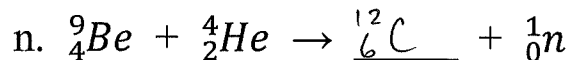
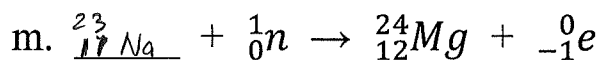
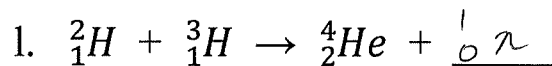
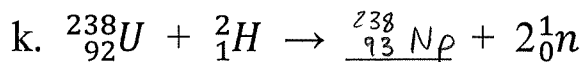
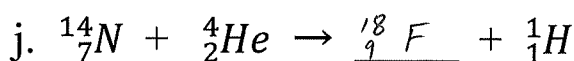
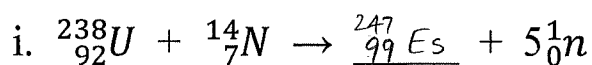
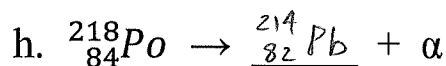
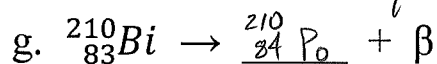
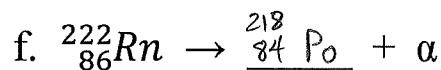
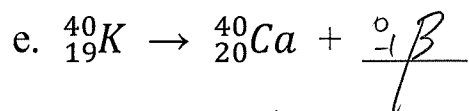
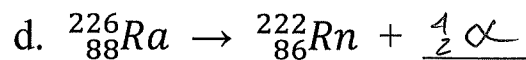
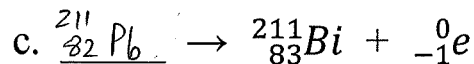
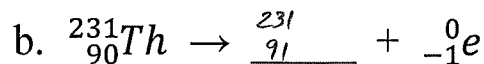
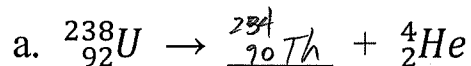
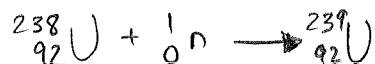


Nuclear Chemistry

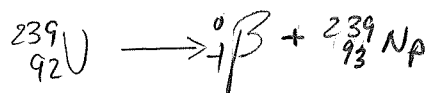
1. Complete the following nuclear reactions



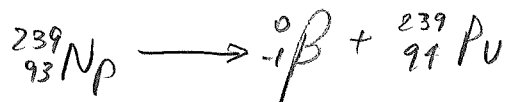
o. uranium-238 absorbs a neutron and forms uranium-239



p. uranium-239 emits an electron and forms neptunium-239



q. neptunium-239 emits an electron and forms plutonium-239



2. Titanium-51 decays with a half-life of six minutes. What fraction of the radioactive material present at time zero would still be available after one hour?

$$\frac{60}{6} = 10 \times \text{ or } 10 \text{ half lives.}$$

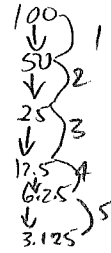
$$\begin{array}{l}
 100 \text{ ) } 1 \\
 \downarrow \\
 50 \text{ ) } 2 \\
 \downarrow \\
 25 \text{ ) } 3 \\
 \downarrow \\
 12.5 \text{ ) } 4 \\
 \downarrow \\
 6.25 \text{ ) } 5 \\
 \downarrow \\
 3.125
 \end{array}$$

$$\begin{array}{l}
 3.125 \text{ ) } 6 \\
 \downarrow \\
 1.5625 \text{ ) } 7 \\
 \downarrow \\
 0.781 \text{ ) } 8 \\
 \downarrow \\
 0.391 \text{ ) } 9 \\
 \downarrow \\
 0.195 \text{ ) } 10 \\
 \downarrow \\
 0.098
 \end{array}$$

0.098% AFTER 10 HALF-LIVES

3. The half-life of radium-226 is 1590 years. What fraction of a sample of radium-226 would remain after 9540 years?

$$\frac{9540}{1590} = 6 \text{ half-lives}$$



$$3.125 \downarrow$$

1.5625 %

OR

$\frac{100}{64}$

4. After 10 half-lives the radioactivity of a sample is considered to be negligible. How long should strontium-90 be stored if  $T_{1/2} = 28a$ ? How long should iodine-131 be stored if  $T_{1/2} = 8.05$  days?

$$28 \times 10 = 280 \text{ years. } \overset{90}{\text{Sr}}$$

$$8.05 \times 10 = 80.5 \text{ days. } \overset{131}{\text{I}}$$

5. A typical fission process occurs after  $^{235}_{92}\text{U}$  absorbs a neutron and becomes the unstable isotope  $^{236}_{92}\text{U}$ . This isotope can break apart, producing a  $^{137}_{52}\text{Te}$  nucleus, a  $^{97}_{40}\text{Zr}$ , and two neutrons. Write an equation to represent this nuclear reaction.



6. It is desired to use radioactive sulphur as a tracer in an experiment. Two beta-emitting isotopes are available:  $^{35}_{16}\text{S}$  ( $T_{1/2} = 87$  days) and  $^{37}_{16}\text{S}$  ( $T_{1/2} = 5$  minutes). Which would you choose and why?

↑  
Choose. Won't stay in the body for too long

7. The half-life of uranium-238 is 4.5 billion years. Explain why there is so much of this isotope still undecayed on Earth.

Earth is  $\approx 13.82$  billion years old. Uranium from Earth formation has only undergone almost 3 half-lives meaning more than 12.5% of that Uranium still remains.

8. The half-life of  $^{125}_{53}\text{I}$  is 60 days. What percent of the original radioactivity would be present after 360 days?

$$\frac{360}{60} = 6 \text{ half-lives}$$

$$6 \text{ half-lives} = 1.563\% \text{ still left.}$$