***Q1***: When the following equation is balanced:

3 CuO + 2 $NH_3$ → 3 Cu + $N_2$ + 3 $H_2O$

the coefficient of "CuO", is:

(A) 3 ◯

B) 2

C) 1

D) 4

---

***Q2***: The mass in "*g*" of "C" present in 5.0 g of "$C_3H_3N_3O_9F_2$" (*molar mass = 263 g/mol*), is:

A) 2.74

B) 0.06

(C) 0.68 ◯

D) 0.80

mol $C_3H_3N_3O_9F_2$ = 5/263 = 0.019 mol
1 mol $C_3H_3N_3O_9F_2$ → 3 mol C
0.019 → x
mol C = 0.057 mol
mass C = 0.057 * 12 = 0.684 g

---

***Q3***: The number of "C" atoms present on 1.0 kg of [$C_6H_{12}N_2O_4Pt$] (*molar mass = 371 g/mol*), is:

A) $6.49\times10^{24}$

(B) $9.73\times10^{24}$ ◯

C) $1.95\times10^{25}$

D) $3.24\times10^{24}$

1000/371 = 2.695 mol $C_6H_{12}N_2O_4Pt$
N = n * Avo no. = 2.695 * $6.022\times10^{23}$ = $1.62\times10^{24}$ molec.
$1.62\times10^{24}$ * 6 = $9.74\times10^{24}$ C atoms

---

***Q4***: The empirical formula of a compound containing 19.36% Ca, 34.26% Cl and 46.38% O by mass, is:

A) $CaCl_2O_3$

B) $CaCl_2O_4$

C) $CaCl_3O_4$

(D) $CaCl_2O_6$ ◯

Ca: 19.36/40.08 = 0.483 mol /0.483
Cl: 34.26/35.45 = 0.966 mol /0.483
O: 46.38/16 = 2.899 mol /0.483
$CaCl_2O_6$ 1:2:6

---

***Q5***: When 5.80 g of "$CoSO_4.xH_2O$" were heated untill all of the water "$xH_2O$" was driven off and 3.20 g of "$CoSO_4$" were left over. The value of "x" is:

$CoSO_4.xH_2O \rightarrow CoSO_4 + xH_2O$

A) 5

B) 4

(C) 7 ◯

D) 6

Mwt $CoSO_4$ = 155 g/mol
n $CoSO_4$ = 3.2/155 = 0.0206 mol
1 mol $CoSO_4.XH_2O$ → 1 mol $CoSO_4$
∴ n $CoSO_4.XH_2O$ = 0.0206
Mwt $CoSO_4.XH_2O$ = 5.8/0.0206 = 281.55

---

So Mwt for $XH_2O$ = 281.55 − 155 = 126.55 g/mol
∴ X = 126.55/18 = 7

***Q6***: A 0.8715 g of a compound is burned completely in oxygen to give 2.053 g of "$CO_2$" and 0.5601 g of "$H_2O$". The empirical formula of this compound, is:

(A) $C_3H_4O$ ◯

B) $C_9H_{12}O_3$

C) $C_6H_8O_2$

D) $C_4H_{10}O_2$

mass C = 2.053/44 * 1 * 12 = 0.56 g; mol C = 0.56/12 = 0.0466
mass H = 0.5601/18 * 2 * 1 = 0.062 g; mol H = 0.062/1 = 0.062
mass O = 0.8715 − (0.56 + 0.062) = 0.2495 g
mol O = 0.2495/16 = 0.0156
بالقسمة على أقل واحد
$C_3H_4O_1$

---

***Q7***: What is the mass of "$Cl_2$" in "*g*" needed to react **completely** with 22.5 g of "$S_8$" ?

$S_8(l) + 4Cl_2(g) \rightarrow 4S_2Cl_2(l)$

A) 99.68

(B) 24.96 ◯

C) 49.74

D) 74.88

Mwt $S_8$ = 256.56 g/mol
Mwt $Cl_2$ = 70.9 g/mol
mol $S_8$ = 22.5/256.56 = 0.0877 mol
mol $S_8$ = mol $Cl_2$/4 → mol $Cl_2$ = 0.0877 * 4 = 0.351 mol
mass $Cl_2$ = 0.351 * 70.9 = 24.89 g

---

***Q8***: According to:

$3CCl_4 + 2SbF_3 \rightarrow 2SbCl_3 + 3CCl_2F_2$

If 146.0 kg of "$SbF_3$" were allowed to react with an excess of "$CCl_4$", producing 117.0 kg of "$CCl_2F_2$". The percentage yield (%) of "$CCl_2F_2$", is:

A) 29.1

B) 63.7

C) 96.3

(D) 78.9 ◯

Mwt $SbF_3$ = 178.76
Mwt $CCl_2F_2$ = 120.9
mol $SbF_3$ = 146000/178.76 = 816.7 mol
mol $SbF_3$/2 = mol $CCl_2F_2$/3 → mol $CCl_2F_2$ = 1225 mol
mass $CCl_2F_2$ = 148102.5 g = 148.1 kg
% yield = 117/148 * 100% = 79%

---

***Q9***: 5 g of "CO" occupied 5.0 L at 25 °C. If the temperature increased to 120 °C at constant pressure, the gas volume in "*L*" will be:

(A) 6.6 ◯

B) 8.3

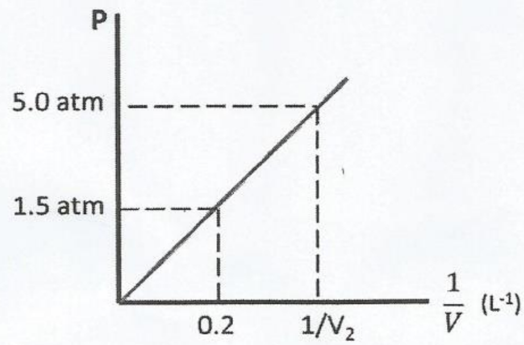
C) 9.9

D) 11.6

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$   $P_1 = P_2$ constant P
$\frac{5}{298} = \frac{V_2}{393}$   $V_2$ = 6.59 L

---

***Q10***: The diagram below shows the change in "P" with "1/V" of an ideal gas at constant "T" and "n":




The final volume "V" in "***L***" is:

A) 2.5
B) 1.0
C) 0.75
(D) 1.5

$P_1V_1 = P_2V_2$ $\quad$ $V_1 = 1/0.2 = 5$
$1.5 * 5 = 5 * V_2$ $\quad$ $V_2 = 1/(1/V_2) = V_2$
$V_2 = 1.5$ L

---

***Q11***: A gas initially at STP is raised to 250°C at constant volume. The final pressure of the gas in "***atm***", is:

A) 1.55
B) 2.65
(C) 1.92
D) 2.28

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad$ V constant, STP 0°C → 273 K, 1 atm
$\frac{1}{273} = \frac{P_2}{523}$
$P_2 = \frac{523}{273} = 1.916$ atm

---

***Q12***: The volume of an ideal gas sample measured at STP is 8.3 L. If the temperature of this gas sample is raised to 30ºC and its pressure is reduced to 0.8 atm, the volume in "***L***" will be:

A) 46.1
(B) 11.5
C) 15.4
D) 23.0

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
$\frac{1 * 8.3}{273} = \frac{0.8 * V_2}{303}$ → $V_2 = 11.5$ L

---

***Q13***: The density in "***g/L***" of "$CCl_2F_2$" gas at **STP**, is:

(A) 5.4
B) 0.2
C) 2.7
D) 1.3

Mwt = 120.9 g/mol
$d = \frac{PM}{RT} = \frac{1 * 120.9}{0.082 * 273} = 5.4$ g/L

---

***Q14***: A sample of gas mixture contains 50 g of "CO" and 50 g of "$CO_2$". If the partial pressures of "CO" 568 mmHg, the total pressure of this sample in "***mmHg***" is:

A) 772
B) 687
(C) 929
D) 838

mol CO = 50/28 = 1.79 mol $\quad$ mol $CO_2$ = 50/44 = 1.14 mol
$X_{CO} = \frac{1.79}{1.79 + 1.14} = 0.611$
$P_{CO} = X_{CO} * P_T$ → $P_T = \frac{568}{0.611} = 929.6$ mmHg

---

***Q15***: A compound contains 36.84% "N" and 63.16% "O" by mass. If 3.61 g of this compound exerted a pressure of 1.2 atm when put in a 0.5 L container at 35°C, what is the molecular formula of the compound ?

A) $N_6O_4$
B) $N_3O_2$
C) $N_2O_3$
(D) $N_4O_6$

PV = nRT $\quad$ $n = \frac{1.2 * 0.5}{0.082 * 308} = 0.024$ mol
Mwt = $\frac{m}{n} = \frac{3.61}{0.024} = 150.42$ g/mol
mass N = 36.84 g → mol = 36.84/14 = 2.63 mol
mass O = 63.16 g → mol = 63.16/16 = 3.95 mol

---

باقي الحل

$N_1O_{1.5}$ → $N_2O_3$ empirical formula $\quad$ Mwt emp. formula = 76 g/mol
$\frac{\text{Mwt molec. formula}}{\text{Mwt emp. formula}} = \frac{150.42}{76} \approx 2$
∴ $(N_2O_3)_2$ → $N_4O_6$