Question bank Chem numericals

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1) $H_2 = 35\% = 0.35$ $C_2H_4 = 10\% = 0.10$
$CH_4 = 40\% = 0.40$ $CO = 5\% = 0.05$

~~$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$~~

$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

$0.10 \times 3 = \boxed{0.30\ m^3}$ of O_2

$CH_4 + 2O_2 \rightarrow CO_2 + H_2O$.

$0.40 \times 2 = \boxed{0.80}\ m^3$ of O_2.

$CO + \frac{1}{2} O_2 \rightarrow CO_2$

$0.05 \times 0.5 = \boxed{0.025}\ m^3$ of O_2.

$H_2 + \frac{1}{2} O_2 \rightarrow H_2O$.

$0.35 \times 0.5 = \boxed{0.175}\ m^3$ of O_2.

Total vol^m of O_2 $= 0.30 + 0.80 + 0.025 + 0.175 - 0.025$

↳ already present

$\boxed{\text{Total vol}^m = 1.275\ m^3 \text{ of } O_2}$

also for $1\ m^3$ of fuel $= 1.275\ m^3$ of O_2 is required.

2) $GCV = \frac{1}{100}\left[8080C + 34500\left(H - \frac{O}{8}\right) + 2240S\right]$

$LCV = GCV - \left(\frac{9H}{100} \times 587\right)$

C = 66 % S = 1.5 %
H = 4 % N = 0.8 % } no need.
O = 28 % ash = 0.2 %

$GCV = \frac{1}{100}\left(8080 \times 66 + 34500\left(4 - \underbrace{\frac{28}{8}}_{0.5}\right) + 2240 \times 1.5\right)$

$= \frac{1}{100}(553890)$

GCV = 5538.90 cal/g

$LCV = 5538.90 - \left(\frac{9 \times 4}{100} \times 587\right)$

$= 5538.90 - (0.36 \times 5587)$

LCV = 5327.58 cal/g

3) % N = $\frac{\text{Vol}^m \text{ of acid consumed} \times \text{Normality of acid} \times 1.4}{\text{weight of coal sample}}$

% S = $\frac{\text{Weight of } BaSO_4 \text{ ppt} \times \frac{32}{233} \times 100}{\text{weight of coal sample}}$

$\frac{32}{233} \times 100 = 13.73$

Soln:-

% N = $\frac{12.5 \times 0.5 \times 1.4}{2.7}$

N = 3.24 %

% S = $\frac{0.64}{2.7} \times 13.73$

S = 3.25 %

4) w_1 = weight of coal = 2.499 g
w_2 = weight after heating = 2.368 g
w_3 = 1.75 g
w_4 = 0.95 g

% of moisture = $\frac{w_1 - w_2}{w_1} \times 100 = \frac{2.499 - 2.368}{2.499} \times 100$

= 5.2 %

% of volatile matter = $\frac{w_2 - w_3}{w_2} \times 100 = \frac{2.368 - 1.75}{2.368} \times 100$

= 24.7 %

% of ash content = $\frac{w_4}{w_1} \times 100 = \frac{0.95}{2.499} \times 100$

= 38.01 %

% Carbon = 100 - 5.2 - 24.7 - 38.01

= 32.09 %

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5) Weight of O_2 reqd $= \left[\frac{32}{12}C + 8H + S - O\right]$ kg

Vol^m of O_2 reqd $= \frac{\text{weight of } O_2 \times 22.4}{28.94}$

Soln:-

Weight of O_2 reqd $= \frac{32}{12} \times 0.90 + 8(0.01) + 0.005 - 0.05$

$= \boxed{2.429 \text{ kg}}$

Vol^m $= \frac{2.429 \times 22.4}{28.94}$

$= \boxed{1.88 \text{ m}^3}$