

Internal energy

Internal energy – sum of total kinetic energy of all particles moving at chaotic motion (molecules, atoms and ions) and of total potential energy (due to the positions between the particles).

Internal energy can be changed by:

- **Doing work** (friction between two objects, compressing of gas)
- **Transfer of energy** (heating)

Change of internal energy by doing work

$$\Delta U = W$$

ΔU – change of internal energy (J, joule)

W – work done (J)

If there is a process in a thermal isolated system, the sum of kinetic, potential and internal energy is constant. (PE= m g h, KE = $\frac{1}{2} m v^2$, g = 9.81 ms⁻²)

- A body of a mass of 2kg is falling from height of 15 metres. What is the change of sand it is falling into?
- A car of a mass 900kg moving at a speed of 80km.h⁻¹ brakes suddenly. What is the change of internal energy of its brakes after braking?
- A tennis ball with a mass of 50g is falling from a height of 1 metre and bounces into 0.6m. Calculate change of its internal energy after the bounce.

Change of internal energy by transfer of heat

$$\Delta U = Q$$

Q – heat transferred - amount of thermal energy transferred (J)

The zero law of thermodynamics:

The transfer of thermal energy (heat) goes always from hot to cold object!

The first law of thermodynamics:

$$\Delta U = Q + W$$