

Unit 9 – Forms of Energy

Main Idea: There are many forms of energy, including radiant energy and chemical energy. Energy can change form.

ENERGY: The capacity for doing work.

Heat, Light and Radiant Energy

- Some energy sources give off heat and light.
- Heat moves from warmer to cooler objects.
- Plants convert light from the Sun into sugars (photosynthesis).
- Doctors, engineers and DVD players use light energy from lasers.
- The Sun is a major source of **radiant energy**.
- Solar power cells (photovoltaic) can convert **solar energy** into electricity.

Chemical Energy

- Your body uses chemical energy to move and grow. The chemical energy in the food you eat is then stored for use by your body.
- Chemical energy is also stored in fuels such as coal and oil, then released when the fuel is used in some way.

Other Forms of Energy

- Electrical - energy from the movement of charged particles.
- Nuclear – energy released when atoms split apart or join together.

Vocabulary

heat

light

radiant energy

chemical energy

solar energy

Energy Changing Form

The Law of Conservation of Energy states that energy cannot be created or destroyed. It can, however, change from one form to another.

Light to Chemical

- Plants convert light energy from the Sun into chemical energy (sugars) during photosynthesis.

Electrical to Radiant

- A heat lamp or electric heater changes electrical energy into radiant heat and light energy, warming the air and any nearby objects.

Chemical to Radiant

- When a fire is lit, chemical energy stored in the fuel changes to radiant heat and light energy.

Energy Transfer

- Heat energy moves from warmer to cooler objects. All objects on Earth are connected by particles, either in solids, liquids or gases (like the air). These particles speed up as they warm and bump into cooler particles, warming them. Eventually all the particles in the air move at the same speed.
- Temperature measures the average energy of the moving particles.

Examples

How Does Heat Change Matter?

By adding or taking away energy from particles, you can change matter.

Heating (Adding energy)

Adding **heat (energy)** to a substance causes its particles to move faster and farther apart. Most matter expands, taking up more space.

- add enough energy to a solid and it will melt, changing to a liquid state
- add enough energy to a liquid, and it will change to a gas (either through evaporation or boiling)

Cooling (Removing energy)

Removing energy from a substance causes its particles to slow down and move closer together. Most matter contracts, taking up less space.

- Removing energy from a gas causing a change from a gas to a liquid. (condensation)
- Removing energy from a liquid causing a change from a liquid to a solid. (freezing)

Why does expansion and contraction of matter matter?

Engineers must take into account that the things they design and build may grow and shrink depending upon the temperature!

Vocabulary

expand

contract



The built-in “cracks” in concrete sidewalks are expansion joints so that the sidewalks don’t really crack when the concrete contracts in the winter and expands in the summer!

Light

Light is a form of energy that allows you to see objects. Light moves in a straight path until it hits an object.

Sources of light: the Sun, fires, lightbulbs, fireflies, anglerfish

Absorption

- dark objects absorb more light energy than light objects (a black sand beach will be much hotter than white sand!)

Reflection

- light changes direction when it bounces off an object
- light bounces off a surface at the same angle it hits the surface (just like a bounce pass in basketball)
- smooth, shiny surfaces reflect more light than dull, rough surfaces
- solid and liquid surfaces can reflect light – gas molecules are generally too small and scattered to reflect light

Refraction

- light travels at different speeds depending upon the density of the material it is passing through
- light bends on the boundaries of materials as it slows down or speeds up
- this bending of light is what causes the optical illusion of objects bending as they pass from air into water

Vocabulary

absorption

reflection

refraction



Lenses

- Lenses are tools that refract light
- Plastic and glass lenses are used in the making of eyeglasses, projectors, cameras, telescopes, microscopes, and many other everyday objects.

concave lenses

- inward, curved shape
- makes objects that are far away appear closer

convex lenses

- bulges outward at the center
- makes objects near the lens appear larger

The Human Eye

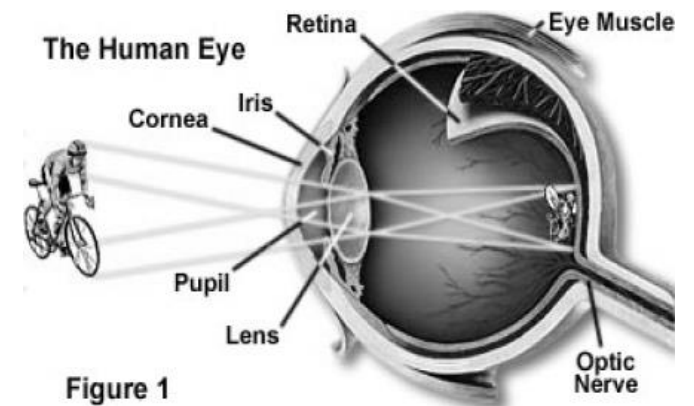
- light bounces off objects and enters the eye through a thin layer of clear tissue called the cornea.
- the opening (black spot) in the eye is called the pupil.
- the iris around the pupil widens or narrows to control the amount of light which enters the eye. The iris is the colored part of the eye.
- a lens then refracts the light and focuses the image onto the back part of the eye, called the retina.
- the retina converts the upside-down image to signals which it transmits to the brain via the optic nerve.

Vocabulary

lens

concave lens

convex lens



When light hits an object

- Some objects block light, some scatter the light, and some let light pass straight through

opaque objects

- you cannot see through opaque objects
- cause shadows to form
- eg. brick wall, human body, the Moon (solar eclipse)

transparent objects

- you can see clearly through transparent objects
- eg. air, glass, clear plastic

translucent objects

- you cannot see clearly through translucent objects
- eg. frosted glass, wax paper. stained glass

Seeing Colors

- white light is made up of every color of light
- when light passes through a prism, it is separated into different colors – Red, Orange, Yellow, Green, Blue, Indigo, Violet (“Richard Of York Gave Battle In Vain”)
- objects absorb some colors and reflect the others – we see the object as the color of the reflected light
- objects that absorb all light appear black, objects that reflect all light appear white

Vocabulary

opaque

transparent

translucent

prism
