

AP CHEMISTRY SUMMER ASSIGNMENT 2010-11



WESTFIELD HIGH SCHOOL
AP CHEMISTRY SUMMER ASSIGNMENT

2010-11

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This packet contains all the information you will need to know to start AP Chemistry in September. The packet should be done over the summer and not left to the last minute.

Please submit your answers clearly labeled with all work shown on separate paper.

Do not copy another student's work. The submission of another student's work as your own is cheating and you will receive a zero on the assignment.

If you have questions email me. I am usually available during normal hours, but rarely check email past 8PM at night. So if you are working at midnight, you won't get your answer until the next day.

AP chemistry is a fast-paced rigorous course. If labs are not completed during class you may have to stay after school to finish them. (This happened rarely this school year.)

AP chemistry is a college level course. It is taught as such, and you will be expected to plan your time and complete your assignments on time. There is a no late work policy.

AP Chemistry is a college course in first year chemistry. The prerequisites for AP chemistry are a first course in high school chemistry and the successful completion of algebra II . It is strongly recommended that students have taken or are currently taking courses in physics and math. The AP course is designed to cover all the topics covered in a first year college course for chemistry majors. Although the course is taught on a high school schedule, the laboratory is designed to be a complete survey of the types of reactions in a first course in inorganic chemistry. The goal of the course is for students to learn to think critically in the area of science, specifically chemistry. Students are expected to be independent learners. The course is fast-paced. This means that the workload is very heavy for a high school student with a full course load. This course requires a commitment of time on the part of the high school student. The expected workload for AP chemistry is 290 minutes per week in class and lab and 5 hours of home study per week. Students completing this course will take the Advanced Placement Chemistry exam in May. The exam in 2011 will be May ?

Textbooks:

The text for this class is Zumdahl, S and Zumdahl, S. (2006). *Chemistry*, sixth edition. Houghton Mifflin: New York.

Vonderbrink, S. (2006). *Laboratory Experiments for Advanced Placement Chemistry* second edition. Flinn Scientific: Batavia, Ill.

These books will be provided. You will have to purchase a lab data book and a webassign pass (approximately 23.50 for both). All homework is done via Webassign.

Supplies

- **Scientific calculator**
- **3 ring binder with notebook paper**
- **Any AP chemistry review book either Barrons or Prentice Hall**
- **Pencils, pen**

What you will be expected to know:

- 1. You will need a working knowledge of the Periodic Table. The AP chemistry periodic table has only a list of elements' symbols, atomic number, and atomic mass.**
- 2. You need to memorize all of the polyatomic ions from the chart enclosed.**
- 3. You need to know the solubility rules.**
- 4. You should memorize the names of acids and bases.**
- 5. You should know the diatomic molecules- HONCIBrIF or BrINCIHOF.**
- 6. You need to know the rules for assigning oxidation numbers**
- 7. You need to know how to write net ionic equations and you must know all the types of reactions as well as predicting products of the reactions.**
- 8. Basically, you need to know the first 4 chapters of Zumdahl before coming to class in September.**

The following section consists of all the problems that make up the summer assignment and are due on SEPTEMBER 9OR 10 DEPENDING ON WHEN YOUR CLASS MEETS.

1.
 - a) Calculate the density of lead if a 20 kg block has a volume of 885 cm^3 .
 - b) What is the volume of a 150 g bar of aluminum if its density is 2.70 g/cm^3
 - c. Calculate the mass of 100 cm^3 of uranium (density 19.07 g/cm^3).
2. At what temperature do Fahrenheit and Celsius scales have the same value?
3. Convert
 - a) 16 C to F
 - b) 300 C to F
 - c) 125 F to C
4. Which of the following physical properties are extensive?
 - a. heat of fusion
 - b. viscosity
 - c. melting point
 - d. conductivity
 - e. color
 - f. density
5. It is possible to use any convenient substance as the basis of a temperature scale. For example benzene freezes at 5 C and boils at 80 C. Suppose you assign the freezing point of benzene as the zero point on a new temperature scale (0 B) and assign the boiling point of benzene as 100 B on your new scale.
 - a) Which is smaller 1 B or 1 C?
 - b) What is the boiling point of ammonia (-33 C) on the new scale?
 - c) What is the melting point of sulfur (115 C) on the new scale?
6. Identify the following changes as physical or chemical changes:
 - a) Baking soda reacts with vinegar to produce carbon dioxide
 - b) Iron metal rusts in the presence of water vapor.

- c) Addition of salt melts ice on the highway
- d) Steam condenses on the bathroom mirror
- e) Milk turns sour
- f) Sugar dissolves in a cup of tea.
- g) Natural gas burns in a furnace.

7. Using dimensional analysis convert

- a. 1342 mL to L
- b. 3.26 km to mm
- c. 87.68 mg to g
- d. 400 cm^3 to m^3

8. What do these SI prefixes equal in scientific notation?

- A. milli
- B. centi
- C. mega
- D. kilo
- E. micro
- F. nano
- G. pico

9. Give the answers in the correct number of significant digits.

- A. $0.0045 \text{ in} + 1.0098 \text{ in} + 0.987 \text{ in} + 23.08 \text{ in}$
- B. $3.45 \text{ cm}^3 \times 2.70 \text{ g/cm} + (7.433 \text{ cm}^3 \times 1.677 \text{ gm cm})$
- C. $2.703 \text{ g} / (1.376 \text{ cm} \times 2.45 \text{ cm} \times 3.78 \text{ cm})$

10 A 12.3 G BLOCK OF AN UNKNOWN METAL IS IMMERSSED IN WATER IN A GRADUATED CYLINDER. The level water in the cylinder rose exactly the same distance when 17. 4 g of aluminum (density 2.70 g/cm) was added to the same cylinder. What is the density of the unknown metal?

11. A sample of a gold alloy contains 5.6 % silver by mass. How many grams of silver are there in 1 kilogram of the alloy?

Chapter 2

1. What is the difference between a molecular formula and a structural formula?
2. What is the difference between a molecular and ionic compound?
3. How can you determine if a compound is ionic or molecular?
4. How do you find the charge on a monatomic ion?
5. What is a polyatomic ion? Be sure the memorize the polyatomic ions from the chart given in the packet.
6. How are binary ionic compounds named? How are binary molecular compounds named?
7. The condensed formula for acetic acid is $\text{CH}_3\text{CO}_2\text{H}$. What is its empirical formula; what is its molecular formula; what is its structural formula?
8. Draw the structural formulas for acrylonitrile $\text{C}_3\text{H}_3\text{N}$ and aspartame $\text{C}_{14}\text{H}_{18}\text{O}_5\text{N}_2$.
9. What are isomers? Butanol and diethylether have the same molecular formula $\text{C}_4\text{H}_{10}\text{O}$. Write the structural formulas for these compounds.
10. Write the formulas for these compounds:
 - A potassium bromide
 - B. calcium carbonate
 - C. magnesium iodide
 - D. Iron II chloride
 - E. Aluminum sulfate
 - F. ammonium chlorate
 - G. Copper II phosphate

11. Name the following compounds:

- A. $(\text{NH}_4)_2\text{SO}_4$
- B. KHCO_3
- C. $\text{Ca}(\text{NO}_3)_2$
 $\text{Co}(\text{C}_2\text{H}_3\text{O}_2)_2$
- D. NaCN
- E. KOH

12. What are the formulas for these compounds?

- A. Silicon dioxide
- B. Xenon tetroxide
- C. Bromine trifluoride
- D. Phosphine
- E. Ammonia
- F. Phosphorus tribromide
- G. Boron trifluoride
- H. Carbon tetrachloride
- I. Sulfur trioxide

Chapter 3

1. **How many moles are present in 128 g of sulfur dioxide?**

2. What is the molar mass of methane?

3. What is the mass of 9 moles of fluorine?

4. How many moles in 120 g of benzene?

5. What are isotopes?

6. There are three naturally occurring isotopes of neon:

Neon 20 mass 19.9924 amu abundance 90.48%

Neon-21 mass 29.9938 amu abundance 0.27%

Neon 22- mass 21.9914 amu abundance 9.25%

What is the average atomic mass of neon. **Show calculations**

7. Uranium has an atomic mass of 238.0289. It consists of two isotopes: uranium-235 with a mass of 235.044 amu and uranium 238 with a mass of 238.051. **Calculate the percent abundance of the uranium 235 isotope. Show all work.**
8. What contribution did each of these scientists make to the study of the nature of matter?
- A. Joseph Thomson
 - B. James Chadwick
 - C. Robert Millikan
 - D. Henry Moseley
 - E. Michael Faraday
 - F. Dimitri Mendeleev
 - G. John Dalton
 - H. Henri Becquerel
 - I. Democritus
 - J. Joseph Proust
 - K. Antoine Lavoisier
 - L. Ernest Rutherford
 - M. Marie Curie
 - N. Benjamin Franklin
9. What mass of lead has the same number of atoms as 50 g of oxygen?
10. What is the percent by mass of nitrogen in ammonium nitrate?
11. What is the percent by mass of phosphorus in calcium phosphate?
12. The hydrocarbons ethylene (MM 28g/mole), cyclobutane (molar mass 56 g/mole), pentene (molar mass 70 g/mole), and cyclohexane (molar mass 84 g/mole) all have the same empirical formula. What is it? Write the molecular formulas for these four compounds.

13. A compound was analyzed and found to contain 76.57% carbon, 6.43% hydrogen, and 17.00% oxygen by mass. Calculate the empirical formula of the compound. If the molar mass of the compound is 90.12 g/mole what is the molecular formula of the compound?
14. A 15.67 g sample of a hydrate of magnesium carbonate was carefully heated without decomposing the carbonate to drive off the water. The mass was reduced to 7.58 g. What is the formula of the hydrate?
15. Anhydrous lithium perchlorate (4.78 g) was dissolved in water and recrystallized. Care was taken to isolate all of the lithium perchlorate as its hydrate. The mass of the hydrated salt obtained was 7.21 g. What hydrate is it?
16. An oxide of copper was analyzed and found to contain 88.82% copper. What is the name and formula of this oxide?
17. A compound has the formula C_3H_9N . What is the percent by mass of carbon, hydrogen and nitrogen in the compound?
18. A 50 g sample of the above compound was analyzed using combustion analysis. What mass of carbon dioxide will be produced in the analysis?
19. What mass of water will be produced in the analysis of the compound in question 17.
20. Polystyrene is often used as a plastic foam insulation in disposable cups and plates. Polystyrene like other plastics and like diamonds and silica is a network solid. Its carbon and hydrogen atoms are connected by huge networks of covalent bonds. It isn't made up of small molecules so it doesn't really have a molar mass, but like any compound polystyrene's atoms are combined in definite proportions. To learn more about the composition of polystyrene, combustion analysis was performed on a 2.57 g sample. In the combustion analysis, 8.67 g of carbon dioxide and 1.77 g of water were produced.
- A. How many moles of carbon were present in the original sample of polystyrene?
 - B. How many moles of hydrogen were present in the original sample?
 - C. What is the empirical formula of polystyrene?

Chapter 4

21. Write balanced equations for the following reactions:

- A. The decomposition of ammonium nitrate to nitrogen gas, oxygen gas, and water vapor.
 - B. The reaction of sodium bicarbonate with sulfuric acid to produce sodium sulfate, water, and carbon dioxide.
 - C. The treatment of phosphorus pentachloride with water to produce phosphoric acid and hydrogen chloride.
 - D. The reaction of ammonia with nitrogen monoxide to produce nitrogen gas and water.
 - E. The reaction of ethanol and phosphorus trichloride to produce ethyl chloride and phosphoric acid.
22. How much silver chloride is produced when 10 g of sodium chloride is treated with an excess of silver nitrate? ("is treated with" means reacts with)
23. 12 g of copper metal react with excess dilute nitric acid:
24. $3\text{Cu(s)} + 8\text{HNO}_{3(\text{aq})} \rightarrow 3\text{Cu(NO}_3)_2 + 2\text{NO(g)} + 4\text{H}_2\text{O(l)}$

How much nitrogen monoxide is produced?

25. 7.321 mg of an organic compound containing carbon, hydrogen, and oxygen was analyzed by combustion. The amount of carbon dioxide produced was 0.2503 g and the amount of water produced was 0.1025 g. A determination of the molar mass of the compound indicated a value of approximately 115 g/mole. Determine the empirical formula and the molecular formula of the compound.

Hint: $(\text{CHO})_n + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

26. The reaction of hydrogen iodide and potassium bicarbonate produces potassium iodide, water, and carbon dioxide. If 32 g of potassium bicarbonate is treated with 48 g of hydrogen iodide, what is the maximum amount of potassium iodide that can be produced?
27. Sodium metal reacts vigorously with water to produce a solution of sodium hydroxide and hydrogen gas. What mass of hydrogen gas can be produced when 10 g of sodium is added to 15 g of water?

28. Nitrous oxide reacts with oxygen to produce nitrogen dioxide. What mass of nitrogen can be made from 42 g of nitrous oxide and 42 grams of oxygen? (Hint: Determine the limiting reactant)
29. If only 75 g of nitrogen dioxide was produced in the reaction described in question 24, what is the percent yield?
30. What is the difference between a strong and weak electrolyte? What kinds of compounds are electrolytes?
31. Classify the following as nonelectrolyte, strong electrolyte or weak electrolyte:
- Glucose
 - NaCl
 - Acetic acid
 - Potassium chloride
 - Sodium bicarbonate
 - Sodium hydroxide
 - HCl
 - Copper sulfate
 - Carbonic acid
 - Citric acid
32. Predict the solubility of the following salts: (Hint:use solubility rules – you need to memorize these)

Sodium sulfate

Potassium chromate

Silver bromide

Nickel II hydroxide

Aluminum nitrate

Barium sulfide

Ammonium acetate

Strontium iodide

33. Write net ionic equations for the following reactions:

- Potassium chromate and lead acetate
- Silver perchlorate and ammonium chloride
- Potassium carbonate and copper acetate
- Sodium fluoride and magnesium iodide
- Barium nitrate and potassium sulfate

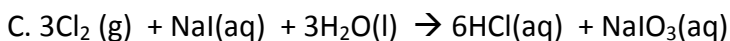
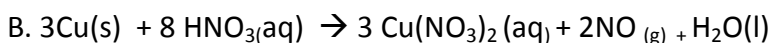
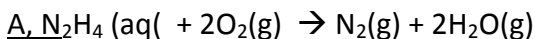
34. Write equations and classify the following reactions:

- Nitric acid and cobalt II carbonate
- Hydrocyanic acid and ammonia
- Ammonia and acetic acid
- Sodium hydroxide and nickel II carbonate
- Lead acetate and hydrochloric acid
- Iron III nitrate and sodium hydroxide

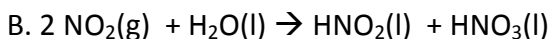
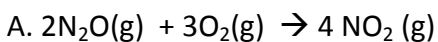
31 Give the oxidation numbers of the underlined elements:



32 In the following reactions, determine which element is oxidized, which element is reduced, which reactant is the reducing agent and which reactant is the oxidizing agent.



33. Determine which of the following reactions are acid-base reactions and which are oxidation-reduction (redox) reactions.



34. If 5.00 g of sodium hydroxide is dissolved to make 600 ml of solution, what is its molarity?

35. How much potassium chloride has to be dissolved in water to produce 2.0 l of a 2.45 M solution?

36. If 24.63 g of magnesium chloride is dissolved in 3 l of solution, what is the concentration of magnesium ions and what is the concentration of chloride ions in solution?

37. What is the molarity of the solution that results from adding 25 mL of a 0.15 M solution of sodium hydroxide in enough water to make 5.00 L of solution?

38. What volume of a 2.50 M solution of hydrochloric acid is required to prepare 2.0 l of a 0.30 M solution?

39. When excess silver nitrate is added to a 25.0 mL sample of a solution of potassium chloride, 0.9256 g of silver chloride precipitated. What is the concentration of potassium chloride solution?

40. What is the pH of a solution with a hydrogen ion concentration equal to $5.6 \times 10^{-4}\text{M}$?

41. What volume of a 0.291 M solution of NaOH is required to reach the equivalence point in a titration against 25.0 ml of 0.350 M HCl?

