

Shedding Light on Nuclear Radiation Episode 8: Synthetic Radioisotope Production

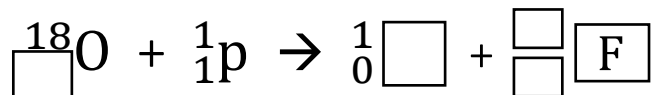
Name: _____

Part A:

1. What is a synthetic radioisotope? _____

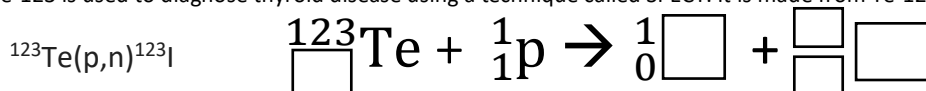
Part B:

2. Fluorine-18 atoms, which are used to generate PET scans, can be made by accelerating protons in a particle accelerator and smashing them into oxygen-18 atoms. A neutron is knocked out of the nucleus in the process. Complete the nuclear reaction below.

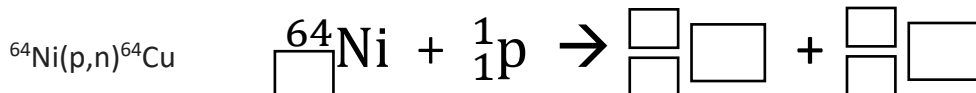


3. The equation above can be written as ${}^{18}\text{O}(p,n){}^{18}\text{F}$ or as ${}^{18}\text{O}(p,n){}^{18}\text{F}$. Re-write the equations below in full equation form.

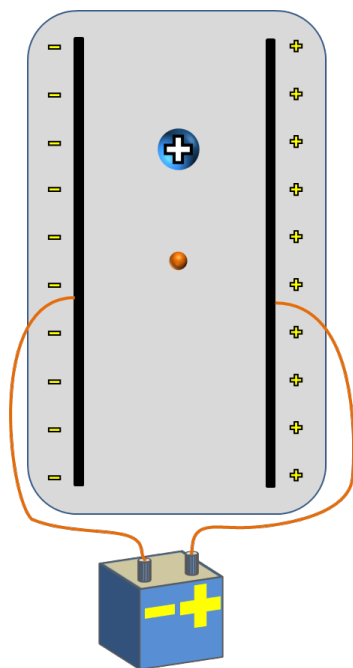
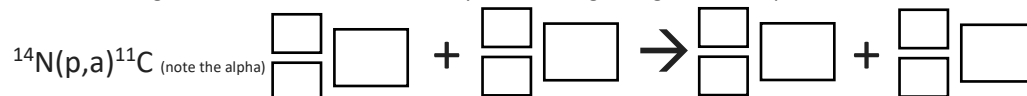
- (a) Iodine-123 is used to diagnose thyroid disease using a technique called SPECT. It is made from Te-123.



- (b) Copper-64 is used to generate PET scans and is also used for radiotherapy (which is attacking cancer cells with radiation).



- (c) Carbon-11 is used to generate PET scans. It is made by bombarding nitrogen-14 with protons.



4. A proton and an electron are placed between two charged metallic plates that are inside a vacuum tube. (See the diagram on the left.) In which direction will the two particles move? Why?

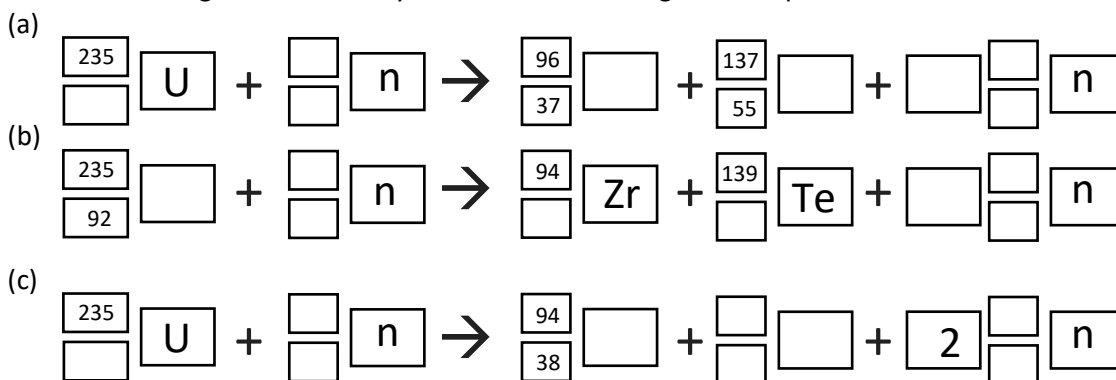
5. Briefly describe how either a linear particle accelerator works or how a cyclotron works. Draw a diagram in the space provided.

Part C:

6. How is cobalt-60 made? Include the nuclear equation.

7. When a U-235 nucleus is struck by a neutron travelling at the right speed, it undergoes fission. Describe what nuclear fission is, explain how a chain reaction occurs, and provide an example of a nuclear equation that shows the reactants and the products of the fission process.

8. Fill in the missing numbers and symbols in the following fission equations.



Atomic Notation Guide

<p>A: mass number: number of protons + number of neutrons</p> <p>Z: atomic number: number of protons</p> <p>In atomic notation, carbon-13 can be written as ${}^{13}_6\text{C}$</p>	$\begin{array}{c} A \\ Z \end{array} X$
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9. How is gold-198 made? Include the nuclear equation.

10. Molybdenum-99 is used to produce technetium-99m, the radioisotope that is the most commonly used radioisotope in diagnostic imaging. How is molybdenum-99 obtained?

11. Describe why technetium-99m is a little unusual. In your answer, include what the “m” means.
