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# Conduction

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## Conduction:

### Conduction in metals:

- Most metals contain a lot of free electrons called as mobile or conduction electrons. These are the atoms that have broken free from their atoms and thus changed them into positively charged ions. These electrons keep moving throughout the metals and are bonded by electrostatic forces of attraction to the positive ions.
- When a metal is heated at one end, the free electrons at the hot end gain kinetic energy and move faster.
- These electrons diffuse, move faster and in the process collide with other free electrons and metal ions in the cooler parts of the metal. Thus the kinetic energy is transferred by the electrons to other electrons and ions. In addition the ions vibrate faster due to an increase in their kinetic energy. Thus heat energy gets transferred from the hot end to the cold end by electrons and ions.

### Conduction in non-metallic solids:

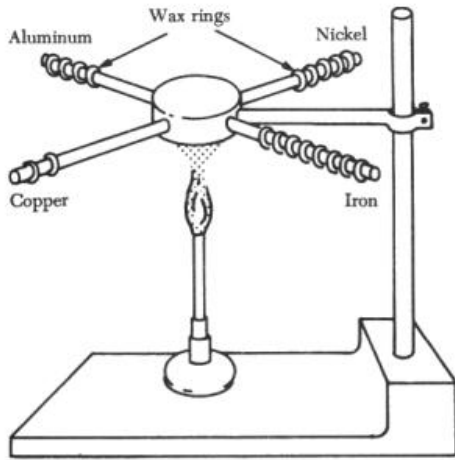
- In non metals, there are no free electrons. Hence when it is heated, heat only gets transferred via the atomic vibrations as the atoms are closely packed.
- This method of heat transfer is less effective as compared to conduction in metals.
- Hence non metals are bad conductors as compared to metals.

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### Conduction facts:

- Conduction cannot happen in vacuum.
  - Metals conduct better than non metals.
  - Conduction can happen in solids, liquids and gases.
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**Identify the best conductor:**



In the adjoining figure, equal heat is supplied to the different metallic rods. The rod that has the minimum number of wax rings left at the end of a particular time interval is the best conductor of heat.

**Note:**

1. Thermal conduction is bad in gases and most liquids  
-> Thermal conduction is bad in gases because gases have only a relatively low number of molecules which are also very far apart. Hence, only little energy can be transported through them. Also thermal conduction in gases and liquids is due to the collisions and the diffusion of the molecules during their random motion.
2. There are many solids that conduct thermal energy better than thermal insulators but do so less well than good thermal conductors

**LIST OF THERMAL CONDUCTORS AND INSULATORS**

Diamond  
Copper  
Gold  
Aluminium  
Concrete  
Glass  
Water  
Wood  
Polystyrene  
Glass wool  
Styrofoam  
Air  
Argon

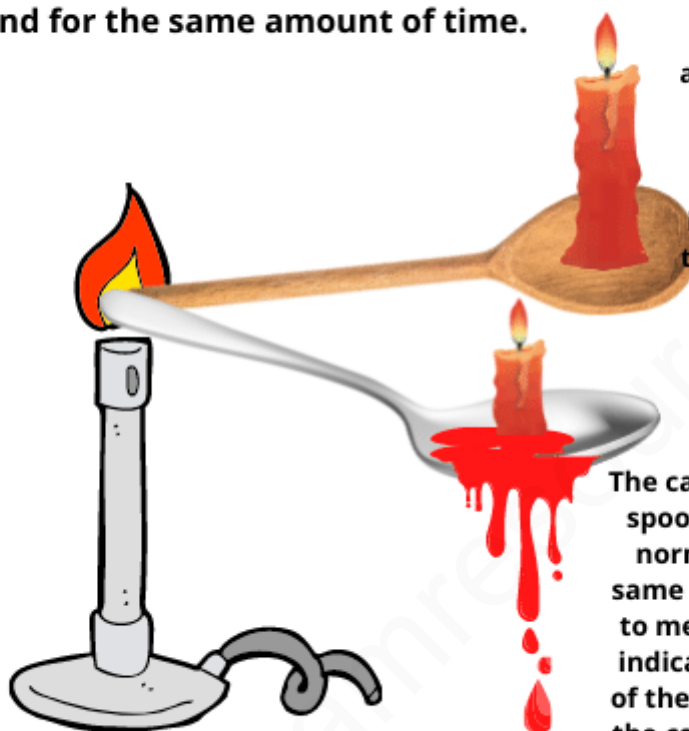
Good thermal conductors  
[or]  
Poor insulators  
↓  
Bad thermal conductors  
[or]  
Good insulators

## THERMAL CONDUCTORS AND INSULATORS

### Experimental set up:

2 spoons [of different materials] kept in the yellow part of the flame, with same type of candles and for the same amount of time.

The candle in the wooden spoon keeps burning normally without any dripping of the wax. This proves that wood is a good thermal insulator or a bad thermal conductor



The candle in the metal spoon keeps burning normally but at the same time, wax is seen to melt and drip. This indicates that the end of the spoon that holds the candle has become hot due to conduction and that metal is a good conductor



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