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Consider the balanced reaction

$2Cl_2O_7 \longrightarrow 4ClO_2 + 3O_2$ $(Cl = 35.5)$

What can be concluded from the coefficients of species in this balanced equation?

(A) For this reaction, exactly 2 g of Cl_2O_7 must be taken to start the reaction

(B) For this reaction, exactly 2 mol of Cl_2O_7 must be taken to start the reaction

(C) Mole ratio of Cl_2O_7, ClO_2 and O_2 during a chemical reaction at any instant (excluding any negative sign) are 2,4 and 3 respectively

(D) The ratio of change in number of moles of Cl_2O_7, ClO_2 and O_2 is $2:4:3$ (excluding any negative sign)

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O-I 26-37

S-I 28-34

(27)

P, V, T

$n = \frac{PV}{RT}$

$\therefore$

O_2 gas

$n_{O_2} = n_{gas}$

$\frac{W_1}{32} = \frac{W_2}{M}$

$\frac{1}{32} = \frac{2.375}{M}$

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(28)

H_2	He	O_2	O_3
1 mol	1	1	1 mol

$2 : 1 : 2 : 3$

(31) $n_{NaNO_3} \longrightarrow n_{O_2} \longrightarrow$ volume

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(32) $2NaN_3 \longrightarrow 2Na + 3N_2$

mass of N_2

$= 368 \times 1.12$ gm

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(37)

$$MgCO_{3(s)} \xrightarrow{\Delta} MgO_{(s)} + CO_{2(g)} \uparrow$$

0.1 mol — 0.1 mol

$$MgO \xrightarrow{\Delta} X$$

mass of $MgCO_3 = 0.1 \times 84$

$= 8.4$ gm

mass of $MgO = 12.46 - 8.4$

mass of $CO_2 = 4.4$ gm

$\text{moles} = \frac{4.4}{44} = 0.1$

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$Al + HCl \longrightarrow$ $\quad 27x + 24y = W = 1$

$Mg + HCl \longrightarrow$ $\quad \left(\frac{3}{2}x + y\right) \times 2 = W_1 = \frac{1}{10}$

$$n_{H_2} = \frac{1.12}{22.4} = \frac{1}{20}$$

$$\text{mass of } H_2 = \frac{1}{20} \times 2 = \frac{1}{10}$$

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Carbonates of 1st group (Na, K--)

$$Na_2CO_3 \xrightarrow{\Delta} \text{don't decompose}$$

$$K_2CO_3 \xrightarrow{\Delta} \times$$

Except $Li_2CO_3 \xrightarrow{\Delta} Li_2O_{(s)} + CO_{2(g)} \uparrow$

Carbonates of 2nd (Be, Mg, Ca--)

$$MgCO_{3(s)} \xrightarrow{\Delta} MgO_{(s)} + CO_{2(g)} \uparrow$$

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Bicarbonates of 1st group

$$2NaHCO_3(s) \xrightarrow{\Delta} Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

(↑ ↑ on H_2O and CO_2)

Except

$$2LiHCO_3 \longrightarrow Li_2O(s) + H_2O(g) + 2CO_2(g)$$

Weight loss

Bicarbonates of 2nd

$$Ca(HCO_3)_2 \longrightarrow CaO + 2CO_2\uparrow + H_2O\uparrow$$

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$$NaCl(aq) + AgNO_3(aq) \longrightarrow AgCl(ppt) + NaNO_3(aq)$$

$AgBr$ (ppt)

AgI (ppt)

$BaSO_4$ (ppt)

CH_3COOAg (ppt)

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7g0 gm mixture $CaCO_3(s)$ & $MgCO_3(s)$ is heated. If weight loss equals to 352 gm, find mass of each in original mixture.

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$
$$x \qquad\qquad x \qquad\quad x$$

$$MgCO_3(s) \longrightarrow MgO(s) + CO_2(g)$$
$$y \qquad\qquad y \qquad\quad y$$

$100x + 84y = 720$ — (1)

$(x+y) \times 44 = 352$ — (2)

$x = 3$
$y = 5$

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Type-4 Problems :- Problems related with % purity & % yield.

Q. 1000 gm sample of $CaCO_3$ of purity 40% is heated. find the mass of CO_2 produced

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$

4 mol — 0 — 0

0 — 4 — 4 mol

mass of $CO_2 = 4 \times 44$

$= 176$

$W_{CaCO_3} = 1000 \times \frac{40}{100}$

$= 400$ gm

$n_{CaCO_3} = 4$

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% yield

$$2NH_3 \longrightarrow N_2 + 3H_2$$

10 mol	5 mol	15 mol
	3 mol	9 mol

Expected

actual moles produced

$$\% \text{ yield} = \frac{\text{actual moles produced}}{\text{Expected moles}} \times 100 = \frac{3}{5} \times 100$$

$$= 60\%$$

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$$\text{actual moles produced} = \frac{\%\ \text{yield} \times \text{expected moles}}{100}$$

Q. Calculate % yield of Rxn if 20 moles of NH_3 produce 8 moles of N_2.

$$2\,NH_3 \longrightarrow N_2 + 3H_2$$

2		
20	10	30
		Expected

$$\%\ \text{yield} = \frac{8}{10} \times 100 = 80\%$$

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Q. $2NH_3 \xrightarrow{60\%} N_2 + 3H_2$

10 mol

$5 \times \frac{60}{100} = 3$

$15 \times \frac{60}{100} = 9$

$n_{N_2} =$

$n_{H_2} =$

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find mass of H_2 produced by 255 gm NH_3

Given

$$n_{NH_3} = \frac{255}{17} = 15$$

$$2NH_3 \xrightarrow{25\%} N_2 + 3H_2$$

15 mol

$$\frac{3}{2} \times 15 \times \frac{25}{\cancel{100}_4}$$

$$= \frac{45}{8} \text{ mol}$$

$$\text{mass} = \frac{45}{8} \times 2 = \frac{45}{4}$$

$$= 11.25 \text{ gm}$$

11.25

10.5

1.25

63.75

7.5 gm

45 gm

2.5 gm

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In a certain operation $358\ g$ of $TiCl_4$ is reacted with $96\ g$ of Mg. Calculate % yield of Ti if $32\ g$ of Ti is actually obtained [At. wt. $Ti = 48, Mg = 24$]

Cl : 35.5

Given: $TiCl_4 + 2Mg \longrightarrow Ti + 2MgCl_2$

(A) 35.38%

(B) 66.6%

(C) 100%

(D) 60%

LR

$TiCl_4 + 2Mg \longrightarrow Ti + 2MgCl_2$

$\frac{358}{190}$ mol 4 mol

$\frac{358}{190}$ moles ← Expected

% yield = $\frac{32}{\frac{358}{190} \times 48} \times 100 = 35.38\%$

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Type-5 problems :— Problems involving Series of reaction

$$Cl_2 + 2KOH \longrightarrow \underline{KClO} + KCl + H_2O$$

x : $2x$: x : x : x

$$\Rightarrow 3\,\underline{KClO} \longrightarrow \underline{KClO_3} + 2KCl$$

x : $x/3$: $2x/3$

Intermediate product = $KClO$, $KClO_3$

$$\Rightarrow 4\,\underline{KClO_3} \longrightarrow 3KClO_4 + KCl$$

x : $x/3$: $\frac{3}{4} \times x/3 = x/4$: $\frac{1}{4} \times x/3 = x/12$

Reactant: Cl_2, KOH

Product: KCl, $KClO_4$, H_2O

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O-I 38 — 44

S-I 35 — 42

O-II 9, 10, 11

] 11th

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$$2\,NH_3 \longrightarrow N_2 + 3\,H_2$$

1 mol