Chapter One: Energy

Potential Energy

-**Potential energy is the energy stored** in a body or system as a result of its position, shape or state

-Gravitational potential energy is the potential energy due to the height of an object, the higher an object, the greater the value of gravitational potential energy

$E_G = mgh$

Gravitational potential energy = mass x height x gravity

-Elastic potential energy is the energy stored in a spring, this can be increased by increasing the extension of a spring, or the spring constant

$E_e = ½ ke^2$

Elastic potential energy = ½ x spring constant x extension

Kinetic energy

-**Kinetic energy is the energy of movement**, the greater the velocity and greater the mass of an object, the greater its kinetic energy will be

$E_k = ½ mv^2$

Kinetic energy = ½ x mass x velocity^2

-**The total energy from a moving object will be shared between kinetic and gravitational potential** energy depending on it's position and movement

-When an object is at ground level, the E_G will be 0, and the E_k will be at its maximum value

-If the object is stationary, the E_k will be 0, and the E_G will be at its maximum value

-Anywhere between these two points, the energy will be shared between the two

Work Done

-**Work is only done by a force when an object moves**

-**Work done is the same as energy transferred**

$W = F \times s$

Work done = Force x distance

Power

-**Power is the same as work done per second, or energy transferred per second**

$$\text{Power} = \frac{\text{Work done}}{\text{Time}}$$

$P = W/t$

$$\text{Power} = \frac{\text{Energy transferred}}{\text{Time}}$$

$P = E/t$

Specific Heat Capacity

-**Specific heat capacity is a measure of how much energy is needed to raise 1 kg of substance by 1^{O}C**

-It is a different value for different materials, lowest for solids, higher for liquids

-This means liquids can absorb a large amount of energy, making liquids such as water useful for coolants and to transfer heat energy around a house

Change in energy = mass x specific heat capacity x temperature change

$\Delta E = mc\Delta\theta$

Dissipation of energy

-Dissipation means to lose energy, with this being a form which is not useful, often lost to the environment / surroundings

-Lubricating moving parts of a machine reduce friction, and so reduce wasted energy as heat

-Thermal insulation reduces the rate at which energy is carried away from a hot object, causing it to cool more slowly

-Ways of insulating a building to reduce heat loss include:

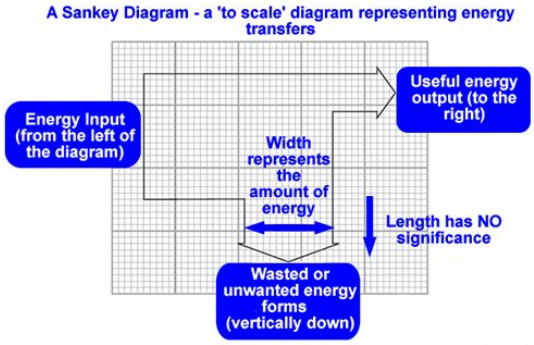
- Double glazing *(reduces conduction of heat as a vacuum is between the panes of glass meaning no particles to conduct energy)*
- Cavity wall insulation *(reduces convection currents to lose heat between walls)*
- Loft insulation *(reduces heat loss by conduction, made of fiberglass, lots of air spaces)*
- Draught excluders *(reduce cold air currents underneath doors)*
- Silver foil behind radiators *(reflects radiation back into room, rather than heating up a wall)*

Energy Efficiency

-**Energy efficiency is the proportion of the input energy that is converted into a useful form**

$$\text{Efficiency} = \frac{\text{Useful energy output}}{\text{Total energy input}} \times 100$$

-Energy efficiency can be represented by sankey diagrams



Using energy resources

-**Renewable resources do not run out, they can be replenished as quickly as they are used**

- Solar
- Wind
- Geothermal
- Wood

-**Non renewable resources will eventually run out they are not being replenished at the same rate at which we are using them**

- Fossil Fuels

Global energy supplies

-Each year the amount of energy need will increase, this is due to an increase in both population and industry

-Burning fossil fuels release greenhouse gases

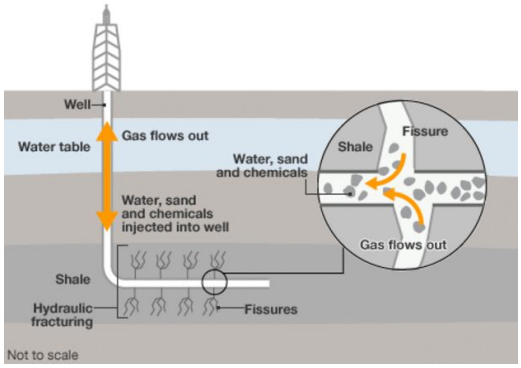
-Nuclear waste remains dangerous for thousands of years

-Ethical considerations take into account the morals of situations

-Social considerations take into account people who are affected

-Economic considerations take into account cost and money

-Fracking is the extraction of pockets of gas underneath the ground, negatives include carcinogens associated with the chemicals used as well as land subsidence



-The efficiency of fuels must be considered before they are used, more useful power comes from an electric motor than a diesel or petrol engine

Energy Transfer

-**The law of conservation of energy states that energy cannot be created or destroyed, only transferred or transformed**

-Richard Feynman compared the conservation of energy to children's blocks, you know how many / how much there should be, but these are not always there when you come to put them away, the energy will still be present, but in another form