Answer on Question #72295 – Physics - Molecular physics – Thermodynamics

Question:

I have a few questions in regards to physics, heat, and temperature

1. How much energy must be removed from 5.5 kg of liquid lead at 327oC to produce a block of solid lead at 327C.

2. How many KJ of energy is required to melt exactly 100g of ice initially at -4.00C? Assume no loss of energy to surroundings.

Solution:

1. Amount of energy that removes from the system during producing of solid lead from liquid can be calculated from negative value of the enthalpy of fusion:

$$q = -m\Delta H_{fus} = -5.5\ kg \cdot 2.45 \cdot 10^4 \frac{J}{kg} = -134.8\ kJ$$

2. The full energy of the melting process consists of two energies. There are energy of heating of ice cube from -4.00 °C till the melting point 0°C – $\boldsymbol{q_1}$ and energy of melting of ice cube to liquid water – $\boldsymbol{q_2}$.

$$q = q_1 + q_2$$

$$q_1 = mc\Delta T$$

$$q_2 = m\Delta H_{fus}$$

where $\boldsymbol{c}$ is a heat capacity of water, ΔH_{fus} is enthalpy of fusion.

$$q = mc\Delta T + m\Delta H_{fus} = m(c\Delta T + \Delta H_{fus})$$

$$q = 100\ g \cdot \left(4.184 \frac{J}{℃ \cdot g} \cdot (-4.00 - 0)℃ + 334 \frac{J}{g}\right) = 31.7\ kJ$$

Answer: during transition of liquid lead to solid block system lost 134.8 kJ; to melt 100 g of ice the system need 31.7 kJ.