

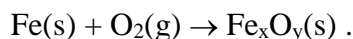
THE UNIVERSITY OF ZAMBIA
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF CHEMISTRY
ACADEMIC YEAR 2022
TERM 1
CHE 1000: INTRODUCTORY CHEMISTRY

ASSIGNMENT SHEET 1

14th April 2023

Answer all the problems in a HARD COVER book and submit in ROOM 124 before 10:00 hrs on Monday, 19th April 2023

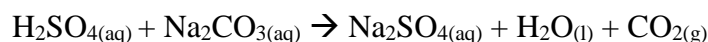
1. The major air pollutant of coal-burning power plants is a colorless, pungent gaseous compound containing only sulfur and oxygen. Chemical analysis of a 1.078 g sample of this gas showed that it contained 0.540 g of S and 0.538 g of O. What is the empirical formula of this compound?
2. A piece of iron ore is found to contain a compound containing 72.3% iron and 27.7% oxygen with a molecular mass of 231.4 g/mol. What is the molecular formula of the compound?
3. An ace chemistry student heats a piece of iron (Fe) metal in a crucible. The reaction is:



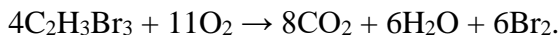
Complete the data below. Determine the empirical formula of iron oxide.

Mass of crucible	27.50 g
Mass of crucible + Fe	28.62 g
Mass of Fe	
Mass of crucible + iron oxide	29.10 g
Mass of iron oxide	
Moles of Fe	
Mass of oxygen	
Moles of oxygen	

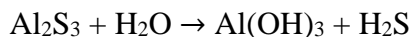
4. Silver nitrate solution is added to 25.00 mL of a 0.500 M potassium chloride solution until no more precipitate forms. What mass of silver chloride will be formed?
5. Calculate the number of moles of CuSO_4 contained in 100mL of 1 M CuSO_4 solution. Calculate the number of SO_4^{2-} ions in CuSO_4 .
6. What volume of a 0.01 M sodium carbonate solution is required to neutralise 25 cm³ of a solution containing 0.98 g l⁻¹ of sulfuric acid? The equation for the reaction is



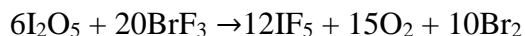
7. What would be the limiting reagent if 75 grams of $C_2H_3Br_3$ reacted with 50.0 grams of O_2 in the following reaction:



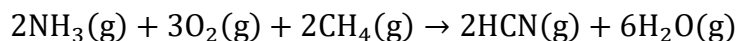
8. Suppose 316.0 g aluminium sulphide reacts with 493.0 g of water. What mass of the excess reactant remains?



9. How many grams of IF_5 would be produced using 44.01 grams of I_2O_5 and 101.0 grams of BrF_3 ?

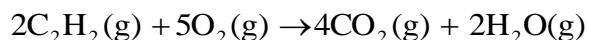


10. Hydrogen cyanide is produced industrially from the reaction of gaseous ammonia, oxygen and methane:



If 5.00×10^3 kg each NH_3 , O_2 and CH_4 are reacted, what mass of HCN and of H_2O will be produced, assuming 100% yield?

11. A sample of 1.00L of C_2H_2 at a temperature of 373.15 K and pressure of 1.00 atmospheres reacted completely with oxygen according to the reaction:



- Use the ideal gas equation to calculate the initial moles of C_2H_2
 - Determine the moles of CO_2 and $H_2O(g)$ produced
 - Given that the total volume of the gas mixture at the end of the reaction was 3.00 L at a total pressure 1.00 atmospheres. Calculate the partial pressure of Carbon dioxide and water.
- 12.
- The cylinder of a bicycle pump has a volume of 1131 cm^3 and is filled with air at a pressure of 1.02 atm. The outlet valve is sealed shut, and the pump handle is pushed down until the volume of the air is 517 cm^3 . The temperature of the air trapped inside does not change. Compute the pressure inside the pump.
 - At some point during its ascent, a sealed weather balloon initially filled with helium at a fixed volume of $1.0 \times 10^4 \text{ L}$ at 1.00 atm and 30°C reaches an altitude at which the temperature is -10°C yet the volume is unchanged. Calculate the pressure at that altitude.
 - What mass of Helium gas is needed to fill a weather balloon to a volume of 10,000 L, 1.00 atm and 30°C ?
- 13.
- Calculate the density of gaseous hydrogen at a pressure of 1.32 atm and a temperature of -66°F .
 - A hydrocarbon is burned in air in a closed container, producing a mixture of gases having a total pressure of 3.34 atm. Analysis of the mixture shows it to contain 0.340 g of water vapor, 0.792 g of carbon dioxide, 0.288 g of oxygen, 3.790 g of

nitrogen, and no other gases. Calculate the mole fraction and partial pressures of carbon nitrogen and water vapor in this mixture.

14.

- (a) At a certain speed, the root-mean-square-speed of the molecules of hydrogen in a sample of gas is 1055 ms^{-1} . Compute the root-mean square speed of molecules of oxygen at the same temperature.
- (b) A gas mixture contains equal numbers of molecules of N_2 and SF_6 . A small portion of it is passed through a gaseous diffusion apparatus. Calculate how many molecules of N_2 are present in the product of gas for every 100 molecules of SF_6 .