Q1: When the following equation is balanced:

$$Fe_2O_3 + H_2 \longrightarrow Fe + H_2O$$

the coefficient of H_2, is:

A) 4
B) 3
C) 2
D) 1
E) 5

$Fe_2O_3 + H_2 \rightarrow \underline{\underline{2}}Fe + H_2O$

$Fe_2O_3 + H_2 \rightarrow 2Fe + \underline{\underline{3}}H_2O$

$Fe_2O_3 + \underline{\underline{3}}H_2 \rightarrow 2Fe + 3H_2O$

Q2: The mass (in *g*) of "O" present in 5.0 g of "$K_2Cr_2O_7$", is:

A) 1.1
B) 0.5
C) 2.4
D) 2.9
E) 1.9

mass of (O) =

$5 g\ K_2Cr_2O_7 \times \frac{1\ mol\ K_2Cr_2O_7}{294.18 g\ K_2Cr_2O_7} \times \frac{7\ mol\ O}{1\ mol\ K_2Cr_2O_7} \times \frac{16 g\ O}{1\ mol\ O}$

Q3: The percentage by mass of "Pt" in $[C_6H_{12}N_2O_4Pt]$, is: 371.256 195.08

A) 21.78 %
B) 61.89 %
C) 15.44 %
D) 52.55 %
E) 33.24 %

$\% Pt = \frac{195.08}{371.256} \times 100$

Q4: The number of calcium atoms "Ca" present in 0.5 g of "$Ca_2P_2O_7$", is: 254.1 40.08

A) 2.37×10^{21}
B) 3.11×10^{22}
C) 4.51×10^{22}
D) 4.26×10^{21}
E) 3.79×10^{23}

$0.5 g\ Ca_2P_2O_7 \times \frac{1\ mol\ Ca_2P_2O_7}{254.1 g\ Ca_2P_2O_7} \times \frac{2\ mol\ Ca}{1\ mol\ Ca_2P_2O_7} \times \frac{6.022\times10^{23}}{1\ mol\ Ca}$

Q5: A compound contains 63.68% C, 12.38% N, 9.80% H, and 14.14% O by mass. The empirical formula of this compound is:

A) $C_8H_{15}NO$
B) $C_6H_{11}NO$
C) $C_7H_{13}NO_2$
D) $C_9H_{18}N_2O_3$
E) $C_2H_8N_2O$

$n_C = 63.68 g \times \frac{1\ mol}{12.011} = 5.302$

$n_H = 9.8 g \times \frac{1\ mol}{1.008 g} = 9.722$

$n_N = 12.38 g \times \frac{1\ mol}{14.01 g} = 0.884$

$n_O = 14.14 g \times \frac{1\ mol}{16 g} = 0.884$

C	H	N	O
$\frac{5.302}{0.884}$	$\frac{9.722}{0.884}$	$\frac{0.884}{0.884}$	$\frac{0.884}{0.884}$
6	11	1	1

Q6: Given the following reaction:

$$2Fe_2O_3(s) + 3C(s) \longrightarrow 4Fe(s) + 3CO_2(g)$$

If 25.5 g of "Fe_2O_3" react with 3.3 g of "C", the mass (in *g*) of "Fe", is: 159.7

A) 10.68
B) 13.80
C) 17.85
D) 28.78
E) 23.94

$25.5 g\ Fe_2O_3 \times \frac{1\ mol\ Fe_2O_3}{159 g\ Fe_2O_3} \times \frac{4\ mol\ Fe}{2\ mol\ Fe_2O_3} \times \frac{55.85 g\ Fe}{1\ mol\ Fe}$

Q7: Given the following reaction:

$$3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$$

If the reaction has a 88.7% yield, then the mass (in *g*) of H_2 needed to produce 120 g of "NH_3" is:

A) 18.09
B) 13.67
C) 27.42
D) 36.87
E) 24.01

$120 g\ NH_3 \times \frac{1\ mol\ NH_3}{17.034 g\ NH_3} \times \frac{3\ mol\ H_2}{2\ mol\ NH_3} \times \frac{2.016 g\ H_2}{1\ mol\ H_2} \times \frac{100}{88.7}$

Q8: The molarity "M" (in ***mol.L***$^{-1}$) of a solution prepared by dissolving 158.0 g of "$(NH_4)_2SO_4$" in enough water to make 1250 mL solution, is:

A) 1.24
B) 0.29
C) 0.48
D) 0.96
E) 1.63

$M = \frac{n}{V}$

$n = \frac{158 g}{132.154} = 1.196\ mol$

$V = 1.250\ L$

Q9: At constant temperature, a sample of gas occupies 5.0 L at 0.98 atm. If the pressure becomes 3.25 atm, the gas volume (in **mL**) will be :

A) 1508
B) 2186
C) 2889
D) 3896
E) 1252

$P_1V_1 = P_2V_2$

$P_1 = 0.98\ atm$ $V_1 = 5 L$

$P_2 = 3.25$ $V_2 = ??$

$V_2 = \frac{P_1V_1}{P_2} = \frac{0.98\times5}{3.25}$

$= 1.508\ L \times 1000\ m$

$= 1508\ mL$

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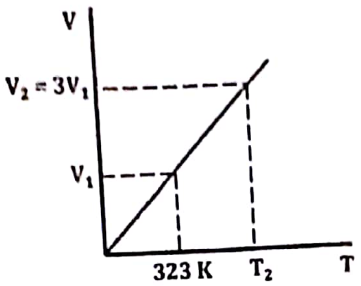
Q10: The diagram below shows the change in volume (V) with temperature (T) of an ideal gas at constant pressure (P) and number of mole (n):



The final temperature (in °*C*) is:

A) 742
B) 498
C) 696
D) 415
E) 969

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$V_1 = V_1$ $\quad$ $V_2 = 3V_1$

$T_1 = 323\ K$ $\quad$ T_2

$T_2 = \frac{T_1 V_2}{V_1} = \frac{323 \times 3V_1}{V_1} = 969\ K$

-273

$696\ °C$

Q11: The density (in *g/L*) of "CO_2" gas at -78 °C and 0.98 atm, is:

A) 1.98
B) 1.25
C) 2.38
D) 3.11
E) 2.70

$d = \frac{MP}{RT}$

$M = 44.01\ g/mol$ $\quad$ $P = 0.98\ atm$

$R = 0.0821\ L.atm/mol\ K$

$T = -78 + 273 = 195\ °C$

Q12: The volume (in *L*) of 2.41×10^{24} "NO_2" molecules at STP, is:

A) 34.1
B) 22.4
C) 11.5
D) 89.7
E) 67.7

$PV = nRT$

$P = 1\ atm$ $\quad$ $R = 0.0821\ L.atm/mol.k$

$T = 273.15\ K$

$n = 2.41 \times 10^{24} \times \frac{1\ mol}{6.022 \times 10^{23}} = 4$

Q13: A 1.995 g of an ideal gas occupies 1.0 L at 20 °C and 1.5 atm. The molar mass (in $g.mol^{-1}$), is:

A) 46
B) 32
C) 40
D) 54
E) 16

$M = \frac{dRT}{P}$

$d = 1.995\ g/L$

$R = 0.0821\ L.atm/gmol.K$

$T = 273.15 + 20 = 293.15\ K$

$P = 1.5\ atm$

Q14: A sample of gas mixture at 750 torr contains 70.0 g of "He" and 30.0 g of "Ar". The partial pressures (in *torr*) of "He" gas is:

$P_{He} = X_{He} \cdot P_T$

A) 719
B) 375
C) 525
D) 225
E) 31

$n_{He} = \frac{70}{4.001} = 17.49$ $\quad$ $n_{Ar} = \frac{30}{39.98} = 0.75$

$X_{He} = \frac{17.49}{17.49 + 0.75} = 0.96$

$P_T = 750\ torr$

Q15: A gas sample has a pressure of 1.2 atm at 25°C. If the temperature changes to -23 °C, the final pressure (in *atm*) of gas, is:

A) 1.50
B) 0.50
C) 1.00
D) 1.75
E) 0.75

$P\cancel{V} = \cancel{n}RT$

constant

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$P_1 = 1.2\ atm$

$T_1 = 25 + 273.15 = 298.15\ K$

$P_2 = ??$

$T_2 = -23 + 273.15 = 250.15\ K$

$P_2 = \frac{P_1 T_2}{T_1}$

$= \frac{1.2 \times 250.15}{298.15} =$ atm

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