Exam 1

# Part 1: Multiple Choice (2 points each)

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

1. Which element is not a representative element?
	1. Aluminum
	2. Sulfur
	3. Potassium
	4. Boron
	5. Iron
2. Which of the following numbers are correctly expressed in scientific notation?

i. 43,200,000 = 4.32×107 ii. 0.000977 = 9.77×104 iii. 606,000 = 6.06×10–5 iv. 0.00000175 = 1.75 × 10–6

1. i and iv
2. ii and iii
3. i and iii
4. ii and iv
5. All of the above
6. What is the measurement shown by the calipers?
	1. 0 mm
	2. 0.8 cm
	3. 10.5 cm
	4. 19.8 cm
	5. 26.8 cm
7. Convert 32.7 m to mm.
	1. 32,700 mm
	2. 0.0327 mm
	3. 327 mm
	4. 0.0327 mm
	5. 0.327 mm
8. Consider a situation in which you are walking at 3.7 miles per hour. Which of the following per expression is true?
	1. 3.7 mi = 1 hr
	2. $\frac{3.7 mi}{1 hr}$
	3. $\frac{1 hr}{3.7 mi}$
	4. Distance in miles is directly proportional to time in hours.
	5. all of the above
9. Which of the following most accurately describes the change represented:



* 1. A physical change which follows the law of conservation of mass.
	2. A physical change which does not follow the law of conservation of mass.
	3. A chemical change which follows the law of conservation of mass.
	4. A chemical change which does not follow the law of conservation of mass.
	5. none of the above
1. The meter stick in the image is being used to measure the length of a piece of wood. How many significant figures should be used to express this measured length?
	1. 1
	2. 2
	3. 3
	4. 4
	5. 5
2. Isotopes of an element vary in mass because of differing numbers of
	1. protons
	2. neutrons
	3. electrons
	4. protons and neutrons
	5. protons and electrons
3. Which statement is consistent with Rutherford’s nuclear model of the atom as it was originally stated?
	1. Helium atoms have two protons in the nucleus and two electrons outside the nucleus.
	2. Most of the volume of hydrogen atoms is due to the nucleus.
	3. Aluminum atoms have 13 protons in the nucleus and 22 electrons outside the nucleus.
	4. The majority of the mass of nitrogen atoms is due to their 7 electrons.
	5. all of the above
4. Tasting chemicals
	1. is allowed for solutions that are very dilute.
	2. is allowed for lab chemicals that we also know are “common chemicals”.
	3. is allowed for chemicals that are known to be nontoxic.
	4. is never allowed in chemistry labs.
	5. all of the above

# 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 chemist in an imaginary universe does an experiment that attempts to correlate the size of an atom with its chemical reactivity. The results are tabulated as follows (6 points).

|  |  |
| --- | --- |
| Size of Atom | Chemical Reactivity |
| small | low |
| medium  | intermediate  |
| large  | high |

* 1. Formulate a law from this data.

All atoms contain a degree of chemical reactivity, so the larger the size of an atom, the higher the chemical reactivity of that atom.

* 1. Formulate a theory to explain this law.

There are many correct answers. One example is” Conceivable, when the size of an atom is increased, the surface area of the atom is also increased; an atom with a greater surface area is more likely to react chemically.

1. Write the chemical formulas for compounds containing (6 points):
	1. Three iron atoms for every four sulfur atoms. \_\_\_\_Fe3S4
	2. Two hydrogen atoms for every one oxygen atom. \_\_\_\_H2O
	3. One phosphorus atoms for every three chlorine atoms. \_\_\_\_PCl3
2. Answer the following questions about the reaction of potassium metal, K, and hydrogen gas, H2, to produce potassium hydride, KH (8 points).

2 K (s) + H2 (g) → 2 KH (s)

* 1. Identify KH (s) as a reactant or product. \_\_\_\_product
	2. Identify K (s) as a reactant or product. \_\_\_\_reactant
	3. What is the name of the group K (s) falls into? \_\_\_\_alkali metals
	4. What is the state of H2 (g)? \_\_\_\_gas
	5. What is the state of KH (s)? \_\_\_\_solid
	6. Calculate the mass of potassium needed to react with 4.50 g of hydrogen gas to produce 179.05 g of potassium hydride.

2 K (s) + H2 (g) → 2 KH (s)

x + 4.50 g = 179.05 g

x = 179.05 g – 4.50 g = 174.55 g

Law of conversation of mass

1. If 1.4% of the mass of a human body is calcium, how many kilograms of calcium are there in a 173 pound man (8 points)?

$$173 lb body×\frac{453.59 g}{1 lb}×\frac{1 kg}{1000 g}×\frac{1.4 kg Ca}{100 kg body}=1.09859498 kg Ca≈1.1 kg Ca$$

1. The density of balsa wood is 0.16 g/cm3. What is mass, in grams, of 6.78 ft3 of balsa wood (8 points)?

$$6.78 ft^{3}×\left(\frac{12 in}{1 ft}\right)^{3}×\left(\frac{2.54 cm}{1 in}\right)^{3}×\frac{0.16 g}{1 cm^{3}}=30718.11518 g=3.1×10^{4} g$$

1. Identify each of the following as a solid, liquid, or gas (5 points).
	1. Vitamin tablets in a bottle solid
	2. Helium in a balloon gas
	3. Milk in a bottle liquid
	4. The air you breathe gas
	5. Charcoal briquettes on a barbecue solid
2. What are the forms of energy involved in the following examples (6 points):
	1. light bulb electrical energy → heat energy + radiant energy
	2. heater electrical energy → heat energy
3. Nail polish remover, acetone, boils at 56.05 °C (8 points).
	1. What is the boiling point in degrees Fahrenheit?

$$°F= \frac{9}{5} °C+32$$

$$°F= \frac{9}{5}\left(56.05\right)+32=100.89+32=132.89=132.9 ℉$$

* 1. What is the temperature in Kelvin?

K = °C + 273.15

K = 56.05 + 273.15 = 329.20 K

1. Determine whether each statement is true or false. If false, correct it (5 points).
	1. The Ti2+ ion contains 22 protons and 24 electrons.

False, the Ti2+ ion contains 22 protons and 20 electrons.

* 1. The I- ion contains 53 protons and 54 electrons.

True

* 1. The Mg2+ ion contains 14 protons and 10 electrons.

False, the Mg2+ ion contains 12 protons and 10 electrons.

1. An element has two naturally occurring isotopes. Isotope 1 has a mass of 120.9038 u and a relative abundance of 57.4%, and isotope 2 has a mass of 122.9042 u (10 points).
	1. What is the percent abundance of the second isotope?

$$100\%-57.4\%=42.6\%$$

* 1. What is the atomic mass of the element?

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

$$atomic mass=\left(120.9038 u\right)\left(\frac{57.4}{100}\right)+(122.9041 u)\left(\frac{42.6}{100}\right)$$

$$atomic mass=69.3987812 u+ 52.3571466 u$$

$$atomic mass=121.7559278 u≈121.8 u$$

* 1. What is the name and symbol of the element? \_\_\_\_\_antimony, Sb
1. Label each of the following pieces of laboratory glassware with their correct names: crucible tongs; evaporating dish; scoopula; Erlenmeyer flask; beaker (5 points).



Erlenmeyer flask beaker scoopula evaporating dish crucible tongs flask

1. In an experiment similar to part 1 of the Mass, Volume, Density experiment the following data was collected (10 points).
	1. Complete the table below:

|  |  |
| --- | --- |
| Mass of beaker and solution | 125.447 g |
| Mass of beaker | 99.887 g |
| Mass of solution | $$125.447 g-99.887 g= 25.560 g$$ |
| Volume of solution | 24.3 mL |
| Density of solution | $$D=\frac{m}{V}=\frac{25.560 g}{24.3 mL}=1.051851852\frac{g}{mL}≈1.05\frac{g}{mL}$$ |
| Actual Value | 1.034 g/mL |
| Percent error  | $$\% error=\frac{observed value-accepted value}{accepted value}×100$$$$percent error=\frac{1.05 \frac{g}{mL}-1.034\frac{g}{mL}}{1.034\frac{g}{mL}}×100$$$$percent error=\frac{0.016\frac{g}{mL}}{1.034\frac{g}{mL}}×100$$$$percent error=1.547388781\%≈2\%$$ |

* 1. If some of the solution spilled before the volume was measured, how would that change the density (too high, too low, unchanged)? Explain your answer.

The volume would be smaller than it should be. Therefore, the density would be higher because density is inversely proportional to volume.