

RAFT IDEAS

Topics: Seasons, Angle of the Earth's Axis to the Sun, Concentration of Energy

Materials List

- ✓ Heat lamp or focused bulb or bulb with sufficiently high heat output
- ✓ Socket or light weight lamp to hold the bulb, if needed
- ✓ Optional: Protractor

This activity can be used to teach:

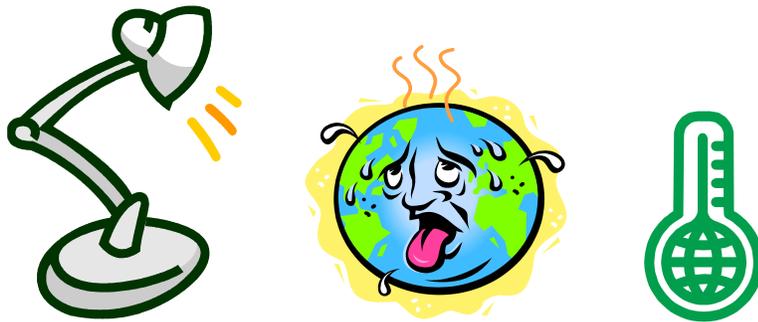
- Energy transferred by light & heat (Next Generation Science Standards: Grade 4, Physical Science, 3-2)
- Earth Sun Moon System (Next Generation Science Standards: Middle School, Earth & Space Science, 1-1)
- Unequal Heating of the Earth (Next Generation Science Standards: Middle School, Earth & Space Science, 2-6)



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Feel the Heat

Sensing the concentration of light energy



Use a heat lamp to sense the changes in concentration of light and heat energy.

To Do and Notice - (Caution: do not let students touch the heat lamp or bulb; it is hot and may cause burns!)

1. An adult should hold the heat lamp or socket and bulb at student shoulder level.
2. Each student holds their hand about 45 cm (1½ ft) away from the bulb.
3. Hold the palm of the hand straight up and down, **directly facing** the bulb so that light falls directly on the palm.
4. **Slowly** rotate the hand at the wrist until the fingers are pointing directly at the lamp, pausing briefly at different angles. Keep the center of the palm at a constant distance from the lamp.
5. Feel the difference in the heat experienced on the palm of the hand at different angles to the lamp.
6. When was the greatest heat experienced? When was the least heat experienced?

The Science Behind the Activity

Many people have the misconception that seasonal differences in temperature are caused by the distance of Earth from the Sun. In fact, during summer in the Northern Hemisphere, Earth is **further** from the Sun and it is **closer** during winter in the Northern Hemisphere. Note: When it is summer in the Northern Hemisphere, it is winter in the Southern Hemisphere, and vice versa.

The actual cause of seasonal temperature differences is the concentration of sunlight - the amount of energy per unit of area. During summer, in either hemisphere, Earth's axis of rotation is tilted **toward** the Sun, which causes longer days, and because the sunlight falls more directly onto that hemisphere, the concentration of sunlight increases. These two factors work together to cause higher temperatures. During the winter, the tilt of the Earth's axis away from the sun causes shorter days and more indirect sunlight, which in turn leads to lower temperatures.

Taking it Further

- Measure heat output over time for different angles of exposure to light. Use a timer and a method of measuring thermal output (e.g., liquid crystal, ice).
- See RAFT Idea Sheet *A Reason for the Seasons* for a visual way measuring changes in concentration of light energy.

Web Resources (Visit www.raft.net/raft-idea?isid=520 for more resources!)

- Seasons & tilt of Earth's axis - <http://www.phy6.org/stargaze/Sunangle.htm>
- http://en.wikipedia.org/wiki/Effect_of_sun_angle_on_climate

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