

Heating Extra Problems

1. In a particularly sunny and hot day I pour myself exactly 1 cup of cold water from the fridge ($T = 10^{\circ}\text{C}$). I go outside where the thermometer reads an ambient temperature of 98°F in the shade. **a)** If my water stays in the shade long enough what will be its final temperature (in degree Celsius)? **b)** How much heat did the surroundings transferred to the water? (Assume that I didn't drink any of the water) ($1 \text{ cup} = 236.6 \text{ cm}^3$) **c)** Then I take the water out of the shade into the sunlight. After a while I notice that the temperature of the water increases to 62°C . How much heat was delivered by the sun? What heat transfer mechanism was responsible for the increase in temperature?

Answers: a) 37°C b) $Q = 27 \text{ kJ}$ c) $Q = 25 \text{ kJ}$ d) Radiating.

2. A certain blow torch has a power of 2000 BTU/min . This blow torch is used to heat a 2.45 kg piece of graphite (Carbon) for 1 hour. If initially the graphite was at room temperature ($T_o = 25^{\circ}\text{C}$), what will be its final temperature? (BTU stands for British Thermal Unit and it is the unit of energy of the English system. $1 \text{ BTU} = 1055 \text{ J}$) (Heat capacity of carbon = $0.71 \text{ J/g}^{\circ}\text{C}$)

Answers: 334°C

3. Calculate the heat necessary to completely evaporate 18 g of ice at -25°C .

Answer: 56.0 kJ

4. What is the energy that must be removed from 100.0 g of water at 50.0°C to cool it to ice at -30.0°C ?

Answer: -60.6 kJ

5. The melting point of gold is 1064°C . If we start with a gold nugget with a mass of 35 g at room temperature (25°C) and add 8 kJ of energy, would the sample of gold completely melt? ($\Delta H_f = 63 \text{ J/g}$)

Answer: Yes, it only takes 6932 J to melt 35 g of gold starting at 25°C .

6. We add 45 kJ of energy to 50 g of ethanol at 20°C . How much of the ethanol will boil away? (Boiling point of ethanol = 78.4°C , Heat of vaporization = 838 J/g)

Answer: 42 g .

7. 180 g of water are placed in the freezer ($T = -8^{\circ}\text{C}$) for a long time. If 97 kJ are removed from the water sample what was the initial temperature of the water?

Answer: 45°C