CH1020 Exercises (Worksheet 16)

(Heat capacity)

1. What is the specific heat of liquid water? What is the heat capacity of 265 g of liquid water?

   Specific heat of water = 4.18 J/g°C

   Heat capacity of 265 g of water = 1.11 kJ/°C

2. How many kilojoules of heat are needed to raise the temperature of 1.00 kg of liquid water from 35.0°C to 60.0°C?

   105 kJ

3. What is the molar heat capacity of water?

   75.4 J/mol.°C

4. If 10 moles each of aluminum (sp. heat = 0.900 J/g.K), copper (sp. heat = 0.387 J/g.K) and iron (sp. heat= 0.450 J/g.K) absorb equivalent amounts of heat, which one of the metals will experience the largest increase in temperature?

   copper

5. The specific heat of elemental silicon is 0.702 J/g-^{0}C. How many joules of heat are necessary to raise the temperature of 156 g of silicon from 25.0°C to 37.5°C?

   1.37×10^3 J

6. The specific heat capacity of silver is 0.24 J/°C.g
   a. Calculate the energy required to raise the temperature of 150.0 g Ag from 273 K to 298 K.

      900 J

   b. Calculate the energy required to raise the temperature of 1.0 mol Ag by 1.0°C (called the molar heat capacity of silver)

      26 J / mol °C

   c. It takes 1.25 kJ of energy to heat a sample of pure silver from 12.0°C to 15.2°C. Calculate the mass of the sample of silver.

      1.6×10^3 g of Ag

7. It takes 585 J of energy to raise the temperature of 125.6 g of mercury from 20.0°C to 53.5°C. Calculate the specific heat capacity and the molar heat capacity of mercury.

   0.139 J/g.°C; 27.9 J/mol. °C

8. Assuming Coca Cola has the same specific heat as water, calculate the amount of heat (in kilojoules) transferred when one can (about 350 g) is cooled from 25°C to 3°C?

   Heat transferred out of the can = -32.2 kJ

9. A 500. g iron bar at 50.0 °C is placed into 500. g water at 25°C. If the iron bar loses 5.1×10^3 J of heat, what will be the final temperature of water?

   27.4 °C

10. What is the final temperature when 20.0 g of water at 25°C is mixed with 30.0 g of water at 80°C?

    58ºC

11. A 275-g sample of nickel at 100.0°C is placed in 100.0 mL of water at 22.0°C. What is the final temperature of the water? Assume that no heat is lost to or gained from the surroundings. Specific heat capacity of nickel = 0.444 J/(g · K)

    39.6 ºC

12. Two substances, A and B, initially at different temperatures come in contact and reach thermal equilibrium. The mass of substance A is 6.15 g and its initial temperature is 20.5 ºC. The mass of substance B is 25.2 g and its initial temperature is 52.7 ºC. The final temperature of both substances at thermal equilibrium is 46ºC. If the specific heat capacity of substance B is 1.17 J/gºC, what is the specific heat capacity of substance A?

    Specific heat capacity of substance A = 1.26 J/g ºC

13. A 2.85 g sample of lead (specific heat capacity = 0.128 J/gºC), initially at 10.3 ºC, is submerged in 7.55 g of water (specific heat capacity = 4.18 J/gºC) at 52.3 ºC in an insulated container. What is the final temperature of both substances at thermal equilibrium?

    51.8 ºC

14. A 5.00 g sample of aluminum pellets (specific heat capacity = 0.89 J/ºC.g) and a 10.00 g sample of iron pellets (specific heat capacity = 0.45 J/ºC.g) are heated to 100.0ºC. The mixture of hot iron and aluminum is then dropped into 97.3 g of water at 22.0ºC. Calculate the final temperature of the metal and water mixture, assuming no heat loss to the surroundings.

    23.7ºC

15. A 110. g sample of copper (specific heat capacity = 0.20 J/ºC.g) is heated to 82.4 ºC and then placed in a container of water at 22.3 ºC. The final temperature of the water and copper is 24.9 ºC. What is the mass of the water in the container, assuming that all the heat lost by the copper is gained by the water?

    120 g of water