



Satellites, Weather and Climate
Unit plan: Weather
Created by: Mike Burris & Rick Imes
Champlain Valley Union High School, VT

Grade Level: 9-10

Social Studies Curriculum Topic Standards:

Subject Keywords:

Essential Question and Understanding #1

<p>How does the transfer of heat energy influence the Earth's weather and climate patterns?</p>
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<p>The Earth's weather and climate patterns are driven by the sun and controlled by the transfer of heat energy between the atmosphere, land, and oceans.</p>

Focus questions to consider:

- ▶ What is heat?
- ▶ Where does heat come from?
- ▶ How is heat transferred through the Earth system?
- ▶ How does heat energy affect weather variables like temperature, humidity, and air pressure?

Which contains the most heat: a pot of boiling water or a gigantic iceberg?

We have all noticed that when you heat something up, its temperature rises. Often we think that heat and temperature are the same thing. However, this is not the case. Heat and temperature are related to each other, but are different concepts.

Heat is the total energy of molecular motion in a substance while temperature is a measure of the average energy of molecular motion in a substance. Heat energy depends on the speed of the particles, the number of particles (the size or mass), and the type of particles in an object. Temperature does not depend on the size or type of object. For example, the temperature of a small cup of water might be the same as the temperature of a large tub of water, but the tub of water has more heat because it has more water and thus more total thermal energy.

It is heat that will increase or decrease the temperature. If we add heat, the temperature will become higher. If we remove heat the temperature will become lower. **Higher temperatures mean that the molecules are moving, vibrating and rotating with more energy.**

If we take two objects which have the same temperature and bring them into contact, there will be no overall transfer of energy between them because the average energies of the particles in each object are the same. But if the temperature of one object is higher than that of the other object, there will be a transfer of energy from the hotter to the colder object until both objects reach the same temperature.

Temperature is not energy, but a measure of it. Heat is energy.

Please write any questions you have so far in the box.

Energy Transfer in the Atmosphere

The Sun provides most of the Earth's energy. This energy drives winds and ocean currents and allows plants to grow and produce food, providing nutrition for many animals. When Earth receives energy from the sun different things can happen to that energy:

1. Some energy is reflected back into space by the atmosphere or the Earth's surface.
2. Some is absorbed by the atmosphere or by land and water on the Earth's surface.

Energy from the Sun reaches Earth's surface and heats it. Heat is then transferred through the Earth by radiation, conduction, and convection.

Radiation

Radiation is energy that is transferred through rays or waves. It is the reason why the Sun warms your face on a nice day. It is why you get "sunburned" if you stay out too long.

Conduction

If you walk barefoot on a hot sandy beach, your feet heat up because of conduction. Conduction is the transfer of heat energy through the contact of two objects or substances. Heat is transferred from the warmer object to the colder object. The Earth's surface conducts heat to the air right above it.

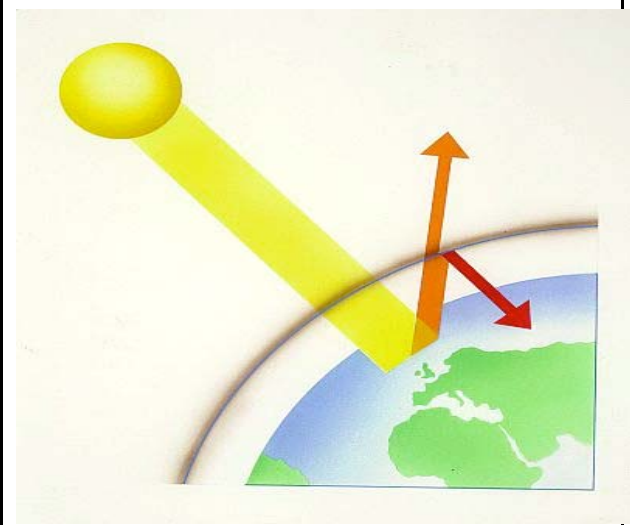
Convection

When air is heated by conduction or radiation it warms up. Molecules in the air move farther apart as they get warmer. When molecules move farther apart the air becomes less dense and rises. When air cools it becomes more dense and sinks. This rising and sinking air creates convection cells in the atmosphere.

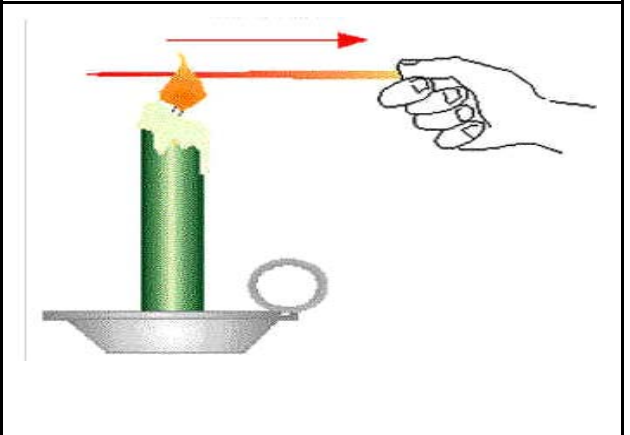
Density - The mass of a substance divided by the amount of space the substance takes up. The equation is written $D=M/V$ or density equals mass divided by volume. If the mass of an object increases and the volume stays the same the density increases. If the volume increases and the mass stays the same the density decreases.

Heat Transfer: Describe the picture in the box on the right.

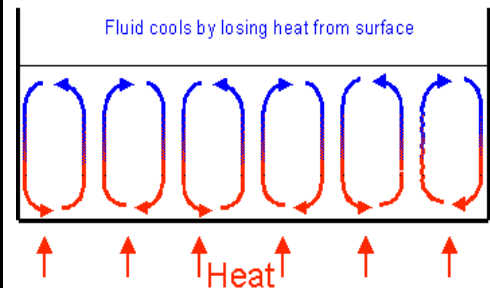
RADIATION:



CONDUCTION:

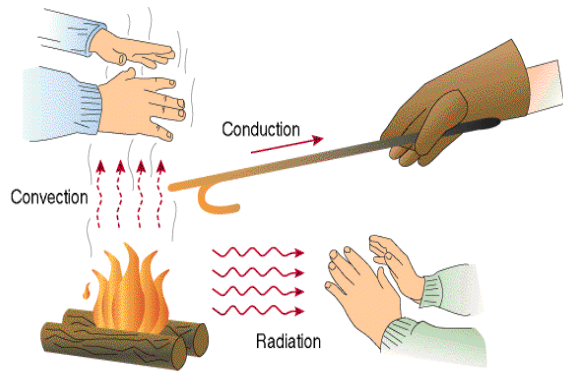


CONVECTION:



Convection cell
Warm, low density fluid rises
Cool, high density fluid sinks

SUMMARY:



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