1. **What is the mass (in grams) of 1.1×10^{22} atom of gold (Au)?**

A) 2.2 B) 2.8 C) 3.6 D) 3.9

Solution:-

Atomic weight for Au = 197 g/mol

$$n = \frac{N}{N_A} = \frac{1.1x1022}{6.022x1023} = 0.018266 \text{ mol}$$

$$m = n \times M = 0.018266 \text{ x } 197 = 3.598 \text{ g}$$

2. How many hydrogen atoms are in 5.37 g of $(NH_4)_3PO_4$?

A) 1.8×10^{23} B) 1.8×10^{24} C) 2.2×10^{23} D) 2.6×10^{23}

Solution:-

1 mol $(NH_4)_3PO_4$ contains 12 mol H

M for $(NH_4)_3PO_4$ = 149 g/mol

mol $(NH_4)_3PO_4$ = 5.37/149 = 0.036 mol

mol H = 0.036 x 12 = 0.5326 mol

No. of H atoms = n x N_A

= 0.5326 x $6.022\text{x}10^{23}$ = 2.6×10^{23} atom

3. How many moles are in 1.0 kg of pure table sugar $C_{12}H_{22}O_{11}$?

A) 2.92 B) 3.32 C) 3.64 D) 4.16

Solution:-

M for $C_{12}H_{22}O_{11}$ = 342 g/mol

n = m/M = 1000/342 = 2.92 mol

4. **The percentage by mass of nitrogen in $Bi(NO_3)_3$ is:**

A) 7.36% **B) 10.64%** **C) 8.54%** **D) 9.75%**

Solution:-

M for $Bi(NO_3)_3$ = 395 g/mol

%N in $Bi(NO_3)_3 = \frac{3\ x\ 14}{395}$ x 100% = 10.63%

5. **The combustion of 1.031 g of an organic compound that contains only carbon, hydrogen and oxygen produced 2.265 g of CO_2 and 1.236 g of H_2O. What is the empirical formula of this compound?**

A) C_2H_6O B) C_3H_5O **C) C_3H_8O** D) CH_2O

Solution:-

Gram C = $\frac{2.265}{44}\, x$ 12 = 0.6177 g

Gram H = $\frac{1.236}{18}\, x$ 2 x 1 = 0.1373 g

Gram O = 1.031 – (0.6177 + 0.1373) = 0.276 g

mol C = 0.6177 / 12 = 0.0515 mol

mol H = 0.1373 / 1 = 0.1373 mol

mol O = 0.276 / 16 = 0.01725 mol

Divide by 0.01725

C : H : O 3 : 8 : 1

C_3H_8O

6. An element "X" combines with oxygen to form a compound with formula XO_2. If 6.7 g of this element combines with 3.9 g of oxygen, what is the atomic mass of this element (in a.m.u.)?

A) 55 B) 40 C) 65 D) 48

Solution:-

$X + O_2 \rightarrow XO_2$

mol of O_2 = 3.9/32 = 0.122 mol

mol X = mol O_2

Atomic mass of X = 6.7/0.122 = 55

7. What is the theoretically yield (in grams) of copper Cu when 18.1 g of NH_3 gas and 90.4 g solid CuO were allowed to react according to:

$$2NH_3(g) + 3CuO(s) \rightarrow 3Cu(s) + N_2(g) + 3H_2O(g)$$

A) 48.7   B) 63.6   C) 68.5   D) 72.2

Solution:-

mol NH_3 = 18.1/17 = 1.065 mol

mol CuO = 90.4/79.55 = 1.136 mol

Stoichiometric ratio

NH_3 mol = 1.065/2 = 0.532

CuO mol = 1.136/3 = 0.379

CuO is the limiting reactant

So, mol Cu/3 = mol CuO/3

mol of Cu = 1.136

mass Cu = 1.136 x 63.55 = 72.2 g

8. **What is the percentage yield of lead (Pb) if 50.00 kg of PbO are reduced by heating with excess carbon and 40.75 kg of lead are produced according to:**

$$PbO(s) + C(s) \rightarrow Pb(L) + CO(g)$$

A) 75.88% **B) 87.79%** **C) 90.32%** **D) 94.65%**

Solution:-

M PbO = 223.2 g/mol

mol PbO = 50000/223.2 = 224 mol

mol PbO = mol Pb produced

mass Pb = 224 x 207.2 = 46412.8 g

%yield = $\frac{40750}{46412.8} x100\% = 87.799\%$

9. **How many milliliter of water must be added to a stock solution of 6.0 M HNO_3 in order to prepare 0.90 L of 0.5 M HNO_3 by dilution?**

A) 825 **B) 850** **C) 780** **D) 800**

Solution:-

$M_1 \times V_1 = M_2 \times V_2$

$6 \times V_1 = 0.5 \times 0.9$

$V_1 = 0.5 \times 0.9 / 6 = 0.075$ L

$V_{H2O} = 0.9 - 0.075 = 0.825$ L $= 825$ mL

10. **What is the percent H_2SO_4 by mass in a 6.0 M of 1.0 L H_2SO_4 solution that has a density of 1.34 g/mL?**

A) 27.83%   B) 32.74%   C) 43.92%   D) 78.25%

Solution:-

mol H_2SO_4 = 6 x 1 = 6 mol

mass H_2SO_4 = 6 x 98 = 588 g

mass of solution = 1000 x 1.34 = 1340 g

% H_2SO_4 = $\frac{588}{1340}\ x\ 100 = 43.88\ \%$

11. **A sample of Cl_2 gas occupies a volume of 5.0 L at 25°C and 15.0 atm. What volume (in L) will this sample occupy at STP?**

A) 68.7 **B) 52.8** **C) 40.6** **D) 28.4**

Solution:-

STP; 0 °C (273 K) and 1 atm

$P_1 V_1 / T_1 = P_2 V_2 / T_2$

$V_2 = 15 \times 5 \times 273 / 298 \times 1 = 68.7$ L

12. A tennis ball has an internal volume of 145 mL and contains 0.366 g of N_2 gas. What will be the pressure (in atm) inside the ball at 25°C?

A) 1.8 B) 2.0 C) 2.2 D) 2.4

Solution:-

P = nRT / V

mol N_2 = 0.366 / 28 = 0.0131 mol

P = 0.0131 x 0.0821 x 298 / 0.145 = 2.2 atm

13. **What volume of oxygen gas at STP would be needed to react completely with 20.1 g of aluminum (Al) according to:**

$$4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$$

A) 10.8 L   B) 12.5 L   C) 14.3 L   D) 15.5 L

Solution:-

mol Al = 20.1 / 26.98 = 0.745 mol

mol Al / 4 = mol O_2 / 3

mol O_2 = 0.745 x 3 / 4 = 0.559 mol

PV = nRT

V = 0.559 x 0.08206 x 273 / 1 = 12.5 L

14. **What is the molar mass (in g.mol^{-1}) of a certain gas if its density is 1.57g/L at 25^oC and 1.2 atm?**

A) 71 B) 44 C) 32 D) 28

Solution:-

$$\mathcal{M} = \frac{d\,R\,T}{P}$$

$$= \frac{1.57\ x\ 0.0821\ x\ 298}{1.2} = 32\ \mathrm{L}$$

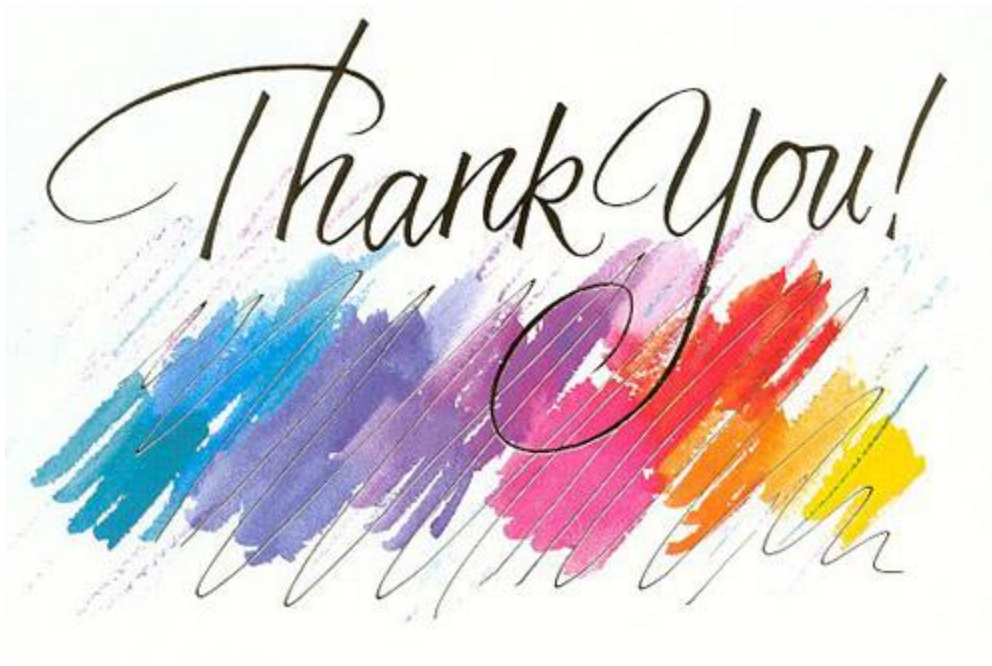
15. **What is the root-mean-square speed of a neon Ne atom (in m/s) at 27°C?**

A) 450 B) 498 C) 585 D) 609

Solution:-

$$u = \sqrt{\frac{3RT}{\mathcal{M}}}$$

$$= \sqrt{\frac{3 \ x\ 8.314 \ x\ 300}{0.02018}} = 608.9 \text{ m/s}$$


Thank You!