Name: _____ Date: _____ Teacher: J. Richardson

AP Chemistry: Week 1 Assignments

4/6-4/13

Do you have access to technology? Did you get this off of my website?
If so, this is not the assignment for you! This packet is only for students who have *little to no* access to technology. Please go to the AP chemistry assignment page instead:
https://ca01001129.schoolwires.net/Page/17496

Scroll down to "current assignments", then click "week 1". That is your assignment!

If you *don't* have technology and got this packet from the school, read on…

Part 1: Notes
We will be finishing our unit 9 (the college board calls this unit 2, which is why the sections are labeled that way. According to their topic list, we are doing sections 2.1-2.7.)

1. Use your textbook or the videos on my website to complete the notes on pages 2-5.
2. Turn in to the front office on Monday, 4/13

Part 2: Practice

1. Complete the practice problems on pages 6-7.
2. Use the answer key on pages 8-9 to check your answers. Correct your work in a distinctly different color.
3. Turn in to the front office on Monday, 4/13

Part 3: Review for the Exam

1. Page 10 has the overview of our updated review assignment. The review assignment is not due until 5/9.
2. I *recommend* you complete at least one progress check per week, and complete at least 1 section of your cheat sheet per week.
3. The review book is now optional (extra credit).

AP Chemistry: Sections 2.1-2.7 Chemical Bonds, Intramolecular Force, and Structure of Solids

U N I T 9 – M O L E C U L A R T H E O R Y

Instructions:

1. Use the videos posted on my website or linked in this document or the listed textbook pages to fill in the notes below.
2. After completing the notes, do the practice problems (the next part of the assignment listed on my website).

Sections 2.1-2.4: Chemical Bonds, Intramolecular Force, and Structure of Solids

Bond Polarity: textbook section 8.4

What is the trend in electronegativity?

X – X vs X – Y: Which one is polar and why?

What do δ^+ and δ^- represent? Which atom gets the partial negative charge?

B – N vs B – F: Which bonds is more polar and why?

Bond Types: textbook section 8.2, 8.3

Ionic bond =

Covalent bond =

We could also examine the properties…more on this in next week's assignment (topic 3.2).

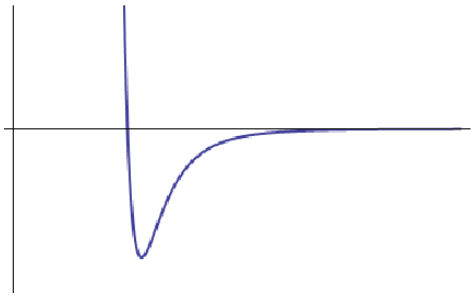
Describe metallic bonding:

Draw a picture of metallic bonding:

Bond PE Diagrams & Bond Length/Strength: textbook section 8.7

Label the axis of the graph below:

Describe the bottom of the curve represents:



For <u>single bonds,</u> does bond length depend on?

How does bond energy relate to bond length?

What is bond order? How does it relate to bond length? How does it relate to bond energy?

Coulombic Attraction between Ions: textbook section 8.2

How does ion charge relate to strength of attractive force?

How does ion size relate to strength of attractive force?

Particulate Diagrams for Ionic and Metallic Substances: textbook section 8.2, 12.3

Sketch a small diagram of what an ionic solid looks like:

What is an alloy?

What is an interstitial alloy? Describe size of particles. Sketch a model.

What is a substitutional alloy? Describe size of particles. Sketch a mode.

Guided Practice

For each of these polar covalent bonds, which atom has a partial positive charge and which atom has a partial negative charge?

C – N F – N Si – O

Explain:

Arrange these three bonds in order, from least polar bond to most polar bond.

N – F P – F O – F

Explain:

Will a Br – Br bond length be longer or shorter than the Cl – Cl bond? Why?

Will a Br – Br bond energy be higher or lower than the Cl – Cl bond? Why?

Sketch how the PE curves will compare:

Define lattice energy:

Using the data to the right, make a prediction about the lattice energy of MgO and KCl. Do you expect it to be higher or lower than 930 kJ/mol? Justify your answer in terms of periodic properties and coulomb's law.

Reaction	Lattice Energy (kJ/mol)
$NaF(s) \rightarrow Na^+(g) + F^-(g)$	930
$MgO(s) \rightarrow Mg^{2+}(g) + O^{2-}(g)$	
$KCl(s) \rightarrow K^+(g) + Cl^-(g)$	

A student checked the conductivity of two different solids, and found that solid Cu conducts electricity but solid $CuCl_2$ does not. Explain why the student got these results, in terms of principles of chemical bonding. Your explanation should include a discussion of the specific particles present in each substance and how the behavior of these particles is related to the conductivity of the solid.

What are two changes that could be made to the sample of $CuCl_2$ that would enable it to become a conductor of electricity?

Brass is an alloy that contains copper and zinc. Copper has an atomic radius of 130 pm, zinc has an atomic radius of 125 pm. Should brass be classified as an interstitial or as a substitutional alloy? Justify your answer.

Sections 2.5-2.7: Lewis Diagrams, Formal Charge, and VSEPR

The next video skips Lewis Diagrams and Formal Charge, which most people said they were comfortable with. If you would like to review those concepts, check out this optional video: Review of Lewis Structures and Formal Charge (also posted on my website) or textbook section 8.5 - 8.7

VSEPR Theory: textbook section 9.2

What is Valence shell electron pair repulsion theory?

Do double bonds count as one or two electron domains?

Give some examples of identifying the shape:

How does the lone pair affect the bond angle? Why?

Hybridization and Sigma/Pi Bonds: textbook section 9.5, 9.6

Describe what hybridization is:

Four electron domains = _____ hybridization
Examples:

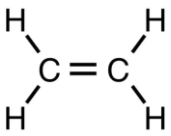
Three electron domains = _____ hybridization
Examples:

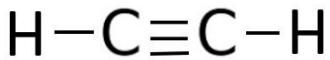
Two electron domains = _____ hybridization
Examples:

What is a sigma bond?

What is a pi bond?

How many sigma and pi bonds in each structure?





AP Chemistry Name_____

Sections 2.1-2.7 Practice

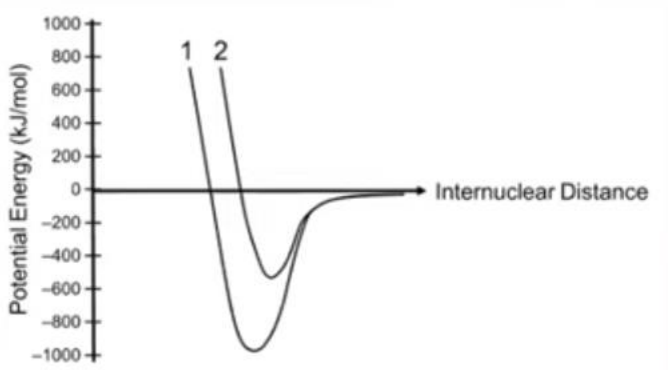
UNIT 9 – MOLECULAR THEORY

Instructions:

1. Complete the following problems.
2. Check and correct your answers in a distinctly different color (no, black pen and pencil do not count as distinctly different). Answer keys can be found at the end of this packet.

Sections 2.1-2.4

1. Answer the following questions about nitrogen and oxygen.
    a. Write the Lewis electron-dot structure for the diatomic molecules N_2 and O_2



    b. The potential energy as a function of internuclear distance for the diatomic molecules N_2 and O_2 is shown in the graph above. Based on the data in the graph and the Lewis Structures that you drew in part (a), which curve, 1 or 2, is the better representation of the N_2 molecules? Justify your answer in terms of the principles of chemical bonding and bond energy.

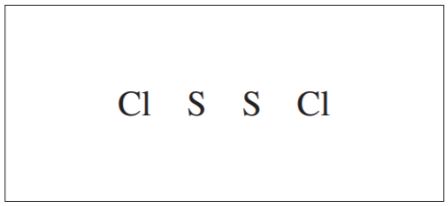
2. Answer the following questions related to Mg and Sr.
    a. Write the completer ground state electron configuration for the ions Mg^{2+} and Sr^{2+}.

    b. Do you predict that the ionic radius of Sr^{2+} is larger or smaller in size than the ionic radius of Mg^{2+}? Justify your answer in terms of atomic structure and the electron configuration of each ion.

    c. The lattice energy of $MgCl_2(s)$ is equal to 2300 kJ/mol. Do you predict that the lattice energy of $SrCl_2(s)$ should be less than or greater than 2300 kJ/mol? Justify your answer in terms of Coulomb's law.

Sections 2.5-2.7

1. S_2Cl_2 is a product of a reaction.
   a. In the box below, complete the Lewis electron-dot diagram for the S_2Cl_2 molecule by drawing in all of the electron pairs.



   b. What is the approximate value of the Cl-S-S bond angle in the S_2Cl_2 molecule that you drew in part a? (If the two Cl-S-S bond angles are not equal, include both)

2. Answer the following questions about the isomers fulminic acid and isocyanic acid.

Two possible Lewis electron-dot diagrams for fulminic acid, HCNO, are shown below.

(a) Explain why the diagram on the left is the better representation for the bonding in fulminic acid. Justify your choice based on formal charges.

(d) The skeletal structure of the HNO_2 molecule is shown in the box below.

(i) Complete the Lewis electron-dot diagram of the HNO_2 molecule in the box below, including any lone pairs of electrons.

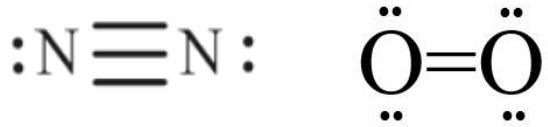
(ii) Based on your completed diagram above, identify the hybridization of the nitrogen atom in the HNO_2 molecule.

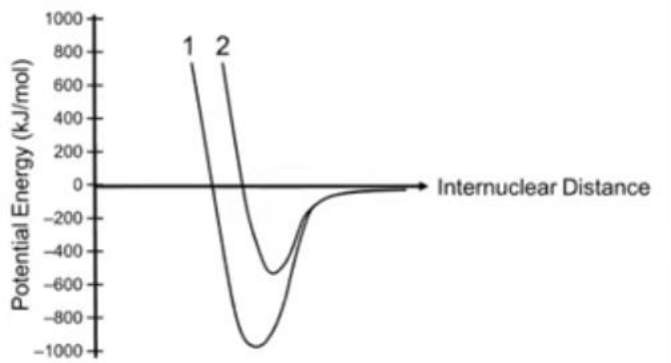
Remember, you must check and correct in a different color to get full credit!!!

Sections 2.1-2.7 Practice ANSWER KEY

Sections 2.1-2.4

3. Answer the following questions about nitrogen and oxygen.
   a. Write the Lewis electron-dot structure for the diatomic molecules N_2 and O_2





   b. The potential energy as a function of internuclear distance for the diatomic molecules N_2 and O_2 is shown in the graph above. Based on the data in the graph and the Lewis Structures that you drew in part (a), which curve, 1 or 2, is the better representation of the N_2 molecules? Justify your answer in terms of the principles of chemical bonding and bond energy.

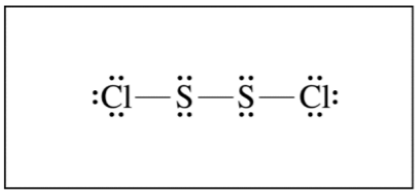
The higher the bond order, the stronger the bond is. In other words, a triple bond is stronger than a double bond. The triple bond in N_2 has a higher bond energy than the double bond in O_2.
Curve 1 is a better representation of N_2. Curve 1 represents the diagram with a higher bond energy, shown by the lowest point of the curve. The triple bond in N_2 has a higher bond energy than the double bond in O_2.

4. Answer the following questions related to Mg and Sr.
   a. Write the completer ground state electron configuration for the ions Mg^{2+} and Sr^{2+}.
   $Mg^{2+} = 1s^2 2s^2 2p^6$
   $Sr^{2+} = 1s^2 2s^2 2p^6 3s^2\ 3p^6 4s^2 3d^{10} 4p^6$ or [Ar] $4s^2 3d^{10} 4p^6$
   b. Do you predict that the ionic radius of Sr^{2+} is larger or smaller in size than the ionic radius of Mg^{2+}? Justify your answer in terms of atomic structure and the electron configuration of each ion.
   The Sr^{2+} ion is larger in size than the Mg^{2+} ion because it has additional occupied energy levels. The valence electrons in Sr^{2+} occupy the 4th energy level, whereas the valence electrons in Mg^{2+} occupy the 2nd energy level. Electrons in the 4th energy level are, on average, located further away from the nucleus than electrons in the 2nd energy level.
   c. The lattice energy of $MgCl_2(s)$ is equal to 2300 kJ/mol. Do you predict that the lattice energy of $SrCl_2(s)$ should be less than or greater than 2300 kJ/mol? Justify your answer in terms of Coulomb's law.
   Coulomb's law states that the force of attraction between cation and anion is inversely proportional to the square of the distance between them. Since the distance between Mg^{2+} and Cl^- is shorter than the distance between Sr^{2+} and Cl^-, the attractive forces in $MgCl_2$ are stronger. Therefore, the lattice energy of $SrCl_2$ should be less than 2300 kJ/mol. *(don't forget to answer the question!!)*

Sections 2.5-2.7

2. S_2Cl_2 is a product of a reaction.

(i) In the box below, complete the Lewis electron-dot diagram for the S_2Cl_2 molecule by drawing in all of the electron pairs.



See correct diagram above.	1 point is earned for a correctly drawn diagram.

(ii) What is the approximate value of the Cl–S–S bond angle in the S_2Cl_2 molecule that you drew in part (c)(i) ? (If the two Cl–S–S bond angles are not equal, include both angles.)

Any value between 104° and 110°	1 point is earned for an acceptable angle that is consistent with the Lewis diagram.

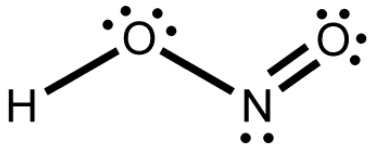
Two possible Lewis electron-dot diagrams for fulminic acid, HCNO, are shown below.

(a) Explain why the diagram on the left is the better representation for the bonding in fulminic acid. Justify your choice based on formal charges.

In the diagram on the left, the C atom has a formal charge of zero and the O atom has a formal charge of −1. In the diagram on the right, the C atom has a formal charge of −1 and the O atom has a formal charge of zero.	1 point is earned for a correct assignment of formal charges in the two diagrams.
The diagram on the left is the better representation because it puts the negative formal charge on oxygen, which is more electronegative than carbon.	1 point is earned for a correct explanation.

(d) The skeletal structure of the HNO_2 molecule is shown in the box below.

(i) Complete the Lewis electron-dot diagram of the HNO_2 molecule in the box below, including any lone pairs of electrons.



See sample response above. (Line segments can be used to represent electron pairs.)	1 point is earned for a valid diagram.

(ii) Based on your completed diagram above, identify the hybridization of the nitrogen atom in the HNO_2 molecule.

sp^2	1 point is earned for the correct answer.

AP Exam Review Assignment

Due to the major changes to our school schedule and the AP exam, the following changes have been made to the AP exam review assignment. You can find the original assignment here, however remember that information is no longer accurate—use the information below instead!

What if I'm not taking the exam? Do I still have to do this?

- Yes! Because we aren't taking any more tests this semester, the AP exam will count as everyone's "final". Anyone who isn't taking the exam will be taking a substitute exam that I make. The test will be similar to the 45 minute AP exam everyone else is taking. You will need to prepare for it like everyone else. 😊

Instead of Completing the 9 Progress Check on AP Classroom…

- If you cannot access AP classroom, please let me know ASAP
- Choose 7 progress checks to complete
- At least 3 must be FRQ progress checks, the rest can be either MC or FRQ (I know some of you already completed 3-4 MC reviews—don't worry, those still count!)
- Progress checks must be from different units. I won't give credit for *both* the MC and FRQ for the same unit, with one exception—Unit 4 (chemical reactions and stoichiometry). You can never do too much stoichiometry practice!
- All of these must be completed no later than Friday, May 8th. (The Friday before the AP exam)

Instead of Annotating the Entire Review book…

- This is now worth extra credit! I still *highly recommend* that you do this, but it will be difficult for me to check. To turn this in, you will need to schedule a zoom appointment with me so you can show me your completed review book. If you don't have access to zoom, another method may be used (just communicate with me and we will figure it out).
- You can get partial extra credit for sections you have already completed if you choose to stop now.
- Skip anything that is part of AP units 8 and 9. There is an overview of what is covered on the exam on pages 12-13 of this packet.

Instead of an in-person practice exam…

- You will be making a cheat sheet for the exam! Instructions are on page 11 of this packet.
- The cheat sheet will be due to Turnitin.com no later than Saturday, May 9th (The Saturday before the exam), or to the front office by Monday, May 11th.
- The cheat sheet needs to be completed individually—either by hand or on the computer, your choice—but should not be a group effort. After it is turned in, I will give you time to compare cheat sheets and add key information to your cheat sheet/modify it however you want.
- Why? Now that the exam is open book/open note, I think it will be really helpful to have key information readily available. The exam is *short*—you *will not have time* to shuffle through your entire binder of notes. Additionally, making a cheat sheet helps you remember key information!

AP Chemistry: Cheat Sheet Review Assignment

Now that the AP Exam is open book/open notes, we are going to make a "cheat sheet" of key information that you can use during the exam.

Why?

- Make a cheat sheet helps you remember key information, and helps you identify what you do and don't understand
- This will allow you to review all of the information and get comfortable with what will and won't be tested.
- You won't have time to flip through all your notes/your textbook—its much better to have all key information in one location!

Expectations/Requirements:

- Cheat sheet can be typed or handwritten
- Cheat sheet must be *at least* 1 page, but should be *no more than* 3 pages (too much information gets overwhelming!)
- Information must be separated into sections—one section for each of college board's 7 units that are on the test
    - See the next page for the list of what belongs in each section!
- Cheat sheet must be completed individually. You will get a chance to compare and add to your cheat sheets after the due date, but complete the original copy *on your own.* Plagiarized cheat sheets will receive a zero for all students involved.
- **Due Saturday, May 9th by 10 pm. Turn in to Turnitin.com**. If you can't do this, contact me for an alternative method of turning in this assignment.

Advice:

- Only put information you think you might forget that will be helpful—don't waste time and space on stuff you know really well.
- Examples are great, but make sure you label them with instructions/labels so you know what you are looking at!
- Color coding helps you sort out information.
- Pictures and diagrams help break up information.

A few recommendations:

If I were you, I would probably include these things on my cheat sheet…

- Mole island
- Equilibrium shifts
- VSEPR chart with bond angles and hybridization

See next page for what topics belong to each unit!

UNIT 1 Atomic Structure and Properties

~9–10 Class Periods | 7–9% AP Exam Weighting

- SPQ 5 — 1.1 Moles and Molar Mass
- SPQ 5 — 1.2 Mass Spectroscopy of Elements
- SPQ 2 — 1.3 Elemental Composition of Pure Substances
- SPQ 5 — 1.4 Composition of Mixtures
- SAP 1 — 1.5 Atomic Structure and Electron Configuration
- SAP 4 — 1.6 Photoelectron Spectroscopy
- SAP 4 — 1.7 Periodic Trends
- SAP 4 — 1.8 Valence Electrons and Ionic Compounds

Textbook Chapters: 2, 6, 7
Our Unit: 8

UNIT 2 Molecular and Ionic Compound Structure and Properties

~12–13 Class Periods | 7–9% AP Exam Weighting

- SAP 6 — 2.1 Types of Chemical Bonds
- SAP 3 — 2.2 Intramolecular Force and Potential Energy
- SAP 4 — 2.3 Structure of Ionic Solids
- SAP 4 — 2.4 Structure of Metals and Alloys
- SAP 3 — 2.5 Lewis Diagrams
- SAP 6 — 2.6 Resonance and Formal Charge
- SAP 6 — 2.7 VSEPR and Bond Hybridization

Textbook Chapters: 8, 9
Our Unit: 9

UNIT 3 Intermolecular Forces and Properties

~14–15 Class Periods | 18–22% AP Exam Weighting

- SAP 4 — 3.1 Intermolecular Forces
- SAP 4 — 3.2 Properties of Solids
- SAP 3 — 3.3 Solids, Liquids, and Gases
- SAP 5 — 3.4 Ideal Gas Law
- SAP 4 — 3.5 Kinetic Molecular Theory
- SAP 6 — 3.6 Deviation from Ideal Gas Law
- SPQ 5 — 3.7 Solutions and Mixtures
- SPQ 3 — 3.8 Representations of Solutions
- SPQ 2 — 3.9 Separation of Solutions and Mixtures Chromatography
- SPQ 4 — 3.10 Solubility
- SAP 4 — 3.11 Spectroscopy and the Electromagnetic Spectrum
- SAP 5 — 3.12 Photoelectric Effect
- SAP 2 — 3.13 Beer-Lambert Law

UNIT 4 Chemical Reactions

~14–15 Class Periods | 7–9% AP Exam Weighting

- TRA 2 — 4.1 Introduction for Reactions
- TRA 5 — 4.2 Net Ionic Equations
- TRA 3 — 4.3 Representations of Reactions
- TRA 6 — 4.4 Physical and Chemical Changes
- SPQ 5 — 4.5 Stoichiometry
- SPQ 3 — 4.6 Introduction to Titration
- TRA 1 — 4.7 Types of Chemical Reactions
- TRA 1 — 4.8 Introduction to Acid-Base Reactions
- TRA 5 — 4.9 Oxidation-Reduction (Redox) Reactions

Textbook Chapters: 3, 4
Our Unit: 1, 2, 7

Textbook Chapters: 10, 11, 12, 13
Our Unit: 10 (distance learning only)

UNIT 5 Kinetics

~13–14 Class Periods | 7–9% AP Exam Weighting

- TRA 6 — 5.1 Reaction Rates
- TRA 5 — 5.2 Introduction to Rate Law
- TRA 5 — 5.3 Concentration Changes Over Time
- TRA 5 — 5.4 Elementary Reactions
- TRA 6 — 5.5 Collision Model
- TRA 3 — 5.6 Reaction Energy Profile
- TRA 1 — 5.7 Introduction to Reaction Mechanisms
- TRA 5 — 5.8 Reaction Mechanism and Rate Law
- TRA 5 — 5.9 Steady-State Approximation
- TRA 3 — 5.10 Multistep Reaction Energy Profile
- ENE 6 — 5.11 Catalysis

Textbook Chapters: 14
Our Unit: 4

UNIT 6 Thermodynamics

~10–11 Class Periods | 7–9% AP Exam Weighting

- ENE 6 — 6.1 Endothermic and Exothermic Processes
- ENE 3 — 6.2 Energy Diagrams
- ENE 6 — 6.3 Heat Transfer and Thermal Equilibrium
- ENE 2 — 6.4 Heat Capacity and Calorimetry
- ENE 1 — 6.5 Energy of Phase Changes
- ENE 4 — 6.6 Introduction to Enthalpy of Reaction
- ENE 5 — 6.7 Bond Enthalpies
- ENE 5 — 6.8 Enthalpy of Formation
- ENE 5 — 6.9 Hess's Law

Textbook Chapters: 5
Our Unit: 3

UNIT 7 Equilibrium

~14–16 Class Periods | 7–9% AP Exam Weighting

- TRA 6 — 7.1 Introduction to Equilibrium
- TRA 4 — 7.2 Direction of Reversible Reactions
- TRA 3 — 7.3 Reaction Quotient and Equilibrium Constant
- TRA 5 — 7.4 Calculating the Equilibrium Constant
- TRA 6 — 7.5 Magnitude of the Equilibrium Constant
- TRA 5 — 7.6 Properties of the Equilibrium Constant
- TRA 3 — 7.7 Calculating Equilibrium Concentrations
- TRA 3 — 7.8 Representations of Equilibrium
- TRA 6 — 7.9 Introduction to Le Châtelier's Principle

Textbook Chapters: 15, 17
Our Unit: 5

- TRA 5 — 7.10 Reaction Quotient and Le Châtelier's Principle
- SPQ 5 — 7.11 Introduction to Solubility Equilibria
- SPQ 2 — 7.12 Common-Ion Effect
- SPQ 2 — 7.13 pH and Solubility
- SPQ 4 — 7.14 Free Energy of Dissolution