

LO: Explain how to prevent unwanted heat transfer

Do Now:

1. State the law of conservation of energy.
2. State the word we use to describe energy that has been wasted
3. Describe the energy transfer when a moving object comes to a sudden stop
4. Name the piece of equipment used to measure the force needed to lift an object.

Give the following to 3 significant figures: 23.4100351

New Information – Insulation

We have learned about the transfers that can occur between different energy stores. And last lesson, we learned that although energy is never lost, it can be wasted, transferred un-usefully or dissipated to the surroundings. Today, we're going to be looking at the transfer of thermal energy, heat, specifically, and how we try to prevent these transfers.

HOT \Rightarrow **COLD**

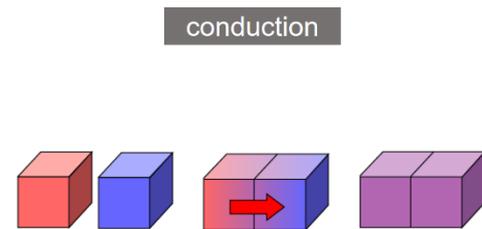
The first thing we need to understand is why thermal energy is transferred. Thermal energy is always transferred from the hotter object, to the colder object. **There is no such thing as 'cold'**. Cold is just the absence of thermal energy, in a similar way to how black is the absence of visible light.

Pause Point (Copy and complete the following sentences):

- Thermal energy is always transferred from ... objects to ... objects

New Information – Conduction

Heat can be transferred in several ways. The first is conduction, when a hotter object and a cooler object are in physical contact. Thermal conductivity describes how well a material transfers heat by conduction. **The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.**



As a non-metal is heated, the atoms near the heat source begin to vibrate. These vibrating atoms bump against neighbouring atoms, passing some of their energy along. This is how heat is conducted in a non-metal material.

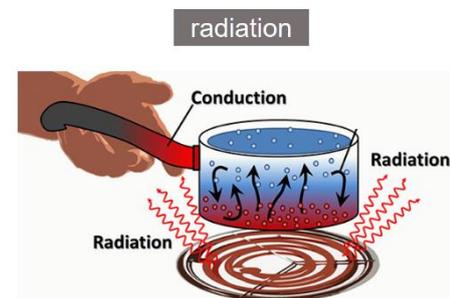
As a metal is heated, the metal atoms begin to vibrate. The delocalised electrons also begin to move around. The delocalised electrons transfer energy more quickly than the vibrating atoms. This is why metals tend to be good conductors of heat.

Pause Point (Copy and complete the following sentences):

- Metals are good conductors of thermal energy because ...
- Conduction occurs when ...

New Information – Radiation

The other way that heat can be transferred is by radiation. All objects emit some infrared radiation. The hotter the object, the more radiation emitted. We will learn more about infrared radiation when we talk about the electromagnetic spectrum.



So how do we reduce unwanted heat transfer? There are several ways. For example, keeping houses warm is a real challenge. So, what are the main factors affecting how quickly the thermal energy store in a house is depleted and dissipated?

1. First, the temperature difference between outside and in \rightarrow the larger the temperature difference the quick energy is dissipated from hot to cold
2. Secondly the area of the walls – the larger the area of the walls the faster energy can be dissipated.
3. Thirdly the thermal conductivity of the walls – walls made of material with high thermal conductivity will dissipate energy faster.
4. Next the thickness of the walls – the thinner the wall, the faster the energy can be dissipated.
5. Finally whether or not there is insulation – no insulation means the energy will be dissipated faster. Insulating material has a low thermal conductivity, and so slows down the rate of heat loss.

Key Knowledge: Complete 2 x LCWC in your book – don't forget to green pen this

Recall Quiz: Answer the following questions from memory in your books, remember to do this without looking back at your key knowledge

1. Most of the energy lost from our houses spreads out into the surroundings by ...
2. Two reasons that we want to stop energy loss happening are because reducing waste helps to... and...
3. A house will also lose more heat if the walls are ...
4. The house will also lose more heat if it has a ... area
5. Insulation between walls is effective because ...

Self-Assess your recall quiz answers using the key knowledge table

Most energy lost from a home is wasted as ...	Dissipated thermal energy
Define conduction.	Heat transferred between objects in contact.
Define radiation.	Heat transferred by infrared radiation.
We want to reduce the amount of energy wasted because ...	it keeps us more comfortable and saves money.
Houses are insulated by filling the walls with a material which has a ...	Low thermal conductivity which slows down the rate of heat loss
What factors increase the rate of thermal energy loss from a house?	<ul style="list-style-type: none"> • There's a larger temperature difference between outside and in. • The walls have a larger area. • The walls are made of a material which is a thermal conductor. • The walls are thin. • The walls don't contain insulation.

I do, We do, You do: Complete the following table, the first one has been done for you as a model. **Use your key knowledge to complete the table and explain which house will lose thermal energy more easily and why.**

Example	Which house will dissipate less energy?	Why?
House A has a roof insulated with fibreglass whereas House B has no roof insulation.	House A	House B will lose the store of thermal energy more quickly because there is no insulation. This means that energy can be transferred more quickly to the surroundings.
House A is in the UK where the temperature outside is only 7°C, but inside it is 24°C. House B is in Spain, where the temperature outside is 30°C, and inside it is 35°C.		
House A is a 10 bedroom mansion with a large area of walls, whereas House B is a 2 bedroom house with a smaller area of walls.		
House A has walls made from brick, whereas House B is made from aluminium.		
House A has thin walls, whereas House B has thick walls.		
House A has no loft insulation, but House B has a roof and walls insulated with fibreglass.		
House A has installed double glazing, but House B just has single-glazing.		