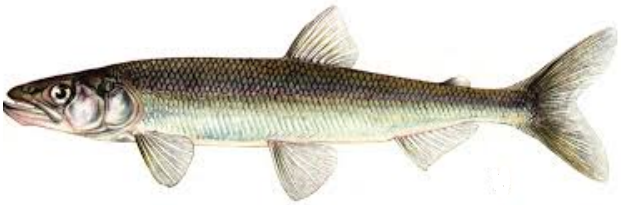


smelt

smelled

1) 31 200 J

2) -31 700 J

3) 120°C

4) 28°C

5) 1100 J

6) 14 900 J

7) 0.0456 J/g °C

8) 424 g

9) 2.60 J/g °C

10) 6.21 J

11) 42.6 L

Homework - Worksheet

③ $m = 50.0\,g$

$C = 2.01 \frac{J}{g \cdot °C}$

$T_i = 140°C$

$q = -2.5\,kJ$

$= -2500\,J$

$T_f = ?$

$q = mC(T_f - T_i)$

$-2500\,J = (50.0\,g)(2.01 \frac{J}{g \cdot °C})(T_f - 140°C)$

$(T_f - 140°C) = \frac{-2500\,J}{(50.0\,g)(2.01 \frac{J}{g \cdot °C})}$

$T_f = 115°C$

$T_f = 120°C$

11. $T_i = 75.0°C$

$T_f = 10.0°C$

$q = -3.32\,kJ$

$V = ?$

$C = 0.0012 \frac{kJ}{L \cdot °C}$

$\frac{MJ}{m^3 \cdot °C}$

$q = vC\Delta T$

$-3.32\,kJ = v(0.0012 \frac{kJ}{L \cdot °C})(-65.0°C)$

$v = \frac{-3.32\,kJ}{(0.0012 \frac{kJ}{L \cdot °C})(-65.0°C)}$

$v = 42.6\,L$

PHASE CHANGE AND ENTHALPY

ENTHALPY (H) - The total internal (potential) energy and kinetic energy of a system under constant pressure.
$\Rightarrow$Enthalpy is usually expressed in kJ.

ENTHALPY CHANGE (ΔH) - A change under constant pressure where the surroundings of a system absorb energy or release it to the system.

PHASE CHANGE - is a change in the state of matter without a change in the chemical composition of the system.
Ex. $H_2O_{(l)} \longrightarrow H_2O_{(g)}$

$\Rightarrow$**always involve a change in energy but never involve a change in temperature.**

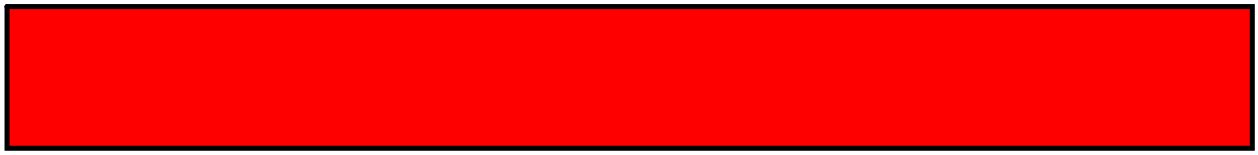
Question:

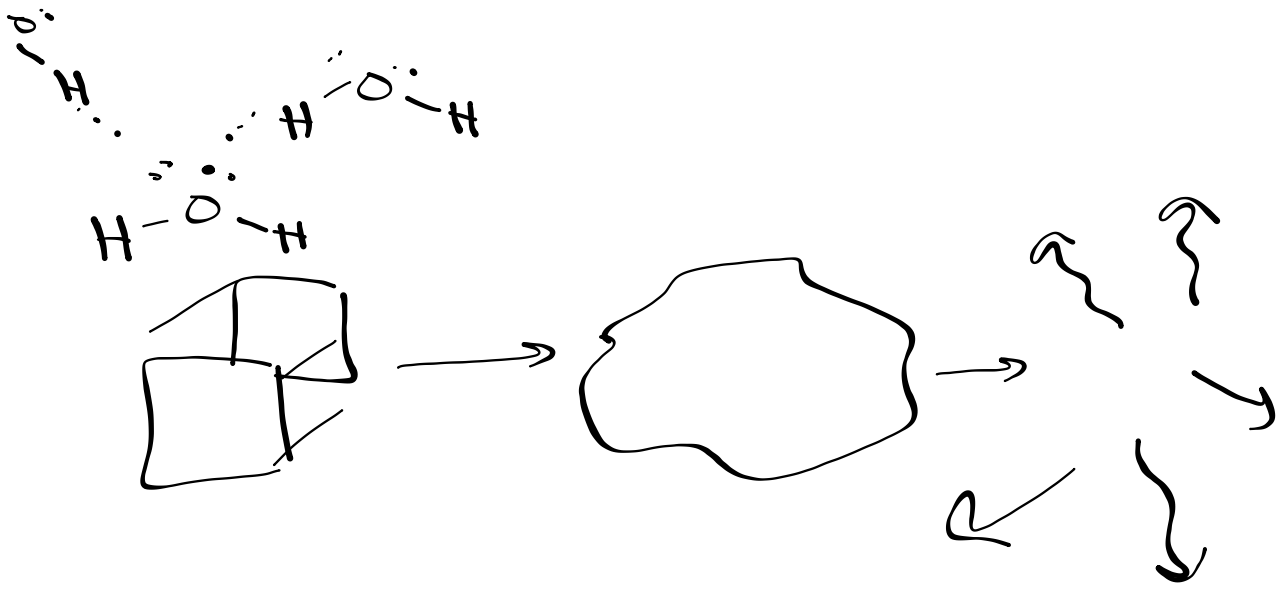
(i) What is the temperature where water just starts boiling?
(ii) What is the temperature when water is boiling violently?
(iii) If energy is still going into the water and the temperature is not increasing, where is the energy going?

The energy is being used to break intermolecular bonds between molecules. This represents a change in phase.

Consider melting ice to water and then boiling water to steam:

$$H_2O_{(s)} \xrightarrow{\text{heat}} H_2O_{(l)} \xrightarrow{\text{heat}} H_2O_{(g)}$$





ENTHALPY CHANGE

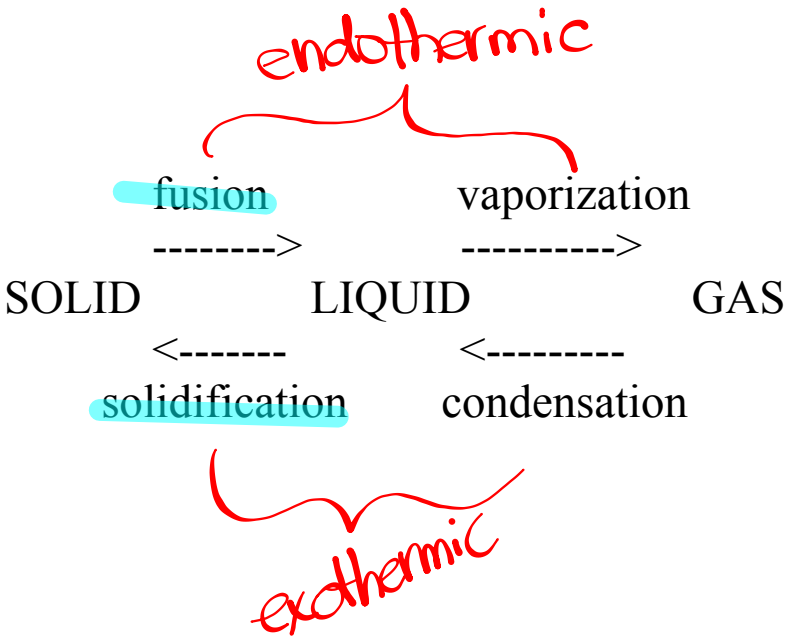
For any system:
- an exothermic change involves a decrease in enthalpy
⇒gives off energy to the surroundings
⇒ΔH (and H) is negative.

- an endothermic change involves an increase in enthalpy.
⇒takes in energy from the surroundings
⇒ΔH (and H) is positive.

The enthalpies for substances undergoing phase changes have been measured experimentally. (TABLE 17.3 p. 522)
- enthalpies are reported as molar enthalpies and are expressed as kJ/mol.

H_{fus} fusion H_{vap}

water (H_2O)	$6.03 \frac{kJ}{mol}$	$40.8 \frac{kJ}{mol}$



$H_{fus} = -H_{solid}$

$$\Delta H_{fus} = -\Delta H_{solid}$$

$$\Delta H_{vap} = -\Delta H_{cond}$$

$H_{vap} = -H_{cond}$

Example

If 500. g of $CCl_2F_{2(l)}$ is vaporized at SATP, find the enthalpy change of the system (H_{vap} = 34.99 kJ/mol).

$m = 500.g$

CCl_2F_2

$\Delta H_{vap} = ?$

$H_{vap} = 34.99 \frac{kJ}{mol}$

$\Delta H_{vap} = n H_{vap}$

$\Delta H_{vap} = \left(\frac{500.g}{120.91 g/mol}\right)\left(34.99 \frac{kJ}{mol}\right)$

$\Delta H_{vap} = 145\ kJ$

$500.g\ CCl_2F_2 \times \frac{1\ mol\ CCl_2F_2}{120.91\ g\ CCl_2F_2}$

$Mm = \frac{m}{n}$

$n = \frac{m}{Mm}$

$CCl_2F_2 \rightarrow (1 \times 12.01) + (2 \times 35.45) + (2 \times 19.00)$

$= 120.91\ g/mol$

Worksheet