Welcome to our CHEM 4 lecture!

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CHEM 4 website: tinyurl.com/SacStateChem4

Week 15: December 7 (Monday)	**December 9 (Wednesday)**	**December 11 (Friday)**
Before class: • Read 8.1-8.4 [reaction calculations] (*90 min*) **PAL worksheets for week 15:** A and B	**Before class:** • Read 8.5-8.6 [limiting reactants] (*2 hours*)	**Before class:** • I'll spend the review session answering your questions from **Practice Final exams** (A and B). • Today, before class is the last day to submit late homework for credit.
After class: • Today's PowerPoint slides and recording *(45 min)* • MasteringChemistry #30 *(40 min)* **[Due: W, 12/9]** • Prepare for our review session **[F, 12/11]** and final exam **[see dates next week]**. Practice finals: A and B *(2 hours each)*. • You have until Dec 11 to complete your online CHEM 4 student evaluation in Canvas. Here is a video explaining the process.	**After class:** • Today's PowerPoint slides and recording *(45 min)* • MasteringChemistry #32 *(40 min)* **[Due: F, 12/11]** • Prepare for our review session **[F, 12/11]** and final exam **[see dates next week]**. Practice finals: A and B *(2 hours each)*. • Before class on **F, 12/11** is the last day to submit late homework for credit.	**After class:** • Finish preparing for our final exam **[see dates next week]**. Practice: A and B *(2 hours each)* • Verify your updated homework and clicker grades on Canvas (posted by 12 midnight). • Verify that you have credit for completing the Commit to Study program on Canvas (posted by 12 midnight).
Week 16: December 14 (Monday)		**December 18 (Friday)**
CHEM 4, Sec 01 (meets MFW @ 8 am) **Final exam time = 8:00 - 10:00 am** • **Covers:** Cumulative, with a slight stress on material since last exam (sections 8.1 - 8.6). • **Practice:** A, B *(2 hours each)* • Log onto our Final using Canvas		**CHEM 4, Sec 03 (meets MWF @ 10 am)** **Final exam time = 8:00 - 10:00 am** • **Covers:** Cumulative, with a slight stress on material since last exam (sections 8.1 - 8.6). • **Practice:** A, B *(2 hours each)* • Log onto our Final using Canvas

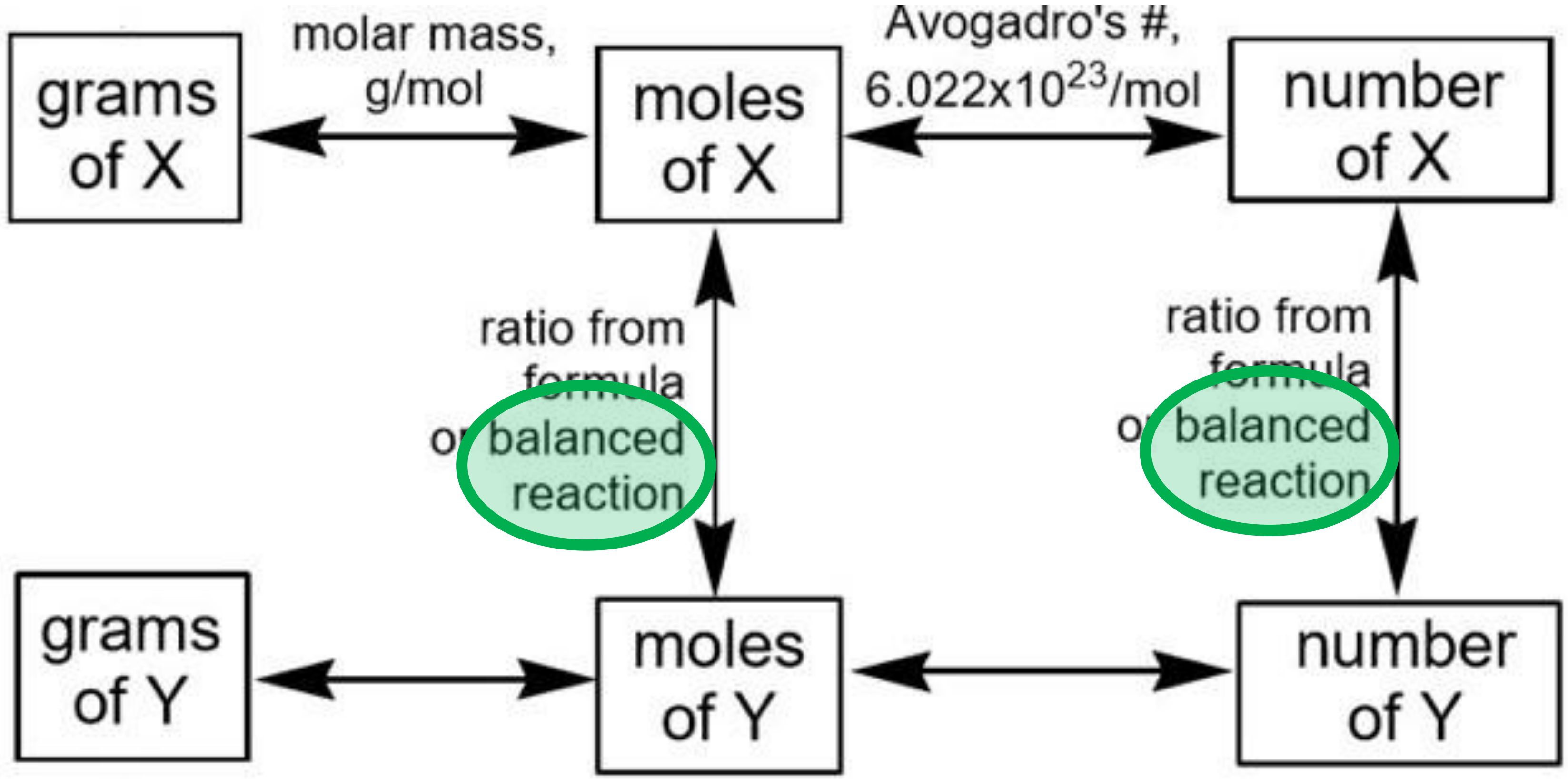
CHEM 4 lecture

Monday – December 7, 2020

Sec 8.1 - 8.4

Reaction calculations

Background: Moles flowchart



Reading question: Mole-to-mole ratios from balanced reactions (Part A)

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1) After balancing the following equation, which of the following would be an appropriate conversion factor to relate H_2O to H_2:

$$\_\_\_\_ NO(g) + \_\_\_\_ H_2(g) \rightarrow \_\_\_\_ NH_3(g) + \_\_\_\_ H_2O(g)$$

A) $\frac{5\ g\ H_2}{2\ g\ H_2O}$

B) $\frac{2\ g\ H_2}{5\ g\ H_2O}$

C) $\boxed{\frac{5\ mol\ H_2}{2\ mol\ H_2O}}$

D) $\frac{2\ mol\ H_2}{5\ mol\ H_2O}$

Answer: $2NO(g) + 5H_2(g) \rightarrow 2NH_3(g) + 2H_2O(g)$

Clicker question: Mole-to-mole ratios from balanced reactions (Part B)
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2) Using the equation we just balanced, how many moles of water can form from 3.0 mol of hydrogen gas?

$$2NO(g) + 5H_2(g) \rightarrow 2NH_3(g) + 2H_2O(g)$$

A) 7.5 mol H_2O

B) 6.0 mol H_2O

C) 15 mol H_2O

D) 1.2 mol H_2O

Answer:

$$(3.0 \text{ mol } H_2)\left(\frac{2 \text{ mol } H_2O}{5 \text{ mol } H_2}\right) = 1.2 \text{ mol } H_2O$$

Clicker question: Mole-to-mole ratios from balanced reactions (Part C)
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3) Using the same balanced equation from the previous question, how many grams of H_2O can be made from 23.0 g of H_2?

$$2NO(g) + 5H_2(g) \rightarrow 2NH_3(g) + 2H_2O(g)$$

A) 164 g H_2O

B) 6.43 gH_2O

C) 82.2 g H_2O

D) 3.22 g H_2O

Answer:

Plan: g H_2 $\rightarrow$ mol H_2 $\rightarrow$ mole H_2O $\rightarrow$ g H_2O

Work: $$(23.0 \text{ g H}_2)\left(\frac{1 \text{ mol H}_2}{2.016 \text{ g H}_2}\right)\left(\frac{2 \text{ mol H}_2\text{O}}{5 \text{ mol H}_2}\right)\left(\frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}}\right) = 82.2 \text{ g H}_2\text{O}$$

Clicker question: Mole-to-mole ratios from balanced reactions
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4) What is the maximum mass (in g) of precipitate that can form when an aqueous sample containing 10.0 g of sodium chloride is added to excess aqueous lead(II) nitrate?

A) 9.05 g $PbCl_2$
B) 14.5 g $PbCl_2$
C) 23.8 g $PbCl_2$
D) 9.05 g $NaNO_3$
E) 14.5 g $NaNO_3$
F) 23.8 g $NaNO_3$

Answer:

Equation: $2\ NaCl(aq) + Pb(NO_3)_2(aq) \rightarrow 2\ NaNO_3(aq) + PbCl_2(s)$

Plan: $g\ NaCl \rightarrow mol\ NaCl \rightarrow mol\ PbCl_2 \rightarrow g\ PbCl_2$

Work: $$(10.0\text{ g NaCl})\left(\frac{1\text{ mol NaCl}}{58.44\text{ g NaCl}}\right)\left(\frac{1\text{ mol PbCl}_2}{2\text{ mol NaCl}}\right)\left(\frac{278.1\text{ g PbCl}_2}{1\text{ mol PbCl}_2}\right) = 23.8\text{ g PbCl}_2$$

Clicker question: Mole-to-mole ratios from balanced reactions
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5) Assuming gasoline is pure octane (C_8H_{18}), how many kg of the green-house gas, carbon dioxide are produced (and injected into our atmosphere) from the combustion of one 15-L tank of gas? The density of octane is 0.703 g/mL.

A) 33 kg CO_2
B) 66 kg CO_2
C) 4.1 kg CO_2
D) 66 x 10^4 kg CO_2
E) 16 kg CO_2
F) 3.3 x 10^4 kg CO_2

Answer:

Equation: $2\ C_8H_{18}(l) + 25\ O_2(g) \rightarrow 16\ CO_2(g) + 18\ H_2O(g)$

Plan: L C_8H_{18} $\rightarrow$ mL C_8H_{18} $\rightarrow$ g C_8H_{18} $\rightarrow$ mol C_8H_{18} $\rightarrow$ mol CO_2 $\rightarrow$ g CO_2 $\rightarrow$ kg CO_2

Work:

$$(15\ \mathrm{L\ C_8H_{18}})\left(\frac{1\ \mathrm{mL}}{10^{-3}\mathrm{L}}\right)\left(\frac{0.703\ \mathrm{g}}{1\ \mathrm{mL}}\right)\left(\frac{1\ \mathrm{mol\ C_8H_{18}}}{114.22\ \mathrm{g\ C_8H_{18}}}\right)\left(\frac{16\ \mathrm{mol\ CO_2}}{2\ \mathrm{mol\ C_8H_{18}}}\right)\left(\frac{44.01\ \mathrm{g\ CO_2}}{1\ \mathrm{mol\ CO_2}}\right)\left(\frac{1\ \mathrm{kg}}{10^3\mathrm{g}}\right) = 33\ \mathrm{kg\ CO_2}$$

Clicker question: Mole-to-mole ratios from balanced reactions

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6) An aqueous solution of silver nitrate reacts with solid copper in a single displacement reaction to form copper(II) nitrate and solid silver. If 67.2 g of silver is obtained during the process, what mass of copper was initially used?

A) 19.8 g Cu
B) 14.7 g Cu
C) 79.2 g Cu
D) 39.6 g Cu
E) 29.4 g Cu
F) 31.0 g Cu

Answer:

Equation: $2\ AgNO_3(aq) + Cu(s) \rightarrow 2\ Ag(s) + Cu(NO_3)_2(aq)$

Plan: mass Ag $\rightarrow$ mol Ag $\rightarrow$ mol Cu $\rightarrow$ mass Cu

Work: $$(67.2\text{ g Ag})\left(\frac{1\text{ mol Ag}}{107.9\text{ g Ag}}\right)\left(\frac{1\text{ mol Cu}}{2\text{ mol Ag}}\right)\left(\frac{63.55\text{ g Cu}}{1\text{ mol Cu}}\right) = 19.8\text{ g Cu}$$