Emily Ogston **Extra Credit Questions**

Net Ionic Equations

For the following…

1. Write the balanced molecular equation
2. Write the total dissociated ionic equation
3. Cancel the spectator ion
4. Write the net ionic equation

A) $CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$

$CaCO_{3(s)} + 2H^{+}_{(aq)} + 2Cl^{-}_{(aq)} \rightarrow Ca^{+2}_{(aq)} + 2Cl^{-}_{(aq)} + CO_{2(g)} + H_2O_{(l)}$

$CaCO_{3(s)} + 2H^{+}_{(aq)} \rightarrow Ca^{+2}_{(aq)} + CO_{2(g)} + H_2O_{(l)}$

B) $H_2SO_{4(aq)} + 2KOH_{(aq)} \rightarrow K_2SO_{4(aq)} + 2H_2O_{(l)}$

$2H^{+}_{(aq)} + SO^{-2}_{4(aq)} + 2K^{+}_{(aq)} + 2OH^{-}_{(aq)} \rightarrow 2K^{+}_{(aq)} + SO^{-2}_{4(aq)} + 2H_2O_{(l)}$

$2H^{+}_{(aq)} + 2OH^{-}_{(aq)} \rightarrow 2H_2O_{(l)}$

$H^{+}_{(aq)} + OH^{-}_{(aq)} \rightarrow H_2O_{(l)}$

Solution Problems

1. Potassium chloride solution was reacted with completely with silver nitrate solution. In an experiment 18.75L of potassium chloride solution reacted completely with 23.2L of silver nitrate, and 0.898g of silver chloride. Determine the concentration of the potassium chloride solution. (Answer: 0.767mol/L)

$$KCl_{(aq)} + AgNO_{3(aq)} \rightarrow KNO_{3(aq)} + AgCl_{(s)}$$

$nAgCl = \frac{0.898}{(26.982 + 35.453)}$ $KCl : AgCl$ $c = \frac{0.014379}{0.01875}$

$nAgCl = \frac{0.898}{62.452}$ $1 : 1$ $c = 0.0767\ mol/L$

$nAgCl = 0.014379$ $x : 0.014379$

2. How many grams of $Ca(NO_3)_2$ can be prepared by reacting 145mL of 7.00M HNO_3 with an excess of $Ca(OH)_2$? (Answer: 83.3g)

$$Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O_{(l)}$$

$nHNO_3 = (7)(0.145)$

$nHNO_3 = 1.015$

$$Ca(NO_3)_2 : HNO_3$$
$$1 : 2$$
$$x : 1.015$$
$$x = 0.5075$$

$mCa(NO_3)_2 = (0.5075)(40.078 + 2 \times 14.0079 + 6 \times 15.9994)$
$mCa(NO_3)_2 = 83.3g$

Limiting Reactant

1. 10.0g of aluminium reacts with 35.0g of chlorine gas to produce aluminium chloride. Which reactant is LR? XS? What mass of aluminium chloride is produced? (Answer: 32.9g)

$$2AL + 3Cl_2 \rightarrow 2AlCl_3$$

$nAl = \frac{10.00}{26.982}$
$nAl = 0.3706$

$Al : Cl_2$
$\frac{0.3706}{2} : \frac{0.4929}{3}$
LR XS

$Cl_2 : AlCl_3$
$0.3706 : x$
$3 : 2$
$x = 0.24706$

$nCl_2 = \frac{35.0}{(2 \times 35.453)}$
$nCl_2 = 0.4929$

$mAlCl_3 = (0.24706)(26.982 + 3 \times 35.453)$
$mAlCl_3 = 32.9g$

2. 15.0g of potassium reacts with 13.1g of iodine. Calculate which reactant is limiting and the maximum mass of product that can be obtained. (Answer: 17.2g)

$$2K + I_2 \rightarrow 2KI$$

$nK = \frac{15.0}{39.098}$
$nK = 0.3836$

$K : I_2$
$\frac{0.3836}{2} : 0.05161$
XS : LR

$I_2 : KI$
$0.05161 : x$
$1 : 2$
$x = 0.10322$

$n I_2 = \frac{13.1}{(2 \times 126.904)}$
$n I_2 = 0.05161$

$mKI = (0.10322)(39.098 + 126.904)$
$mKI = 17.2g$

Ideal Gas Law

1. If 4.00 moles of gas at a pressure of 5.40kPa has a volume of 121L, what is the temperature? (Answer: 19.6K)

$$PV = nRT$$
$$\frac{(5.4)(121)}{(4.00)(8.314)} = \frac{(4.00)(8.314)T}{(4.00)(8.314)}$$
$$\frac{653.4}{33.256} = T$$
$$19.6K = T$$

2. A gas has a volume of 88.0L, a pressure of 6.7kPa, a temperature of $34.0 \circ C$… What is the number of moles? (Answer: 0.231 moles)

$$PV = nRT$$
$$(6.7)(88) = n(8.314)(307.15)$$
$$\frac{589.6}{2553.64} = n$$
$$0.2308 = n$$
$$0.231 = n$$

Pressure Volume Relationship

1. Yesterday's atmospheric pressure is 101kPa and had a volume of 2L. Today's atmospheric pressure is 95kPa, assuming constant temperature, what's its new volume? (Answer: 2.13L)

$$P_1V_1 = P_2V_2$$
$$(101)(2) = (95)\ V_2$$
$$\frac{202}{95} = V_2$$
$$2.126 = V_2$$
$$2.13 = V_2$$

2. A gas measured at 210kPa occupies 65L. It now exerts one third of that pressure, assuming constant temperature, what is the new volume? (Answer: 195L)

$P_1 = 210kPa$

$$P_1V_1 = P_2V_2$$
$$(210)(65) = (70)\ V_2$$
$$\frac{13{,}650}{70} = V_2$$
$$195 = V_2$$

$P_2 = \frac{210}{3} = 70kPa$

$V_1 = 65L$

$V_2 = ?$