Exercise 21.2a

Nuclear Equations

Name: _____

Date: _____ Per: _____

While chemical reactions occur when electrons are rearranged within the electron cloud (stolen, lost or shared with other atoms), nuclear reactions occur when protons and neutrons are rearranged within the nucleus of an atom. In both cases, the rearrangements are driven by the same thing – the tendency of matter to become more stable. Nuclear reactions, therefore, occur when the protons and neutrons are rearranged to form a more stable nucleus.

While three common forms of radioactivity (alpha, beta, and gamma) might occur during these rearrangements, this worksheet focuses on the alpha and beta decay. Alpha radiation occurs as particles made up of 2 protons and 2 neutrons (essentially the nucleus of a helium atom) split from the nucleus. Beta radiation also occurs as particles, but are simply high-energy, high-speed electrons (or positrons – which we won't address here) ejected from the nucleus during rearrangement. The changes from these decay events can be summarized with equations:

Alpha $^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm + {}^{4}_{2}He$ ← Alpha Particle

Beta $^{137}_{55}Cs \rightarrow {}^{137}_{56}Ba + {}^{0}_{-1}e$ ← Beta Particle

1) Notice that the superscript of the atom undergoing decay is equal to the sum of the superscripts of the decay products. The same goes for the subscript of the decaying atom and the subscripts of the decay products. They must be equal.

DIRECTIONS: *Complete the following equations in the space provided.*

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

2. $^{131}_{53}I \rightarrow {}^{\_\_}_{\_\_} \_\_ + {}^{0}_{-1}\beta$

3. $^{238}_{92}U \rightarrow {}^{\_\_}_{\_\_} \_\_ + {}^{4}_{2}He$

4. $^{81}_{36}Kr \rightarrow {}^{81}_{37}Rb + {}^{\_\_}_{\_\_} \_\_$

5. $^{212}_{84}Po \rightarrow {}^{208}_{82}Pb + {}^{\_\_}_{\_\_} \_\_$

6. $^{\_\_}_{\_\_} \_\_ \rightarrow {}^{209}_{82}Pb + {}^{4}_{2}\alpha$

7. $^{140}_{56}Ba \rightarrow {}^{\_\_}_{\_\_} \_\_ + {}^{0}_{-1}e$

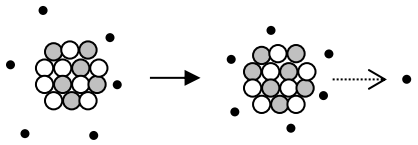
8. $^{11}_{6}C \rightarrow {}^{\_\_}_{\_\_} \_\_ + {}^{0}_{-1}\beta$

DIRECTIONS: *Write a complete nuclear decay equation for each of the following.*

9. The alpha decay of bismuth-213. _____.
10. The beta decay of silver-106. _____.
11. The beta decay of hydrogen-3. _____.
12. The alpha decay of uranium-238. _____.
13. The beta decay of radium-218. _____.
14. The alpha decay of polonium-210. _____.

DIRECTIONS: Decipher the diagrams below and write a decay equation for each of the diagrams.

15. Describe the diagram below:



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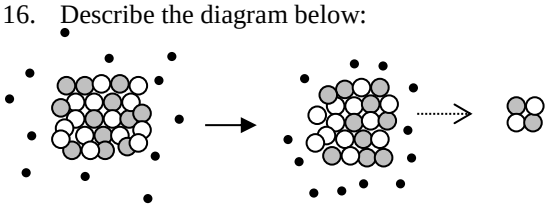
16. Describe the diagram below:



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17. What is the biggest problem with the diagrams in *Questions 15. & 16.* ? _____

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