Quiz 4c 25 Pts TR Fall 2005 *Name:* Key

SHOW WORK TO RECEIVE CREDIT. ***Molar Masses: H = 1.008, K = 39.10, C = 12.01, N = 14.01, Na = 22.99, O = 16.00, S = 32.07***

1. (6 Pts) Consider the balanced equation for the combustion of propane, C_3H_8

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$

5.00 g 10.0 g ? mol CO_2 ← "pick a product"

If propane reacts with oxygen as above. Which reactant and how much (in grams) remains in excess from a mixture containing 5.00 g of C_3H_8 and 10.0 g of O_2?

Based on C_3H_8: $\frac{5.00\ g\ C_3H_8}{1} \left| \frac{mol\ C_3H_8}{44.094\ g\ C_3H_8} \right| \frac{3\ mol\ CO_2}{1\ mol\ C_3H_8} = 0.3402\ mol\ CO_2$

Based on O_2: $\frac{10.00\ g\ O_2}{1} \left| \frac{mol\ O_2}{32.0\ g\ O_2} \right| \frac{3\ mol\ CO_2}{5\ mol\ O_2} = 0.1875\ mol\ CO_2$

Difference is related to XS C_3H_8: $\frac{(0.3402 - 0.1875)\ mol\ CO_2}{1} \left| \frac{1\ mol\ C_3H_8}{3\ mol\ CO_2} \right| \frac{44.094\ g\ C_3H_8}{mol\ C_3H_8} = 2.244\ g\ \frac{XS}{C_3H_8}$

2. (5 Pts) A solution of methanol (CH_3OH) in water has a concentration of 0.200 *M*. What mass of methanol, in grams, is present in 0.150 liters of this solution?

$\frac{0.150\ L}{1} \left| \frac{0.200\ mol\ CH_3OH}{L} \right| \frac{32.042\ g\ CH_3OH}{mol\ CH_3OH} = 0.9613\ g\ CH_3OH$

3. (5 Pts) Aluminum metal dissolved in hydrochloric acid as follows

$2Al(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2(g)$

3.20 g 6.0 mol/L

What is the minimum volume of 6.0 *M* HCl(*aq*) needed to completely dissolve 3.20 g of aluminum in this reaction?

$\frac{3.20\ g\ Al}{1} \left| \frac{mol\ Al}{27.0\ g\ Al} \right| \frac{6\ mol\ HCl}{2\ mol\ Al} \left| \frac{L_{HCl}}{6.0\ mol\ HCl} \right. = 0.05926\ L_{HCl}$

or $59.3\ mL_{HCl}$

4. (4 Pts) Complete and balance the equation for the following acid-base reactions.

a. $Ca(OH)_2(aq) + 2HCl(aq) \rightarrow 2H_2O + CaCl_2$

b. $3Ca(OH)_2(aq) + 2H_3PO_4(aq) \rightarrow 6H_2O + Ca_3(PO_4)_2$

5. (5 Pts) 55.0 mL of the 0.150 *M* aqueous NaOH is titrated against sulfuric acid, H_2SO_4, according to the equation

$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$

55.0 mL 0.150 mol/L 48.62 mL

If the volume of sulfuric acid solution required to neutralize the NaOH is 48.62 mL, what is its concentration?

☺ $\left| \frac{55.0\ mL\ NaOH}{1} \right| \frac{0.150\ mol\ NaOH}{1000\ mL\ NaOH} \left| \frac{1\ mol\ H_2SO_4}{2\ mol\ NaOH} \right. = 0.08484\ \frac{mol\ H_2SO_4}{L_{H_2SO_4}}$

$48.62 \times 10^{-3}\ L_{H_2SO_4}$

Quiz 4d 25 Pts TR Fall 2005 *Name:* Key

SHOW WORK TO RECEIVE CREDIT. ***Molar Masses: H = 1.008, K = 39.10, C = 12.01, N = 14.01, Na = 22.99, O = 16.00, S = 32.07***

1. (6 Pts) Consider the balanced equation for the combustion of propane, C_3H_8

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$

6.00 g 10.0 g ? mol CO_2 ← "pick a product"

If propane reacts with oxygen as above. Which reactant and how much (in grams) remains in excess from a mixture containing 6.00 g of C_3H_8 and 10.0 g of O_2?

Based on C_3H_8: $\frac{6.00\ g\ C_3H_8}{44.094\ g\ C_3H_8} \left| \frac{1\ mol\ C_3H_8}{3\ mol\ CO_2} \right. = 0.4082\ mol\ CO_2$

Based on O_2: $\frac{10.0\ g\ O_2}{32.00\ g\ O_2} \left| \frac{5\ mol\ O_2}{3\ mol\ CO_2} \right. = 0.1875\ mol\ CO_2$

Difference is related to XS C_3H_8: $(0.4082 - 0.1875)\ mol\ CO_2 \left| \frac{1\ mol\ C_3H_8}{3\ mol\ CO_2} \right| \frac{44.094\ g\ C_3H_8}{1\ mol\ C_3H_8} = 3.244\ g\ C_3H_8$ IN XS

2. (5 Pts) A solution of methanol (CH_3OH) in water has a concentration of 0.200 *M*. What mass of methanol, in grams, is present in 0.250 liters of this solution?

$\frac{0.250\ L}{1\ L} \left| \frac{0.200\ mol\ CH_3OH}{1\ L} \right| \frac{32.042\ g\ CH_3OH}{1\ mol\ CH_3OH} = 1.60\ g\ CH_3OH$

3. (5 Pts) Aluminum metal dissolved in hydrochloric acid as follows

$2Al(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2(g)$

6.20 g 6.0 mol/L ? mL

What is the minimum volume of 6.0 *M* HCl(*aq*) needed to completely dissolve 6.20 g of aluminum in this reaction?

$\frac{6.20\ g\ Al}{27.0\ g\ Al} \left| \frac{6\ mol\ HCl}{2\ mol\ Al} \right| \frac{1000\ mL\ HCl}{6.0\ mol\ HCl} = 114.8\ mL$

4. (4 Pts) Complete and balance the equation for the following acid-base reactions.

a. $Ba(OH)_2(aq) + 2\,HBr(aq) \rightarrow 2H_2O(l) + BaBr_2$

b. $3\,Ba(OH)_2(aq) + 2\,H_3PO_4(aq) \rightarrow 6H_2O + Ba_3(PO_4)_2$

5. (5 Pts) 75.0 mL of the 0.150 *M* aqueous NaOH is titrated against sulfuric acid, H_2SO_4, according to the equation

$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$

75.0 mL 0.150 mol/L 68.62 mL

If the volume of sulfuric acid solution required to neutralize the NaOH is 68.62 mL, what is its concentration?

☺

$\frac{75.0\ mL\ NaOH}{1000\ mL\ NaOH} \left| \frac{0.150\ mol\ NaOH}{1\ L\ NaOH} \right| \frac{1\ mol\ H_2SO_4}{2\ mol\ NaOH} = 0.08197\ \frac{mol\ H_2SO_4}{L\ H_2SO_4}$

$68.62 \times 10^{-3}\ L\ H_2SO_4$