Internal energy and changes of state

Internal energy

- When a material is heated or cooled, two changes may happen to the particles within the material:
  - Chemical bonds between the particles may form, break or stretch. There is a change in the chemical potential store of energy in the material.
  - The material will heat up or cool down as the particles within it gain or lose speed. There is a change in the thermal store of energy within the material.

- **Internal energy is defined as**

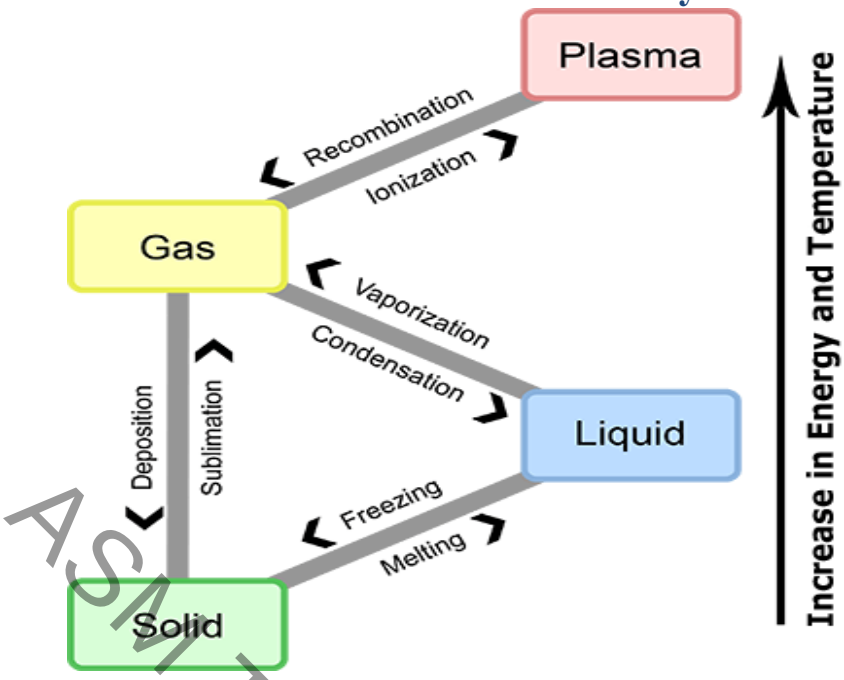
" Total amount of kinetic energy and chemical potential energy of all the particles of an object "

Internal energy = kinetic energy + potential energy

- The molecules within a substance have energy in their:
  - **Kinetic store** (due to their random motion / vibration)
  - **Potential store** (due to their position relative to each other)

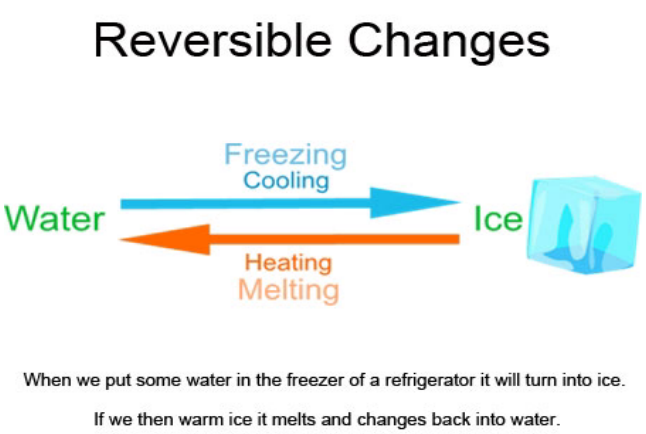
Change in Temperature or Heating

- Heating a system changes a substance's internal energy by **increasing the kinetic energy** of its particles
- The higher the temperature, the higher the kinetic energy of the molecules and vice versa. This means particles of an object move **faster**
- This increase in kinetic energy (and therefore internal energy) can:
  - Cause the **temperature** of the system to increase
  - Or, produce a **change of state** (solid to liquid or liquid to gas).



Change of State

- **Conservation of mass :**
  - When a substance changes state,The **number of molecules** in that substance does **not** change, they are arranged differently. It means mass is conserved. None of its particle lost or gain
  - Unlike chemical changes, **physical changes** like changes of state are **reversible**



➢ Phases of changes in state

- There are six phases of changes in state that can occur between solids, liquids and gases:
  - **Melting** - A solid turns into a liquid (e.g. ice to water) when energy is transferred to the system
  - **Boiling** - A liquid turns into a gas (evaporating) when energy is transferred to the system
  - **Condensing** - A gas turns into a liquid when energy is transferred away from the system
  - **Freezing** - A liquid turns into a solid when energy is transferred away from the system
  - **Subliming** - A solid turns into a gas when energy is transferred to the system