

## UNIT 1 FORMATIVE II

### DENSITY, SPECIFIC HEAT, HEAT OF FUSION/VAPORIZATION

**Directions:** for each of the following questions you must complete each of the steps listed below!!! Each question is worth 4 points, in order to get all 4 points you must do each step.

**Step 1:** Write the appropriate formula:  $D = m/V$ ,  $Q = mc\Delta T$ ,  $Q = mL$

**Step 2:** You must show all of your work! If you do not show everything you do, you will not get your point.

**Step 3:** Circle your answer. You must get the answer right in order to get your point.

**Step 4:** The answer must have the correct units in order to get this point.

1. Titanium metal is used as a structural material in many high-tech applications such as jet engines. What is the specific heat of titanium in  $J/g^{\circ}C$  if it takes 89.7 J to raise the temperature of a 33.0g block by  $5.20^{\circ}C$ ?
2. Find the volume that 35.2 g of carbon tetrachloride ( $CCl_4$ ) will occupy if it has a density of 1.60 g/mL.
3. Methane ( $CH_4$ ) has a normal boiling point of  $-161.6^{\circ}C$ . At this temperature, the  $\Delta H_{\text{vaporization}} = 8.17\text{kJ/mol}$ . If 16.5g of liquid methane vaporize, how much energy is absorbed?
4. When 25 mL of 1.0M  $H_2SO_4$  is added to 50 mL of 1.0 M NaOH at  $25^{\circ}C$  in a calorimeter, the temperature of the aqueous solution increases to  $33.9^{\circ}C$ . Assuming that the specific heat of the solution is  $4.18 J/g^{\circ}C$ , that its density is 1.00 g/mL, and that the calorimeter itself absorbs a negligible amount of heat, calculate the amount of heat absorbed for the reaction.
5. A rectangular block of lead (Pb) measures 20.0 mm X 30.0 mm X 45.0 mm. If the density of Pb is  $11.34 g/cm^3$ , calculate the mass of the block. You must first determine the volume of the rectangular block of lead in  $cm^3$  NOT  $mm^3$  HINT: There are 10 mm in 1 cm (so 50mm = 5cm)
6. How much energy is required to melt a 20.0 lb bag of ice at  $0^{\circ}C$ ? A pound (lb.) of ice is equivalent to 0.4536 kg. The  $H_f H_2O @0^{\circ}C = 334 J/g$
7. A 0.3 g piece of copper is heated and fashioned into a bracelet. The amount of energy transferred by heat to the copper is 66,300 J. If the specific heat of copper is  $390 J/g^{\circ}C$ , what is the change of the copper's temperature?
8. An irregularly shaped sample of aluminum (Al) is put on a balance and found to have a mass of 43.6 g. The student decides to use the water-displacement method to find the volume. The initial volume reading is 25.5 mL and, after the Al sample is added, the water level has risen to 41.7 mL. Find the density of the Al sample in  $g/cm^3$ .
9. A 15.75-g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from  $25^{\circ}C$  to  $175^{\circ}C$ . Calculate the specific heat capacity of iron.
10. The hydrogen stored inside a large weather balloon has a mass of 13.558 g. What is the volume of this balloon if the density of hydrogen is 0.089 g/L?
11. What mass of aluminum metal would absorb 250.0 kJ when it melted at its melting point? The Heat of fusion for aluminum is  $396.6J/g$
12. Calculate the specific heat capacity of a piece of wood if 1500.0 g of the wood absorbs 67,500 joules of heat, and its temperature changes from  $32^{\circ}C$  to  $57^{\circ}C$ .
13. A graduated cylinder has a mass of 80 g when empty. When 20 mL of water is added, the graduated cylinder has a mass of 100 g. If a stone is added to the graduated cylinder, the water level rises to 45 mL and the total mass is now 156 g. What is the density of the stone? (answer =  $2.24 g/mL$  or  $2.24 g/cm^3$ )
14. Calculate the energy absorbed when  $2.0 \times 10^3 g$  of dry ice ( $CO_2$ ) sublimate at the normal sublimation point. The enthalpy of sublimation ( $H_s$ ) =  $196.3J/g$ .