

## ANSWERS: Energy, Solids, and Liquids Worksheet

1. A 15.75-g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from 25°C to 175°C. Calculate the specific heat capacity of iron.

$$Q = mc\Delta T \quad 1086.75 \text{ J} = (15.75)(c)(150) \quad c = 0.460 \text{ J/g}^\circ\text{C}$$

2. How many joules of heat are needed to raise the temperature of 10.0 g of aluminum from 22°C to 55°C, if the specific heat of aluminum is 0.90 J/g°C?

$$Q = mc\Delta T \quad Q = (10.0\text{g})(0.90)(33) \quad Q = 297\text{J}$$

3. To what temperature will a 50.0 g piece of glass raise if it absorbs 5275 joules of heat and its specific heat capacity is 0.50 J/g°C? The initial temperature of the glass is 20.0°C.

$$Q = mc\Delta T \quad 5275 \text{ J} = (50.0)(0.50)(\Delta T) \quad \Delta T = 211^\circ\text{C} \quad \text{Final Temp} = 211 + 20.0 = 231^\circ\text{C}$$

4. 100.0 mL of 4.0°C water is heated until its temperature is 37°C. If the specific heat of water is 4.18 J/g°C, calculate the amount of heat energy needed to cause this rise in temperature.

$$100.0 \text{ mL} = 100.0\text{g} \quad Q = mc\Delta T \quad Q = (100.0)(4.184)(33) \quad Q = 14,000 \text{ J}$$

5. What is the specific heat capacity of silver metal in J/g°C if 55.00 g of the metal absorbs 47.3 calories of heat and the temperature rises 15.0°C?

$$Q = mc\Delta T \quad 47.4 \text{ cal} = (55.00)(c)(15) \quad c = 0.05745 \text{ cal/g}^\circ\text{C} \quad c = 0.24 \text{ J/g}^\circ\text{C}$$

6. A 2.70 gram piece of metal is heated to 98.7°C. It is then added to a beaker containing 150 mL of water at 23.5°C. The final temperature of the water and metal is 25.2°C. What is the specific heat of this metal?

$$\text{Heat Lost} = \text{Heat Gained} \quad -mc\Delta T_{\text{metal}} = mc\Delta T_{\text{water}} \quad -(2.70)(c)(-73.5) = (150)(4.184)(1.7) \quad c = 5.4\text{J/g}^\circ\text{C}$$

7. In an exothermic reaction, is the chemical potential energy of the products less or greater than that of the reactants?

Products have less potential energy. Energy is released in an exothermic reaction so the products end up with less potential energy.

8. In an endothermic reaction, is the chemical potential energy of the products less or greater than that of the reactants?

Products have more potential energy. Energy is adsorbed in an endothermic reaction so products end up with more energy stored in them.

9. Classify the following as exothermic or endothermic reactions:

- 550 KJ is released - EXOTHERMIC
- the metabolism of glucose in the body provides energy - EXOTHERMIC
- The synthesis of proteins requires energy - ENDOTHERMIC
- 125 KJ is absorbed - ENDOTHERMIC