Second Semester Final Review

1. $2\,NF_{3(g)} + 3\,H_2O_{(g)} \rightarrow 6\,HF_{(g)} + NO_{(g)} + NO_{2(g)}$

$$34.6\text{ L } NF_3 \left| \frac{1\,NO_2}{2\,NF_3} \right. = 17.3\text{ L } NO_2$$

2. $$2.35\text{g } Sb_2O_3 \left| \frac{1\text{ mol}}{291.12\text{g}} \right| \frac{4\,Sb}{2\,Sb_2O_3} \left| \frac{121.76\text{g}}{1\text{ mol}} \right. = 1.96\text{g Sb}$$

3. $$70.0\text{g } CH_4 \left| \frac{1\text{ mol}}{16.05\text{g}} \right| \frac{4\,H_2}{1\,CH_4} \left| \frac{22.4\text{L}}{1\text{ mol}} \right. = 391\text{ L } H_2$$

$$17.3\text{g } H_2O \left| \frac{1\text{ mol}}{18.02\text{g}} \right| \frac{4\,H_2}{2\,H_2O} \left| \frac{22.4\text{L}}{1\text{ mol}} \right. = 43.0\text{ L } H_2 \leftarrow H_2O \text{ limits}$$

4. $$123.0\text{g } Al_2O_3 \left| \frac{1\text{ mol}}{101.96\text{g}} \right| \frac{3\,O_2}{2\,Al_2O_3} \left| \frac{22.4\text{L}}{1\text{ mol}} \right. = 40.5\text{ L } O_2$$

5. $4\,NH_{3(g)} + 5\,O_{2(g)} \rightarrow 4\,NO_{(g)} + 6\,H_2O_{(l)}$

$$\Delta H = 6(-68.3\ \text{Kcal/mol}) + 4(21.6\ \text{Kcal/mol}) - [5(0\ \text{Kcal/mol}) + 4(-11.0\ \text{Kcal/mol})]$$
$$= -279.4\text{ Kcal}$$

6. $Zb_2O_{3(s)} \rightarrow 2\,ZbO_{(s)} + \frac{1}{2}O_{2(g)}$ $128.0\ KJ = \Delta H$

$2\,ZbO_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow Zb_2O_{5(s)}$ $-344.5\ KJ = \Delta H$

$Zb_2O_{3(s)} + O_{2(g)} \rightarrow Zb_2O_{5(s)}$ $-216.5\ KJ = \Delta H$

7. $q = m\Delta T c$

$\Delta T = 32.75°C - 25.88°C$

$= 6.87°C$

$843\,J = (254g)(6.87°C)(c)$

$c = .483\ J/g°C$

8. $\frac{75.0g\ N_2 \mid 1mol}{28.02g} = 2.68mol$ $PV = nRT$

$T = 25°C + 273$ $V = 1.5L$

$= 298K$

$P = \frac{nRT}{V}$

$= \frac{(2.68mol)(.0821\ \frac{atmL}{molK})(298K)}{1.5L}$

$= 43.7\ atm$

9. $925\ mm\ Hg = 265\ mm\ Hg + 250mm\ Hg + 225\ mm\ Hg + P_{N_2}$

$P_{N_2} = 185\ mm\ Hg$

10. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $T_1 = 10.5°C + 273$ $T_2 = 15.0°C + 273$

$= 283.5K$ $= 288K$

$\frac{(2\ atm)(2.50mL)}{283.5K} = \frac{(1.2atm)(V_2)}{288K}$ $V_2 = 4.23mL$

11. $P_1V_1 = P_2V_2$

$(735\ mm\ Hg)(285.0mL) = (P_2)(725mL)$

$P_2 = 289\ mm\ Hg$

12. $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad T_1 = 23.0°C + 273 = 296K$ $\quad T_2 = 85.0°C + 273 = 358K$

$\frac{2.1atm}{296K} = \frac{P_2}{358K}$

$P_2 = 2.5atm$

13. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad T_1 = 15.0°C + 273 = 288K$ $\quad T_2 = ?$

$\frac{120mL}{288K} = \frac{75mL}{T_2}$

$T_2 = 180K$

$= -93°C$

14. $q = m\Delta TC$ $\quad \Delta T = 725° - 100° = 625°C$

$q = (125.0g)(625°C)(.25\ cal/g°C)$

$= 19500cal$

15. $q = m$ (heat of phase change)

$q = (14.5mol)(4.88\ Kcal/mol)$

$= 70.8\ Kcal$

16. $\frac{75.0\text{g} \mid 1\text{mol}}{\mid 101.11\text{g}} = .742\text{ mol}$

$M = \frac{\text{mol solute}}{\text{L solution}}$

$= \frac{.742\text{ mol}}{.750\text{L}}$

$= .989\text{ M}$

17. $M_1V_1 = M_2V_2 \qquad V_2 = V_1 + \text{some more}$

$(4\text{M})(825\text{mL}) = (12\text{M})(V_2)$

$V_2 = 275\text{mL}$

add 275mL HCl to 550 mL H_2O

18. $m = \frac{\text{mol solute}}{\text{Kg solvent}}$

$3.50\text{m} = \frac{\text{mol}}{4.5\text{Kg}}$

$\text{mol} = 16\text{mol}$

$\frac{16\text{mol} \mid 90.04\text{g}}{\mid 1\text{mol}} = 1440\text{g } H_2C_2O_4$

20. $K_{eq} = \frac{[NO]^2}{[N_2][O_2]}$

$= \frac{[4.7\times10^{-4}\text{M}]^2}{[.041\text{M}][.0018\text{M}]}$

$= 6.9\times10^{-4}$

21. $2\,H_2O_{(g)} \rightleftharpoons 2\,H_{2\,(g)} + O_{2\,(g)}$ $\quad K_{eq} = 2.4 \times 10^{-3}$

$$K_{eq} = \frac{[H_2]^2[O_2]}{[H_2O]^2}$$

$$2.4 \times 10^{-3} = \frac{[1.9 \times 10^{-2}\,M]^2[O_2]}{[1.1 \times 10^{-1}\,M]^2}$$

$$[O_2] = .080M$$

22. a. towards products
    b. towards reactants
    c. towards reactants
    d. towards products
    e. towards products