Chapter 2: Atoms and Elements

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1. Define the 3 scientific laws that developed modern Atomic Theory.
    a. Law of Conservation of Mass:

    b. Law of Definite Proportions:

    c. Law of Multiple Proportions:

2. Two samples of carbon dioxide are decomposed into their constituent elements. One sample produces 25.6 g of oxygen and 9.60 g of carbon, and the other produces 21.6 g of oxygen and 8.10 g of carbon. Show that these results are consistent with the law of definite proportions.

3. Which of the following compounds CANNOT demonstrate the law of multiple proportions?
    a. NO, NO_2

    b. CO, CO_2

    c. H_2O, H_2O_2

    d. Na_2S, NaF

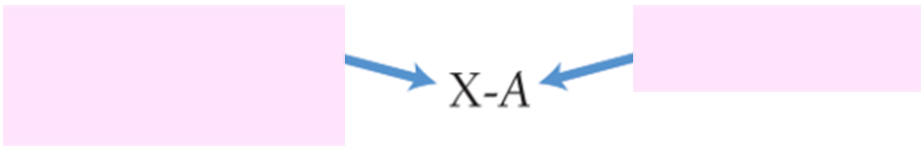
4. Draw the following atom models below.
    a. J.J. Thomson's Plum-Pudding model:

b. Rutherford's model:

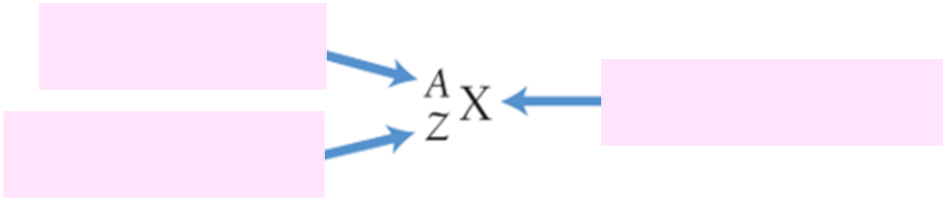
c. James Chadwick's model:

5. Fill in the blanks for the following isotope notations.

a.



b.



6. What would the atomic number, mass number, and symbol be for a potassium isotope with 8 neutrons?

a. Set up with both versions of isotope notation.

7. What is the difference between a cation and an anion? What classification of elements in the periodic table tend to be cations/anions?
   a. Cation:

   b. Anion:

8. How many electrons are in each of the following?
   a. F^{-3}

   b. Mg^{+1}

   c. S^{-5}

   d. Rb^{+4}

9. Use the periodic table to give the name and symbol for each of the following elements.
    a. The alkaline earth metal with 56 protons.

    b. The halogen that is in the same period as a neutral alkali metal with 11 electrons.

    c. The noble gas that has 77 neutrons.

10. What is the formula for the average atomic mass?

    a. How do we use percentages in calculations?

11. Bromine has two naturally occurring isotopes (Br-79 and Br-81) and has an atomic mass of 79.904 amu. The mass of Br-81 is 80.9163 amu, and its natural abundance is 49.31%. Calculate the mass and natural abundance of Br-79.

12. Boron has only two naturally occurring isotopes. The mass of boron-10 is 10.01294 amu, and the mass of boron-11 is 11.00931 amu. Calculate the relative abundances of the two isotopes.

13. An element has two naturally occurring isotopes. Isotope 1 has a mass of 120.9038 amu and a relative abundance of 57.4%, and isotope 2 has a mass of 122.9042 amu. Find the atomic mass of this element and identify it.

14. List the two ways we can use the 'mole' (6.022×10^{23}) as a conversion factor.
    a. Converting atoms into moles:

b. Converting moles into atoms:

15. Calculate the mass of the following below.

a. 1.1×10^{27} nitrogen atoms

b. 8.23×10^{16} calcium atoms

c. 5.96×10^{29} silicon atoms

16. Calcuate the amount of moles of the following below.

a. 44.3 g neon

b. 9.56 g mercury

c. 713.2 g zinc

17. Calculate the number of atoms of the following below.

a. 68.325 g iron

b. 1045.7 g krypton

c. 3.95 g lithium

18. A pure copper sphere has a radius of 0.935 in. How many copper atoms does it contain? (The volume of a sphere is $V=(4/3)\pi r^3$ and the density of copper is 8.96 g/cm^3).

19. Common brass is a copper and zinc alloy containing 37.0% zinc by mass and having a density of 8.48 g/cm^3. A fitting composed of common brass has a total volume of 112.5 cm^3. How many atoms (copper and zinc) does the fitting contain?

20. The mass of an average blueberry is 0.75 g, and the mass of an automobile is 2.0 × 10^3 kg. Find the number of automobiles whose total mass is the same as 1.0 mol of blueberries.

21. Pure gold is usually too soft for jewelry, so it is often alloyed with other metals. How many gold atoms are in an 0.255-ounce, 18 K gold bracelet? (18 K gold is 75% gold by mass.)

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