Answer on Question #63689-Physics-Other

A substance has the following properties; Boiling Point = 140 °C, Freezing Point = -10 °C, specific heat as a gas, liquid and solid, 0.3 cal/g.C°, 1.8 cal/g.C° and 0.8 cal/g.C° respectively. Heat of fusion =100 cal/g and heat of vaporization = 480 cal/g. How much heat must be removed in changing 20g of this substance at 150 °C to -30 °C?

Solution

Step #1

Cool the gas

$$\Delta T = 150 - 140 = 10\,^\circ$$

$$\Delta H = 20 \cdot 10 \cdot 0.3 = 60\ cal.$$

Step #2

Condense the gas

$$\Delta H = 480 \cdot 20 = 9600\ cal.$$

Step #3

Cool the liquid

$$\Delta T = 140 - (-10) = 150^\circ$$

$$\Delta H = 20 \cdot 150 \cdot 1.8 = 5400\ cal.$$

Step #4

Freeze the liquid

$$\Delta H = 100 \cdot 20 = 2000\ cal.$$

Step #5

Cool the solid

$$\Delta T = -10 - (-30) = 20\,^\circ C$$

$$\Delta H = 20 \cdot 20 \cdot 0.8 = 320\ cal.$$

Total:

$$\Delta H = 60 + 9600 + 5400 + 2000 + 320 = 17380\ cal.$$