Energy Transfer

Energy Stores

- Thermal
- Kinetic
- Gravitational potential
- Elastic potential
- Chemical
- Magnetic
- Electrostatic
- Nuclear

Energy Transfer

Energy is transferred between energy stores:

- Mechanically (a force)
- Electrically (moving charges)
- Heating
- Radiation (light or sound) ← Scientific name for an object.

When a system changes energy is transferred. This can be into or away from the system, between objects in a system or between different energy stores.

A closed system is where neither matter nor energy enters or leaves. The total energy change in a closed system is zero (energy is not created or destroyed.

Specific Heat Capacity

A measure of the energy transferred to a thermal store of an object. It is the amount of energy needed to raise the temperature of 1kg substance by 1°C. Different substances will need different amounts of energy to do this.

Kinetic Store

All moving objects have energy in the kinetic store.

The more **mass** an object has the more KE it has.

The **faster** an object is going the more KE it has.

$$E_k = \frac{1}{2} mv^2$$

Eg. A car has a mass of 3000kg is travelling at 20m/s. Calculate the energy in the KE store.

$E_k = \frac{1}{2} \times 3000 \times 20^2 = 600\ 000$ J

Energy Transfer by Heating (eg. kettle boiling)

1) The water is the system.

Energy is transferred by heating to the waters thermal store.

2) A two object system (water and heating element).

Energy is transferred to the thermal store of the heating element electrically. This is then transferred to the thermal store of the water.

Energy Transfer by Doing Work

Throwing a ball upwards: Force from a person does work – energy is transferred from the chemical store of the person to the kinetic store of the ball.

A ball is dropped: Energy is transferred from the gravitational store to the kinetic store. The gravitational force does work.

A car braking to slow down: The friction on the brakes does work. Energy is transferred from the cars kinetic store to the thermal store of the surroundings.

$$\Delta E = mc\Delta\theta$$

ΔE = change in thermal energy (J)
m = mass (kg)
$\Delta\theta$ = temperature change (°C)
c = specific heat capacity (J/kg°C)

Gravitational Potential Store

Is increased when objects are raised off the ground. The amount of energy depends on the mass and height of the object and strength of the gravitational field it is in.

$$E_p = mgh$$

Mass (kg) Height (m)
Gravitational field strength (N/kg)

A falling object has energy transferred from its gpe store to a kinetic store.

If there is **no air resistance** the energy lost from the gpe store = energy gained in the KE store.

There is usually air resistance, so some energy will be transferred to other stores, such as the thermal store of the surroundings.

Elastic Potential Store

Stretching or squashing an objects raises its elastic potential energy store.

$$E_p = \frac{1}{2} ke^2$$

Spring constant extension

Calculates the elastic potential energy of a spring if it has not exceeded its limit of proportionality.