JEE Main 2026 Mole Concept and Stoichiometry Practice Set with Solutions PDF

Q1. Empirical formula CH_2O; molar mass ≈ 180 $g·mol^{-1}$. Find molecular formula.

Solution

Empirical mass = 12.011 + 2×1.008 + 15.999 = 30.026 $g·mol^{-1}$. n = 180 ÷ 30.026 ≈ 5.993 ≈ 6.
Molecular formula = $(CH_2O)_6$ = $C_6H_{12}O_6$.

Answer: $C_6H_{12}O_6$

Q2. 10.0 g of A reacts theoretically to give 14.0 g product B. If the actual yield is 12.6 g, what is the % yield?

Solution

% yield = (actual ÷ theoretical)×100 = (12.6 ÷ 14.0)×100 = 0.9×100 = 90.0%.

Answer: 90.0%

Q3. What is % potassium (K) in K_2SO_4? (K = 39.098, S = 32.06, O = 15.999)

Solution

Molar mass = 2×39.098 + 32.06 + 4×15.999 = 78.196 + 32.06 + 63.996 = 174.252 $g·mol^{-1}$. Mass K = 78.196. %K = (78.196 ÷ 174.252)×100 = compute quotient: 78.196 ÷ 174.252 ≈ 0.4489. ×100 = 44.89%.

Answer: 44.89% K (≈44.9%)

Q4. A mixture of 2.0 mol He and 3.0 mol N_2 at a total pressure 1.0 atm. What is the partial pressure of N_2?

Solution

Mole fraction of N_2 = 3.0 ÷ (2.0+3.0) = 3.0 ÷ 5.0 = 0.6. Partial pressure = 0.6×1.0 atm = 0.6 atm.

Answer: 0.6 atm

Q5. 0.25 mol of an ideal gas at STP (22.414 $L \cdot mol^{-1}$) occupies what volume?

Solution

$V = n \times 22.414 = 0.25 \times 22.414 = 5.6035$ L

Answer: 5.6035 L (≈5.60 L)

Q6. 4.0 g NaOH reacts with 6.5 g HCl. Reaction: $NaOH + HCl \rightarrow NaCl + H_2O$. Which is limiting and mass of NaCl produced? (Na=22.990, O=15.999, H=1.008, Cl=35.45)

Solution

Molar masses: NaOH = 22.990 + 15.999 + 1.008 = 39.997 $g \cdot mol^{-1}$. Moles NaOH = 4.0 ÷ 39.997 = 0.1000 (approx). HCl = 1.008 + 35.45 = 36.458 $g \cdot mol^{-1}$. Moles HCl = 6.5 ÷ 36.458 = compute: 36.458 into 6.5 ≈ 0.1782. Reaction 1:1; NaOH moles 0.1000 < HCl 0.1782 → NaOH limiting. Moles NaCl produced = 0.1000. Molar mass NaCl = 22.990 + 35.45 = 58.440 $g \cdot mol^{-1}$. Mass = 0.1000 × 58.440 = 5.844 g.

Answer: NaOH limiting; 5.844 g NaCl

Q7. 49 g H_2SO_4 (98.079 $g \cdot mol^{-1}$) dissolved to make 1 L solution. What is normality for acid–base reactions (H_2SO_4 provides 2 H^+)?

Solution

Moles = 49 ÷ 98.079 = 0.4995 ≈ 0.500 mol. Normality = molarity × equivalents per mole = 0.500 $mol \cdot L^{-1}$ × 2 = 1.000 N.

Answer: 1.00 N

Q8. A solution contains 20 mg of solute in 2 L of water. Express concentration in ppm (assume density ≈1 $g \cdot mL^{-1}$).

Solution

2 L = 2000 g (approx). ppm = (mass solute (mg) ÷ mass solution (kg)×10^6?)
Simpler: ppm ≈ mg solute per kg solution. Mass solution ≈ 2000 g = 2.000 kg.
ppm = 20 mg ÷ 2.000 kg = 10 $mg \cdot kg^{-1}$ = 10 ppm.

Answer: 10 ppm

Q9. A sample of $CuSO_4 \cdot xH_2O$: mass 2.518 g. After heating anhydrous mass = 1.600 g. Find x. (Cu=63.546, S=32.06, O=15.999, H=1.008)

Solution

Mass water lost = 2.518 − 1.600 = 0.918 g. Moles water = 0.918 ÷ 18.015 = 0.05096. Moles anhydrous $CuSO_4$ = mass ÷ M($CuSO_4$). M($CuSO_4$)=63.546 + 32.06 + 4×15.999 = 63.546 + 32.06 + 63.996 = 159.602 $g \cdot mol^{-1}$. Moles = 1.600 ÷ 159.602 = 0.01002. Ratio x = moles H_2O ÷ moles $CuSO_4$ = 0.05096 ÷ 0.01002 = 5.086 ≈ 5. So x = 5 (but common hydrate is 5 for $CuSO_4$? actually usual is 5).

Answer: x = 5 → $CuSO_4 \cdot 5H_2O$

Q10. 10 L of CO (g) reacts with excess O_2 at same T & P to give CO_2. Volume of CO_2 produced?

Solution

1 mol CO → 1 mol CO_2, volumes equal at same T & P. So 10 L CO → 10 L CO_2.

Answer: 10 L

Q11. What is the molarity of 25.0 g NH_4Cl (M = 53.491 $g \cdot mol^{-1}$) dissolved to make a 500 mL solution?

Solution

Moles = 25.0 ÷ 53.491 = 0.4674. Volume = 0.500 L. M = 0.4674 ÷ 0.500 = 0.9348 M.

Answer: 0.9348 M (≈0.935 M)

Q12. In reaction $2Fe^{3+} + Sn^{2+} \rightarrow 2Fe^{2+} + Sn^{4+}$, how many moles of Fe^{3+} are reduced by 0.10 mol Sn^{2+}?

Solution

Stoichiometry: 2 mol Fe^{3+} per 1 mol Sn^{2+}. So for 0.10 mol Sn^{2+}, Fe^{3+} required = 2×0.10 = 0.20 mol.

Answer: 0.20 mol Fe^{3+}

Q13. A sample labelled Na_2CO_3 (pure) weighing 5.00 g actually contains 10% impurity by mass (inert). How many moles of CO_3^{2-} are present? (Na_2CO_3 molar mass = 105.988 g·mol^{-1} approximate)

Solution

Pure Na_2CO_3 mass = 90% of 5.00 = 4.50 g. Moles = 4.50 ÷ 105.988 = compute: 105.988 into 4.50 ≈ 0.04245. (4.50 ÷ 105.988 = 0.04245). Each formula unit has one CO_3^{2-} → moles CO_3^{2-} = 0.04245 mol.

Answer: 0.04245 mol

Q14. Ammonium nitrate decomposes: $NH_4NO_3 \rightarrow N_2O + 2H_2O$. If 17.0 g NH_4NO_3 decomposes, what volume of N_2O at STP (22.414 L·mol^{-1}) is produced? (N=14.007, H=1.008, O=15.999)

Solution

Molar mass NH_4NO_3 = 2×14.007 + 4×1.008 + 3×15.999 = 28.014 + 4.032 + 47.997 = 80.043 g·mol^{-1}. Moles = 17.0 ÷ 80.043 = 0.2123. Reaction gives 1 mol N_2O per 1 mol NH_4NO_3. Volume = 0.2123 × 22.414 = 4.757 L

Answer: 4.76 L (approx)

Q15. 25.0 mL of 0.100 M H_2SO_4 is neutralized by NaOH. Volume of 0.150 M NaOH required? Reaction: $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$.

Solution

Moles H_2SO_4 = 0.0250 × 0.100 = 0.00250 mol. Needs 2 mol NaOH per mol acid → moles NaOH = 0.00500 mol. Volume = moles ÷ M = 0.00500 ÷ 0.150 = 0.03333 L = 33.33 mL.

Answer: 33.33 mL NaOH

Q16. A container has 1.00 mol A and 2.00 mol B at 300 K and total pressure 3.00 atm. If A reacts completely with B consuming 0.50 mol B to produce C (1:1 stoichiometry A + B → C), what is final total pressure (assume T constant and ideal gas)?

Solution

Initial total moles = 1.00 + 2.00 = 3.00 mol. Reaction consumes A: amount reacted = 0.50 mol (since B consumed 0.50). A left = 1.00 − 0.50 = 0.50 mol. B left = 2.00 − 0.50 = 1.50 mol. C formed = 0.50 mol. Final total moles = 0.50 + 1.50 + 0.50 = 2.50 mol. Pressure ∝ moles (at constant V and T) so P_{final} = $P_{initial}$ × (n_{final} ÷ $n_{initial}$) = 3.00 atm × (2.50 ÷ 3.00) = 3.00 × 0.833333... = 2.50 atm

Answer: 2.50 atm