

Easter HW 1 Combined science - Physics (Higher and Foundation)

Physics Paper 1

Topic P4 Atomic Structure

6.4.2 Atoms and nuclear radiation

You must complete this homework on Lined/ plain A4 paper and bring it in to school on 19/04/22

Q1.

Between 1951 and 1992 the USA tested nuclear weapons in a desert.

(a) Complete the sentence.

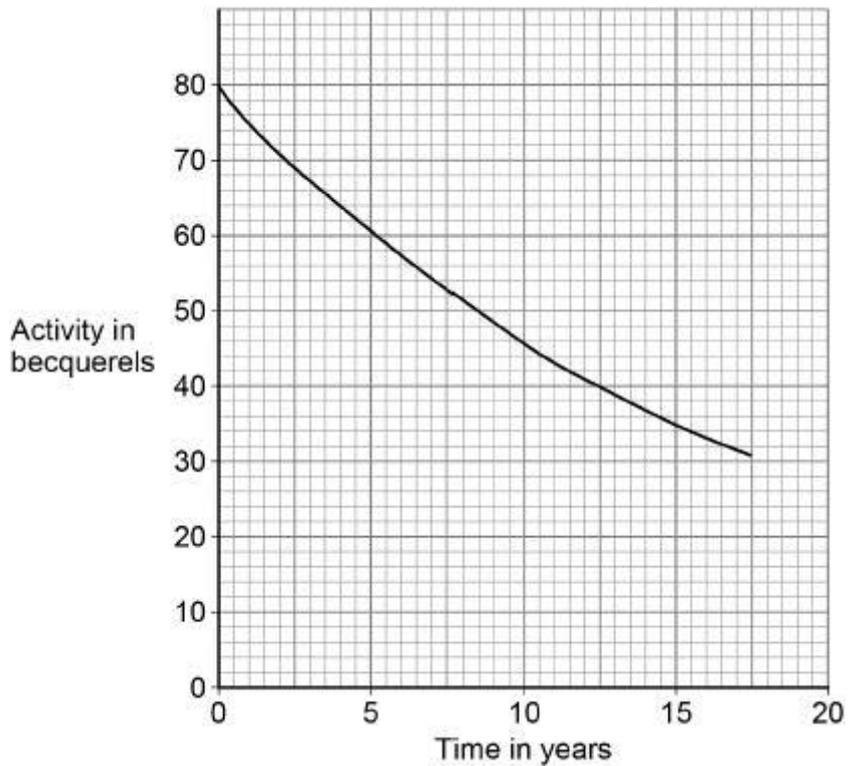
Choose the answer from the box.

| | | | |
|----------------------|--------------------|-------------------|--------------|
| contamination | irradiation | ionisation | decay |
|----------------------|--------------------|-------------------|--------------|

Radioactive dust from the nuclear weapons testing settled on the desert. This is called radioactive _____.

The desert now contains radioactive tritium.

The graph below shows how the activity of the tritium in a sample taken from the desert changed with time.



(1)

(b) The sample was collected from the desert in 1992.

Determine the activity of the tritium in the sample in 2007.

Activity = _____ Bq

(2)

(c) How much time did it take for the activity of the tritium in the sample to decrease from 80 Bq to 40 Bq?

Time = _____ years

(1)

(d) What is the half-life of tritium?

Half-life = _____ years

(1)

(e) The sample started with 45 billion atoms of tritium.

After 4 years the sample had 36 billion atoms of tritium.

Calculate the percentage of the tritium in the sample that remained after 4 years.

Percentage of tritium remaining = _____ %

(2)

- (f) A scientist determined the activity of a sample of tritium every minute for 3 minutes.

The table below shows the results.

| Time in minutes | Activity in Bq |
|-----------------|----------------|
| 0 | 149 |
| 1 | 151 |
| 2 | 148 |
| 3 | 152 |

Why do the activity readings in table vary?

Tick (✓) **one** box.

Radioactive decay is a random process.

Temperature changes affect the radioactive decay.

The number of radioactive nuclei keeps increasing and decreasing.

(1)

- (g) What safety precaution should scientists take when working with radioactive materials in a laboratory?

Tick (✓) **one** box.

Tie long hair back before handling the materials.

Use long tongs to handle the materials.

Wear safety goggles when handling the materials.

(1)

- (h) Studies show that children born near the area of the desert containing tritium were more likely to develop cancer.

It is important that the results from these studies are checked by other scientists.

What is this process called?

Tick (✓) **one** box.

Experiment review

Peer review

Results review

Test review

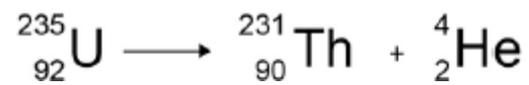
(1)
(Total 10 marks)

Q2.

This question is about radioactive decay.

(a) **Figure 1** shows a nuclear equation for the decay of an atom of uranium.

Figure 1



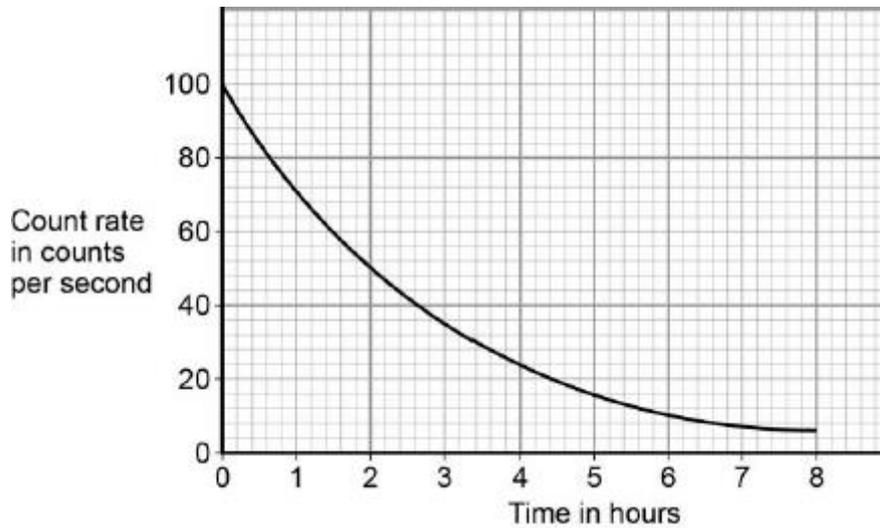
Use information from **Figure 1** to complete the table below.

| | U | Th |
|--------------------|----------|-----------|
| Mass number | 235 | |
| Number of protons | | 90 |
| Number of neutrons | 143 | |

(3)

(b) **Figure 2** shows how the count rate from a radioactive isotope changes with time.

Figure 2



What is the half-life of the radioactive isotope?

Explain why you chose that value.

Half-life = _____ hours

Explanation _____

(2)

(c) When a radioactive isotope decays it can produce beta particles.

What is a beta particle?

Tick **one** box.

- A high-speed electron
- A neutron and an electron
- A neutron and a proton
- A helium nucleus

(1)

(d) Beta particles can cause cancer.

Complete the sentences.

Use words from the box.

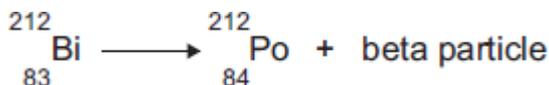
| | | | | | |
|---------------|-------------------|-----------------------|------------------|-------------|---------------------|
| benign | controlled | differentiated | malignant | slow | uncontrolled |
|---------------|-------------------|-----------------------|------------------|-------------|---------------------|

Tumours form when cell division is _____

Tumours that do not invade other tissues are called _____

Q3.

- (a) Atoms of the isotope bismuth-212 decay by emitting either an alpha particle or a beta particle.
The equation represents what happens when an atom of bismuth-212 decays by beta emission into an atom of polonium-212.



- (i) The bismuth atom and the polonium atom have the same mass number (212).

What is the *mass number* of an atom?

(1)

- (ii) Beta decay does **not** cause the mass number of an atom to change.

Explain why not.

(2)

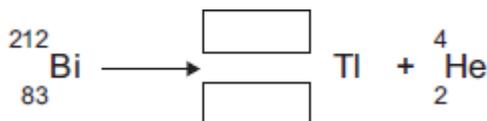
- (b) When an atom of bismuth-212 emits an alpha particle, the atom decays into an atom of thallium.

An alpha particle is the same as a helium nucleus.
The symbol below represents an alpha particle.



- (i) The equation below represents the alpha decay of bismuth-212.

Complete the equation by writing the correct number in each of the two boxes.



(2)

- (ii) It is impossible for the alpha decay of bismuth-212 to produce the same element as the beta decay of bismuth-212.

Explain why.

(2)
(Total 7 marks)