

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 post daily homework/reminders on the Class Calendar (www.mychemistryclass.net) - check it every day!

Some assignments will be uploaded to Google Classroom – check it every day!

Assignments on the Class Calendar are due the next day unless otherwise noted.

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 the website AND THE CALENDAR on your phone and/or computer. Homework is often turned in on Google Classroom, but this is where daily homework is posted!

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 Google Classroom 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
Where you go <u>EVERY DAY</u> to know what the classwork and homework are!	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	<ul style="list-style-type: none"> I suggest getting a 3-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. I usually suggest a 2" binder. Your first and last name needs to be <u>clearly</u> 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 five 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 add extra sections at the back that is fine, but these sections are required. <ol style="list-style-type: none"> Reference (R) Study Materials (S) Current Packet (P) Old Packets (OP) Glue-ins (GI) [and Extra Paper would be a good idea! Binder paper <u>and</u> graph paper] 										
Composition notebook <i>(supplied to you)</i>	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 <i>(supplied to you)</i>	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	These are the items I expect you to have with you in class <i>every single day</i> . If you need supplies for any reason please come to my room at lunch so I can get them to you! <table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> Glue sticks (or liquid glue)</td> <td><input type="checkbox"/> Scissors</td> <td><input type="checkbox"/> Post-it Notes</td> </tr> <tr> <td><input type="checkbox"/> Red Pen</td> <td><input type="checkbox"/> Color pencils or markers</td> <td><input type="checkbox"/> Pen/pencils</td> </tr> <tr> <td><input type="checkbox"/> Green pen</td> <td><input type="checkbox"/> Highlighter</td> <td></td> </tr> </table>		<input type="checkbox"/> Glue sticks (or liquid glue)	<input type="checkbox"/> Scissors	<input type="checkbox"/> Post-it Notes	<input type="checkbox"/> Red Pen	<input type="checkbox"/> Color pencils or markers	<input type="checkbox"/> Pen/pencils	<input type="checkbox"/> Green pen	<input type="checkbox"/> Highlighter	
<input type="checkbox"/> Glue sticks (or liquid glue)	<input type="checkbox"/> Scissors	<input type="checkbox"/> Post-it Notes									
<input type="checkbox"/> Red Pen	<input type="checkbox"/> Color pencils or markers	<input type="checkbox"/> Pen/pencils									
<input type="checkbox"/> Green pen	<input type="checkbox"/> Highlighter										
Things in Your Welcome Packet											
<p>*IMPORTANT! <i>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!</i></p>											
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 and Equation Sheet	A copy of what you are given on the real AP test. 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 <i>"Reference" section of binder, 1st handout in section</i>									
Curriculum Organization	A document I typed up that outlines the order of the AP Units at DVHS, the topic order College Board materials are in, the textbook chapters, etc.	R – 2									
Common Ions	List of common ions from Honors Chem – you should already know them!	R – 3									
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 – 4									
VSPER Chart	Make sure you remember your shapes and bond angles from last year!	R – 5									
Formulas/Constants	A list of some formulas and constants that you may need during the year.	R – 6									
Sig Fig Review	A reminder of how we do sig figs. They are important in AP Chem!	R – 7									
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 – 8									
Notes Setup	Read this! It explains how we will do our class notes. Notes are graded!	R – 9									
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 – 10									
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 – 11									
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									
Red Rainbow Packet – (homework packet)											
Red Cover Sheet	You will fill this out before you turn in your packet.	Current Rainbow Packet section of your binder									
Worksheet #1	Part of your homework for week 1 – <i>a long assignment! Do not leave until the last minute! Covers some important Honors Chem topics.</i>										
Worksheet #2, 2B, 3	Homework for later in the week(s).										

**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

† Actinide 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
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 AND CONSTANTS, EFFECTIVE 2025

UNIT SYMBOLS	
gram,	g
mole,	mol
liter,	L
meter,	m
second,	s
hertz,	Hz
atmosphere,	atm
millimeter of mercury,	mm Hg
degree Celsius,	°C
Kelvin,	K
joule,	J
volt,	V
coulomb,	C
ampere,	A

UNIT CONVERSIONS
1 hertz = 1 s ⁻¹
1 atm = 760 mm Hg = 760 torr
K = °C + 273.15
1 volt = $\frac{1 \text{ joule}}{1 \text{ coulomb}}$
1 ampere = $\frac{1 \text{ coulomb}}{1 \text{ second}}$

METRIC PREFIXES		
Factor	Prefix	Symbol
10 ⁹	giga	G
10 ⁶	mega	M
10 ³	kilo	k
10 ⁻²	centi	c
10 ⁻³	milli	m
10 ⁻⁶	micro	μ
10 ⁻⁹	nano	n
10 ⁻¹²	pico	p

ATOMIC STRUCTURE

$$E = h\nu$$

$$c = \lambda\nu$$

$$F_{\text{coulombic}} \propto \frac{q_1q_2}{r^2}$$

E = energy

ν = frequency

λ = wavelength

F = force

q = charge

r = separation

Planck's constant, *h* = 6.626 × 10⁻³⁴ J s

Speed of light, *c* = 2.998 × 10⁸ m s⁻¹

Avogadro's number = 6.022 × 10²³ mol⁻¹

GASES, LIQUIDS, AND SOLUTIONS

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$PV = nRT$$

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

$$P_{\text{total}} = P_A + P_B + P_C + \dots$$

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

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

$$KE = \frac{1}{2}mv^2$$

$$M = \frac{n_{\text{solute}}}{L_{\text{solution}}}$$

$$A = \epsilon bc$$

P = pressure

V = volume

T = temperature

n = number of moles

X = mole fraction

m = mass

M = molar mass

D = density

KE = kinetic energy

v = velocity

M = molarity

A = absorbance

ε = molar absorptivity

b = path length

c = concentration

Gas constant, *R* = 8.314 J mol⁻¹ K⁻¹

= 0.08206 L atm K⁻¹ mol⁻¹

STP = 273.15 K and 1.0 atm

Ideal gas at STP = 22.4 L mol⁻¹

KINETICS

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

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

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

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

k = rate constant

t = time

*t*_{1/2} = half-life

EQUILIBRIUM

$$K_c = \frac{[C]^c[D]^d}{[A]^a[B]^b}, \text{ where } aA + bB \rightleftharpoons cC + dD$$

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

$$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14} \text{ at } 25^\circ\text{C}$$

$$pK_w = 14 = \text{pH} + \text{pOH} \text{ at } 25^\circ\text{C}$$

$$\text{pH} = -\log[H_3O^+], \quad \text{pOH} = -\log[OH^-]$$

$$K_a = \frac{[H_3O^+][A^-]}{[HA]}, \quad K_b = \frac{[OH^-][HB^+]}{[B]}$$

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

$$K_w = K_a \times K_b, \quad pK_w = pK_a + pK_b$$

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

Equilibrium Constants

K_c (molar concentrations)

K_p (gas pressures)

K_w (water)

K_a (acid)

K_b (base)

THERMODYNAMICS/ELECTROCHEMISTRY

$$q = mc\Delta T$$

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

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

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

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

$$= -RT \ln K$$

$$= -nFE^\circ$$

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

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{RT}{nF} \ln Q$$

q = heat

m = mass

c = specific heat capacity

T = temperature

S[°] = standard entropy

H[°] = standard enthalpy

G[°] = standard Gibbs free energy

R = gas constant

K = equilibrium constant

n = number of moles of electrons

E[°] = standard potential

I = current (amperes)

q = charge (coulombs)

t = time (seconds)

Q = reaction quotient

Faraday's constant, *F* = 96,485 coulombs / 1 mol e⁻

AP Chemistry Curriculum Organization

Over the years College Board has repeatedly reorganized the AP Chemistry curriculum – meaning they change the order of the chapters, give chapters new titles, try to “chunk” topics into Big Ideas etc. This has resulted in lots of great online resources and textbooks being “out of order” compared to what College Board publishes. This makes it hard when trying to use these resources since the numbering of chapters/units/topics no longer match. This document is intended to help you keep track of these different systems so you know what you are looking at, or where to find things. I will use my own personal preference of what order to teach the topics in – over the years I have found an order that seems to be the most logical for students and seems to set them up for success the most. While my order may differ than other teachers’ or College Board’s order, the content and topics should be essentially the same. Remember...the chemistry will be the same no matter what number or title we give the chapter! ☺

DVHS AP Chem Unit Order	College Board Unit Order	College Board’s “Big Four Ideas”
0 – Honors Chemistry Review 1 – Thermochemistry 2 – Thermodynamics 3 – Kinetics 4 – Equilibrium 5 – Atomic Structure & Periodicity 6 – Bonding 7 – Gases 8 – Intermolecular Forces 9 – Solutions 10 – Acid Base 11 – Electrochemistry 12 – Full Exam Review	1 – Atomic Structure & Properties 2 – Compound Structure & Properties 3 – Properties of Substances & Mixtures (formally IMFs) 4 – Chemical Reactions 5 – Kinetics 6 – Thermochemistry 7 – Equilibrium 8 – Acids and Bases 9 – Thermodynamics & Electrochemistry	1 – Scale Proportion & Quantity 2 – Structure & Properties 3 – Transformations 4 – Energy <i>The current way they chunk the Big Ideas.</i>
		College Board’s “Big Six Ideas”
		1 – Atoms 2 – Bonds 3 – Reactions 4 – Rates 5 – Thermodynamics 6 – Equilibrium <i>This was an old way of chunking the Big Ideas.</i>

Tro Textbook Unit Order		
1 – Matter, Measurement 2 – Atoms and Elements 3 – Molecules, Compounds & Chemical Equations 4 – Chemical Quantities and Aqueous Reactions 5 – Gases 6 – Thermochemistry 7 – The Quantum Mechanical Model of the Atom	8 – Periodic Properties of the Elements 9 – Chemical Bonding I: The Lewis Model 10 – Chemical Bonding II: Molecular Shapes, Valence Bond Theory, and Molecular Orbital Theory 11 – Liquids, Solids, and Intermolecular Forces	13 – Solutions 14 – Chemical Kinetics 15 – Chemical Equilibrium 16 – Acids and Bases 17 – Aqueous Ionic Equilibrium 18 – Free Energy and Thermodynamics 19 – Electrochemistry <i>Chapters 12, 20-25 are skipped</i>

College Board “Science Practices”	DVHS Honors Chem Unit Order	
1 – Models & Representations 2 – Question & Method 3 – Representing Data & Phenomena 4 – Model Analysis 5 – Mathematical Routines 6 – Argumentation	1 – Chemistry Basics & Atomic Structure 2 – Nuclear Chemistry 3 – Electrons 4 – Periodic Table 5 – Bonding & Structure 6 – Reactions 7 – Stoichiometry	8 – Advanced Chemical Ratios 9 – Gas Laws 10 – Thermochemistry 11 – Solutions 12 – Kinetics 13 – Equilibrium 14 – Acids and Bases

Website Links

Here are some links to things that will be helpful related to the Course Description and the topics that are taught during the year.

College Board Course Description	“Condensed” Course Content List	Mrs. Farmer’s Class Website
https://tinyurl.com/mrzprf9x 	https://tinyurl.com/26k9y5ae 	www.mychemistryclass.net 

AP Chemistry Course at a Glance

This is a list of the broad "learning objectives" in College Board's Course Description. It is not a full list of every fact, skill, piece of info you need to learn this year. The order here is not the order we go in the class. As always, see the full Course Description and the class website for more details.

Unit 1 Atomic Structure and Properties		Unit 2 Compound Structure and Properties		Unit 3 Properties of Substances and Mixtures	
1.1	Moles and Molar Mass	2.1	Types of Chemical Bonds	3.1	Intermolecular and Interparticle Forces
1.2	Mass Spectra of Elements	2.2	Intermolecular Force and Potential Energy	3.2	Properties of Solids
1.3	Elemental Composition of Pure Substances	2.3	Structure of Ionic Solids	3.3	Solids, Liquids, and Gases
1.4	Composition of Mixtures	2.4	Structure of Metals and Alloys	3.4	Ideal Gas Law
1.5	Atomic Structure and Electron Configuration	2.5	Lewis Diagrams	3.5	Kinetics Molecular Theory
1.6	Photoelectron Spectroscopy	2.6	Resonance and Formal Charge	3.6	Deviation from Ideal Gas Law
1.7	Periodic Trends	2.7	VSEPR and Bond Hybridization	3.7	Solutions and Mixtures
1.8	Valence Electrons and Ionic Compounds	Unit 5 Kinetics		3.8	Representations of Solutions
Unit 4 Chemical Reactions		5.1	Reaction Rates	3.9	Separation of Solutions and Mixtures
4.1	Introduction for Reactions	5.2	Introduction to Rate Law	3.10	Solubility
4.2	Net Ionic Equations	5.3	Concentration Changes Over Time	3.11	Spectroscopy and the Electromagnetic Spectrum
4.3	Representations of Reactions	5.4	Elementary Reactions	3.12	Properties of Photons
4.4	Physical and Chemical Changes	5.5	Collision Model	3.13	Beer-Lambert Law
4.5	Stoichiometry	5.6	Reaction Energy Profile	Unit 6 Thermochemistry	
4.6	Introduction to Titration	5.7	Introduction to Reaction Mechanisms	6.1	Endothermic and Exothermic Processes
4.7	Types of Chemical Reactions	5.8	Reaction Mechanism and Rate Law	6.2	Energy Diagrams
4.8	Introduction to Acid-Base Reactions	5.9	Pre-Equilibrium Approximation	6.3	Heat Transfer and Thermal Equilibrium
4.9	Oxidation-Reduction (Redox) Reactions	5.10	Multistep Reaction Energy Profile	6.4	Heat Capacity and Calorimetry
Unit 7 Equilibrium		5.11	Catalysis	6.5	Energy of Phase Changes
7.1	Introduction to Equilibrium	Unit 8 Acids and Bases		6.6	Introduction to Enthalpy of Reaction
7.2	Direction of Reversible Reactions	8.1	Introduction to Acids and Bases	6.7	Bond Energies
7.3	Reaction Quotient and Equilibrium Constant	8.2	pH and pOH of Strong Acids and Bases	6.8	Enthalpy of Formation
7.4	Calculating the Equilibrium Constant	8.3	Weak Acid and Base Equilibria	6.9	Hess's Law
7.5	Magnitude of the Equilibrium Constant	8.4	Acid-Base Reactions and Buffers	Unit 9 Thermodynamics and Electrochemistry	
7.6	Properties of the Equilibrium Constant	8.5	Acid-Base Titrations	9.1	Introduction to Entropy
7.7	Calculating Equilibrium Concentrations	8.6	Molecular Structure of Acids and Bases	9.2	Absolute Entropy and Entropy Change
7.8	Representations of Equilibrium	8.7	pH and pKa	9.3	Gibbs Free Energy and Thermodynamic Favorability
7.9	Introduction to Le Chatelier's Principle	8.8	Properties of Buffers	9.4	Thermodynamic and Kinetic Control
7.10	Reaction Quotient and Le Chatelier's Principle	8.9	Henderson-Hasselbalch Equation	9.5	Free Energy and Equilibrium
7.11	Introduction to Solubility Equilibria	8.10	Buffer Capacity	9.6	Free Energy of Dissolution
7.12	Common-Ion Effect	8.11	pH and Solubility	9.7	Coupled Reactions
				9.8	Galvanic (Voltaic) and Electrolytic Cells
				9.9	Cell Potential and Free Energy
				9.10	Cell Potential Under Nonstandard Conditions
				9.11	Electrolysis and Faraday's Law

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+		2+		3+		4+	
Hydrogen	H ⁺	Cadmium	Cd ²⁺	Chromium (III)	Cr ³⁺	Lead (IV) <i>(Plumbic)</i>	Pb ⁴⁺
Ammonium	NH ₄ ⁺	Chromium (II)	Cr ²⁺	Cobalt (III)	Co ³⁺	Manganese (IV)	Mn ⁴⁺
Copper (I) <i>(Cuprous)</i>	Cu ⁺	Cobalt (II)	Co ²⁺	Gold (III)	Au ³⁺	Carbon cation	C ⁴⁺
Silver	Ag ⁺	Copper (II) <i>(Cupric)</i>	Cu ²⁺	Iron (III) <i>(Ferric)</i>	Fe ³⁺	Silicon (IV)	Si ⁴⁺
Gold (I)	Au ⁺	Iron (II) <i>(Ferrous)</i>	Fe ²⁺	Manganese (III)	Mn ³⁺	Tin(IV) <i>(Stannic)</i>	Sn ⁴⁺
And all elements in Group IA		Lead (II) <i>(Plumbous)</i>	Pb ²⁺	Nickel (III)	Ni ³⁺	And Group 4A can potentially make 4+	
		Manganese (II)	Mn ²⁺	Boron	B ³⁺		
		Mercury (II) <i>(Mercuric)</i>	Hg ²⁺	Aluminum	Al ³⁺		
		Nickel (II)	Ni ²⁺	Gallium	Ga ³⁺		
		Tin (II) <i>(Stannous)</i>	Sn ²⁺	Indium	In ³⁺		
		Zinc	Zn ²⁺				
		Mercury (I) <i>(Mercurous)</i>	Hg ₂ ²⁺				
		And all elements in Group 2A					

--- Negative Ions – Anions ---

1-		2-		3-		4-	
Acetate	C ₂ H ₃ O ₂ ⁻	Carbonate	CO ₃ ²⁻	Borate	BO ₃ ³⁻	Carbon anion	C ⁴⁻
Bicarbonate	HCO ₃ ⁻	Peroxide	O ₂ ²⁻	Phosphate	PO ₄ ³⁻	And Group 4A can potentially make 4-	
Chlorate	ClO ₃ ⁻	Sulfate	SO ₄ ²⁻	Phosphide	P ³⁻		
Chlorite	ClO ₂ ⁻	Sulfite	SO ₃ ²⁻	Phosphite	PO ₃ ³⁻		
Cyanide	CN ⁻	Chromate	CrO ₄ ²⁻	Arsenate	AsO ₄ ³⁻		
Hydride	H ⁻	Dichromate	Cr ₂ O ₇ ²⁻	And all elements in Group 5A			
Hydroxide	OH ⁻	Oxalate	C ₂ O ₄ ²⁻				
Hypochlorite	ClO ⁻	Thiosulfate	S ₂ O ₃ ²⁻				
Nitrate	NO ₃ ⁻	And all elements in Group 6A					
Nitrite	NO ₂ ⁻						
Perchlorate	ClO ₄ ⁻						
Permanganate	MnO ₄ ⁻						
Thiocyanate	SCN ⁻						
And all elements in Group 7A (Halogens)							

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 → O²⁻ oxide
 N nitrogen → N³⁻ nitride

Other things to Memorize

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

Prefixes				Common Molecular Gases	Common Acids		Diatomic Elements	
One	mono	Six	hexa	F ₂ , Cl ₂ , H ₂ , N ₂ , O ₂ , SO ₂ ,	Hydrochloric	HCl	Hydrogen	H ₂
Two	di	Seven	hepta	SO ₃ , CO, CO ₂ , H ₂ S,	Sulfuric	H ₂ SO ₄	Nitrogen	N ₂
Three	tri	Eight	octa	NO, NO ₂ , NH ₃ , P ₂ O ₃ ,	Nitric	HNO ₃	Oxygen	O ₂
Four	tetra	Nine	nona	P ₂ O ₅ , SiF ₄ , HCl, HBr,	Phosphoric	H ₃ PO ₄	Fluorine	F ₂
Five	penta	Ten	deca	HI, HF, N ₂ O ₅ , N ₂ O ₃ , N ₂ O	Common Bases		Chlorine	Cl ₂
					Ammonia	NH ₃	Bromine	Br ₂
					Sodium hydroxide	NaOH	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 ₂ SO 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*		Acid Nomenclature**	
Per-.....-ate	Greatest number of oxygens	Per-.....-ic	Greatest number of oxygen atoms
.....-ate	Greater-ic	Greater
.....-ite	Smaller-ous	Smaller
Hypo.....-ite	Smallest number of oxygens	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 can be either binary or ternary compounds. The names of binary acids have the form Hydro-...-ic acids. The names of ternary acids use a series of prefixes and suffixes to specify the relative number of oxygen atoms in the molecule.

Solubility of Some Ionic Compounds in Water

Always Soluble

Alkali metals =	$\text{Li}^+, \text{Na}^+, \text{K}^+, \text{Rb}^+, \text{Cs}^+$
Ammonium =	NH_4^+
Acetate =	$\text{C}_2\text{H}_3\text{O}_2^-$
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.

AAA
CNP

Generally Soluble

$\text{Cl}^-, \text{Br}^-, \text{I}^-$ Except when with: $\text{Ag}^+, \text{Pb}^{2+}, \text{Hg}_2^{2+}$

AP-H

F^- Except when with: $\text{Ca}^{2+}, \text{Ba}^{2+}, \text{Sr}^{2+}, \text{Pb}^{2+}, \text{Mg}^{2+}$

CBS-PM

Sulfate = SO_4^{2-} Except when with: $\text{Ca}^{2+}, \text{Ba}^{2+}, \text{Sr}^{2+}, \text{Pb}^{2+}$

CBS-P

Generally Insoluble

$\text{O}^{2-}, \text{OH}^-$ Except when with: Alkali metals and NH_4^+

AA

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

CBS

$\text{CO}_2^{2-}, \text{CO}_3^{2-}$

$\text{S}^{2-}, \text{SO}_3^{2-}$

PO_4^{3-}

$\text{CrO}_4^{2-}, \text{Cr}_2\text{O}_4^{2-}$

Except when with: Alkali metals and NH_4^+

AA

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

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*

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.

Least
Active

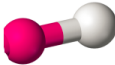
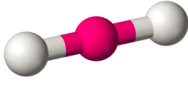
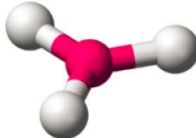
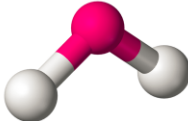
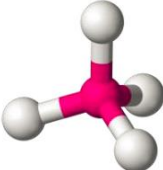
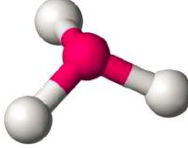
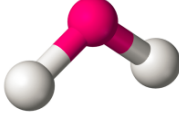
Elements CANNOT replace anything ABOVE them.
The reaction DOES NOT OCCUR in this situation.

Examples: $ZnCl_2 + Mg \rightarrow MgCl_2$
Magnesium is above Zinc so the reaction happens

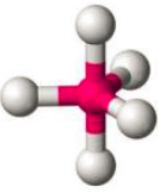
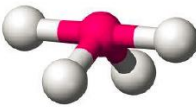
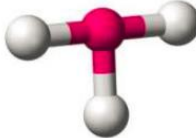
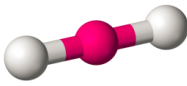

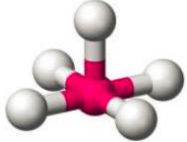
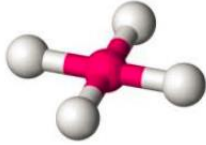
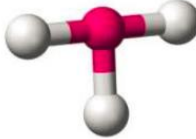
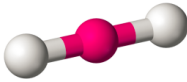
$ZnCl_2 + Cu \rightarrow$ No Reaction
Copper is below Zinc so no reaction happens

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 ₂ E)	< 120	
4	4	0	Tetrahedral (sp ³)	Tetrahedral (AX ₄)	109.5	
	3	1		Trigonal Pyramidal (AX ₃ E)	< 109.5	
	2	2		Bent (AX ₂ E 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	

Useful and Necessary Formulas

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

1. Electromagnetic Radiation

- a) Speed of Light $c = \lambda \cdot \nu$
- b) Wavelength $\lambda = c / \nu$
- c) Frequency $\nu = c / \lambda$
- d) Energy in a photon $E = h \cdot \nu$

2. Concentration and Molar Mass

- a) Density (D) $D = m / V$
- b) Moles (n) $n = g / mm$
- c) Moles (# of particles) $n = \text{number of particles} / \text{Avogadro's number}$
- d) Moles (solution) $n = \text{concentration} \cdot \text{volume}$
- e) Moles (gas equation) $n = PV / RT$
- f) Molarity (M) $M = n / \text{volume}$
- g) Molar mass (mm) $mm = m / n$

3. Gases

- a) Boyle's Law $P_1 \cdot V_1 = P_2 \cdot V_2$
- b) Charles' Law $V_1 \cdot T_2 = V_2 \cdot T_1$
- c) Combined Gas Law $P_1 \cdot V_1 / T_1 = P_2 \cdot V_2 / T_2$
- d) Ideal Gas Law $PV = nRT$
- e) Dalton's Law of Partial Pressures $P_T = P_1 + P_2 + P_3 + \dots + P_n$

4. Acids and Bases

- a) pH $\text{pH} = -\log[\text{H}^{+1}]$
- b) pOH $\text{pOH} = -\log[\text{OH}^{-1}]$
- c) $[\text{H}_3\text{O}^{+1}] = 10^{-\text{pH}}$
- d) $[\text{OH}^{-1}] = 10^{-\text{pOH}}$

5. Heat

- a) Quantity of Heat (Q) $Q = m \cdot c \cdot \Delta t$
- b) Quantity of Heat (fusion) $Q = m \cdot L_f$
- c) Quantity of Heat (vaporization) $Q = m \cdot L_v$
- d) Celsius to Kelvin $K = ^\circ\text{C} + 273.15$
- e) Kelvin to Celcius $^\circ\text{C} = K - 273.15$

6. Mathematics

- a) Quadratic Equation $x = \frac{-b \pm (b^2 - 4ac)^{-2}}{2a}$

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°C, 1 atm)
1 mole of any gas at SATP	24.8 L (25°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 X 10 ⁸ m s ⁻¹)
Rest mass of an electron (m _e)	0.000548712 u = 9.1093897 X 10 ⁻²⁸ g
Rest mass of a proton (m _p)	1.00727605 u = 1.67262305 X 10 ⁻²⁴ g
Rest mass of a neutron (m _n)	1.008665 u = 1.674954 X 10 ⁻²⁴ g
1 kiloWattHour(kWh)	3.6 MJ
1 Joule (J)	1 kg m ² s ⁻² = 1.0 X 10 ⁷ erg
1 Coulomb(C)	6.24 x 10 ¹⁸ e ⁻
Electronic charge on an electron	1.60217733 X 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 x 10 ⁻¹⁹ J
Faraday's Constant	96,486.7 C/mole e ⁻

Significant Figures in Measurement and Calculations Reader

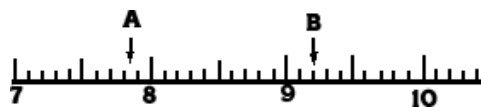
It is important to always label your numbers with units because in Chemistry class our numbers represent measurements. It is also important to only report digits that are reliable – we call these *significant figures*. If we report more digits than we can adequately ensure are reliable then our results 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 = 0.04 <u>20</u> cm	(e) 2403 ft.	answer = <u>2 403</u> ft.
(b) 5.320 in.	answer = <u>5.320</u> in.	(f) 80.5300 m	answer = <u>80.5300</u> m
(c) 10 lb.	answer = <u>10</u> lb.	(g) 200. g	answer = <u>200</u> g
(d) 0.020 ml	answer = 0.0 <u>20</u> ml	(h) 2.4×10^3 kg	answer = <u>2.4</u> $\times 10^3$ 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 0.024×1244 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. = $6.804 \text{ cm}^2 \rightarrow 6.8 \text{ cm}^2$

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 = $151.2864 \rightarrow 150 \text{ cm}^3$

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 $528 \div 0.14$ would be rounded off to contain *two* sig figs. The answer to $0.340 \div 3242$ would be rounded off to contain three significant figures.

Sample Problem #5: Calculate $20.45 \div 2.4 = 8.52083 \rightarrow 8.5$

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 + 4.1 g

Solution:

$$\begin{array}{r} 42.56 \text{ g} \\ 39.460 \text{ g} \\ + 4.1 \text{ g} \\ \hline \text{Sum} = 86.120 \text{ g} \end{array}$$

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:*

$$\begin{array}{r} 12.523 \text{ g} \\ 12.497 \text{ g} \\ + 12.515 \text{ g} \\ \hline \text{Sum} = 37.535 \text{ g} \end{array}$$

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 $[H^+] = 5.5 \times 10^{-11} \text{ M}$)
pKa = 4.730 has three significant figures (this represents a $K_a = 1.86 \times 10^{-5}$)

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: $\log(2.4 \times 10^3) = 3.3802 \rightarrow 3.38$, 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: $\log(5.5 \times 10^{-11}) = 10.2596 \rightarrow 10.26$, 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

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 $2.0000(1.008 \text{ g}) + 15.99 \text{ g} = 18.01$

Perform the multiplication first → $2.0000(1.008 \text{ g}) = 2.016 \text{ g}$, 4 sig figs because 1.008 was the smallest number of sig figs.

Then, perform the addition → $2.016 + 15.99 = 18.006 \rightarrow$ round to 2 decimal places since 15.99 only has 2 decimal places.

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



<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!

Sample Problem #11 $(2.0 \times 10^{12}) / (8.330 \times 10^9) = 2.40096 \times 10^3 \rightarrow 2.4 \times 10^3$, 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 $(2.113 \times 10^4) + (9.2 \times 10^4) = 11.313 \times 10^4 \rightarrow 11.3 \times 10^4 \rightarrow 1.13 \times 10^5$ *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 $(1.032 \times 10^4) + (2.672 \times 10^5) \rightarrow$ convert so they have the same exponent even if it makes your number look weird format. $(1.032 \times 10^4) + (26.72 \times 10^4) \rightarrow$ Now follow normal adding subtracting rules → $27.752 \times 10^4 \rightarrow$ round to two decimal places because 26.72×10^4 only had two decimal places so that limits your answer → $27.75 \times 10^4 \rightarrow$ now fix your format to put it back in proper scientific notation format → Final answer of 2.775×10^5



<https://tinyurl.com/48jjyeac>

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

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

$$m = (2.5 \text{ kJ}) / (4.18 \text{ J/g}^\circ\text{C})(45^\circ\text{C} - 40^\circ\text{C}) = 0.12 \text{ g}$$

$$m = (2500 \text{ J}) / (4.18 \text{ J/g}^\circ\text{C})(45^\circ\text{C} - 40^\circ\text{C}) = 119.6 \text{ g}$$

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) $K = C + 273$

$K = 25C + 273 = \boxed{298 K}$

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 = +
- $Q_{water} = -Q_{metal}$
 - $m\Delta T = -(m\Delta T)$

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

$$Ti = 214.92C$$

You can do calorimetry with two cups of water!
Instead of Q_{metal} and $Q_{water} \rightarrow Q_{W1}$ and Q_{W2}

<p><u>K</u></p> <p>Add any key terms, vocab words, equations, etc. Bullet points are fine!</p>	<p><u>C</u></p> <p>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.</p>	<p><u>Q</u></p> <p>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</p>
--	---	---

- 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

- 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.

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	<input type="checkbox"/> No title <input type="checkbox"/> Non-descriptive/obvious title <input type="checkbox"/> No Target in red pen <input type="checkbox"/> Incomplete notes lacking info <input type="checkbox"/> No color <input type="checkbox"/> Min. Color &/or not used meaningfully <input type="checkbox"/> No KCQ boxes <input type="checkbox"/> KCQ incomplete/lacking effort/detail <input type="checkbox"/> Other	10
N47 Nomenclature, Strong Acids/Bases, Ionization of Water Naming Glue In	<input type="checkbox"/> No title <input type="checkbox"/> Non-descriptive/obvious title <input type="checkbox"/> No Target in red pen <input type="checkbox"/> Incomplete notes lacking info <input type="checkbox"/> No color <input type="checkbox"/> Min. Color &/or not used meaningfully <input type="checkbox"/> No KCQ boxes <input type="checkbox"/> KCQ incomplete/lacking effort/detail <input type="checkbox"/> Other	10
Warmup #22	<input type="checkbox"/> Missing <input type="checkbox"/> Not graded <input type="checkbox"/> No transfer stamp <input type="checkbox"/> Other	5
N48 Weak Acids and Bases Glue In Practice Problems x 2	<input type="checkbox"/> No title <input type="checkbox"/> Non-descriptive/obvious title <input type="checkbox"/> No Target in red pen <input type="checkbox"/> Incomplete notes lacking info <input type="checkbox"/> No color <input type="checkbox"/> Min. Color &/or not used meaningfully <input type="checkbox"/> No KCQ boxes <input type="checkbox"/> KCQ incomplete/lacking effort/detail <input type="checkbox"/> Other	10
Warmup #23	<input type="checkbox"/> Missing <input type="checkbox"/> Not graded <input type="checkbox"/> No transfer stamp <input type="checkbox"/> Other	5
Warmup #24	<input type="checkbox"/> Missing <input type="checkbox"/> Not graded <input type="checkbox"/> No transfer stamp <input type="checkbox"/> Other	5
N49 Salts Steps Glue In Chart Glue in x 2	<input type="checkbox"/> No title <input type="checkbox"/> Non-descriptive/obvious title <input type="checkbox"/> No Target in red pen <input type="checkbox"/> Incomplete notes lacking info <input type="checkbox"/> No color <input type="checkbox"/> Min. Color &/or not used meaningfully <input type="checkbox"/> No KCQ boxes <input type="checkbox"/> KCQ incomplete/lacking effort/detail <input type="checkbox"/> Other	10
N48 Titrations Hands On Lecture	<input type="checkbox"/> No title <input type="checkbox"/> Non-descriptive/obvious title <input type="checkbox"/> No Target in red pen <input type="checkbox"/> Incomplete notes lacking info <input type="checkbox"/> No color <input type="checkbox"/> Min. Color &/or not used meaningfully <input type="checkbox"/> No KCQ boxes <input type="checkbox"/> KCQ incomplete/lacking effort/detail <input type="checkbox"/> 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!			

- Any chemicals with a * need to be included.
- 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.
- Note safety/cleanup points (if provided on MSDS – **BE DESCRIPTIVE!**)
- 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. <https://www.flinnsci.com/sds/>
- DO NOT squish your information into the table. DO NOT do this at the last minute. **SAFETY MATTERS!**



PROCEDURE

- 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...
- Do not copy directly from lab handout!
- Full sentences not needed.
- 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.
- Included drawings of lab setups when applicable. Label the drawings and equipment names.
- Add reminders, equations, notes to yourself, etc.
- The intention is to *think about* the steps by putting it in your own shortened and more visual version.
- You should be able to do the lab with nothing but your notebook!

DATA TABLE SECTION

- 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.
- Must include sections for QUANTITATIVE and QUALITATIVE data.
- Make it large – does not have to be an entire page, but it needs to be sufficiently large.
- 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 $\text{MgCl}_2 + 2\text{NaOH} \rightarrow \text{Mg(OH)}_2 + 2\text{NaCl}$
- Must have labels and units in the headers of the columns/rows.
- 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.
- 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 not 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

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

TOPIC

- 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

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

KEY EQUATIONS

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

KEY CONCEPTS EXPLAINED

- Written in complete sentences.
- This is sometimes called a "Background Paragraph."
- It should be a summary of the topic the lab is about.
- It should read like a very dense little textbook paragraph.
- 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.
- 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

- You are NOT listing your materials section. You are NOT telling me the procedure.
- 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.
- Label drawings, explain how special equipment works, how you do the named lab techniques etc
- 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

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

YOUR EXPERIMENTAL RESULTS

- 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.
- Include all relevant results. Often students will be testing multiple things and only report one of the results.
- Clearly label what your results are and have units on them. Do NOT just put a number in the box.
- Your experimental results may not always be numerical. That is fine! Depends on the lab.

ACCEPTED VALUE/RESULTS

- What value/result should you have gotten? What is considered the "correct" answer?
- This will either be given to you in the lab handout, during class, or you will look it up online.
- 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

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

POSSIBLE LAB ERRORS

- This is one of the hardest and most important sections. Take it seriously!
- Number the errors so that you can refer to them easily in the next box.
- I will be looking for very specific key errors that are “big deals” to the lab. Yes, you have figure out what those are!
- Do not ever say “human error” – that isn’t a “thing!” Obviously we are humans, not aliens or cats.
- ONLY say errors that did or may have reasonably happened. If you didn’t knock over your beaker, or mix up your test tubes, or have Godzilla come break your scale, don’t list those as error! Don’t list all sorts of crazy things!
- 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.
- 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!
- 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

- One of the other hardest and most important sections! Take it seriously!
- 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

- 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.
- Be specific! You can’t just say something like “do another trial, “test a different compound” or “use better equipment.”
- Make sure to explain how/why this would be a good change or addition.

EXAMPLE TEST QUESTION ON THIS TOPIC

- Brainstorm a question related to the lab topic that you think I might put on a quiz or a test.
- 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.
- 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.
- 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

- 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.

Use binder paper if
you need more space!

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



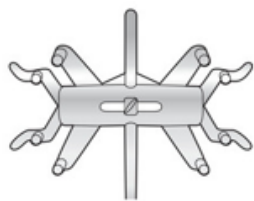



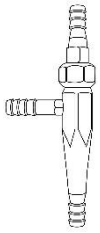


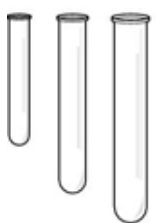
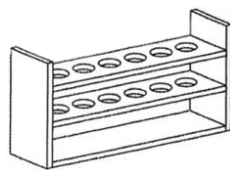

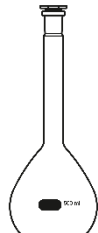





Example Only

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.

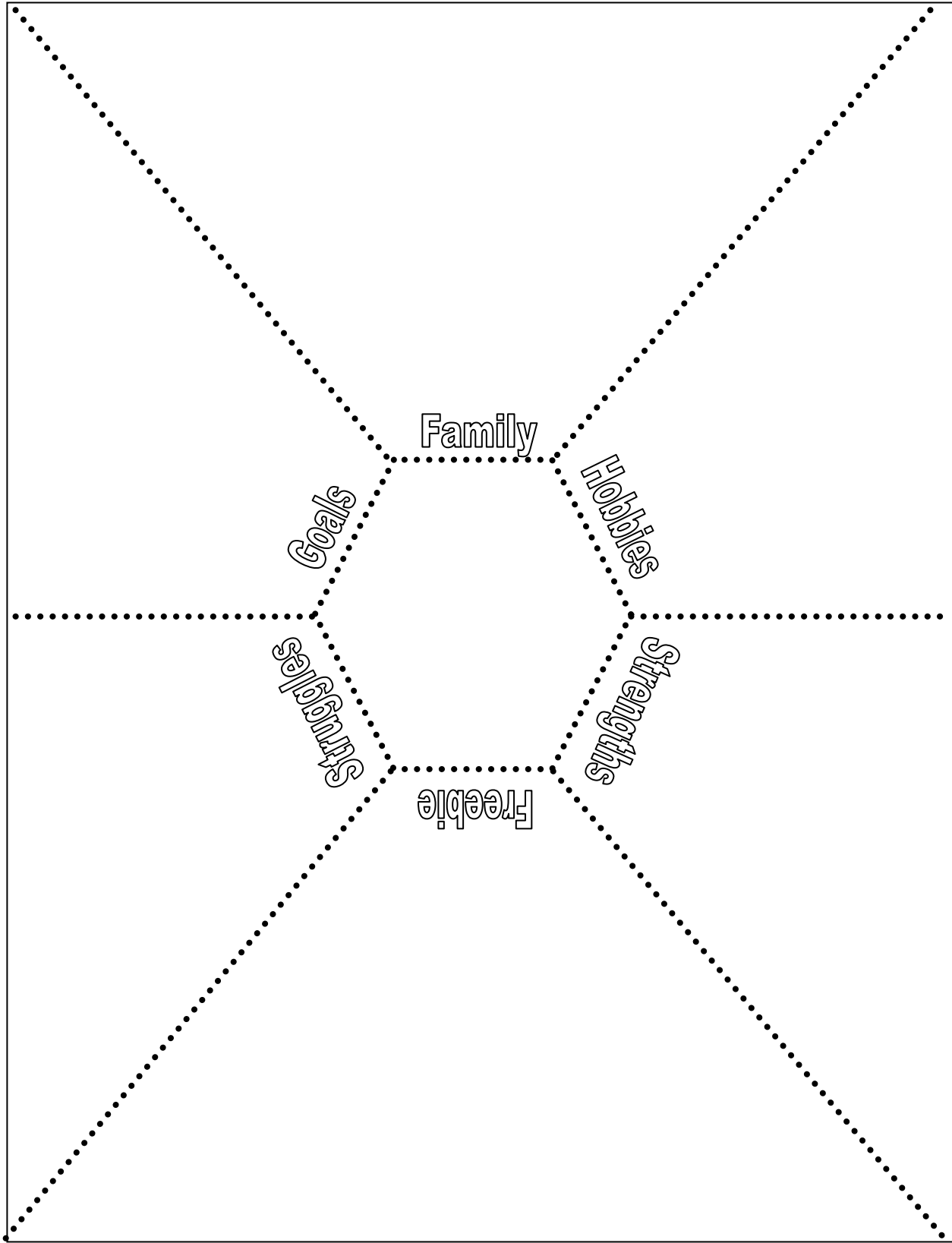
Common Laboratory Equipment and Techniques

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

<p>Crucible with Lid</p> 	<p>Evaporating Dish</p> 	<p>Burette Clamp</p> 	<p>Burette</p> 
<p>Filter Flask</p> 	<p>Buchner Funnel</p> 	<p>Aspirator for Sink</p> 	<p>Glass Funnel</p> 
<p>Test Tube Brush</p> 	<p>Test Tubes</p> 	<p>Test Tube Rack</p> 	<p>Mortar and Pestle</p> 
<p>Volumetric Flask</p> 	<p>Glass Watch Glass</p> 	<p>Volumetric Pipette</p> 	<p>Rubber Pipette Bulb</p> 
<p>Rubber Stoppers</p> 	<div style="text-align: center;">  <p>SCAN ME</p> <p>Common Lab Techniques: https://tinyurl.com/3eyn4faa</p> </div> <p>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.</p>		

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!