Q1. Number of molecules in 154 g of carbon dioxide "CO_2" is:

$n = \frac{154}{44} = 3.5\ mol$ $N = 3.5 * 6.022 * 10^{23}$

A) 3.5 B) 4.21×10^{24} C) 9.27×10^{25} (D) 2.11×10^{24}

Q2. The percent, by mass, of chromium "**Cr**" in K_2CrO_4 is: $\%Cr = \frac{52}{194.18} * 100 = 26.78\%$

$M = 194.18\ g/mol$

A) 31.8 (B) 26.8 C) 40.3 D) 42.2

Q3. A sample of "$C_7H_5N_3O_4$" has a mass of 7.81 g, the mass in (g) of oxygen atoms"O" in this sample is: $M = 195\ g/mol$ $\%O = \frac{4*16}{195} * 100 = 32.8\%$ mass of O $= 0.328 * 7.81 = 2.56g$

A) 3.12 B) 1.75 (C) 2.56 D) 6.4

Q4. A compound has an empirical formula of CH_2Cl. Its molar mass is between 194 and 198 g. The molecular formula of the compound is: $M = 49.45$

$\frac{M_{molec}}{M_{emp}} \simeq \frac{196}{49.45} \simeq 4$

Molec. formula $4(CH_2Cl) \rightarrow C_4H_8Cl_4$

(A) $C_4H_8Cl_4$ B) $C_4H_6Cl_4$ C) $C_4H_5Cl_4$ D) $C_4H_4Cl_4$

Q5. When the following equation is balanced:

$CuO + NH_3 \rightarrow Cu + N_2 + H_2O$ $3CuO + 2NH_3 \longrightarrow 3Cu + N_2 + 3H_2O$

The coefficient of "NH_3" is:

A) 3 (B) 2 C) 1 D) 4

Q6. Given the following equation:

$C_4H_4 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$.

C_4H_4 + $5O_2$ $\longrightarrow$

$\frac{0.3618}{1}$ $\frac{1.818}{5}$

0.3618 0.3636

C_4H_4 is the limiting reactant

If 0.3618 moles of C_4H_4 are allowed to react with 1.818 moles of O_2, the mass of water in (g) that could be produced is

1 mol C_4H_4 $\rightarrow$ 2 mol H_2O

0.3618 mol $\rightarrow$ x

mol $H_2O = 0.7236$ mol

mass $= 0.7236 * 18 = 13.02g$

A) 11.021 B) 13.20 C) 19.64 (D) 13.02

Q7. Agas-evolved volume was found to be 25.01 L at 295.5 K and 702 mmHg. The moles of the gas were: $PV = nRT$ $n = \frac{0.924 * 25.01}{0.082 * 295.5} =$ $\frac{702}{760} = 0.924$ atm

A) 1.05 B) 12.5 (C) 0.95 D) 22.4

Q8. The density in (g/L) of "CO_2" (g) at 120 °C and 790 torr pressure is: $= 393K$ $\frac{790}{760} = 1.04$ atm

$d = \frac{PM}{RT} = \frac{1.04 * 44}{0.082 * 393} =$

(A) 1.42 B) 8.0 C) 3.4 D) 1.8

Q9. The mass in "g" of "CO_2" gas present at STP in a 5.9 L container is: STP 1 atm 0°C (273K) $n = \frac{1 * 5.9}{0.082 * 273} = 0.26$ mole

mass $= 0.26 * 44 = 11.58g$

A) 0.24 (B) 11.58 C) 0.26 D) 17.0

Q10. The highest average kinetic energy among this (H_2, N_2 and Cl_2) at 25 °C is:

A) Cl

B) N_2

C) H_2

$\frac{3}{2}RT$

(D) All the gases have the same average kinetic energy.

Q11. A 100 g of water at 25°C releases 2.51 kJ of heat. The final temperature of the water is:
(Specific heat of water (s) = 4.18 J/g.°C)

$q = -2510\ J$ (release) exothermic process

$q = m s \Delta T \rightarrow -2510 = 100 * 4.18 * (T_2 - 25)$

$T_2 = -6 + 25 = 19^\circ C$

A) 22 B) 3 C) 11 (D) 19

Q12. Methane is completely burned in oxygen at 25°C according to:

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l) \quad \Delta H^\circ = -890.4\ kJ$

"ΔE°" (in kJ) for this combustion process, is:

$\Delta E = \Delta H - RT\Delta n$

$\Delta n = 1 - 3 = -2 \qquad R = 8.314\ J/mol\,K$

$\Delta E = -890400 - (8.314 * 298 * -2)$

$= -885445\ J$

$= -885.4\ kJ$

A) –887.9 B) –886.4 (C) – 885.4 D) – 894.9

Q13. Given the following thermochemical reaction:

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g) \qquad \Delta H^\circ = -902\ kJ$

ΔH_f^o for: NO(g) = 91 kJ.mol^{-1} and for $NH_3(g)$ = -46.5 kJ.mol^{-1}. Therefore, ΔH_f^o for $H_2O(g)$ in kJ.mol^{-1} is:

$\Delta H_{rxn} = \Sigma \Delta H_P - \Sigma \Delta H_R$

$\Delta H_f^\circ (O_2) = 0$

$-902 = ((4 * \Delta H_f^\circ (NO)) + (6 * \Delta H_f^\circ (H_2O))) - (4 * \Delta H_f^\circ (NH_3))$

(A) – 242.0 B) -58.7 C) – 46.5 D) – 120.7

Q14. The volume of an ideal gas increased from 1.3 L to 2.95 L. If the work done by the system is 1327 J, the external pressure on the system (in atm), is:

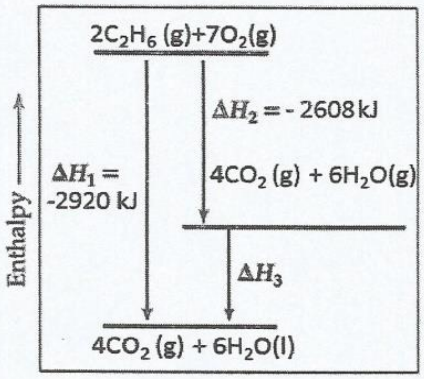
$1\ L.atm = 101.3\ J \qquad w = 1327 / 101.3 = -13.1\ L.atm$

$w = -P\Delta V \rightarrow -13.1 = -P(2.95 - 1.3)$

$P = \frac{13.1}{1.65} = 7.9\ atm$

A) 88.5 (B) 7.94 C) 4.3 D) 145.2

Q15. From data illustrated in the diagram below:



$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l) \qquad \Delta H = -2920\ kJ$

$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g) \qquad \Delta H = -2608\ kJ$

$4CO_2(g) + 6H_2O(g) \rightarrow 4CO_2(g) + 6H_2O(l) \qquad \Delta H = -312\ kJ$

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$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l) \qquad \Delta H = -2920\ kJ$

$4CO_2(g) + 6H_2O(g) \rightarrow 2C_2H_6(g) + 7O_2(g) \qquad \Delta H = +2608\ kJ$

$4CO_2(g) + 6H_2O(g) \rightarrow 4CO_2(g) + 6H_2O(l) \qquad \Delta H = -312\ kJ$

$12H_2O(g) \rightarrow 12H_2O(l) \qquad \Delta H = -624\ kJ$

The change in enthalpy of the following reaction $2H_2O(g) \rightarrow 2H_2O(l)$ (in kJ), is:

divided by 6

$2H_2O(g) \rightarrow 2H_2O(l)$

$\Delta H = \frac{-624}{6} = -104\ kJ$

A) – 312 B) + 104 C) + 312 (D) – 104
