3/23/16

Stoichiometry Review:

1. B
2. B
3. C
4. A
5. D
6. D
7. B
8. D
9. B (28.02 g/mol)
10. C
11. D
12. D
13. NO ANS !! 89.6L
14. A
15. C
16. A
17. C
18. D
19. D
20. D

Types:

11. mass → mass
12. mass → vol
13. mol → mol
14. mass → mass Limiting Factor
15. vol → vol

$$72.08\text{g}\,H_2O \times \frac{22.4\text{L}\,H_2O}{18.02\text{g}\,H_2O}$$

$$6\text{mol}\,SO_2 \times \frac{3\text{mol}\,O_2}{2\text{mol}\,SO_2} =$$

$$9.2\text{g}\,Cu \times \frac{1\text{mol}\,Cu}{63.55\text{g}\,Cu} \times \frac{1\text{mol}\,Fe}{1\text{mol}\,Cu} \times \frac{55.85\text{g}\,Fe}{1\text{mol}\,Fe} = 8.1\text{g}\,Fe$$

$$3.0\text{L}\,CH_4 \times \frac{1\text{mol}\,CH_4}{22.4\text{L}\,CH_4} \times \frac{2\text{mol}\,O_2}{1\text{mol}\,CH_4} \times \frac{22.4\text{L}\,O_2}{1\text{mol}\,O_2} = 6.0\text{L}\,O_2$$

$\_\_F_2(g) + \underline{2}\,NaCl \rightarrow \underline{2}\,NaF + \_\_Cl_2(g)$

16. given: 0.98 mol F_2 needed: ? mol NaF type: mol → mol

$0.98 mol\ F_2 \times \frac{2\ mol\ NaF}{1\ mol\ F_2} = \boxed{1.9 \rightarrow 2.0\ mol\ NaF}$

17. given: 86.7g F_2 needed: ? g NaCl type: mass → mass

$86.7g\ F_2 \times \frac{1\ mol\ F_2}{38.00g\ F_2} \times \frac{2\ mol\ NaCl}{1\ mol\ F_2} \times \frac{58.45g\ NaCl}{1\ mol\ NaCl} = \boxed{267g\ NaCl}$

18. given: 54.2L F_2 needed: ? L Cl_2 type: vol → vol

$54.2L\ F_2 \times \frac{1\ mol\ F_2}{22.4L\ F_2} \times \frac{1\ mol\ Cl_2}{1\ mol\ F_2} \times \frac{22.4L\ Cl_2}{1\ mol\ Cl_2} = \boxed{54.2L\ Cl_2}$

$\_\_N_2O_5(g) + \_\_H_2O(l) \rightarrow \underline{2}\,HNO_3(aq)$

19. given: 142.3g HNO_3 needed: ? mol H_2O type: mass → mol

$142.3g\ HNO_3 \times \frac{1\ mol\ HNO_3}{63.02g\ HNO_3} \times \frac{1\ mol\ H_2O}{2\ mol\ HNO_3} = \boxed{1.129\ mol\ H_2O}$

20. given: 65.7g H_2O needed: ? g H_2O
→ oops — can't be done

21. given: 312g HNO_3 needed: ? L N_2O_5 type: mass → vol

$312g\ HNO_3 \times \frac{1\ mol\ HNO_3}{63.02g\ HNO_3} \times \frac{1\ mol\ N_2O_5}{2\ mol\ HNO_3} \times \frac{22.4L\ N_2O_5}{1\ mol\ N_2O_5} = \boxed{55.4L\ N_2O_5}$

$\_\ CH_4(g) + \underline{2}\ O_2(g) \rightarrow \underline{2}\ H_2O(g) + \_\ CO_2(g)$

22. given #1 $54.3\,L\ CH_4$ } needed: $?\,L\ CO_2$
given #2 $79.5\,L\ O_2$ } type: vol → vol

$$54.3\,L\ CH_4 \times \frac{1\ mol\ CH_4}{22.4\,L\ CH_4} \times \frac{1\ mol\ CO_2}{1\ mol\ CH_4} \times \frac{22.4\,L\ CO_2}{1\ mol\ CO_2} = 54.3\,L\ CH_4$$

$$\underbrace{79.5\,L\ O_2}_{\text{limiting factor}} \times \frac{1\ mol\ O_2}{22.4\,L\ O_2} \times \frac{1\ mol\ CO_2}{2\ mol\ O_2} \times \frac{22.4\,L\ CO_2}{1\ mol\ CO_2} = \underbrace{39.8\,L\ CO_2}_{\text{Theo. Yield}}$$

Excess:

$$39.8\,L\ CO_2 \times \frac{1\ mol\ CO_2}{22.4\,L\ CO_2} \times \frac{1\ mol\ CH_4}{1\ mol\ CO_2} \times \frac{22.4\,L\ CH_4}{1\ mol\ CH_4} = 39.8\,L\ CH_4 \text{ used in reaction}$$

$54.3\,L\ CH_4$ (starting quant.) $- 39.8\,L\ CH_4$ (used) $= \boxed{14.5\,L\ CH_4 \text{ left over}}$

% yield $\frac{37.8\,L}{39.8\,L} \times 100 = \boxed{95.0\%\ \text{yield}}$

$1\ SO_3 + 1\ H_2O \longrightarrow 1\ H_2SO_4(aq)$

given #1: 6.58g SO_3 } needed: ? g H_2SO_4

given #2: 1.64g H_2O } type: mass → mass

Limiting factor ∴ Theo yield

$$6.58\text{g } SO_3 \times \frac{1\text{mol } SO_3}{78.97\text{g } SO_3} \times \frac{1\text{mol } H_2SO_4}{1\text{mol } SO_3} \times \frac{98.09\text{g } H_2SO_4}{1\text{mol } H_2SO_4} = \boxed{8.17\text{g } H_2SO_4}$$

EXCESS Reactant

$$1.64\text{g } H_2O \times \frac{1\text{mol } H_2O}{18.02\text{g } H_2O} \times \frac{1\text{mol } H_2SO_4}{1\text{mol } H_2O} \times \frac{98.09\text{g } H_2SO_4}{1\text{mol } H_2SO_4} = 8.93\text{g } H_2SO_4$$

EXCESS:

$$8.17\text{g } H_2SO_4 \times \frac{1\text{mol } H_2SO_4}{98.09\text{g } H_2SO_4} \times \frac{1\text{mol } H_2O}{1\text{mol } H_2SO_4} \times \frac{18.02\text{g } H_2O}{1\text{mol } H_2O} = 1.50\text{g } H_2O \text{ used}$$

$1.64\text{g} - 1.50\text{g} = \boxed{0.14\text{g } H_2O \text{ left over}}$

$\frac{7.99\text{g}}{8.17\text{g}} \times 100 = \boxed{97.8\%\text{ yield}}$

22. $\_\_CH_4(g) + \underline{2}\,O_2(g) \rightarrow \underline{2}\,H_2O(g) + \_\_CO_2(g)$

given #1 54.3L CH_4
given #2 79.5L O_2
} needed: ? L CO_2 Type: vol → vol

Excess: $54.3\,L\,CH_4 \times \frac{1\,mol\,CH_4}{22.4\,L\,CH_4} \times \frac{1\,mol\,CO_2}{1\,mol\,CH_4} \times \frac{22.4\,L\,CO_2}{1\,mol\,CO_2} = 54.3\,L\,CO_2$

Limiting factor: $79.5\,L\,O_2 \times \frac{1\,mol\,O_2}{22.4\,L\,O_2} \times \frac{1\,mol\,CO_2}{2\,mol\,O_2} \times \frac{22.4\,L\,CO_2}{1\,mol\,CO_2} =$ Theo. yield: $39.8\,L\,CO_2$

Excess: Theoyield → excess

$39.8\,L\,CO_2 \times \frac{1\,mol\,CO_2}{22.4\,L\,CO_2} \times \frac{1\,mol\,CH_4}{1\,mol\,CO_2} \times \frac{22.4\,L\,CH_4}{1\,mol\,CH_4} = 39.8\,L\,CH_4$ used in reaction

$54.3\,L - 39.8\,L =$ 14.5L CH_4 left over

% yield

$\frac{37.8\,L}{39.8\,L} \times 100 = 95.0\%$ yield