

Stoichiometry

- 1) A sample of dolomitic limestone containing only CaCO_3 and MgCO_3 was analyzed.
- When a 0.2800 gram sample of this limestone was decomposed by heating, 75.0 milliliters of CO_2 at 750 mm Hg, and 20°C were evolved. How many grams of CO_2 were produced?
 - Write equations for the decomposition of both carbonates described above.
 - It was also determined that the initial sample contained 0.0448 gram of calcium. What percent of the limestone by mass was CaCO_3 ?
 - How many grams of the magnesium-containing product were present in the sample in (a) after it had been heated?
2. Water is added to 4.267 grams of UF_6 . The only products are 3.730 grams of a solid containing only uranium, oxygen, and fluorine and 0.970 gram of a gas. The gas is 95.0 percent fluorine, and the remainder is hydrogen.
- From these data, determine the empirical formula of the gas.
 - What fraction of the fluorine of the original compound is in the solid and what fraction in the gas after the reaction?
 - What is the formula of the solid product?
 - Write a balanced equation for the reaction between UF_6 and H_2O . Assume that the empirical formula of the gas is the true formula.
3. The molecular formula of a hydrocarbon is to be determined by analyzing its combustion products.
- (3 points) The hydrocarbon burns completely, producing 7.2g of water and 14.15g of CO_2 at standard conditions. What is the hydrocarbon's empirical formula?
 - (2 points) Calculate the mass in grams of O_2 required for the complete combustion of the sample of the hydrocarbon described in (a).
 - (1 point) Using mass spec, the molecular mass of the main isotope of the hydrocarbon is 56 amu. What is the molecular formula of the hydrocarbon?

Nuclear Chemistry (same as the ones I gave you previously)

- Explain each of the following in terms of nuclear models.
 - The mass of an atom of ^4He is less than the sum of the masses of 2 protons, 2 neutrons, and 2 electrons.
 - Alpha radiation penetrates a much shorter distance into a piece of material than does beta radiation of the same energy.
 - Products from a nuclear fission of a uranium atom such as ^{90}Sr and ^{137}Ce are highly radioactive and decay by emission of beta particles.
 - Nuclear fusion requires large amounts of energy to get started, whereas nuclear fission can occur spontaneously, although both processes release energy.
- Answer each of the following questions regarding radioactivity.
 - Write the nuclear equation for decay of $^{94}\text{Pu-234}$ by alpha emission.
 - Account for the fact that the total mass of the products of the reaction in part (a) is slightly less than that of the original $^{94}\text{Pu-234}$.
 - Describe how α , β , and γ rays each behave when they pass through an electric field (positive plate/negative plate)

Review Packet #3 - Random Topics

Bonding/Organic

- 1) Explain each of the following in terms of atomic and molecular structures and/or intermolecular forces.
 - (a) Solid K conducts an electric current, whereas solid KNO_3 does not.
 - (b) SbCl_3 has a measurable dipole moment, whereas SbCl_5 does not.
 - (c) The normal boiling point of CCl_4 is 77°C , whereas that of CBr_4 is 190°C .
 - (d) $\text{NaI}(\text{s})$ is very soluble in water whereas $\text{I}_2(\text{s})$ has a solubility of only 0.03 gram per 100 grams of water.

- 2) Explain each of the following in terms of the electronic structure and/or bonding of the compounds involved.
 - (a) At ordinary conditions, HF (normal boiling point = 20°C) is a liquid, whereas HCl (normal boiling point = -114°C) is a gas.
 - (b) Molecules of AsF_3 are polar, whereas molecules of AsF_5 are nonpolar.
 - (c) The N-O bonds in the NO_2^- ion are equal in length, whereas they are unequal in HNO_2 .
 - (d) For sulfur, the fluorides SF_2 , SF_4 , and SF_6 are known to exist, whereas for oxygen only OF_2 is known to exist.

- 3) Using principles of chemical bonding and/or intermolecular forces, explain each of the following.
 - (a) Xenon has a higher boiling point than neon has.
 - (b) Solid copper is an excellent conductor of electricity, but solid copper chloride is not.
 - (c) SiO_2 melts at a very high temperature, while CO_2 is a gas at room temperature, even though Si and C are in the same chemical family.
 - (d) Molecules of NF_3 are polar, but those of BF_3 are not.