 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_

**Specific Heat Problems**

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).

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Process** | **Heat Gained or Heat Lost?** | **Endo- or Exothermic?** | **Q: + or -?** |
| An **ice cube** is placed into a glass of room temperature lemonade in order to cool the beverage down. |  |  |  |
| A cold **glass of lemonade** sits on the picnic table in the hot afternoon sun and warms up to 42°F. |  |  |  |
| The **burners** on an electric stove are turned off and gradually cool down to room temperature. |  |  |  |
| The teacher removes a large chunk of **dry ice** from a thermos and places it into water. The dry ice sublimes into a gas. |  |  |  |
| **Water vapor** in the air strikes the window pane and turns to a dew drop of water. |  |  |  |

4. A sample of zinc was heated and then placed into a Styrofoam cup containing 50.0 mL of room temperature water (T=27.0°C; density = 1.00 g/mL). The water warms to a temperature of 28.1°C. Determine the quantity of thermal energy absorbed by the water.

(cont. on back)

4. (cont) The amount of heat gained by the water would be the same as the amount of heat lost by the zinc. It would just have the opposite sign. The zinc sample had a mass of 11.98 g and had originally been at a temperature of 78.4°C.

What would the final temperature of the zinc have been?

What is the cp of zinc?

5. Is Q for the object positive or negative if….

A. \_\_\_\_\_ an object is the same temperature as the air?

B. \_\_\_\_\_ an object is dropped a warmer liquid?

|  |  |
| --- | --- |
| **Substance** | **Cp**  **J/(g•˚C)** |
| Al | .899 |
| Cu | .387 |
| Au | .129 |
| Fe | .448 |
| Steam | 2.010 |
| Ice | 2.090 |
| Water | 4.186 |

C. \_\_\_\_\_ an object is surrounded by colder air?

6. If 1000 J of heat are applied to each, which will experience a greater increase in temperature?

A. Copper or gold?

B. Ice or steam?

C. Ice or water?

D. Aluminum or iron?

7. How much energy is needed to raise the temperature of 52.1 kg of water from 45.3 ˚C to 80.6 ˚C?

8. If 12.0 kg of gold at 90.0˚ C cools to 20.2 ˚C, how much heat is given off?

9. A piece of aluminum requires 3.989 J of energy to change from 68.1 ˚C to 110.3 ˚C. How much aluminum is there?

10. If 5.03 x 104 J of heat are added to 35.5 kg of water that has a temperature of 12.0 ˚C, what is the water’s final temperature?

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 (ΔHfusion = 333 J/g).

See Answer

6. The heat of sublimation (ΔHsublimation) 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)

See Answer

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).

See Answer