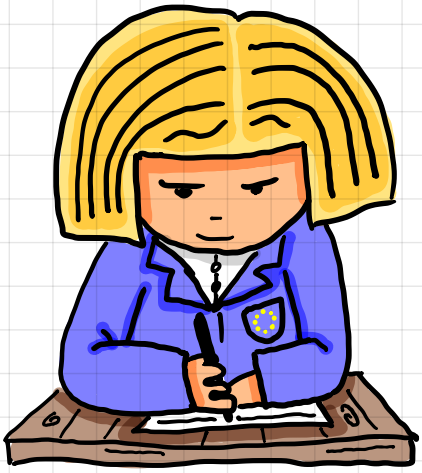


Energy transfers in a system

1. Understand that energy can be transferred usefully, stored or dissipated.
2. Explain how to reduce unwanted energy transfers.

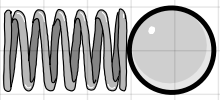
Energy transfers in a system

Energy can be usefully transferred, stored or dissipated. Energy cannot be created or destroyed.

Open and closed systems

A closed system is when there is no net change in the total energy. The types of energy within the system may change.

An open system is when energy can be transferred between the system and its surroundings. The total energy in the system can increase or decrease.

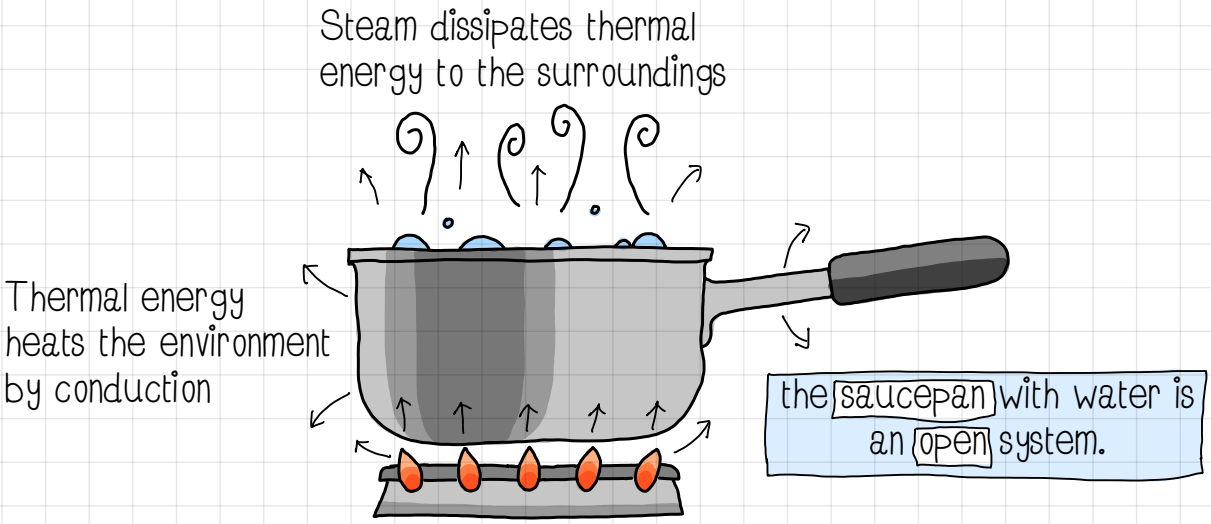


An example of a closed system is a pinball machine. When the spring is released the elastic potential energy stored is converted to kinetic energy in the ball.

An example of an open system is a cup of coffee. As steam escapes from the coffee, thermal energy is transferred to the surroundings. Over time the coffee becomes cold (total energy is decreased).

Dissipated energy

When energy is dissipated, it is transferred to a less useful store (usually thermal energy). This energy is often described as being wasted.



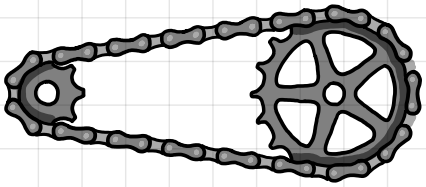
Energy transfers in a system...

Reducing unwanted energy transfers

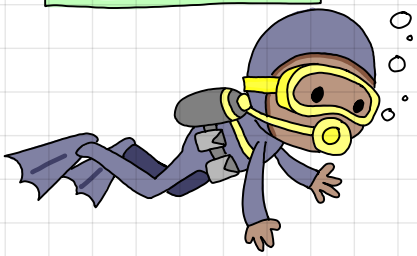
Unwanted energy transfers can be reduced through lubrication and thermal insulation.

Lubrication

Friction between the gear and the chain causes energy to be dissipated to the surroundings as thermal energy. By lubricating the chain with oil, friction is reduced and less energy is dissipated



Thermal insulation

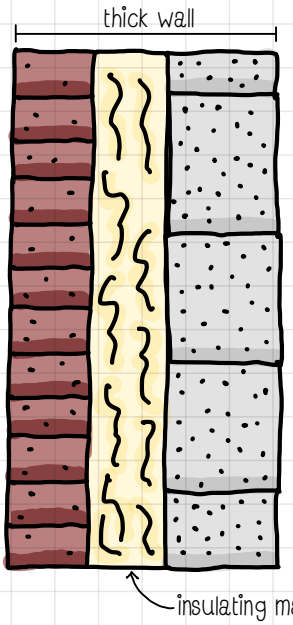


Heat from an object can be quickly dissipated to the environment. Insulation can be used to reduce the transfer of thermal energy. Examples of thermal insulation include foam coffee cups, clothing and loft insulation

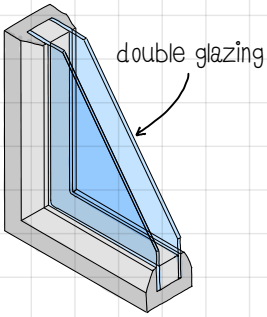
Thermal conductivity

The higher the thermal conductivity of a material, the higher the rate of energy transfer by conduction across the material. Metals and other conductors have a high thermal conductivity. Insulators have a low thermal conductivity.

Cooling in buildings



The rate of cooling in buildings can be reduced by the use of insulating material in the walls which has a low thermal conductivity. Thick walls also reduce the cooling rate. Double glazing traps air between two panes of glass. Air has a low thermal conductivity. Materials with low thermal conductivity can also be used in the loft to reduce the rate of cooling.



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