G11 Chemistry: Class 9 Homework

MULTIPLE CHOICE: Circle the correct answer. [5 marks]

1. How many grams of Cr can be produced by the reaction of 44.1 g of Cr_2O_3 with 35.0 g of Al according to the following chemical reaction?

$$2Al + Cr_2O_3 \rightarrow Al_2O_3 + 2Cr$$

A) 7.56 g
B) 30.2 g
C) 67.4 g
D) 104 g
E) None of these.

2. Washing soda is a hydrate of sodium carbonate. Elemental analysis of a sample of washing soda gave 4.20% C and 7.05% H. What is the formula for washing soda?
A) $Na_2CO_3 \cdot 2H_2O$
B) $Na_2CO_3 \cdot 4H_2O$
C) $Na_2CO_3 \cdot 6H_2O$
D) $Na_2CO_3 \cdot 8H_2O$
E) $Na_2CO_3 \cdot 10H_2O$

3. The first step in the Ostwald process for producing nitric acid is

$$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g).$$

If the reaction of 150. g of ammonia with 150. g of oxygen gas yields 87. g of nitric oxide (NO), what is the percent yield of this reaction?
A) 100%
B) 49%
C) 77%
D) 33%
E) 62%

4. Ammonia reacts with diatomic oxygen to form nitric oxide and water vapor:

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

When 20.0 g NH_3 and 50.0 g O_2 are allowed to react, which is the limiting reagent?
A) NH_3
B) O_2
C) NO
D) H_2O
E) No reagent is limiting.

5. Calculate the mass of excess reagent remaining at the end of the reaction in which 90.0 g of SO_2 are mixed with 100.0 g of O_2.

$$2SO_2 + O_2 \rightarrow 2SO_3$$

A) 11.5 g
B) 22.5 g
C) 67.5 g
D) 77.5 g
E) 400 g

SHORT ANSWER: Answer the following questions.

1. Yeast can act on a sugar, such as glucose, $C_6H_{12}O_6$ to produce ethyl alcohol, C_2H_5OH and carbon dioxide.

$$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2CO_2$$

If 223 g of ethyl alcohol are recovered after 1.63kg of glucose react, what is the percentage yield of the reaction? **[6 marks]**

2. Marble is made primarily of calcium carbonate. When calcium carbonate reacts with hydrogen chloride, it reacts to form calcium chloride, carbon dioxide and water. If this reaction occurs with 81.5% yield, what mass of carbon dioxide will be collected if 15.7 g of $CaCO_3$ is added to sufficient hydrogen chloride? **[7 marks]**

3. Ethylene oxide, C_2H_4O is a multi-purpose industrial chemical used, among other things as a rocket propellant. It can be prepared by reacting ethylene bromohydrin, C_2H_5OBr with NaOH.

$$C_2H_5OBr + NaOH \rightarrow C_2H_4O + NaBr + H_2O$$

If this reaction proceeds with an 89% yield, what mass of C_2H_4O can be obtained when 3.61×10^{23} molecules of C_2H_5OBr react with excess NaOH? **[5 marks]**

4. Methyl salicylate, otherwise known as oil of wintergreen, is produced by the wintergreen plant. It can also be synthesized by heating salicylic acid, $C_7H_6O_3$, with methanol, CH_3OH.

$$C_7H_6O_3(s) + CH_3OH(l) \rightarrow C_8H_8O_3(l) + H_2O(l)$$

A chemist reacts 3.50 g of salicylic acid with excess methanol. She calculates the theoretical yield of methyl salicylate to be 3.86 g. If 2.84 g of methyl salicylate are recovered, what is the percentage yield of the reaction? **[2 marks]**

5. Dinitrogen pentoxide is a white solid. When heated it decomposes to produce nitrogen dioxide and oxygen.

$$2N_2O_5(s) \rightarrow 4NO_2(g) + O_2(g)$$

How many grams of oxygen gas will be produced in this reaction when 2.34 g of NO_2 are made? **[5 marks]**

6. A 2.524 g sample of a compound contains carbon, hydrogen, and oxygen. The sample is subjected to carbon-hydrogen analysis. 3.703 g of carbon dioxide and 1.514 g of water are collected. **[10 marks]**

a) Determine the empirical formula of the compound.

b) If one molecule of the compound contains 12 atoms of hydrogen, what is the molecular formula of the compound?