# Radioactivity – 2022 GCSE Gateway Physics Combined Science A

**1.** June /2022/Paper_ J250/06/No.4

Some radioactive elements give out beta radiation.

What is beta radiation stopped by?

**A** Aluminium

**B** Thin cardboard

**C** Thin paper

**D** Skin

Your answer ☐ **[1]**

**2.** June /2022/Paper_ J250/06/No.11

**(a)** Uranium-238 is a radioactive isotope.

When uranium decays, it gives out an alpha particle forming thorium-234.

Complete the radioactive decay equation using the symbols below:

$^{4}_{2}\alpha$ $^{234}_{90}Th$ $^{238}_{92}U$

You must write **one** symbol in **each** box.

**[2]**

**(b)** Atoms can give out different types of electromagnetic radiation.

Draw lines to connect each **question** with its correct **answer**.

| Question | Answer |
|---|---|
| Which radiation is given out by atoms? | Radiation with a large range of frequencies |
| | Radiation with a small range of frequencies |
| Which radiation is detected by our eyes? | Only gamma radiation |
| | Only infra-red radiation |

**[2]**

**3.** June /2022/Paper_ J250/06/No.18

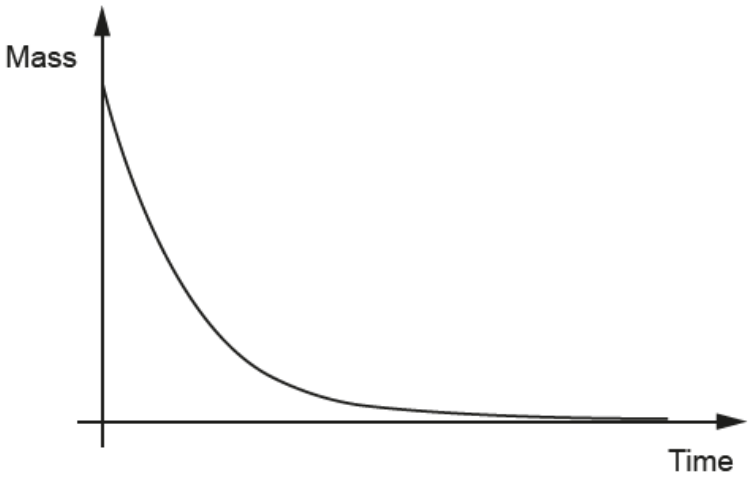
This question is about radioactivity.

**(a)** Which statements about the nucleus of an atom are correct?
Tick (✓) **two** boxes.

| | |
|---|---|
| In radioactive atoms, the nucleus is stable. | ☐ |
| Most of the nucleus contains empty space. | ☐ |
| Scientists can say exactly when a nucleus will emit radiation. | ☐ |
| The diameter of a nucleus is approximately 1 nm. | ☐ |
| The mass of a nucleus is much less than the mass of an atom. | ☐ |
| The nucleus contains protons and electrons. | ☐ |
| The nucleus contains protons and neutrons. | ☐ |
| The nucleus has a positive charge. | ☐ |

**[2]**

**(b)** The graph shows how the mass of a radioactive element changes with time.




Describe the trend shown by the graph.

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..... **[2]**

**4.** June /2022/Paper_ J250/12/No.8

The table shows information about the number of protons, neutrons and electrons in different atoms.

| Atom | Number of protons | Number of neutrons | Number of electrons |
|---|---|---|---|
| **1** | 8 | 10 | 8 |
| **2** | 10 | 10 | 10 |
| **3** | 10 | 12 | 10 |
| **4** | 12 | 12 | 12 |

Which two atoms are isotopes?

**A** **1** and **2**

**B** **1** and **3**

**C** **2** and **3**

**D** **3** and **4**

Your answer ☐ **[1]**

**5.** June /2022/Paper_ J250/12/No.12

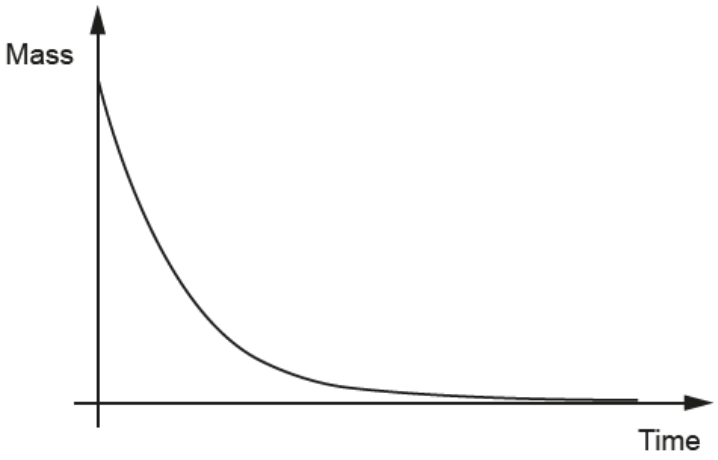
This question is about radioactivity.

**(a)** Which statements about the nucleus of an atom are correct?
Tick (✓) **two** boxes.

| | |
|---|---|
| In radioactive atoms, the nucleus is stable. | ☐ |
| Most of the nucleus contains empty space. | ☐ |
| Scientists can say exactly when a nucleus will emit radiation. | ☐ |
| The diameter of a nucleus is approximately 1 nm. | ☐ |
| The mass of a nucleus is much less than the mass of an atom. | ☐ |
| The nucleus contains protons and electrons. | ☐ |
| The nucleus contains protons and neutrons. | ☐ |
| The nucleus has a positive charge. | ☐ |

**[2]**

**(b)** The graph shows how the mass of a radioactive element changes with time.




Describe the trend shown by the graph.

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..... **[2]**

**6.** June /2022/Paper_ J250/12/No.15

In 1986, a nuclear power station exploded in Chernobyl.

The radioactive isotopes caesium-137 (Cs-137) and iodine-131 (I-131) were released.

**(a)** An old unit of activity is the Curie (Ci).

- The activity of Cs-137 released in the explosion was 2 300 000 Ci.
- 1 Ci = 37 000 000 000 Bq

Calculate the activity of Cs-137 released in Bq.
Give your answer in standard form.

Activity = ..... Bq **[2]**

**(b)** Cs-137 emits beta radiation. The table shows some information about this decay.

| Element | Symbol | Charge on nucleus | Mass of nucleus |
|---|---|---|---|
| **Caesium** | Cs | +55 | 137 |
| **Barium** | Ba | +56 | 137 |

Use the table to complete the balanced nuclear equation for Cs-137 decay.

$$\overset{\cdots\cdots}{\underset{\cdots\cdots}{\phantom{Cs}}}Cs \longrightarrow \overset{\cdots\cdots}{\underset{\cdots\cdots}{\phantom{Ba}}}Ba + \overset{\cdots\cdots}{\underset{\cdots\cdots}{\phantom{\beta}}}\beta$$

**[3]**

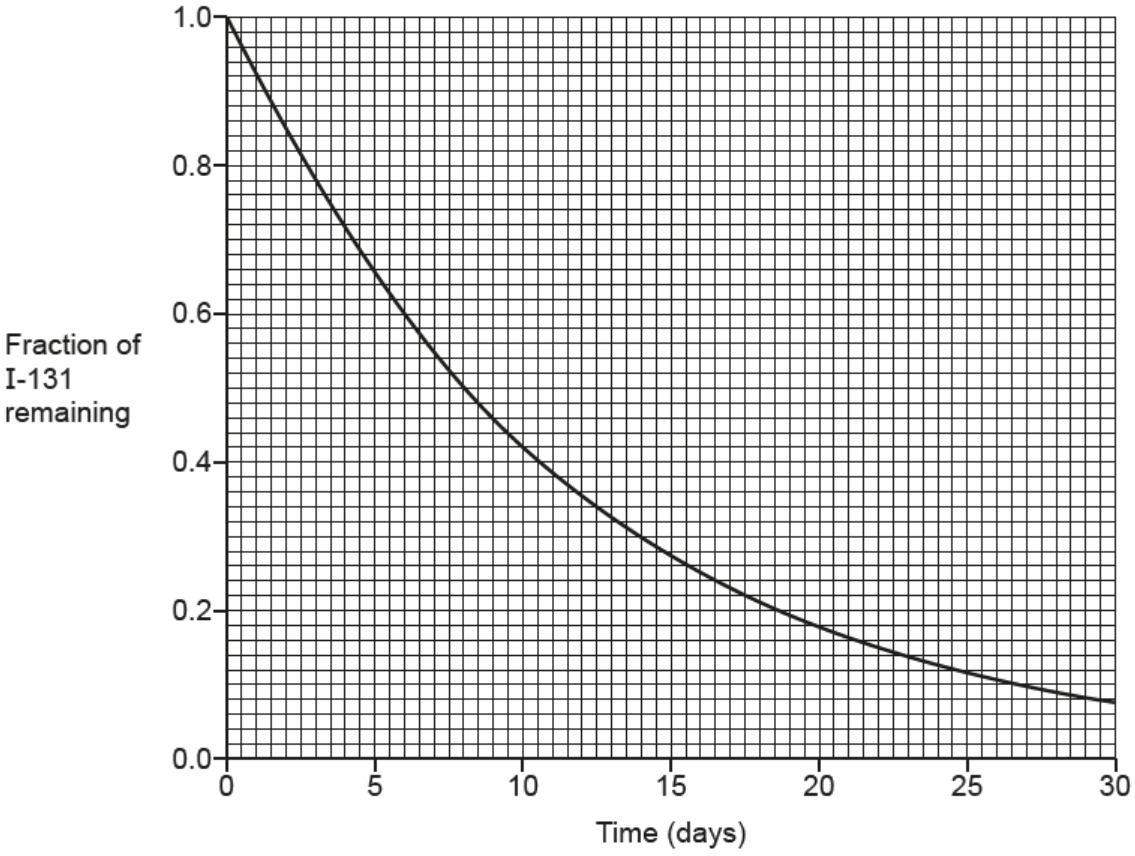
***(c)** The isotopes I-131 and Cs-137 from Chernobyl contaminated sheep.

The government stopped the movement of contaminated sheep for 26 years.

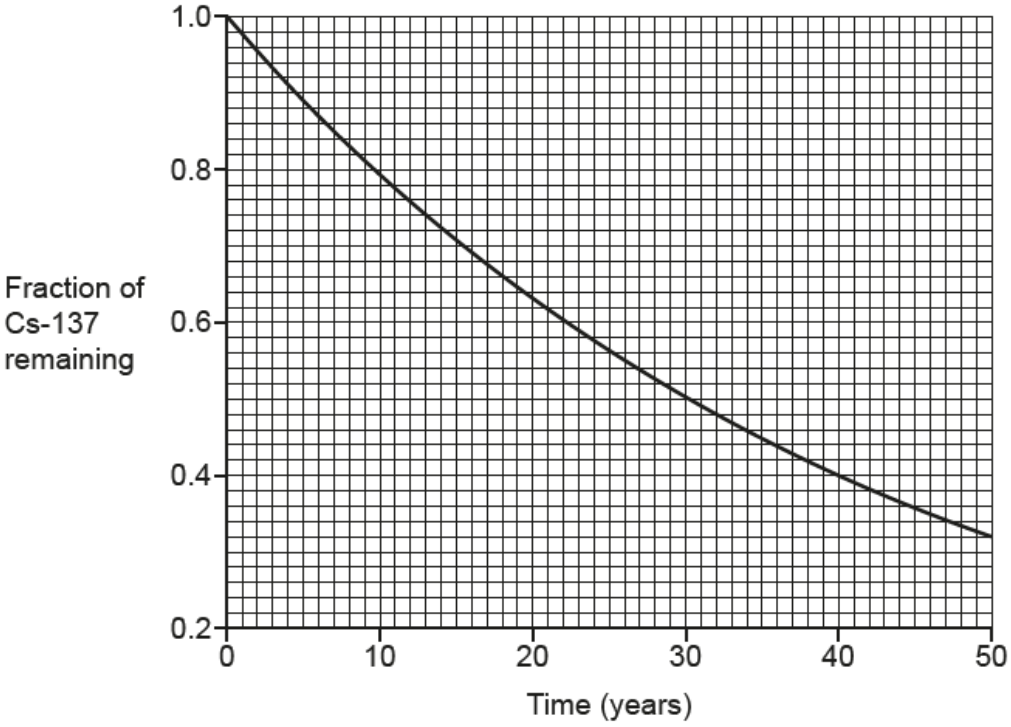
- If the activity per kilogram of sheep was greater than 1000 Bq/kg, the sheep were **contaminated**.
- In 1986, the activity per kg of some sheep was greater than 1600 Bq/kg.
- I-131 emits beta radiation.
- Cs-137 emits beta **and** gamma radiation.

The graphs show how the amount of I-131 and Cs-137 change with time:

**Graph for I-131**



**Graph for Cs-137**




Use the graphs to explain why the government stopped the movement of contaminated sheep for 26 years.

Use ideas about half-life and half-life calculations.

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