

ChemCollective Virtual Labs Thermochemistry Coolant Problem

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Problem: Open ChemCollective Vlabs interface go to File>>Load Homework>>Thermochemistry>>Coolant1 problem

Procedure:

1. Take 100 gms of **water** in an insulated 250 mL beaker, set at 100 °C.
2. Take 10 gms (3.6 mL) of **Compound Y** in 250 mL insulated beaker.
3. Pour 100 gms of **water** which is at 100 °C into beaker containing 10 gms of **compound Y**.
4. Allow the temperature to come to equilibrium.
5. Note the equilibrium temperature and calculate the Specific Heat Capacity.

Calculations:

$$\text{Heat of reaction} = M \times C_{sp} \times (T_f - T_i)$$

M = Mass of the compound

C_{sp} = Specific Heat Capacity of the compound

$(T_f - T_i)$ = Temperature difference

The method of mixtures is used here.

$$M_Y \times C_Y \times (T_f - T_1) = M_W \times C_W \times (T_f - T_2)$$

M_Y = Mass of Compound Y = 10 gms

C_Y = Specific Heat Capacity of Compound Y

$(T_f - T_1)$ = Temperature change

M_W = Mass of water = 100 gms

C_W = 4.18 J/g °C

$$T_f = 93.86\text{ }^{\circ}\text{C}$$

$$T_1 = 25\text{ }^{\circ}\text{C}$$

$$T_2 = 100^{\circ}\text{C}$$

$$M_Y \times C_Y \times (T_f - T_1) = M_W \times C_W \times (T_f - T_2)$$

$$10 \times C_Y (93.86 - 25.0) = 100 \times 4.2 (100 - 93.86)$$

$$10 \times C_Y \times 68.86 = 100 \times 4.2 \times 6.14$$

$$688.6 \times C_Y = 2578.8$$

$$C_Y = 3.74$$

Specific heat capacity of Compound Y = **3.74 J/g °C**

Compound Y is a better coolant than Ethylene Glycol which has a heat capacity of **2.20 J/g °C**

