Chemistry
Heat Exchange Problems
Worksheet #2

Single-Phase Heating/Cooling (Hot Water – Cold Water Experiment)

1. What mass of water at 5.00 °C would we need to mix with 140.0 g of water at 85.0 °C to obtain a final temperature of 43.0 °C ?

2. What mass of water at 78.0 °C would we need to mix with 35.0 g of water at 14.5 °C to obtain a final water temperature of 19.5 °C ?

3. We have 150.0 g of water that we will split into two samples. We'll heat the hot sample to 85.0 °C and we'll cool the other sample to 7.50 °C. The final temperature of the re-combined sample will be 35.0 °C. What will be the masses of the two samples?

4. The metal sodium is sometimes used as a coolant in nuclear reactors. Sodium melts at 98 °C and boils at 883 °C. Sodium's specific heat capacity is 1.23 joules/g/°C. What mass of sodium at 135 °C would we need to mix with 1450 g at 710 °C to obtain a final temperature of 485 °C ?

Determination of Specific Heat Capacities, and SHC Calculations

5. A 45.7 g sample of glass was brought to thermal equilibrium with boiling water and then transferred to 250.0 g of water that was at 22.5 °C. This combination reached thermal equilibrium at 24.2 °C. What is the specific heat capacity of glass?

6. A 101.2 g sample of silver was heated in boiling water and then transferred to 350.0 g of water at 21.8 °C. The combination reached thermal equilibrium at 23.1 °C. What is the specific heat capacity of silver?

7. What mass of silver at 100.0 °C, when added to 150.0 g of water at 21.0 °C, would raise the water's temperature to 24.0 °C ?

8. What mass of water at 20.0 °C would be needed to cool 556 g of silver at 100.0 °C to 23.0 °C ?

Determination of Molar Heats of Fusion, and Molar Heat Calculations

9. The molar heat of fusion of H_2O is 6.1 kJ/mole. What amount of energy would be needed to melt 376 g of ice at 0.0 °C?

10. What mass of water at 75.0 °C would be needed to melt 145 g of ice at 0.0 °C ?

11. What mass of water at 68.5 °C would be needed to melt 275 g of ice at 0.0 °C ?

12. Benzene (C_6H_6) is a liquid at room temperature; benzene's melting temperature is 5.7 °C. 97.9 g of benzene melts in 100.0 g of 35.0 °C water, with the water and excess solid benzene reaching thermal equilibrium at 5.7 °C. What is the molar heat of fusion (melting) of benzene, in kJ per mole?

13. The solvent dimethyl sulfoxide, DMSO, C_2H_6OS, melts at 18.5 °C. A sample of DMSO is placed in 200.0 g of water at 45.0 °C. The water's temperature drops to 18.5 °C; 120.0 g of DMSO melts as a result. What is the molar heat of fusion of DMSO?

14. What amount of energy would be needed to melt an iceberg at 0.0 °C if the iceberg's mass is $2.4 * 10^7$ kg ?

15. What mass of ice would need to melt in 124,500 kg of water to cool the water from 12.5 °C to 9.5 °C ?