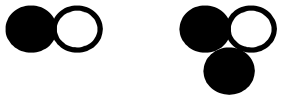
Answers to the Thanksgiving Break Assignment

Question 1

Different compounds must have a different ratio of elements X and Z.



The first compound would have the chemical formula XZ and the second compound would have the chemical formula X_2Z. Since the ratios are different, these two diagrams represent two different compounds.

Question 2

a. The reaction shown is nuclear fission. One heavy element, uranium, is broken down into two smaller elements, barium and krypton, through neutron bombardment.
b. During a nuclear reaction, a small amount of mass of the reactants is converted into energy.
c. Nuclear fusion is another nuclear reaction which releases a ton of energy. Two lighter elements fuse to form one heavier element.

Question 3

Nonmetal ions have larger radii than nonmetal atoms because nonmetal ions have more electrons. These added electrons repel away from one another, causing the electron shells to expand.

Question 4

If an atom gains electrons, it now possesses more negative electrons than positive protons; therefore, the charge of the sulfur ion would be -2 since it has 2 more electrons compared to the neutral atom.

Question 5

In order for elements to have similar chemical properties, they must have the same number of valence electrons (part b). The two elements which contain the same number of valence electrons are sodium and rubidium (part a).

Question 6

a. The valence electrons are found in the last occupied principal energy level. Element X has two electrons in the fourth occupied PEL, so it contains 2 valence electrons.
b. Calcium has the ground state configuration of 2-8-8-2, as shown on the Periodic Table in your Reference Tables. To obtain an excited state configuration, one or more electrons have to jump to higher electron shells. Element Y is therefore calcium in the excited state since one electron from the third shell has jumped to the fourth shell.
c. Element Z has 18 total electrons. A neutral atom has to contain the same number of electrons and protons, so the nucleus must have a charge of +18.
d. Element Z is unlikely to form chemical bonds with other elements because it has a full valence shell.

Question 7

a. The spectral lines in the mixture must match each spectral line in one or more of the gases shown in the question. The spectral lines of gases A and D are present in the mixture's spectrum, so those two elements must be found in the mixture.
b. As an electron in the excited state falls to the ground state, a specific amount of energy is released, which is seen as one spectral line in the emission spectrum.

Question 8

a. The Rutherford Gold Foil Experiment OR The Cathode Ray Tube
b. In the Rutherford experiment, alpha particles were shot at a thin piece of gold foil. Most of the alpha particles passed straight through the foil, whereas a small fraction of the alpha particles were deflected at angles.
   In the cathode ray tube experiment, J.J. Thomson evacuated most of the gas a cathode ray tube. When electricity was supplied to the tube, radiation was seen to pass through the tube. An applied electrical field caused the radiation to be deflected toward the positive electrical field.
c. Due to the Rutherford experiment, it was concluded that the atom is mostly empty space with a small, dense, positive center called the nucleus.
   Due to the cathode ray tube experiment, the first subatomic particle was discovered (the electron).

Question 9

a. In a nuclear decay equation, the unstable nucleus is placed to the left of the arrow. To the right of the arrow, the emission particle (Table N) and the new element is placed. In the reading, it states that the americium isotope is an alpha emitter, so the alpha particle is placed to the right of the arrow and the americium-241 is placed to the left of the arrow.

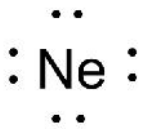
$$^{241}_{95}\text{Am} \rightarrow {}^{4}_{2}\alpha + \text{X}$$

   The new element formed can be determined because the mass and charge must be conserved during a reaction (i.e. remains the same). The element must have a mass of 237 and a nuclear charge of +93. The americium-241 therefore transmuted into $^{237}_{93}\text{Np}$.

Answer: $^{241}_{95}\text{Am} \rightarrow {}^{4}_{2}\alpha + {}^{237}_{93}\text{Np}$

b. Americium-241 is an alpha emitter whereas krypton-85 is a beta particle emitter (Table N).
c. Radioactivity can be used to kill bacteria and other pathogens on food. Radioisotopes can also be used in some medical diagnoses and treatments.
d. Radiation from radioactive decay can cause radiation sickness, cancer, and/or death.

Question 10

a. The different isotopes of neon contain the same number of protons and electrons because they are all the same element; however, a different number of neutrons in the nucleus results in the element having different isotopes with different mass numbers.
b. atomic mass $= \frac{(90.9)(19.99)+(0.3)(20.99)+(8.8)(21.99)}{100} = 20.16$ amu
c. 

Question 11

Experiment should be conducted in a well-ventilated area; students should ensure that the lab area is clean and free of clutter; girls should tie their hair back.

Question 12

Tin(II) fluoride is an ionic compound, so the oxidation states need to be criss-crossed: SnF_2.

Question 13

a. Litmus Paper
   pH paper
   A specific liquid indicator from Table M
   pH meter
b. Litmus Paper: in an acid, litmus appears red and in a base, litmus appears blue.
   pH paper: the pH paper turns different colors depending on the pH. If the pH is less than 7, the solution is an acid and if the pH is greater than 7, the solution is a base.
   Phenolphthalein: In an acid, phenolphthalein will turn colorless and in a base, it will appear pink. (or some other liquid indicator, need to give specific colors).
   pH meter: Provides exact pH. If the pH is less than 7, the solution is an acid and if the pH is greater than 7, the solution is a base.

Question 14

a. Since the chemical equation shows one reactant to the left of the arrow breaking down into two or more products to the right of the arrow, this equation represents a decomposition reaction.
b. The mass during a chemical reaction is conserved. The problem indicates that 80 grams of oxygen and 20 grams of hydrogen were produced. This equates to a combined mass of 100 grams of products; therefore, due to the Law of Conservation of Mass, the reactants must also have a mass of 100 grams. Since there is only one reactant in this reaction, all 100 grams must have been present in the initial water sample.