Answer on Question #83457, Chemistry / General Chemistry

A certain substance has a specific heat of 0.355 J/g °C for the solid, a specific heat of 0.552 J/g °C for the liquid, and a melting point of 843 °C. A 14.3 gram sample of the substance required 4.35 kJ of energy to change its temperature from 825 °C to 853 °C. (a) What was the heat of fusion for the substance in cal/g.

(b) If energy was being added to the substance at a rate of 15 J/s, how many minutes would it take for 6.25 g of the substance to melt?

Solution

a) $Q_{total} = c_s m(T_{mp} - T_{1)} + \lambda m + c_{liq} m(T_2 - T_{mp})$

$$\lambda = \frac{Q_{tot} - c_s m(T_{mp} - T_1) - c_{liq} m(T_2 - T_{mp})}{m}$$

$$\lambda = \frac{4350 - 0.355 \times 14.3 \times (843 - 825) - 0.552 \times 14.3 \times (853 - 843)}{14.3} = \mathbf{292.3\ (J/g)} = \mathbf{69.8\ (cal/g)}$$

b) $Q = \lambda m = 292.3 \times 6.25 = 1827\ (J)$

$$t = \frac{Q}{V} = \frac{1827}{15} = \mathbf{121.8\ (s)} \cong \mathbf{2\ min\ 2\ s}$$

Answer

The heat of fusion for the substance is **69.8 (cal/g).**

It would take **2 min 2 s** to melt 6.25 g of the substance.