Exam 1

Part I: Multiple Choice (2 points each)

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

Question 1. Molecules can be described as

1. two or more atoms chemically joined together.
2. mixtures of two or more elements that has a specific ratio between components.
3. homogeneous mixtures.
4. heterogeneous mixtures.
5. mixtures of two or more pure substances.

Question 2. Which of the following represents a hypothesis?

1. Nickel has a silvery sheen.
2. When wood burns, heat is given off.
3. Sodium reacts with water to form sodium hydroxide and hydrogen gas.
4. When a substance combusts, it combines with air.
5. Nitrogen gas is a fairly inert substance.

Question 3. Which of the following does not describe a metal?

1. Good conductor of heat.
2. Found on the left side of the periodic table.
3. Good conductor of electricity.
4. Forms ionic compounds with nonmetals.
5. Tends to gain electrons.

Question 4. Which of the following contains the fewest atoms? You shouldn’t need to do a calculation here.

1. 4.0 g Ca
2. 4.0 g Rb
3. 4.0 g na
4. 4.0 g Li
5. 4.0 g K

Question 5. Gallium has an atomic mass of 69.723 amu. Ga-69 has a mass of 68.926 amu and a percent abundance of 60.11%. How many neutrons does the other isotope contain?

1. 70.924 amu
2. 71
3. 40
4. 39.89%
5. not enough information

Question 6. Which of the following is a molecular element?

1. Krypton
2. Silver
3. Sulfur
4. Magnesium
5. Mercury

Question 7. What species is represented by the following information?

p+ = 47, n = 62, e- = 46

1. Ag+
2. Nd
3. Pd
4. Ag
5. Pd+

Question 8. Which of the following is an ionic compound?

1. SeBr2
2. CF4
3. PCl3
4. NO2
5. LiCl

Question 9. Determine the concentration of a solution prepared by diluting 25.0 mL of a stock 0.188 M Ca(NO­3)2 solution to 150.0 mL.

1. 1.13 M
2. 0.0887 M
3. 0.0313 M
4. 0.0199 M
5. 0.0501 M

Question 10. Which statement about lab safety is not true?

1. If you get a chemical on your hand you must rinse for 15 minutes.
2. Small fires may be put out with a beaker.
3. Gum chewing is permitted during experiments, but eating and drinking is not.
4. a & b

e) none of the above

Part II: 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.

Question 1. Explain how the results of the gold-foil experiment led Rutherford to dismiss the plum-pudding model of the atom and create his own model based on a nucleus surrounded by electrons (3 points).

Question 2. Can an extensive property be used to identify a substance? Explain why or why not (2 points).

Question 3. The widths of copper lines in printed circuit board must be close to a specified value. Three manufacturers were asked to prepare circuit boards with copper lines that are 0.500 μm wide. Each manufacturer’s quality control department reported the following line widths on five sample circuit boards (given in micrometers) (8 points):

|  |  |  |  |
| --- | --- | --- | --- |
|  | Manufacturer #1 | Manufacturer #2 | Manufacturer #3 |
|  | 0.512 | 0.514 | 0.500 |
|  | 0.508 | 0.513 | 0.501 |
|  | 0.516 | 0.514 | 0.502 |
|  | 0.504 | 0.514 | 0.502 |
|  | 0.513 | 0.512 | 0.501 |
| Average |  | 0.5134 | 0.5012 |
| St Dev |  | 0.00089 | 0.00084 |

* 1. Calculate the standard deviation for manufacturer #1.
  2. Can any of the manufacturers justifiably advertise that they produce circuit boards with “high precision”?
  3. Is there an instance where this claim is misleading? If so, explain.

Question 4. Ferrophosphorus (Fe2P) reacts with pyrite (FeS2), producing iron(II) sulfide and a compound that is 27.87% P and 72.13% S by mass and has a molar mass of 444.56 g/mol (10 points).

1. Determine the empirical and molecular formulas of this compound.

1. What is the name of the molecular formula? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Bonus. Write the balanced chemical equation.

Question 5. A particular brand of beef jerky contains 0.0552% sodium nitrite by mass and is sold in an 8.00-oz bag. What mass of sodium in mg does the sodium nitrite contribute to the sodium content of the bag of beef jerky (8 points)?

Question 6. Is the element with the largest atomic mass always that element present in the highest percentage by mass in a compound (2 points)?

Question 7. The U.S. Environmental Protection Agency (EPA) sets limits on the healthful levels of air pollutants. The maximum level that the EPA considers safe for lead air pollution is 1.5 µg/m3. If your lungs were filled with air containing this level of lead, how many lead atoms would be in your lungs? (Assume a total lung volume of 5.60 L.) (7 points)

Question 8. Suppose that a new temperature scale has been devised on which the melting point of ethanol is (-117oC) and the boiling point of ethanol is (78.3oC) are taken as 0oS and 100oS, respectively, where S is the symbol for the new temperature scale (8 points).

1. Derive an equation relating a reading on this scale to a reading on the Celsius scale.
2. What would this thermometer read at 45oC?

Question 9. If 10.00 mL of a ferrous chloride solution of unknown molarity is diluted with 90.00 mL of 1.0 M hydrochloric acid and 5 drops of barium diphenylaminesulfonate is added and it takes 27.30 mL of 0.01552 M potassium dichromate to reach the end point. What is the concentration of the ferrous chloride? Given the unbalanced equation (12 points):

Fe2+ (aq) + Cr2O72- (aq) 🡪 Fe3+ (aq) + Cr3+ (aq)

Question 10. Answer the following questions about the reaction of 10.4 g silver nitrate and 15.0 g barium chloride when both are dissolved in 250.00 mL of solution (20 points).

Write the balanced molecular, total ionic and net ionic equations.

How many grams of precipitate are produced? Use an ICE table.

Inventory the molarity of the ions left in the solution after the reaction has taken place.