

PHASE CHANGE PROBLEMS

1. How much energy is transferred when 750.0 g of water are cooled from 200°C to a liquid at 0°C?

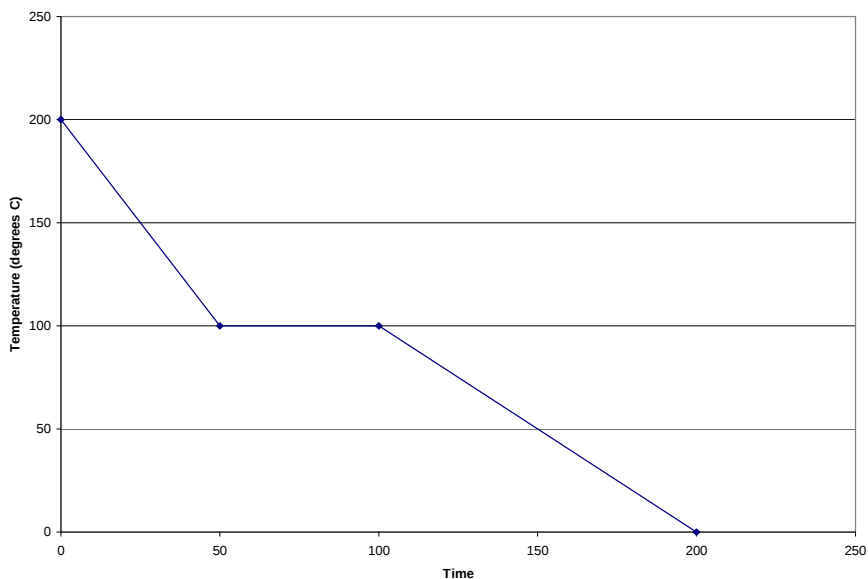
$$\text{sp. ht.}_{\text{sol}} = 2.09 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$$

$$\text{sp. ht.}_{\text{liq}} = 4.18 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$$

$$\text{sp. ht.}_{\text{gas}} = 2.10 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$$

$$\Delta H_{\text{vap}} = 2.26 \text{ kJ g}^{-1}$$

$$\Delta H_{\text{fus}} = 0.332 \text{ kJ g}^{-1}$$



$$E_1 = 2.10 \frac{\text{J}}{\text{g } ^{\circ}\text{C}} \times 750.0 \text{ g} \times 100^{\circ}\text{C} = 157,500 \text{ J}$$

$$E_2 = 2260 \frac{\text{J}}{\text{g}} \times 750.0 \text{ g} = 1,695,000 \text{ J}$$

$$E_3 = 4.18 \frac{\text{J}}{\text{g } ^{\circ}\text{C}} \times 750.0 \text{ g} \times 100^{\circ}\text{C} = 313,500 \text{ J}$$

$$E_1 + E_2 + E_3 = 2,166,000 \text{ J} = 2.17 \times 10^6 \text{ J}$$

2. How much energy is required to convert 800.0 g of a substance from -50°C to 182°C ?

m. p. = -17°C

b. p. = 122°C

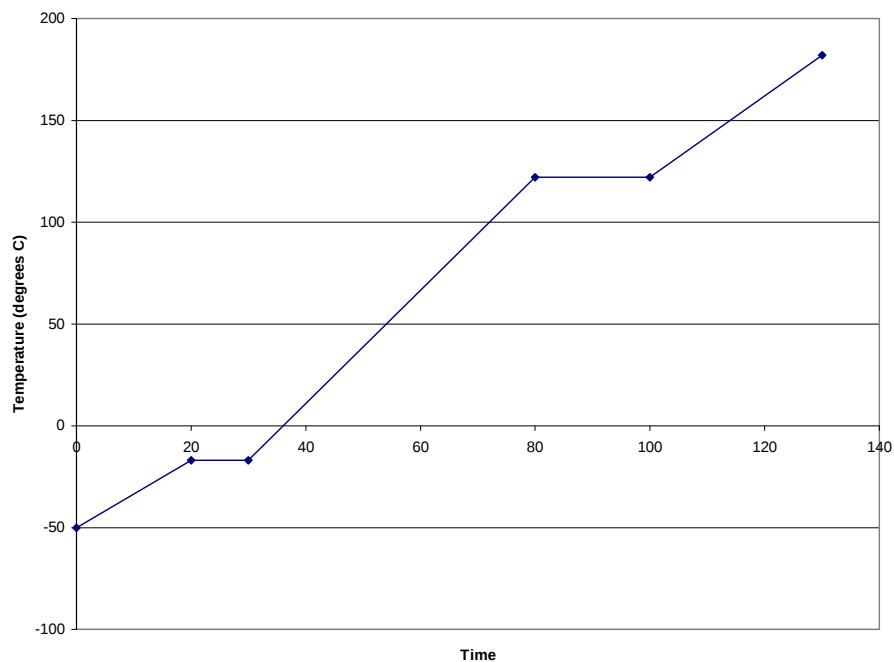
sp. ht. $_{\text{sol}} = 0.98 \text{ cal g}^{-1} ^{\circ}\text{C}^{-1}$

sp. ht. $_{\text{liq}} = 1.25 \text{ cal g}^{-1} ^{\circ}\text{C}^{-1}$

sp. ht. $_{\text{gas}} = 0.71 \text{ cal g}^{-1} ^{\circ}\text{C}^{-1}$

$\Delta H_{\text{vap}} = 1.15 \text{ kcal g}^{-1}$

$\Delta H_{\text{fus}} = 598 \text{ cal g}^{-1}$



$$E_1 = 0.98 \frac{\text{cal}}{\text{g } ^{\circ}\text{C}} \times 800.0 \text{ g} \times 33^{\circ}\text{C} = 25,872 \text{ cal}$$

$$E_2 = 598 \frac{\text{cal}}{\text{g}} \times 800.0 \text{ g} = 478,400 \text{ cal}$$

$$E_3 = 1.25 \frac{\text{cal}}{\text{g } ^{\circ}\text{C}} \times 800.0 \text{ g} \times 139^{\circ}\text{C} = 139,000 \text{ cal}$$

$$E_4 = 1150 \frac{\text{cal}}{\text{g}} \times 800.0 \text{ g} = 920,000 \text{ cal}$$

$$E_5 = 0.71 \frac{\text{cal}}{\text{g } ^{\circ}\text{C}} \times 800.0 \text{ g} \times 60^{\circ}\text{C} = 34,080 \text{ cal}$$

$$E_1 + E_2 + E_3 + E_4 + E_5 = 1,597,352 \text{ cal} = 1.597 \times 10^6 \text{ cal}$$