

Radioactivity

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1. Which type of radioactive emission
(a) is positively charged
(b) is not deflected by magnetic fields
(c) is the most penetrative
(d) is the most intensely ionising
(e) cannot pass through cardboard
(f) does not cause a change in mass number or atomic number
(g) has the greatest mass
2. The isotope ^{235}U decays into another element, emitting an alpha particle. What is the element?
This element decays, and the next, and so on until a stable element is reached. The complete list of particles emitted in this chain is:
$$^{235}_{92}\text{U} \rightarrow [\alpha\beta\alpha\beta\alpha\alpha\alpha\beta\alpha\beta] \rightarrow \text{X}.$$

What is the stable element X?
(You could write down each element in the series, but there is a quicker way.)
3. The following fission reaction can take place in a nuclear reactor:
Complete the equation, showing how many neutrons are produced in the reaction. What is the significance of the number of neutrons produced?
Why are the products of the reaction, caesium-137 and rubidium-95, likely to be radioactive? What type of decay are these isotopes likely to show?
4. Boron absorbs neutrons with results as follows:
Why is boron suitable for use in a control rod?
5. When the isotope is irradiated with alpha particles, the products from each aluminium nucleus are a neutron, and a nuclide that emits positrons to give the stable isotope. Write nuclear equations for these two processes.
6. Complete the following nuclear

equations. In each case describe the decay process:

7. The Manhattan Project, the development of the atomic bomb, led to the discovery of the transuranic elements (elements beyond uranium in the periodic table). Plutonium, element 94, is formed by the bombardment of uranium-238 with neutrons. The nuclear equations are:

Complete the following nuclear equation for the formation of americium:

Curium is produced if plutonium-239 is bombarded with alpha particles. If the curium isotope is, complete the equation

If curium is made the target for alpha particle bombardment californium is produced. Complete the nuclear equation to find the atomic number of californium:

By firing heavier particles such as carbon or boron ions at the target materials heavier elements can be synthesised. Complete the nuclear equation (Lw is lawrencium)

One of the transuranic elements is commonly found in the home. Which is this and where is it used?