Understanding Heat and how Heat gets Transferred

Conduction, Convection and Radiation

Heat & Heat Transfer

- **Heat**: Heat is energy! Heat is the energy transferred (passed) from a hotter object to a cooler object.

- **Heat Transfer**: The transfer (passing) of heat from one object to another. Heat **always** moves in the direction from: higher temperatures to lower temperatures.
  warm to cool
- Always! Always! Always from high energy to low!
- Hot objects in a cooler room will cool to room temperature.
- Cold objects in a warmer room will heat up to room temperature.

Question #1

- If a cup of coffee and a red popsicle were left on the table in this room what would happen to them? Why?
- The cup of coffee will cool until it reaches room temperature. The popsicle will melt and then the liquid will warm to room temperature.
- This is because nature works to balance heat energy! Equal energy for all!

Question #2

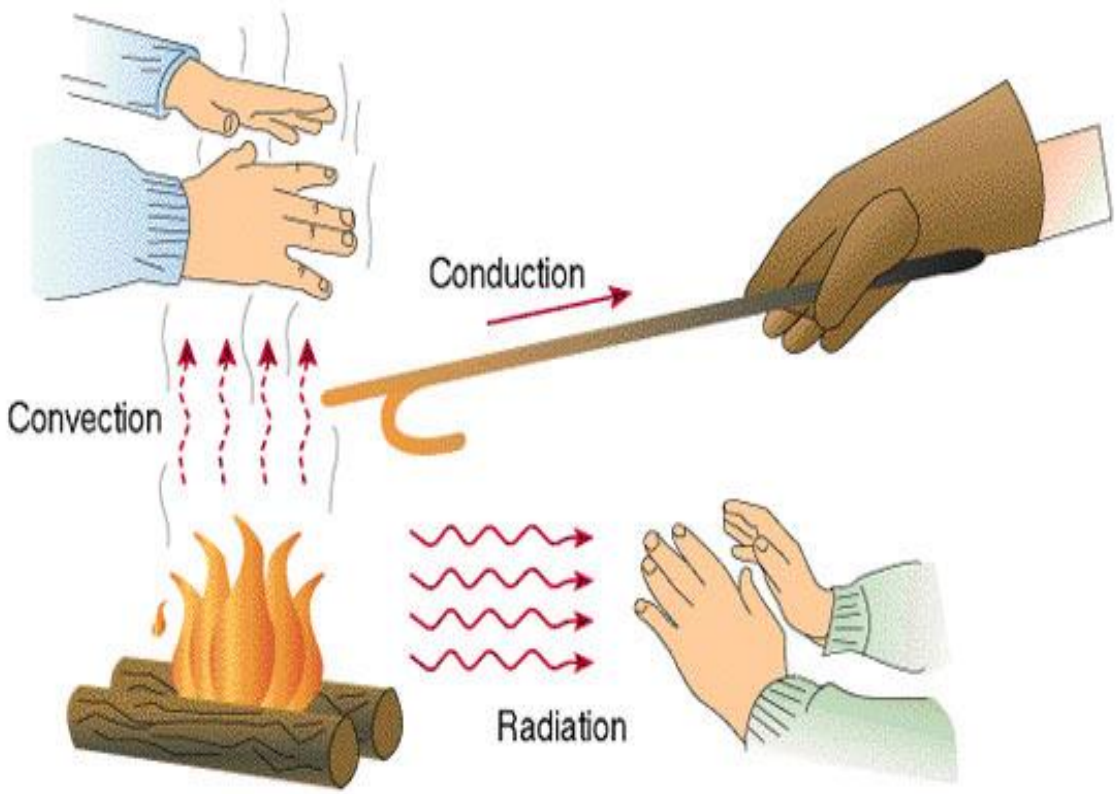
- As the cup of coffee cools, how is the heat energy moving? Why?
- The heat in the cup of coffee is moving from the cup of coffee into the air. This is because heat energy **always** moves in the direction from higher temperatures to a lower temperatures.

Question #3

- As the red popsicle melts, how is the heat energy moving? Why?
- The heat in the air is moving from the air into the popsicle.
  This is because heat energy **always** moves in the direction from higher temperatures to a lower temperatures.

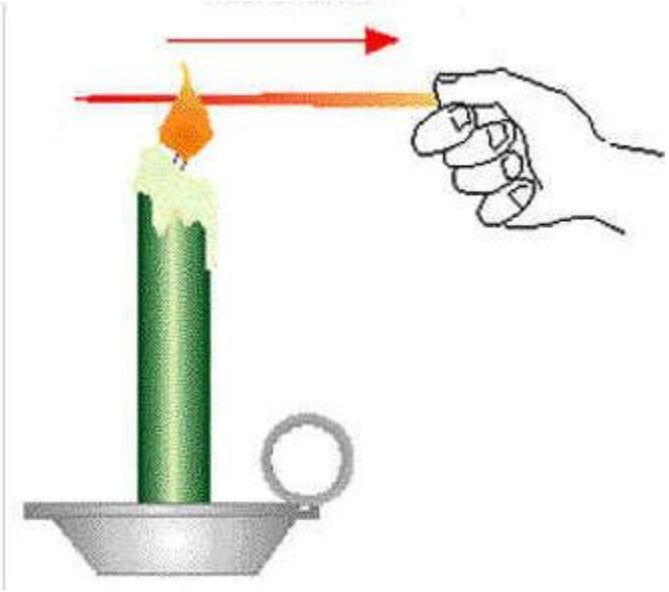
Heat Transfer Methods

- Heat transfers in three ways:
  1. Conduction
  2. Convection
  3. Radiation



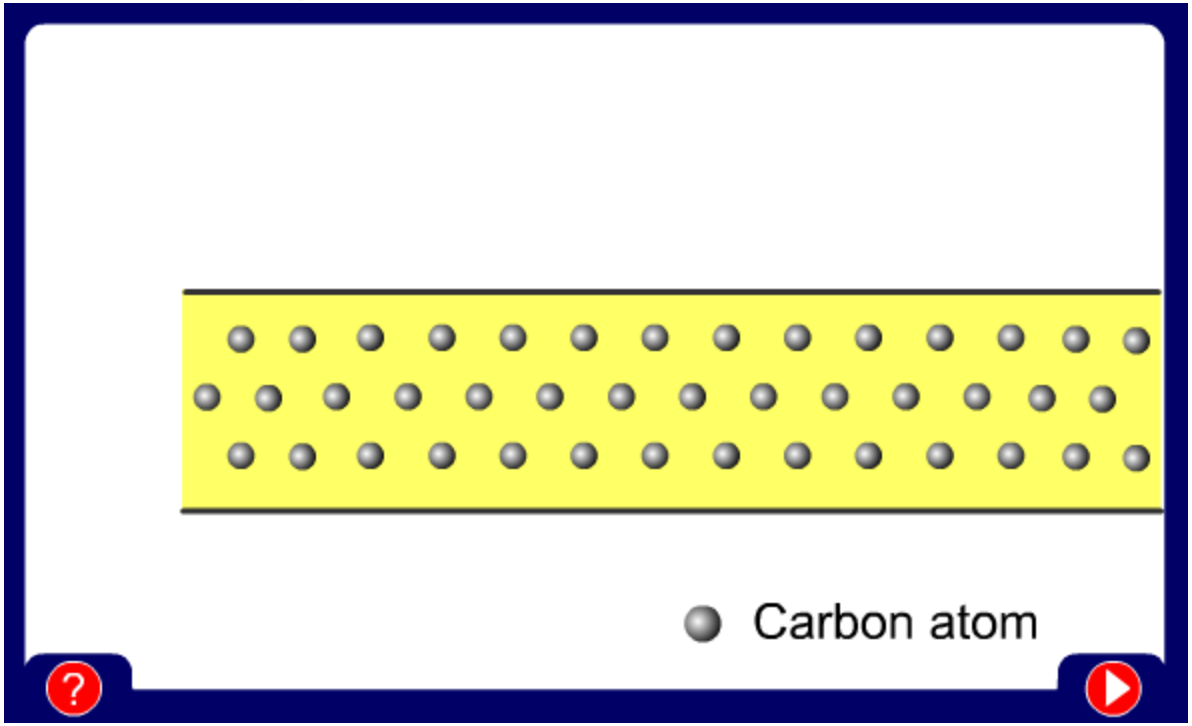
Conduction

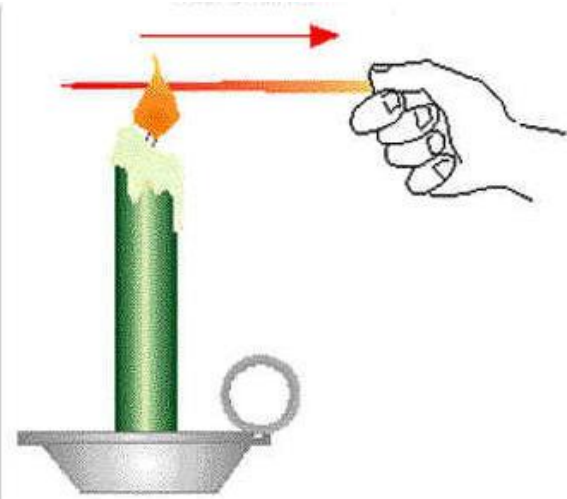
- **Conduction**: Conduction happens when 2 objects at different temperatures *touch each other*. Heat flows from the warmer to the cooler object.
- Examples?



Conduction

Close up of what happens when you heat a metal strip at one end, how the heat travels to the other end.





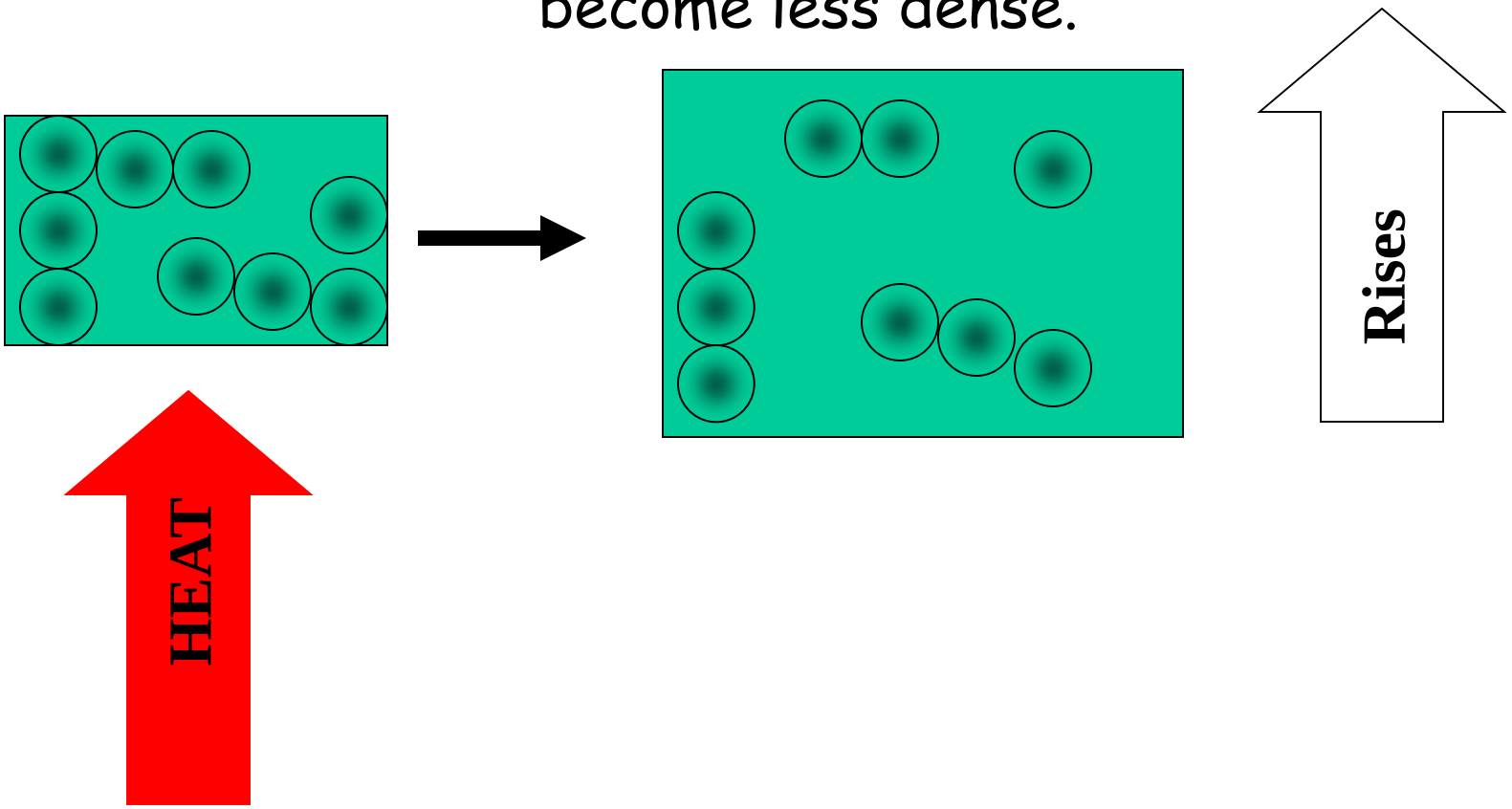
As you heat the metal, the particles vibrate, these vibrations make the adjacent particles vibrate, and so on and so on, the vibrations are passed along the metal and so is the heat. We call this? **Conduction**

Convection

- **Convection:** In liquids and gases, convection happens when the part of the *liquid or gas* that is warmer rises. As this happens, cooler liquid or gas sinks taking the place of the warm part.
- Examples?

This is a close up of what happens to the particles in a liquid or a gas when you heat them

The particles spread out and become less dense.



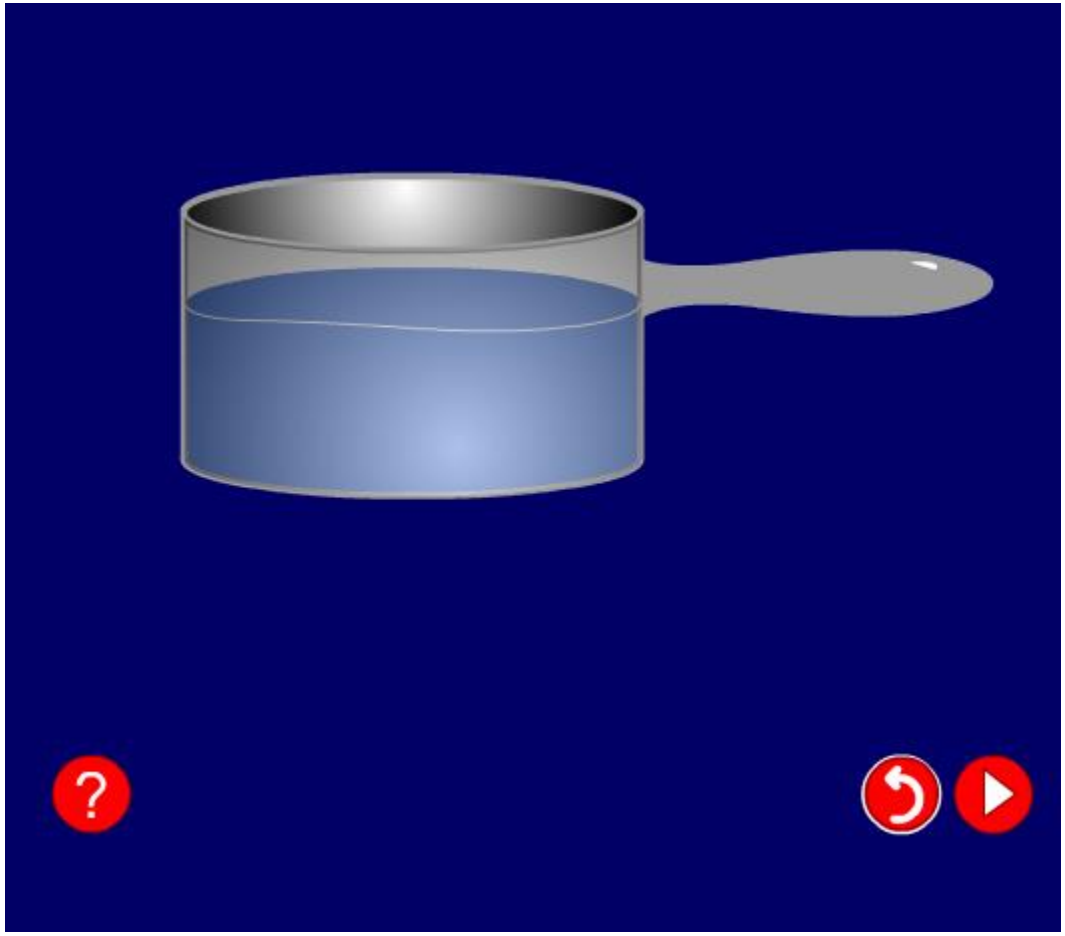
Convection:

Example: Water Movement

Cools at the surface

Convection current

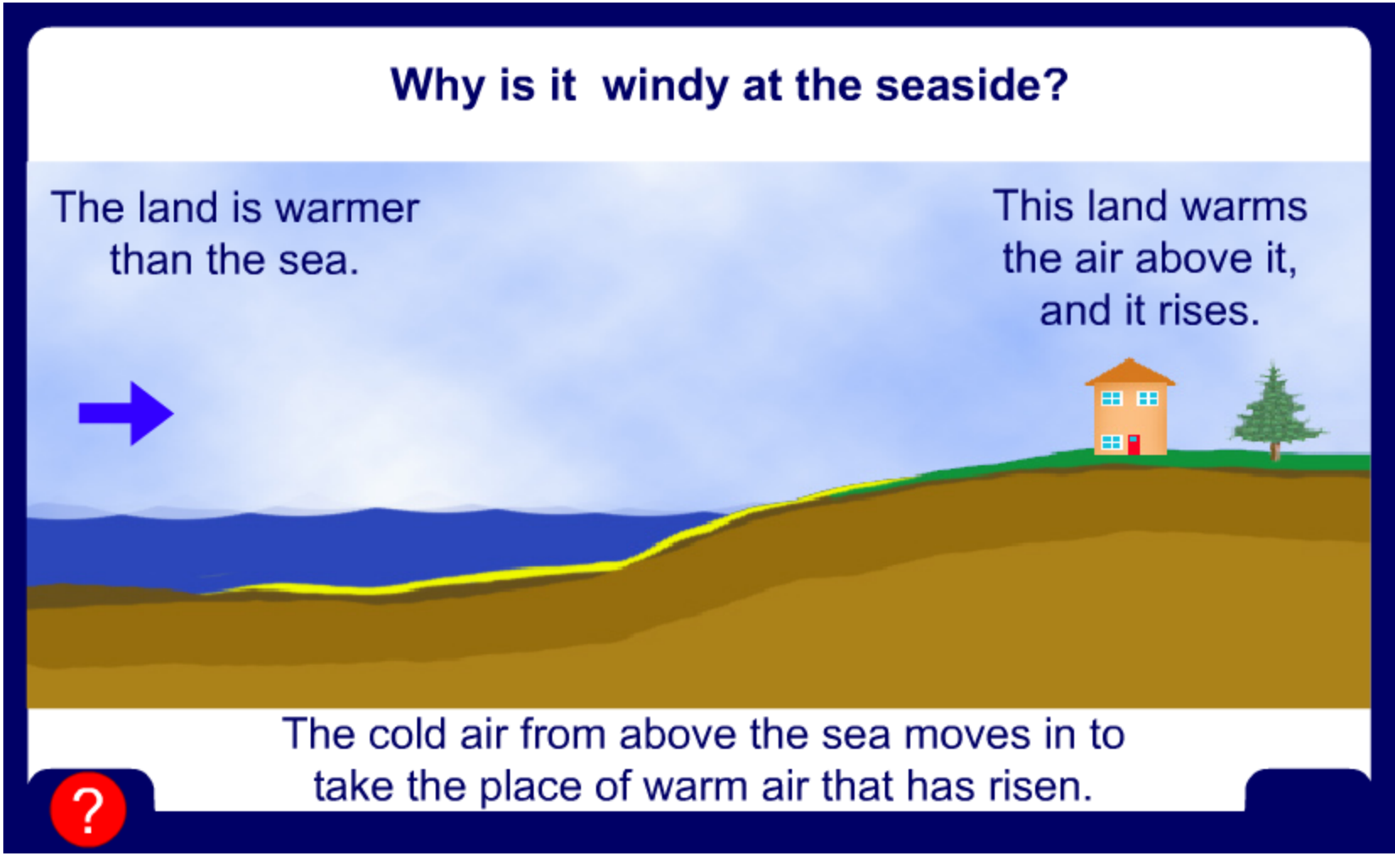
Cooler water sinks



Hot water rises

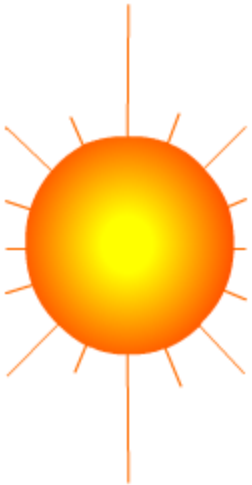
Convection:

Example: Air Movement



What is the third method of heat transfer?

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



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

RADIATION: The direct transfer of energy by electromagnetic waves (Infared Radiation).

Examples: Heat from solar energy and a campfire.

Radiation Quiz

Radiation travels in waves

True/~~False~~

Radiation can travel through a vacuum

True/~~False~~

Radiation requires particles (molecules) to travel

~~True~~/False

Radiation travels at the speed of light

True/~~False~~

1. Which of the following is <u>not</u> a method of heat transfer?

A. Radiation

B. Temperature

C. Conduction

D. Convection

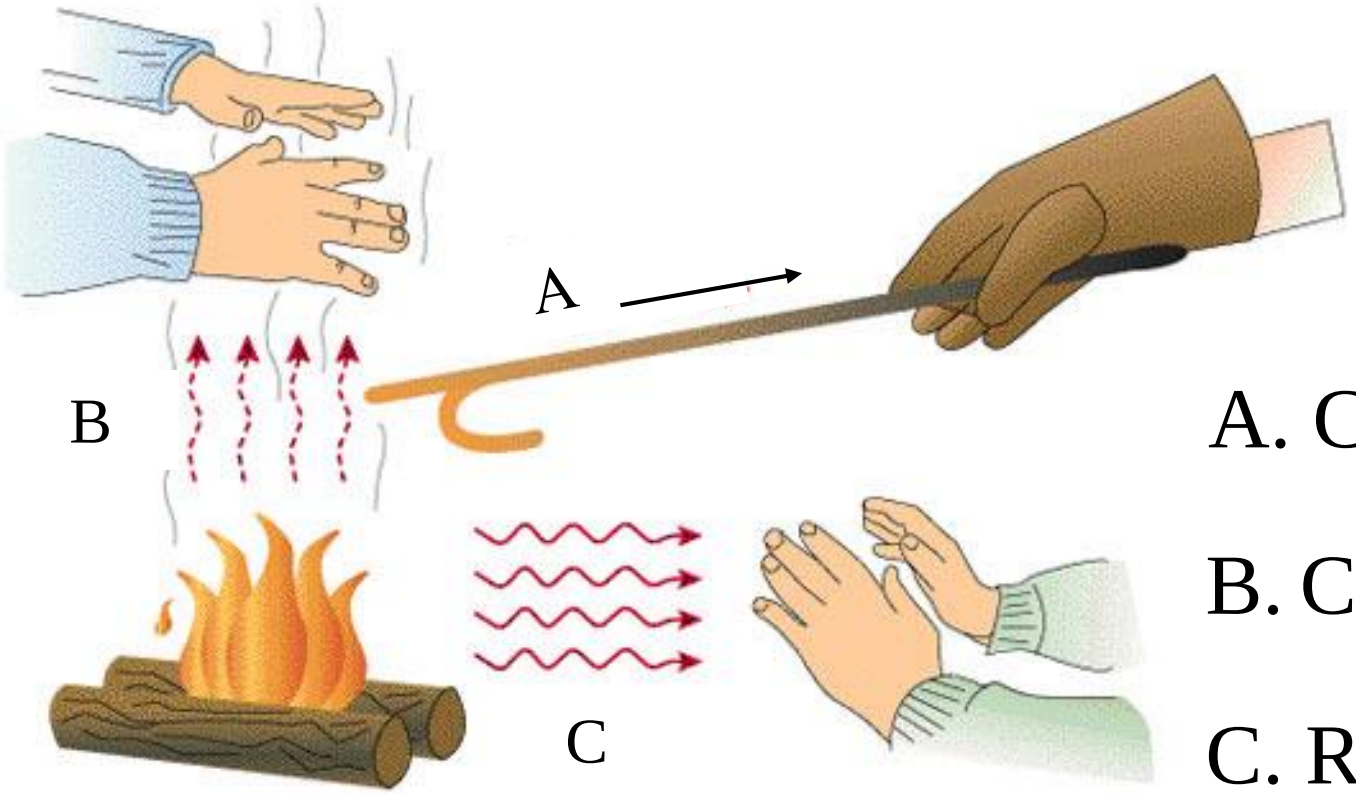
2. How does heat energy reach the Earth from the Sun?

A. Radiation

B. Conduction

C. Convection

Name that Form of Heat Transfer



A. Conduction

B. Convection

C. Radiation