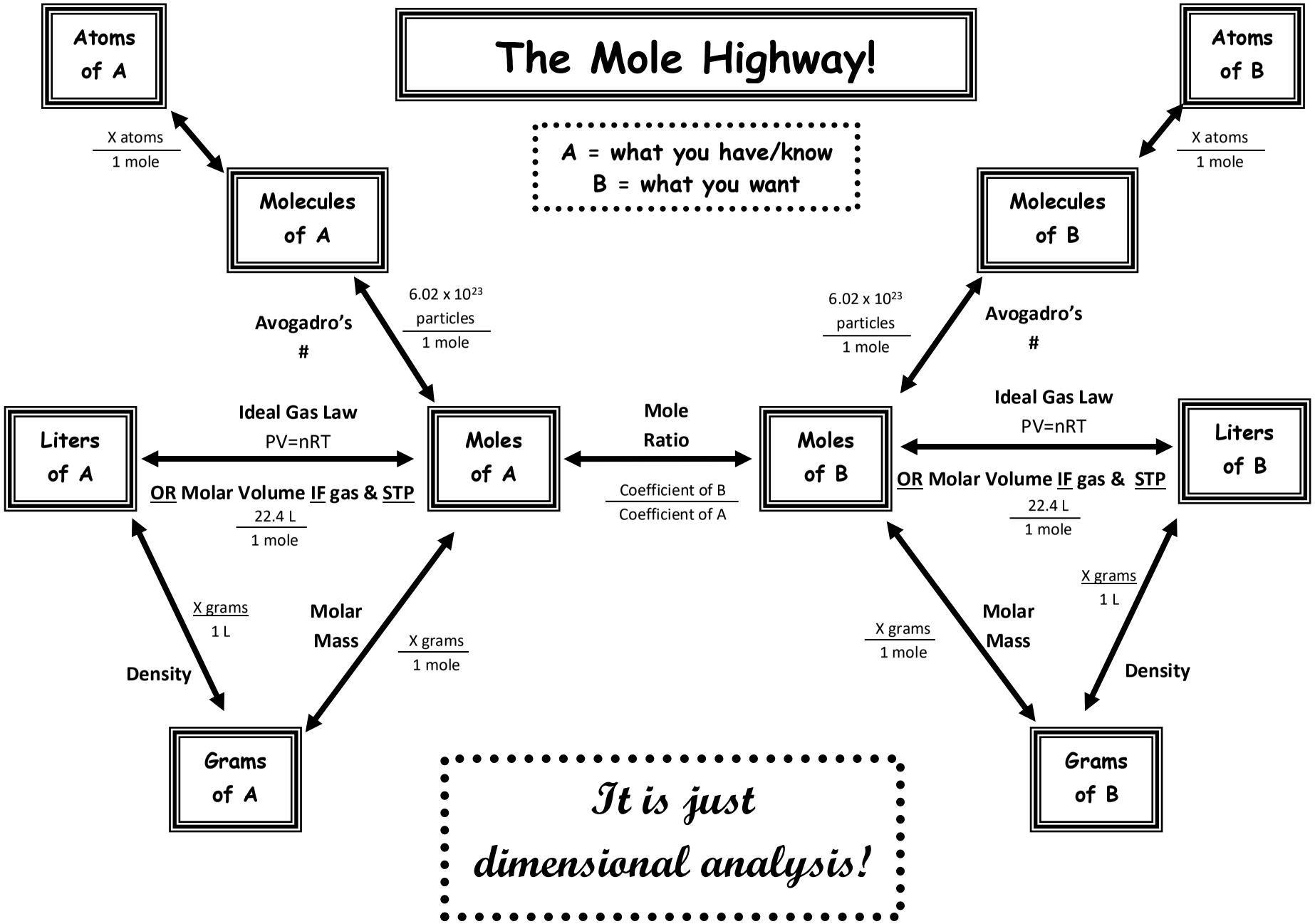
Reference Sheets for
Unit #7 – Stoichiometry


The Mole Highway!
A = what you have/know
B = what you want
Atoms of A
X atoms / 1 mole
Molecules of A
Avogadro's #
6.02 x 10^23 particles / 1 mole
Atoms of B
X atoms / 1 mole
Molecules of B
6.02 x 10^23 particles / 1 mole
Avogadro's #
Liters of A
Ideal Gas Law
PV=nRT
OR Molar Volume IF gas & STP
22.4 L / 1 mole
Moles of A
Mole Ratio
Coefficient of B / Coefficient of A
Moles of B
Ideal Gas Law
PV=nRT
OR Molar Volume IF gas & STP
22.4 L / 1 mole
Liters of B
X grams / 1 L
Density
Molar Mass
X grams / 1 mole
X grams / 1 mole
Molar Mass
X grams / 1 L
Density
Grams of A
Grams of B
It is just dimensional analysis!

Stoichiometry Walk-Through

Some examples using the mole highway

$N_2 + 3H_2 \rightarrow 2NH_3$

You start with 25.00g of N_2 - How much H_2 do you need?

Grams A → Moles A

Use molar mass A

$$\frac{25.00\text{g } N_2}{28.01\text{ g } N_2 \text{ / } 1\text{ mol } N_2}$$

$= 0.8925\text{mol } N_2$

Moles A → Moles B

Use mole ratio B/A

$$\frac{0.8925\text{mol } N_2}{1\text{ mol } N_2 \text{ / } 3\text{ mol } H_2}$$

$= 2.678\text{ mol } H_2$

Grams A → Moles B

Use molar mass A, then mole ratio B/A

$$\frac{25.00\text{g } N_2}{28.01\text{ g } N_2 \text{ / } 1\text{ mol } N_2 \text{ / } 3\text{ mol } H_2}$$

$= 2.678\text{ mol } H_2$

Grams A → Grams B

Use molar mass A, then mole ratio B/A, then molar mass B

$$\frac{25.00\text{g } N_2}{28.01\text{g } N_2 \text{ / } 1\text{mol } N_2 \text{ / } 3\text{mol } H_2 \text{ / } 2.02\text{g } H_2}$$

$= 5.409\text{ mol } H_2$

Grams A → Molecules B

Use molar mass A, then mole ratio B/A, then Avogadro's # B

$$\frac{25.00\text{g } N_2}{28.01\text{g } N_2 \text{ / } 1\text{mol } N_2 \text{ / } 3\text{mol } H_2 \text{ / } 1\text{mol } H_2}\ \frac{6.02\times10^{23}\text{ molec. } H_2}{1}$$

$= 1.612 \times 10^{24}$ molecules H_2

These are not all the combinations of routes on the mole highway, just some examples of possible routes

Winter Break Reminders and Suggestions:

When we return from Winter Break we will be starting a new chapter called "Advanced Chemical Ratios." This chapter adds in a more complicated type of stoich called "limiting reagents." It also adds in problems where you determine the formula of unknown compounds using stoichiometry and mole ratios.

There is no official homework over Winter Break, however, please make sure that you do not forget the following topics while on vacation! If you struggled with these topics during 1st semester please spend some time reviewing the topics. We want to make sure that everyone comes back from vacation ready to start 2nd semester off in a strong way!

Included in this handout is a list of topics to remember, a chart of notes where you learned the topics, starred (*) optional worksheets where you have practice problems, and a small practice test of some examples of the types of things we need to make sure we don't forget how to do. Please realize that this practice test is not required, and it does not show every single possible thing you need to remember from 1st semester, it is just some examples to remind you.

We will keep using the same Composition Book and 3-ring binder 2nd semester so do not lose them or get new ones. You may take out your old rainbow packets BUT you need to keep them safe because they will be graded again at the end of 2nd semester. If you would rather leave them in your binder that is ok too. The gradebook starts over 2nd semester so everyone gets to start fresh and work towards completing all their work, doing well on quizzes and tests, etc.

If you have questions please email me. I will not be checking email daily, but I will check it occasionally over vacation. Thank you, and have a fabulous Winter Break!

Mrs. Farmer

Some Key Topics to Remember Over Vacation:

1. Study your ions!

- ***There will be an ion quiz the week we return!***
- The day is unannounced, but it will be during the first week.
- Remember to know the ones on your ion sheet, but also any atoms from the periodic table s, p, d block that follow the pattern of the group numbers and those that use roman numerals.

2. Types of bonds

- Identify if a molecule is ionic or covalent

3. Writing formulas

- Crossing over to make neutral ionic compounds
- Using prefixes to write covalent molecules

4. Naming formulas

- Remember - two different ways to name things – one for ionic, one for covalent

5. Type of reactions

- Be able to identify the type of reaction shown.

6. Predicting products

- Use the main types of reactions to predict the products and write valid formulas for the products made – cross over if ionic, careful of diatomics, etc.

7. Balancing equations

- Remember to balance AFTER predicting your products and writing valid formulas!

8. Molar Conversions and Stoichiometry

- ***There will be a quiz on molar conversions and stoichiometry the week we return!***
- The day is unannounced, but it will be during the first week.
- Make sure you can do any type of problem given to you – don't forget conversion factors like density, molar volume at STP, metric conversions thrown in, etc.

Where to Go to Refresh Your Memory Over Vacation:

Topic	Notes	* Optional Worksheets
Ions	N-17	R-2
Types of bonds	N-16	P5-WS16*
Writing/ naming formulas	N-16 N-17	P5-WS16*
Types of Reactions	N-23	P6-5*
Predicting products	N-24	P6-5*
Balancing equations	N-22	P6-5*
Molar conversions and stoich	N-25 N-26	P7-5*

***Remember –** You have your rainbow packets, reference pages, study materials, the class website has a "Resources" tab that has links to other websites and other practice, the "Notebook" tab has worksheets from my regular chem class that cover some similar basic level topics, and you have the entire internet at your fingertips too! ☺

Practice Test for Jogging Your Memory Before 2nd Semester:

1. Which of the following statements is **not** true of balancing a chemical equation?
   A) Subscripts in the reactants must be conserved in the products.
   B) Coefficients are used to balance the atoms on both sides.
   C) The law of conservation of matter must be followed.
   D) Phases are often shown for each compound but are not critical to balancing an equation.

2. The name for $Al(OH)_3$ is
   A) aluminum(III) hydroxide
   B) aluminum trihydroxide
   C) aluminum hydroxide
   D) monaluminum trihydroxide

3. Calculate the molecules of oxygen required to react with 35.9 g of sulfur.
   $2S + 3O_2 \rightarrow 2SO_3$
   A) 2.02×10^{24} molecules O_2
   B) 1.01×10^{24} molecules O_2
   C) 3.37×10^{23} molecules O_2
   D) 6.74×10^{23} molecules O_2

4. iron(III) phosphide is
   A) Fe_3P_2
   B) FeP
   C) Fe_3P
   D) FeP_3

5. Convert 9.51×10^{22} molecules NH_3
   A) 5.73×10^{46} mol
   B) 6.33 mol
   C) 2.69 mol
   D) 0.158 mol

6. The reaction $Pb(NO_3)_2 + Mg \rightarrow Pb + Mg(NO_3)_2$ is:
   A) synthesis
   B) acid-base
   C) single-replacement
   D) double-replacement

7. Sodium chloride and lead(II) nitrate react. Which is one of the products?
   A) PbCl(s)
   B) Pb_2Cl(s)
   C) $NaNO_3$(aq)
   D) $2NaNO_3$(aq)

8. The compound PI_3 is named
   A) potassium iodide
   B) monophosphorus iodide
   C) phosphorus iodide
   D) phosphorus triiodide

9. Which has covalent bond(s)?
   A) NaCl
   B) CaO
   C) CO_2
   D) Cs_2O

10. A 4.7-mol sample of $KClO_3$ was decomposed. How many moles of O_2 are formed? $2KClO_3 \rightarrow 2KCl + 3O_2$
    A) 7.1 mol
    B) 3.9 mol
    C) 4.7 mol
    D) 2.3 mol

11. The correct name for FeO is
    A) iron oxide
    B) iron(II) oxide
    C) iron(I) oxide
    D) iron monoxide

12. How many kilograms of silver can be produced when 40.3 g copper reacts with silver nitrate? Assume product has copper (II)
    A) 0.137 kg Ag
    B) 68.4 kg Ag
    C) 0.342 kg Ag
    D) 47.5 kg Ag

13. Ammonium sulfate is
    A) NH_4SO_3
    B) NH_4SO_4
    C) $(NH_4)_2SO_3$
    D) $(NH_4)_2SO_4$

14. What mass of oxygen gas is required to react completely with 18.8 g of C_6H_{14}?
    A) 5.72×10^3 g
    B) 33.2 g
    C) 6.98 g
    D) 66.3 g

15. How many atoms of calcium are present in 87.1 g of calcium?
    A) 3.61×10^{-24}
    B) 5.25×10^{25}
    C) 6.02×10^{23}
    D) 1.31×10^{24}

16. Convert: 45.0 g NaCl into mol
    A) 2.63×10^3
    B) 1.30
    C) 0.770
    D) 1.47×10^{23}

17. The charge on a barium ion is:
    A) +1
    B) +2
    C) +3
    D) -1

18. Convert: 2.64 g O_3 into molecules
    A) 1.59×10^{24}
    B) 7.63×10^{25}
    C) 3.31×10^{22}
    D) 9.13×10^{-26}

19. 2.85 moles of water weighs
    A) 1.58×10^{-1} g
    B) 51.3 g
    C) 6.32 g
    D) 21.0 g

20. Titanium(IV) oxide has the formula
    A) Ti_4O
    B) TiO_4
    C) Ti(IV)O
    D) TiO_2

21. The percent yield is a ratio of the _____ yield to the _____ yield, multiplied by 100%.

22. Which of the following formulas is **incorrect***?*
    A) NaBr
    B) $AlCl_3$
    C) $CsCl_2$
    D) $Mg(OH)_2$

23. An aqueous solution of potassium chloride is mixed with an aqueous solution of sodium nitrate. Which is a product?
    A) KCl*(s)*
    B) KNO_3*(aq)*
    C) KNa*(aq)*
    D) $ClNO_3$*(aq)*

24. When they react, alkali metals:
    A) gain 1 electron
    B) gain 7 electrons
    C) gain or lose 7 electrons
    D) lose 1 electron

25. The molar mass of ammonium phosphate is
    A) 113.01 g/mol
    B) 131.05 g/mol
    C) 144.06 g/mol
    D) 149.10 g/mol

26. The balanced equation $P_4(s) + 6H_2(g) \rightarrow 4PH_3(g)$ tells us that 5.0 mol H_2
    A) reacts with 2.5 mol P_4
    B) produces 10.0 mol PH_3
    C) cannot react with phosphorus
    D) produces 3.3 mol PH_3

27. Classify the following reaction: $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$
    A) Synthesis
    B) combustion
    C) double replacement
    D) single replacement

28. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type? $Al + Fe_3O_4 \rightarrow Al_2O_3 +$ **Fe**
    A) 1
    B) 3
    C) 6
    D) 9

29. True or false? Covalent bonding occurs when a metal reacts with a nonmetal.
    A) True
    B) False

30. Which of the following compounds contains an ionic bond?
    A) HCl*(g)*
    B) NaCl
    C) CCl_4
    D) SO_2

Answer Key

*****Answer Key has not been checked!
If you see typos please email me so I can fix them! ☺

1. A
2. C
3. B
4. B
5. D
6. C
7. D
8. D
9. C
10. A
11. B
12. A
13. D
14. D
15. D
16. C
17. B
18. C
19. B
20. D
21. actual, theoretical
22. C
23. B
24. D
25. D
26. D
27. A
28. D
29. B
30. B