Heating and Cooling Curves Part 2

1. How much thermal energy, in kJ, is required to heat 10.0 g of ice from -10.0°C to 45.0°C?

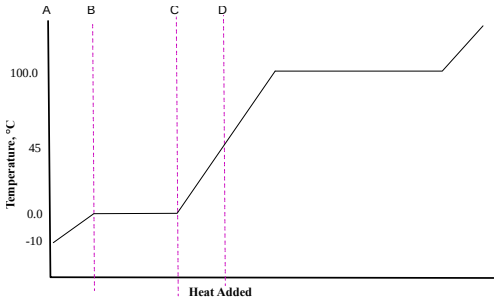
Boiling Point = 100.0°C
Melting Point = 0.0°C

c_{solid} = 2.03 $\frac{J}{g \cdot K}$ ΔH_{fus} = 6.01 kJ/mol

c_{liquid} = 4.18 $\frac{J}{g \cdot K}$ ΔH_{vap} = 40.67 kJ/mol

c_{gas} = 1.84 $\frac{J}{g \cdot K}$

Draw the heating curve.



ΔT_{AB} = 0.0°C – (-10.0°C) = 10.0 °C
= 10.0 K
ΔT_{CD} = 45.0°C – 0.0°C = 45.0 °C
45.0 K
M_m H_2O = 18.02 g/mol
10.0 g = 0.555 mol H_2O

q_{AB} = 10.0 g x 2.03 $\frac{J}{g \cdot K}$ x 10.0 K = 203 J = 0.203 kJ
q_{BC} = 6.01 kJ/mol x 0.555 mol = 3.34 kJ
q_{CD} = 10.0g x 4.18 $\frac{J}{g \cdot K}$ x 45.0 K = 1881 J = 1.88 kJ

ΔH = 0.203 kJ + 3.34 kJ + 1.88 kJ = **5.42 kJ**
It would take 5.42 kJ of heat.

2. Methane has a boiling point of -161.6 °C and a melting point of -182 °C. What phase changes take place under the following conditions if the pressure is held at 760 mmHg?

a) heat is added as the temperature is held at -182 °C.
The solid, methane, melts to form liquid methane.

b) the temperature is lowered from -169 °C to -175 °C.
The methane just remains a liquid.