Exam 1

Part I: Multiple Choice (2 points each)

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

Question 1. According to Dalton’s atomic theory, which of the following are true?

1. Atoms of an element are identical to atoms of other elements.
2. Atoms of two different elements combine to form compounds.
3. In a chemical reaction, some atoms disappear and new atoms appear.
4. Every element is made of atoms.
5. b and d

Question 2. Electrons drop to lower energy levels when they \_\_\_\_ a photon.

1. absorb
2. emit
3. kilojoule
4. walk
5. none of the above

Question 3. In this list, which substance can be classified as a chemical?

1. Heat
2. Cold
3. Salt
4. Temperature
5. Sleep

Question 4. How many centimeters are there in 57.0 in?

1. 145 cm
2. 22.4 cm
3. 140 cm
4. 0.0445 cm
5. 22 cm

Question 5. The measurement 0.000043 m, expressed correctly using scientific notation, is

1. 4.3 m
2. 4.3 x 10-6 m
3. 43000 m
4. 4.3 x 106 m
5. 4.3 x 10-5 m

Question 6. How many oxygen atoms are in hydroxyapatite, Ca5(PO4)3OH, a major compound in human bones and teeth?

1. 1
2. 3
3. 4
4. 5
5. 13

Question 7. When ice melts, the change that takes place is

1. a chemical change.
2. an exothermic process.
3. evaporation.
4. a physical change.
5. fusion.

Question 8. A pure substance is matter that consists of matter with a composition that

1. always contains oxygen.
2. varies according to the amount of water present.
3. depends on the temperature.
4. always contains two or more substances.
5. is fixed in a definite proportion at all times.

Question 9. The visible light spectrum covers the wavelength range

1. 900 to 1400 nm
2. 400 to 700 nm
3. 250 to 400 nm
4. 1400 to 2000 nm
5. 700 to 900 nm

Question 10. The 2s orbital

1. is lobe shaped.
2. has no shape.
3. is spherical and larger than the 1s orbital.
4. is spherical and smaller than the 1s orbital.
5. is spherical and the same size as the 1s orbital.

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. Identify the following statements as true or false (10 points):

|  |  |  |
| --- | --- | --- |
| a.  | Organic chemistry is the study of substances that contain carbon. | true |
| b. | Geochemistry is the study of chemical reactions that take place in the body.  | false |
| c. | Compounds can be broken down into their elements by melting.  | false |
| d. | To change from Celsius temperature to Kelvin, add 100.  | false |
| e. | Heat flows from a hotter to a cooler body.  | true |
| f. | The symbol for the wavelength of electromagnetic radiation is λ. | true |
| g. | The shortest wavelength of visible light is violet light.  | true |
| h. | The atomic radium of strontium is smaller than the atomic radius of magnesium. | false |
| i.  | Fluorine has a higher ionization energy than sodium. | true |
| j. | Ca2+, K+, S2-, and Cl- are all isoelectronic. | true |

Question 2. Identify each of the following activities in the scientific method as an observation (O), a hypothesis (H), an experiment (E), or a theory (T). Lucia wants to develop a process for dying shirts so that the color will not fade when the shirt is washed. She proceeds with the following activities (6 points):

|  |  |  |
| --- | --- | --- |
| a.  | Lucia notices that the dye in a design fades when the shirt is washed. | Observation |
| b. | Lucia decides that the dye needs something to help it combine with the fabric. | Hypothesis |
| c. | She places a spot of dye on each of four shirts and then places each one separately in water, salt water, vinegar, and baking soda and water. | Experiment |
| d. | After one hour, all the shirts are removed and washed with a detergent.  | Experiment |
| e. | Lucia notices that the dye has faded on the shirts in water, salt water, and baking soda, while the dye did not fade on the shirt soaked in vinegar. | Observation |
| f. | Lucia thinks that the vinegar binds with the dye so it does not fade when the shirt is washed.  | Theory |

Question 3. Arrange the following elements in order of increasing metallic character (4 points): Fr, Sb, In, S, Ba, Se

 S, Se, Sb, In, Ba, Fr

Question 4. Complete the following table (5 points):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Symbol | Z | A | #p | #e- | #n | Charge |
| Na | 11 | 23 | 11 | 11 | 12 | 0 |
| Se2- | 34 | 79 | 34 | 36 | 45 | 2- |
| P | 15 | 31 | 15 | 15 | 16 | 0 |

Question 5. Races are measured in terms of laps. If one lap is 400 ft, how far does a runner run in mm if they run 0.523 laps (5 points)?

$$0.523 laps×\frac{400 ft}{1 lap}×\frac{12 in}{1 ft}×\frac{2.54 cm}{1 in}×\frac{10 mm}{1 cm}=63764.16 mm=6.38×10^{4} mm$$

Question 6. A radio station broadcasts at a frequency of 99.0 MHz. What is this frequency in Hz (3 points)?

$$99.0 MHz×\frac{10^{6} Hz}{1 MHz}=9.90×10^{7} Hz$$

 Question 7. Complete the following sentences with the elements bromine, calcium, or carbon (4 points):

1. \_\_\_\_\_Bromine\_\_\_\_\_\_\_\_\_\_ is an atom with 7 valence electrons.
2. \_\_\_\_\_Carbon\_\_\_\_\_\_\_\_\_\_ is an atom with 4 valence electrons.
3. \_\_\_\_\_Calcium\_\_\_\_\_\_\_\_\_\_ is an atom with 2 valence electrons.
4. \_\_\_\_\_Calcium\_\_\_\_\_\_\_\_\_\_ is an atom with 18 core electrons.

Question 8. Do the following elements represent a group, period, or neither (5 points):

1. Li, Na, K \_\_\_\_\_\_\_\_group\_\_\_\_\_\_\_\_
2. Li, C, F \_\_\_\_\_\_\_\_period\_\_\_\_\_\_\_\_
3. F, S, P \_\_\_\_\_\_\_\_\_neither\_\_\_\_\_\_\_\_
4. H, He, I \_\_\_\_\_\_\_\_\_neither\_\_\_\_\_\_\_\_
5. O, S, Se \_\_\_\_\_\_\_\_\_group\_\_\_\_\_\_\_\_

Question 9. A mixture of celery, carrots, and broccoli is prepared from 48.2 g of celery, 83.6 g of carrot, and 28.5 g of broccoli. What is the mass percent of carrot in the mixture (4 points)?

$$\%carrot=\frac{m\_{carrot}}{m\_{total}}×100=\frac{83.6 g}{(48.2 g+83.6 g+28.5g)}×100=\frac{83.6 g}{160.3 g}×100=52.1522146\%=52.2\% carrot$$

Question 10. State at least 3 characteristics of metal and at least 3 characteristics of a nonmetal. Please put each term under the correct heading (6 points).

Metal Nonmetal

Shiny, ductile, malleable Dull, brittle, nonconductive

React with nonmetals to form cations React with metals to form anions

Conduct heat and electricity Can react with both metals and nonmetals

All solids except mercury 5 solids, 11 gases, 1 liquid

Question 11. Classify each of the following as macroscopic, microscopic, or particulate (4 points)

* 1. Mountain macroscopic
	2. Plant cell microscopic
	3. Protein molecule particulate
	4. Neutron particulate

Question 12. Answer the following questions about iodine (5 points):

1. Symbol \_\_\_I\_\_\_
2. Complete electron configuration 1s22s22p63s23p64s23d104p65s24d105p5
3. Short hand electron configuration [Kr]5s24d105p5
4. Electron dot structure 

Question 13. Identify each of the following transformations as a chemical or physical change (5 points).

1. Silver tarnishing \_\_\_\_\_\_\_\_\_chemical\_\_\_\_\_\_\_
2. Cutting the grass \_\_\_\_\_\_\_\_\_physical\_\_\_\_\_\_\_
3. A nail rusting \_\_\_\_\_\_\_\_\_chemical\_\_\_\_\_\_\_
4. Water boiling \_\_\_\_\_\_\_\_\_physical\_\_\_\_\_\_\_\_
5. A button falling off a shirt \_\_\_\_\_\_\_\_\_physical\_\_\_\_\_\_\_\_

Question 14. The number of kilojoules needed to raise the temperature of 48.7 g of water from 22.8 °C to 62.0 °C. The specific heat of water is 4.184 J/g °C (6 points).

$$q=mc∆T$$

$$q=\left(48.7 g\right)\left(4.184\frac{J}{g ℃}\right)\left(62.0 ℃-22.8 ℃\right)×\frac{1 kJ}{1000 J}$$

$$q=\left(48.7 g\right)\left(4.184\frac{J}{g ℃}\right)\left(39.2 ℃\right)×\frac{1 kJ}{1000 J}$$

$$q=7.98742336 kJ≈7.99 kJ$$

Question 15. A cannonball has a mass of 3.25 kg. When the ball is placed in a graduated cylinder containing 600. mL of water, the water level rises to 745 mL. What is the density of the cannonball in g/mL (6 points)?

$$d=\frac{m}{V}=\frac{3.25 kg}{(745 mL-600.mL)}×\frac{1000 g}{1 kg}=\frac{3.25 kg}{145 mL}×\frac{1000 g}{1 kg}=22.4\frac{g}{mL}$$

Question 16. Explain the proper procedure for obtaining a solid from a reagent bottle (2 points).

 With your goggles on bring a beaker to the reagent area. Remove the cap from the reagent bottle; be sure to keep it in between your fingers, pour out approximately how much you require into your beaker with the label pointing the opposite direction that you are pouring. Replace cap.