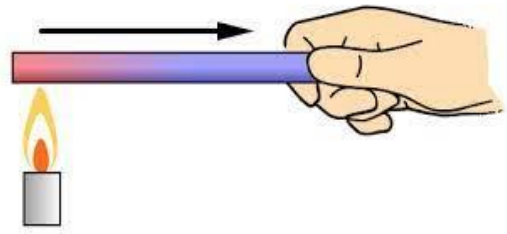
Internal energy

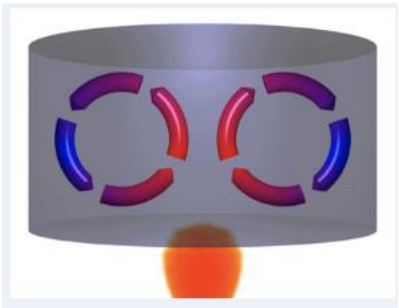
1. **Internal energy = kinetic energy** of the particles in a system **+ potential energy** of particles in a system.
2. Particles in solids, liquids and gases have **kinetic energy** because they are always moving.
3. The **hotter** a material is the faster its particles move and the **larger** the kinetic store of energy.
4. Particles have **potential energy** because their motion keeps them separated. The **further apart** the particles the **larger** the potential energy.
5. Particles in a gas have more internal energy because they have more kinetic energy and potential energy.
6. Heating changes the energy stored in the system by increasing the energy of the particles that make up the system.
7. Heating either **raises the temperature** of the system or **produces a change of state**.
8. The thermal energy of an object depends on its mass, temperature and what it is made of.

Thermal transfers

9. Energy transfers from hotter substances to cooler substances.
10. **Temperature** is a measure of the **motion and energy of the particles**. It is related to their **kinetic energy**.
11. When thermal energy is transferred to an object by heating, its temperature depends on what the substance is made from, its mass and the amount of energy transferred.
12. The **more thermal energy** transferred the **higher the temperature** unless there is a **change in state**.
13. **Conduction** is thermal transfer by the vibration of particles.
14. Metals are good thermal conductors because they contain **delocalised (free) electrons** which can move freely through the metal.



15. **Convection** is thermal transfer when particles in a heated fluid rise.
16. A **fluid** is a substance with no fixed shape – a liquid or a gas.
17. Liquids and gases expand when they are heated, the gaps between particles increases.
18. The liquid or gas becomes **less dense** and rises. The denser, colder fluid sinks, forming a convection current.



19. **Radiation** is the transfer of thermal energy as a wave.
20. Thermal transfer by radiation can occur in a **vacuum** as it does not require particles.
21. Some surfaces are better than others at absorbing and reflecting radiation. Shiny silvered surfaces are good at reflecting radiation.

Specific heat capacity

22. **Specific heat capacity** is the energy needed to raise the temperature of **1 kg** of substance by **1 °C.**
23. **ΔE = m c Δθ**
    a. ΔE = energy change (J)
    b. m = mass (kg)
    c. c = specific heat capacity (J/kg °C)
    d. Δθ = temperature change (°C)
24. Different materials require different amounts of energy to heat up or change state.

Specific latent heat

25. **Specific latent heat** of a material is the energy needed to change the state of **1 kg** of the substance with **no change in temperature**.
26. **E = m L**
    e. E = energy for a change of state (J)
    f. m = mass (kg)
    g. L = specific latent heat (J/kg)
27. **Specific latent heat of fusion** refers to a change of state from solid to liquid.
28. **Specific latent heat of vaporisation** refers to a change of state from liquid to vapour.
29. Different materials have different latent heats.
30. When a substance **changes state** the **kinetic energy** does not increase, the absorbed energy goes into the **potential energy** store. The increase in energy is used to weaken the **forces of attraction** between particles to enable a change in state.
31. A solid substance at its melting point has less energy than the same mass of the substance when it is a liquid at the same temperature.