

Heat transfer: Radiation

Name: _____

RECAP: Conduction and Convection are two ways heat energy can be transferred. **Conduction** requires that two substances be **in direct contact** with each other in order for heat to be transferred. **Convection** requires that the particles of the substance can move around transferring the heat from one part of the system to another.

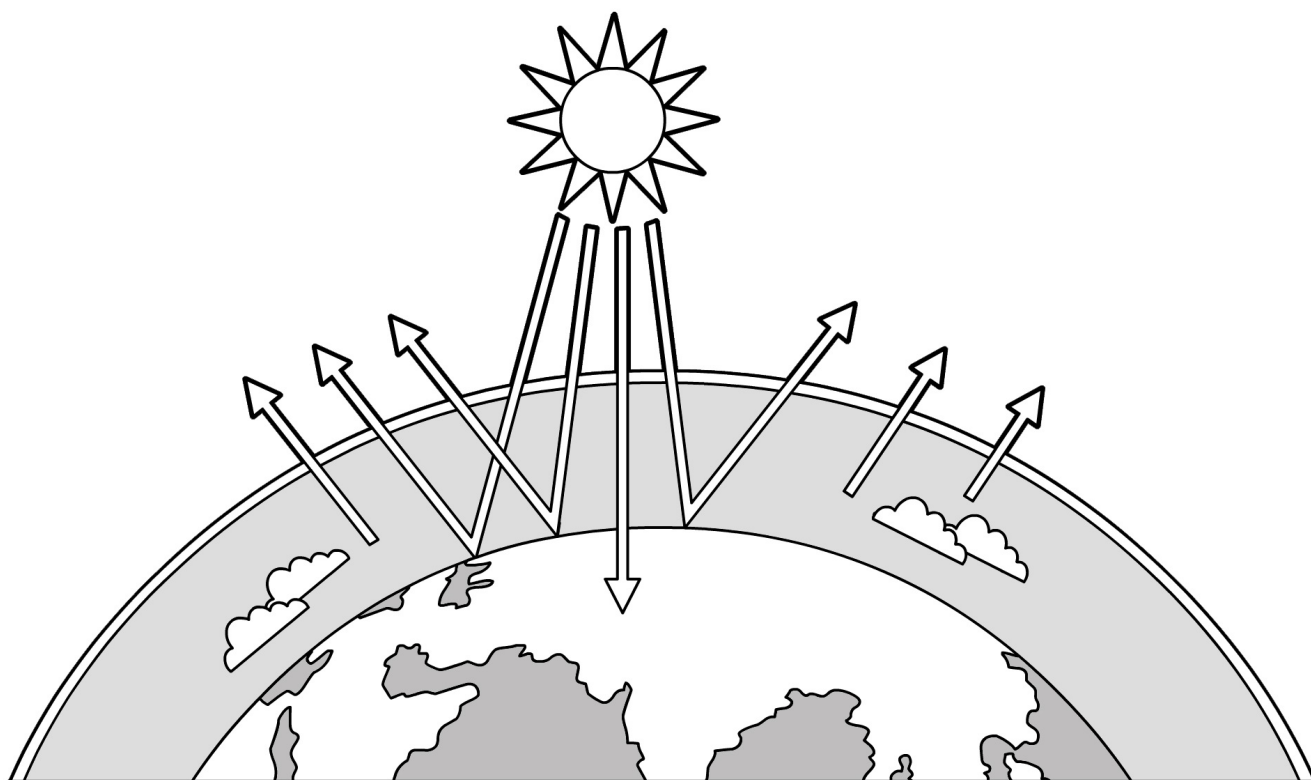
Both conduction and convection rely on **matter** through which the heat can be transferred. But consider this: **How does the sun transfer its heat to Earth?**

Could this happen by conduction? No, because the sun is not in direct contact with Earth or Earth's atmosphere.

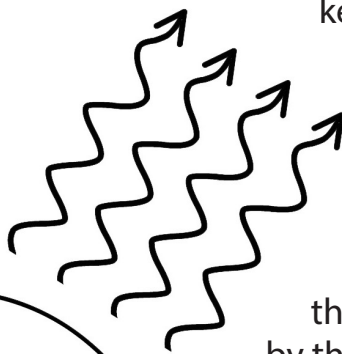
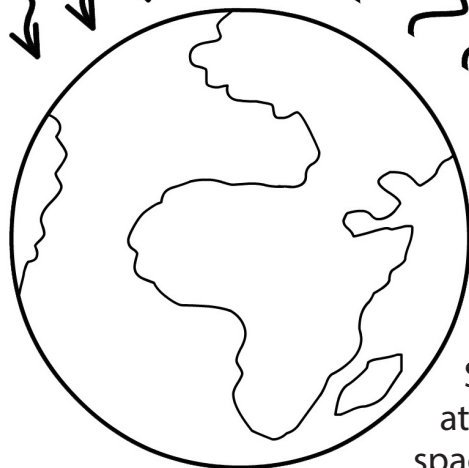
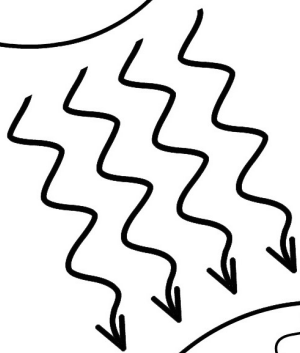
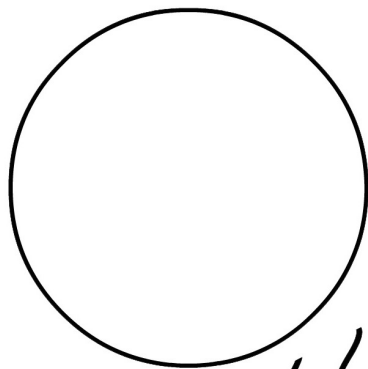
Could it do it by convection? No, because the heat of the sun has to pass through a huge space between itself and the Earth's atmosphere where there is no matter, like air or other gases.

NOTE: Earth's atmosphere is made of various gases that make up air. Other planets have atmospheres that contain gases as well. Between the planets however, there is no matter, it is what we call a **vacuum**. This is why you cannot breathe in space and why you cannot hear sound in space. Breathing requires air and sound waves need a medium like air to flow through.

The sun uses another type of heat energy transfer called **radiation**. Radiation does not require matter or the movement of particles of matter to transfer heat, because it



uses **electromagnetic waves**. These waves from the sun carry light and heat across the vacuum of space to the Earth's atmosphere; they go through the atmosphere and heat up the surface of the Earth. Some of this radiation is **absorbed** by the Earth and some is **reflected** back into space.



Discuss in groups: What do you know about **GLOBAL WARMING** and the **GREENHOUSE EFFECT**?

The **Greenhouse Effect** is what keeps our atmosphere warm and is able to support life. Our atmosphere plays an important role in doing this. Radiation from the sun comes into our atmosphere. Some of this radiation is absorbed by the Earth and the rest is reflected off the surface of the Earth. The atmosphere traps these waves of heat and light and this keeps the surface of the Earth at a good temperature for living in – we will not burn and we will not freeze. Some of the waves do escape the atmosphere and are reflected back into space.

Global warming happens when the Greenhouse effect is enhanced. Due to smoke particles and other harmful gas particles in the atmosphere, more waves from the sun are being trapped in the atmosphere, and less radiation is escaping. This means that the atmosphere is warmer than it should be. As a result, climate change and global warming are becoming a bigger problem to Earth.

The sun is not the only object that radiates heat. **All hot objects radiate electromagnetic waves that transfer heat.** This is why, when a group of people all stand around a fire, they can all feel the warmth of the flames.

Radiated heat can be absorbed or reflected by different materials. Materials have different properties that make them better reflectors or absorbers of heat.

Good absorbers of heat	Good reflectors of heat
Dark colours	Light colours
Matt texture	Shiny texture

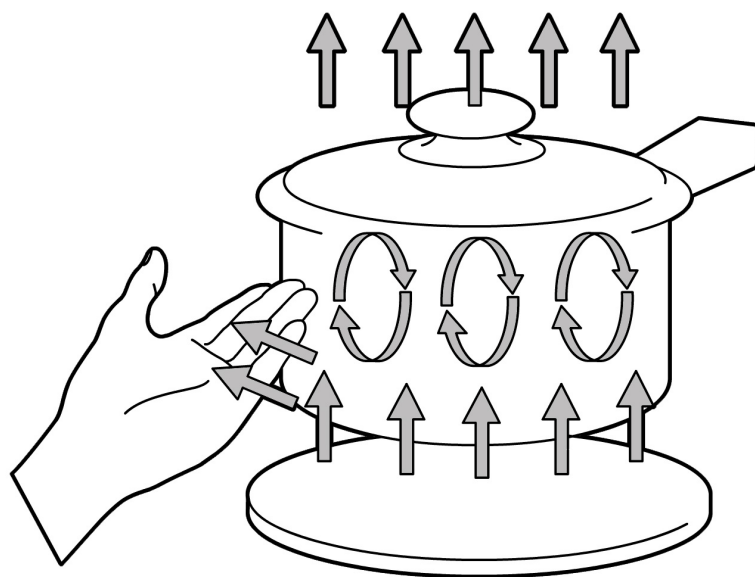
Activity 1: Answer these questions.

- 1) What method of heat energy transfer does the sun use to transfer heat to the Earth?

- 2) What makes this transfer possible – what does the sun use to transfer this heat?

- 3) Is the Greenhouse Effect a good thing or a bad thing? Explain your answer.

- 4) Label the types of heat energy transfer in this diagram.



- 5) In the colour spectrum, which colour **absorbs** the most radiated heat?

- 6) In the colour spectrum, which colour **reflects** the most radiated heat?

- 7) Put these in the correct order, from the substance that would reflect the least radiation to the substance that would reflect the most radiation.
A Shiny, light green surface _____

Answer Sheet

- B Shiny, black surface _____
- C Matt, white surface _____
- D Matt, dark blue surface _____

Discuss in groups: What do you know about GLOBAL WARMING and the GREENHOUSE EFFECT?

The learners should have heard these terms in school or in the news. As extension to this activity, if you have access to the Internet, allow the children to do further research. You can use the links below or find your own. It is always a good idea to limit the children to look at a few websites you have checked out yourself.

<http://climatekids.nasa.gov/greenhouse-effect/>

<http://www.epa.gov/climatestudents/basics/today/greenhouse-effect.html>

Activity 1: Answer these questions in your book.

- 1) What method of heat energy transfer does the sun use to transfer heat to the Earth?

Radiation

- 2) What makes this transfer possible – what does the sun use to transfer this heat?

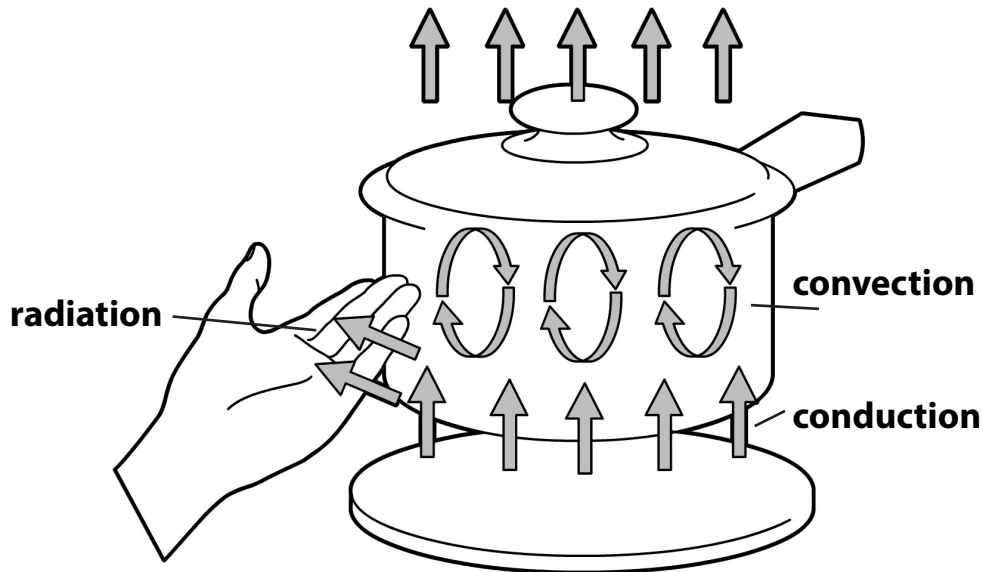
Electromagnetic waves

- 3) Is the Greenhouse Effect a good thing or a bad thing? Explain your answer.

It is a good thing because it keeps the surface of the Earth at a relatively constant temperature – a temperature that can support life. However, the Greenhouse Effect can have a negative impact on the Earth if it is enhanced. This means that if too much radiation is trapped in the atmosphere, the surface of the Earth heats up more than it should. This causes climate change and global warming.

Answer Sheet

4) Label the types of heat energy transfer in this diagram.



5) In the colour spectrum, which colour would absorb the most radiated heat?

Black

6) In the colour spectrum, which colour would **reflect** the most radiated heat?

White

7) Put these in the correct order, from the substance that would reflect the least radiation to the substance that would reflect the most radiation.

A Shiny, light green surface

B Shiny, black surface

C Matt, white surface

D Matt, dark blue surface

D, B, C, A