

## CHAPTER 4 REVIEW

KEY

1. Water has an unusually high specific heat capacity. Which one of the following statements logically follows from this fact?

- A. Compared to other substances, hot water causes severe burns because it is a good conductor of heat
- B. Compared to other substances, water will quickly warm up to high temperatures when heated.
- C. Compared to other substances, it takes a considerable amount of heat for a sample of water to change its temperature by a small amount.

2. Explain why large bodies of water such as Lake Michigan can be quite chilly in early July despite the outdoor air temperatures being near or above 90°F (32°C).

it takes a lot of energy to warm up water

3. The table below describes a thermal process for a variety of objects (indicated by bold-faced text). For each description, indicate if heat is gained or lost by the object and whether Q for the indicated object is a positive or negative value.

Process	Heat Gained or Heat Lost?	Q: + or -?
An <b>ice cube</b> is placed into a glass of room temperature lemonade in order to cool the beverage down.	gained	+
A cold <b>glass of lemonade</b> sits on the picnic table in the hot afternoon sun and warms up to 32°F.	gained	+
The <b>burners</b> on an electric stove are turned off and gradually cool down to room temperature.	lost	-
The teacher removes a large chunk of <b>dry ice</b> from a thermos and places it into water. The dry ice sublimates, producing gaseous carbon dioxide.	gained	+
<b>Water vapor</b> in the humidified air strikes the window and turns to a dew drop (drop of liquid water).	lost	-

An 11.98-gram sample of zinc metal is placed in a hot water bath and warmed to 78.4°C. It is then removed and placed into a Styrofoam cup containing 50.0 mL of room temperature water  $T=27.0^\circ\text{C}$ ; density = 1.00 g/mL,  $c=4.186 \text{ J/g}^\circ\text{C}$ . The water warms to a temperature of 28.1°C. Determine the specific heat capacity of the zinc. \*\*Hint- use the density to determine the mass of the room temperature water\*\*

$$Q_{\text{H}_2\text{O}} = -Q_{\text{zinc}}$$

$$50\text{g}(4.186)(28.1-27) = 11.98(c)(78.1-28.1)$$

$$\frac{230.23}{602.594} = \frac{602.594c}{602.594}$$

$$c = .337 \text{ J/g}^\circ\text{C}$$

$$V_{\text{H}_2\text{O}} = \rho \cdot V$$

$$.50 \text{ mL}$$

$$m = 50 \text{ g}$$

5. Jake grabs a can of soda from the closet and pours it over ice in a cup. Determine the amount of heat lost by the room temperature soda as it melts 61.9 g of ice ( $\Delta H_{\text{fusion}} = 333 \text{ J/g}$ ).

$$Q = mL$$

$$61.9 \text{ g}(333 \text{ J/g})$$

$$Q_{\text{lost}} = 20,612.7 \text{ J}$$

6. The heat of sublimation ( $\Delta H_{\text{sublimation}}$ ) of dry ice (solid carbon dioxide) is 570 J/g. Determine the amount of heat required to turn a 5.0-pound bag of dry ice into gaseous carbon dioxide. (Given: 1.00 kg = 2.20 lb)

$$\frac{5.0 \text{ lb}}{2.20 \text{ lb/kg}}$$

$$Q = mL$$

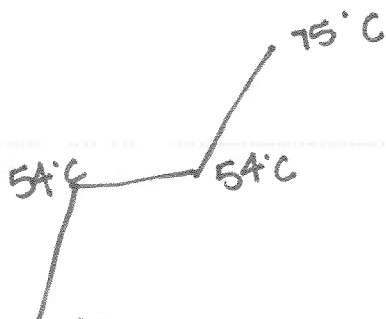
$$2.27 \text{ kg}$$

$$2272.72 \text{ g}(570 \text{ J/g})$$

$$1.29 \times 10^6 \text{ J}$$

$$m = \frac{2.27 \text{ kg} \cdot 1000 \text{ g}}{1 \text{ kg}} = 2272.72$$

7. Determine the amount of heat required to increase the temperature of a 3.82-gram sample of solid para-dichlorobenzene from 24°C to its liquid state at 75°C. Para-dichlorobenzene has a melting point of 54°C, a heat of fusion of 124 J/g and specific heat capacities of 1.01 J/g°C (solid state) and 1.19 J/g°C (liquid state).



$$Q = mc_{\text{solid}}\Delta T + mL + mc_{\text{liquid}}\Delta T$$

$$3.82(1.01)(54-24) + 3.82(124) + 3.82(1.19)(75-54)$$

$$115.746 + 473.68 + 95.4618$$

$$Q = 684.89 \text{ J}$$