Unit 2 · Stoichiometry

WORKSHEET

Full marks 33

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 33

1 Key words [4]

Write True or False after each sentence. Correct the false ones. Each carries 0.5 mark.

i. A compound always contains the same elements combined in the same proportion by mass, however it is made. ☐

ii. One mole of any gas occupies 22.4 L at room temperature. ☐

iii. The limiting reactant is the reactant present in the larger mass. ☐

iv. The molecular mass of a gas is twice its vapor density. ☐

v. Gay-Lussac's law says that the masses of reacting gases are in a simple whole-number ratio. ☐

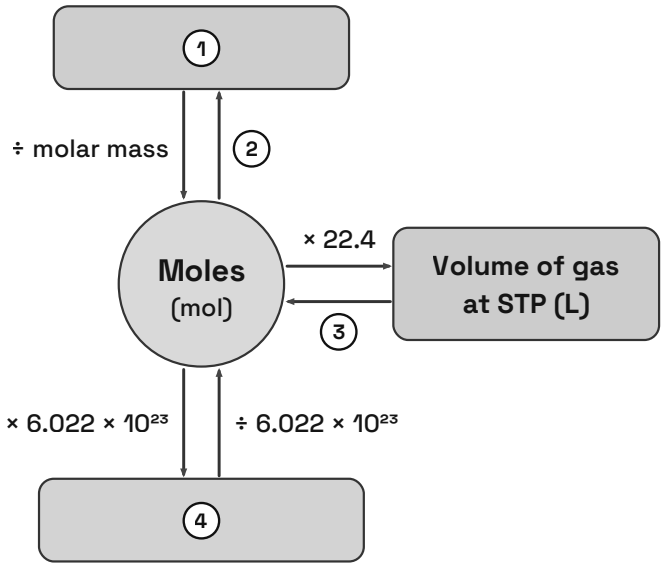
vi. Percentage yield is the actual yield divided by the theoretical yield, times 100%. ☐

vii. One mole of water contains 6.022×10^{23} atoms. ☐

viii. Equal volumes of all gases at the same temperature and pressure contain equal numbers of molecules. ☐

2 Label the diagram [2]

The diagram shows how the mole links a substance's mass, its number of particles and its volume as a gas. Write what belongs in place of 1 to 4. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. When 2 volumes of hydrogen combine with 1 volume of oxygen to give 2 volumes of steam, at the same temperature and pressure, the result shows: [1]

a. the law of conservation of mass
b. the law of reciprocal proportions
c. Gay-Lussac's law of gaseous volumes
d. the law of multiple proportions

ii. Sulphur dioxide, SO_2, and sulphur trioxide, SO_3, are two compounds of the same two elements. Together they illustrate the law of: [1]

a. definite proportions
b. multiple proportions
c. reciprocal proportions
d. gaseous volumes

iii. How many atoms are there in 0.5 mol of ozone, O_3? [1]

a. 3.011×10^{23}
b. 6.022×10^{23}
c. 9.033×10^{23}
d. 1.807×10^{24}

iv. What volume does 8 g of methane, CH_4, occupy at STP? [1]

a. 5.6 L
b. 11.2 L
c. 22.4 L
d. 44.8 L

v. In $2\,H_2 + O_2 \rightarrow 2\,H_2O$, 3 mol of hydrogen is mixed with 2 mol of oxygen. Which is the limiting reactant, and how much water forms? [1]

a. hydrogen; 3 mol
b. oxygen; 4 mol
c. hydrogen; 2 mol
d. oxygen; 3 mol

4 Short answers [7]

Write short answers to the following questions.

a. Use Avogadro's law to show that the molecular mass of a gas is twice its vapor density. [2]

b. A flask holds 5.6 L of carbon dioxide and another 5.6 L of nitrogen, both at STP. Which flask holds more molecules, and which gas is heavier? (C = 12, N = 14, O = 16) [2]

c. Bhumika burns 1.2 g of magnesium and gets 2.0 g of magnesium oxide. Rohan finds that a sample of magnesium oxide bought from a shop, 3.0 g, contains 1.8 g of magnesium. Show that the results follow the law of definite proportions. **[3]**

5 Long answer **[4]**

Write a long answer to the following question.

State the law of multiple proportions. Three oxides of nitrogen contain 63.6%, 46.7% and 30.4% nitrogen by mass. Show that they follow the law.

6 Numerical problems **[8]**

Solve the following problems. Show your working. Take H = 1, C = 12, Al = 27, Cl = 35.5.

a. Aluminium burns in chlorine: $2\,Al + 3\,Cl_2 \rightarrow 2\,AlCl_3$. Sabina heats 5.4 g of aluminium in 14.2 g of chlorine. **[4]**

i. Which is the limiting reactant?
ii. Find the theoretical yield of aluminium chloride.
iii. What mass of the excess reactant is left?
iv. She collects 15.0 g of aluminium chloride. Find the percentage yield.

Answer:

b. A gaseous hydrocarbon contains 82.76% carbon and the rest hydrogen by mass. Its vapor density is 29. Find its empirical formula and its molecular formula. **[4]**

Answer: _____

7 Think [3]

Sujan explodes 10 g of hydrogen with 10 g of oxygen: $2H_2 + O_2 \rightarrow 2H_2O$. He says, "Equal masses, so neither gas is left over." Show that he is wrong: which gas is limiting, what mass of water forms, and what is left? (O = 16)

8 Activity: Counting by weighing (not marked)

A chemist can't count atoms, but can count them by weighing. Try it with a grain: count 50 grains of rice (or lentils), weigh them on a kitchen balance, and find the mass of one grain. Then work out how many grains there would be in 100 g, and check by counting a weighed handful.

Grain	Mass of 50 grains (g)	Mass of one grain (g)	Grains in 100 g (worked out)
rice			
lentils			

How is this like using the molar mass to find the number of molecules in a mass of a substance?