STOICHIOMETRY

1 $2\,KClO_{3(s)} \longrightarrow 2\,KCl_{(s)} + 3\,O_{2(g)}$

(a) $3.00\,g\,KClO_3 \times \frac{1\,mol\,KClO_3}{122.6\,g\,KClO_3} \times \frac{3\,mol\,O_2}{2\,mol\,KClO_3} \times \frac{32.0\,g\,O_2}{1\,mol\,O_2} = 1.17$

(b) $6.00\,g\,O_2 \times \frac{2 \times 74.6\,g\,KCl}{3 \times 32.0\,g\,O_2} = \underline{9.33\,g\,KCl}$

(c) $16.0\,g\,O_2 \times \frac{1\,mol\,O_2}{32.0\,g\,O_2} \times \frac{2\,mol\,KClO_3}{3\,mol\,O_2} \times \frac{122.6\,g\,KClO_3}{1\,mol\,KClO_3} = 40.$

2. $\overset{A}{2\,Na_2S_2O_3} + \overset{B}{AgBr} \longrightarrow \overset{C}{NaBr} + \overset{D}{Na_3[Ag(S_2O_3)_2]}$

(a) $1.0 \times 10^{-3}\,g\,(B) \times \frac{1\,mol\,(B)}{187.8\,g\,(B)} \times \frac{2\,mol\,(A)}{1\,mol\,(B)} \times \frac{158.2\,g\,(A)}{1\,mol\,(A)} = 1.68 \times 10^{-3}\,g$

(b) $1.00\,g\,(D) \times \frac{1\,mol\,(D)}{401.3\,g\,(D)} \times \frac{1\,mol\,(B)}{1\,mol\,(D)} \times \frac{187.8\,g\,(B)}{1\,mol\,(B)} = \underline{0.468\,g}$

3. $\overset{A}{2\,C_{57}H_{110}O_{6(s)}} + 163\,O_{2(g)} \longrightarrow 114\,CO_{2(g)} + \underset{(110 \times 18.0)\,g}{110\,H_2O_{(l)}}$

$(2 \times 891.1)\,g$

(a) $2.5 \times 10^3\,g\,(A) \times \frac{(110 \times 18.0)\,g\,(D)}{(2 \times 891.1)\,g\,(A)} = \underline{2.777 \times 10^3\,g\,H_2O}$

(b) $2.5\,g\,(A) \times \frac{(163 \times 32.0)\,g\,(B)}{(2 \times 891.1)\,g\,(A)} = \underline{7.32\,g\,O_2}$

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4 $\underset{\text{(A)}}{2\,Al(s)} + 3\,\underset{\text{(B)}}{H_2SO_4(aq)} \longrightarrow \underset{\text{(C)}}{Al_2(SO_4)_3(s)} + \underset{\text{(D)}}{3H_2(g)}$

$$50.0\,g\,\text{(A)} \times \frac{1\,mol\,\text{(A)}}{2.00\,g\,\text{(A)}} \times \frac{3\,mol\,\text{(B)}}{3\,mol\,\text{(A)}} \times \frac{98.1\,g\,\text{(B)}}{1\,mol\,\text{(B)}} = 2.45 \times 10^3\,g\,\text{(B)}$$

$$2.45 \times 10^3\,g\,\text{(B)} \times \frac{100\,g\ ACID}{55.1\,g\,\text{(B)}} = 4447\,g\ \text{COMMERCIAL ACID}$$

$$4447\,g\ \text{COMM ACID} \times \frac{1\,mL\ \text{COMM ACID}}{1.45\,g\ \text{COMM ACID}} = 3067\,mL\ \text{Acid}$$

$$= 3.07\,L\ \text{ACID}$$

5. $\underset{\text{(A)}}{2\,FeBr_3} + \underset{\text{(B)}}{3\,Na_2S} \longrightarrow \underset{\text{(C)}}{Fe_2S_3} + \underset{\text{(D)}}{6\,NaBr}$

$(2 \times 295.5)\,g \quad (3 \times 78.1)\,g \quad 207.9\,g$

$$3.50\,g\,\text{(A)} \times \frac{207.9\,g\,\text{(C)}}{(2 \times 295.5)\,g\,\text{(A)}} = 1.23\,g\ Fe_2S_3$$ ← ANSWER

$$6.4\,g\,\text{(B)} \times \frac{207.9\,g\,\text{(C)}}{(3 \times 78.1)\,g\,\text{(B)}} = 5.68\,g\ Fe_2S_3$$

6. $\underset{\text{(A)}}{CaC_2} + 2\,\underset{\text{(B)}}{H_2O} \longrightarrow \underset{\text{(C)}}{Ca(OH)_2} + \underset{\text{(D)}}{C_2H_2}$

$64.1\,g \quad (2 \times 18.0)\,g \quad 74.1\,g \quad 26.0\,g$

(a) $$100\,g\,\text{(A)} \times \frac{26.0\,g\,\text{(D)}}{64.1\,g\,\text{(A)}} = 40.6\,g\,\text{(D)}$$

$$100\,g\,\text{(B)} \times \frac{26.0\,g\,\text{(D)}}{(2 \times 18.0)\,g\,\text{(B)}} = 72.2\,g\,\text{(D)}$$

ANSWER: CaC_2 is LR b/c it produces

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6. (b) 40.6 g C_2H_2 produced.

(c) $100\ g\ CaC_2 \times \frac{1\ mol\ CaC_2}{64.1\ g\ CaC_2} \times \frac{2\ mol\ H_2O}{1\ mol\ CaC_2} \times \frac{18.0\ g\ H_2O}{1\ mol\ H_2O}$

$= 56.2\ g\ H_2O$ USED

H_2O REMAINING = 100 (given) − 56.2 (used)

$= \underline{43.8}\ g$

7. $\underset{(3\times71.8)\,g}{3\,FeO} + \underset{(2\times27.0)\,g}{2\,Al} \longrightarrow \underset{(3\times55.8)\,g}{3\,Fe} + Al_2O_3$

(A) (B) (C) (D)

(a) $7.45\ g\ (A) \times \frac{(2\times27.0)\ g\ (B)}{(3\times71.8)\ g\ (A)} = 1.87\ g$ Al needed.

We are given more Al than we need, so Al is excess reactant and FeO is limiting reactant

(b) $7.45\ g\ (A) \times \frac{(3\times55.8)\ g\ (C)}{(3\times71.8)\ g\ (A)} = \underline{5.79\ g\ Fe}$

(c) Excess reactant is Al = 3.00 (given) − 1.87 (needed)

$= \underline{1.13\ g\ Al}$

8. $\underset{(3\times164.1)}{3\,Ca(NO_3)_2} + \underset{(2\times98.0)}{2\,H_3PO_4} \longrightarrow \underset{(1\times310.3)}{Ca_3(PO_4)_2} + 6\,HNO_3$

(A) (B) (C) (D)

$206\ g\ (A) \times \frac{(1\times310.3)\ g\ C}{(3\times164.1)\ g\ (A)} = \underline{130\ g\ (C)}$

$150\ g\ (B) \times \frac{(1\times310.3)\ g\ C}{(2\times98.0)\ g\ (B)} = 237\ g\ (C)$