AP Chemistry Summer Assignment 2026

Prerequisites:

AP Chemistry is intended to be a second-year chemistry course. It is assumed that prior to taking AP Chemistry, you have successfully completed a Chemistry I course (with at least a B average). The College Board also recommends that students have successfully completed an Algebra II course (or at the very least be familiar with logarithms). Due to the intense nature of the course curriculum, and the limited amount of time prior to the AP exam for covering the material, it is expected that you have a strong grasp of Chemistry I topics. If you need additional practice with these topics, there are many resources out there on the internet. Here is a link to a digital copy of the class textbook: Chemistry- The Central Science (14th Edition) (MasteringChemistry) (1).pdf

Know that if you took Advanced Chemistry, there are topics that you are expected to know prior to taking the AP class and you will need to do some self-study over the summer to be caught up.

Topics Expected to Have Been Mastered in Chemistry I:

- Chemical Foundations (Scientific Method, Measurement, Lab Equipment, Lab techniques, SI System, Significant Figures, Density, Matter, Calculations)
- Atoms, Molecules, and Ions (Fundamental Chemical laws, Historical - Democritus, Dalton, Lavoisier, Thomson, Rutherford, Bohr, Molecules & Ions)
- Stoichiometry (Atomic masses, mole conversions, percent composition, empirical formula, molecular formula, chemical equations, balancing equations, stoichiometric calculations, limiting reactants, percent yield)
- Types of Chemical Reactions & Solutions Stoichiometry (types of chemical reactions, precipitation reactions, describing reactions in solution, stoichiometry of precipitation reactions, net ionic equations)
- Gases (Pressure, Boyle's Law, Charles' Law, Avogadro's Law, Ideal Gas Law, Gas Stoichiometry, Dalton's Law of Partial Pressures, Kinetic Molecular Theory, Effusion & Diffusion, Real Gases)
- Atomic Structure & Periodicity (Electromagnetic Radiation, Nature of Matter, Atomic Spectrum of Hydrogen, Bohr model, Quantum-Mechanical Model, Electron Configurations & Rules, History of the Periodic Table, Periodic Trends)
- Bonding (Types of Chemical Bonds, Electronegativity, Bond Polarity and Dipole moments, Ions - electron configurations and sizes, binary ionic compounds, covalent bonds, Lewis structures, exceptions to the octet rule, nomenclature)

There will be a chemical nomenclature (names and formulas of chemical compounds) test on the **SECOND** day of class. Keep in mind that in AP Chemistry you need to have the common polyatomic ions and their charges **MEMORIZED** (this is the same list that you were expected to know in MST Chemistry; those who took other courses will need to learn these over the summer) and the periodic table that is allowed to be used only has element symbols and not element names. Since nomenclature is a foundational concept of chemistry, there will be weekly nomenclature quizzes throughout the year as well.

There will be an optional summer session before school starts where we will cover chemistry I topics, math topics pertinent to the course, and lab equipment and techniques. There are tentatively two sessions (they will be the same so it is not necessary to attend both). The tentative dates are Monday, June 22nd through Wednesday, June 24th and Tuesday, July 14th through Thursday, July 16th from 9 am to 11 am in my classroom, 304. Bring appropriate materials if you attend (pencils, paper, laptop).

AP Chemistry Preview

The first unit of AP Chemistry will cover solutions chemistry and basic solubility concepts (Chapters 4 & 13 in Brown & LeMay Chemistry: The Central Science). The following topics are expected to be done during the summer (this was covered in MST Chemistry; will most likely be new material for those who took other courses):

- Hydration
- Strong and Weak Electrolytes
- Molarity
- Dilutions
- Precipitation Reactions
- Solubility Rules
- Complete and Net Ionic Equations
- Stoichiometry of Precipitation Reactions
- Acid-Base Neutralization
- Oxidation-Reduction Reactions
- Solution Composition
- Energies of Solution Formation
- Factors Affecting Solubility
- Vapor Pressures of Solutions

There will be a test over these concepts on the fourth class day, so if you haven't studied the material, you will already be behind. I highly recommend getting an AP Chemistry review book as a supplement as well.

If you would like to get early access to the AP Chemistry notes Dropbox file, email me and I will add you.

AP Chemistry requires significant preparation and study on the part of the student. Make sure that your work skills are honed for the coming year. Expect to spend time on the class every day.

Summer Assignment - Due in Google classroom on the first day of class!

1. The ideal gas law best describes the properties of which of the following gases at STP?
    a. NH_3
    b. HBr
    c. SO_2
    d. N_2
2. At 298 K and 1 atm, I_2 is a solid and Br_2 is a liquid. Those observations provide evidence that under the given conditions, the
    a. forces among I_2 molecules are stronger than those among Br_2
    b. forces among Br_2 molecules are stronger than the Br – Br bond
    c. I – I bond is stronger than the Br – Br bond
    d. Br – Br bond is stronger than the I – I bond
3. Which of the following has the bonds arranged in order of increasing polarity?
    a. F – F < N – F < H – F
    b. H – F < H – Br < H – I
    c. O – Te < O – S < O – N
    d. Sb – Cl < Sb – Te < Sb – I
4. A student is given a sample of pure, white crystalline substance. Which of the following would be most useful in providing data to determine if the substance is an ionic compound?
    a. examining the crystals of the substance under a microscope
    b. determining the density of the substance
    c. testing the electrical conductivity of the crystals
    d. testing the electrical conductivity of an aqueous solution of the substance
5. Which of the following substances has the highest boiling point, and why? Ne, HF, C_2H_6, CH_4
    a. Ne, because its atoms have the largest radius
    b. HF, because the molecules form hydrogen bonds
    c. C_2H_6, because each molecule can form multiple hydrogen bonds
    d. CH_4, because its molecules have the greatest London dispersion forces
6. A sample of a solid labeled as NaCl may be impure. A students analyzes the sample and determines that it contains 75% chlorine by mass. Pure NaCl (s) contains 61% chlorine by mass. Which of the following statements is consistent with the data?
    a. The sample contains only NaCl (s)
    b. The sample contains NaCl (s) and NaI (s)
    c. The sample contains NaCl (s) and KCl (s)
    d. The sample contains NaCl (s) and LiCl (s)
7. If a pure sample of an oxide of sulfur contains 40.% sulfur and 60.% oxygen by mass, then the empirical formula of the oxide is
    a. SO_3
    b. SO_4
    c. S_2O_6
    d. S_2O_8
8. When 4.0 L of He (g), 6.0 L of N_2 (g) and 10. L of Ar (g), all at 0 C and 1.0 atm, are pumped into an evacuated 8.0 L rigid container, the final pressure in the container at 0 C is
    a. 0.5 atm
    b. 1.0 atm

c. 2.5 atm
d. 4.0 atm

9. On the basis of molecular structure and bond polarity, which of the following compounds is most likely to have the greatest solubility in water?
    a. CH_4
    b. CCl_4
    c. NH_3
    d. PH_3
10. The compound CCl_4 is nonflammable and was once commonly used in fire extinguishers. On the basis of the periodic properties, which of the following compounds can most likely be used as a fire-resistant chemical?
    a. BCl_3
    b. CH_4
    c. CBr_4
    d. $PbCl_2$
11. Convert the following to scientific notation:
    a. 110, 575
    b. 0.0003450
    c. 123,45
12. Convert the following to standard notation:
    a. 1.23×10^5
    b. 3.680×10^{-3}
    c. 9.05×10^6
13. How many significant figures in the following values:
    a. 0.00045
    b. 0.0000560
    c. 123, 000
    d. 1030
    e. 1050.
    f. 1030.0000
14. How many protons, neutrons, and electrons in the following:
    a. chlorine-37
    b. uranium-238
    c. $\frac{208}{82}Pb^{4+}$
    d. $\frac{80}{35}Br^{-}$
15. Calculate the energy of a photon of light with a wavelength of 345 nm.
16. Write the full and abbreviated electron configuration and orbital diagram for the following:
    a. Ca
    b. Sn
    c. Hg
    d. Fe^{3+}
17. Explain the periodic trends in terms of Coulomb's law.
18. Give the name of the following compounds:
    a. $SnCl_4$
    b. $CaSO_4$

c. HBr
d. H_3PO_3
e. SiF_4
f. N_2O_5

19. Give the formula of the following compounds:
    a. iron (III) chromate
    b. auric nitrate
    c. hydrofluoric acid
    d. nitrous acid
    e. rubidium nitride
    f. diphosphorus decoxide
20. Draw the Lewis structure and give the bond angle, molecular geometry, and molecular polarity for the following molecules:
    a. CO_2
    b. BCl_3
    c. CH_2O
    d. $SiBr_4$
    e. H_2S
21. Account for the difference in boiling point for CH_4 and C_4H_{10}.
22. Explain why as you go down group 17 on the periodic table, the state of matter at 25 C goes from gas to liquid to solid.
23. A sample of diphosphorus trioxide occupies a volume of 0.997 L at STP. What is its mass?
24. If 3.550×10^{24} formula units of aluminum oxide are needed for a reaction, what mass of the compound must be obtained?
25. Determine the empirical formula for a compound having 49.30% C, 6.91% H and 43.79% O.
26. Determine the molecular formula for a compound with the following Percent composition: 59.37% C, 8.98% H and 31.64 % O and a molar mass = 202.3 g/mol
27. Balance the following equations:
    - Aluminum + chlorine → aluminum chloride
    - Calcium carbonate (heated) → calcium oxide + carbon dioxide
    - Magnesium + silver nitrate → magnesium nitrate + silver
    - Iron (III) chlorate + sodium phosphate → iron (III) phosphate + sodium chlorate
    - Propane (C_3H_8) + oxygen → carbon dioxide + water
28. Balance the following redox equations:
    - Br^- (aq) + MnO_4^- (aq) → Br_2 (l) + Mn^{2+} (aq)
    - CH_3OH (aq) + $Cr_2O_7^{2-}$ (aq) → CH_2O (aq) + Cr^{3+} (aq)
    - Mn^{2+} (aq) + $NaBiO_3$ (s) → Bi^{3+} (aq) + MnO_4^- (aq) [basic]
    - H_3AsO_4 (aq) + Zn (s) → AsH_3 (g) + Zn^{2+} (aq) [basic]
29. Predict and balance the following equations:
    - Aluminum chlorate (heated) →
    - Butane (C_4H_{10}) + oxygen →
    - Lithium + copper (II) sulfate →
    - Calcium oxide + water →
    - Aluminum sulfate + sodium hydroxide →
30. Write the complete and net ionic equations and state spectator ions for the following reactions:
    a. calcium nitrate + sodium carbonate →
    b. aluminum + cupric acetate →

31. 17.45 grams of magnesium react with excess nitrogen. How many grams of magnesium nitride can be produced?
32. What mass of octane (C_8H_{18}) must burn in oxygen to produce 15.3 L of carbon dioxide?
33. 0.285 grams of sodium chlorate decompose to sodium chloride and oxygen. How many grams of sodium chloride can be produced?If a student actually produces 0.135 grams of salt what is their percent yield?
34. What mass of ammonium nitrate must decompose to produce 7.2 liters of nitrogen at STP? (The other products are water and oxygen).
35. 15.0 grams of diantimony trisulfide react with 18.3 grams of iron to produce 9.84 antimony (ferrous sulfide is the other product). What is the limiting reactant, theoretical yield, and percent yield?
36. If 17.4 L of a gas exerts a pressure of 100.3 kPa at 25°C, what pressure would be exerted if the volume decreased to 15.0 L and the temperature decreased to 23°C?
37. How many grams of oxygen gas in a 4.50 L container are present at 2.35 atm and and 37 C?
38. How many milliliters of water are needed to make 500. mL of HCl (aq) from an 18 M stock solution?
39. Determine the $[H^+]$, $[OH^-]$, pH, and pOH of the following solutions and state whether they are acidic, basic, or neutral:
    a. 3.5×10^{-6} M HNO_3
    b. 2.35×10^{-2} M $Ca(OH)_2$
    c. 6.7×10^{-5} M NaOH
    d. 0.000323 M HBr
40. In the following reactions, identify the acid, base, conjugate acid, and conjugate base: **(4 each)**
    a. CH_3NH_2 (aq) + H_2O (l) <- -> $CH_3NH_3^+$ (aq) + OH^- (aq)
    b. HBr (aq) + H_2O (l) <- -> H_3O^+ (aq) + Br^- (aq)

41. If 25.00 mL of HBr is titrated with 32.00 mL of 0.25 M KOH, what is the concentration of the HBr?

42. 40.00 mL of 0.20 M HCl is titrated with 0.20 M LiOH. Calculate the $[H^+]$ and pH at each of the following points in the titration:

a. Start (0 mL of titrant added)
b. 10.00 mL of titrant added
c. 20.00 mL of titrant added
d. 30.00 mL of titrant added
e. 40.00 mL of titrant added
f. 50.00 mL of titrant added