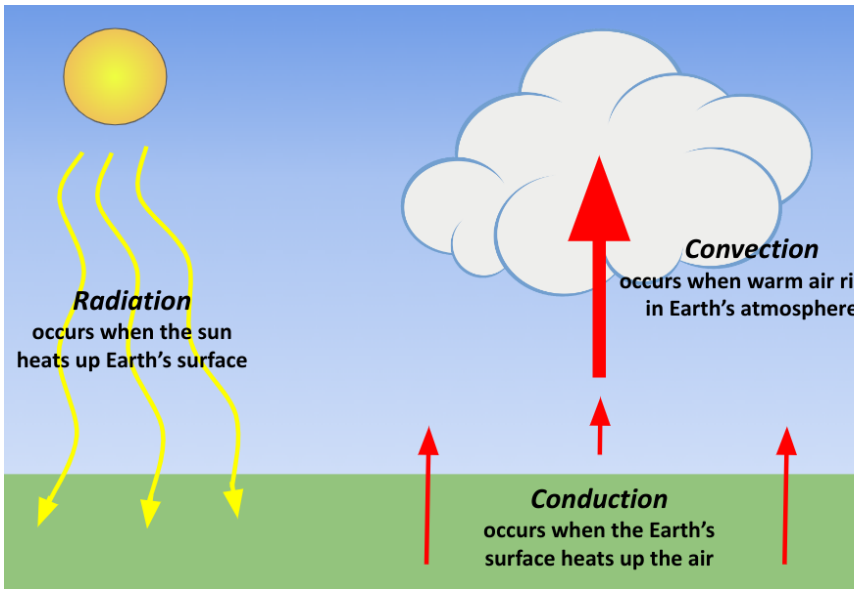
Title: Energy Transfer in Earth's Atmosphere

Student Sheet

The __Sun__ is Earth's heat source and energy from the Sun travels through electromagnetic _waves_____ through Earth's atmosphere to the surface.

- Heat energy is created when the ground becomes heated.
- **Heat transfer** occurs when there is a ____difference_____ in temperature between 2 objects.
- The __warmer_____ object transfers heat to the cooler object.
- Heat energy can be __transferred_____ by 3 processes:
  - Radiation
  - Conduction
  - Convection



Radiation is a type of heat transfer that occurs through ___elecgtromagnetic_____ waves from the Sun.

- The ___radiation_____ from the Sun warms the Earth.
- Whenever you _feel_____ heat without actually touching it, you are experiencing radiation.
- The heat from a campfire is another example.

Conduction is the transfer of heat through matter by *direct* _____contact_____.

- ____conduction_____ occurs when Earth's surface heats the air directly in contact with the surface.
- When a pot of water is placed on a stove burner, heat is transferred from the ___burner_____ to the bottom of the pot then from the pot to the water.

Convection is the movement of heat by actual __motion_____ of matter in _fluids__ like the air and ocean.

- As pockets of air become heated, they become __less_____ dense than the surrounding air and rise.

- As the air rises, it _expands_____ and cools and begins to sink.
- Think about boiling water in a pot.

Earth's Energy Budget is the ___balance_____ between the amount of incoming and outgoing energy from Earth's atmosphere.

- *Earth's Energy Balance* occurs when the ___incoming_____ energy + the outgoing energy = 0.
- If more energy is coming in than what is given off, the Earth will __heat__ up.
- If more energy is going out than what is coming in, the Earth will __cool____ down.

__Solar_____ radiation from the Sun is also referred to as **shortwave radiation** - much of it never reaches Earth's surface.

- About __50%_____ is reflected back into space or absorbed by our atmosphere or clouds.
- Another 50% is _abosrbed_____ by land and oceans.
- Dark colors absorb a lot more heat than lighter ones because they absorb more light energy.
    - Oceans and __rainforests_____ absorb a lot of the Sun's radiation.
- Lighter regions are reflective and absorb less of the Sun's energy.
    - Deserts and the __polar_____ regions reflect the Sun's energy.

Energy at Earth's surface is ___converted_____ into heat or **longwave radiation** and then sent out towards space.

- Some of that radiation will get ____trapped_____ by the atmosphere creating the greenhouse effect.
- The **greenhouse effect** is the way in which heat is trapped close to Earth's ___surface_____ by **greenhouse gases** (carbon dioxide, methane, trace gases).
- Greenhouse gases are important to keep our planet at a ___suitable_____ temperature for life.