Exam 1

# Part 1: Multiple Choice (2 points each)

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

1. Which elements on the periodic table are found as liquids at room temperature?
	1. Mercury
	2. Bromine
	3. Carbon
	4. a and b
	5. all of the above
2. Which particle-level diagram is the best representation for a $^{+}$ ion?



a.  c. 

b.  d. 

e. none of the above

1. John Dalton postulated that all matter is composed of small particles called atoms. For this proposition to be considered a valid scientific theory,
	1. it must be impossible to prove wrong by experiment.
	2. all possible experiments must never find an exception to it.
	3. some, but only a few, experiments may find exceptions to it.
	4. it must be voted on by the scientific community and accepted by all.
	5. it must be supported by experimental evidence and testing.
2. What is the precise of the calipers?
	1. 0.01 cm
	2. 0.1 cm
	3. 1 cm
	4. 10 cm
	5. 20 cm
3. Molecules can be described as
	1. mixtures of two or more pure substance.
	2. mixtures of two or more elements that has a specific ratio between components.
	3. two or more atoms chemically joined together.
	4. heterogeneous mixtures.
	5. homogeneous mixtures.
4. Which of the following represents a valid hypothesis?
	1. Neon does not react with oxygen.
	2. Sodium metal reacts violently with water.
	3. Lead is soft and malleable.
	4. Oxygen is a gas at room temperature.
	5. Metals tend to lose electrons.
5. Which of the following rules about lab safety is false?
	1. You should always pour away from the label.
	2. If you spill chemical on your hand, you should wash it with water for 5 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
6. Which metric system prefixes is correctly paired with its mathematical meaning?
7. milli- and 10-2
8. micro- and 10-6
9. giga and 10-9
10. deci and 105
11. kilo and 101
12. 26 students is an example of a/an
13. exact number.
14. per expression.
15. unit conversion.
16. rounded number.
17. all of the above
18. Which of the following is a property of both the liquid and the solid state?
19. A definite volume.
20. A definite shape.
21. An indefinite shape.
22. An indefinite shape and definite volume.
23. A definite shape and an indefinite volume.

# 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. Assume that you have four pennies with unknown mint dates and four hypotheses concerning these dates: (1) all dates are the same; (2) two different dates are present; (3) three different dates are present; (4) all dates are different. Which of the listed scientific hypothesis could be eliminated by determining that (6 points)
	1. two pennies have the same date? 4
	2. two pennies have different dates? 1
	3. two of three pennies have the same date? 1 and 4
	4. three pennies have different dates? 1 and 2
2. 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. What are the name and symbol of the element whose average atoms have a mass (8 points)
	1. close to four times the mass of an average nitrogen atom? Iron, Fe
	2. that is 81.2% of the mass of an average silver atom? Strontium, Sr
2. that is three times the atomic number of lithium? Beryllium, Be
3. close to one-fifth the mass of an average neon atom? Helium, He
4. What is the difference in meaning between the times 3.3 seconds and 3.30 seconds (3 points)?

The uncertainty in the first reading is ± 0.1 second, and the uncertainty in the second reading is ± 0.01 second.

1. Identify each as a mixture or pure substance (5 points).
	1. Table salt (NaCl) \_\_\_\_\_\_pure substance\_\_\_\_\_\_\_\_\_
	2. Ethanol (CH3CH2OH) \_\_\_\_\_\_\_pure substance\_\_\_\_\_\_\_\_\_\_\_
	3. Air (mostly N­2 and O2) \_\_\_\_\_\_\_\_mixture\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. Whole blood \_\_\_\_\_\_\_mixture\_\_\_\_\_\_\_\_\_\_\_\_\_
	5. Root beer float \_\_\_\_\_\_\_mixture\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. The cost of manufacturing a pain-killing drug is calculated to be 75 cents per gram. What is the cost, in dollars and cents of 3.75 cg of the drug (5 points)?

$$3.75 cg×\frac{1 g}{100 cg}×75\frac{cents}{g}=2.8 cents≈\$0.03$$

1. Suppose that you need 515 mL of tomatoes to make salsa, but only have cups. How many cups of tomatoes do you need (5 points)?

$$515 mL×\frac{1 L}{1000 mL}×\frac{1.057 qt}{1 L}×\frac{4 cups}{1 qt}=2.17742 cups≈2.18 cups$$

|  |  |
| --- | --- |
| Metal | Density (g/mL) |
| Gold | 19.3 |
| Silver | 10.5 |
| Copper  | 8.96 |
| Lead | 11.3 |

1. You buy an ingot of silver off of the internet. Given the current price of silver you want to make sure that it is real. You decide to determine the density use the method of water displacement of the ingot and compare it to the density of silver. The ingot has a mass of 208.635 g. The initial volume of the water is 92.01 mL and after the ingot was added the volume is 102.51 mL. The density of some metals are given (8 points):
	1. What is the volume of the ingot?

$$V\_{ingot}=102.51 mL-92.01 mL=10.50 mL$$

* 1. What is the density of the ingot?

$$D=\frac{m}{V}=\frac{208.635 g}{10.50 mL}=19.87\frac{g}{mL}$$

* 1. Is the ingot likely to be silver, if not what is it likely to be? \_\_\_\_No, the ingot is likely to be gold based on the density\_\_\_\_\_\_\_
1. Specify the physical state of a pure substance at each of the following conditions, or indicate that the state determination is not possible from the information given (4 points).
2. 10 °C below its freezing point solid
3. 30 °C above its melting point not possible
4. After sublimation has taken place gas
5. At its boiling point not possible
6. The liquid propyl cyanide has a density of 0.794 g/mL at 20.0 °C (8 points).
	1. If a 142 gram sample of this compound is needed, what volume of the liquid at 20.0 °C must be provided (4 points)?

$142 g×\frac{1 mL}{0.794 g}=178.8413098 mL=179 mL$

* 1. What is the temperature of the propyl cyanide in degrees Fahrenheit?

$$T\_{F}=\left(\frac{9 ℉}{5 ℃}\right)T\_{C}+32=\left(\frac{9 ℉}{5 ℃}\right)\left(20.0 ℃\right)+32=36.0 ℉+32=68.0 ℉$$

* 1. What is the temperature of propyl cyanide in Kelvin?

$$T\_{K}=T\_{C}+273.15=20.0+273.15=293.15 K=293.2 K$$

1. Identify the principal type of energy (kinetic or potential) exhibited by each of the following (4 points):
	* + - 1. A car traveling at 60 miles per hour. \_\_\_\_\_kinetic\_\_\_\_\_\_\_\_\_\_
				2. Compressed air in a tank. \_\_\_\_potential\_\_\_\_\_\_\_\_\_\_\_\_\_
				3. A car parked on a hill. \_\_\_\_\_potential\_\_\_\_\_\_\_\_\_\_\_\_
				4. Chemical energy. \_\_\_\_\_potential\_\_\_\_\_\_\_\_\_
2. Classify each change as physical or chemical (4 points):
	* + - 1. Table salt, sodium chloride, dissolves in hot water. physical
				2. Copper metal turns green on exposure to air and water. chemical
				3. 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
1. Characterize each of the following pairs of atoms as containing (1) the same number of neutrons, (2) the same number of electrons, or (3) the same total number of subatomic particles (4 points).
	1. $ and $ (3) same total number of subatomic particles, 60
	2. $ and $ (1) same number of neutrons, 16
	3. $ and $ (1) same number of neutrons, 12
	4. $ and $ (2) same number of electrons, 3
2. The three main isotopes of hydrogen are protium, 1H (1.007825082 u, 99.9885% abundance), deuterium, 2H (2.0141101778 u, 0.0115% abundance) and tritium, 3H (3.016049268 u, 0% abundance) (12 points).
	* + - 1. What is the atomic mass of hydrogen? Use a calculation to support your answer.

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

$$atomic mass=m\_{H-1}\left(\frac{\%abundance\_{H-1}}{100}\right)+m\_{H-2}\left(\frac{\%abundance\_{H-2}}{100}\right)$$

$$atomic mass=\left(1.0078250802 u\right)\left(\frac{99.9885}{100}\right)+\left(2.0141101778 u\right)\left(\frac{0.0115}{100}\right)$$

$$atomic mass=1.00770918 u+0.000231623 u $$

$$atomic mass= 1.007940803 u≈1.00794 u$$

* + - * 1. How many neutrons are there in deuterium? \_\_\_1
				2. How many protons are there in tritium? \_\_\_\_1
				3. Why is tritium not included in the atomic mass calculation?

It is not a naturally occurring isotope of hydrogen.