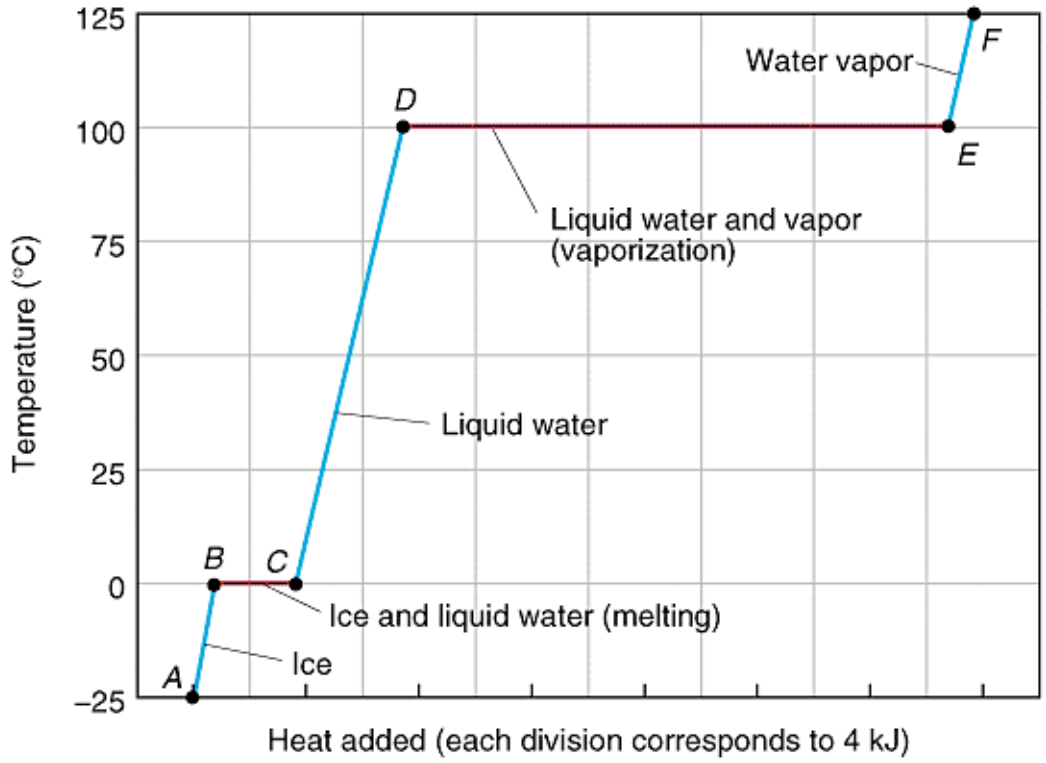
Thermal Energy and Phase Changes



EXAMPLE: How much total energy does it take to convert 40.0 g of ice at –30 °C to steam at 125 °C?

Data you need to know:

ΔH_{fus} = 333 J/g ΔH_{vap} = 2256 J/g

C_{ice} = 2.06 J/g°C C_{water} = 4.18 J/g°C C_{steam} = 1.92 J/g°C

Heat ice to melting point

Melt ice

Heat water to boiling point

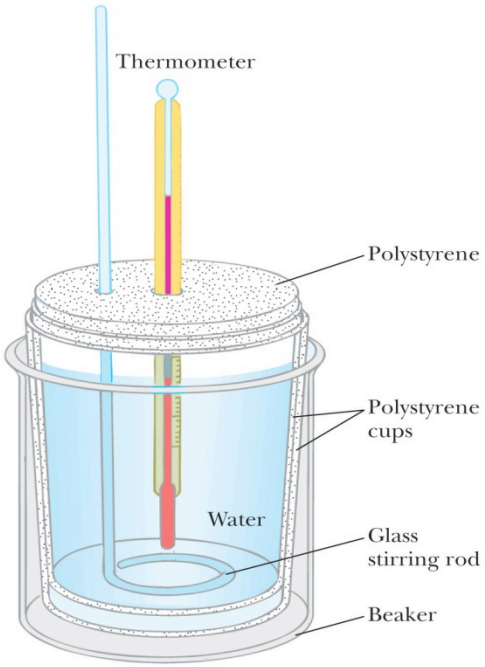
Vaporize water

Heat steam to 125 °C

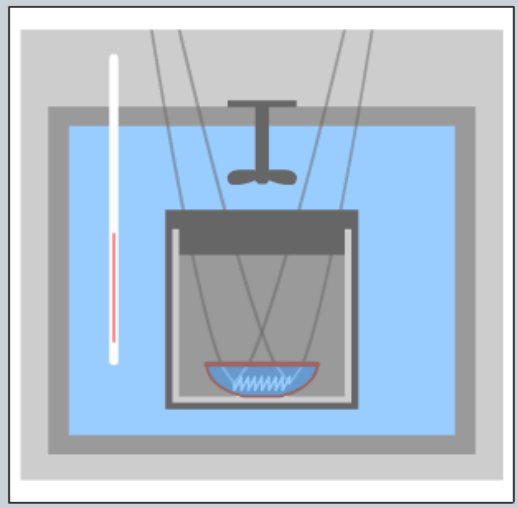
Clicker Question:
50g of ethanol is at 20°C. I add 6385 J of heat. What is the final temperature and state of the ethanol? (T_{bp}=78.4°C, C_{etoh}= 1.43J/g-°C, ΔH_{vap}=837.0J/g)

Calorimetry

1. Constant Pressure



2. Constant Volume



The heat capacity of the calorimeter vessel is 420 J/°C

20.0 °C ⟶ 22.8 °C

	exothermic	endothermic
ΔT		
$\Delta H_{reaction}$		
q_{system}		
$q_{surroundings}$		

Hess' Law

- **Enthalpy is a state function.**
- **If a reaction can be written as the sum of two or more reactions, the ΔH for the net reaction is the sum of the ΔH's for the individual steps.**
- **If a reaction is reversed, the sign of ΔH is reversed.**
- **If the coefficients of the reactants/products are multiplied by a number, then the ΔH must be multiplied by that number, as well.**