4 half-lives**
**So 1 half life is 4 hours**

## "The time it takes for activity to fall to ½ the original level"

3. A sample takes 4 hours to fall from 300Bq to 75Bq. What is the half life?

4. A sample takes 24 weeks to fall from 1,200Bq to 75Bq. What is the half life?

**A graph to demonstrate radioactive half-life**