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AP Chemistry Summer Assignment 2018-2019

Welcome to AP Chemistry! I am happy that you have decided to take AP Chemistry. AP Chemistry is a difficult course and it requires that you keep up with the assignments and are willing to spend time working through the course material. You already have a strong background in chemistry from Pre-chemistry; however, since it may have been a little while since you applied your knowledge you will need to take some initiative to recall that knowledge. The purpose of this summer assignment is to help you review and relearn the fundamentals of chemistry, your polyatomic ions, the strong acids, solubility rules and to set up a notebook.

We will be using the ninth edition of Zumdahl/Zumdahl CHEMISTRY for our textbook.

Also these two web site will help you understand more of what we will try to accomplish during the course.
http://www.bozemanscience.com/chemistry
https://www.youtube.com/playlist?list=PL8dPuuaLjXtPHzzYuWy6fYEaX9mQQ8oGr
http://www.chem.purdue.edu/gchelp/howtosolveit/howtosolveit.html

Below you will find your summer packet, getting together with friends and working on your own will get you prepared for this course. Passing the AP Chemistry exam will get you college credits in most colleges. You will need to do some research on the requirements of the college of your choice.

Once again I am happy that you signed on. I LOVE what and do and I LOVE to see students excel. I am extremely excited to start AP chemistry and enjoy the ride with you. See you in the spring.

Summer Packet

Recall and memorize:

1. SI base units and prefixes (SI unit for length = meter, for mass = kg, for volume = m^3)

2. Rules for significant figures

3. Element Names & Symbols (Element symbols 1 to 38 and Ag, Cd, I, Xe, Cs, Ba, W, Hg, Pb, Sn, Rn, Fr, U, Th, Pu, and Am written correctly (Co, not CO)! Students should be able to locate these elements quickly on the periodic table provided since the table provided on the exam does not include element names.)

4. Monatomic Ions

a. Ions with (usually) one oxidation state:

Li^+, Na^+, K^+, Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Ag^+, Zn^{2+}, Cd^{2+}, Al^{3+} N^{3-}, O^{2-}, S^{2-}, F^-, Cl^-, Br^-, I^-

5. Strong Acids (for all practical purposes, all others are weak acids): HCl, HBr, HI, H_2SO_4, HNO_3, $HClO_3$, $HClO_4$

6. Strong Bases (for all practical purposes all others are weak):

Group I hydroxides and Group II hydroxides (except $Be(OH)_2$ and $Mg(OH)_2$)

7. Solubility Rules

Soluble Ionic Compounds (aqueous)	**Exceptions (solids or precipitates)**
Group IA and ammonium (NH_4^+) salts	
nitrates (NO_3^-) and acetates ($C_2H_3O_2^-$)	
Chlorides (Cl^-), bromides (Br^-) and iodides (I^-)	Compounds of Ag^+, Hg_2^{2+}, and Pb^{2+}
Sulfates (SO_4^{2-})	Compounds of Sr^{2+}, Ba^{2+}, Ca^{2+}, and Pb^{2+}
Insoluble Ionic Compounds (solids)	**Exceptions (aqueous)**
Sulfides (S^{2-})	Compounds of NH_4^+, Group IA ions, or Ca^{2+}, Sr^{2+}, and Ba^{2+}
Carbonates (CO_3^{2-})	Compounds of NH_4^+ and Group IA ions
Phosphates (PO_4^{3-})	Compounds of NH_4^+ and Group IA ions
Hydroxides (OH^-)	Compounds of NH_4^+, Group IA ions, or Ca_{2+}, Sr^{2+}, and Ba^{2+}

From the table:	
Cations	**Name**
H^{+}	Hydrogen
Li^{+}	Lithium
Na^{+}	Sodium
K^{+}	Potassium
Rb^{+}	Rubidium
Cs^{+}	Cesium
Be^{2+}	Beryllium
Mg^{2+}	Magnesium
Ca^{2+}	Calcium
Ba^{2+}	Barium
Sr^{2+}	Strontium
Al^{3+}	Aluminum
Anions	**Name**
H^{-}	Hydride
F^{-}	Fluoride
Cl^{-}	Chloride
Br^{-}	Bromide
I^{-}	Iodide
O^{2-}	Oxide
S^{2-}	Sulfide
Se^{2-}	Selenide
N^{3-}	Nitride
P^{3-}	Phosphide
As^{3-}	Arsenide
Type II Cations	**Name**
Fe^{3+}	Iron(III)
Fe^{2+}	Iron(II)
Cu^{2+}	Copper(II)
Cu^{+}	Copper(I)
Co^{3+}	Cobalt(III)
Co^{2+}	Cobalt(II)
Sn^{4+}	Tin(IV)
Sn^{2+}	Tin(II)
Pb^{4+}	Lead(IV)
Pb^{2+}	Lead(II)
Hg^{2+}	Mercury(II)

Ions to Memorize	
Cations	**Name**
Ag^{+}	Silver
Zn^{2+}	Zinc
Hg_2^{2+}	Mercury(I)
NH_4^{+}	Ammonium
Anions	**Name**
NO_2^{-}	Nitrite
NO_3^{-}	Nitrate
SO_3^{2-}	Sulfite
SO_4^{2-}	Sulfate
HSO_4^{-}	Hydrogen sulfate (bisulfate)
OH^{-}	Hydroxide
CN^{-}	Cyanide
PO_4^{3-}	Phosphate
HPO_4^{2-}	Hydrogen phosphate
$H_2PO_4^{-}$	Dihydrogen phosphate
NCS^{-}	Thiocyanate
CO_3^{2-}	Carbonate
HCO_3^{-}	Hydrogen carbonate (bicarbonate)
ClO^{-}	Hypochlorite
ClO_2^{-}	Chlorite
ClO_3^{-}	Chlorate
ClO_4^{-}	Perchlorate
BrO^{-}	Hypobromite
BrO_2^{-}	Bromite
BrO_3^{-}	Bromate
BrO_4^{-}	Perbromate
IO^{-}	Hypoiodite
IO_2^{-}	iodite
IO_3^{-}	iodate
IO_4^{-}	Periodate
$C_2H_3O_2^{-}$	Acetate
MnO_4^{-}	Permanganate
$Cr_2O_7^{2-}$	Dichromate
CrO_4^{2-}	Chromate
O_2^{2-}	Peroxide
$C_2O_4^{2-}$	Oxalate
NH_2^{-}	Amide
BO_3^{3-}	Borate
$S_2O_3^{2-}$	Thiosulfate

3. Solubility rules State whether the following are soluble or insoluble?

Na_2CO_3 ____________	$CoCO_3$ ______________	$Pb(NO_3)_2$ ______________
K_2S ____________	$BaSO_4$ ______________	$(NH_4)_2S$ ______________
AgI ____________	$Ni(NO_3)_2$ ______________	KI ______________
FeS ____________	$PbCl_2$ ______________	$CuSO_4$ ______________
Li_2O ____________	$Mn(C_2H_3O_2)_2$ ______________	$Cr(OH)_3$_ ______________
$AgClO_3$ ____________	$Sn(SO_3)_4$ ______________	FeF_2 ______________

Write out the balanced chemical equation for each of the following double replacement reactions. Predict whether each of these double replacement reactions will give a precipitate or not based on the solubility of the products. If yes, identify the precipitate.

silver nitrate and potassium chloride

magnesium nitrate and sodium carbonate

strontium bromide and potassium sulfate

cobalt (III) bromide and potassium sulfide

ammonium hydroxide and copper (II) acetate

lithium chlorate and chromium (III) fluoride

Show the total ionic and net ionic forms of the following equations. If all species are spectator ions, please indicate that no reaction takes place. Note! You need to make sure the original equation is balanced before proceeding!

1. $AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO_3(aq)$

2. $Mg(NO_3)_2(aq) + Na_2CO_3(aq) \rightarrow MgCO_3(s) + NaNO_3(aq)$

3. strontium bromide(aq) + potassium sulfate(aq) → strontium sulfate(s) + potassium bromide(aq)

4. manganese(II)chloride(aq) + ammonium carbonate(aq) → manganese(II)carbonate(s) + ammonium chloride(aq)

5. chromium(III)nitrate(aq) + iron(II)sulfate(aq) → chromium(III)sulfate(aq) + iron(II)nitrate(aq)

9. Colors of common ions in aqueous solution – most common ions are colorless in solution; however, some have distinctive colors. These colors have appeared on past AP Chemistry exams:

Fe^{2+} and Fe^{3+} - various colors

Cu^{2+} - blue to green

Cr^{2+} - blue

Cr^{3+} - green or violet

Mn^{2+} - faint pink

Ni^{2+} - green

Co^{2+} - pink

MnO_4^- - dark purple

CrO_4^{2-} - yellow

$Cr_2O_7^{2-}$ - orange

10. Rules for assigning (determining) oxidation numbers:

Rule 1: Atoms in a pure element have an oxidation number of zero.

Rule 2: The more electronegative element in a binary compound is assigned the number equal to the negative charge it would have as an anion. The less-electronegative atom is assigned the number equal to the positive charge it would have as a cation.

Rule 3: Fluorine has an oxidation number of -1 in all of its compounds because it is the most electronegative element.

Rule 4: Oxygen has an oxidation number of -2 in almost all compounds.

Exceptions:

Peroxides, such as H_2O_2, in which its oxidation # is -1

When oxygen is in compounds with halogens, such as OF_2, its oxidation # is +2.

Rule 5: Hydrogen has an oxidation # of +1 in all compounds that are more electronegative than it; it has an oxidation # of -1 in compounds with reactive metals (hydrides).

Rule 6: The algebraic sum of the oxidation numbers of all atoms in a neutral compound is zero.

Rule 7: The algebraic sum of the oxidation numbers of all atoms in a polyatomic ion is equal to the charge of the ion.

Rule 8: Rules 1-7 apply to covalently bonded atoms; however, oxidation numbers can also be assigned to atoms in ionic compounds.

11. Basic Organic Nomenclature

- Prefixes indicate the number of carbons in the compound:

Prefix	**Number of carbons**
Meth-	1
eth	2
Prop	3
But	4
Pent	5
Hex	6
Hept	7
Oct	8
Non	9
Dec	10
Undec	11
Dodec	12

Section B: Calculations and Short Answer

I. **Dimensional Analysis and Significant Figures Review**

1. Write the most common guidelines to determine significant figures (digits) with an example?

2. Use factor labeling method to convert the following:
a. 515 m = ___ miles.
b. 200 in = ____ meters
c. 325 days = _____ seconds.
d. 20 gallons = _____ ml
e. 3 meters into centimeters
f. 10 kilometers into meters
g. 15,050 milligrams into grams
h. 3,264 milliliters into liters
i . 9,674,444 grams into kilograms

3. Classify each of the following as units of mass, volume, length, density, energy, or pressure.
a. mg
b. mL
c. cm3
d. mm
e. kg/m3
f. kJ
g. atm
h. cal.

4. Most laboratory experiments are performed at room temperature at 25˚C. Express this temperature in:

a. ˚F
b. K

5. A cylinder rod formed from silicon is 16.8 cm long and has a mass of 2.17 kg. The density of silicon is 2.33 g/cm3. What is the diameter of the cylinder? (the volume of cylinder is given by Π r2h, where r is the radius and h is the length)

6. How many significant figures are in each of the following?
a. 1.92 mm
b. 0.030100 kJ
c. 6.022 x1023 atoms
d. 460.00 L
e. 0.00036 cm3
f. 100
g. 1001
h. 0.001
i. 0.010

7. Record the following in correct scientific notation:
a. 350,000,000 cal
b. 0.0000721 mol
c. 0.0000000809 Å
d. 765,400,000,000 atoms

8. Calculate the following to the correct number of significant figures.
a. 1.27 g / 5.296 cm^3
b. 12.235 g / 1.01 L
c. 12.2 g + 0.38 g
d. 17.3 g + 2.785 g
e. 2.1 x 3.21
f. 200.1 x 120
g. 17.6 + 2.838 + 2.3 + 110.77

9. If you drive 154 miles in 3.0 hours, what is your average speed in meters per minute?

10. Calculate the mass of a sample of copper that occupies $4.2x10^3cm^3$ if the density of copper is $8.94g/cm^3$

II. Atomic Structure Review

1. Fill in the table:

Element or ion	Complete symbols	# protons	# neutrons	# electrons
Fe-55				
K^+				
		27		25
O^{2-}		11	12	11
Pb-208				

2. Find the average atomic mass of an element if, out of 100 atoms, 5 have a mass of 176amu, 19 have a mass of 177amu, 27 have a mass of 178amu, 14 have a mass of 179amu and 35 have a mass of 180amu.

3. Strontium consists of four isotopes with masses and percent abundances as follows: 83.9134amu (0.5%), 85.9094amu (9.9%), 86.9089amu (7.0%), and 87.9056amu (82.6%). Calculate the atomic mass of strontium.

4. Write the complete and abbreviated ground state electron configurations for:

   a. Strontium

   b. Iron

   c. Sulfur Ion

   d. Neodymium

III. Nomenclature Review

Forming binary ionic compounds

A. In a binary ionic compound the total positive charges must equal the total negative charges. The best way to write correct formula units for ionic compounds is to use the "least common multiple" method.

B. Sample problem: What ionic compound would form when calcium ions combine with bromide ions?
Steps to writing ionic formulas:
1. Write the ions with their charges, cations are always first. Ex: Ca^{2+} Br^{1-}

2. Determine the least common multiple of the charges. This is the total positive and total negative value that would result in a neutral compound. Ex: LCM = 2

3. Use subscripts after each element symbol to indicate the number of that ion needed to reach the least common multiple of charge. Ex: $CaBr_2$

Naming binary ionic compounds

A. Combine the names of the cation and the anion.

B. Example; $BaBr_2$ is named barium bromide.

Naming binary ionic compounds that contain polyatomic ions

A. The polyatomic ions on your common ions list should be memorized.

B. The most common oxyanions – polyatomic anions that contain oxygen, end in –ate. Oxyanions with one less oxygen end in –ite. For example:
NO_3^{-1} is nitrate SO_4^{2-} is sulfate
NO_2^{-1} is nitrite SO_3^{2-} is sulfite

C. Anions with one less oxygen than the –ite ion are given the prefix hypo-.

D. Anions with one more oxygen than the –ate ion are given the prefix per-.
ClO^{-1} is hypochlorite ClO_3^{-1} is chlorate
ClO_2^{-1} is chlorite ClO_4^{-1} is perchlorate

E. Naming compounds with polyatomic ions is the same as naming other compounds, just name the cation and then the anion.
If there is a transition metal involved, be sure to check the charges to identify which ion (+1, +2, +3, +4….) it may be so that you can put the correct Roman numeral in the name.

Naming binary molecular compounds

With molecules, the prefix system is used.

Number Prefix	Number Prefix
1 mono-	7 hepta-
2 di-	8 octa-
3 tri-	9 nona-
4 tetra-	10 deca-
5 penta-	11 undeca-
6 hexa-	12 dodeca-

A. The less-electronegative element is always written first. It only gets a prefix if it has more than one atom in the molecule.
B. The second element gets the prefix and the ending –ide.
C. The o or a at the end of the prefix is dropped when the word following the prefix begins with another vowel, for example monoxide or pentoxide.

III. Nomenclature Review (continued)

1. Write formulas for the following substances:
a. Barium sulfate ___________________
b. Ammonium chloride ___________________
c. Chlorine monoxide ___________________
d. Silicone tetrachloride ___________________
e. Magnesium fluoride ___________________
f. Sodium oxide ___________________
g. Sodium peroxide___________________
h. Copper (I) iodide ___________________
i. Zinc sulfide ___________________
j. Potassium carbonate ___________________
k. Hydrobromic acid ___________________
l. Perchloric acid ___________________
m. Lead (II) acetate ___________________
n. Sodium permanganate ___________________
o. Lithium oxalate ___________________
p. Potassium cyanide ___________________
q. Iron (III) hydroxide ___________________
r. Silicone dioxide ___________________
s. Nitrogen trifluoride ___________________
t. Chromium (III) oxide ___________________
u. Calcium chlorate ___________________
v. Sodium thiocyanate ___________________
w. Cobalt (III) nitrate ___________________
x. Nitrous acid ___________________
y. Ammonium phosphate ___________________
z. Potassium chromate __________________

2. Name each of the following compounds (Give acid names where appropriate)

a. $CuSO_4$ ______________________________

b. PCl_3 ______________________________

c. Li_3N ______________________________

d. $BaSO_3$ ______________________________

e. N_2F_4 ______________________________

f. $KClO_4$ ______________________________

g. NaH ______________________________

h. $(NH_4)_2Cr_2O_7$ ______________________________

i. HNO_2 ______________________________

j. Sr_3P_2 ______________________________

k. $Mg(OH)_2$ ______________________________

l. Al_2S_3 ______________________________

m. AgBr ______________________________

n. P_4O_{10} ______________________________

o. $HC_2H_3O_2$ ______________________________

p. CaI_2 ______________________________

q. MnO_2 ______________________________

r. Li_2O ______________________________

s. FeI_3 ______________________________

t. Cu_3PO_4 ______________________________

u. PCl_3 ______________________________

v. NaCN ______________________________

w. Cs_3N ______________________________

x. $Zn(NO_3)_2$ ______________________________

y. N_2O ______________________________

z. HF ______________________________

Nomenclature Review (continued)

Practice with acids!

Remember:

-IC from –ATE;   -OUS from –ITE;   HYDRO-, -IC from –IDE

Complete the Following Table:

Name of Acid	Formula of Acid	Name of Anion
hydrochloric	HCl	chloride
sulfuric acid	H_2SO_4	sulfate
	HI	
		sulfite
chlorous acid		
		nitrate
	$HC_2H_3O_2$ or CH_3COOH	
hydrobromic acid		
		sulfide
	HNO_2	

III. Balancing Equations Review

Balance the following equations by adding coefficients as needed. Some equations may already be balanced.

1) __ C_6H_6 + __ O_2 → __ H_2O + __ CO_2

2) __ NaI + __ $Pb(SO_4)_2$ → __ PbI_4 + __ Na_2SO_4

3) __ NH_3 + __ O2 → __ NO + __ H_2O

4) __ $Fe(OH)_3$ → __ Fe_2O_3 + __ H_2O

5) __ HNO_3 + __ $Mg(OH)_2$ → __ H_2O + __ $Mg(NO_3)_2$

6) __ H_3PO_4 + __ NaBr → __ HBr + __ Na_3PO_4

7) __ C + __ H_2 → __ C_3H_8

8) __ CaO + __ MnI_4 → __ MnO_2 + __ CaI_2

9) __ Fe_2O_3 + __ H_2O → __ $Fe(OH)_3$

10) __ C_2H_2 + __ H_2 → __ C_2H_6

11) __ VF_5 + __ HI → __ V_2I_{10} + __ HF

12) __ OsO_4 + __ $PtCl_4$ → __ PtO_2 + __ $OsCl_8$

13) __ CF_4 + __ Br_2 → __ CBr_4 + __ F_2

14) __ Hg_2I_2 + __ O_2 → __ Hg_2O + __ I_2

15) __ $Y(NO_3)_2$ + __ $GaPO_4$ → __ YPO_4 + __ $Ga(NO_3)_2$

IV. Chemical Reactions
In AP Chemistry, most of the reaction we write are called “net ionic.” But before we can do that, you need to review and memorize some basic reaction types. For some basic review, go to the following website: http://misterguch.brinkster.net/6typesofchemicalrxn.html
Now try these sample problems from the website.
Give the type for each of the following reactions:

1) $NaOH + KNO_3 \rightarrow NaNO_3 + KOH$ ______________________________

2) $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$ ______________________________

3) $2\ Fe + 6\ NaBr \rightarrow 2\ FeBr_3 + 6\ Na$ ______________________________

4) $CaSO_4 + Mg(OH)_2 \rightarrow Ca(OH)_2 + MgSO_4$ ______________________________

5) $NH_4OH + HBr \rightarrow H_2O + NH_4Br$ ______________________________

6) $Pb + O_2 \rightarrow PbO_2$ ______________________________

7) $Na_2CO_3 \rightarrow Na_2O + CO_2$ ______________________________

Learn these types of decomposition reactions:
1. Metallic carbonates, when heated, form metallic oxides and CO_2(g).
EX. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

2. Most metallic hydroxides, when heated, decompose into metallic oxides and water.
EX. $Ca(OH)2(s) \rightarrow CaO(s) + H_2O(g)$

3. Metallic chlorates, when heated, decompose into metallic chlorides and oxygen.
EX. $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

4. Some acids, when heated, decompose into nonmetallic oxides and water.
EX. $H_2SO_4 \rightarrow H_2O(l) + SO_3(g)$

5. Some oxides, when heated, decompose.
EX. $2HgO(s) \rightarrow 2Hg(l) + O_2(g)$

6. Some decomposition reactions are produced by electricity.
EX. $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$
EX. $2NaCl(l) \rightarrow 2Na(s) + Cl_2(g)$

Learn these types of synthesis reactions:

1. Metal + oxygen → metal oxide
EX. $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

2. Nonmetal + oxygen → nonmetallic oxide
EX. $C(s) + O_2(g) \rightarrow CO_2(g)$

3. Metal oxide + water → metallic hydroxide
EX. MgO(s) + H2O(l) → Mg(OH)2(s)

4. Nonmetallic oxide + water → acid
EX. $CO_2(g) + H_2O(l) \rightarrow$; $H_2CO_3(aq)$

5. Metal + nonmetal → salt
EX. $2\ Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$

6. A few nonmetals combine with each other.
EX. $2P(s) + 3Cl_2(g) \rightarrow 2PCl_3(g)$

Now try these decomposition reactions: (Rewrite as a balanced equation with the products predicted):

1. barium hydroxide (heated)
2. sodium carbonate (heated)
3. lithium chlorate (heated)
4. electrolysis of aluminum oxide
5. sulfuric acid heated gently]

Now try these synthesis reactions: (Rewrite as a balanced equation with the products predicted):

1. magnesium burned in oxygen
2. hydrogen gas + nitrogen gas
3. sulfur burned (complete combustion)
4. calcium oxide added to water

How many nanometers are there in 23.2 centimeters?

An iron sample has a mass of 3.50 lbs. What is the mass of this sample in grams?

Perform the following conversion: 6.00m/s = _________ mi/hr

Convert 23.2 ºC to ___________ ºF

An experiment requires 75.0 g or ethyl alcohol (density 0.790 g/mL). What volume, in liters will be required?

Calculate the mass of a rectangular solid that has a density of 2.53 g/cm^3, and which measures 2.50 cm by 1.80 cm by 3.00 cm.

A sample containing 2.94 mol of calcium contains how many atoms?

A 14.8 g sample of magnesium represents how many atoms?

Stoichiometry: Show all of your work for the following problems:

Composition

1. A 0.941 gram piece of magnesium metal is heated and reacts with oxygen. The resulting magnesium oxide weighed 1.560 grams. Determine the percent composition of each element in the compound.

2. Determine the empirical formula given the following data for each compound:

   a) Fe = 63.53%, S = 36.47%

   b) Fe = 46.55%, S = 53.45%

3. A compound contains 21.6% sodium, 33.0% chlorine, 45.1% oxygen. Determine the empirical formula of the compound.

Find the mass percent of nitrogen in each of the following compounds:

NO

NO_2

N_2O_4

N_2O

Benzene contains only carbon and hydrogen and has a molar mass of 78.1 g/mol. Analysis shows the compound to be 7.44% hydrogen by mass. Find the empirical and molecular formula of benzene.

Calcium carbonate decomposes upon heating, producing calcium oxide and carbon dioxide. (answer questions a-d)

a. Write a balanced chemical equation for this reaction.

b. How many grams of calcium oxide will be produced after 12.25 grams of calcium carbonate are completely decomposed?

c. What volume of carbon dioxide gas is produced from 12.25 grams of calcium carbonate at STP?

d. What is the volume of carbon dioxide in L if the pressure is 785 mmHg and the temperature is 30.0°C?

Hydrogen gas and bromine gas react to form hydrogen bromide gas. (answer questions a-e)

a. Write a balanced equation for this reaction.

b. 3.2 grams of hydrogen reacts with 9.5 grams of bromine. Which is the limiting reactant?

C How many grams of hydrogen bromide gas can be produced using the amounts in (b)?

d. How many grams of excess reactant are left unreacted?

e. What volume of HBr, measured at STP is produced in (b)?

When ammonia gas, oxygen gas and methane gas (CH_4) are combined, the products are hydrogen cyanide gas and water. (answer questions a-c)

a. Write a balanced equation for this reaction.

b. Calculate the mass of each product produced when 225 grams of oxygen gas react with an excess of the other two reactants.

c. If the actual yield of the experiment in (b) is 105 grams of HCN, calculate the percent yield.

Given the equation below, what mass of water would be needed to react with 10.0g of sodium oxide?
$Na_2O + H_2O \rightarrow 2NaOH$

$2NaClO_3 \rightarrow 2NaCl + 3O_2$
What mass of sodium chloride is formed along with 45.0g of oxygen gas?

$4NH_3 + 5O_2 \rightarrow 4NO + 6\ H_2O$
What mass of water will be produced when 100.0g of ammonia is reacted with excess oxygen?

If the reaction in the previous problem is done with 25.0g of each reactant, which would be the limiting factor?

$Na_2S + 2AgNO_3 \rightarrow Ag_2S + 2NaNO_3$
If the above reaction is carried out with 50.0g of sodium sulfide and 35.0g of silver nitrate, which is the limiting factor? What mass of the excess reactant remains? What mass of silver sulfide would precipitate?

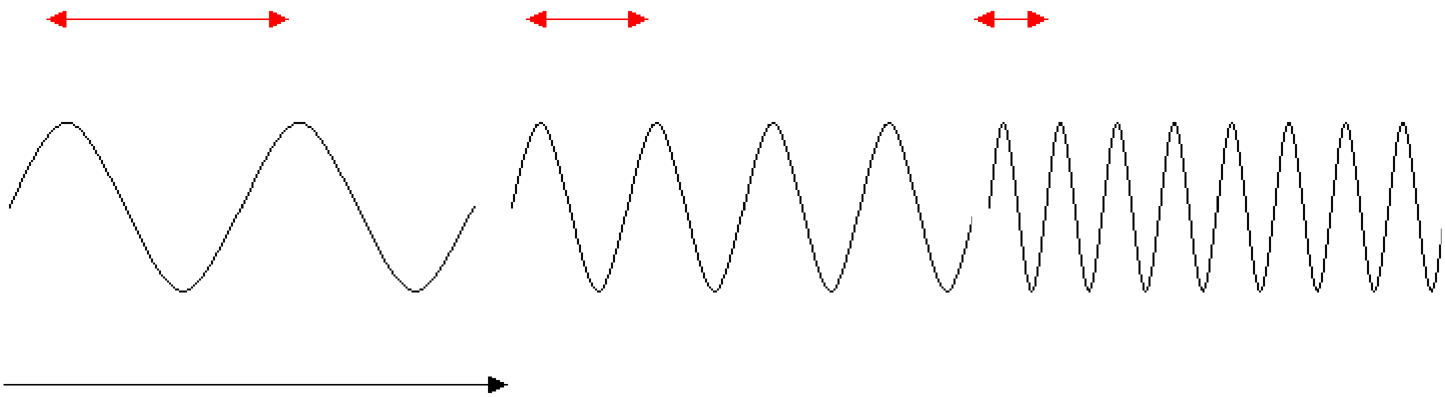
6. $6NaOH + 2Al \rightarrow 2Na_3AlO_3 + 3H_2$
What volume of hydrogen gas (measured at STP) would result from reacting 75.0g of sodium hydroxide with 50.0g of aluminum?

Classify the following types of reactions:

1) $NaOH + KNO_3 \text{ --> } NaNO_3 + KOH$ ___________________________
2) $CH_4 + 2\ O_2 \text{ --> } CO_2 + 2\ H_2O$ ___________________________
3) $2\ Fe + 6\ NaBr \text{ --> } 2\ FeBr_3 + 6\ Na$ ___________________________
4) $CaSO_4 + Mg(OH)_2 \text{ --> } Ca(OH)_2 + MgSO_4$ ___________________________
5) $NH_4OH + HBr \text{ --> } H_2O + NH_4Br$ ___________________________
6) $Pb + O_2 \text{ --> } PbO_2$ ___________________________
7) $Na_2CO_3 \text{ --> } Na_2O + CO_2$ ___________________________

Electromagnetic Radiation and the Bohr Atom

Light is known to have the **wave-like** properties of **frequency** (υ) and **wavelength** (λ). These are illustrated below. The x-axis is a measure of time. The distance between the peaks is called the **wavelength** and the number of waves per unit time (1 second in this example) is called the number of **cycles**. The first wave pattern has **2 cycles per second**, the middle example has **4 cycles per second** and the example on the right has **8 cycles per second**. This is the **frequency** of the wave, and has the units of **hertz**, **Hz** (cycles/s).



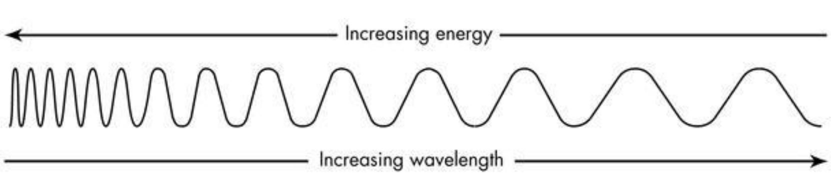
As the frequency increases, the wavelength decreases.

In **Electromagnetic radiation** (light) these are related by the equation:

$$c = \lambda\upsilon$$

where **c** = the speed of light, 2.998 x 10^8 m/s, λ □= wavelength (m) and υ = frequency (s^{-1} or Hz). The electromagnetic spectrum (EMS) is shown below.

Which color of visible light has the shortest wavelength? Which radiation has wavelengths longer than visible light?



1. The wavelength of green light is about 522 nm. What is the frequency of this radiation?

2. What is the wavelength of a photon that has a frequency of 2.10×10^{14} Hz? Answer in nm and determine what type of radiation this is.

Planck recognized that energy is **quantized** and related the energy of radiation (emitted or absorbed) to its frequency.

$$\Delta \mathbf{E} = \mathbf{n}\ \mathbf{h}\ \nu$$

where **n** = integer and **h** = Planck's constant = 6.626×10^{-34} J s

3. Which of the following are **directly** related?

   a) energy and wavelength

   b) wavelength and frequency

   c) frequency and energy

4. A classical radio station broadcasts at 93.5 MHz (M = 10^6). Find the wavelength of this radiation, in meters, and the energy of one of these photons, in J. What type of radiation is this?

5. What is the energy of a photon with:

a) a wavelength of 827 nm? What type of radiation is it?

b) a wavelength of 1 nm? What type of radiation is it?

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