

WORKSHEET- STOICHIOMETRY AND CHEMICAL FORMULA CALCUATIONS

SET A: (Time required, 1 hour)

1. A compound with the formula, $B_xH_{20}O_3$, contains 36.14 % by mass oxygen. What is the value of the integer, x ?
1) Ans: x = 6
2. A mixture of cobalt(II) oxide and cobalt(III) oxide contains 32.50 % by mass cobalt (II) oxide. What is the total number of oxide ions in a 122 g of the mixture?
2) Ans: 1.22×10^{24} oxide ions
3. A sulfur containing compound is treated chemically to convert all its sulfur into barium sulfate. A 8.19 mg sample of the compound gave 5.46 mg barium sulfate.
a) What is the percentage of sulfur in the compound? 3a) Ans: 9.18 % S
b) If there is one sulfur atom in the molecule, what is the molar mass of the compound ?
3b) Ans: 349 g/mole
4. An alloy of Co, Rh and Mn contains these elements in the atomic ratio of 2 : 5 : 2 , respectively. What is the mass of a sample of this alloy containing a total of 8.75×10^{21} atoms ?
4) Ans: 1.20 g
5. The percent of aluminum in the compound, Al_2X_3 , is 18.56 %. What is the molar mass of element X ?
5) Ans: 79.00 g/mole
6. 3.9104 g sample of a compound made of carbon, hydrogen, nitrogen, and oxygen is burned completely. 3.820 g CO_2 and 3.125 g H_2O are produced. Analysis of nitrogen showed that the compound contains 46.62 % by mass nitrogen. The molar mass of the compound is about 170 + 15 g/mole.
a) Calculate the empirical formula of the compound. 6a) Ans: $C_2H_8N_3O$
b) What is the molecular formula of the compound? 6b) Ans: $C_4H_{16}N_6O_2$
7. 169 g $FeCr_2O_4$, 298 g K_2CO_3 and an excess of O_2 (g) are sealed in a reaction vessel and allowed to react at high temperature. The amount of K_2CrO_4 obtained is 194 g. Calculate the percent yield of K_2CrO_4 .
$$4 FeCr_2O_4 + 8 K_2CO_3 + 7 O_2 \rightarrow 8 K_2CrO_4 + 2 Fe_2O_3 + 8 CO_2$$

(Molar mass: $FeCr_2O_4 = 223.84$, $K_2CO_3 = 138.21$, $K_2CrO_4 = 194.19$ g/mole)
7) Ans: 66.2 %

SET B: (time required, 1 hour)

1. Excess amount of HCl is added to a mixture of $CaCO_3$ and K_2CO_3 . The mixture reacted completely.
$$CaCO_3 + 2 HCl \rightarrow CaCl_2 + H_2O + CO_2$$
$$K_2CO_3 + 2 HCl \rightarrow 2 KCl + H_2O + CO_2$$

4.48 g CO_2 and 3.57 g KCl are produced along with some $CaCl_2$ and H_2O . Calculate the mass of the mixture.
1) Ans: 11.10 g mixture
2. The percent of manganese in the compound, Mn_5X_2 , is 42.10 %. What is the molar mass of element X ?
2) Ans: 186.9 g/mole

3. A mixture of potassium phosphate and potassium nitrate contains 36.55 % by mass potassium nitrate. What is the total number of potassium ions in 83.5 g mixture?

3) Ans: 6.32×10^{23} ions

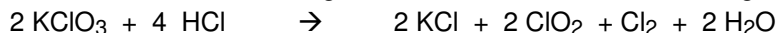
4. A carbon containing compound was treated chemically to convert all its carbon into SrCO_3 . A 31.23 g sample of the compound gave 1.203×10^2 g SrCO_3 .

a) What is the percentage of carbon in the compound? 4a) 31.3 % C

b) If there are three carbon atoms in a molecule of the compound, what is the molar mass of the compound?

4b) Ans: 114.8 g/mole

5. 80.0 g KClO_3 are mixed with 59.5 g HCl and allowed to react according to the equation:



(Molar mass: $\text{KCl} = 74.6$, $\text{KClO}_3 = 122.6$, $\text{HCl} = 36.5$, $\text{ClO}_2 = 67.5$, $\text{Cl}_2 = 71.0$, $\text{H}_2\text{O} = 18.0$ g/mole)

The amount of Cl_2 produced is 18.7 g. Calculate the percent yield of Cl_2 .

5) Ans: 80.6 %

6. 28.50 g sample of a compound of carbon, sulfur, hydrogen, and oxygen is burned. 35.25 g CO_2 and 14.65 g SO_2 are produced. Analysis of hydrogen showed that the compound contains 8.514 % hydrogen by mass. The molar mass of the compound is 500 ± 5 g/mole.

a) Calculate the empirical formula of the compound.

6a) Ans: $\text{C}_7\text{H}_{21}\text{S}_2\text{O}_5$

b) What is the molecular formula of the compound?

6b) Ans: $\text{C}_{14}\text{H}_{42}\text{S}_4\text{O}_{10}$

SET C:

1. A phosphorus containing compound is treated chemically to convert all its phosphorus into $\text{Mg}_3(\text{PO}_4)_2$. A 7.88 g sample of the compound gave 4.75 g $\text{Mg}_3(\text{PO}_4)_2$. What is the percentage by mass of phosphorus in the compound?

1) Ans: 14.2 % P

2. The percent by mass of boron in the compound, B_7X_3 , is 42.1 % . What is the molar mass of X ?

2) Ans: 34.7 g/mole

3. A 39.11 g sample of a compound containing Cr is analyzed to show the presence of 86.22 % Cr. It is found that there are five chromium atoms per molecule of the compound. What is the molar mass of the compound?

3) Ans: 301.6 g/mole

4. The percent by mass of silicon in the compound, Si_8X_3 , is 72.33 %. What is the molar mass of element X ?

4) ans: 28.65 g/mole

5. Consider the following reaction:



A reaction mixture contained 22.44 g of CaBr_2 and 16.85 g Na_3PO_4 .

(Molar mass: $\text{CaBr}_2 = 199.9$, $\text{Na}_3\text{PO}_4 = 164.0$, $\text{Ca}_3(\text{PO}_4)_2 = 207.2$, $\text{NaBr} = 102.9$ g/mole)

a. What is the mass of $\text{Ca}_3(\text{PO}_4)_2$ produced after the reaction is complete ?

6a) Ans: 7.753 g

b. How many grams of each reactant is left after the reaction is complete?

6b) Ans: zero grams of CaBr_2
and 4.58 g Na_3PO_4

