

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Q1.

A smoke detector contains a source of alpha radiation in a plastic case.

- (a) A source of beta radiation in a smoke detector would be more hazardous than a source of alpha radiation.

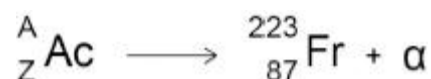
Explain why.

(2)

- (b) Actinium (Ac) is one source of alpha radiation.

An actinium (Ac) nucleus emits an alpha particle (α) and turns into a francium (Fr) nucleus.

This can be represented as:



Determine the values of **A** and **Z**.

A = _____

Z = _____

(2)

- (c) A teacher wanted to find out what nuclear radiation is emitted from a source.

The teacher placed different barriers between the source and a detector.

The teacher recorded the count for 30 seconds after each barrier was put in place.

The table below shows the results.

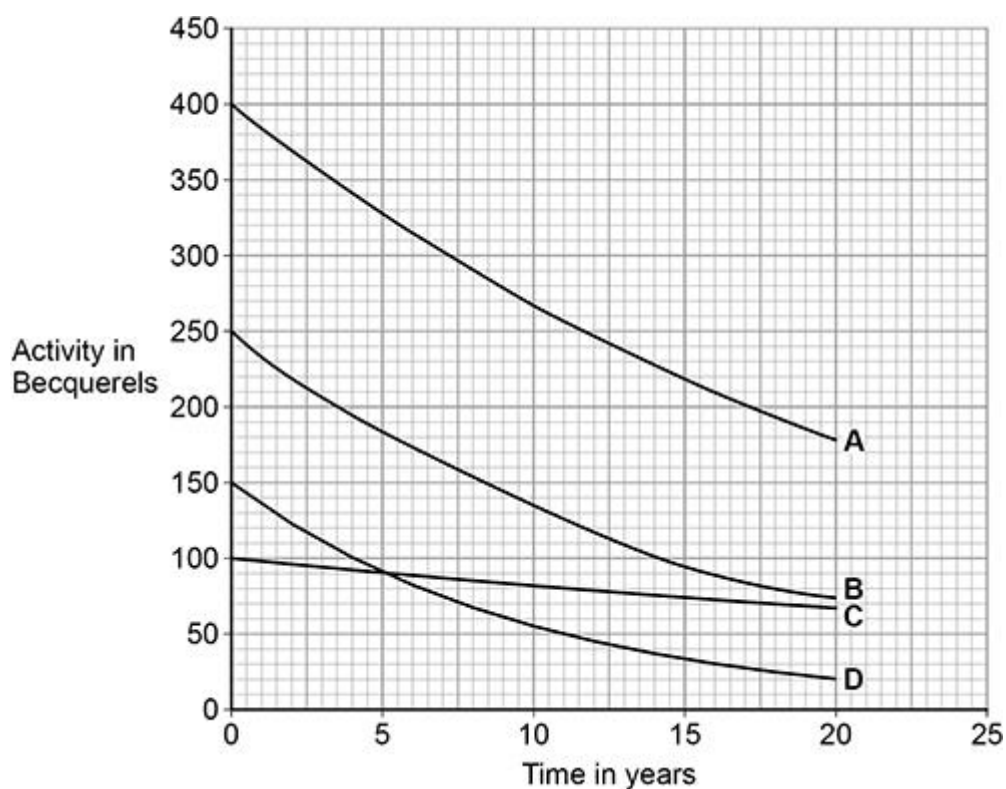
Barrier	Thickness in	Count after
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	millimetres	30 seconds
None		985
Paper	0.1	149
Aluminium	5.0	0
Lead	20.0	0

Explain what nuclear radiation was emitted by the source.

(4)

- (d) The graph below shows how the activity of four different radioactive isotopes, **A**, **B**, **C** and **D**, changes over time.



Write the isotopes **A**, **B**, **C** and **D** in order of increasing stability of their nuclei.

Explain your answer.

Least stable

Most stable

Explanation _____

(3)

(Total 11 marks)

Q2.

A student modelled radioactive decay by rolling some dice in a tray.

Dice that landed on the number six were removed from the tray.

The removed dice represent nuclei that have decayed.

(a) Why is rolling dice a suitable model for radioactive decay?

(1)

(b) The student rolled 144 dice and removed all those that landed on the number six.

The student rolled the remaining dice and again removed all those that landed on the number six.

When the student had rolled the dice 20 times there were 9 dice left.

Calculate the most likely number of times that the student had rolled the dice before the number of dice had halved.

You should show how you work out your answer.

Answer = _____ rolls of the dice

(3)

- (c) The number of times the dice have to be rolled to halve the original number of dice in the tray represents the half-life.

The image below shows an eight-sided dice and a six-sided dice.



The student now used eight-sided dice to model radioactive decay. Dice that landed on the number six were again removed from the tray.

The half-life represented by rolling eight-sided dice is likely to be different from the half-life represented by rolling six-sided dice.

Explain how.

(2)

- (d) A teacher has two radioactive sources, **A** and **B**.

Source **A** has a longer half-life than source **B**.

What can be deduced about the nuclei in source **A** compared with the nuclei in source **B**?

Do **not** refer to isotopes in your answer.

(1)

(Total 7 marks)