

Unit 6 • Radioactivity—What is the Nucleus Like?

STATION 1 — QUIZ ON PEOPLE

Match the people with the following ideas. Each name may be used once, more than once, or not at all.

a) Albert Einstein b) Marie Curie c) Henri Becquerel

- ___ 1. Discovered two new radioactive elements.
- ___ 2. Was looking for a source of x-rays.
- ___ 3. Theorized that mass could be turned into energy.
- ___ 4. Earned two Nobel prizes for work on radioactivity.
- ___ 5. First used the term “radioactivity”.
- ___ 6. Discovered radioactivity.
- ___ 7. Invented $E=mc^2$.
- ___ 8. Died of leukemia.

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STATION 2 — CLOUD CHAMBERS



1. Sketch and label an alpha track.
2. Sketch and label a beta track.

Match the following pieces with their function in a cloud chamber:

- | | |
|-----------------------|--|
| ___ 3. alcohol | a) source of radioactivity |
| ___ 4. dry ice | b) provides vapor for tracks |
| ___ 5. black felt | c) holds the alcohol |
| ___ 6. lantern mantle | d) cools the alcohol vapor so it will form fog |

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STATION 3 — QUIZ ON RAYS

Match the rays with the following ideas. Each ray may be used once, more than once, or not at all.

a) alpha

b) beta

c) gamma

___ 1. Two protons and two neutrons

___ 2. High speed electron

___ 3. α

___ 4. ${}^4_2\text{He}$

___ 5. Higher energy than x-rays

___ 6. β^-

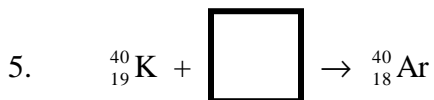
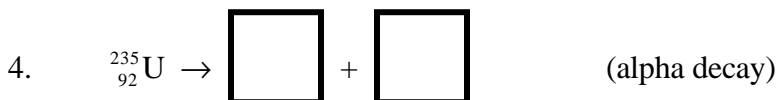
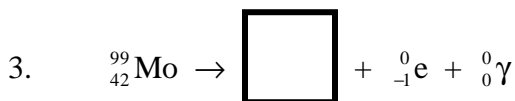
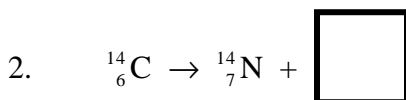
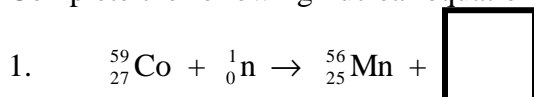
___ 7. Helium nucleus

___ 8. ${}^0_{-1}\text{e}$

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STATION 4 — NUCLEAR EQUATIONS

Complete the following nuclear equations:



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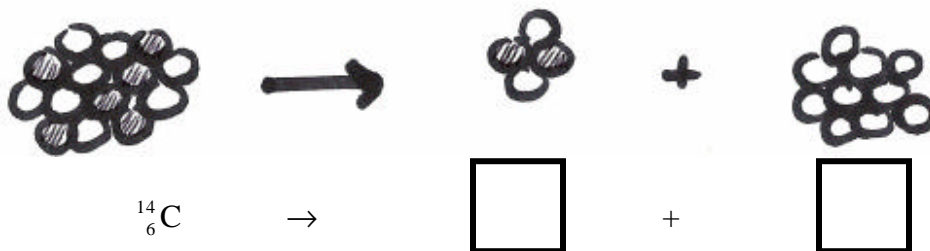
STATION 5—DRAWING NUCLEAR CHANGES

Color in the third particle below and label each of the three particles with their isotopic notation.

This is an example of _____ decay.

● = proton

○ = neutron

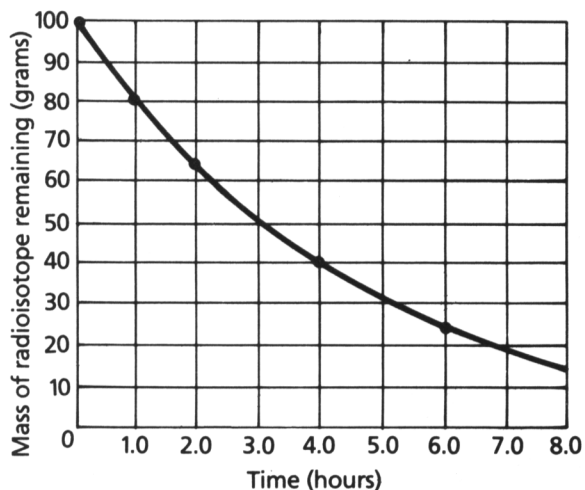


If the same particle went through beta (${}^0_{-1}\text{e}$) decay, draw the other product:



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STATION 6—HALF LIFE GRAPHS



1. What is the half life of the graphed material? ____
2. What mass of radioisotope will remain after 9.0 hours?

3. Plot the data from a substance with a half-life of 1.5 hours.

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STATION 7 — HALF LIFE PROBLEMS

1. Lr-257 has a half life of 8 seconds. What % of a sample will remain 32 seconds after it is made?

2. Na-24 has a half life of 15 hours. How long will it take for a sample to decay to 25% of its original mass?

3. A 64 gram sample of I-131 is tested after 40 days and is found to contain only 2 grams of I-131. What is the half life of I-131?

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STATION 8 — USES OF RADIOACTIVITY

Decide whether each of the following “uses” of radioactivity is True or False:

1. Even after it has been packaged, gamma rays can be used to kill bacteria, mold and insects in food.
2. The age of fossils can be found by measuring the amount of Carbon-14 that is left.
3. Radioisotopes can be used for medical purposes, such as checking for a blocked kidney.
4. Radioisotopes are used in industry to detect leaking pipes. A small amount is injected into the pipe. It is then detected with a Geiger counter above ground.
5. Cancer treatment because gamma rays can kill living cells. Cancer cells can't repair themselves when damaged by gamma rays, as healthy cells can.
6. A gamma source is placed on one side of welded metal and a photographic film on the other side. Weak points or air bubbles will show up on the film, like an X-ray.
7. Am-241 (half life 460 years) keeps air ionized in a smoke detector.
8. In paper mills, the thickness of the paper can be controlled by measuring how much beta radiation passes through the paper to a Geiger counter. Beta radiation is used because alpha particles do not penetrate paper.

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STATION 9 — ENERGY FROM NUCLEAR CHANGES

The mass of a proton is 1.00728 amu and the mass of a neutron is 1.00866 amu.

What is the mass of 6 protons and 6 neutrons? _____

One atom of carbon-12 (6 protons and 6 neutrons) has a mass of *exactly* 12 amu.

How much mass is lost when 6 protons and 6 neutrons combine to form a C-12 atom? _____

What happens to this mass? _____