

Name:	Student ID No:
-------	----------------

Choose the correct choice and write your answer in the table below

1) How many phosphate ions are present in 3.01×10^{23} formula units of $\text{Cu}_3(\text{PO}_4)_2$?

- (A) 2 ions (B) 3 ions (C) 6.02×10^{23} ions (D) 1.2×10^{24} ions

2) A gas sample contains 16.0 g of CH_4 and 16.0 g of O_2 . What is the total number of moles of the gas in the sample?

- (A) 0.500 mol (B) 15.0 mol (C) 1.50 mol (D) 1.00 mol

$$\frac{16}{16} = 1 \text{ mol CH}_4$$

$$\frac{16}{32} = 0.5 \text{ mol O}_2$$

3) How many moles of chloride ions are present in a 66.7g sample of AlCl_3 ?

- (A) 1.0 mol (B) 1.33 mol (C) 2.0 mol (D) 1.5 mol

$$\text{mol} = \frac{66.7}{133.33} = 0.5$$

$$1 \text{ mol AlCl}_3 \rightarrow 3 \text{ mol Cl}^-$$

$$\text{mol Cl}^- = 3 \times 0.5 = 1.5$$

4) How many oxygen atoms are there in 22.0 g of CO_2 ?

- (A) 1.42×10^{24} atoms
 (B) 6.02×10^{23} atoms
 (C) 1.20×10^{24} atoms
 (D) 5.09×10^{23} atoms

$$\text{mol CO}_2 = \frac{22}{44} = 0.5 \text{ mol}$$

$$N = 6.022 \times 10^{23} \times 0.5 = 3.011 \times 10^{23} \text{ molecules CO}_2$$

$$\text{no. of O atoms} = 3.011 \times 10^{23} \times 2 = 6.022 \times 10^{23} \text{ atoms}$$

5) The empirical formula for an oxide of nitrogen that is 30.4% by mass nitrogen is

- (A) NO (B) NO_2 (C) N_2O (D) NO_4

$$\frac{14}{14+32} \times 100 = 30.4\%$$

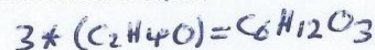
6) A compound has an empirical formula of $\text{C}_2\text{H}_4\text{O}$. An independent analysis gave a value of 132 g for its molar mass. What is the molecular formula of the compound?

- (A) $\text{C}_4\text{H}_4\text{O}_5$ (B) $\text{C}_{10}\text{H}_{12}$ (C) C_7O_3 (D) $\text{C}_6\text{H}_{12}\text{O}_3$

$$\text{C}_2\text{H}_4\text{O} \quad \mu = 44$$

$$n = \frac{132}{44} = 3$$

7) Consider the following reaction:



Which of the following is a correct interpretation of this equation?

- I. 3 grams of A react with 2 grams of B to form 1 gram of A_3B_2 .
 II. 3 atoms of A react with 2 atoms of B to form 1 molecule of A_3B_2 .
 III. 3 moles of A react with 2 moles of B to form 1 mole of A_3B_2 .

- (A) I only
 (B) II only
 (C) III only
 (D) II and III

5] suppose we have 100g of the compound

$$\text{so mass N} = 30.4\% / 14 = 2.17 \text{ mol}$$

$$\text{mass O} = 69.6\% / 16 = 4.35 \text{ mol}$$

divided by the smaller one

2

molar ratio

$$N \quad 2.17 / 2.17 = 1 \rightarrow \text{NO}_2$$

$$O \quad 4.35 / 2.17 = 2$$

Name:	Student ID No:
-------	----------------

8) When the following equation is balanced, the coefficients from left to right are _____



- (A) 2, 3, 4, 4
- (B) 1, 4, 8, 9
- (C) 4, 4, 32, 36
- (D) 2, 25, 16, 18**

9) $\text{S}_8(\text{s}) + 24\text{F}_2(\text{g}) \rightarrow 8\text{SF}_6(\text{g})$

If you need 2.50 moles of SF_6 , you will need to use _____

- (A) 0.313 moles of S_8 and 7.50 moles of F_2**
- (B) 0.313 moles of S_8 and 3.00 moles of F_2
- (C) 0.125 moles of S_8 and 7.50 moles of F_2
- (D) 0.125 moles of S_8 and 3.00 moles of F_2

$$n \text{ S}_8 = \frac{2.5}{8} = 0.313 \text{ mol}$$

$$n \text{ F}_2 = \frac{2.5}{8} \times 24 = 7.5 \text{ mol}$$

10) An element "X" combines with oxygen to form XO_2 . If 13.4 g of this element combines with 7.8 g of O_2 , therefore the molar mass of X is _____

- (A) 83.5 g/mol
- (B) 54.9 g/mol**
- (C) 47.2 g/mol
- (D) 37.5 g/mol

$$\text{X} + \text{O}_2 \rightarrow \text{XO}_2$$

$$n \text{ O}_2 = \frac{7.8}{32} = 0.244$$

$$n \text{ X} = n \text{ O}_2$$

$$M \text{ X} = \frac{m}{n} = \frac{13.4}{0.244}$$

11) The molar volume of a gas at STP is _____

- (A) 22.4 L**
- (B) 22.4 mL
- (C) 2.24 L
- (D) 44.8 L

Volume of 1 mol gas at STP

12) The volume occupied by 88.02 g of CO_2 at 6.54 atm and 75 °C is _____

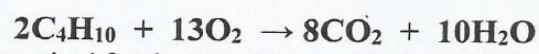
- (A) 8.74×10^3 mL**
- (B) 1.88×10^3 mL
- (C) 8.74×10^{-3} mL
- (D) 8.74 mL

$$n = \frac{88.02}{44} = 2$$

$$T = 273 + 75 = 348 \text{ K}$$

$$V = \frac{nRT}{P} = \frac{2 \times 8.74 \text{ L}}{1} = 8.74 \times 10^3 \text{ mL}$$

13) The combustion of butane (C_4H_{10}) is shown in the equation below



$V \propto n$ at constant T & P for gases

What is the volume of O_2 required for the complete combustion of 12.9 L of C_4H_{10} at constant temperature and pressure?

- (A) 0.99 L
- (B) 1.01 L
- (C) 1.98 L
- (D) 83.85 L**

$$V \text{ O}_2 = \frac{12.9}{2} \times 13$$

14) The pressure of a mixture of N_2 , CO_2 , and O_2 is 150 kPa. If the partial pressures of N_2 and CO_2 are 100 kPa and 24 kPa, respectively, the partial pressure of O_2 in this gaseous mixtures is _____

- (A) 26.0 atm
- (B) 2.60×10^{-1} atm**
- (C) 2.74×10^2 atm
- (D) 2.63×10^3 atm

$$P_T = P_1 + P_2 + P_3$$

$$P_{\text{O}_2} = 150 - (100 + 24)$$

$$= 26 \text{ kPa}$$

$$= 26 \times 10^3 \text{ Pa}$$

$$\Rightarrow \frac{26 \times 10^3}{101325} = 0.26 \text{ atm}$$

15) H_2 gas generated when Ca metal reacts with water. If the volume of H_2 gas collected at 25 °C and pressure of 988 mmHg is 461 mL, what is the mass of the H_2 gas obtained? (The pressure of water vapor at 25 °C is 23.76 mmHg)?

- (A) 9.6×10^2 g
- (B) 3.3×10^{-2} g
- (C) 6.7×10^{-2} g
- (D) 4.78×10^{-2} g**

$$m_{\text{H}_2} = 0.0239 \times 2 = 0.0478 \text{ g} = 4.78 \times 10^{-2} \text{ g}$$

$$n_{\text{H}_2} = \frac{PV}{RT} = \frac{1.269 \times 0.461}{0.082 \times 298} = 0.0239 \text{ mol}$$

$$P_T = P_{\text{H}_2} + P_{\text{H}_2\text{O}}$$

$$P_{\text{H}_2} = 988 - 23.76 = 964.24 \text{ mmHg}$$

$$P_{\text{H}_2} = \frac{964.24}{760} = 1.2687 \text{ atm}$$