Oklahoma Christian School
4680 E 2nd Street, Edmond, OK 73034
(405) 341-2265

AP Chemistry Summer Packet

Dear Future AP Chemistry Students,

First I want to welcome you to AP Chemistry and look forward to our journey together in Chemistry next year. In preparation for the coming 2022-2023 school year, I have prepared a packet of practice material to gear you up for the first unit in the AP Chemistry curriculum. The packet contains practice problems on material you have already covered in PreAP Chemistry last year in addition to helpful links from Tyler Dewitt on Youtube that will help you prepare for the upcoming AP Chemistry Material. I also included a couple of AP Chemistry workbooks that I have found helpful for preparing for the AP Chemistry Exam at the end of the year. Please feel free to email me with any questions about the material in the packet or about the upcoming course curriculum. The practice problems are due on the first day of class this Fall 2022 semester. Good luck and have a great summer break.
Sincerely,
Mrs. Kendrick

Significant Figures and Unit Conversions:

Rules for Sig figs

- For numbers without a decimal place, you count every number except for trailing zeroes (those which appear after all non zeros). So 100 mL has only one significant figure, and 250 mL has two significant figures. -the zero in that measurement does not trail all other numbers.
- For numbers with a decimal point, you count every number except leading zeroes (those which appear before all non zeroes). The number 0.052 has two significant figures, but 0.0520 g would have three significan t because trailing zeroes count in numbers with decimals.

Video Links: Check out Tyler DeWitt on Youtube.

- https://www.youtube.com/watch?v=5UjwJ9PIUvE
- https://www.youtube.com/watch?v=PNH7_nDE6SQ
- https://www.youtube.com/watch?v=7NolRJLwpPI
- https://www.youtube.com/watch?v=LdZ00OFAfaQ

1. Indicate the number of significant digits in each of the following measurements.

a. 23.500 g _____

b. 100.35 mL _____

c. 1.004 3 10^{-7} m _____

d. 0.00230 kg _____

2. Round off the following numbers to the indicated number of significant figures.

a. 0.0089346 kg (3 sig figs) _____

b. 96515 mL (3 sig figs) _____

c. 3.50492 m (3 sig figs) _____

3. Determine the result to the correct number of significant figures.

a. $\frac{3.2 \text{ cm} \times 1.23 \text{ cm} \times 0.5 \text{ cm}}{8.32 \text{ cm} \times 1.000 \text{ cm} \times 0.500 \text{ cm}} =$

b. $\frac{2.420 \text{ g} + 15.6 \text{ g}}{5.31 \text{ g}} =$

4. Perform the following conversions (1 lb= 453.59 g; 1 L = 1.0567 qt; 1 inch = 2.54 cm):

a. 100. km to miles (use at least 3 conversion factors).

b. A liquid has a critical temperature of 154.4 K; calculate the temperature in °F and °C.

c. The thickness of a human hair is approximately 70,000 nm; calculate the thickness in millimeters.

d. A typical soft drink container is 355 mL; determine the number of quarts of the soft drink container.

5. Perform the following conversion: The density of water is 1.00 g/cm3. Convert to pounds/foot^3.

Balancing Equations Practice
Youtube Videos: Tyle Dewitt Channel on Chemistry
https://www.youtube.com/watch?v=yA3TZJ2em6g
https://www.youtube.com/watch?v=eNsVaUCzvLA

Balance the following equations:

1. $Ca(OH)_2(aq) + H_3PO_4(aq) \rightarrow H_2O(l) + Ca_3(PO_4)_2(s)$

2. $Al(OH)_3(s) + HCl(aq) \rightarrow AlCl_3(aq) + H_2O(l)$

3. $AgNO_3(aq) + H_2SO_4(aq) \rightarrow Ag_2SO_4(s) + HNO_3(aq)$

4. $KO_2(s) + H_2O(l) \rightarrow KOH(aq) + O_2(g) + H_2O_2(aq)$

5. $Fe_2O_3(s) + HNO_3(aq) \rightarrow Fe(NO_3)_3(aq) + H_2O(l)$

6. $C_{12}H_{22}O_{11}(s) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$

7. $Fe(s) + O_2(g) \rightarrow Fe_2O_3(s)$

8. $FeO(s) + O_2 \rightarrow Fe_2O_3(s)$

9. $SiO_2(s) + C(s) \rightarrow Si(s) + CO(g)$

10. $C_{12}H_{22}O_{11}(aq) + H_2O(l) \rightarrow C_2H_5OH(aq) + CO_2(g)$

Nomenclature : Naming Compounds and Writing Chemical Formulas
Ionic Compound Empirical Formula Video Review
https://www.youtube.com/watch?v=URc75hoKGLY

Part 1:Practice writing the Chemical Formula for the following compounds.

1. Lithium Sulfide

   _____

2. Rubidium chloride

   _____

3. Aluminum sulfide

   _____

4. Barium sulfide

   _____

5. Aluminum nitride

   _____

6. Calcium oxide

   _____

7. Gallium phosphide

   _____

8. Strontium oxide

   _____

9. Cesium iodide

_____

10. Aluminum nitrate

_____

11. Sodium phosphate

_____

12. Potassium chlorate

_____

13. Gallium nitrate

_____

14. Lithium carbonate

_____

15. Sodium bicarbonate

_____

16. Iron (III) fluoride

_____

17. Gold(II) nitride

_____

18. Lead(II) nitride

_____

Part 2: Practice naming the following compounds

1. $NaCl$_____
2. KBr_____
3. $MgCl_2$_____
4. $AlCl_3$_____
5. $AlBr_3$_____
6. $Fe(NO_3)_2$_____
7. $Fe(NO_3)_3$_____
8. KNO_3_____
9. $CaBr_2$_____
10. NH_4NO_3_____

11. NaI_____
12. Li_3PO_4_____
13. Na_2CO_3_____
14. CsF_____
15. $AgCl$_____
16. RbI_____
17. BaF_2_____
18. $CuSO_4$_____

<u>Periodic Table Review</u>

Vocabulary: Define the following..

1. Element

_____

2. Atomic Number

   _____

3. Atomic Mass

   _____

4. Compound

   _____

5. Cation

   _____

6. Anion

   _____

7. Molecule

   _____

Metals: Of the 118 elements, 92 are metals

1. Where are metals found on the periodic table: elements to the _____ of the "zig zag" line are metals.

   Examples:

   A._____

   B._____

   C._____

2. Physical Properties of Metals (most of them at least)
   a. Color?_____
   b. Shiny? _____
   c. Dense? _____
   d. Conduct electricity? _____
   e. Melting Point (high, low)? _____
   f. Can they be drawn into a wire (ductile)? _____
   g. Can they be hammered into thin sheets (malleable)? _____
   h. Good/poor conductors of heat? _____

3. Chemical Properties
    a. Most metals react with water and/or oxygen which causes them to corrode, oxidize (rust)
    b. A few metals like _____ and _____ don't rust (Noble metals)
    c. Metals like to _____ (donate/ accept) electrons to nonmetals.

Nonmetals - The next largest group of elements on the periodic table (18 of 118)

1. They are found to the _____ of the "zig zag" line
2. Examples:
    a. _____
    b. _____
    c. _____
    d. _____

3. Physical properties
    a. Color? _____
    b. Luster? _____
    c. Ductile or Brittle? _____
    d. Conduct electricity? _____
    e. Can be solid, liquid or gas but most are _____
4. Chemical Properties
    a. Elements in the _____ group are non-reactive, also called the _____.
    b. Non-metals like to _____ (donate/accept) from elements that lose electrons.

Metalloids- smallest group of elements (8 of 118)

Metalloids are found on the "zig zag" line. Also called semi-metals because they are found in between the metals and nonmetals.

The Metalloids:

Atomic #	Element Name	Atomic #	Element Name
5	_____	14	_____
32	_____	33	_____
51	_____	52	_____
84	_____	85	_____

Which element is missing that looks like it should be on the list? _____--it's a metal!

Properties of Metalloids:

a. All metalloids are (solids, liquids or gases)?_____
b. Shiny or dull?_____
c. Metalloids conduct heat and electricity better than nonmetals but not as well as metal. They are semiconductors such as Silicon and Germanium.
d. Brittle or malleable?_____

Mol Calculations

Tyler Dewitt Videos on YouTube
https://www.youtube.com/watch?v=HMAOrGpkTsQ
https://www.youtube.com/watch?v=hY7lzRBylSk

Complete the following table and show your work on space below or your own paper:

Formula	M, Molar Mass (g/mol)	m, Mass of Sample (g)	n, Moles of Sample (mol)	N, Number of Atoms, Molecules or Formula Units
H_20			5.50	
CH_4				$4.55x10^{24}$
KI		10		
NaCl			5.50	
H_2SO_4		20		
Si			12.5	
HNO_3		10		
H_3PO_4				$3.15x10^{24}$
Ga_2O_3		15		
PCl_5			6.5	
C_2H_5OH		20		

Stoichiometry Practice

Review Videos

https://www.youtube.com/watch?v=nZOVR8EMwRU&t=90s
https://www.youtube.com/watch?v=Mlu_v8rE1TY

1. Consider the following unbalanced equation for the neutralization of acetic acid.

   $$HC_2H_3O_2\ (aq) + Ba(OH)_2(aq) \rightarrow H_2O(l) + Ba(C_2H_3O_2)_2(aq)$$

   Balance the equation and determine how many grams of $Ba(OH)_2(aq)$ are required to completely neutralize 0.461 moles of $HC_2H_3O_2$ (aq).

2. Calculate how many moles of NO_2 form when 2.87 kg N_2O_5 react in the following unbalanced reaction. You must balance the reaction first!

   $$N_2O_5(g) \rightarrow NO_2(g) + O_2(g)$$

3. For the following reaction, determine the limiting reactant for each of the following initial amounts of reactants and calculate the amount of product in moles. Use an RICE table to show your work:

   $2Na(s) + Br_2(g) \rightarrow 2NaBr_2(s)$

   a. 2 mole of Na and 2 mole of Br_2

   b. 1.8 mol Na and 1.4 mol Br_2

   c. 30 g Na and 50 g Br_2

Helpful Information

Mole Calculations and Conversions

To convert from Grams to Moles

1. Determine the molar mass of of the atom or molecular mass of the molecule
2. Divide the mass of the sample by the molar mass to get moles of sample

Ex. Find the number of moles of $CaCl_2$ in a 20.0 g sample.

Molar mass of $CaCl_2$ = (40.08 g Ca/mol) +2(35.45 g Cl/mol) = 110.98 g $CaCl_2$/mol

Moles of $CaCl_2$ = 20.0 g $CaCl_2$ / (110.98 g$CaCl_2$/mol) = 0.180 mol $CaCl_2$

To convert from moles to grams

1. Determine the molar mass of of the atom or molecular mass of the molecule
2. Multiply the moles of the sample by the molar mass to get grams of sample

Ex: Find the mass of 20 moles of CO.

Mass CO = (20 mol CO)(12 g C/mo + 16 g O/mol) = 560 g CO

Understanding molar ratios in empirical formulas

If you have an empirical formula, the subscripts of each atom in the formula indicate the mole ratio of the compound.

Ex: In 1 mole of the compound C_2H_6, there are 2 mol of C and 6 mol of H. They always have the same ratio according to the Law of Constant Composition.

Ex: How many moles of carbon are in Calcium Carbonate?

1. Find the empirical formula for Calcium carbonate. Carbonate is a polyatomic ion with the following formula and charge CO_3^{2-}. Calcium cation has a 2+ charge.
    a. $CaCO_3$ is the formula
2. There is 1 mol of C for every 1 mol of $CaCO_3$ according to the formula
3. Likewise, there are 3 mol of O for every mole of $CaCO_3$.
4. How many moles of Ca are there in the formula? 1 mol Ca

Ex: Calculate the amount of Calcium in grams in 1 mole of $CaCO_3$.

Since there is 1 mol of Ca in 1 mol $CaCO_3$, then the amount of grams in 1 mol of Ca (40.08 g/mol) is 40.08 g.

Ex: Calculate the amount of Oxygen in grams in 1 mol $CaCO_3$.

Since there are 3 mol of oxygen in 1 mol of $CaCO_3$, then there will be
(3 mol O)(16g O/mol) = 48 g of O in 1 mol $CaCO_3$

Some Helpful links: In addition to Tyler Dewitt's Youtube channel, I also recommend Khan Academy and Bozeman Science Videos on Youtube

Here are some Helpful AP Chemistry Test Prep Books

- The Princeton Review AP Chemistry Premium Prep
- 5 Steps to a 5 (McGraw-Hill)
- Barron's AP Chemistry Premium, 2022-2023
- AP Chemistry Practice Questions (Sterling Test Prep