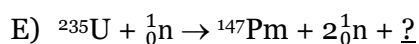
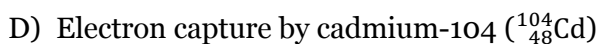
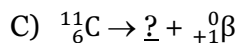
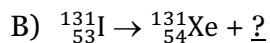
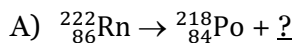


Particle	Symbol	Description
Neutron	${}^1_0\text{n}$	Mass approximately equal to proton, but no charge
Proton	${}^1_1\text{H}$ or ${}^1_1\text{p}$	Nuclei of a hydrogen atom
Deuteron	${}^2_1\text{H}$ or ${}^2_1\text{D}$	Nuclei of a hydrogen atom with 2 neutrons
Electron (β particle)	${}^0_{-1}\beta$ or ${}^0_{-1}\text{e}$	(High-energy) electrons
Positron α particle	${}^0_{+1}\beta$ or ${}^0_{+1}\text{e}$ ${}^4_2\alpha$ or ${}^4_2\text{He}$	Same mass as electron, but positive charge (High-energy) helium nuclei (2 protons + 2 neutrons)

1. Complete each nuclear reaction given below.



2. Mercury-197 has a half-life of 65 hours. What fraction of a mercury sample remains after 6 days?

$$\text{Rate} = kN \quad t_{1/2} = \frac{\ln 2}{k} \quad t = -\frac{1}{k} \ln \frac{N_t}{N_0}$$

3. Both carbon-14 and potassium-40 can be used for radiometric dating. The half-life of ^{14}C is 5730 years and the half-life of ^{40}K is 1.28×10^9 years.

$$\text{Rate} = kN \quad t_{1/2} = \frac{\ln 2}{k} \quad t = -\frac{1}{k} \ln \frac{N_t}{N_0}$$

- A) If a rock is predicted to be 20,000 years old, which form of radio dating is preferred? Why?
- B) If a rock is predicted to be 200,000 years old, neither method is preferred. Why?
4. Silicon-28 can be made by many different nuclear fusion reactions.

- A) Which of the two fusion reactions releases the greater amount of energy?

Recall $\Delta E = \Delta mc^2$ where $c = 3.00 \times 10^8$ m/s and $1 \text{ J} = 1 \text{ kg} \cdot \text{m}^2/\text{s}^2$.

- i. $^{14}\text{N} + ^{14}\text{N} \rightarrow ^{28}\text{Si}$ $^{14}\text{N} = 14.00307 \text{ amu}$ $^{28}\text{Si} = 27.97693 \text{ amu}$
- ii. $^{16}\text{O} + ^{12}\text{C} \rightarrow ^{28}\text{Si}$ $^{16}\text{O} = 15.99491 \text{ amu}$ $^{12}\text{C} = 12.00000 \text{ amu}$

- B) Propose a nuclear reaction that could produce an isotope of Si.