Welcome to Mrs. Farmer's AP Chemistry Class!

www.mychemistryclass.net

I am very excited to start this school year and get to know all of you! The first week can be very hectic - programs don't always work, schedules change every day, tons of handouts from teachers, lockers to find, books to check out, etc. Hopefully this paper will help you keep track of all the "start of the year" type assignments for this class.
I will post due dates and daily homework on Schoology so make sure to check there every day!

The first table is a list of some "start of the year" assignments. **These are due by Friday of the 2nd week of school.** The second table is a summary of what you can find on the class website, and where to find it.

The back of this page will tell you how to set up your 3-ring binder and composition notebooks. Please try to get the supplies mentioned as soon as possible! If you are having any difficulties obtaining the supplies quickly please let me know so we can figure something out. You can find copies of worksheets and handouts on my class website: *www.mychemistryclass.net* I hope your first week of school goes well, and let me know if you have any questions!

Start of the Year Assignments

IMPORTANT *For all Google Forms – You must be signed into your School Email Account to access them.*

Lab Safety Assignment *Watch a Lab Safety Video and answer the questions regarding what was covered in the video. You cannot perform any labs until you have earned 80% or higher on this assignment.* https://tinyurl.com/2xwf6nx5 ☐ *I'm all done with this assignment!*	**Get to Know You Google Form** *Help me get to know you a little bit! I will ask you questions about the classes you have already taken, the classes you are in now, hobbies, clubs, etc.* https://tinyurl.com/rhh4582r ☐ *I'm all done with this assignment!*	**About Your Chem Class Assignment** *In order to maximize our in class time, please watch this video about how we do things in my class, how the class website is set up etc. Watch the video, pay attention, answer the Q's.* https://tinyurl.com/x829pbu6 ☐ *I'm all done with this assignment!*
Sign up for Remind Messaging *A program that lets me message you without seeing your phone number, and without you seeing mine. Can use it on your phone or computer.* **Send a text to** 81010 **Text this message** @apchemfarm ☐ *I'm all done with this assignment!*	**Mrs. Farmer's Website to Bookmark** *Bookmark on your phone and/or computer. Homework is posted on Schoology, but this is where lots of important stuff is!* Mrs. Farmer's Class Website www.mychemistryclass.net ☐ *I'm all done with this assignment!*	**Some Nice Phone Apps to Get** *Not required, but are nice to have! You can find lots of free versions!* • A Scanner App - turns photos into PDFs for submitting photos of work. All photos uploaded to Schoology must be in PDF format for my class. • Remind Messaging App – a lot easier than the browser version. • A Periodic Table App – nice to have if you don't have a hard copy with you.

Things You Can Find on the Class Website

Thing	Where?
Welcome letter from teacher, commonly used links	Home Page
Overview of what we did, or are going to do each day in class	Calendar Tab
Links for lab report guidelines, absent lab form, resources for doing labs or writing lab reports	Lab Tab
Extra worksheets, videos, practice tests, helpful websites, etc. Great if you need extra practice, or a different way of explaining a concept.	Resources Tab
Syllabus, class rules, information about what the class will be like.	About Your Class Tab
Handouts and PowerPoints for your class. You will usually be given handouts in class, but if you need to print a copy, or if you lose a copy and need a new one, you can find them here.	AP Chem
A little bit about Mrs. Farmer!	About Mrs. Farmer Tab

Setting things up for your AP Chemistry Class

Supplies

Three Ring Binder	• I suggest getting a three ring binder that will last you all year. I can't tell you exactly what size to get because it will partially depend on how big you write when doing your homework – some people may take more pieces of binder paper per assignment than other people! I usually suggest a 2" binder. • Your first and last name needs to be clearly written on the outside of the binder in Sharpie, large enough for me to see it when I go to grade your notebook. I won't waste my time trying to figure out whose binder it is!
Dividers for your Three Ring Binder	Please label the dividers in the order below. The letters in parenthesis are the abbreviations I will use like page numbers on handouts you get this year. If you want to get your own dividers and add extra sections at the back that is fine, but these sections are required. 1. Reference (R) 2. Study Materials (S) 3. Current Packet (P) 4. Old Packets (OP) 5. Extra Paper (binder paper and graph paper)
Composition notebook (*supplied to you*)	This is where we will do our warmups and our class notes. The formatting guidelines are given to you in your packet, and you will keep the guidelines handout in your three ring binder in the Reference section. We will go over the guidelines as we do the first couple warmups and class notes.
Lab notebook (*supplied to you*)	Your lab notebook will be a composition notebook with graph paper instead of normal paper. You will use it to do "pre-lab" assignments to get ready for the lab, to collect your lab data, do your calculations, and answer "post-lab questions."
Non-graphing calculator	My favorite non-graphing calculator is a TI-30x IIs made by Texas Instruments. It works in a very logical way, is usually inexpensive, and can be found at stores like Office Depot, Staples, Target, Walmart, sometimes even drug stores or grocery stores. This is the brand of class calculators you will use on exams, and know how to help you with it. You can use another non-graphing calculator on class/homework but I may not know how to help you with it. Graphing calculators will not be allowed in class or during quizzes/tests.
Sack of school supplies *(supplied to you)*	These are the items I expect you to have with you in class every single day. If you would rather use your own set of colored pencils, or post-it notes, etc. please return the ones I gave you. • Glue, Red pen, Green pen, Pen/pencils, Highlighter, Post-it Notes, Colored pencils or markers, scissors.

Things in Your Packet

IMPORTANT! *These papers are all stapled together in this packet. If you want to take the staple out and put the papers where they belong in your 3-ring binder tonight that is awesome! Tomorrow I will have a bunch of staple removers that you can use to take the staples out during class if you would rather wait until you can use my staple removers. Either way is fine!*

Handout	Description	Where to put it
Welcome Letter	This paper you are reading right now!	Somewhere in your binder
Red Divider	We will use rainbow color order to color code our chapters during the year. The first chapter will be red, the second will be orange, etc.	Put as the very first thing in the Reference section
Periodic Table	Will be used all year. Notice that the AP Version doesn't give you the names! Get comfortable with that – that is what you get on the class exams and AP Test.	R – 1 *"Reference" section of binder, 1st handout in section*
Equation Sheet	Copy of what you are given on the AP Exam.	R – 2
Common Ions	List of common ions from Honors Chem – you should already know them!	R – 3
TYSK-BDKY	Things You Should Know, But Don't Know Yet – some important AP things!	R – 4
Solubility and Activity	Solubility chart describes which ions will be soluble in water. The Activity Series chart describes which atoms are "stronger" than others.	R – 5
VSPER Chart	Make sure you remember your shapes and bond angles from last year!	R – 6
Acids and Bases	Make sure the strong acids and bases are memorized!	R – 7
Conversion Chart	Common Conversion Factors that we use all year long. These do not have to be memorized for a quiz, but it will make problems go faster if you know some!	R – 8
Formulas/Constants	A list of some formulas and constants that you may need during the year.	R – 9
Sig Fig Review	A reminder of how we do sig figs. They are important in AP Chem!	R – 10
Summary of Rxns	A summary of different reaction types to help you predict products. Don't need to memorize but you should feel familiar with the main patterns.	R – 11
Ion Periodic Table	A periodic table that shows you the typical ion charges different atoms like to make.	R – 12
DPP Setup	Read this! It explains how we will do our Daily Practice Problems in this class. They are graded! They are similar to warmups but typically take a bit longer each day.	R – 13
Notes Setup	Read this! It explains how we will do our class notes. Notes are graded!	R – 14
Pre-Lab and Post-Lab Instructions	Instructions on how to do prelab assignments, what to do if you're absent for a lab, and a list of "post-lab" guidelines (you can print extras on the class website "Labs" tab if you want to use them like a check sheet to make sure you don't forget things)	R – 15
Lab Equipment and Named Techniques	Commonly used Lab Equipment. Familiarize yourself with these so you don't waste time during a lab looking for things!	R – 16
Worksheet #1	Part of your homework for week 1 *(P1-1 means in "Current Packet" section of your binder, 1st packet, 1st paper in that packet)*	P1 – 1
All About Me	This is a get to know you assignment for page 1 in your Composition Notebook. Should be the first thing I see when I open your notebook!	Page 1 in Composition Notebook

Reference Sheets for
Unit #0 –Review of Honors Chem

PERIODIC TABLE OF THE ELEMENTS

1 **H** 1.008																	2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.30											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.91	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57 ***La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.02	89 **†Ac** 227.03	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (264)	108 **Hs** (277)	109 **Mt** (268)	110 **Ds** (271)	111 **Rg** (272)							

*Lanthanide Series	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 151.97	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
† Actinide Series	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (247)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

AP Chemistry Equations & Constants

Throughout the test the following symbols have the definitions specified unless otherwise noted.

L, mL	=	liter(s), milliliter(s)	mm Hg	=	millimeters of mercury
g	=	gram(s)	J, kJ	=	joule(s), kilojoule(s)
nm	=	nanometer(s)	V	=	volt(s)
atm	=	atmosphere(s)	mol	=	mole(s)

ATOMIC STRUCTURE

$E = h\nu$

$c = \lambda\nu$

E = energy
ν = frequency
λ = wavelength

Planck's constant, $h = 6.626 \times 10^{-34}$ J s

Speed of light, $c = 2.998 \times 10^{8}$ m s^{-1}

Avogadro's number = 6.022×10^{23} mol^{-1}

Electron charge, $e = -1.602 \times 10^{-19}$ coulomb

EQUILIBRIUM

$K_c = \dfrac{[C]^c[D]^d}{[A]^a[B]^b}$, where $a\ A + b\ B \rightleftarrows c\ C + d\ D$

$K_p = \dfrac{(P_C)^c(P_D)^d}{(P_A)^a(P_B)^b}$

$K_a = \dfrac{[H^+][A^-]}{[HA]}$

$K_b = \dfrac{[OH^-][HB^+]}{[B]}$

$K_w = [H^+][OH^-] = 1.0 \times 10^{-14}$ at 25°C

$= K_a \times K_b$

$pH = -\log[H^+]$, $pOH = -\log[OH^-]$

$14 = pH + pOH$

$pH = pK_a + \log\dfrac{[A^-]}{[HA]}$

$pK_a = -\log K_a$, $pK_b = -\log K_b$

Equilibrium Constants

K_c (molar concentrations)
K_p (gas pressures)
K_a (weak acid)
K_b (weak base)
K_w (water)

KINETICS

$\ln[A]_t - \ln[A]_0 = -kt$

$\dfrac{1}{[A]_t} - \dfrac{1}{[A]_0} = kt$

$t_{1/2} = \dfrac{0.693}{k}$

k = rate constant
t = time
$t_{1/2}$ = half-life

GASES, LIQUIDS, AND SOLUTIONS

$$PV = nRT$$

$$P_A = P_{\text{total}} \times X_A, \text{ where } X_A = \frac{\text{moles A}}{\text{total moles}}$$

$$P_{total} = P_A + P_B + P_C + \ldots$$

$$n = \frac{m}{\boldsymbol{M}}$$

$$\text{K} = {}^\circ\text{C} + 273$$

$$D = \frac{m}{V}$$

$$KE \text{ per molecule} = \frac{1}{2} m v^2$$

Molarity, M = moles of solute per liter of solution

$$A = abc$$

P = pressure
V = volume
T = temperature
n = number of moles
m = mass
$\boldsymbol{M}$ = molar mass
D = density
KE = kinetic energy
v = velocity
A = absorbance
a = molar absorptivity
b = path length
c = concentration

Gas constant, $R = 8.314 \text{ J mol}^{-1}\text{ K}^{-1}$
$= 0.08206 \text{ L atm mol}^{-1}\text{ K}^{-1}$
$= 62.36 \text{ L torr mol}^{-1}\text{ K}^{-1}$
$1 \text{ atm} = 760 \text{ mm Hg}$
$= 760 \text{ torr}$
STP = 0.00 °C and 1.000 atm

THERMOCHEMISTRY/ ELECTROCHEMISTRY

$$q = mc\Delta T$$

$$\Delta S^\circ = \sum S^\circ \text{ products} - \sum S^\circ \text{ reactants}$$

$$\Delta H^\circ = \sum \Delta H_f^\circ \text{ products} - \sum \Delta H_f^\circ \text{ reactants}$$

$$\Delta G^\circ = \sum \Delta G_f^\circ \text{ products} - \sum \Delta G_f^\circ \text{ reactants}$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$
$$= -RT \ln K$$
$$= -n F E^\circ$$

$$I = \frac{q}{t}$$

q = heat
m = mass
c = specific heat capacity
T = temperature
S° = standard entropy
H° = standard enthalpy
G° = standard free energy
n = number of moles
E° = standard reduction potential
I = current (amperes)
q = charge (coulombs)
t = time (seconds)

Faraday's constant, F = 96,485 coulombs per mole of electrons

$$1 \text{ volt} = \frac{1 \text{ joule}}{1 \text{ coulomb}}$$

Common Ions

Memorize the names and formulas for these ions NOW! Pop quizzes all year long starting in September!

You do not need to memorize the old-fashioned names in parentheses and italics. They are only there in case you stumble across them on an assignment or online during the year. The roman numerals after some names are required parts of the name! Do not add them to others, and do not forget them on ones that have them.

+++ Positive Ions – Cations +++

1+	
Hydrogen	H^+
Ammonium	NH_4^+
Copper (I) (*Cuprous*)	Cu^+
Silver	Ag^+
Gold (I)	Au^+
And all elements in Group IA	

2+	
Cadmium	Cd^{2+}
Chromium (II)	Cr^{2+}
Cobalt (II)	Co^{2+}
Copper (II) (*Cupric*)	Cu^{2+}
Iron (II) (*Ferrous*)	Fe^{2+}
Lead (II) (*Plumbous*)	Pb^{2+}
Manganese (II)	Mn^{2+}
Mercury (II) (*Mercuric*)	Hg^{2+}
Nickel (II)	Ni^{2+}
Tin (II) (*Stannous*)	Sn^{2+}
Zinc	Zn^{2+}
Mercury (I) (*Mercurous*)	Hg_2^{2+}
And all elements in Group 2A	

3+	
Chromium (III)	Cr^{3+}
Cobalt (III)	Co^{3+}
Gold (III)	Au^{3+}
Iron (III) (*Ferric*)	Fe^{3+}
Manganese (III)	Mn^{3+}
Nickel (III)	Ni^{3+}
Boron	B^{3+}
Aluminum	Al^{3+}
Gallium	Ga^{3+}
Indium	In^{3+}

4+	
Lead (IV) (*Plumbic*)	Pb^{4+}
Manganese (IV)	Mn^{4+}
Carbon cation	C^{4+}
Silicon (IV)	Si^{4+}
Tin(IV) (*Stannic*)	Sn^{4+}
And Group 4A can potentially make 4+	

--- Negative Ions – Anions ---

1-	
Acetate	$C_2H_3O_2^-$
Bicarbonate	HCO_3^-
Chlorate	ClO_3^-
Chlorite	ClO_2^-
Cyanide	CN^-
Hydride	H^-
Hydroxide	OH^-
Hypochlorite	ClO^-
Nitrate	NO_3^-
Nitrite	NO_2^-
Perchlorate	ClO_4^-
Permanganate	MnO_4^-
Thiocyanate	SCN^-
And all elements in Group 7A (Halogens)	

2-	
Carbonate	CO_3^{2-}
Peroxide	O_2^{2-}
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}
Chromate	CrO_4^{2-}
Dichromate	$Cr_2O_7^{2-}$
Oxalate	$C_2O_4^{2-}$
Thiosulfate	$S_2O_3^{2-}$
And all elements in Group 6A	

3-	
Borate	BO_3^{3-}
Phosphate	PO_4^{3-}
Phosphide	P^{3-}
Phosphite	PO_3^{3-}
Arsenate	AsO_4^{3-}
And all elements in Group 5A	

4-	
Carbon anion	C^{4-}
And Group 4A can potentially make 4-	

The "monatomic" anions (made of only one type of atom) from groups 5A, 6A, 7A are named by dropping the ending on the neutral atom's name and replacing it with -ide. Because they follow such a dependable pattern, they are not individually named on this common ion list.

Examples:

F fluorine → F^- fluoride

O oxygen → O^{2-} oxide

N nitrogen → N^{3-} nitride

Other things to Memorize

We do not need these until later in the year – you will be told when to memorize these.

Prefixes			
One	mono	Six	hexa
Two	di	Seven	hepta
Three	tri	Eight	octa
Four	tetra	Nine	nona
Five	penta	Ten	deca

Common Molecular Gases
F_2, Cl_2, H_2, N_2, O_2, SO_2,
SO_3, CO, CO_2, H_2S,
NO, NO_2, NH_3, P_2O_3,
P_2O_5, SiF_4, HCl, HBr,
HI, HF, N_2O_5, N_2O_3, N_2O

Common Acids	
Hydrochloric	HCl
Sulfuric	H_2SO_4
Nitric	HNO_3
Phosphoric	H_3PO_4

Common Bases	
Ammonia	NH_3
Sodium hydroxide	NaOH

Diatomic Elements	
Hydrogen	H_2
Nitrogen	N_2
Oxygen	O_2
Fluorine	F_2
Chlorine	Cl_2
Bromine	Br_2
Iodine	I_2

Strong Acid, Strong Base Handout

Memorize these 15, ALL ELSE ARE considered WEAK

7 Strong Acids (H^+) All other acids are weak	
Hydrochloric acid	HCl
Hydrobromic acid	HBr
Hydroiodic	HI
Perchloric acid	$HClO_4$
Chloric acid	$HClO_3$
Nitric acid	HNO_3
Sulfuric acid	H_2SO_4

8 Strong Bases (OH^-) All other bases are weak	
Lithium hydroxide	LiOH
Sodium hydroxide	NaOH
Potassium hydroxide	KOH
Rubidium hydroxide	RbOH
Cesium hydroxide	CsOH
Calcium hydroxide	$Ca(OH)_2$
Strontium hydroxide	$Sr(OH)_2$
Barium hydroxide	$Ba(OH)_2$

Pattern for Some Polyatomic Ion Names, and Some Acid Names

If this is helpful to you then great! If not, then just memorize them! 😊

Polyatomic Ions Containing Oxygen*	
Per-……..-ate	Greatest number of oxygens
……..-ate	Greater
……..-ite	Smaller
Hypo……-ite	Smallest number of oxygens

Acid Nomenclature**	
Per-……..-ic	Greatest number of oxygen atoms
……..-ic	Greater
……..-ous	Smaller
Hypo……-ous	Smallest number of oxygen atoms

*****Names of polyatomic ions containing oxygen- some elements form several polyatomic ions with oxygen. A series of suffixes and prefixes is used to specify the relative number of oxygen atoms.

******Acids – Acids are molecular compounds that contain hydrogen bonded to a nonmetal to a group of atoms that behave like a nonmetal. Acids an be either binary or ternary compounds. The names of binary acids have the form Hydro-...-ic acids. The naems of ternary acids use a series of prefixes and suffixes to specify the relative number of oxygen atoms in the molecule.

STUFF I SHOULD KNOW FOR THE AP TEST BUT DO NOT KNOW YET

IONS LIST

acetate	$C_2H_3O_2^-$	ferr**ic**	Fe^{3+} (Orange – red)	oxalate	$C_2O_4^{2-}$
aluminum	Al^{3+}	ferr**ous**	Fe^{2+} (Yellow - *green*)	oxide	O^{2-}
ammonium	NH_4^+	fluoride	F^-	perbromate	BrO_4^-
barium	Ba^{2+}	hydrogen	H^+	perchlorate	ClO_4^-
bicarbonate	HCO_3^-	hydronium	H_3O^+	periodate	IO_4^-
bisulfate	HSO_4^-	Hydroxide	OH^-	Permanganate	MnO_4^- *(purple)*
bisulfide	HS^-	hypobromite	BrO^-	Peroxide	O_2^{2-}
bisulfite	HSO_3^-	hypochlorite	ClO^-	phosphate	PO_4^{3-}
bromate	BrO_3^-	hypoiodite	IO^-	phosphide	P^{3-}
bromide	Br^-	iodate	IO_3^-	phosphite	PO_3^{3-}
bromite	BrO_2^-	iodide	I^-	potassium	K^+
calcium	Ca^{2+}	iodite	IO_2^-	silver	Ag^+
carbonate	CO_3^{2-}	Plumb**ous**	Pb^{2+}	sodium	Na^+
chlorate	ClO_3^-	lithium	Li^+	stann**ic**	Sn^{4+}
chloride	Cl^-	magnesium	Mg^{2+}	stann**ous**	Sn^{2+}
chlorite	ClO_2^-	manganese	Mn^{2+} (*Pink*)	strontium	Sr^{2+}
chromate	CrO_4^{2-} (yellow)	mercur**ic**	Hg^{2+}	sulfate	SO_4^{2-}
chromium	Cr^{3+} (Violet ($Cr(NO_3)_3$ to Green ($CoCl_3$)	mercur**ous**	Hg_2^{2+}	sulfide	S^{2-}
cobalt	Co^{3+} (*pink)*	nickel	Ni^{2+} (*green*)	sulfite	SO_3^{2-}
cupr**ic**	Cu^{2+} (*blue*)	nitrate	NO_3^-	thiocyanate	SCN^-
cupr**ous**	Cu^+ (*green*)	nitride	N^{3-}	thiosulfate	$S_2O_3^{2-}$
cyanide	CN^-	nitrite	NO_2^-	zinc	Zn^{2+}
dichromate	$Cr_2O_7^{2-}$ (orange)				

SOLUBILITY RULES

Always soluble:

alkali metal ions (Li^+, Na^+, K^+, Rb^+, Cs^+), NH_4^+, NO_3^-, ClO_3^-, ClO_4^-, $C_2H_3O_2^-$

Generally soluble: (mnemonics)

Cl^-, Br^-, I^- Soluble except Ag^+, Pb^{2+}, Hg_2^{2+} (AP/H)

F^- Soluble except Ca^{2+}, Sr^{2+}, Ba^{2+}, Pb^{2+}, Mg^{2+} (CBS-PM)

SO_4^{2-} Soluble except Ca^{2+}, Sr^{2+}, Ba^{2+}, Pb^{2+} (CBS/PBS)

Generally insoluble:

O^{2-}, OH^- Insoluble except and alkali metals, and NH_4^+ Ca^{2+}, Sr^{2+}, Ba^{2+} (CBS) somewhat soluble

CO_3^{2-}, PO_4^{3-}, S^{2-}, SO_3^{2-}, $C_2O_4^{2-}$, CrO_4^{2-} Insoluble except alkali metals and NH_4^+

GASES THAT FORM

$\rightarrow$ **H_2CO_3** $\rightarrow$ **CO_2** + H_2O

$\rightarrow$ **H_2SO_3** $\rightarrow$ **SO_2** + H_2O

$\rightarrow$ **HNO_2** $\rightarrow$ **NO** + **NO_2** + H_2O

$\rightarrow$ **NH_4OH** $\rightarrow$ **NH_3** + H_2O

$\rightarrow$ **H_2S**

$\rightarrow$ **HCN**

WEAK ELECTROLYTES

Weak Acids (*esp*. $HC_2H_3O_2$ and HF)

(Memorize the 8 strong acids… all others are weak)

HCl	hydrochloric acid	HNO_3	nitric acid
HBr	hydrobromic acid	HIO_4	periodic acid
HI	hydroiodic acid	H_2SO_4	sulfuric acid
$HClO_4$	perchloric acid	$HClO_3$	chloric acid

Ammonium Hydroxide ($NH_4OH \approx NH_3(aq)$) Water (H_2O)

DRIVING FORCES — Double Replacement

- Insoluble Solid (Precipitate)
- Weak Electrolyte (H_2O or Weak Acid)
- Gas Formation

STRONG OXIDIZERS (Oxidizing Agents)

MnO_4^- in acid solution	$\rightarrow Mn^{2+} + H_2O$
MnO_2 in acid solution	$\rightarrow Mn^{2+} + H_2O$
MnO_4^- in neutral or basic sol'n	$\rightarrow MnO_2$
$Cr_2O_7^{2-}$ in acid solution	$\rightarrow Cr^{3+} + H_2O$
$Cr_2O_7^{2-}$ with a base	$\rightarrow CrO_4^{2-} + H_2O$
CrO_4^{2-} in basic solution	$\rightarrow CrO_2^- + H_2O$
HNO_3, concentrated	$\rightarrow NO_2 + H_2O$
HNO_3, dilute (e.g. 6 M)	$\rightarrow NO + H_2O$
H_2SO_4, hot, concentrated	$\rightarrow SO_2 + H_2O$
Free halogens (e.g. Cl_2)	$\rightarrow$ halide ions (Cl^-)
H_2O_2 in acid solution	$\rightarrow H_2O$
Note: H_2O_2 decomposes	$\rightarrow H_2O + O_2$
Na_2O_2	$\rightarrow$ NaOH
$HClO_4$	$\rightarrow Cl^- + H_2O$

Other Oxidizers

Metal-"ic" ions (e.g. Sn^{4+}, Fe^{3+})	$\rightarrow$ "-ous" ions (Sn^{2+}, Fe^{2+})
H_2O	$\rightarrow H_2 + OH^-$

STRONG REDUCERS (Reducing Agents)

Halide ions (e.g. Cl^-)	$\rightarrow$ Free halogen (Cl_2)
Free metals	$\rightarrow$ metal ions
"ites" SO_3^{2-} or SO_2, NO_2^-	$\rightarrow$ "ates" SO_4^{2-}, NO_3^-
Free halogens, dil. basic sol'n	$\rightarrow$ hypohalite ions (ClO^-)
Free halogens, conc. basic sol'n	$\rightarrow$ halate ions (ClO_3^-)
$S_2O_3^{2-}$	$\rightarrow S_4O_6^{2-}$

Other Reducers

Metal-"ous" ions (e.g. Sn^{2+})	$\rightarrow$ "-ic" ions (Sn^{4+})
H_2O	$\rightarrow O_2 + H^+$

Universal Gas Law Constants

——— = **62.4** —— = **0.0821** —— = **8.314**

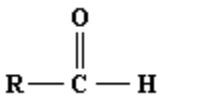
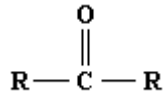
Stuff I Should Know (Page 2)

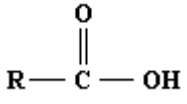
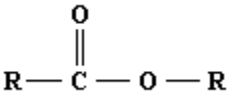
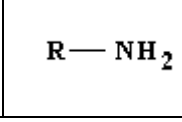
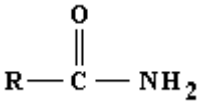
Complex Ions & Common Ligands

Ligands	polar molecules & anions	NH_3, H_2O, OH^-, CN^-, Cl^-	**Odd example:** $Fe^{3+} + SCN^- \rightleftharpoons FeSCN^{2+}$
Central Ions	transition metals and Al^{3+}	Ag^+, Cu^{2+}, Ni^{2+}, Zn^{2+}, etc. & Al^{3+}	
Examples	Usually twice the number of ligands as the charge on the central ion. **Key Words**: "excess, concentrated"	$Ag(CN)_2^-$, $Cu(NH_3)_4^{2+}$, $Ni(OH)_4^{2-}$, $Zn(NH_3)_4^{2+}$, $Al(OH)_6^{3-}$	**Reaction with Acid:** $Cu(NH_3)_4^{2+} + H^+ \rightarrow Cu^{2+} + NH_4^+$

Organic Chemistry & Functional Groups

alkanes	alkenes	alkynes	aromatics (benzene)
C_nH_{2n+2}	C_nH_{2n}	C_nH_{2n-2}	C_6H_6

alcohol	aldehyde	ketone	ether
R — OH			R — O — R

carboxylic acid	ester	amine	amide
			

Substituted benzene:	ortho = 1,2	meta = 1,3	para = 1,4

nuclear chem

alpha ^4_2He

beta/electron $^0_{-1}e$

neutron ^1_0n

positron $^0_{+1}e$

ΔH	ΔS	Spont.?
–	+	at all temps
+	+	high temps
–	–	low temps
+	–	no temps

Note: ΔS in J
ΔG & ΔH in kJ

K_{sp} & Solubility, s

1:1 $K_{sp} = s^2$
1:2 $K_{sp} = 4s^3$
1:3 $K_{sp} = 27s^4$
2:3 $K_{sp} = 108s^5$

Lewis Acids & Bases

$BF_3 + NH_3 \rightarrow BF_3NH_3$

acid anhydrides (oxides of nonmetals, CO_2)

basic anhydrides (oxides of metals, MgO)

$MgO + CO_2 \rightarrow MgCO_3$

decomposition reactions: $MgCO_3 \rightarrow MgO + CO_2$

Strange Examples: $P_4O_{10} + H_2O \rightarrow H_3PO_4$

Strange Ions: (nitride, N^{3-}) (hydride, H^-)

$Li + N_2 \rightarrow Li_3N$ $\quad$ $LiH + H_2O \rightarrow H_2 + Li^+ + OH^-$

Flame Test Colors

Barium – green
Sodium – yellow
Copper – blue (w/ green)
Potassium – lavender
Strontium – red
Lithium – red
Calcium – orange

Quantum Numbers

n	1, 2, 3, …
ℓ	0 … (n–1)
m_ℓ	$-\ell$ … $+\ell$
m_s	+½, –½

ℓ	0 = s, 1 = p, 2 = d, 3 = f

Writing Lewis Structures

hint: use one valence electron to connect F's or Cl's then determine lone pairs (Ex: XeF_4)

Product–Favored (Spontaneous) Reactions

$\Delta G < 0$ $\quad$ $E° > 0$ $\quad$ $K_{eq} > 1$

Properties Indicate Strength of Intermolecular Forces (IMF's)

IMF	BP	FP	H_{vap}	H_{fus}	VP
IMF	BP	FP	H_{vap}	H_{fus}	VP

Orders of Reactions & Graphs That Give Straight Lines

0 Order	1st Order	2nd Order
[R] vs. Time	ln[R] vs. Time	1/[R] vs. Time
slope = -k	slope = -k	slope = k

Electrochemical Cells

anode	cathode
oxidation	reduction
– side	+ side
lower E°	higher E°
e^- leave	e^- enter

Bond Orders

bond	B.O.	
single	1	σ
double	2	σ+π
triple	3	σ+π+π

SN & hybridization & shape

Steric Number	hybridization	basic shape
1	s	––
2	sp	linear
3	sp^2	△ planar
4	sp^3	tetrahedral
5	sp^3d	△ bipyramidal
6	sp^3d^2	octahedral

IMF's

London	nonpolar molecules, ex: CH_4, He
dipole–dipole	polar molecules, ex: H_2S, SO_2
hydrogen bonding	H–F, H–O–, H–N–, NH_3, H_2O amines and alcohols
metallic	metals, Ag, Pb
ionic	salts, NaCl, $CaCO_3$ (Note: "ates" contain covalent bonds)
covalent network	C(graphite), C(diamond), SiO_2, WC, Si, SiC (Note: graphite = London, too)

Activity of Metals (Four Groups)

Metals	React with…
Groups I & II	H_2O ex: $Li + H_2O \rightarrow Li^+ + OH^- + H_2$
all others	Non-oxidizing Acid, ex: HCl $Zn + 2HCl \rightarrow H_2 + ZnCl_2$
Cu, Ag, Hg	Oxidizing Acid, HNO_3 or H_2SO_4 (conc.) $Cu + HNO_3 \rightarrow NO_2 + H_2O + Cu^{2+}$
Au, Pt, Ir	Aqua Regia (HNO_3 + HCl)

Adapted from Paul Groves

Solubility of Some Ionic Compounds in Water

Always Soluble

AAA CNP

Alkali metals = Li^+, Na^+, K^+, Rb^+, Cs^+

Ammonium = NH_4^+

Acetate = $C_2H_3O_2^-$

Chlorate = ClO_3^-

Nitrate = NO_3^-

Perchlorate = ClO_4^-

Memorize the Always Soluble Ones!
These are the only ones you need to memorize. Others will be provided as needed.

Generally Soluble

AP-H

Cl^-, Br^-, I^- — *Except when with*: Ag^+, Pb^{2+}, Hg_2^{2+}

CBS-PM

F^- — *Except when with*: Ca^{2+}, Ba^{2+}, Sr^{2+}, Pb^{2+}, Mg^{2+}

CBS-P

Sulfate = SO_4^{2-} — *Except when with*: Ca^{2+}, Ba^{2+}, Sr^{2+}, Pb^{2+}

Generally Insoluble

AA

O^{2-}, OH^- — *Except when with*: Alkali metals and NH_4^+

CBS

Somewhat soluble: Ca^{2+}, Ba^{2+}, Sr^{2+}

AA

CO_2^{2-}, CO_3^{2-}
S^{2-}, SO_3^{2-}
PO_4^{3-}
CrO_4^{2-}, $Cr_2O_4^{2-}$

Except when with: Alkali metals and NH_4^+

Insoluble = forms precipitate
Soluble = dissolves in water (aqueous)

Acronyms to help with memorizing the rules.

Activity Series Chart

Metals

Non-Metals

Most Active

Name	Symbol
Lithium	Li
Potassium	K
Barium	Ba
Strontium	Sr
Calcium	Ca
Sodium	Na
Magnesium	Mg
Aluminum	Al
Manganese	Mn
Zinc	Zn
Iron	Fe
Cadmium	Cd
Cobalt	Co
Nickel	Ni
Tin	Sn
Lead	Pb
Hydrogen	H
Copper	Cu
Silver	Ag
Mercury	Hg
Gold	Au

Least Active

Name	Symbol
Fluorine	F
Chlorine	Cl
Bromine	Br
Iodine	I

You do NOT need to memorize this chart!
If you need this information it will be provided to you on any exams. If you are not provided this information then you can assume the reaction takes place.

***

Elements CANNOT replace anything ABOVE them.
The reaction DOES NOT OCCUR in this situation.

***

Examples: $ZnCl_2 + Mg \rightarrow MgCl_2$

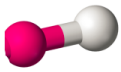
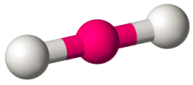
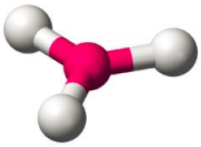
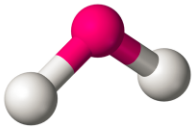
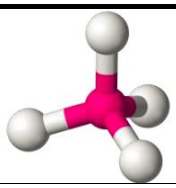
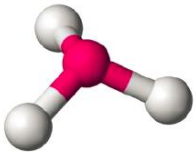
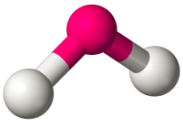
Magnesium is above Zinc so the reaction happens

$ZnCl_2 + Cu \rightarrow$ No Reaction

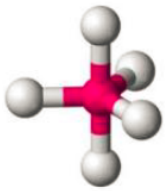
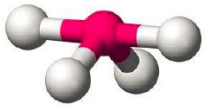
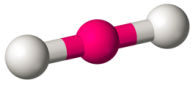
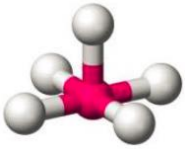
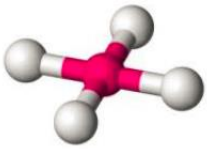
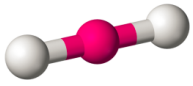
Copper is below Zinc so no reaction happens

VSEPR

Valence Shell Electron Pair Repulsion

Steric #	X	E	"generic" Looking at shape of everything attached	"specific" Only looking at shape of atoms		
Electron Pairs	**Bonded Pairs**	**Lone Pairs**	**Electron Geometry** (hybridization)	**Molecular Geometry** (AXE Formula)	**Bond Angles**	**3-D example**
2	1	1-3	Linear (sp)	Linear (AXE, AXE_2, AXE_3)	180	
	2	0		Linear (AX_2)		
3	3	0	Trigonal Planar (sp^2)	Trigonal Planar (AX_3)	120	
	2	1		Bent (AX_2E)	< 120	
4	4	0	Tetrahedral (sp^3)	Tetrahedral (AX_4)	109.5	
	3	1		Trigonal Pyramidal (AX_3E)	< 109.5	
	2	2		Bent (AX_2E_2)	<< 109.5	

Continued on the back!

Steric #	X	E	"generic" Looking at shape of everything attached	"specific" Only looking at shape of atoms	*it is unclear if d orbitals hybridize – currently we think they do not.	
Electron Pairs	**Bonded Pairs**	**Lone Pairs**	**Electron Geometry** (hybridization)	**Molecular Geometry** (AXE Formula)	**Bond Angles**	**3-D example**
5	5	0	Trigonal Bipyramidal (sp^3d^*)	Trigonal Bipyramidal (AX_5)	90 Axial (above & below) 120 Equatorial (in plane)	
	4	1		Seesaw (AX_4E)	90 120 180	
	3	2		T-Shaped (AX_3E_2)	90 180	
	2	3		Linear (AX_2E_3)	180	
6	6	0	Octahedral (sp^3d^2*)	Octahedral (AX_6)	90	
	5	1		Square Pyramidal (AX_5E)	90 180	
	4	2		Square Planar (AX_4E_2)	90 180	
	3	3		T-Shaped (AX_3E_3)	90 180	
	2	4		Linear (AX_2E_4)	180	

Dougherty Valley HS Honors Chemistry
Strong Acid, Strong Base Handout

7 Strong Acids (H^+) All other acids are weak			8 Strong Bases (OH^-) All other bases are weak	
Hydrochloric acid	HCl		Lithium hydroxide	LiOH
Hydrobromic acid	HBr		Sodium hydroxide	NaOH
Hydroiodic	HI		Potassium hydroxide	KOH
Perchloric acid	$HClO_4$		Rubidium hydroxide	RbOH
Chloric acid	$HClO_3$		Cesium hydroxide	CsOH
Nitric acid	HNO_3		Calcium hydroxide	$Ca(OH)_2$
Sulfuric acid	H_2SO_4		Strontium hydroxide	$Sr(OH)_2$
---	---		Barium hydroxide	$Ba(OH)_2$

Memorize these 15, ALL ELSE ARE considered WEAK

Dougherty Valley High School Chemistry — Weak Acid/Base Reference Sheet

Acid Dissociation Constant (K_a) Values for Some Weak Acids

Weak Acid	Chemical Formula	K_a
acetic	$HC_2H_3O_2$	1.8×10^{-5}
arsenic	H_3AsO_4	5.6×10^{-3}
arsenous	$HAsO_2$	6×10^{-10}
ascorbic	$H_2C_6H_6O_6$	8.0×10^{-5}
benzoic	C_6H_5COOH	6.5×10^{-5}
boric	H_3BO_3	5.8×10^{-10}
carbonic	H_2CO_3	4.3×10^{-7}
chloroacetic	$CH_2ClCOOH$	1.4×10^{-3}
citric	$H_3C_6H_5O_7$	7.4×10^{-4}
formic	$HCOOH$	1.8×10^{-4}
hydrazoic	HN_3	1.9×10^{-5}
hydrocyanic	HCN	4.9×10^{-10}
hydrofluoric	HF	6.8×10^{-4}
hydrosulfuric	H_2S	5.7×10^{-8}
hypobromous	$HBrO$	2×10^{-9}
hypochlorous	$HClO$	3.0×10^{-8}
hydrogen peroxide	H_2O_2	2.4×10^{-12}
iodic	HIO_3	1.7×10^{-1}
malonic	$H_2C_3H_2O_4$	1.5×10^{-3}
nitrous	HNO_2	4.5×10^{-4}
oxalic	$H_2C_2O_4$	5.9×10^{-2}
phosphoric	H_3PO_4	7.5×10^{-3}
selenous	H_2SeO_3	5.3×10^{-9}
sulfurous	H_2SO_3	1.7×10^{-2}
tartaric	$H_2C_4H_4O_6$	1.0×10^{-3}

Base Dissociation Constant (K_b) Values for Some Weak Bases

Weak Base	Chemical Formula	K_b
ammonia	NH_3	1.8×10^{-5}
aniline	$C_6H_5NH_2$	4.3×10^{-10}
dimethylamine	$(CH_3)_2NH$	5.4×10^{-4}
ethylamine	$C_2H_5NH_2$	6.4×10^{-4}
hydrazine	N_2H_4	1.3×10^{-6}
hydroxylamine	$HONH_2$	1.1×10^{-8}
methylamine	CH_3NH_2	4.4×10^{-4}
pyridine	C_5H_5N	1.7×10^{-9}
trimethylamine	$(CH_3)_3N$	6.4×10^{-5}

Common English and Metric Conversions Chart

American Linear Units	
12 inches (in)	1 foot (ft)
3 feet	1 yard (yd)
36 inches	1 yard
63,360 inches	1 mile (mi)
5,280 feet	1 mile
1,760 yards	1 mile

Weight and Mass	
1 Ton (T)	2,000 pounds
1 pound (lb)	16 ounces (oz)
1 Ton	32,000 ounces
1 metric ton (t)	1000 kg
60 grains	1 dram

Converting American Units	
Larger unit → smaller unit	*Multiply*
smaller unit → Larger unit	*Divide*

American to Metric Units	
1 inch	2.540 centimeters
1 foot	0.305 meters
1 yard	0.914 meters
1 mile	1.609 kilometers
1 gallon	3.78 Liters
1 quart	0.95 Liter
1 pound	0.45 kilogram
1 ounce	28.35 grams
1 fluid ounce	29.57 mL
1 grain	60 milligrams (mg)
1 teaspoon (tsp)	5 mL
1 fluid dram	4 mL
1 tablespoon (tbsp)	15 mL
1 pint (pt)	500 mL (approx)
1 quart (qt)	1000 mL (approx)
1 pound (lb)	453.6 g

American Capacity	
8 fluid ounces (fl oz)	1 cup
16 fluid ounces	2 cups
2 cups	1 pint (pt)
16 fluid ounces	1 pint
2 pints	1 quart (qt)
4 quarts	1 gallon
8 pints	1 gallon
32 fluid ounces	1 quart
8 fluid dram	1 fluid ounce
3 teaspoon (tsp)	1 tablespoon (tbsp)
6 teaspoon	1 fluid ounce
2 tablespoon	1 fluid ounce
1 drop (gtt)	1 minim
60 drop	1 fluid dram
60 drop	1 teaspoon
60 minims	1 fluid dram

Metric Units

mega (M)	*	*	kilo (k)	hector (h)	deka (da)	unit (m, g, L)	deci (d)	centi (c)	milli (m)	*	*	micro (mc) (u)

When going from larger unit to smaller unit move decimal to the right

When going from smaller unit to larger unit move decimal to the left

Time	
1 day	24 hours
1 hour (hr)	60 minutes (min)
1 minute	60 seconds (sec)
1 year (yr)	365.25 days
1 week	7 days
1 year	12 months (mon)
1440 minutes	1 day
3600 seconds	1 hour

Stones	
1 carat (karat)	200 mg

Metric to American Units	
1 km	0.621 miles
1 meter	1.094 yards
1 meter	3.281 feet
1 meter	39.370 inches
1 cm	0.3937 inch
1 Liter	0.26 gallon
1 Liter	1.06 quarts
1 kg	2.20 lbs
1 gram	0.035 oz
1 gram	15 grains
1 milliliter (mL)	15 minims

Temperature Formulas	
$C = \frac{(F - 32)}{1.8}$	$F = 1.8 \cdot C + 32$

Medical Application (Micrograms)	
1,000,000 micrograms (mcg)	1 gram
1,000,000 micrograms	1,000 mg
1 mL = 1 cc = 1 cm^3	
1 gram = 1 cm^3	
Nursing students 1fl oz = 30 mL	
Nursing students 1 in. = 2.5 cm	

Useful and Necessary Formulas

http://www2.ucdsb.on.ca/tiss/stretton/Database/formulas_content.html

1. **Electromagnetic Radiation**
   - a) Speed of Light — $c = \lambda * v$
   - b) Wavelength — $\lambda = c / v$
   - c) Frequency — $v = c / \lambda$
   - d) Energy in a photon — $E = h * v$
2. **Concentration and Molar Mass**
   - a) Density (D) — $D = m / V$
   - b) Moles (n) — $n = g / mm$
   - c) Moles (# of particles) — $n =$ number of particles / Avogadro's number
   - d) Moles (solution) — $n =$ concentration • volume
   - e) Moles (gas equation) — $n = PV / RT$
   - f) Molarity (M) — $M = n /$ volume
   - g) Molar mass (mm) — $mm = m / n$
3. **Gases**
   - a) Boyle's Law — $P_1 \bullet V_1 = P_2 \bullet V_2$
   - b) Charles' Law — $V_1 \bullet T_2 = V_2 \bullet T_1$
   - c) Combined Gas Law — $P_1 \bullet V_1 / T_1 = P_2 \bullet V_2 / T_2$
   - d) Ideal Gas Law — $PV = nRT$
   - e) Dalton's Law of Partial Pressures — $P_T = P_1 + P_2 + P_3 + ... + P_n$
4. **Acids and Bases**
   - a) pH — $pH = -\log[H^{+1}]$
   - b) pOH — $pOH = -\log[OH^{-1}]$
   - c) $[H_3O^{+1}]$ — $[H_3O^{+1}] = 10^{-pH}$
   - d) $[OH^{-1}]$ — $[OH^{-1}] = 10^{-pOH}$
5. **Heat**
   - a) Quantity of Heat (Q) — $Q = m \bullet c \bullet \Delta t$
   - b) Quantity of Heat (fusion) — $Q = m \bullet L_f$
   - c) Quantity of Heat (vaporization) — $Q = m \bullet L_v$
   - d) Celsius to Kelvin — $K = {}^oC + 273.15$
   - e) Kelvin to Celcius — ${}^oC = K - 273.15$
6. **Mathematics**
   - a) Quadratic Equation — $x = -b \pm (b^2 - 4ac)^{-2} / 2a$

Common Physical and Chemical Constants

http://www2.ucdsb.on.ca/tiss/stretton/Database/constants.htm

Avogadro's Number	**6.02217×10^{23} things/mole**
Planck's Constant	**$6.6260755 \times 10^{-34}$ Js**
1 atmosphere (atm)	**101,325 Pascals (Pa) = 101.325 kPa = 760 mm of Hg = 760 Torr = 1.01325 bar**
1 mole of any gas at STP	**22.4 L (0^{o}C, 1 atm)**
1 mole of any gas at SATP	**24.8 L (25^{o}C, 1 atm)**
Ideal Gas Law Constant (R)	**0.0821 L atm mol^{-1} K^{-1} = 8.31430 L kPa mol^{-1} K^{-1} = 8.31441 J mol^{-1} K^{-1}**
1 calorie (cal)	**4.184 J**
1 Cal	**1 kcal = 1000 calories**
1 atomic mass unit (amu)	**$1.6605665 \times 10^{-24}$ g**
1 tonne(t)	**1000 kg = 1 Mg**
Speed of light in a vacuum	**299792458 m s^{-1} (3.0×10^{8} m s^{-1})**
Rest mass of an electron (m_e)	**0.000548712 u = $9.1093897 \times 10^{-28}$ g**
Rest mass of a proton (m_p)	**1.00727605 u = $1.67262305 \times 10^{-24}$ g**
Rest mass of a neutron (m_n)	**1.008665 u = 1.674954×10^{-24} g**
1 kiloWattHour(kWh)	**3.6 MJ**
1 Joule (J)	**1 kg m^2 s^{-2} = 1.0×10^{7} erg**
1 Coulomb(C)	**6.24×10^{18} e^-**
Electronic charge on an electron	**$1.60217733 \times 10^{-19}$ C**
1 Ampere(A)	**1 Coulomb/s**
1 Volt(V)	**1 J/C = 96.5 kJ/mole**
1 electron volt (eV)	**1.60219×10^{-19} J**
Faraday's Constant	**96,486.7 C/mole e^-**

Significant Figures in Measurement and Calculations Reader

It is important to always label your numbers with units because in Chemistry class our numbers represent measurements. It is also important to only report digits that are reliable – we call these *significant figures.* If we report more digits than we can adequately ensure are reliable then our results will have too high of a margin of error. When we report a number we report:

Figures (digits) definitely known + One estimated figure (digit)

In class you will hear this expressed as "all of the digits known for certain plus one that is a guess."

Recording Measurements

When you read an instrument (ruler, thermometer, etc), you report the reading with the right number of "sig figs" so your data is reliable. For example, in the image below, note the reading marked *A*. This reading is definitely beyond the 7 cm mark and also beyond the 0.8 cm mark. We know the 7.8 with certainty. We then *estimate* that the reading is between the 7.8 mark and the 7.9 mark. So, we estimate the length as 0.05 cm more than 7.8 cm. All of these have meaning and are therefore significant. We express the reading as 7.85 cm, accurate to three sig figs. All of these figures, *7.85*, can be used in calculations. In reading B we see that 9.2 cm is definitely known. We can use one estimated digit in our reading, so we estimate the next digit to be zero. Our reading is reported as 9.20 cm. It is accurate to three sig figs.

Rules for Zeros

If a zero represents a measured quantity, it is a significant figure. If it merely locates the decimal point, it is not a sig fig.

- **Zero Inside a Number**. 9.04 cm, the zero represents a measured quantity, just as 9 and 4, and is, therefore, a significant number. A zero trapped or "captive" between any of the other digits is a significant figure.
- **Zero at the Front of a Number**. 0.46 cm, the zero does not represent a measured quantity, it just locates the decimal point. It is not a sig fig. Also, in the measurement 0.07 kg, the zeros are used to locate the decimal point and are, therefore, not significant. Zeros at the front of a number are "leading zeros" and are not significant figures.
- **Zero at the End of a Number AFTER a Decimal Point**. 11.30 cm, the zero is an estimate and represents a measured quantity. It is significant. Another way to look at this: The zero is not needed as a placeholder, and yet it was included by the person recording the measurement. It must have been recorded as a part of the measurement, making it significant. Zeros to the right of the decimal point, and at the end of the number, are significant figures.
- **Zeros at the End of a Number with NO Decimal Point**. Zeros at the end of a number when there is no decimal point are functioning as place holders and are not actual measured digits. If a distance is reported as 1600 feet, one assumes two sig figs. It could have been 1604 feet, or 1683 feet, we don't know. We only know the number is reliable to the hundreds place so we only report 1600.
- One trick – putting a number in scientific notation can help reduce the number of non significant zeros you are writing down.

1.6×10^3 feet	Two significant figures
1.60×10^3 feet	Three significant figures
1.600×10^3 feet	Four significant figures

Sample Problem #1: Underline the significant figures in the following numbers.

(a) 0.0420 cm	answer = 0.0420 cm	(e) 2403 ft.	answer = 2 403 ft.
(b) 5.320 in.	answer = 5.320 in.	(f) 80.5300 m	answer = 80.5300 m
(c) 10 lb.	answer = 10 lb.	(g) 200. g	answer = 200 g
(d) 0.020 ml	answer = 0.020 ml	(h) 2.4×10^3 kg	answer = 2.4×10^3 kg

Rounding Off Numbers

In reporting a numerical answer, one needs to know how to "round off" a number to include the correct number of significant figures. Even in a series of operations leading to the final answer, one must "round off" numbers. There are different sets of rules out there, the rules here are common and well accepted rules:

1. Less than 5, round down
2. Greater than 5, round up
3. If 5 followed by any number other than 0 round up
4. If 5 followed only by zeros, and the previous number was odd, then round up
5. If 5 followed only by zeros, and the previous number was even then round down

Sample Problem #2: Round off the following to three significant figures.

(a) 3.478 m	answer = 3.48 m	(c) 5.333 g	answer = 5.33 g
(b) 4.8055 cm	answer = 4.81 cm	(d) 7.999 in.	answer = 8.00 in.

Multiplication

In multiplying two numbers, you should inspect the numbers multiplied and find which has the least number of sig figs. This is the number of sig figs you should have in your answer (the product). Thus the answer to 0.024 x 1244 would be rounded off to contain two sig figs since the factor with the lesser number of sig figs (0.024) has only *two* such figures.

Sample Problem #3: Find the area of a rectangle 2.1 cm x 3.24 cm.= *6.804 cm2 → 6.8 cm²*

2.1 contains two sig figs, while 3.24 contains three. Our product should contain no more than *two* sig figs. Therefore, round to 6.8 cm^2

Sample Problem #4: Find the volume of a rectangular solid 10.2 cm x 8.24 cm x 1.8 cm = *151.2864 → 150 cm³*

The number with the fewest sig figs is 1.8 cm. It contains two sig figs so you round your final answer to 2 sig figs.

Division

In dividing two numbers, the answer (quotient) should contain the same number of sig figs as are contained in the number (divisor or dividend) with the least number of sig figs. Thus the answer to 528 ÷ 0.14 would be rounded off to contain *two* sig figs. The answer to 0.340 ÷ 3242 would be rounded off to contain three significant figures.

Sample Problem #5: Calculate 20.45 ÷ 2.4 = *8.52083 → 8.5*

2.4 has fewer sig figs than the 20.45. It has only *two* sig figs.

Therefore, our answer should have no more than two sig figs so round to 8.5.

Addition and Subtraction

In adding (or subtracting), write down the numbers, being sure to keep the decimal places stacked under each other, and add (or subtract). Next, note which column contains the first estimated figure. This column determines the last decimal place of the answer. After the answer is obtained, it should be rounded off in this column. In other words, round to the least number of decimal places in you data.

Sample Problem #6: Add 42.56 g + 39.460 g + 4.1g *Solution:*

42.56 g
39.460 g
+ 4.1 g
Sum = 86.120 g

Since the number 4.1 only extends to the first decimal place, the answer must be rounded to the first decimal place, yielding the answer 86.1 g

Average Readings

The average of a number of successive readings will have the same number of decimal places that are in their sum.

Sample Problem #7: A graduated cylinder was weighed three times and the weightings were 12.523 g, 12.497 g, 12.515 g. Calculate the average weight. *Solution:*

12.523 g
12.497 g
+ 12.515 g
Sum = 37.535 g

In order to find the average, the sum is divided by 3 to give an answer of 12.51167. Since each number extends to three decimal places, the final answer is rounded to three decimal places, *yielding a final answer of 12.512 g*. Notice that the divisor of 3 does not effect the rounding of the final answer. This is because 3 is an exact number - known to an infinite number of decimal places.

Exact Numbers

Exact numbers have infinite number of sig figs. If I were to count how many students were in my classroom I would know there were exactly 35. It isn't possible to have 35.4 students in the room, or 35.8 students. I have *exactly* 35 students. I could report it with an infinite number of zeros but that would clearly not be practical. When performing calculations involving an exact number, you assume the number is infinite sig figs and therefore doesn't determine how many sig figs are in your final answer. Be careful though – a "whole number" isn't always an exact number. If I told you there were four people in my family that has infinite sig figs. But if I told you that I walked 4 miles that is a measurement and only has 1 sig fig. I could have walked 3.7 miles, or 4.2 miles etc.

Sample Problem #8: Convert 12 minutes into hours = 12 / 60 = *0.20 hours* → there are exactly 60 minutes in an hour so the 60 is an exact number. It will not limit your sig figs even though it looks like it only has 1 sig fig. It actually has infinite. Therefore your answer can be reported to two sig figs.

Logarithms, and values like pH and pKa

In answers to logarithmic calculations (like pH and pKa values), only those numbers to the right of the decimal place count as significant. These digits are called the "mantissa."

Sample Problem #8: pH = 10.26 has only two significant figures (this represents a $[H^+] = 5.5 \times 10^{-11}$ M)
pKa = 4.730 has three significant figures (this represents a Ka = 1.86×10^{-5})

When you take the log of a number with X number of significant figures, the result should have X number of decimal places. The number in front of the decimal place only indicates the order of magnitude, it isn't a significant figure.

Sample Problem #9: log (2.4×10^3) = *3.38*02 → 3.38, there were two sig figs in the number you took the log of. So your answer should have two sig figs. 3.38 is two sig figs because the answer to a logarithm problem only counts the numbers after the decimal as significant.
Another example: log (5.5×10^{-11}) = *10.2596* → *10.26*, 5.5×10^{-11} only had two sig figs, so the final answer should only have two sig figs. Since the answer came from a logarithm only the numbers after the decimal are significant so 10.26 only has two sig figs.

Multiple Operations

These last two categories are a bit more complicated to explain in words, so here are some videos that you might find helpful:

When performing multiple operations you need to take into account the "order of operations" Remember the mnemonic: *Please Excuse My Dear Aunt Sally* = Parenthesis, Exponents, Multiplication, Division, Addition, Subtraction

Sample Problem #10 2.0000(1.008 g) + 15.99 g = *18.01*
Perform the multiplication first → 2.0000(1.008 g), = 2.016 g, 4 sig figs because 1.008 was the smallest number of sig figs. Then, perform the addition → 2.016 + 15.99 = 18.006 → round to 2 decimal places since 15.99 only has 2 decimal places.

SCAN ME *https://tinyurl.com /3he62jz8*

Scientific Notation

(Note – the video I am putting here shows doing these by hand. We will typically have a calculator which helps! But you need to still report your answer with the right sig figs!) When multiplying or dividing scientific notation numbers, the sig figs are determined by the number with the least amount of sig figs. Make sure you are careful that you check what your exponent ends up being, even if both numbers have the same exponent to start doesn't mean it won't change when you have your final answer! Common mistake!

SCAN ME *https://tinyurl.com /48jjyeac*

Sample Problem #11 (2.0×10^{12}) / (8.330×10^8) = *2.40096x10^3 → 2.4x10^3*, only 2 sig figs because 2.0×10^{12} only had 2 sig figs.

When adding or subtracting scientific notation numbers, you have to FIRST have the same exponent for each number before you can determine the true number of sig figs. If your numbers have the same exponent then just count the number of decimal places in the mantissa and that will be the number of decimal places to use in your final answer. You make sure your answer is using the same exponent that you started the problem with, adjust your sig figs and THEN you reformat your answer if needed to be a more proper scientific notation format.

Sample Problem #12 (2.113×10^4) + (9.2×10^4) = *11.313 x 10^4 → 11.3 x 10^4 → 1.13 x 10^5* **Calculators can cause real problems for these, be careful!* Only 1 decimal place because 9.2×10^4 only had one decimal place so it limits your answer to 11.3×10^4. But that is not good scientific notation form so adjust it to have one number and then the decimal which results in 1.13×10^5.

If your numbers do not have the same exponent, convert one of them so it matches the other. It won't be in perfect scientific notation form with one number and then the decimal but it doesn't matter because you are just trying to determine the sig figs. Once your numbers both have the same exponent determine which has the fewest decimal places in the mantissa and that will be the number of decimal places to use in your final answer.

Sample Problem #13 (1.032×10^4) + (2.672×10^5) → *convert so they have the same exponent even if it makes your number look weird format. (1.032 x 10^4) + (26.72 x 10^4) → Now follow normal adding subtracting rules → 27.752 x 10^4 → round to two decimal places because 26.72 x 10^4 only had two decimal places so that limits your answer → 27.75 x 10^4 → now fix your format to put it back in proper scientific notation format → Final answer of 2.775 x 10^5*

Summary of Reactions

The AP Test used to have questions where you had to write various types of complex reactions that required memorizing some categories and patterns. Those questions have been removed from the AP Test in terms of having to just write them from memory, but seeing these categories and examples can be helpful when doing other types of problems. You will not have to memorize these categories and examples like you used to, but familiarizing yourself with them will help you do better in general so it is still a good idea to look at this reference sheet!

Anhydrides

- Metallic hydrides plus water produce hydrogen gas and metallic hydroxides.
- Soluble metallic oxides and water form bases (metallic hydroxides).
- Group IA and IIA metallic nitrides react with water to produce metallic hydroxides and ammonia.
- Soluble nonmetallic oxides and water form acids. (Note: The nonmetal retains its oxidation number.)

Combustion

- Hydrocarbons and other organic compounds combine with excess oxygen to form carbon dioxide and water.
- Metals combine with oxygen to form metallic oxides.
- Nonmetallic hydrides combine with oxygen to form water and nonmetal oxides.
- Nonmetallic sulfides combine with oxygen to form sulfur dioxide and nonmetal sulfides.

Complex Ions

- Complex ion solutions treated with a strong acid solution produce the free metal ion or a metal precipitate and the ligand ion.
- An electron pair acceptor is combined with an electron pair donor to form a coordinate covalent compound.
- Metal ion solutions react with an excess of concentrated ammonia to form ammine complex ions.
- Metal ion solutions react with an excess of cyanide solution to form cyano complex ions.
- Metal ion solutions react with an excess of hydroxide solution to form hydroxo complex ions.
- Metal ion solutions react with thiocyanate solution to form thiocyanato complex ions.
- Solid metallic hydroxides when combined with concentrated ammonia solution produce soluble ammine complex ions and hydroxide ions.
- Solid metallic hydroxides when added to hydroxide solution produce hydroxo complex ions.

Decomposition

- Ammonium carbonate decomposes into ammonia, water and carbon dioxide.
- Ammonium hydroxide decomposes into ammonia and water.
- Binary ionic compounds (molten) can be electrolyzed into their metal and nonmetal components.
- Carbonic acid decomposes into water and carbon dioxide.
- Hydrogen peroxide decomposes into water and oxygen.
- Metallic carbonates decompose into metallic oxides and carbon dioxide.
- Metallic chlorates decompose into metallic chlorides and oxygen.
- Oxyacids decompose into water and a nonmetallic oxide.
- Sulfurous acid decomposes into water and sulfur dioxide

Synthesis

- Binary molecular comp. combined w/ a nonmetal (contained in the compound) forms a single compound.
- An electron pair acceptor is combined with an electron pair donor to form a coordinate covalent compound.
- A halogen is added to an alkane forming a halogenated alkane.
- A halogen is added to an alkene forming a halogenated alkane.
- Hydrogen is added to an alkene forming an alkane
- Metals and nonmetals combine to form binary ionic compounds.
- Metal ion solutions react with an excess of concentrated ammonia to form ammine complex ions.
- Metal ion solutions react with an excess of cyanide solution to form cyano complex ions.
- Metal ion solutions react with an excess of hydroxide solution to form hydroxo complex ions.
- Metal oxides combine with carbon dioxide to form metallic carbonates.
- Metal oxides combine with sulfur dioxide to form metallic sulfites.
- Nonmetallic oxides and water form acids. (Note: The nonmetal retains its oxidation number.)
- Soluble metallic oxides and water form bases (metallic hydroxides).

Double Replacement (Metathesis)

- Two soluble ions in aqueous solution may form an insoluble precipitate.
- Metal sulfides when combined with any acid will form hydrogen sulfide gas and a salt.
- Metallic carbonates when combined with any acid will form carbon dioxide gas, water and a salt.
- Metallic sulfites when combined with any acid will form sulfur dioxide gas, water and a salt.
- Ammonium salts when heated with a soluble strong hydroxide will form ammonia gas, water and a salt.
- An acid and a base will form a salt and water.
- A salt formed from a strong acid and a weak base will hydrolyze in water to form a strong acid and a weak base.
- A salt formed from a weak acid and a strong base will hydrolyze in water to form a weak acid and a strong base.

Redox

- Binary ionic compounds (molten) can be electrolyzed into their metal and nonmetal components.
- Chlorine gas reacts w/ *dilute* sodium hydroxide to produce sodium hypochlorite, sodium chloride, and water.
- Copper reacts with *concentrated* nitric acid to produce copper (II) nitrate, nitrogen dioxide, and water.
- Copper reacts with *dilute* nitric acid to produce copper (II) nitrate, nitrogen monoxide, and water.
- Copper reacts with *concentrated* sulfuric acid to produce copper (II) sulfate, sulfur dioxide, and water.
- A halogen is added to an alkane forming a halogenated alkane.
- A halogen is added to an alkene forming a halogenated alkane.
- Active free halogen s replace less active halide ions from their compounds in aqueous solutionn to form a halogen and halide ion in solution.
- Hydrocarbons and other organic compounds combine with excess oxygen to form carbon dioxide and water.
- Hydrogen gas is added to an alkene forming an alkane
- Hydrogen gas reacts with a hot metallic oxide to produce the elemental metal and water.
- Metals and nonmetals can combine to form binary ionic compounds.
- Active free metal s replace hydrogen in acids to form metallic ions and hydrogen gas.
- Active free metals replace hydrogen in water to form metallic hydroxides and hydrogen gas.
- Active free metals replace less active metals from their compounds in aqueous solution to form a metal and metal ion in solution.
- Metal sulfides react with oxygen to produce metallic oxides and sulfur dioxide.
- Nonmetallic hydrides combine with oxygen to form nonmetal oxides and water.
- Nonmetallic sulfides combine with oxygen to form nonmetal sulfides and sulfur dioxide.

Single Replacement

- Active free halogens replace less active halide ions from their compounds in aqueous solution to form a halogen and halide ion in solution.
- Active free metals replace hydrogen in acids to form metallic ions and hydrogen gas.
- Active free metal s replace hydrogen in water to form metallic hydroxides and hydrogen gas.
- Active free metals replace less active metals from their compounds in aqueous solution to form a metal and metal ion in solution.

Atypical Redox Reactions

Note: The following reactions look like single replacements from their reactants but are actually tricky redox reactions.

- Hydrogen reacts with a hot metallic oxide to produce the elemental metal and water.
- Metal sulfides react with oxygen to produce metallic oxides and sulfur dioxide.
- Chlorine gas reacts w/ *dilute* sodium hydroxide to produce sodium hypochlorite, sodium chloride, and water.
- Copper reacts with *concentrated* sulfuric acid to produce copper (II) sulfate, sulfur dioxide, and water.
- Copper reacts with *dilute* nitric acid to produce copper (II) nitrate, nitrogen monoxide, and water.
- Copper reacts with *concentrated* nitric acid to produce copper (II) nitrate, nitrogen dioxide, and water.

PERIODIC TABLE OF IONS

TABLE OF POLYATOMIC IONS

acetate	CH_3COO^-	dihydrogen phosphate	$H_2PO_4^-$	oxalate	$C_2O_4^{2-}$
arsenate	AsO_4^{3-}	hydrogen carbonate	HCO_3^-	perchlorate	ClO_4^-
arsenite	AsO_3^{3-}	hydrogen oxalate	$HC_2O_4^-$	periodate	IO_4^-
benzoate	$C_6H_5COO^-$	hydrogen sulfate	HSO_4^-	permanganate	MnO_4^-
borate	BO_3^{3-}	hydrogen sulfide	HS^-	peroxide	O_2^{2-}
bromate	BrO_3^-	hydrogen sulfite	HSO_3^-	phosphate	PO_4^{3-}
carbonate	CO_3^{2-}	hydroxide	OH^-	pyrophosphate	$P_2O_7^{4-}$
chlorate	ClO_3^-	hypochlorite	ClO^-	sulfate	SO_4^{2-}
chloride	Cl^-	iodate	IO_3^-	sulfite	SO_3^{2-}
chlorite	ClO_2^-	monohydrogen phosphate	HPO_4^{2-}	thiocyanate	SCN^-
chromate	CrO_4^{2-}	nitrate	NO_3^-	thiosulfate	$S_2O_3^{2-}$
cyanate	CNO^-	nitrite	NO_2^-	**POSITIVE POLYATOMIC IONS**	
cyanide	CN^-	orthosilicate	SiO_4^{4-}	ammonium	NH_4^+
dichromate	$Cr_2O_7^{2-}$			hydronium	H_3O^+

KEY: atomic number; symbol; ion charge; ion name (IUPAC)

Example: 26 Fe^{3+} iron (III); Fe^{2+} iron (II)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H^+ hydrogen																1 H^- hydride	2 He helium
3 Li^+ lithium	4 Be^{2+} beryllium											5 B boron	6 C carbon	7 N^{3-} nitride	8 O^{2-} oxide	9 F^- fluoride	10 Ne neon
11 Na^+ sodium	12 Mg^{2+} magnesium											13 Al^{3+} aluminum	14 Si silicon	15 P^{3-} phosphide	16 S^{2-} sulfiide	17 Cl^- chloride	18 Ar argon
19 K^+ potassium	20 Ca^{2+} calcium	21 Sc^{3+} scandium	22 Ti^{4+} titanium (IV); Ti^{3+} titanium (III)	23 V^{3+} vanadium(III); V^{5+} vanadium (V)	24 Cr^{3+} chromium (III); Cr^{2+} chromium (II)	25 Mn^{2+} manganese(II); Mn^{4+} manganese(IV)	26 Fe^{3+} iron (III); Fe^{2+} iron (II)	27 Co^{2+} cobalt (II); Co^{3+} cobalt (III)	28 Ni^{2+} nickel (II); Ni^{3+} nickel (III)	29 Cu^{2+} copper (II); Cu^+ copper (I)	30 Zn^{2+} zinc	31 Ga^{3+} gallium	32 Ge^{4+} germanium	33 As^{3-} arsenide	34 Se^{2-} selenide	35 Br^- bromide	36 Kr krypton
37 Rb^+ rubidium	38 Sr^{2+} strontium	39 Y^{3+} yttrium	40 Zr^{4+} zirconium	41 Nb^{5+} niobium (V); Nb^{3+} niobium(III)	42 Mo^{6+} molybdenum	43 Tc^{7+} technetium	44 Ru^{3+} ruthenium(III); Ru^{4+} ruthenium(IV)	45 Rh^{3+} rhodium	46 Pd^{2+} paladium(II); Pd^{4+} paladium(IV)	47 Ag^+ silver	48 Cd^{2+} cadmium	49 In^{3+} indium	50 Sn^{4+} tin (IV); Sn^{2+} tin (II)	51 Sb^{3+} antimony(III); Sb^{5+} antimony(V)	52 Te^{2-} telluride	53 I^- iodide	54 Xe xenon
55 Cs^+ cesium	56 Ba^{2+} barium	57 La^{3+} lanthanum	72 Hf^{4+} hafnium	73 Ta^{5+} tantalum	74 W^{6+} tungsten	75 Re^{7+} rhenium	76 Os^{4+} osmium	77 Ir^{4+} iridium	78 Pt^{4+} platinum(IV); Pt^{2+} platinum(II)	79 Au^{3+} gold (III); Au^+ gold (I)	80 Hg^{2+} mercury (II); Hg^+ mercury (I)	81 Tl^+ thallium (I); Tl^{3+} thallium(III)	82 Pb^{2+} lead (II); Pb^{4+} lead (IV)	83 Bi^{3+} bismuth(III); Bi^{5+} bismuth(V)	84 Po^{2+} polonium(II); Po^{4+} polonium(IV)	85 At^- astatide	86 Rn radon
87 Fr^+ francium	88 Ra^{2+} radium	89 Ac^{3+} actinium															

58 Ce^{3+} cerium	59 Pr^{3+} praseodymium	60 Nd^{3+} neodymium	61 Pm^{3+} promethium	62 Sm^{3+} samarium(III); Sm^{2+} samarium(II)	63 Eu^{3+} europium (III); Eu^{2+} europium (II)	64 Gd^{3+} gadolinium	65 Tb^{3+} terbium	66 Dy^{3+} dysprosium	67 Ho^{3+} holmium	68 Er^{3+} erbium	69 Tm^{3+} thulium	70 Yb^{3+} ytterbium(III); Yb^{3+} ytterbium(II)	71 Lu^{3+} lutetium
90 Th^{4+} thorium	91 Pa^{5+} protactinium(V); Pa^{4+} protactinium(IV)	92 U^{6+} uranium (VI); U^{4+} uranium (IV)	93 Np^{5+} neptunium	94 Pu^{4+} plutonium(IV); Pu^{6+} plutonium(VI)	95 Am^{3+} americium(III); Am^{4+} americium(IV)	96 Cm^{3+} curium	97 Bk^{3+} berkelium(III); Bk^{4+} berkelium(IV)	98 Cf^{3+} californium	99 Es^{3+} einsteinium	100 Fm^{3+} fermium	101 Md^{2+} mendelevium (II); Md^{3+} mendelevium (III)	102 No^{2+} nobelium(II); No^{3+} nobelium(III)	103 Lr^{3+} lawrencium

How to Set Up Your Daily Practice Problems (DPPs)

Daily Practice Problem #1

HW: *(You copy it down from the board/PowerPoint)*

Questions: *(provided for you - here is an example)*
1) What does temperature measure?
2) Convert 25°C into Kelvin

1) Molecular movement

2) K = C +273

K = 25C + 273 = 298 K

Average movement! Don't forget!

Daily Practice Problem #2

HW: *(You copy it down from the board/PowerPoint)*

Questions: *(provided for you - here is an example)*
1) What sign should Q be if you are heating something up?
2) What SI unit do we use for specific heat capacity?
3) What mass of water would absorb 2.5 kJ of energy while heating 40°C to 45°C?

1) +

2) J/g°C

3) $Q = mC\Delta T \rightarrow m = Q/(C\Delta T)$

$m = (2.5kJ)/(4.18\ J/g°C)(45°C-40°C) =$ ~~0.12g~~

$m = (2500\ J)/(4.18\ J/g°C)(45°C-40°C) =$ 119.6 g

Forgot to convert kJ to J - Check units!

- Daily Practice Problems (DPPs) are graded assignments.
- If you are absent you are required to make up the missed Daily Practice Problems. They can be found on the class website.
- You are responsible for knowing/understanding/following the formatting requirements.
- If you have questions about the formatting requirements it is your responsibility to ask.
- See the back of this paper for more details.

DPP slip glued in! ALWAYS!

Copy down your HW! ALWAYS!

Show all your work! ALWAYS!

Include Units! ALWAYS!

Box your # answers! ALWAYS!

Correct in GREEN pen! ALWAYS!

Highlighter to show end! ALWAYS!

New work under highlighter! ALWAYS!

Cross out with single line! ALWAYS!

More Details about DPPs

1) DPPs are to be completed in your composition book only. No paper(s) can be stapled, taped, etc. into the book and receive credit.
2) May only receive up to FULL credit if the work is done in the composition book on that date.
3) Composition books will be graded in class the same day whenever possible. You may sometimes leave them in class to be graded. Sometimes they will be graded later, or not at all.
4) When graded they may be graded for completion and/or accuracy. Sometimes part of the grade will be whether or not you finished your notes from the previous lesson.
5) Following instructions regarding formatting is not optional. If you do not follow the instructions you will not receive full credit.

Possible Situations:

1) **ABSENT**:
   - You can find the DPPs on the class website. If possible, please print at home and glue into your notebook and complete at home before returning to school so you are not behind.
   - If you cannot print at home as described above, then you must get the DPP slip from the absent bin and do the DPP.
   - **SHOW** me that it was completed according to the standard absent procedure – you get the number of days as you were absent. Absent one day, you get one day. Absent two days, you get two days.
   - If shown to me within the allotted number of days, I will stamp it.
   - If there is no stamp for being absent, the students will earn no more than 50% of the points.

2) **FORGOT TO BRING COMPOSITION BOOK TO CLASS:**
   - If a DPP is completed on paper other than in the composition book, you cannot receive full credit.
   - When a DPP is transferred into your composition book (as in written in), there will be no handwritten grade, but there will be a Transfer Stamp, therefore they may earn up to 75% of possible points for that specific DPP.
   - You must show me your original graded DPP in order to get a Transfer stamp to show that you have transferred the DPP from binder paper into your composition book.
   - If there is no stamp for the transfer, you will only be eligible to earn 50% of the points.
   - Transfer of work into the composition book must occur by the **NEXT** school day.
   - *Transfer*: Means to re-write the information in the composition book, not staple, tape, etc… the paper into the composition book

3) **LOST COMPOSITION BOOK:**
   - Don't lose your composition book…
   - If you lose your composition book you will not have any of the handwritten grades, so there is no record of your scores. Therefore, your redone work will only be eligible to earn up to 50% of the points possible.
   - I strongly suggest you scan or take pictures of your composition book to keep a record of your scores just in case you may have lost it.
     - If you do this, YOUR FULL NAME and THE DATE in INK must be written on each page so I know it is your work.

**Requirements, formatting instructions, grading procedures, etc are subject to change at teacher's discretion. If changes are made you will be notified in class.*

** If a situation arises that is not discussed above, it is your responsibility to bring it to the teacher's attention immediately. If you have questions it is your responsibility to bring it to the teacher's attention immediately.*

How to Set Up Your Notes in AP Chem

DPP #1

HW: *(You copy it down from the board/PowerPoint)*

Questions: *(provided for you - here is an example)*
1) What does temperature measure?
2) Convert 25°C into Kelvin

1) Molecular movement
2) K = C +273
   K = 25C + 273 = 298 K

Average movement! Don't forget!

Calorimetry – using one substance to find values for another substance

Target: I can determine unknown information for a substance by using calorimetry since energy is simply transferred not created or destroyed.

- Cant always know the values for everything
- Energy in = energy out
  - But opposite sign! Careful! Pay attention to sign
- Exothermic = - Endothermic = +
- Qwater = -Qmetal
  - mCΔT = -(mCΔT)

(15g)(4.18J/gC)(31C-20C) = -(5g)(0.75J/gC)(31C-Ti)
Ti = 214.92C

You can do calorimetry with two cups of water!
Instead of Qmetal and Qwater → Qw1 and Qw2

K	C	Q
Add any key terms, vocab words, equations, etc. Bullet points are fine!	*Add connections to other things you have learned about in the past. It could be from this class, another class, the news, a book, etc.*	*Add **two** questions that are representative of the material learned in the notes. Questions you want to ask me, you think someone else would ask, or that you think would be on a quiz/test*

- Notes are graded assignments.
- If you are absent you are required to make up the missed Notes.
- Your notes need to look readable to another person, and should not be cramped together. Use space!
- KCQ Boxes are required to be finished by the start of the next class period. All efforts will be made to post this as an assignment on Schoology each day, but it is expected and required even if something happens and it is not posted. You now know it is a daily requirement!
- You are responsible for knowing, understanding, and following the formatting requirements.
- If you have questions about the formatting requirements it is your responsibility to ask.
- Notes should reflect effort, thought, detail, reflection, and should demonstrate processing and learning taking place.

Don't need a new page, just continue!

Highlighter to show separation btwn work

Descriptive underlined title for notes

Target in RED below the title

Take notes in a format you like

Include ALL important details

Practice problems are required!

Meaningful addition of THREE other colors

KCQ Boxes at the end of the set of notes

EXAMPLE GRADING RUBRIC

This example gives you an idea of the types of things I look for when grading notebooks. This is not a guaranteed format or amount of points, it is simply an example to help guide you into doing complete and quality work. Notebook checks will be announced and unannounced. No points will be awarded if you fail to have your notebook on a collection day, either announced or unannounced.

Chapter 14 Composition Notebook Grade Sheet			
Name:		**Period:**	**Seat #:**
ITEM	**COMMENTS**		**SCORE**
N46 Acids and Bases and pH calculations pH Calculations Chart pH Square x 2	☐ No title ☐ Non-descriptive/obvious title ☐ No Target in red pen ☐ Incomplete notes lacking info ☐ No color	☐ Min. Color &/or not used meaningfully ☐ No KCQ boxes ☐ KCQ incomplete/lacking effort/detail ☐ Other	10
N47 Nomenclature, Strong Acids/Bases, Ionization of Water Naming Glue In	☐ No title ☐ Non-descriptive/obvious title ☐ No Target in red pen ☐ Incomplete notes lacking info ☐ No color	☐ Min. Color &/or not used meaningfully ☐ No KCQ boxes ☐ KCQ incomplete/lacking effort/detail ☐ Other	10
Warmup #22	☐ Missing ☐ Not graded	☐ No transfer stamp ☐ Other	5
N48 Weak Acids and Bases Glue In Practice Problems x 2	☐ No title ☐ Non-descriptive/obvious title ☐ No Target in red pen ☐ Incomplete notes lacking info ☐ No color	☐ Min. Color &/or not used meaningfully ☐ No KCQ boxes ☐ KCQ incomplete/lacking effort/detail ☐ Other	10
Warmup #23	☐ Missing ☐ Not graded	☐ No transfer stamp ☐ Other	5
Warmup #24	☐ Missing ☐ Not graded	☐ No transfer stamp ☐ Other	5
N49 Salts Steps Glue In Chart Glue in x 2	☐ No title ☐ Non-descriptive/obvious title ☐ No Target in red pen ☐ Incomplete notes lacking info ☐ No color	☐ Min. Color &/or not used meaningfully ☐ No KCQ boxes ☐ KCQ incomplete/lacking effort/detail ☐ Other	10
N48 Titrations Hands On Lecture	☐ No title ☐ Non-descriptive/obvious title ☐ No Target in red pen ☐ Incomplete notes lacking info ☐ No color	☐ Min. Color &/or not used meaningfully ☐ No KCQ boxes ☐ KCQ incomplete/lacking effort/detail ☐ Other	10
		Total 65	

Sometimes things are simply graded on a 0-3 scale more for general completion. One point would be deducted for each item missing or unfinished. A decent effort must be made on each part to receive full credit.

Example: *Student had all parts of the notes finished with effort*	Example: *Student didn't finish KCQ Boxes, but the rest is done*	Example: *Student didn't do KCQ boxes or annotations, but did take notes with Target*
0 1 2 **(3)**	0 1 **(2)** 3	0 1 2 **(3)**

LAB INFORMATION PACKET

PRE-Lab Assignment

USE BLACK OR BLUE PEN IN YOUR LAB NOTEBOOK. NO PENCIL or ERASABLE PEN!
You can use color to annotate, but the majority of the writing needs to be in black or blue pen.
Make a mistake? Cross out with a SINGLE line. NO WHITE OUT – EVER!

GENERAL GUIDELINES

- **Done in your Lab Notebook. Will physically turn in Lab Notebook and/or submit photos digitally.**
- Prelab due prior to the beginning of lab (data tables must be created as part of the prelab, will be filled out later).
- You may not participate in a lab without having it completed.
- The top of your lab handout will tell you which sections need to be completed each time.
- Do NOT do extra sections than what is asked for at the top of your lab handout.
- Sections must be done in the order listed here unless the lab handout says otherwise.
- Sections must be clearly labeled.
- Headers must be filled out at the top of each lab, and you must initial and circle your initials in the bottom right-hand corner of every page. The sticker in the front of your lab notebook shows you how to set up the headers.
- Will sometimes be graded for completion and/or accuracy. Not all completed sections will necessarily be graded every time, one section might be chosen, or all might be chosen for grading.
- Professionalism matters – If I can't read it, if it looks like you did it last minute walking to class, if it looks like you put no thought, effort, care, detail into your work, that will be reflected in your score.
- Must use adequate spacing between sections to keep your work clear and understandable. Do NOT try to save space. You have plenty of pages in your lab notebook. Clearly communicating your work matters more than saving a few pages in your lab notebook. Worst case, I get you a second lab notebook if you run out of space!

PURPOSE/GOAL/QUESTION OF THE EXPERIMENT

a. State the general chemistry principle being studied.
b. State any specific results to be obtained.

HYPOTHESIS

a. Must be done BEFORE the lab starts – we never come up with a hypothesis after we do the lab!
b. Must have the three required parts:
   - If _____ (*If I add fertilizer to the soil…)*
     - What are you physically doing in the lab. Be specific. Include chemicals that are being used. Include named techniques you are using.
   - Then _____ (…*then the tomato plants will grow taller than the plants without fertilizer…)*
     - What results do you expect to see/obtain? If you have been paying attention to the lessons in class this shouldn't be hard to predict! Our labs are demonstrating concepts we are learning!
   - Because _____ (…*because fertilizer has extra nutrients to promote growth than the control soil has.)*
     - Needs to be a scientific explanation. It is showing you understand what we have learned in class and which scientific principle/concept is the explanation for what you are seeing in lab!
c. These do not literally have to use the words if/then/because – you can use more sophisticated or varied verbiage if you would like.

PRE-LAB QUESTIONS/TASKS

a. Complete any listed pre-lab questions.
b. Number all questions.
c. Must show all work for calculations.
d. Do not recopy the question. Paraphrase it into your answers so a reader can infer what the question was.
e. Full sentence answers are not needed, but complete, detailed and Honors level answers are required!
f. Box any final numerical or short phrase like answers.

MATERIALS

a. List all needed chemicals, and equipment in a bullet list.
b. Yes this will match your lab handout – that is ok.
c. Make sure you include relevant concentrations, states of matter, etc.

REAGENTS TABLE

Name	Formula	Molecular Weight (g/mol)	Physical and Chemical Properties	First Aid Measures	Fire Measures	Accidental Release Measures
		SAMPLE – make yours as big as needed!				

a. Any chemicals with a * need to be included.
b. Provide the above info for the state (s, l, g, aq) that is being used in the lab. Sometimes there is different information based on if we are using the solid, liquid, gas form.
c. Note safety/cleanup points (if provided on MSDS – **BE DESCRIPTIVE!**)
d. We don't really use physical MSDS books anymore. This is my "go-to" MSDS site, but if there is a chemical not listed here then just Google "MSDS" and then the chemical name, look for a free site that has it.

SCAN ME

https://www.flinnsci.com/sds/

e. DO NOT squish your information into the table. DO NOT do this at the last minute. **SAFETY MATTERS!**

PROCEDURE

a. Rewrite the procedure in your own words and in FLOW CHART STYLE! A flow chart is a highly visual representation of information. It is not a bunch of sentences with boxes around them…
b. Do not copy directly from lab handout!
c. Full sentences not needed.
d. Do not combine steps. Keep the original numbering system in the lab handout. This is important in case we make changes to the lab, or if you need help you can tell me which step you are on.
e. Included drawings of lab setups when applicable. Label the drawings and equipment names.
f. Add reminders, equations, notes to yourself, etc.
g. The intention is to *think about* the steps by putting it in your own shortened and more visual version.
h. You should be able to do the lab with nothing but your notebook!

DATA TABLE SECTION

a. Setting up data table(s) BEFORE the lab starts is part of your pre-lab. The setup may be checked even though you won't be adding data until during the lab. Finished version checked with Post-Lab.
   - I will sometimes show you an example Data Table in the lab handout, but it is not always a finished table! You must always make sure your table is complete, has all the required parts, etc. You do not need to set your table up the same as my sample table necessarily.
b. Must include sections for QUANTATATIVE and QUALITATIVE data.
c. Make it large – does not have to be an entire page, but it needs to be sufficiently large.
d. Give tables a **descriptive** title. It should specifically mention any rxn(s) that is occurring as part of the title.
   - If I found your data table on the floor, I should know exactly which lab it is for.
   - Bad titles – Data Table, Lab Data, Temperatures taken, Taking temperatures of my reaction
   - Better titles – Effect of Concentration on Absorbance, pH of Common Household Substances, Temperature Change for the Reaction of $MgCl2 + 2Na(OH) \rightarrow Mg(OH)_2 + 2NaCl$
e. Must have labels and units in the headers of the columns/rows.
f. Data collection should reflect the significant figures that are appropriate for each piece of equipment you are using. Remember that our equipment is inherently limited in precision!
   - Always record data with the appropriate sig figs for **that** device! Some devices/equipment have more/less sig figs than others.
   - Final calculations will be limited by the smallest number of sig figs from the equipment. We worry about that when doing the calculations, not when recording our data.
g. Qualitative observations must be descriptive and detailed. It is not sufficient to say "it changed colors," or "it reacted." Qualitative data is as important as quantitative data!

This pre-lab assignment can change at teacher's discretion

ALWAYS read the top of the lab handout, the assignment instructions posted on Schoology and listen to your teacher's instructions!
Those supersede what is on this handout – this is a generic set of guidelines and expectations.
If in doubt – ASK! Ahead of the due date!

POST-Lab Assignment

USE BLACK OR BLUE PEN IN YOUR LAB NOTEBOOK. NO PENCIL or ERASABLE PEN!
You can use color to annotate, but the majority of the writing needs to be in black or blue pen.
Make a mistake? Cross out with a SINGLE line. NO WHITE OUT – EVER!

- **Will physically turn in your Lab Notebook and Two Pager handout and/or will submit photos of work digitally.**
- **Filling out data tables during lab, Calculations Section and Discussion Questions will be done in your Lab Notebook.**
- **The rest of the sections will be done on your "Post-Lab Two Pager" handout.**
- The top of your lab handout will tell you which sections need to be completed each time.
- Do NOT do extra sections than what is asked for at the top of your lab handout.
- Not all sections on the Two Pager will be relevant to each lab. One of the things you are being assessed on is whether you can accurately determine which sections are relevant to the lab!
    - If a section is not relevant you can leave it blank, put a slash or x through it, or write NA for "not applicable."
- Will sometimes be graded for completion and/or accuracy. Not all completed sections will necessarily be graded every time, one section might be chosen, or all might be chosen for grading.
- Professionalism matters – If I can't read it, if it looks like you did it last minute walking to class, if it looks like you put no thought, effort, care, detail into your work, that will be reflected in your score.
- You must use adequate spacing and handwriting size to keep your work clear and understandable. Do NOT try to save space. You can always staple on an extra piece of binder paper to the back of your Post-Lab Two Pager. Clearly communicating your work matters more than saving a few pieces of paper.
    - If you run out of space for a section and finish it on binder paper, make sure to tell me that on your Post-Lab Two Pager so I don't mark you down before seeing your binder paper!

POST-LAB NOTEBOOK WORK

DATA TABLES

a. You started your data tables in your prelab and then filled them out during the lab.
b. They get turned in with Post-Lab Notebook Work.
c. Will be looking for:
    - Descriptive title, all data recorded, labels and units where needed, data recorded with appropriate sig figs based on the equipment being used, detailed and descriptive qualitative observations, any notes if something went wrong during the lab, etc

CALCULATIONS

a. Not all labs will have calculations. However, if there are ANY calculations happening you need to show them.
b. Must show ANY calculation or manipulation of numbers done during and/or after the lab. If it is not a direct measurement there should be evidence of it in the calculation section.
c. Sometimes the results of calculations are also put into your data tables. You still need to show the calculations here!
d. Even "simple" calculations need to be shown. Includes adding, subtracting, metric conversions, averaging trials, etc.
e. If the lab handout listed specific calculations in a numbered list then make sure to number the calculations in your lab notebook to match the lab handout.
f. Make sure to give a short label of what you are calculation I know what the calculation is.
g. The "flow of work" must be clear – if I can't follow what you are doing, if it is just random numbers scribbled on the page then I can't/won't grade it. Professionalism and clearly communicating thoughts matters even for calculations!
h. Make sure you include units EVERYWHERE!

POST LAB DISCUSSION QUESTIONS

a. Number all questions.
b. Do <u>not</u> recopy the question. Paraphrase into your answers so a reader can infer what the question was.
c. Complete sentences not needed unless asked for. Complete thoughts and answers ARE needed!
d. If it involves a calculation make sure to show all work, use units, sig figs, label and/or describe what you are doing etc.
e. Answer with the level of thought and detail expected of your level of chemistry!

The Post-Lab Notebook Work should be done before you do your Two Pager.
It will help prepare you for the things that you will need to put on your Two Pager.

POST LAB TWO PAGER SECTIONS

LAB TITLE

a. I am fine if you use the same lab title that is on your lab handout.
b. If you make your own lab title it should still be specific.

TOPIC

a. Make sure you are telling me the topic not the chapter or subtopic.
   - Chapter = big broad category (*Thermochemistry)*
   - Topic = the concept the lab is covering (*Calorimetry)*
   - Subtopic = too specific, a fact or part of the topic (*Specific heat)*

KEY VOCAB TERMS

a. This should be a bullet list of all the key terms related to the topic, not just words you haven't heard before!
b. Just list them, you do not need to define them.

KEY EQUATIONS

a. This is where you tell me equations that will be relevant to the lab, not showing how you do your calculations.
b. Make sure you label the equation so people know what it is for. Example – Density D = m/V

KEY CONCEPTS EXPLAINED

a. Written in complete sentences.
b. This is sometimes called a "Background Paragraph."
c. It should be a summary of the topic the lab is about.
d. It should read like a very dense little textbook paragraph.
e. If I asked you to tell me everything you have learned about "Intermolecular Forces" you should pack it full of detail and specifics! I will be looking for specific key points.
f. You are NOT telling me the procedure of the lab. You should connect it to the lab at the end of your paragraph.

IMPORTANT OR UNIQUE LAB EQUIPMENT, SET UP, or NAMED LAB TECHNIQUES

a. You are NOT listing your materials section. You are NOT telling me the procedure.
b. You are showing me any special/new/unique equipment that is important to the lab, and describing any special techniques that will be used in the lab.
c. Label drawings, explain how special equipment works, how you do the named lab techniques etc
d. Examples – If you are using a digital balance to weigh an object before and after you do something to that object you would draw a picture of the balance and explain that you will be "weighing by difference"

SIG FIGS RELATED TO LAB EQUIPMENT

a. Report how many sig figs the each piece of lab equipment had and which one limited the sig figs in your calculations.
b. Example – Digital Balance = 5 SF, Graduated Cylinder = 4 SF, limited by graduated cylinder
c. Your calculations should reflect the appropriate number of sig figs based on the equipment used in lab.

YOUR EXPERIMENTAL RESULTS

a. List the final results you obtained.
   - You are NOT listing all your data or individual trials – we average trials together, we don't report every single one.
b. Include all relevant results. Often students will be testing multiple things and only report one of the results.
c. Clearly label what your results are and have units on them. Do NOT just put a number in the box.
d. Your experimental results may not always be numerical. That is fine! Depends on the lab.

ACCEPTED VALUE/RESULTS

a. What value/result should you have gotten? What is considered the "correct" answer?
b. This will either be given to you in the lab handout, during class, or you will look it up online.
c. It is fine if you didn't get this! Your experimental results don't always match the accepted ones - labs aren't perfect!

PERCENT ERROR AND/OR PERCENT YIELD CALCULATIONS

a. Sometimes we calculate Percent Errors, or Percent Yields, or describe in words what the error was, etc.
b. If it is a calculation (percent error, percent yield, etc) then make sure to show the calculation.
c. If it is not a calculation make sure you are being detailed in your written description.

POSSIBLE LAB ERRORS

a. This is one of the hardest and most important sections. Take it seriously!
b. Number the errors so that you can refer to them easily in the next box.
c. I will be looking for very specific key errors that are "big deals" to the lab. Yes, you have figure out what those are!
d. Do not ever say "human error" – that isn't a "thing!" Obviously we are humans, not aliens or cats.
e. ONLY say errors that did or may have reasonably happened. If you didn't knock over your beaker, or mix up your test tubes, of have Godzilla come break your scale, don't list those as error! Don't list all sorts of crazy things!
f. You are listing errors that are built into the way we did the lab or things that truly happened. Example – We did not maintain a constant temperature during the reaction, we did not specify how long to let the reaction stir for, we did not use real filter paper when filtering our product we just used coffee filters, etc.
g. If you list a source of error you should be able to brainstorm a way to fix it! Example – change lab procedure to specify how long to stir the rxn for, use better filter paper to trap more particles, etc. I can, and will ask you for your ideas!
h. If you really did make an error that is ok – as long as you tell me about it. If you forgot to heat your reaction like the procedure said then list that. But make sure you can tell me what affect that might have had on your final results. Example – reaction mixture was not heated, you should be able to tell me that means you will make less product if I ask you. AND you should be more careful next time!
    - If an error you make ever impacts your data to the point that it is useless - you will either get data from another group or use sample data that I provide. Talk to me and we will decide which is best based on which lab it is.

MATHEMATICAL IMPACT OF LAB ERRORS ON RESULTS

a. One of the other hardest and most important sections! Take it seriously!
b. For each error you listed in your Lab Error box you need to tell me what the impact on your results were.
    - Example: If Error #1 was that some of your solid product slipped under the filter paper then your Mathematical Impact box would say: Error #1 = Final yield of product will be lower than accepted.

WAY TO EXTEND OR IMPROVE THIS LAB

a. Think of a way to improve the lab procedure to help address one or more of your sources of error, or a way to extend the lab to test another substance/variable/aspect to further your learning.
b. Be specific! You can't just say something like "do another trial, "test a different compound" or "use better equipment."
c. Make sure to explain how/why this would be a good change or addition.

EXAMPLE TEST QUESTION ON THIS TOPIC

a. Brainstorm a question related to the lab topic that you think I might put on a quiz or a test.
b. You may NOT copy the question from a worksheet or the internet. Copying results in a zero. Do not try to play games and "paraphrase" it by changing one word…that counts as plagiarizing too! Actually think of your own question.
c. Write the Q out exactly as it would be on a quiz or test – if it needs data then make up fake numbers and include them.
d. Make sure your question shows sufficient depth and complexity so that I can tell that you have learned what is important from this chapter! Do NOT just say something like "tell me everything you know about intermolecular forces." Do NOT say something specific to the lab like "what was the molar mass of the unknown in the lab?"

SOLVED EXAMPLE TEST QUESTION ON THIS TOPIC

a. Show all your work and solve the question you came up with. If it is not a math question that is ok, but give a through and detailed answer with key terms/phrases etc.

The Post-Lab assignments can change at teacher's discretion

ALWAYS read the top of the lab handout, the assignment instructions posted on Schoology and listen to your teacher's instructions!
Those supersede what is on this handout – this is a generic set of guidelines and expectations.
If in doubt – ASK! Ahead of the due date!

Make-up Lab Sheet for Missed Lab Assignment

You can print copies of this on the "Labs" tab of the class website. You have one day longer than you were gone to complete this assignment. Gone one day, then you get two days to complete. Gone two days, then you get three days. If you were present for the lab but did not participate then it is due the next day.

Name:
Period:
Seat #:

Write the name of the missed lab here: _____

Write the date that the lab was originally performed here: _____

Instructions: Interview at least three (3) students who were present for the lab activity and have them verbally answer the questions listed below. Take notes while discussing the lab and staple them to this paper. Please have your interviewees provide their names and signatures in the table below. Turn this paper into the absent basket. Also collect lab data from another student, record in your lab notebook as if you had been present for the lab. Finish the rest of the Post-Lab work as if you had been here.

Interviewee Name (Printed)	Their Period/Teacher	Signature

Now, YOU answer the following questions on this sheet:

1. What was the main idea that this lab activity was trying to demonstrate?

2. How did the lab activity demonstrate this idea (i.e., what did people do to find out the main idea?)

3. How does the information from questions 1 and 2 relate to what we are currently studying?

4. Identify at least one applicable (or use) for the information presented in the lab; that is, how could the information relate to you own personal use, an industrial use, or a societal application?

5. Write two test questions that would be fair to ask about this lab on a unit test or a quiz.

Dougherty Valley HS Chemistry
Post Lab Two Pager

Use binder paper if you need more space!

Worksheet #____B

Name: **Period:** **Seat#:**

Lab Title	**Topic**
Purpose/Question/Problem/Goal/Hypothesis	
Key Vocab Terms	**Key Equations**
Key Concept Explained	
Important or Unique Lab Equipment, Set Up, or Named Lab Techniques	**Sig Figs Related to Lab Equipment**
Your Experimental Results	**Accepted Value/Results**

Error Calculations/Reporting	
Possible Lab Errors	**Impact of Lab Errors on Results**
Way to Extend or Improve this Lab	
Example Test Question on this Topic	**Solved Example Test Question on this Topic**

Things to Turn In

- **Prelab –** Done in lab notebook, photos turned in on Schoology before the lab.
- **Post Lab –** Turned in after the lab. Photos turned in on Schoology. Due dates will be told to you in class.
  - **Page 1 –** Data Tables – Done in lab notebook.
  - **Page 2 –** Calculation Section – Done in lab notebook.
  - **Page 3 –** Post Lab Questions – Questions on lab sheet, answers done in lab notebook.
- **Post Lab Two Pager –** Done on this template, photos turned in on Schoology. Only do sections that are relevant to the lab.
- **Post Lab Quiz –** If done, will be on a pop lab quiz, or questions may appear on other pop quizzes, chapter quizzes or tests/finals.

Dougherty Valley High School Chemistry

General Feedback about Pre-Labs

ONLY BLACK OR BLUE PEN

- Read ALL of R-15…not just the first page!
    - Use it as a checklist if you want! Print more copies from the website!
- Fill out headers and initial (and circle your initials) on the bottom right hand corner of <u>every</u> page.
- Stop squishing things
- Include ALL asked for parts
    - Don't include things that weren't asked for
- DON'T COPY!
    - That means don't copy background info, procedures, etc
- Shorten procedures
    - Get right to the point! Just enough to jog your memory! Stop writing so much!
    - A Flow Chart is meant to be partially visual! Not just drawing boxes around a bunch of writing!
- Reagent tables need to be filled out!
    - Writing "don't eat it" in every safety concern box is not going to get you points…obviously don't eat ANYTHING in the lab. List things like flammability, skin irritant, etc. Actually look it up!
- Don't leave pre-labs until the very last minute…

What do I do once my lab is pre-lab is graded?

- Unless you got 100% you should go over the "Feedback Rubric" provided by your teacher.
- Fill out the "self-assessment" column with comments about where you have room for growth.
- Talk to your teacher if you need help of have questions!

Satisfied with your pre-lab score?

- Do not get complacent!
    - We need to show growth, improvement, and refinement as the year goes on.
    - Expectations do not remain stagnant – they grow as our skills should be growing as the year goes on! Turning in the same level of work in August as in May is not the goal! You should be getting better and better as the year goes on.

Not satisfied with your pre-lab score?

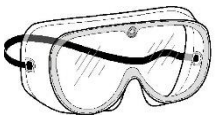
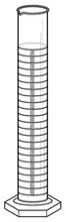
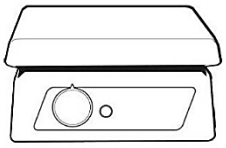
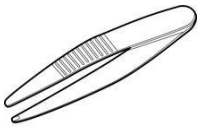
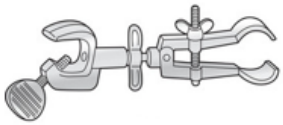
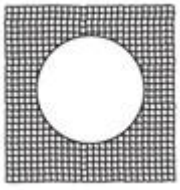
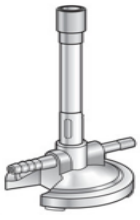
- Fill out the "Pre-Lab Feedback Rubric" – Should show that you reflected on where you went off track.
- Make corrections on a piece of binder paper for any sections you would like me to regrade.
    - Ask questions! Come to Access Period! I will help you but you need to ask and do your part!
- Use homework pass to resubmit it
    - Fill out a "Gold Form" found next to the turn in baskets in the classroom.
    - Staple your binder paper of corrections to the back of the Gold Form.
    - Place your Gold Form inside your lab notebook sticking out the top like a bookmark on the page where your original pre-lab started.
    - Put the entire thing in the "Late or Redo" basket
- Do not ask me when your redo will be graded. I grade all on time and current work first, redo and late work gets graded when I have time.

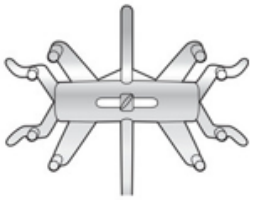
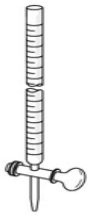
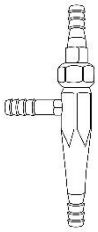
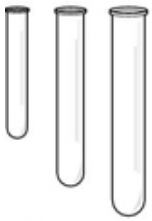
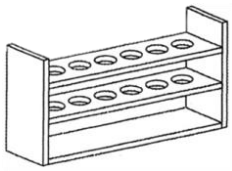
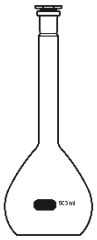
Need help?

- Ask BEFORE the day it is due!
- Come see me during brunch/lunch/access or email me!
- Don't email me at a crazy hour of the night the day before it is due…that is not being responsible…

Add this to your R-15 lab info Reference Sheets!

Common Laboratory Equipment and Techniques

Safety Splash Goggles 	Beaker 	Erlenmeyer Flask 	Graduated Cylinder 
Distilled Water Wash Bottle 	Beaker Tongs 	Crucible Tongs 	Test Tube Tongs 
Hot Plate 	Spatulas and Scoopulas 	Disposable Pipette 	Rubber Policeman 
Forceps 	Ring Stand 	Iron Support Ring 	Utility Clamp 
Wire Gauze with Clay Center 	Bunsen Burner 	Flint Striker 	Clay Triangle 

Crucible with Lid 	Evaporating Dish 	Burette Clamp 	Burette 
Filter Flask 	Buchner Funnel 	Aspirator for Sink 	Glass Funnel 
Test Tube Brush 	Test Tubes 	Test Tube Rack 	Morter and Pestle 
Volumetric Flask 	Glass Watch Glass 	Volumetric Pipette 	Rubber Pipette Bulb 
Rubber Stoppers 	SCAN ME **Common Lab Techniques:** https://tinyurl.com/3eyn4faa	You will sometimes be asked to look at certain sections of this Common Lab Techniques PowerPoint as part of your “Pre-Lab” assignments. This will maximize our in class lab time and help ensure that you are safe in the lab.	

Dougherty Valley HS Chemistry - AP
Honors Review – Review of Commonly Missed Honors Topics

Worksheet #1

Name: **Period:** **Seat#:**

Directions:
This worksheet is not intended to be done in one night! You will have a couple days to work on it. Do some each night! The intention of this assignment is to make sure that you are *really* "solid" in your formulas so that you are not slowed down as we proceed into the new AP Chem material. This is the equivalent of learning your alphabet so you can write a five page essay in a timed write setting. If you don't know your alphabet you can't write words, sentences, paragraphs, or your five page essay!

In each blank:

a) Write the balanced chemical equation for the dissolution in water of this ionic compound
b) Highlight or circle the side that is predominant in a 1 M solution (use solubility rules!). If the reactant is not soluble then you would highlight the reactant side. If the reactant is soluble then you would highlight the product side.
c) If compound is a metal oxide or metal hydride, write the appropriate reaction with water, not a dissociation.
$MO + H_2O \rightarrow M(OH)$ $MH + H_2O(l) \rightarrow M(OH) + H_2(g)$
d) Here is a link to the solubility rules →

https://tinyurl.com/yau4dlfx

1) Zinc iodide
2) Potassium phosphate
3) Magnesium nitrate $Mg(NO_3)_2\ (s) \rightarrow Mg^{2+}\ (aq) + 2NO_3^-\ (aq)$
4) Lithium hydride
5) Calcium carbonate
6) Manganese (II) sulfide
7) Manganese (IV) hydride
8) Aluminum oxide
9) Sodium cyanide
10) Manganese (II) sulfate

11) Ammonium sulfide
12) Copper (III) oxide
13) Iron (II) chloride
14) Barium oxide
15) Calcium phosphate
16) Mercury (II) chloride
17) Calcium hydroxide
18) Sodium chromate
19) Aluminum nitrate
20) Potassium bromate
21) Cesium oxide
22) Cobalt (II) chloride
23) Zinc sulfide
24) Iron (II) nitrate
25) Sodium hypochlorite

Extras to Practice – You can (and will) be assigned some of these occasionally. They can (and will) show up on homework, pop quizzes, quizzes, tests, and the AP test.

26) Lithium nitride	**57)** Calcium hydroxide	**87)** Lithium bromide
27) Barium chloride	**58)** Iron (II) oxide	**88)** Potassium sulfite
28) Zinc hydroxide	**59)** Nickel (II) chloride	**89)** Potassium permanganate
29) Nickel (II) nitrate	**60)** Cobalt (II) nitrate	**90)** Ammonium thiocyanate
30) Potassium dihydrogen phosphate	**61)** Ammonium nitrate	**91)** Sodium oxalate
31) Magnesium oxide	**62)** Lead (II) carbonate	**92)** Sodium sulfide
32) Lithium oxide	**63)** Barium nitrate	**93)** Lithium carbonate
33) Silver chloride	**64)** Nickel (II) sulfate	**94)** Sodium chloride
34) Barium acetate	**65)** Copper (II) chloride	**95)** Potassium oxide
35) Sodium bromide	**66)** Tin (II) nitrate	**96)** Copper (II) sulfate
36) Sodium phosphate	**67)** Potassium hydrogen carbonate	**97)** Copper (II) sulfide
37) Calcium chloride	**68)** Strontium oxide	**98)** Magnesium carbonate
38) Calcium oxide	**69)** Potassium dihydrogen phosphate	**99)** Potassium bromide
39) Strontium nitrate	**70)** Iron (II) sulfite	**100)** Hydrogen peroxide
40) Calcium sulfite	**71)** Copper (II) oxide	**101)** Potassium thiocyanate
41) Sodium hydrogen carbonate	**72)** Sodium hydride	**102)** Manganese (IV) oxide
42) Sodium dichromate	**73)** Potassium sulfate	**103)** Copper (II) nitrate
43) Potassium iodate	**74)** Hydrogen chloride	**104)** Sodium chromate
44) Calcium fluoride	**75)** Nickel (II) bromide	**105)** Iron (III) oxide
45) Sodium fluoride	**76)** Strontium chloride	**106)** Ammonium carbonate
46) Iron (III) nitrate	**77)** Magnesium iodide	**107)** Barium hydroxide
47) Lead (II) acetate	**78)** Sodium acetate	**108)** Ammonium sulfate
48) Aluminum sulfate	**79)** Hydrogen iodide	**109)** Ammonium chloride
49) Potassium dichromate	**80)** Potassium carbonate	**110)** Potassium chlorate
50) Sodium sulfate	**81)** Iron (III) chloride	**111)** Sodium oxide
51) Lithium hydrogen carbonate	**82)** Sodium iodide	**112)** Potassium iodide
52) Sodium hydroxide	**83)** Lead (II) nitrite	**113)** Tin (II) chloride
53) Sodium permanganate	**84)** Hydrogen sulfide	**114)** Aluminum hydroxide
54) Sodium sulfite	**85)** Potassium hydroxide	**115)** Iron (III) sulfate
55) Zinc carbonate	**86)** Silver nitrate	**116)** Zinc nitrate
56) Calcium acetate		

Acid Naming

Acid naming is not always taught in all Honors Chem classes. If you need a tutorial on naming acids please see a brief overview here, or use Google…you have a world of info at your fingertips! Get used to using it! ☺
https://tinyurl.com/yd3zrord

1) Hydrofluoric acid	**2)** Phosphoric acid	**3)** Sulfuric aicd
4) Nitric acid	**5)** Hydrobromic acid	**6)** Oxalic acid
7) Formic acid	**8)** Nitrous acid	**9)** Hydroiodic acid
10) Acetic acid	**11)** Hydrochloric acid	**12)** Find one more acid not on this list, name it and write the formula.

Organic Compound Formulas

Naming organic compounds gets really tricky, really fast. We will not be covering much of this topic, but you should look up these commonly seen organic compounds on Google, so you start to notice some patterns. Try to look for the formula as well as the shape. The shape of the molecules may have some patterns to them. What do you notice about the prefix and the suffix of the compounds? Are there patterns? Noticing patterns like this can speed things up for you a lot during the year – it is a skill you should practice!

1) Ethanoic acid	**2)** Ethanol	**3)** Methanoic acid
4) Hexane	**5)** Butanol	**6)** Propane
7) 1-propanol	**8)** Ethanol	**9)** Ethane
10) Methane	**11)** Propene	**12)** Benzene
13) Propanoic acid	**14)** Dimethyl ether	**15)** Ethyne (acetylene)

Molecular Compounds

It is VERY important to know how to draw good Lewis Structures! It is one of the most frequently missed Honors Chem topics not because it is inherently difficult, but because people wont follow the steps! PLEASE use my method for drawing Lewis Structures because it will work every time! There is an overview of the steps below, but if you need more review please consider watching my YouTube lectures on this topic. Links are below.

Steps to Draw Lewis Dot Structures

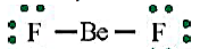
1) **Count** and sum valence electrons
2) **Place** atoms
   - Least electronegative atom in the center
   - Hydrogen is always on the outside
3) Bond all atoms with a **single bond**
4) Give all atoms a **full shell**
5) **Re-count** the # of e- used
6) **Used too few?** Give them to the central atom
7) **Used too many?** Try double or triple bonds to fix it!
   - Take a pair away from two neighboring atoms
   - Put a pair between them to form the extra bond
   - *"Take two away, put one back in between"*

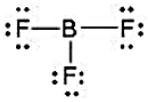
✓ **Correct number of valence electrons used ???**
✓ **Is each atom "happy" now ???**

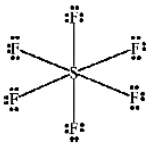
Exceptions to the Octet Rule

Some elements have a tendency to break the octet rule. This is a list of the common ones that break the rule. Please know that you should always draw the best structure possible, and sometimes that means something will break the octet rule even if it isn't listed here. You can only do the best you can do!

- **H – 2**
- **Li - 2**
- **Be - 4**
- **B - 6**
- **P - 10**
- **S – 12**







Part A	Part B	Part C
https://youtu.be/on_-k2-jvns	https://youtu.be/HeX66BXt2-w	https://youtu.be/KBP_sUPYK3E

Write the formula for the molecular compounds below, count the number of valence electrons the molecule has, and then draw a valid Lewis Structure. Make sure to use lines for bonds, and leave lone pairs as dots.

1) Phosphorus trihydride *Formula* *# of ve-* PH_3 8	**2)** Boron trifluoride *Formula* *# of ve-*	**3)** Sulfur dioxide *Formula* *# of ve-*
4) Sulfur trioxide *Formula* *# of ve-*	**5)** Ammonia *Formula* *# of ve-*	**6)** Dinitrogen pentoxide *Formula* *# of ve-*
7) Carbon disulfide *Formula* *# of ve-*	**8)** Carbon dioxide *Formula* *# of ve-*	**9)** Phosphorus pentachloride *Formula* *# of ve-*
10) Dinitrogen trioxide *Formula* *# of ve-*	**11)** Boron trichloride *Formula* *# of ve-*	**12)** Carbon monoxide *Formula* *# of ve-*

Strong and Weak Acids and Bases

Write the name. Write if it is a strong or weak acid. Write how it would be written in a 1.0 M solution. List of strong acids and bases is on the back of your common ion list. They need to get memorized ASAP!

S/W A/B List https://tinyurl.com/yd9w685k

Quizlet: https://tinyurl.com/yat3x6tg

S/W A/B List

Quizlet

Acid	Name	Strong/Weak?	How Written in 1.0 M
1) HF	Hydrofluoric acid	W	HF (aq)
2) HCl	Hydrochloric acid	S	H^+ (aq) + Cl^- (aq)
3) HBr			
4) H_2S			
5) $HClO_4$			
6) $HClO_3$			
7) $HClO_2$			
8) HClO			
9) HNO_3			
10) HNO_2			
11) H_2SO_4			
12) H_2SO_3			
13) H_2CO_3			
14) H_3PO_4			
15) $H_2C_2O_4$			
16) CH_3COOH			

Net Ionic Equations - Write, balance, and indicate phases. Write the molecular equation and the net ionic. You will need to use your solubility rules to decide if something is soluble and therefore aqueous and breaks into ions, or if it is insoluble so it is a solid and does not get broken apart into ions. The solubility rules are linked on the front page of this worksheet!

1) Solutions of zinc sulfate and sodium phosphate are mixed
Molecular: $3ZnSO_4$ (aq) + $2Na_3PO_4$ (aq) → $Zn_3(PO_4)_2$ (s) + $3Na_2SO_4$ (aq)
Net Ionic: $3Zn^{2+}$ (aq) + $2(PO_4)^{3-}$ (aq) → $Zn_3(PO_4)_2$ (s)
2) A solution of sodium sulfide is added to a solution of zinc nitrate
Molecular:
Net Ionic:
3) Solutions of silver nitrate and lithium bromide are mixed
Molecular:
Net Ionic:
4) Solutions of sodium iodide and lead (II) nitrate are mixed
Molecular:
Net Ionic:
5) Solutions of silver nitrate and sodium chromate are mixed
Molecular:
Net Ionic:
6) A solution of copper (II) sulfate is added to a solution of sodium hydroxide.
Molecular:
Net Ionic:
7) Sodium hydroxide solution is added to a solution of magnesium nitrate.
Molecular:
Net Ionic:

8) Solutions of potassium phosphate and zinc nitrate are mixed.
Molecular:
Net Ionic:
9) Solutions of manganese (II) sulfate and ammonium sulfide are mixed.
Molecular:
Net Ionic:
10) A solution of nickel (II) chloride is added to a solution of sodium sulfide.
Molecular:
Net Ionic:

Extras to Practice – You can (and will) be assigned some of these occasionally. They can (and will) show up on homework, pop quizzes, quizzes, tests, and the AP test.

11) Solutions of cobalt (II) nitrate and sodium hydroxide are mixed.
12) A solution of copper (II) chloride is added to a solution of sodium sulfide.
13) Solutions of strontium nitrate and sodium sulfate are mixed.
14) Solutions of sodium chromate and lead (II) nitrate are mixed.
15) A solution of sodium iodide is added to a solution of lead (II) acetate.
16) Solutions of lead (II) nitrate and potassium sulfate are mixed.
17) A solution of sodium phosphate is mixed with a solution of calcium acetate.
18) A solution of sodium phosphate is added to a solution of aluminum nitrate.
19) Solutions of silver nitrate and sodium chloride are combined.
20) A solution of calcium hydroxide and sodium chloride are combined.

Extra Review

Everyone has had a summer off from chemistry, sometimes even more if you skipped a year between Honors Chem and AP Chem. Everyone can benefit from some extra review. Only you know which topics were hardest for you last year – spend some time looking through the materials on theHonors Chemistry Tab of my class website. http://mychemistryclass.net/honorschem.html

1st Semester Chapters

1. Chemistry Basics
2. Atomic Structure
3. Electrons
4. Periodic Table
5. Bonding and Structure
6. Reactions
7. Stoichiometry

2nd Semester Chapters

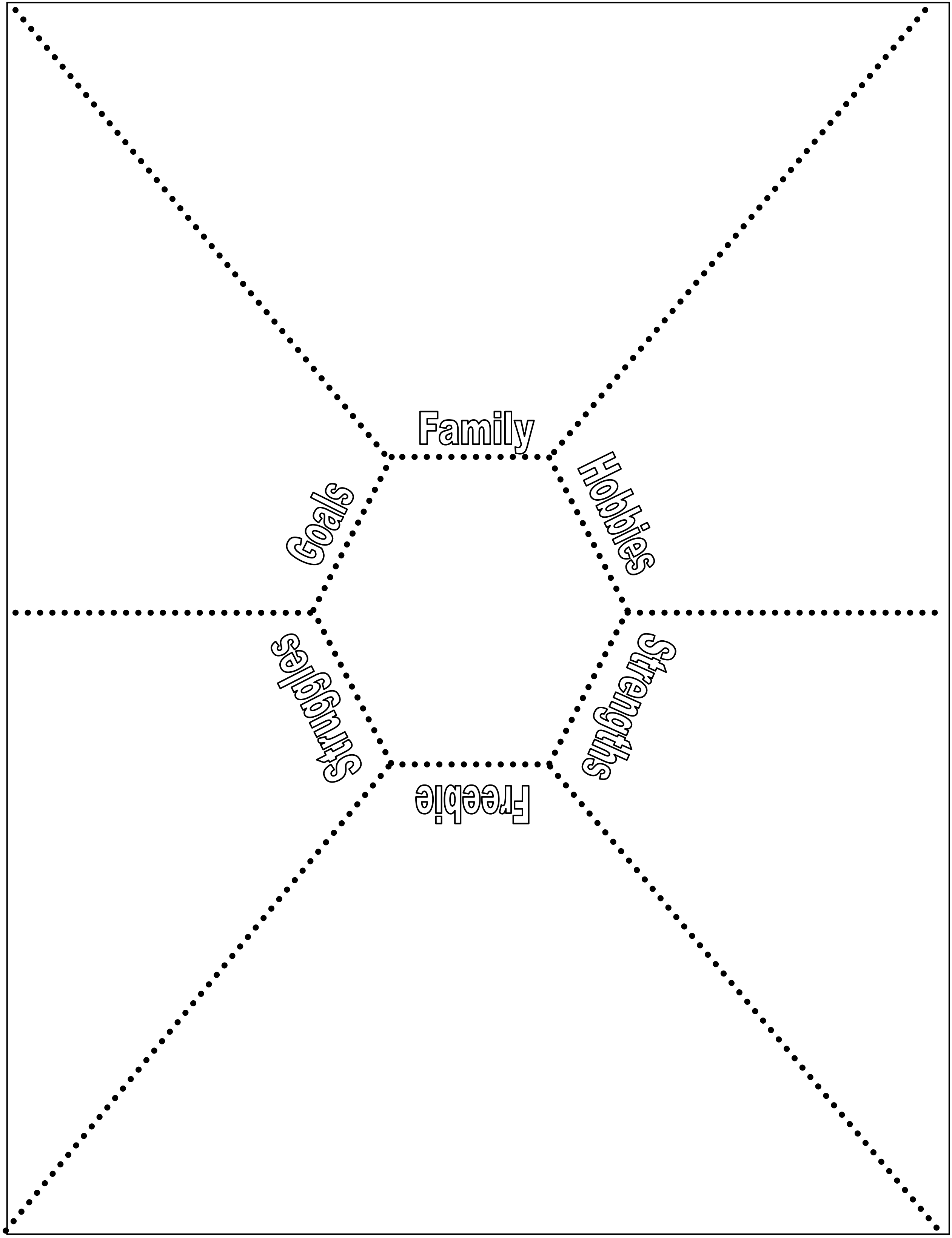
8. Advanced Chemical Ratios
9. Gas Laws
10. Thermochemistry
11. Solutions
12. Kinetics
13. Equilibrium
14. Acids and Bases

You can even watch all my Honors Chem lecture videos on my YouTube Channel!

https://tinyurl.com/5fa5bkh5

All About Me Page

- **This is actually the back! After reading these instructions you will put glue all over these words and glue this down into your composition notebook on the very first page.**
- **This paper should be the right size so that when you print it and trim it down, it will fit perfectly into your composition notebook! Please try to use glue instead of tape. After 15 years of doing notebooks, I promise that glue is the way to go!**
- **You do NOT need to include this instruction page into your notebook. If you print this document, you only need to print page 2 !**
- **Put your first AND last name in the center hexagon.**
- **Three of the boxes need to be filled up with drawings**
  - **Hand drawn – stick figures and tracing is ok!**
  - **Use color!**
  - **Big, bold drawings! Fill the box!**
  - **You can label drawings if you want.**
- **Three of the boxes need to be filled up with sentences.**
  - **Complete sentences! Not bullet points**
  - **Fill the box! It should be a little miniature paragraph**
  - **Use highlighters, color pencils, or markers to highlight or underline or emphasize key words inside your paragraphs**
- **I don't care which three boxes are drawings and which three are paragraphs**
- **The "Freebie" box is a category of your choosing! Something not represented by the other box categories.**
- **This is your first graded assignment. It is your first chance to show me what kind of effort, thought, and detail you put into your work. It is also your first chance to let me know what kind of person you are!**
- **I will show you my All About Me page later in the week!**
- **This is due on Monday of the second week of the school year. Glue it in your notebook, I will check it during class at some point.**



trim this page to fit!