Exam 1

# Part 1: Multiple Choice (2 points each)

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

1. What is the difference between a crystalline solid and an amorphous solid?
	1. The amorphous solid has assumed the shape of its container whereas the crystalline solid always has its own specific form.
	2. The atoms or molecules of crystalline solids are arranged in patterns with long-range, repeating order. The atoms or molecules of amorphous solids do not have any long-range order.
	3. The atoms or molecules of amorphous solids are arranged in patterns with long-range, repeating order. The atoms or molecules of crystalline solids do not have any long-range order.
	4. The atoms or molecules of crystalline solids are packed much more closely to each other than atoms or molecules of amorphous solids.
	5. none of the above
2. What kind of mixture can be separated by filtration?
	1. Two insoluble solid compounds
	2. An insoluble solid and a liquid compound
	3. Two liquid compounds
	4. Any mixture
	5. none of the above
3. Which statement best explains the difference between a law and a theory?
	1. A theory describes what nature does; a law describes why nature does it.
	2. A law summarizes a series of related observations; a theory gives the underlying reasons for them.
	3. A law is truth; a theory is mere speculation.
	4. all of the above
	5. none of the above
4. What are the main ideas in Dalton’s atomic theory?
	1. Atoms of one element can change into atoms of another element.
	2. Each atom is composed of elements.
	3. Atoms of one element cannot change into atoms of another element.
	4. Nuclear particles combine in simple, whole number ratios to form atoms.
	5. all of the above
5. 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
6. Which of the following is an ionic compound?
	1. SeBr2
	2. CF4
	3. PCl3
	4. NO2
	5. LiCl
7. Which statement about lab safety is not true?
8. If you get a chemical on your hand you must rinse for 15 minutes.
9. Small fires may be put out with a beaker.
10. Gum chewing is permitted during experiments, but eating and drinking is not.
11. a & b
12.  none of the above
13. What is the precision of the graduated cylinder?
	1. ± 1 mL
	2. ± 0.1 mL
	3. ± 0.01 mL
	4. 23.2 mL
	5. 9.3 mL
14. When multiplying or dividing measured quantities, what determines the number of significant figures in the result?
	1. The quantity with the fewest number of significant figures.
	2. The quantity with the largest number of significant figures.
	3. The quantity with the fewest number of decimal places.
	4. The quantity with the largest number of decimal places.
	5. The quantity with the largest number of zeros.
15. In the copper experiment, what color was the aluminum chloride solution produced in step 7?
	1. Red
	2. Purple
	3. Blue
	4. Colorless
	5. Clear

# 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. A sample of liquid isopropanol is placed in a sealed container. Some of the volatile isopropanol vaporizes. Does the mass of the sealed container and its contents change during the vaporization? Explain (4 points).

No. The vaporized isopropanol is just in a different physical state. It still has mass and therefore the gas plus the remaining liquid and container have the same total mass after the vaporization of some of the isopropanol.

1. In early press conferences about the *Curiosity* rover on Mars scientists and engineers expressed distances in either the English or the metric system and temperatures in K, °C, and °F in response to questions from journalists from different countries. After an early drive, *Curiosity* stopped 8.0 ft away from an interesting football-shaped rock. *Curiosity’s* wheels are 50 cm in diameter, and the rover moves at a speed of 200 m/sol, where 1 sol = 1 Martian day = 24.65 hrs (14 points).
	1. How many minutes would it take the rover to move to within 1.0 ft of the rock?
	2. One night *Curiosity* recorded a temperature reported as “-132°” on the Fahrenheit scale. If the daytime temperature was 263 K, what was the day/night temperature range in °C?

The temperature range

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

No, extensive properties change with the size of the sample and so cannot be used to identify a substance.

1. 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)?
2. 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)
3. Sulfur and fluorine form several different compounds including sulfur hexafluoride and sulfur tetrafluoride. Decomposition of a sample of sulfur hexafluoride produced 4.47 g of fluorine and 1.24 g of sulfur, while decomposition of a sample of sulfur tetrafluoride produced 4.44 g of fluorine and 1.85 g of sulfur (10 points).
	1. Calculate the mass of fluorine per gram of sulfur for the sample of sulfur hexafluoride.
	2. Calculate the mass of fluorine per gram of sulfur for the sample of sulfur tetrafluoride.
	3. Show that these results are consistent with the law of multiple proportions.

This is a simple whole number ratio. Looking at the formulas of sulfur hexafluoride and sulfur tetrafluoride: , -you can see the that ratio of fluorine atoms simplifies as follows: , which is the same ratio shown above.

1. Define the term ionic conduction (2 points).

Ionic conduction occurs when the charge is carried by ions.

1. Explain the difference between a strong acid and a weak acid (4 points).

Acids are molecular compounds that ionize when the dissolve in water. A strong acid completely ionizes in solution. They are considered strong electrolytes and conduct electricity well. A weak acid does not completely ionize in water, in fact is remains mostly in it’s nonionized state. They are considered weak electrolytes and conduct electricity poorly.

1. A certain element consists of two stable isotopes. The first has an atomic mass of 68.9257 u and a percent natural abundance of 60.40%. The second has an atomic mass of 70.9249 u (8 points).
	1. What is the percent abundance of the second isotope?
	2. What is the atomic mass of the element?
	3. What is the name and symbol of the element? \_\_\_\_\_gallium, Ga
2. Write the a) conventional, b) total ionic and c)net ionic equations for the reactions which occur when the following aqueous solutions are mixed (6 points):
	1. hydrobromic acid and calcium bisulfite

2 HBr (aq) + Ca(HSO3)2 (aq) → CaBr2 (aq) + 2 H2SO3 (aq) decomposes:

2 HBr (aq) + Ca(HSO3)2 (aq) → CaBr2 (aq) +2 H2O (l) +2 SO2 (g)

2 H+ (aq) + 2 Br- (aq) + Ca2+ (aq) + 2 HSO3- (aq) → Ca2+ (aq) + 2 Br- (aq) + 2 H2O (l) +2 SO2 (g)

2 H+ (aq) + 2 HSO3- (aq) → 2 H2O (l) +2 SO2 (g) simplifies to:

H+ (aq) + HSO3- (aq) → + H2O (l) +SO2 (g)

* 1. iron(III) nitrate and ammonia

Fe(NO3)3 (aq) + NH3 (aq) replace NH3 with NH4OH to complete double displacement rxn

Fe(NO3)3 (aq) + 3 NH4OH (aq) → 3 NH4NO3 (aq) + Fe(OH)3 (s) replace NH4OH with NH3 and H2O

 Fe(NO3)3 (aq) + 3 NH3 (aq) + 3 H2O (l) → 3 NH4NO3 (aq) + Fe(OH)3 (s)

Fe3+(aq) + 3 NO3- (aq) + 3 NH3 (aq) + 3 H2O (l) → 3 NH4+ (aq) + 3NO3- (aq) + Fe(OH)3 (s)

Fe3+(aq) + 3 NH3 (aq) + 3 H2O (l) → 3 NH4+ (aq) + Fe(OH)3 (s)

1. If 15.00 mL of a ferrous ion solution is diluted with base and then titration with 42.57 mL of 0.1155 M potassium permanganate. Given the unbalanced equation (15 points):

Fe2+ (aq) + MnO4- (aq) → Fe3+ (aq) + MnO2 (s)

* 1. What is the balanced redox reaction?

Red: MnO4- (aq) + 2 H2O (l) + 3 e- → MnO2 (s) + 4 OH- (aq)

Ox: **(**Fe2+ (aq) → Fe3+ (aq) + e-**) × 3**

Overall: MnO4- (aq) + 2 H2O (l) + 3 e- + 3 Fe2+ (aq) → MnO2 (s) + 4 OH- (aq) + 3 Fe3+ (aq) +3 e-

MnO4- (aq) + 2 H2O (l) + 3 Fe2+ (aq) → MnO2 (s) + 4 OH- (aq) + 3 Fe3+ (aq)

* 1. What is the molarity of ferrous ions in the original solution?
	2. What is the molarity of potassium ions at the end of the reaction?

M1 = 0.1155 M KMnO4

V1 = 42.57 mL

V2 = 15.00 mL + 42.57 mL = 57.57 mL

M2 = ?