Physics – P2

Energy Transfer by Heating

Headings:

[Insulation](#Insulation)

[Specific Heat Capacity](#Specific_Heat_Capacity)

[Storage Heaters](#Storage_Heaters)

[Heating and Insulating Buildings](#Heating_and_Insulating_Buildings)

[Solar Panels](#Solar_Panels)

Equations:

[Specific Heat Capacity](#Specific_Heat_Capacity_EQ)

R-J Sammé

This content is not intended to be modified or redistributed in any way. © R-J Sammé 2021

Insulation

Good insulating materials need to have a low thermal conductivity, so that the energy transfer through them is as low as possible. The energy transfer per second through a layer of insulating material depends on:

* The temperature difference across the material
* The thickness of the material
* The thermal conductivity of the material

To reduce the energy transfer as much as possible, the material should be as thick as reasonably possible, and the thermal conductivity of the material should be as low as possible.

For example, several layers or one thick layer of fibreglass in an attic will reduce the energy transfer through the roof.

Specific Heat Capacity

Different materials heat up by different amounts when provided with the same amount of heat energy. For example, a block of metal would heat up more than a block of concrete. The change in temperature of a material is dependent on:

* The amount of energy supplied to it
* The mass of the material
* What the material is

Specific Heat capacity can be calculated using:

A picture containing table

Description automatically generated

Storage Heaters

A Storage Heater uses electricity at night (off-peak) to heat special bricks or concrete. Energy transferred from the bricks heats the room. The bricks have a high specific heat capacity, which means that they can store lots of energy. They heat up slowly when the heating element is on, and cool down slowly when it is off.

Heating and Insulating Buildings

Houses are often heated by heaters, or central heating system, which mostly run on gas or electric. However, a lot of the energy used to heat the room is transferred to the surroundings outside of your house. This wastes money and energy. Here are some methods which can reduce the energy lost.

* Loft insulation such as fibreglass reduces the rate of energy transfer through the roof. The air between the fibres helps to reduce the rate of energy transfer by conduction. The greater the number of layers, the less energy will be transferred.
* Cavity wall insulation reduces the rate of energy transfer through the outer walls of the house. The cavity of an outer wall is the space between the two layers of bricks. The insulation is pumped into the cavity, and traps small bubbles of air, reducing the rate of energy transfer by conduction
* Aluminium foil between a radiator and the wall reduced the energy transfer by radiation. The foil reflects the heat away from the wall, back into the room. This reduces the rate of energy transfer by radiation.

Solar Panels

Heating a home using gas or electricity can be expensive. Solar panels can be used instead. They work by absorbing infrared radiation from the sun. This energy can either be used to generate electricity (solar cell panels), or heat or heat water directly (solar heating panels). In the Northern hemisphere, solar panels are normally fitted on roofs facing South, to absorb as much infrared energy from the sun as possible.