Changes of State

Pg. 287 #6

$$Q_{Released} + Q_{Absorbed} = 0$$

Q Released (Gold)

$m = ?$

$T_i = 95°C$

$T_f = 27°C$

$c = 1.29 \times 10^2 \frac{J}{kg°C}$

Q Absorbed (Ethyl Alcohol)

$m =$

$V = 500\,ml$

$D = \frac{m}{V}$

$m = DV$

$D = 0.789\,g/ml$

$m = 0.789 \frac{g}{ml} \times 500\,ml$

$m = 394.5\,g$

$m = 0.39\,kg.$

$T_i = 25°C$

$T_f = 27°C$

$c = 2.46 \times 10^3 \frac{J}{kg°C}$

Released (gold) Absorbed

$$mc\Delta T + mc\Delta T = 0$$

$$m\left(1.29\times10^2 \frac{J}{kg°C}\right)\left(27°C - 95°C\right) + (0.39kg)\left(2.46\times10^3 \frac{J}{kg°C}\right)\left(27°C - 25°C\right) = 0$$

$$\left(-8772 \frac{J}{kg}\right)m + 1918.8\,J = 0$$

$$-8772\,\frac{J}{kg}\,(m) = -1918.8\,J$$

$$m = \frac{-1918.8\,\cancel{J}}{-8772\,\cancel{J}/kg}$$

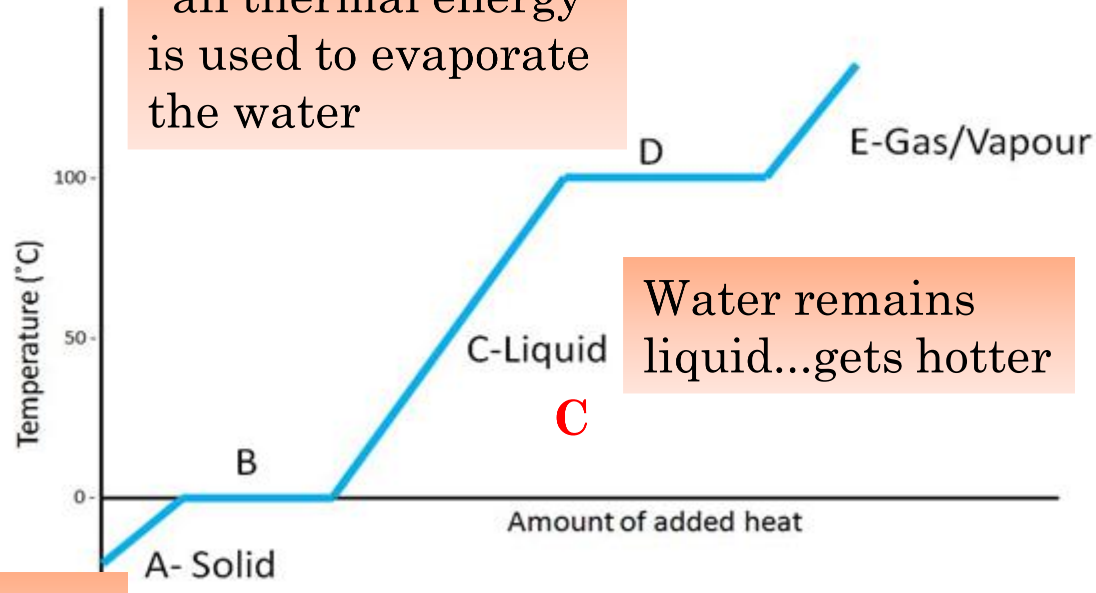
$$\boxed{m = 0.22\,kg}$$

Thermal Expansion and Contraction

- Thermal Expansion:
  - the expansion of a substance as it warms up
- Thermal Contraction:
  - the contraction (shrinking) of a substance when it cools down

Heating Curve for Water

D Changing states
*all thermal energy is used to evaporate the water



Water remains liquid…gets hotter **C**

A Ice
(below 0^{o}C)

B Changing states (temp doesn't change!)
*all additional thermal energy is used to melt the ice

- Q: What do the flat parts of the graph indicate?

-temperature is not changing because the added thermal energy is changing the physical state of the water

-two states of matter are present

-thermal energy is used to break the bonds connecting the particles

LATENT HEAT

Absorbing Q(+)
Releasing Q(−)

- “Latent” – hidden
  - Absorbed thermal energy is stored in the material until the opposite change of state can release it

- “Latent heat of fusion” – the amount of thermal energy required to change a solid into a liquid (melts) or a liquid into a solid (freezes)

  Absorbing — Releasing

- “Latent heat of vaporization” – the amount of thermal energy required to change a liquid into a gas or a gas into a liquid.

  Absorbing — Releasing

- “Specific latent heat” – the amount of thermal energy per kilogram of a substance required for a change of state

$$Q=mL_f$$
$$Q=mL_V$$

Example #1

- p. 293 #3

- HWK:
  - Read 6.4
  - P.295 #1-4, 6-9

1, 3, 4, 6-9

Pg 293 #3.

① Steam 100°C → Water 100°C
② Water 100°C → Water 50°C

$m = 500\,g$
$= 0.5\,kg$

*Assume 2 sig digs.

$L_v = 2.3 \times 10^6 \frac{J}{kg}$

$c = 4.18 \times 10^3 \frac{J}{kg\,°C}$

$Q_{Released} = Q_{L_v} + Q_{\Delta T}$

① $Q = mL_v$
$= (0.5\,kg)(2.3 \times 10^6 \frac{J}{kg})$

$Q = -1,150,000\,J$

② $Q = mc\Delta T$
$= (0.5\,kg)(4180 \frac{J}{kg\,°C})(50°C - 100°C)$
$Q = -104,500\,J$

∴ QReleased

1150000 J
104500 J
1254500 J

∴ 1,300,000 J