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	${}^{0}_{+1}\beta$ or ${}^{0}_{+1}\text{e}$	Same mass as electron, but positive charge
α particle	${}^{4}_{2}\alpha$ or ${}^{4}_{2}\text{He}$	(High-energy) helium nuclei (2 protons + 2 neutrons)

1. Complete each nuclear reaction given below.

   A) ${}^{222}_{86}\text{Rn} \rightarrow {}^{218}_{84}\text{Po} + \underline{?}$

   B) ${}^{131}_{53}\text{I} \rightarrow {}^{131}_{54}\text{Xe} + \underline{?}$

   C) ${}^{11}_{6}\text{C} \rightarrow \underline{?} + {}^{0}_{+1}\beta$

   D) Electron capture by cadmium-104 (${}^{104}_{48}\text{Cd}$)

   E) ${}^{235}\text{U} + {}^{1}_{0}\text{n} \rightarrow {}^{147}\text{Pm} + 2{}^{1}_{0}\text{n} + \underline{?}$

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

$$\text{Rate} = k\text{N} \quad t_{1/2} = \frac{\ln 2}{k} \quad t = -\frac{1}{k}\ln\frac{\text{N}_t}{\text{N}_0}$$

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.

$$\text{Rate} = k\text{N} \quad t_{1/2} = \frac{\ln 2}{k} \quad t = -\frac{1}{k}\ln\frac{\text{N}_t}{\text{N}_0}$$

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 J = 1 kg · m^2/s^2.

i. $^{14}N + {}^{14}N \rightarrow {}^{28}Si$ ^{14}N = 14.00307 amu ^{28}Si = 27.97693 amu

ii. $^{16}O + {}^{12}C \rightarrow {}^{28}Si$ ^{16}O = 15.99491 amu ^{12}C = 12.00000 amu

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