South Pasadena • AP Chemistry

Review for the Summer Final

STUDY LIST

Chapter 1 – Matter and Measurement

- ☐ Know the difference between homogeneous and heterogeneous mixtures
- ☐ Know the difference between elements and atoms
- ☐ Know the difference between ions and molecules
- ☐ Know how to distinguish physical properties
- ☐ Know the density formula and how to use it to calculate density, mass and volume
- ☐ Know the difference between Celsius and Kelvin; convert from one to the other
- ☐ Know the difference between intensive and extensive properties
- ☐ Know your safety rules
- ☐ Know the difference between physical and chemical changes
- ☐ Know the SI units
- ☐ Know all the prefixes and their values
- ☐ Know how to do dimensional analysis
- ☐ Know how to do scientific notation
- ☐ Know the difference between precision and accuracy, and experimental error
- ☐ Know significant figures of measurements and in calculations
- ☐ Know how to do percents

Chapter 2 – Atoms and Elements

- ☐ Know the locations of Group 1A (Alkali Metals), Group 2A (Alkaline Earth Metals), Group 3A-Group 6A, Group 7A (Halogens) and Group 8A (Noble Gases/inert gases)
- ☐ Know the 7 diatomic elements

Chapter 3 – Molecules and Compounds

- ☐ Know the terms chemical formula, empirical formula, molecular formula, and structural formula
- ☐ Know your ions (monatomic ions and polyatomic ions)
- ☐ Know how to name ions in the traditional (-ic, -ous) and Stock system (II, III)
- ☐ Know the terms cations and anions
- ☐ Write and name ionic compounds
- ☐ Write and name nonmetal (molecular) compounds (mono-, di-, tri-, etc.)
- ☐ Know common names of binary compounds
- ☐ Know definition of mole and Avogadro's Number (6.02×10^{23} molecules in one mole)
- ☐ Calculate the molar mass of a substance
- ☐ Know how to convert from moles to mass(g), molecules, volume(L) using conversion factor
- ☐ Know how to calculate % composition
- ☐ Know how to calculate empirical and molecular formulas from mass percent
- ☐ Define hydrated compounds
- ☐ Know how to determine the formula of a hydrated compound from experimental data

Chapter 4 – Chemical Equations and Stoichiometry

- ☐ Define combustion
- ☐ Recognize products and reactants
- ☐ Be able to write combustion equations
- ☐ Know when to label the substances solid (s), gas (g), liquid (l), or aqueous (aq)
- ☐ Know how to balance equations
- ☐ Be able to find the molecular and empirical formulas and differentiate between the two
- ☐ Know how to convert mass and moles (i.e. 1 mol = 22.4 L = 6.02×10^{23})
- ☐ Know Molar Mass (grams / mol or $g \cdot mol^{-1}$)
- ☐ Know how to use the stoichiometric factor (♥ of the problem) (i.e. 1 mol CO_2 = 1 mol C)
- ☐ Define limiting reactant and excess reactant
- ☐ Know how to determine the limiting reactant and excess reactant

- ☐ Solve problems involving Limiting Reactants
- ☐ Given the actual yield, know how to find the theoretical yield and the percent yield
- ☐ Know how to find the mass of each element of a compound
- ☐ Know how to find empirical and molecular formula using stoichiometry

Chapter 5 – Reactions in Aqueous Solution

Properties of Aqueous Solutions

- ☐ Define **solute**, **solvent**, and **solution**. Give examples
- ☐ Give **operational** and **theoretical** definitions of **electrolytes**
- ☐ Know that soluble ionic compounds and strong acids are **strong electrolytes**. Ionic compounds of low solubility [e.g. $Mg(OH)_2$] and weak acids/bases are **weak electrolytes**.
- ☐ Know that molecular compounds (except acids) are **non-electrolytes**
- ☐ Know that **alcohols** (e.g. CH_3OH) are **not ionic hydroxides** (and are not bases). Bases are usually **metallic** hydroxides
- ☐ Know the **solubility rules**. State whether an ionic compound is soluble in water

Precipitation Reactions

- ☐ Know that precipitation reactions are **double replacement** reactions that produce an insoluble product
- ☐ Given two ionic compounds in solution, correctly **determine the products**. (Know your ions)
- ☐ Determine which product(s) is/are **precipitates**. **Use (aq) and (s)** symbols
- ☐ Correctly write the **ions** in a soluble ionic compound. [e.g. $CaCl_2$(aq) becomes Ca^{2+} + $2Cl^-$]
- ☐ Identify **spectator ions**
- ☐ Write **molecular, detailed ionic, and net ionic** equations for a precipitation reaction

Acids and Bases

- ☐ Give **operational** (cabbage juice) and **theoretical** definitions of acids and bases.
- ☐ Know that acids increase the **H^+ ion** concentration in an aqueous solution. (Theoretical definition)
- ☐ **Memorize** the 8 strong acids.
- ☐ Know that acids are **molecular compounds** that **form ions** when in aqueous solution.
- ☐ **Name acids** according to their anion.
- ☐ **ide** → hydro__ic acid; **ate** → __ic acid;
- ☐ **ite** → __ous acid;
- ☐ sulfur: add "ur"; phosphorus: add "or"]
- ☐ Know that bases increase the **OH^- ion** concentration in an aqueous solution. (Theoretical definition)
- ☐ Memorize the eight **soluble hydroxides** (except NH_4OH) that are the **strong bases**.
- ☐ Understand that **ammonia(aq)**,

  $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

  forms a **weak basic** solution.
- ☐ Know that **acids react with bases** to form H_2O and a salt. (**Neutralization**)
- ☐ Write **equations** for acid-base reactions including **NH_3** (ex on page 199) as the base.
- ☐ Know that **strong acids** and **strong bases** are **written as ions** in the ionic equations.

Gas Forming Reactions

- ☐ Recognize the six products that turn into gases. Memorize the gases formed.

Organizing Reactions in Aqueous Solution

- ☐ Know the **three examples** of double replacement reactions and each driving force:
- ☐ Precipitate reactions form an insoluble product. Acid-Base reactions form water (a very weak electrolyte therefore, a very stable product). Gas-forming reactions form a gas.
- ☐ Know that a **driving force** is something that keeps the new combinations of ions from reforming the old combinations of ions.

- ☐ **Oxidation-Reduction** is a fourth type of reaction driven by the **transfer of electrons**.

Oxidation-Reduction Reactions

$Fe_2O_3 + 3\ CO \rightarrow 2\ Fe(s) + 3\ CO_2$

- ☐ Know that an important type of reaction gets its **name** from atoms that combine with **oxygen**. During the refining of iron, carbon monoxide combines with oxygen (from the iron ore), $CO \rightarrow CO_2$ and is **oxidized**. Large masses of iron ore (Fe_2O_3) are **reduced** to a smaller amount of iron metal.
- ☐ Understand that since CO helps the iron ore to be **reduced**, CO is called the **reducing agent**. Since Fe_2O_3 causes the C to be **oxidized**, iron ore is called the **oxidizing agent**. Whatever is **oxidized** acts as the **reducing agent**. What-ever is **reduced** acts as the **oxidizing agent**.
- ☐ Mnemonics to help: **GROL**; **LeO** the lion says **GeR**; and **OIL RIG**
- ☐ Be able to **assign oxidation numbers** to any atom in any substance. Rules on page 207.
- ☐ Recognize **redox** reactions because **oxidation numbers change**. (# ↑ = oxidation / # ↓ = reduction), electrons are gained or lost.
- ☐ Know several common oxidizing agents and reducing agents and what they turn into.

Measuring Concentrations of Solutions

- ☐ Know the definition of **molarity**, **M**, as one way to communicate **concentration** of solute.
- ☐ Know that the symbol **[X]** means the concentration of X in moles/Liter ($mol \cdot L^{-1}$).
- ☐ Be able to determine the concentration of **ions** in an ionic compound.
- ☐ For example, in 0.25 M $AlCl_3$
  $[AlCl_3] = 0.25$ M
  $[Al^{3+}] = 0.25$ M $[Cl^{-}] = 0.75$ M
- ☐ Use the molarity formula to calculate **moles**, **mass**, **volume**, or **molarity** of a solution.
- ☐ Know that **Volume x Molarity = moles** of solute. **Dilution** problems use $V_iM_i = V_fM_f$.
- ☐ Describe how to **make a solution** correctly. Know what a **volumetric flask** is.

Stoichiometry of Reactions in Aqueous Solution

- ☐ Use **molarity** as a **conversion factor**.
- ☐ Know that **titration** is a technique called ***quantitative*** **chemical analysis** because you are measuring. It is also called **volumetric analysis** (because you are measuring volumes).
- ☐ Understand the terms **indicator**, **neutralization**, and **equivalence point**.
- ☐ Know common indicators such as **phenolphthalein** for titrations with strong bases.

Chapter 6 – Energy & Chemical Reactions
Driving Forces

I can…

- ☐ state the sign of ΔH based on observation of warming or cooling of the surroundings.
- ☐ correctly apply the terms exothermic and endothermic to situations where the surroundings are warming or cooling.
- ☐ draw a PE curve (uphill or downhill) based on information about warming or cooling of the surroundings.

Measuring Heat

- ☐ state the units of heat capacity, specific heat, and molar heat capacity as well as their significance.
- ☐ convert between the heat units of calories and Joules. (4.184 J = 1 calorie)
- ☐ use calorimetry ($q=mC\Delta T$) to calculate heat changes during temperature changes.
- ☐ calculate the heat transferred when two objects, at different temperatures, come into contact.

Energy = Heat and Work

- ☐ state the difference between work and heat energy.
- ☐ state the difference between system and surroundings.
- ☐ recognize the system and the surroundings in a chemical or physical system.
- ☐ calculate the change in internal energy based on changes in heat absorbed by the system and work done by the system.
- ☐ state that ΔH is a more general (and useful) measure of energy than ΔE and that $\Delta H = q$ when a reaction occurs at constant pressure.

Chemical Work = Expanding Gases

- ☐ relate physical work ($w=F\cdot d$) and chemical work ($w=P\cdot \Delta V$).
- ☐ calculate **PV work** done by an expanding gas.
- ☐ state that no work is done in a **constant volume** situation such as a bomb calorimeter.

Calculating ΔH -- Hess's Law

- ☐ state the definition of a state function.
- ☐ list examples of properties that are and are not state functions.
- ☐ write the equation for the **heat of formation** of a substance.
- ☐ state that the heat of formation of an **element** under standard conditions has a value of zero.
- ☐ use **Hess's Law** to calculate the energy of a chemical or physical change.

Calculating Heat During Phase Changes – Heats of Fusion and Vaporization

- ☐ use heats of vaporization or heats of fusion to calculate heat changes during phase changes.
- ☐ write an equation showing the heat of fusion or heat of vaporization.
- ☐ Sketch a Heating Curve and for each segment, list the energy change, the phase or phases present, and the type of calculation needed to determine the energy change.

Labs & Demonstrations

- ☐ Eye Safety Demonstration (denaturation)
- ☐ Chromatography Lab
- ☐ Density Lab
- ☐ Hydrate Demo/Lab
- ☐ Handboiler Distillation
- ☐ Flame Test Demo
- ☐ MicroMole Rockets Lab
- ☐ Decomposition of HgO
- ☐ Precipitation Lab
- ☐ Baggie Lab & Filtration
- ☐ Testing for Carbonates with Acid
- ☐ Cabbage Lab & Electrolytes
- ☐ Introduction to Redox ($CuCl_2$ + Al°)
- ☐ Molarity Demo/Lab
- ☐ Dry Ice & Acid-Base Indicators
- ☐ Steel Wool & Vinegar—Exothermic Rxn
- ☐ Exothermic & Endothermic Bags
- ☐ Heat of Fusion Lab