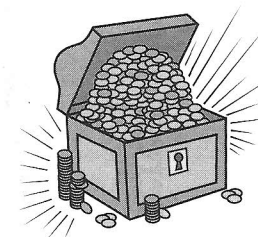# Old Gold
## Formation of Elements

Name _____

Date _____ Period _____

## Purpose

To practice interpreting nuclear equations and to predict the products of specific nuclear reactions.

## Part 1: Nuclear Equations

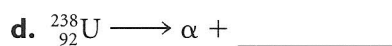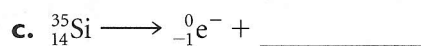Use a periodic table and the isotope chart from Lesson 14.

1. Fill in this table.

| Nuclear equation | Change in atomic number | Change in number of protons | Change in number of neutrons | Change in mass number | Type of nuclear change |
|---|---|---|---|---|---|
| a $^{226}_{88}Ra \longrightarrow {}^{4}_{2}He + {}^{222}_{86}Rn$ | | | | | alpha decay |
| b $^{214}_{84}Po \longrightarrow {}^{4}_{2}He + {}^{210}_{82}Pb$ | | | | | |
| c $^{17}_{8}O + {}^{14}_{7}N \longrightarrow {}^{31}_{15}P$ | | | | | |
| d $^{47}_{20}Ca \longrightarrow {}^{0}_{-1}e^- + {}^{47}_{21}Sc$ | | | | | |
| e $^{148}_{64}Gd \longrightarrow {}^{4}_{2}He + {}^{144}_{62}Sm$ | | | | −4 | |
| f $^{8}_{4}Be + {}^{4}_{2}He \longrightarrow {}^{12}_{6}C$ | | +2 | | | |
| g $^{14}_{6}C \longrightarrow {}^{0}_{-1}e^- + {}^{14}_{7}N$ | +1 | | | | beta decay |

2. Based on the equations, how do you know which nuclear changes are fusion?

3. When an alpha particle is lost from an atom, where on the periodic table would you find the product of the nuclear reaction?

4. Explain how you figured out how many neutrons an isotope has.

5. Fill in the missing parts of these nuclear reactions:

   a. _____ $\longrightarrow \beta + {}^{40}_{20}Ca$      b. _____ $\longrightarrow {}^{4}_{2}He + {}^{226}_{88}Rn$

   c. $^{35}_{14}Si \longrightarrow {}^{0}_{-1}e^- +$ _____      d. $^{238}_{92}U \longrightarrow \alpha +$ _____

   e. $^{110}_{53}I \longrightarrow$ _____ $+ {}^{106}_{51}Sb$      f. $^{140}_{56}Ba \longrightarrow$ _____ $+ {}^{140}_{57}La$
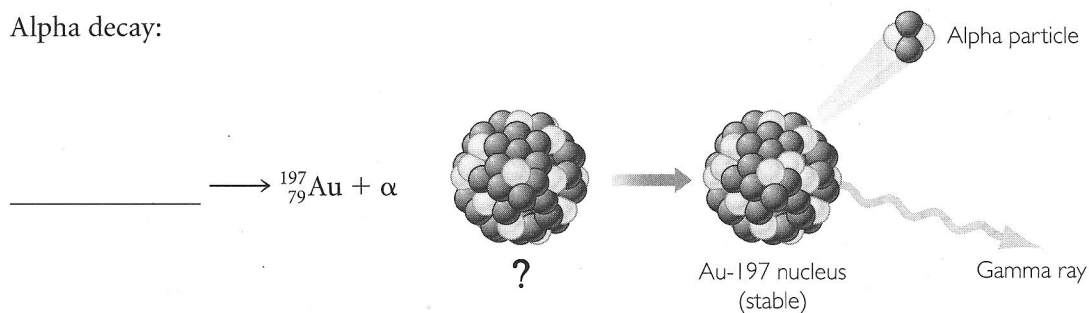
**6.** If a francium atom, element 87, undergoes beta decay, what type of atom will be produced?
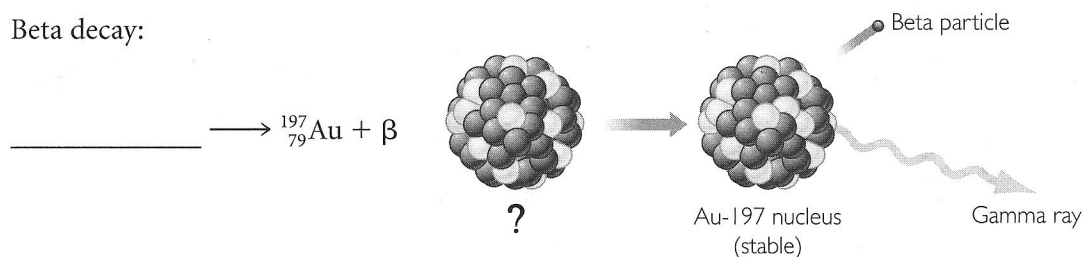
## Part 2: Making Gold By Radioactive Decay

**7.** Examine the possibility of making gold atoms by alpha or beta decay as shown in these two illustrations. Place the appropriate starting isotope in each equation.

Alpha decay:

$$\underline{\hspace{3cm}} \longrightarrow {}^{197}_{79}\text{Au} + \alpha$$

?      Au-197 nucleus (stable)      Alpha particle      Gamma ray

Beta decay:

$$\underline{\hspace{3cm}} \longrightarrow {}^{197}_{79}\text{Au} + \beta$$

?      Au-197 nucleus (stable)      Beta particle      Gamma ray

**8.** Referring to question 7, find the two starting isotopes in the equations on the isotope chart. Are they found in nature?

**9. Making Sense** Why do you think the alchemists were not successful in making gold from other metals?

**10. If You Finish Early** Write the nuclear equation representing the alpha decay of element 85, astatine.