1 Most elements have some isotopes which are radioactive.

What is meant by the term radioactive?

..................................................................................................................

..................................................................................................................

(1 mark)

1 (a) The graph shows how the number of nuclei in a sample of the radioactive isotope Uranium-238 changes with time.

1 (a) (i) Use the graph to find the half-life of uranium-238.

Show clearly on the graph how you obtain your answer.

Half-life = ....................... years

(2 marks)

This question continues on the next page.
1 (a) (ii) Complete the following table for an atom of uranium-238.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass number</td>
<td>238</td>
</tr>
<tr>
<td>Number of protons</td>
<td>92</td>
</tr>
<tr>
<td>Number of neutrons</td>
<td></td>
</tr>
</tbody>
</table>

\[ ^{238}_{92} \text{U} \hspace{5em} ^{234}_{90} \text{Th} \]

1 (a) (iii) An atom of uranium-238 decays to form an atom of thorium-234.

What type of radiation, alpha, beta or gamma, is emitted by uranium-238?

.......................................................................................................................... (1 mark)

1 (a) (iv) Why does an atom that decays by emitting alpha or beta radiation become an atom of a different element?

.................................................................................................................................................................................. (1 mark)

1 (b) An atom of actinium-228 decays by emitting a beta particle, \( \beta \). A neutron in the nucleus changes into a proton and an electron. The electron is ejected, while the neutron remains.

An isotope of thorium is left behind.

Complete the equation for this decay.

\[ ^{228}_{89} \text{Ac} \rightarrow \hspace{5em} ^{234}_{90} \text{Th} + \beta \]

.................................................................................................................................................................................. (2 marks)

(Total 7 marks)

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