Thermo Physics

Temperature: A measure of random average kinetic energy of the molecules (of a substance)
*same "temperature" = same "average internal energy"

Internal Energy: the sum of total random kinetic energy of all the molecules and total intermolecular potential energy of a substance
*In general, the temperature of a substance is controlled by its random average kinetic energy; meanwhile its phase is controlled by its average intermolecular potential energy

Phases of substances:
1. Solids
   - fixed volume and fixed shape (mainly by bonds)
   - molecules vibrating around their mean positions
2. Liquids
   - fixed volume and changeable shape
   - free to move around relative to their nearest-neighbor particles
   - vibrating also
3. Gases
   - no fixed volume or shape; would expand to fill the container
   - the molecules are not fixed in position; only very weak forces exist between
   - almost independent of each other

Heat: the energy that has been transmitted
*Heat can include either E_k or E_p or both

Equal temperature:
When two objects are in "**thermal equilibrium**"—meaning that they have equal heat exchange—they are considered to have equal temperature

Specific Heat Capacity, c (without phase change)
The energy required to change the temperature of 1 kg of substance by 1 K.

$$c = \frac{Q}{m\Delta T}$$

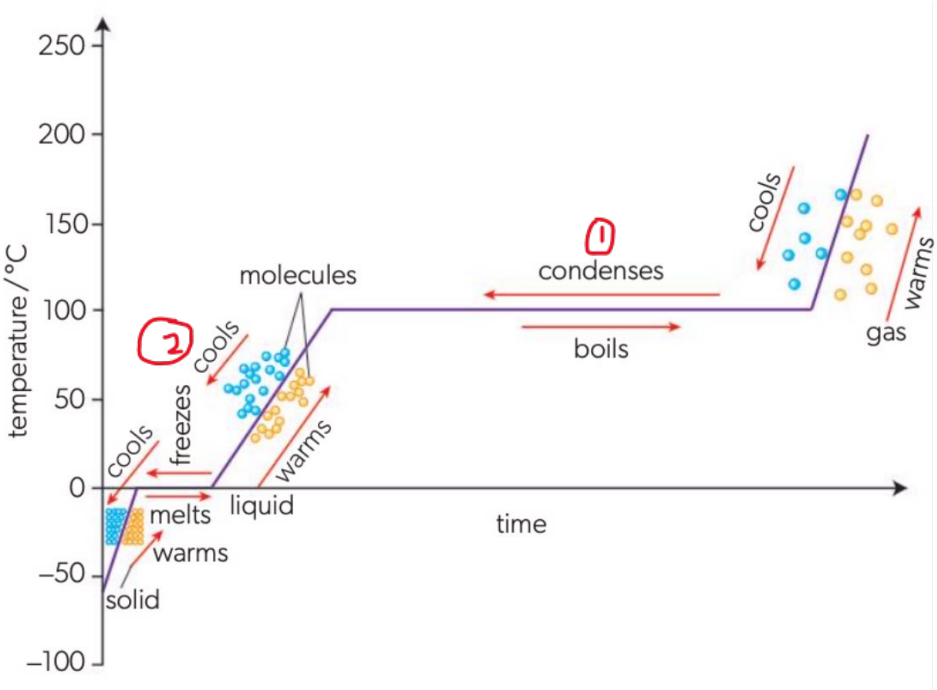
$$Q = cm\Delta T$$

**Nature of SHC: different molecular mass results in different amounts of molecules within different substances when the mass is held constant; thus, when the energy input is equal, the amount of average energy input to each of the molecules in different substances differ, leading to different increases in the (random) average kinetic energy of each of the molecules, thus different SHCs leads to different temperature increases*

Specific Latent Heat, L, of fusion/vaporization (with phase change)
The energy required to change the phase of the substance per unit mass at constant

temperature and pressure.

$$Q = mL_{fusion}$$
$$Q = mL_{vaporization}$$



Sections 1&2:

1. Temperature holds constant, thus the (random) average kinetic energy of the molecules holds constant; as a result, the average intermolecular potential energy of the substance increases while energy continues to be supplemented into it
2. The separation of the molecules increase, bonds get broken, phase change takes place