Exam 1

# Part 1: Multiple Choice (2 points each)

## Directions: Please circle the *best* answer for each of the following questions.

1. The scientific method
   1. is just a theory.
   2. is a strict set of rules and procedures that lead to inarguable fact.
   3. isn't used much in modern chemistry.
   4. is based on continued observation and experiment.
   5. is a framework for proving an argument you know to be true.
2. Which of the following represents a physical property?
   1. Sodium metal is extremely reactive with chlorine gas.
   2. Mercury is a silvery liquid at room temperature.
   3. Aluminum has a tendency to “rust.”
   4. Argon has an unreactive nature.
   5. none of the above
3. What is the empirical formula for Hg2(NO3)2?
   1. Hg2(NO3)2
   2. HgNO3
   3. Hg(NO3)2
   4. Hg2NO3
   5. Hg4(NO3)4
4. What is the name for Hg2(NO3)2
   1. Mercurous nitrate
   2. Mercury(II) nitrate
   3. Mercury(I) nitrite
   4. Mercurous nirate
   5. a and d
5. The boiling point of neon is 27 K or
   1. -401 °F
   2. -105 °F
   3. -246 °C
   4. 300 °C
   5. none of the above
6. Choose the statement below that is true.
   1. A weak acid solution consists of mostly nonionized acid molecules.
   2. The term “strong electrolyte” means that the substance is extremely reactive.
   3. A strong acid solution consists of only partially ionized acid molecules
   4. The term “weak electrolyte” means that the substance is inert.
   5. A molecular compound that does not ionize in solution is considered a strong electrolyte.

1. Which of the following could be described as a polar covalent, partially ionized substance with poor conductivity?
   1. 0.1 M CH3CO2H (aq)
   2. Glacial acetic acid, CH3CO2H (l)
   3. 0.1 M HCl
   4. 0.1 M NaCl
   5. KClO3 (s)
2. Which isotope has 43 protons, 43 electrons, and 56 neutrons?
   1. Barium-99
   2. Neodymium-99
   3. Technicium-99
   4. Scandium-43
   5. none of the above
3. The best way to avoid inhalation of volatile chemicals while working with them it is to
   1. work in a chemical hood when using them.
   2. avoid breathing the vapors by holding beakers and flasks at arm’s length.
   3. wear a common dust mask.
   4. always keep beakers, flasks, and bottle of the chemical capped or covered.
   5. none of the above
4. Carry out the calculation below, paying special attention to significant figures, round, and units.
   1. 4.3695902
   2. 4.37 g/cm3
   3. 1.66 × 105 g/cm
   4. 1.66 × 1013 g cm3
   5. 2.01 × 102 g/cm3

# Part 2: Short Answer

## Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work.

1. What kind of information is needed to formulate a hypothesis (3 points)?
2. How is it that all soluble ionic compounds are electrolytes but soluble molecular compounds may or may not be electrolytes (3 points)?
3. Convert 46 μs to ps (3 points).
4. State the mass law(s) demonstrated by the following experimental results, and explain your reasoning (8 points).

Experiment 1: A student heats 1.00 g of a blue compound and obtains 0.64 g of a white compound and 0.36 g of a colorless gas.

Experiment 2: A second student heats 3.25 g of the same blue compound and obtains 2.08 g of a white compound and 1.17 g of a colorless gas.

1. Tellurium has an average atomic mass of 127.60 amu, which is heavier than iodine, whose mass is 126.90447 amu, yet iodine comes after tellurium on the modern periodic table. Why does this occur? Find one other instance where heavier atoms precede lighter ones on the periodic table (4 points).
2. Ethylene gas, C2H4, reacts with water at high temperature to yield ethyl alcohol, C2H6O (10 points).
   1. Write the balanced chemical equation.
   2. How many grams of carbon are in 15.43 g of ethylene?
   3. How many grams of ethyl alcohol will result from the reaction of 1.33 × 1024 molecules of water with excess ethylene gas?
3. A solution of hydrochloric acid is prepared by bubbling hydrogen chloride gas into water. If the resulting solution has a pH of 0.9745 (10 points)
   1. what is the hydrogen ion concentration of the solution?
   2. If 5.00 mL of this solution is dilute to 25.00 mL, what is the concentration of the new solution?
4. A person’s blood alcohol (C2H5OH) level can be determined by titrating a sample of blood plasma with a potassium dichromate solution. The balanced equation is (15 points)

16 H+ (aq) + 2 Cr2O72- (aq) + C2H5OH (aq) → 4 Cr3+ (aq) + 2 CO2 (g) + 11 H2O (l)

* 1. What is the oxidation state of C in C2H5OH (aq)? \_\_\_\_\_\_\_\_\_\_\_\_
  2. What is the oxidation state of C in CO2 (g)? \_\_\_\_\_\_\_\_\_\_\_\_
  3. What is the element that is oxidized? \_\_\_\_\_\_\_\_\_\_\_\_
  4. What is the element that is reduced? \_\_\_\_\_\_\_\_\_\_\_\_
  5. What is the oxidizing agent? \_\_\_\_\_\_\_\_\_\_\_\_
  6. What is the reducing agent? \_\_\_\_\_\_\_\_\_\_\_\_
  7. How many electrons are transferred in the reaction as it is balanced? \_\_\_\_\_\_\_\_\_\_\_\_
  8. If 35.46 mL of 0.05961 M Cr2O72- is required to titrate 28.00 g of plasma, what is the mass percent of alcohol in the blood?

1. Interpretation of Reactions by Ionic Type Equations. Aqueous solutions of the following substances or their mixtures with water if they are only slightly soluble, are mixed. Write first the conventional equation, second the total ionic equation, and lastly the net ionic equation. If you predict no appreciable reaction, indicate this, and state why (9 points).

* Hydrobromic acid and calcium bisulfite
* Aqueous ammonia and acetic acid

1. Barium chloride and magnesium nitrate
2. Combustion of a 1.000 g sample of an organic compound known to contain carbon, hydrogen, and oxygen produces 2.360 g of carbon dioxide and 0.640 g of water (15 points).
   1. What is the empirical formula?
   2. The molar mass of the gas cyclopronanone is about 56 g/mol. Write the balanced combustion reaction.
   3. What is the functional group for cyclopronanone? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_