Exam 1

# Part 1: Multiple Choice (2 points each)

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

1. Which of the following rules about lab safety is true?
	1. You should always add acid to water.
	2. If you spill chemical on your hand, you should wash it with water for 15 minutes unless the substance is reactive with water.
	3. At a minimum closed toed shoe should be worn in the lab.
	4. all of the above
	5. none of the above
2. Which statement is an example of an observation?
	1. In a chemical reaction, matter is conserved.
	2. All matter is made of atoms.
	3. When a given sample of gasoline is burned in a closed container, the mass of the container and its contents does not change.
	4. Atoms bond to one another by sharing electrons.
	5. all of the above
3. Which of the following mixtures could be mostly separated by use of decantation?
	1. Sugar and water
	2. Ball bearings and tennis balls
	3. Sand and salt
	4. Ball bearings and water
	5. c and d
4. Which of the following chemical reactions are not possible according to Dalton’s Atomic Theory?
	1. CCl4 🡪 CH4
	2. N2 + 3 H2 🡪 2 NH3
	3. 2 H2 + O2 🡪 2 H2O + Au
	4. a and c
	5. all of the above
5. Two samples of sodium chloride were decomposed into their constituent elements. One sample produced 1.97 g of sodium and 3.03 g of chlorine. Which of the following could be the results of the decomposition of the other sample, being consistent with the law of definite proportions?
6. 4.82 g of sodium and 1.20 g of chlorine
7. 4.82 g of sodium and 14.5 g of chlorine
8. 4.82 g of sodium and 4.34 g of chlorine
9. 4.82 g of sodium and 7.42 g of chlorine
10. 4.82 g of sodium and 4.82 g of chlorine
11. Which metric system prefixes is correctly paired with its mathematical meaning?
12. milli- and 10-2
13. micro- and 10-6
14. giga and 10-9
15. deci and 105
16. kilo and 101
17. Which of the following statements contain an exact number?
18. There are 63 apples in the box.
19. The magazine has 24 pages.
20. The paper dimensions are 8.5 x 11 inches
21. all of the above
22. none of the above
23. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ symbol/name pairs is/are *correctly* matched.
24. Fl, Fluorine
25. N, Neon
26. S, Sodium
27. Ch, Chlorine
28. H, Hydrogen
29. The meter stick in the image is being used to measure the length of a piece of wood. What is the uncertainty of the ruler?
	1. 34.2 cm
	2. ± 0.1 cm
	3. ± 1 cm
	4. ± 10 cm
	5. none of the above
30. Consider the following periodic table.

In what numbered section would the transition metals be found?

|  |  |  |
| --- | --- | --- |
|   | a.  | 1 |
|   | b.  | 2 |
|   | c.  | 3 |
|   | d.  | 4 |
|   | e.  | 5 |

# 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 is wrong with the statement, “It is just a theory” (4 points)?

To say “It is just a theory” makes it seems as if theories are easily discardable. However, many theories are very well established and are as close to truth as we get in science. Established theories are backed up with years of experimental evidence, and are the pinnacle of scientific understanding.

1. Classify each of the following as macroscopic, microscopic, or particulate (4 points)
	1. Tree macroscopic
	2. Plant cell microscopic
	3. Protein molecule particulate
	4. Electron particulate
2. Identify the principal type of energy (kinetic or potential) exhibited by each of the following (5 points):
	* + - 1. A car parked on a hill. \_\_\_\_\_potential\_\_\_\_\_\_\_\_\_\_\_\_
				2. A car traveling at 60 miles per hour. \_\_\_\_\_kinetic\_\_\_\_\_\_\_\_\_\_
				3. Chemical energy. \_\_\_\_\_potential\_\_\_\_\_\_\_\_\_
				4. A falling rock. \_\_\_\_\_kinetic\_\_\_\_\_\_\_\_
				5. Compressed air in a tank. \_\_\_\_potential\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Aluminum bromide, AlBr3, is a white-yellow crystalline solid that has a melting point of 97.5 °C. When aluminum metal and bromine liquid are placed in a container aluminum bromide is formed (10 points).
	1. What is its melting point in degrees Fahrenheit?

$T\_{F}=\left(\frac{9 ℉}{5 ℃}\right)T\_{C}+32=\left(\frac{9 ℉}{5 ℃}\right)\left(97.5 ℃\right)+32=175.5 ℉+32=207.5 ℉=208 ℉$

* 1. What is its melting point in Kelvin?

$$T\_{K}=T\_{C}+273.15=97.5+273.15=370.65 K=370.7 K$$

* 1. List all the physical properties of AlBr3 found in the preceding narrative.

White-yellow crystalline solid

Melting point of 97.5 °C

* 1. List all the chemical properties of AlBr3 found in the preceding narrative.

Aluminum and bromine react to form aluminum bromide.

1. A student wants to determine the density of an irregular solid, gold. The sample weighs 288.223 grams. The initial volume of the graduated cylinder is 10.4 mL and after the solid is added the volume is 24.9 mL (10 points).
2. What is the volume of the solid?

Vsolid = 24.9 mL – 10.4 mL = 14.5 mL

1. What is the density of the solid?

$$D=\frac{m}{V}=\frac{288.223 g}{14.5 mL}=19.87744828\frac{g}{mL}≈19.9\frac{g}{mL}$$

1. Gold has a density of 19.3 g/mL. What is the percent error in the student’s density?

$$\%error=\frac{experimental value-accepted value}{accepted value}×100\%$$

$$\%error=\frac{(19.9\frac{g}{mL}-19.3\frac{g}{mL})}{19.3\frac{g}{mL}}×100\%=\frac{0.6\frac{g}{mL}}{19.3\frac{g}{mL}}×100\%=3.10880829\%≈3\%$$

1. Classify each change as physical or chemical (5 points):
	* + - 1. Sugar burns in a pot. chemical
				2. The liquid propane in a barbecue evaporates away because someone physical

left the value open.

* + - * 1. The liquid propane in a barbecue ignites upon contact with a spark. chemical
				2. Copper metal turns green on exposure to air and water. chemical
				3. Table salt, sodium chloride, dissolves in hot water. physical
1. Consider the following models of the atom: (a) Dalton, (b) Thomson (Plum Pudding Model), (c) Rutherford (Nuclear Model) (6 points).
	* + - 1. How does the location of the electrons in an atom vary?

Electrons

Dalton – electrons are not part of his model

Thomson – electrons are scattered throughout the positive mass of matter in an atom

Rutherford – electrons are located out in space away from the central positive mass

* + - * 1. How does the location of the atom’s positive matter compare?

Positive matter

Dalton – no positive matter in his model

 Thomson – positive matter is distributed throughout the atom

 Rutherford – positive matter is concentrated in a small central nucleus

1. A sunscreen preparation contains 2.50% by mass benzyl salicylate. If a tube contains 4.0 ounces of sunscreen, how many kilograms of benzyl salicylate are needed to manufacture 325 tubes of sunscreen (8 points)?

$$325 tubes×\frac{4.0 oz sunscreen}{1 tube}×\frac{1 lb}{16 oz}×\frac{453.59 g}{1 lb}×\frac{1 kg}{1000 g}×\frac{2.50 kg benzyl salicylate}{100 kg sunscreeen}=0.92 kg benzyl salicylate $$

1. Earth has a surface area of 197 million square miles. What is its area in square kilometers (6 points)?

$197×10^{6} mi^{2}×\left(\frac{5280 ft}{1 mi}\right)^{2}×\left(\frac{12 in}{1 ft}\right)^{2}×\left(\frac{2.54 cm}{1 in}\right)^{2}×\left(\frac{10^{-3} km}{100 cm}\right)^{2}=5.10×10^{8} km^{2}$ or

$$197×10^{6} mi^{2}×\left(\frac{1.609 km}{1 mi}\right)^{2}=5.10×10^{8} km^{2} or $$

510 million square kilometers

1. Complete the following table (8 points):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Atomic | Atomic | Mass  | Number of | Number of | Number of  |
|  | Notation | Number | Number | Protons | Electrons | Neutrons |
|  | **7834Se2-** |  **34** | 78 | 34 | 36 |  **44** |
|  | Xe-131 |  **54** | 131 |  **54** | **54**  |  **77** |
|  | **120**50Sn4+ | 50 | **120**  |  **50** |  **46** | 70 |

1. The CRC Handbook, a large reference book of chemical and physical data, lists two isotopes of silver (Z = 47). The atomic mass of 51.839% silver-107 is 106.9051 u. Through a typographical oversight, the atomic mass of the second isotope, silver-109, is not printed (14 points).
	* + - 1. What is the percent abundance of silver-109?

$$\%abundance\_{Ag-109}=100-51.839=48.161\%$$

* + - * 1. Calculate that atomic mass, taking the tabulated atomic mass of silver of 107.8682 u.

$$atomic mass=\sum\_{}^{}m\_{isotope}\left(\frac{\%abundance\_{isotope}}{100}\right)$$

$$atomic mass=m\_{Ag-107}\left(\frac{\%abundance\_{Ag-107}}{100}\right)+m\_{Ag-109}\left(\frac{\%abundance\_{Ag-109}}{100}\right)$$

$$107.8682 u=\left(106.9051 u\right)\left(\frac{51.839}{100}\right)+\left(m\_{Ag-109}\right)\left(\frac{48.161}{100}\right)$$

$$107.8682 u=55.41853479 u+\left(m\_{Ag-109}\right)\left(\frac{48.161}{100}\right) $$

$$52.44966521 u= \left(m\_{Ag-109}\right)(0.48161)$$

$$\left(m\_{Ag-108}\right)=108.9048508 u ≈108.90 u$$

* + - * 1. Identify the number of protons, neutrons, and electron in silver-109.

Protons = 47, neutrons = 109 – 47 = 62, electrons = 47