AP Chemistry Midterm review packet

The test will be formatted like a mini AP Test

The exam starts at 7:00 so there 2 hours and 25 minutes.

The period will be broken into 2 70 minute segments with a 5 minute break in the middle. One for multiple choice without a calculator, and one for free response where you are allowed to use a calculator. You will not be able to work on the other section if you finish early.

There will be 40 multiple choice questions, 4 free response questions. Each section is worth 50% of the exam grade. The actual AP test will be 3 hours long and consist of 60 multiple choice questions (90 minutes) and 3 long free response problems and 4 short free response questions (105 minutes).

In most cases, questions will come off of old AP tests.

You will be given the AP periodic table, and the double sided equations and constants sheet for the exam

The AP test covers the following 9 Units

Unit 1 Atomic Structure and Properties

Unit 2 Molecular and Ionic Structure and Properties

Unit 3 Intermolecular Forces and Properties

Unit 4 Chemical Reactions

Unit 5 Kinetics

Unit 6 Thermodynamics

Unit 7 Equilibrium

Unit 8 Acids and Bases

Unit 9 Applications of Thermodynamics

I don't go in order. We haven't covered all of units 3, 6, 8 or 9.

If I haven't covered it yet, it won't be on the test.

Units Covered

Summer Assignment

This was a review a material learned in Honors Chemistry. Anything from last year could be asked.

Theory

Law

Scientific Method

Sig Figs

Mass, Volume, Density

Nomenclature

Periodic table

Stoichiometry

Limiting Reactant

Percent composition

Empirical Formula

Ultimate handbook of Chemistry

*for the purposes of this exam, you can ignore all material we have not covered in class yet. That includes redox reactions, electrolysis and complex metal ions.

Equation writing

Organic reactions

Molecular reactions

Precipitation reactions

Acid base reactions

Thermochemistry

Heat

Energy

Work

Enthalpy

Absolute Zero

ΔH

Hess' law

Laws of thermodynamics

Standard Enthalpy of Formation ΔH_f (kJ/mol)

Heat of reaction

Bonding

Atomic structure

Orbital diagrams

Electron configuration

Quantum numbers

Types of bonds

Size of atoms/ions

Bond Energy

Bond Length

Lewis dot

Molecular geometry (VSEPR)

Dipole moment

Kinetics

Rate

Rate Law

1st order rate law

2nd order rate law

Zero order rate law

Reaction mechanism

Collision theory

Molecularity

Activation energy

Activated complex

Catalyst

Arrhenius equation

Equilibrium

Equilibrium

LeChatelier's principle

Equilibrium expression (k value)

Concentration

ICE charts

Arrhenius acid and base

Bronsted Lowry acid and base

Lewis acid and base

pH

pOH

$[H^+]$ or $[H_3O^+]$

$[OH^-]$

Conjugate acid and base

Strong and weak acids and bases

K_a

K_b

Name_____

AP Chemistry 2013 Free Response

2009 AP® CHEMISTRY FREE-RESPONSE QUESTIONS (Form B)

CHEMISTRY
Section II
(Total time—95 minutes)

Part A
Time—55 minutes
YOU MAY USE YOUR CALCULATOR FOR PART A.

CLEARLY SHOW THE METHOD USED AND THE STEPS INVOLVED IN ARRIVING AT YOUR ANSWERS. It is to your advantage to do this, since you may obtain partial credit if you do and you will receive little or no credit if you do not. Attention should be paid to significant figures.

Be sure to write all your answers to the questions on the lined pages following each question in this booklet. Do NOT write your answers on the lavender insert.

Answer Questions 1, 2, and 3. The Section II score weighting for each question is 20 percent.

1. A pure 14.85 g sample of the weak base ethylamine, $C_2H_5NH_2$, is dissolved in enough distilled water to make 500. mL of solution.

   (a) Calculate the molar concentration of the $C_2H_5NH_2$ in the solution.

   The aqueous ethylamine reacts with water according to the equation below.

   $$C_2H_5NH_2(aq) + H_2O(l) \rightleftarrows C_2H_5NH_3^+(aq) + OH^-(aq)$$

   (b) Write the equilibrium-constant expression for the reaction between $C_2H_5NH_2(aq)$ and water.

   (c) Of $C_2H_5NH_2(aq)$ and $C_2H_5NH_3^+(aq)$, which is present in the solution at the higher concentration at equilibrium? Justify your answer.

   (d) A different solution is made by mixing 500. mL of 0.500 *M* $C_2H_5NH_2$ with 500. mL of 0.200 *M* HCl. Assume that volumes are additive. The pH of the resulting solution is found to be 10.93.

      (i) Calculate the concentration of $OH^-(aq)$ in the solution.

      (ii) Write the net-ionic equation that represents the reaction that occurs when the $C_2H_5NH_2$ solution is mixed with the HCl solution.

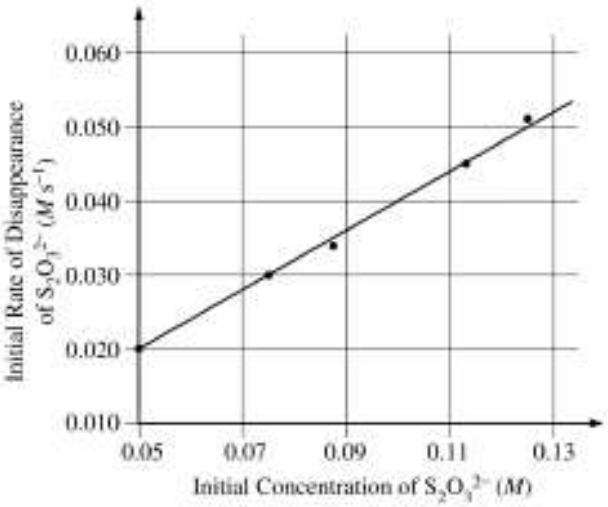
      (iii) Calculate the molar concentration of the $C_2H_5NH_3^+(aq)$ that is formed in the reaction.

      (iv) Calculate the value of K_b for $C_2H_5NH_2$.

$$S_2O_3^{2-}(aq) \xrightarrow{H^+} SO_3^{2-}(aq) + S(s)$$

2. A student performed an experiment to investigate the decomposition of sodium thiosulfate, $Na_2S_2O_3$, in acidic solution, as represented by the equation above. In each trial the student mixed a different concentration of sodium thiosulfate with hydrochloric acid at constant temperature and determined the rate of disappearance of $S_2O_3^{2-}(aq)$. Data from five trials are given below in the table on the left and are plotted in the graph on the right.

Trial	Initial Concentration of $S_2O_3^{2-}(aq)$ (M)	Initial Rate of Disappearance of $S_2O_3^{2-}(aq)$ ($M\ s^{-1}$)
1	0.050	0.020
2	0.075	0.030
3	0.088	0.034
4	0.112	0.045
5	0.125	0.051



(b) Determine the order of the reaction with respect to $S_2O_3^{2-}$. Justify your answer by using the information above.

(c) Determine the value of the rate constant, k, for the reaction. Include units in your answer. Show how you arrived at your answer.

(d) In another trial the student mixed 0.10 M $Na_2S_2O_3$ with hydrochloric acid. Calculate the amount of time it would take for the concentration of $S_2O_3^{2-}$ to drop to 0.020 M.

(e) On the graph above, sketch the line that shows the results that would be expected if the student repeated the five trials at a temperature lower than that during the first set of trials.

3. (2009)

A student was assigned the task of determining the molar mass of an unknown gas. The student measured the mass of a sealed 843 mL rigid flask that contained dry air. The student then flushed the flask with the unknown gas, resealed it, and measured the mass again. Both the air and the unknown gas were at 23.0°C and 750. torr. The data for the experiment are shown in the table below.

Volume of sealed flask	843 mL
Mass of sealed flask and dry air	157.70 g
Mass of sealed flask and unknown gas	158.08 g

(a) Calculate the mass, in grams, of the dry air that was in the sealed flask. (The density of dry air is 1.18 g L^{-1} at 23.0°C and 750. torr.)

(b) Calculate the mass, in grams, of the sealed flask itself (i.e., if it had no air in it).

(c) Calculate the mass, in grams, of the unknown gas that was added to the sealed flask.

(d) Using the information above, calculate the value of the molar mass of the unknown gas.

After the experiment was completed, the instructor informed the student that the unknown gas was carbon dioxide (44.0 g mol^{-1}).

(e) Calculate the percent error in the value of the molar mass calculated in part (d).

(f) For each of the following two possible occurrences, indicate whether it by itself could have been responsible for the error in the student's experimental result. You need not include any calculations with your answer. For each of the possible occurrences, justify your answer.

Occurrence 1: The flask was incompletely flushed with $CO_2(g)$, resulting in some dry air remaining in the flask.

Occurrence 2: The temperature of the air was 23.0°C, but the temperature of the $CO_2(g)$ was lower than the reported 23.0°C.

(g) Describe the steps of a laboratory method that the student could use to verify that the volume of the rigid flask is 843 mL at 23.0°C. You need not include any calculations with your answer.