Answer on Question # 72819 - Chemistry - General Chemistry

How many calories are needed to change 225g of ice at 0*C to steam at 100 *C . Heat of fusion (ice) = 80 cal/g. Heat of vaporization = 540 cal/g

Solution

When 225g of ice at 0°C are being converted into steam at 100°C, there are the following stages:

1. From ice at 0°C to water at 0°C and heat required is mass×(heat of fusion), the latent heat required for conversion of each unit mass of substance. From ice to water it is

$$225\text{g}\ (80\ \text{cal/g}) = 18000\ \text{cal}.$$

2. From water at 0°C to water at 100°C - here it continues to be in the same state i.e. water and hence heat required is mass×(specific heat)×(change in temperature). Specific heat for water is 1cal/g°C, therefore the heat required is

$$225\text{g}\ (1\text{cal/g°C})(100\ °\text{C}) = 22500\ \text{cal}.$$

3. From water at 100°C to steam at 100°C the heat required is mass×(heat of vaporization):

$$225\text{g}\ (540\ \text{cal/g}) = 121500\ \text{cal}.$$

Hence, total heat required is 18000 cal + 22500 cal + 121500 cal = 162000 cal, or 162 kcal.

Answer: 162 kcal.