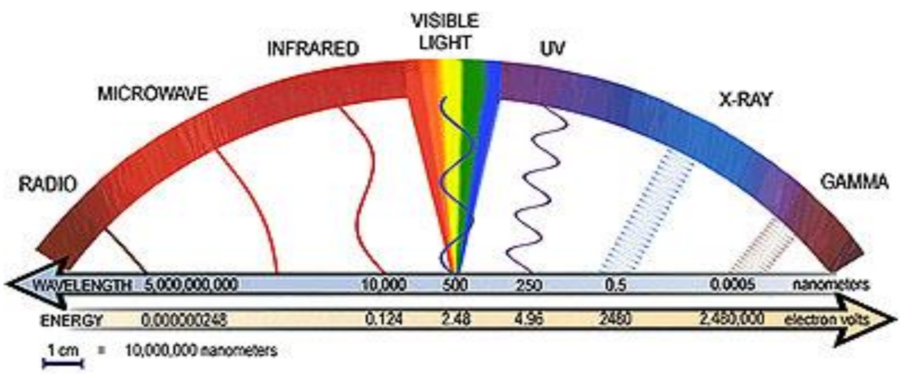
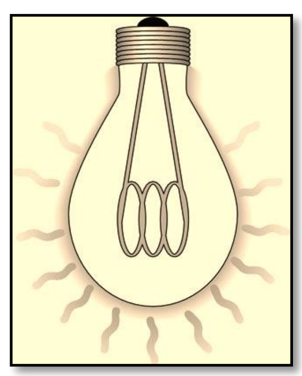
Student Sheet 1

LAB ACTIVITY: HEAT TRANSFER BY RADIATION

All of the energy from the Sun that reaches the Earth arrives as ***solar radiation***, part of a large collection of energy called the ***electromagnetic radiation spectrum***. Solar radiation includes visible light, ultraviolet light, infrared, radio waves, X-rays, and gamma rays.



The Electromagnetic Spectrum

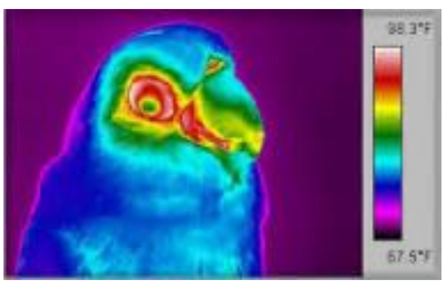


Radiation is one way to transfer heat. To "*radiate*" means to send out or spread from a central location. Whether it is light, sound, waves, rays, flower petals, wheel spokes or pain, if something radiates then it spreads outward from a starting point. You experience radiation personally whenever you get out of the shower, soaking wet, in the dead of winter and enjoy the warmth of the heat lamp in your bathroom. The heat lamp beams out heat to you and keeps you warm through radiation.

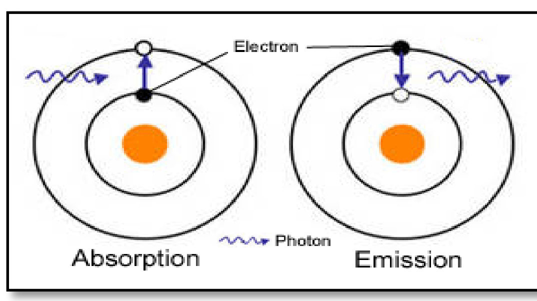
With *radiation*, ***electromagnetic waves*** carry the energy. Electromagnetic radiation comes from accelerating electric charges. On a molecular level, that's what happens as objects warm up — their molecules vibrate harder and harder, causing acceleration of electric charges.

Student Sheet 2

Heat energy transferred through radiation is as familiar as the light of day; in fact, it is the light of day. The Sun is a huge thermal reactor about 93 million miles away. In heat transfer by radiation, energy is carried by ***electromagnetic waves*** from a starting point to the space surrounding it and does not involve contact with matter. The other forms of heat transfer cannot produce any of the energy that arrives to Earth through the vacuum of space. The Sun's energy gets to the Earth through radiation, which you can prove just by standing outside and letting the sun's rays warm your face on a sunny day.



Every object around you is continually radiating, unless its temperature is at ***absolute zero***, at which point its molecules completely stop moving. A scoop of ice cream, for example, radiates heat, but that radiation isn't visible as light because it's in the infrared part of the spectrum. However, it is visible to ***infrared scopes***, as you've probably seen in movies or on television.



Objects emit radiation when high energy ***electrons*** in a high atomic level fall down to lower energy levels. The energy lost is emitted as light or electromagnetic radiation. Energy that is absorbed by an atom causes its electrons to "jump" up to higher energy levels. All objects absorb and emit radiation. When the absorption of energy balances the emission of energy, the temperature of an object stays ***constant***. If the absorption of energy is greater than the emission of energy, the temperature of an object rises. If the absorption of energy is less than the emission of energy, the temperature of an object falls.

Student Sheet 3

DATA TABLE: TEMPERATURE READINGS-RADIATION

TIME	TEMPERATURE
INITIAL	
1	
2	
3	
4	
5	
6	
7	
8	
8	
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11	
12	
13	
14	
15	

Student Sheet 4

GRAPH:

Student Sheet 5

ANALYSIS:

1. What happened to the temperature inside the beaker?
2. Was there any direct physical contact, molecules to molecules?
3. Was there any air flow to carry the heated molecules?
4. How did the heat travel through the glass and the air?
5. Give 2 examples of radiation heat transfer.
6. What does the increased temperature tell you about the activity of the electrons in the atoms?
7. Explain how heat transfer by radiation is different from other forms of heat transfer. Use diagrams to clarify your explanation.