

Heat Transfer Methods

- Heat transfers in three ways:
 - Conduction
 - Convection
 - Radiation

Conduction

- Heat is transferred from one particle of matter to another in an object without the movement of the object.
- **Heat traveling through solids.**
- **Two objects must touch** or have direct contact.
- As molecules heat up they move faster and expand.
- When you touch one hot surface to another, the hot molecules bump into the other molecules which makes them start to move faster.
- An object gets hotter from the movement of the molecules.
- All solid objects conduct heat, some are better conductor than others.
- Metals are good conductors.

Have you ever...

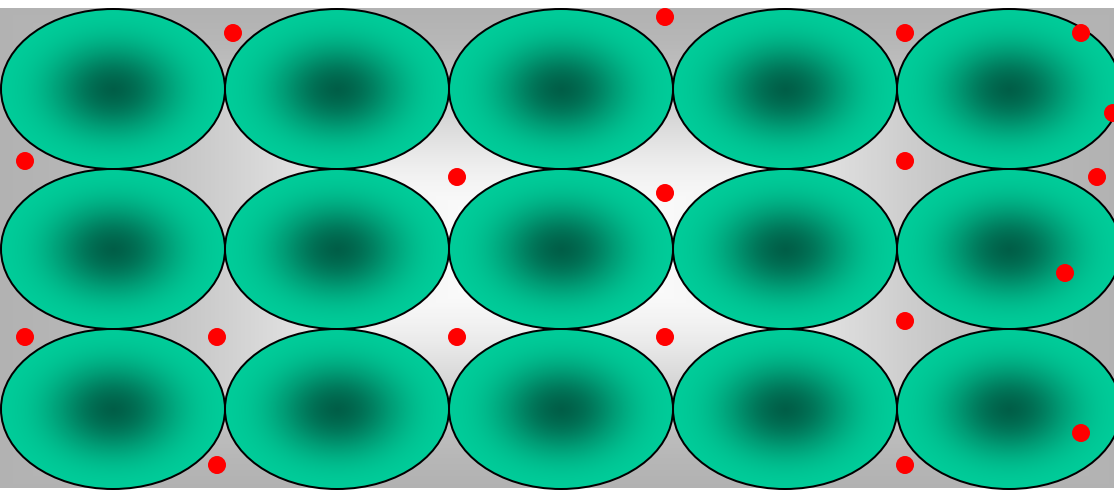
- Touched a metal spoon sitting in a pan of boiling water only to be surprised by HOW hot it is??



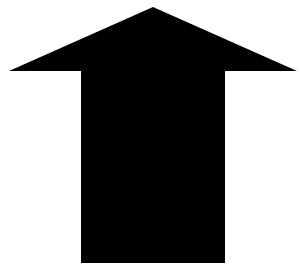
Think back to what you know about metals and nonmetals. What conducts heat better, metal or nonmetal? Why?

Metals are different

The outer electrons of metal atoms drift, and are free to move.



When the metal is heated, this 'sea of electrons' gain kinetic energy and transfer it throughout the metal.



Insulators, such as wood and plastic do not have this 'sea of electrons' which is why they do not conduct heat as well as metals.

EXAMPLE OF CONDUCTION

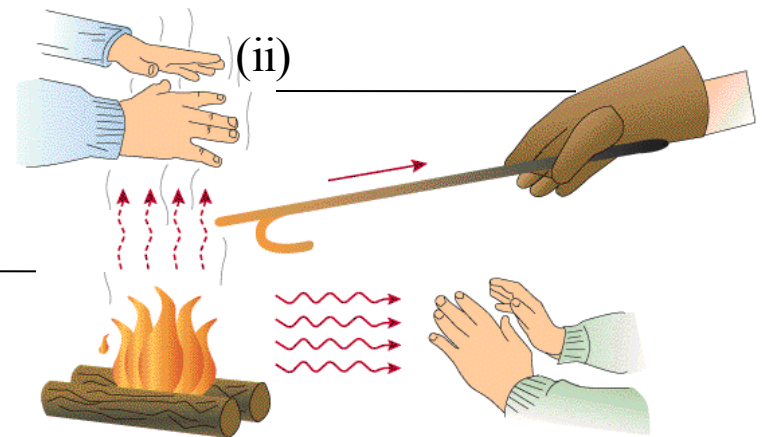
- A piece of cheese melts as heat is transferred from the meat to the cheese (Contact)



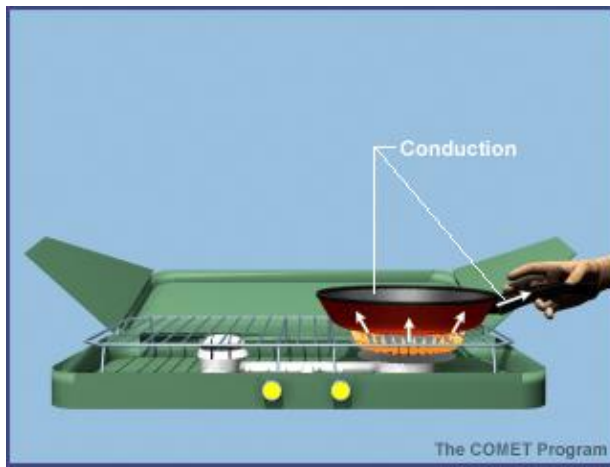
Examples of Conduction



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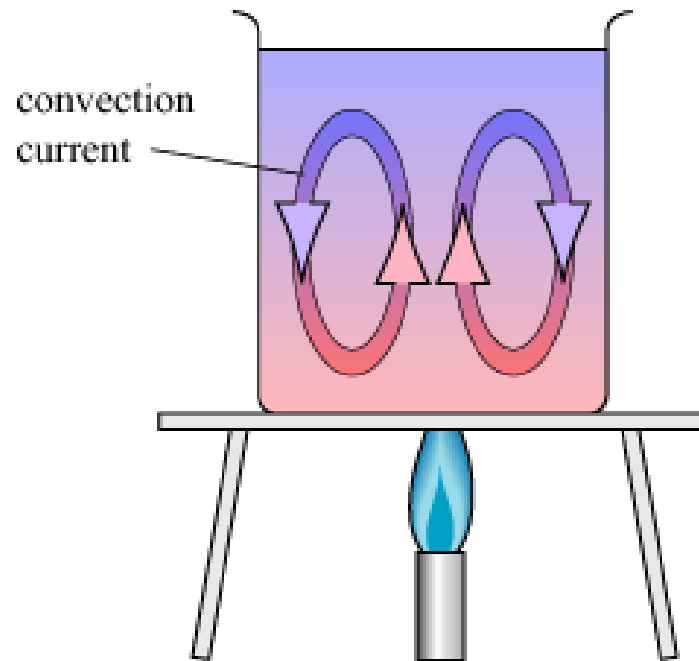


(iii) _____



CONVECTION

- Convection is the movement that transfers heat within fluids and air (gas)
- Heat is transferred by currents within the fluid or gas
- Convection = (through air and liquid particles)
- Convection moves in a circular pattern



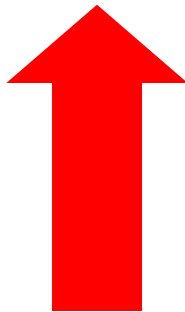
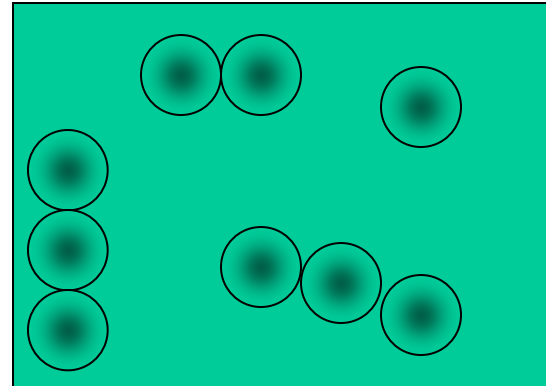
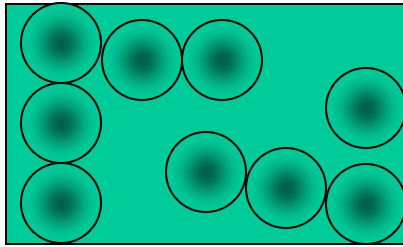
Convection

- **Heat traveling through liquids or gases**
- As molecules heat up, the heat makes the molecules move more rapidly and expand.
- Creates currents in liquids or gases – hot air rises and cold air sinks.
- Uneven heating of our ocean creates ocean currents.
- Uneven heating of our atmosphere produces huge convection wind currents.
- Scientists use global and local wind patterns to predict weather.

Convection

What happens to the particles in a liquid or a gas when you heat them?

The particles spread out and become less dense.



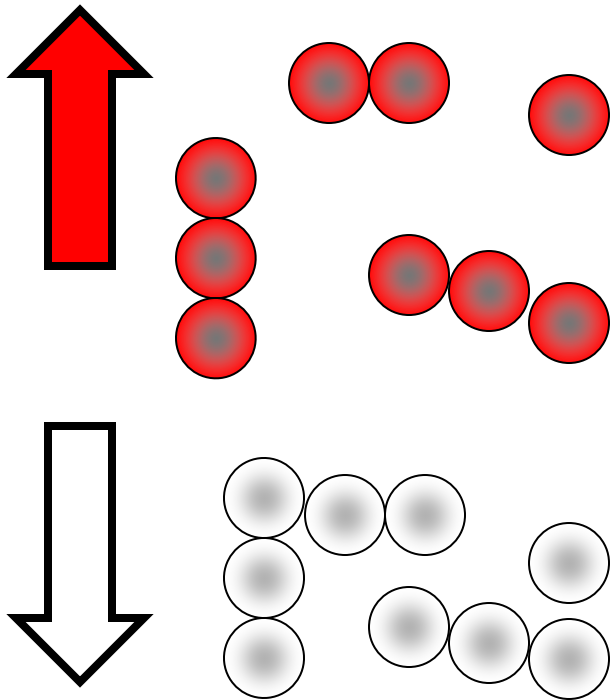
This effects fluid movement.

Fluid movement

Cooler, more dense fluids,
sink through warm, less
dense fluids.

In effect, warmer liquids and
gases rise up.

Cooler liquids and gases sink.



Why is it windy at the seaside?

Why is it windy at the seaside?

The land is warmer
than the sea.

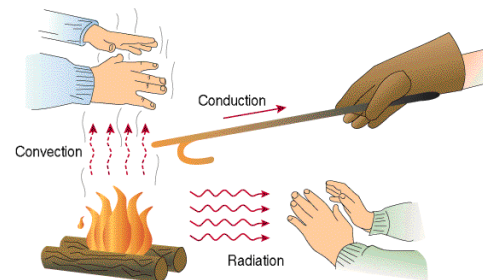
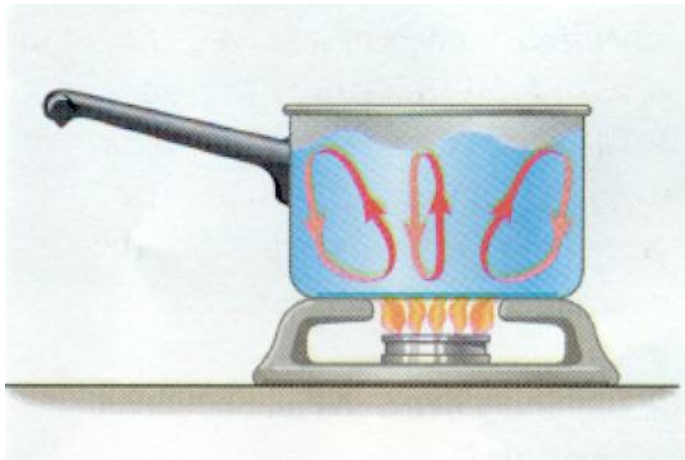
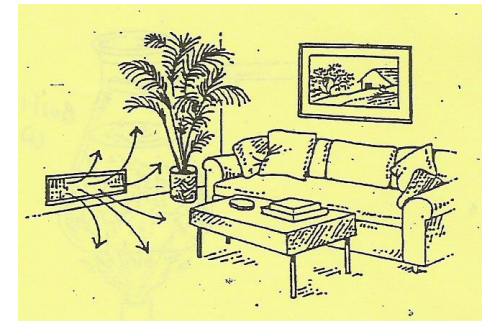
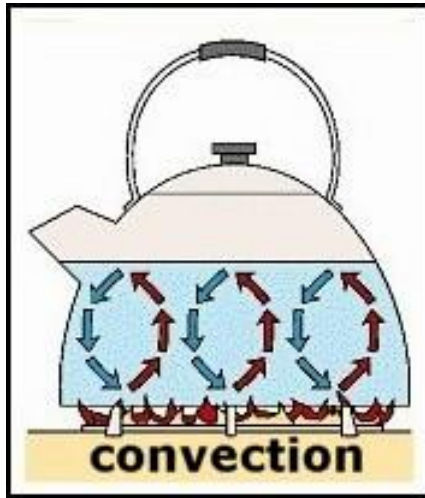
This land warms
the air above it,
and it rises.



The cold air from above the sea moves in to
take the place of warm air that has risen.

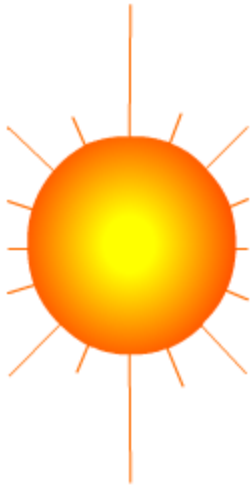


Examples of Convection



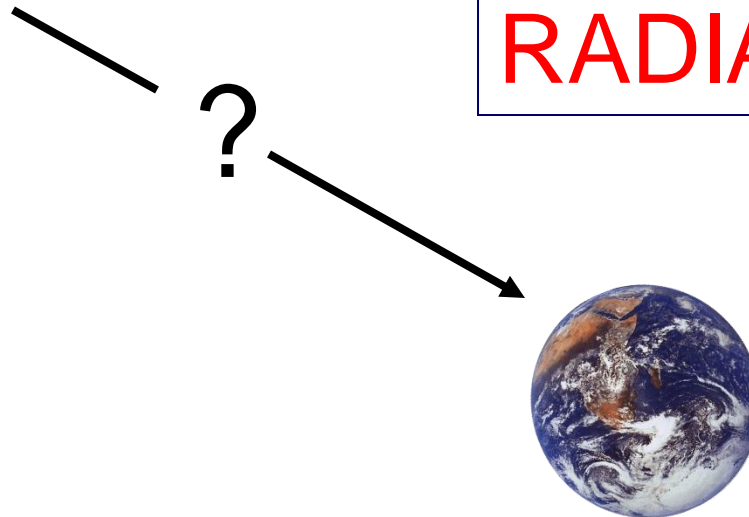
The third method of heat transfer

How does heat energy get from the Sun to the Earth?



There are no particles between the Sun and the Earth so it CANNOT travel by conduction or by convection.

RADIATION



Radiation

- Radiation is the transfer of energy by electromagnetic waves
- Radiation does NOT require matter to transfer thermal energy
- **Release of invisible heat energy waves from the sun or fire.**
- **No movement of molecules** to transfer heat.
- Feel warm without touch – heat radiates.
- Radiators got their name from this type of heat.
- When the radiant energy from the sun hits the earth, the earth soaks up the energy and changes it into heat.

Examples of Radiation

