

**Part One: Multiple Choice (60 points)**

Choose the best answer for each question. There is only one correct answer.

- How many significant figures are in the following measurement: 0.050620 mg  
a. 7      b. 6      **c. 5**      d. 4      e. 3
- What is the mass of 23.7 mL of sodium hydroxide (density = 1.53 g/cm<sup>3</sup>):  
a. 15.5 g      **b. 36.3 g**      c. 64.5 mg      d. 23.7 g
- What is the correct way to express 54.080 mg in grams and in scientific notation?  
a. **5.4080 x 10<sup>-2</sup> g**      b. 54.08 x 10<sup>-3</sup> g      c. 5.4 x 10<sup>-2</sup> g      d. 0.5408 x 10<sup>3</sup> g
- A metal sample has a mass of 726 g. When placed in 15.6 mL of water the water level rose to 80. mL. What is the density of this sample?  
a. 0.088 g/mL      **b. 11 g/ml**      c. 4.6 g/ml      d. 2.2 g/mL      e. 9.1 g/mL
- Round the measurement: 605, 071.6 cm to three significant figures:  
a. 605 cm      **b. 6.05 x 10<sup>5</sup> cm**      c. 605, 070 cm      d. none of these
- Given that there are 453.6 g in 1.00 lb, how many kilograms would a 7.0 lb 6.0 oz baby weigh? (note: there are 16 oz in a pound)  
a. 5.9 kg      b. 16 kg      **c. 3.3 kg**      d. none of these
- How many calories are required to raise the temperature of 60.0 g of water 10.0°C?  
a. **600. cal**      b. 60.0 cal      c. 6.00 cal      d. none of these
- Which pair shows an incorrect chemical symbol?  
a. Iron, Fe      b. Chlorine, Cl      c. Magnesium, Mg      **d. Sulfur, Sr**
- 2.54 cm = 1.00 inch. How many cm should be reported if a measurement is 6.80 inches?  
a. 17 cm      **b. 17.3 cm**      c. 2.7 cm      d. 2.68 cm
- Which of the following is **NOT** the name of a polyatomic ion?  
a. phosphate      b. ammonium      **c. sulfide**      d. nitrite
- How is the quantity: 0.00560 g expressed in mg?  
a. 5.6 mg      b. 0.0000056 mg      c. 0.560 mg      **d. 5.60 mg**
- Which of the following is **NOT** a phase of matter:  
a. liquid      **b. plastic**      c. solid      d. gas
- Which of the following is an example of kinetic energy:  
a. a stretched rubber band      b. a 9-V battery      **c. a bouncing ball**      d. a donut

14. Two metals, A and B, have the following S.H. values: metal A (S.H.  $0.219 \text{ J/g}^\circ$ ) and metal B (S.H.  $0.597 \text{ J/g}^\circ$ ). Which statement is true:
- More energy is required to heat metal A  $15^\circ\text{C}$  than to heat metal B  $15^\circ\text{C}$ .
  - Under the same conditions metal A will cool off faster than metal B.**
  - Metal A has a higher density than metal B.
  - Metal B is more flexible than metal A.
15. Which of the following is a chemical change?
- Lighting a candle**
  - melting wax
  - breaking wax into pieces
  - none of these
16. Which of the following element-symbol pairs is incorrect?
- Copper, Co**
  - Lead, Pb
  - Sodium, Na
  - Iron, Fe
17. How many atoms are in the formula:  $\text{Ca}(\text{H}_2\text{PO}_4)_2$ ?
- 7
  - 8
  - 14
  - 15**
  - 16
18. Which temperature scale does not have negative degrees?
- Kelvin**
  - Celsius
  - Fahrenheit
  - They all do
19. If metal A has a mass equal to metal B but metal B occupies more space, which statement is true?
- Metal A is denser than metal B.**
  - Metal B is denser than metal A.
  - Metal A and metal B have the same density.
  - It is not possible to determine the relationship between the densities of these metals without more information.
20. What is the best definition of matter?
- Anything in the universe is matter.
  - Anything that has a density is matter.**
  - Everything is matter.
  - Nothing matters.

### Part Two: Short Answer (10 points)

*Write your answer in the space provided*

For the following names, please provide the correct chemical formulas:

- Cyanide ion  $\text{CN}^{1-}$
- Nitrate ion  $\text{NO}_3^{1-}$
- Ammonium ion  $\text{NH}_4^{1+}$
- Carbonate ion  $\text{CO}_3^{2-}$
- Phosphate ion  $\text{PO}_4^{3-}$

For the following ions, please provide the correct name:

1.  $\text{NO}_2^{-1}$  Nitrite
2.  $\text{HCO}_3^{-1}$  Hydrogen Carbonate or Bicarbonate
3.  $\text{OH}^{-1}$  Hydroxide
4.  $\text{SO}_4^{2-}$  Sulfate
5.  $\text{Cl}^{-}$  Chloride

### Part Three: Terminology (10 points)

1. What is the difference between a hypothesis and a theory? A hypothesis is a tentative explanation of an observable phenomena while a theory is a general explanation of a large number of experimental results.
2. What is the difference between a homogeneous mixture and a heterogeneous mixture? A homogeneous mixture has a constant composition throughout while a heterogenerous mixture has an uneven or variable composition.

### Part Four: Short Answer (20 points)

1. A student determines the mass of the empty container to be 13.28 g. The student places some metal bearings (small pieces that are shaped like round beads) of an unknown metal into the empty container and weighs the container plus the unknown metal. This time the mass of the container and the metal sample is 61.09 g. The student then places the metal bearings into a graduated cylinder that contains 15.3 mL of water and records that the water level rises to the 22.6 mL mark. What is the density of this unknown metal?

$$\text{Mass of metal} = 61.09 \text{ g} - 13.28 \text{ g} = 47.81 \text{ g}$$

$$\text{Volume of metal} = 22.6 \text{ mL} - 15.3 \text{ mL} = 7.3 \text{ mL}$$

$$\text{Density} = 47.81 \text{ g} / 7.3 \text{ mL} = \underline{\underline{6.5 \text{ g/mL}}}$$

2. The specific heat of water is 4.184 J/g°. An unknown metal is heated to a temperature of 450°F in an ordinary oven and then dropped into a calorimeter (thermos) containing 408.0 g of water at room temperature (25°C). The mass of the metal has been measured to be 116.9 g. The temperature of the water and the unknown metal reaches 43°C and then remains constant. Find the specific heat of this unknown metal.

$$\text{mass}_1 \times \Delta T_1 \times \text{S.H.}_1 = \text{mass}_2 \times \Delta T_2 \times \text{S.H.}_2$$

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$

$$T_{\text{metal}} = (450 - 32) / 1.8 = 232^{\circ}\text{C}$$

$$116.9 \times (232 - 43) \times \text{S.H. metal} = 408.0 \times (43 - 25) \times 4.184$$

$$116.9 \times 189 \times \text{S.H. metal} = 408.0 \times 18 \times 4.184$$

$$22094 \times \text{S.H. metal} = 30727$$

$$\underline{\underline{\text{S.H. metal} = 1.4 \text{ J/g}^{\circ}}}$$