CHEM 1364
Thursday Quiz #6
February 21, 2013
Spring 2013 (Buckley)

Each question is worth 2 points. If you show your work you could receive some partial credit.

1. A substance has a molar mass of 50 g/mol. How many grams of the substance are in 5.0 moles of it?
   \[ g = \frac{5.0 \text{ mol}}{1} \times \frac{50 \text{ g}}{1 \text{ mol}} = 250 \text{ g} \]

2. A substance has a molar mass of 50 g/mol. How many moles of the substance are in 350 g of it?
   \[ \text{mol} = \frac{350 \text{ g}}{50 \text{ g/mol}} = 7.0 \text{ mol} \]

For the remaining questions consider the reaction given below.

\[ \text{Al(OH)}_3 (s) + 3 \text{ HCl (aq)} \rightarrow \text{AlCl}_3 (aq) + 3 \text{ H}_2 \text{O (l)} \]

3. How many moles of H\textsubscript{2}O could be formed from the reaction of 6.0 mol of Al(OH\textsubscript{3})?
   \[ \text{mol H}_2\text{O} = \frac{6.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol H}_2\text{O}}{1 \text{ mol Al(OH)}_3} = 18.0 \text{ mol H}_2\text{O} \]

4. How many moles of HCl would be required to react with 6.0 mol of Al(OH\textsubscript{3})?
   \[ \text{mol HCl} = \frac{6.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = 18.0 \text{ mol HCl} \]

5. If 8.0 mol of Al(OH\textsubscript{3}) reacted with 20.0 mol of HCl, which would be the limiting reactant? How much Al\textsubscript{3}Cl\textsubscript{4} would be formed if the reaction went to completion?
   \[ \text{mol HCl} = \frac{8.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = 24.0 \text{ mol HCl} \]
   \[ \text{AlCl}_3 \text{ limited} \]

6. How many moles of AlCl\textsubscript{3} could be formed from the reaction in Question 5?
   \[ \text{mol AlCl}_3 = \frac{20.0 \text{ mol HCl}}{3} \times \frac{1 \text{ mol AlCl}_3}{3 \text{ mol HCl}} = \frac{20}{3} \text{ mol AlCl}_3 \]
   \[ = 6.7 \text{ mol AlCl}_3 \]
Each question is worth 2 points. If you show your work you could receive some partial credit.

1. A substance has a molar mass of 70 g/mol. How many grams of the substance are in 5.0 moles of it?
   \[ \text{? g} = 5.0 \text{ mol} \times \frac{70 \text{ g}}{1 \text{ mol}} = \boxed{350 \text{ g}} \]

2. A substance has a molar mass of 70 g/mol. How many moles of the substance are in 210 g of it?
   \[ \text{? mol} = \frac{210 \text{ g}}{70 \text{ g/mol}} \times \frac{1 \text{ mol}}{1 \text{ mol}} = \boxed{3.0 \text{ mol}} \]

For the remaining questions consider the reaction given below.

\[
\text{Al(OH)}_3 (s) + 3 \text{HCl (aq)} \rightarrow \text{AlCl}_3 (aq) + 3 \text{H}_2\text{O (l)}
\]

3. How many moles of H$_2$O could be formed from the reaction of 5.0 mol of Al(OH)$_3$?
   \[ \text{? mol H}_2\text{O} = \frac{5.0 \text{ mol Al(OH)}_3 \times 3 \text{ mol H}_2\text{O}}{1 \text{ mol Al(OH)}_3} = \boxed{15 \text{ mol H}_2\text{O}} \]

4. How many moles of HCl would be required to react with 5.0 mol of Al(OH)$_3$?
   \[ \text{? mol HCl} = \frac{5.0 \text{ mol Al(OH)}_3 \times 3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = \boxed{15 \text{ mol HCl}} \]

5. If 6.0 mol of Al(OH)$_3$ reacted with 20.0 mol of HCl, which would be the limiting reactant? Find out how much HCl is left over after the reaction with 6.0 mol Al(OH)$_3$.
   \[ \text{? mol HCl} = \frac{6.0 \text{ mol Al(OH)}_3 \times 3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = 18 \text{ mol HCl} \]
   \[ \text{Al(OH)}_3 \text{ is limiting} \]

6. How many moles of AlCl$_3$ could be formed from the reaction in Question 5?
   \[ \text{? mol AlCl}_3 = \frac{6.0 \text{ mol Al(OH)}_3 \times 1 \text{ mol AlCl}_3}{1 \text{ mol Al(OH)}_3} = \boxed{6 \text{ mol AlCl}_3} \]
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Each question is worth 2 points. If you show your work you could receive some partial credit.

1. A substance has a molar mass of 60 g/mol. How many grams of the substance are in 5.0 moles of it?

\[ \text{? g} = 5.0 \text{ mol} \times \frac{60 \text{ g}}{1 \text{ mol}} = 300 \text{ g} \]

2. A substance has a molar mass of 60 g/mol. How many moles of the substance are in 240 g of it?

\[ \text{? mol} = \frac{240 \text{ g}}{60 \text{ g/mol}} = 4 \text{ mol} \]

For the remaining questions consider the reaction given below.

\[ \text{Al(OH)}_3 (s) + 3 \text{HCl (aq)} \rightarrow \text{AlCl}_3 (aq) + 3 \text{H}_2\text{O (l)} \]

3. How many moles of H₂O could be formed from the reaction of 8.0 mol of Al(OH)₃?

\[ \text{? mol H}_2\text{O} = \frac{8.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol H}_2\text{O}}{1 \text{ mol Al(OH)}_3} = 24.0 \text{ mol H}_2\text{O} \]

4. How many moles of HCl would be required to react with 8.0 mol of Al(OH)₃?

\[ \text{? mol HCl} = \frac{8.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = 24.0 \text{ mol HCl} \]

5. If 7.0 mol of Al(OH)₃ reacted with 20.0 mol of HCl, which would be the limiting reactant?

How much HCl required to react with 7.0 mol of Al(OH)₃?

\[ \text{? mol HCl} = \frac{7.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = 21.0 \text{ mol HCl} \]

HCl is limiting.

6. How many moles of AlCl₃ could be formed from the reaction in Question 5?

\[ \text{? mol AlCl}_3 = \frac{7.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol AlCl}_3}{1 \text{ mol Al(OH)}_3} = 21.0 \text{ mol AlCl}_3 \]
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1. A substance has a molar mass of 40 g/mol. How many grams of the substance are in 5.0 moles of it?
   \[
   ? \text{ g} = \frac{5.0 \text{ mol}}{1} \times \frac{40 \text{ g}}{1 \text{ mol}} = 200 \text{ g}
   \]

2. A substance has a molar mass of 40 g/mol. How many moles of the substance are in 160 g of it?
   \[
   ? \text{ mol} = \frac{160 \text{ g}}{40 \text{ g/mol}} = 4 \text{ mol}
   \]
   For the remaining questions consider the reaction given below.

   \[
   \text{Al(OH)}_3 (s) + 3 \text{ HCl (aq)} \rightarrow \text{AlCl}_3 (aq) + 3 \text{ H}_2\text{O (l)}
   \]

3. How many moles of H\(_2\)O could be formed from the reaction of 4.0 mol of Al(OH)_3?
   \[
   ? \text{ mol H}_2\text{O} = \frac{4.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol H}_2\text{O}}{1 \text{ mol Al(OH)}_3} = 12.0 \text{ mol H}_2\text{O}
   \]

4. How many moles of HCl would be required to react with 4.0 mol of Al(OH)_3?
   \[
   ? \text{ mol HCl} = \frac{4.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = 12.0 \text{ mol HCl}
   \]

5. If 6.0 mol of Al(OH)_3 reacted with 22.0 mol of HCl, which would be the limiting reactant? How much HCl required to react with 6.0 mol of Al(OH)_3?
   \[
   ? \text{ mol HCl} = \frac{6.0 \text{ mol Al(OH)}_3}{1} \times \frac{3 \text{ mol HCl}}{1 \text{ mol Al(OH)}_3} = 18.0 \text{ mol HCl required}
   \]
   (This answer is correct according to the stoichiometry of the reaction.)

6. How many moles of AlCl_3 could be formed from the reaction in Question 5?
   \[
   ? \text{ mol AlCl}_3 = \frac{6.0 \text{ mol Al(OH)}_3}{1} \times \frac{1 \text{ mol AlCl}_3}{1 \text{ mol Al(OH)}_3} = 6.0 \text{ mol AlCl}_3
   \]
   (This is the correct number of moles of AlCl_3 formed.)