Radioactivity

Name - _____

1.) What happens when a radioactive atom undergoes radioactive decay?

When a radioactive atom undergoes radioactive decay the nucleus will release radiation in the form of alpha, beta or gamma. This will often cause transmutation to occur and a new element to be made as the daughter atom.

2.) Why are alpha and beta radiation referred to as particles, while gamma radiation is referred to as rays?

Alpha and beta radiation are referred to as particles because they are matter (mass and take up space) where as gamma radiation is just raw energy like light or heat.

3.) Write a definition for transmutation in your own words.

Transmutation is the changing of an atom into a different atom by releasing radiation.

4.) In the following generic element $_A^Z D$ what happens to the atomic number (A) and mass number (Z) during alpha decay?

During alpha decay a helium nucleus is ejected from the nucleus $_2^4 He$. Therefore the atomic mass must decrease by 4 and the atomic number by 2 for mass and energy to be conserved.

5.) The following parent isotopes undergo alpha decay. Write the nuclear equation for these transmutations.

a.) tungsten-180 $_{74}^{180}W \rightarrow \ _2^4 He \ + \ _{72}^{176}Hf$

b.) samarium-147 $_{62}^{147}Sm \rightarrow \ _2^4 He \ + \ _{60}^{143}Nd$

c.) sodium-20 $_{11}^{20}Na \rightarrow \ _2^4 He \ + \ _9^{16}F$

6.) The mass number of an atom undergoing beta decay does not change. However, the daughter nucleus is a different element than the parent. Explain how this is possible.

The daughter nucleus changes from the parent during beta decay because a neutron breaks into a proton and an electron. This causes the proton number to increase by one and the electron from the broken neutron is emitted as beta decay. This new proton number causes a new element to be formed.

7.) The following parent isotopes undergo beta decay. Write the nuclear equation for this transmutation.

a.) nickel-64 $_{28}^{64}Ni \rightarrow \ _{-1}^0 e \ + \ _{29}^{64}Cu$

b.) tritium $\qquad \frac{3}{1}H \rightarrow {}_{-1}^{0}e + {}_{2}^{3}He$ $\qquad$

c.) iron-59 $\qquad \frac{59}{26}Fe \rightarrow {}_{-1}^{0}e + {}_{27}^{59}Co$ $\qquad$

8.) Iron-60 undergoes beta decay. The daughter nucleus is in an excited state and undergoes gamma decay. Write both nuclear equations to show these changes.

$${}_{26}^{60}Fe \rightarrow {}_{27}^{60}Co^* + {}_{-1}^{0}e \qquad\qquad {}_{27}^{60}Co^* \rightarrow {}_{27}^{60}Co + {}_{0}^{0}\gamma$$
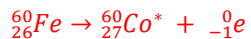
9.) State whether the following descriptions apply to alpha, beta or gamma radiation:

a.) has a negative charge $\qquad$ beta

b.) is a helium nucleus $\qquad$ alpha

c.) its path is deflected by a magnet $\qquad$ alpha and beta

d.) is similar to x-rays $\qquad$ gamma

e.) is stopped by a few sheets of paper $\qquad$ alpha

f.) an electric charge does not affect its path $\qquad$ gamma

g.) has the most mass $\qquad$ alpha

h.) easily penetrates skin and tissue $\qquad$ gamma

10.) Complete the following nuclear equations:

a.) ${}_{93}^{239}Np \rightarrow {}_{94}^{239}Pu + {}_{-1}^{0}e$

b.) ${}_{90}^{232}Th \rightarrow {}_{88}^{228}Ra + {}_{2}^{4}He$

c.) ${}_{6}^{14}C \rightarrow {}_{7}^{14}N + {}_{-1}^{0}e$

d.) ${}_{66}^{152}Dy^* \rightarrow {}_{66}^{152}Dy + {}_{0}^{0}\gamma$

e.) ${}_{92}^{238}U \rightarrow {}_{90}^{234}Th + {}_{2}^{4}He$

f.) ${}_{83}^{213}Bi \rightarrow {}_{81}^{209}Tl + {}_{2}^{4}He$

g.) ${}_{90}^{234}Th \rightarrow {}_{91}^{234}Pa + {}_{-1}^{0}e$

h.) ${}_{93}^{239}Np \rightarrow {}_{94}^{239}Pu + {}_{-1}^{0}e$

i.) ${}_{43}^{99}Tc^* \rightarrow {}_{43}^{99}Tc + {}_{0}^{0}\gamma$