## LATENT HEAT

The amount of energy required to change a material from one phase to another.

Q = mL

Q = energy in Joules

m = mass in kg

L = latent heat of the material

## SPECIFIC HEAT CAPACITY

The amount of energy required to raise a kilogram of water to 1 degree Celsius (kilogram because our constants are defined with kilograms).

Q = $mc\Delta T$

Q = energy in Joules

m = mass in kg

c = specific heat capacity of material

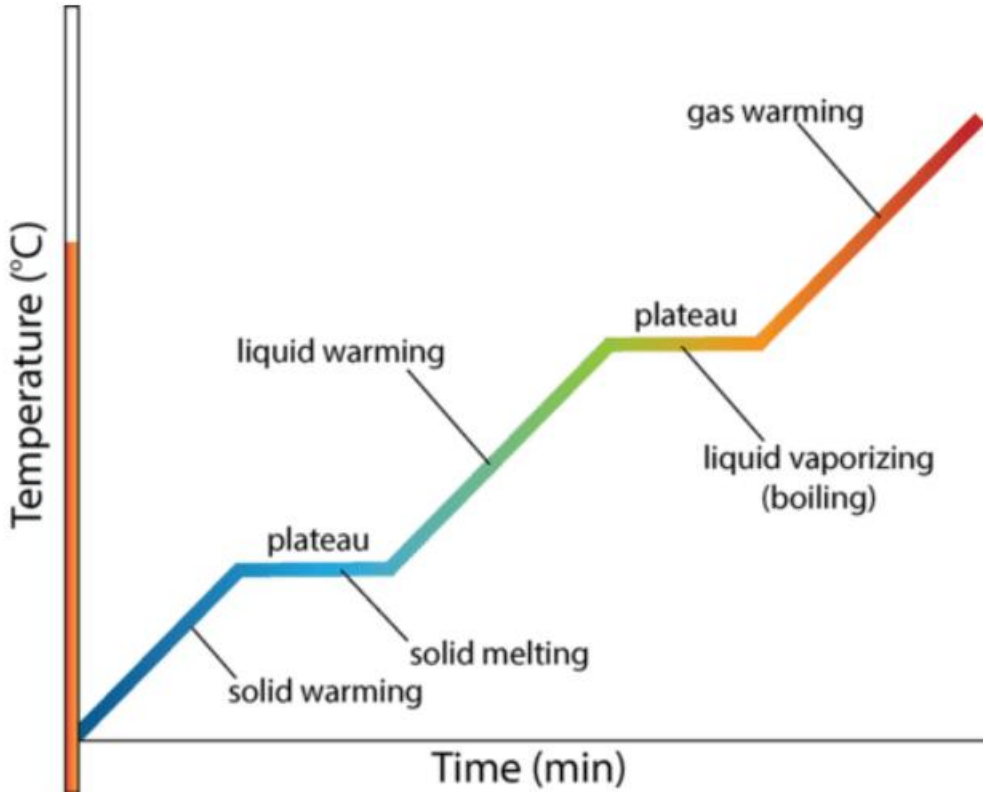
$\Delta T$ = change in temperature of the material ($T_F - T_I$)

## SHC AND LH OF COMMON MATERIALS

| specific heat capacity | J / (kg C) |
|---|---|
| ice | 2100 |
| water | 4186 |
| steam | 2010 |
| aluminum | 900 |
| copper | 385 |

| latent heat | fusion (J / kg) | vaporization (J / kg) |
|---|---|---|
| positive | 3.33 x 10^5 | 2.26 x 10^6 |
| negative | 1.08 x 10^5 | 8.85 x 10^5 |
| negative | 1.39 x 10^4 | 2.13 x 10^5 |

**THE HEAT CURVE**




**EXAMPLES.**

1. How much energy is required to melt 790 grams of ice?
   Q = mL
   = (0.79 kg)(3.33 x $10^5$ J/kg) (convert grams to kilograms)
   = (0.79 kg)(3.33 x $10^5$ J/kg)
   = 263.07 kJ

2. How much heat is required to raise the temperature of 0.15kg water from 20 C to 55 C?
   Q = $mc\Delta T$
   = (0.15 kg)(4186 J/kg)(55C – 20C)
   = 21.9765 kJ

3. How much energy is required to convert 3kg of ice at 0C to water at 30C?

   First we need energy, $Q_1$, to phase change ice to water, then we need energy, $Q_2$, to raise the temperature from 0C to 30C. In total, we need to add $Q_1$ and $Q_2$.

   $Q_1 = mL$

   $= (3\text{ kg})(3.33 \times 10^5\text{ J/kg})$

   $= 999\text{ kJ}$

   $Q_2 = mc\Delta T$

   $= (3\text{ kg})(4186\text{ J/kg})(30\text{C} - 0\text{C})$

   $= 376.74\text{ kJ}$

   $Q_{total} = Q_1 + Q_2$

   $= 999\text{ kJ} + 376.74\text{ kJ}$

   $= 1.3754\text{ MJ}$