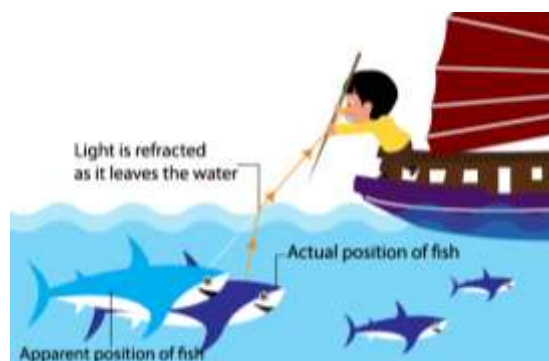


Unit 1 Broken Chopstick / Unit 2 Tall Boy, Short Legs

Refraction is the bending of light (it also happens with sound, water, and other waves) as it passes from one transparent substance into another. This bending by refraction makes it possible for us to have lenses, magnifying glasses, prisms, and rainbows. Even our eyes depend upon this bending of light. Without refraction, we wouldn't be able to focus light onto our retina.

When light travels from air into water, it slows down, causing it to change direction slightly. Imagine a fisherman aims at the fish with the spear. As the light from the fish leaves the water, it bends away from the normal (right angled line to the surface). This makes the fish appear to be nearer to the surface and further away because your eye assumes light travels in a straight line. When light enters a more dense substance (higher refractive index), it bends more toward the normal line.



The amount of bending depends on two things:

1. Change in speed

If a substance causes the light to speed up or slow down more, it will refract (bend) more.

2. Angle of the incident ray

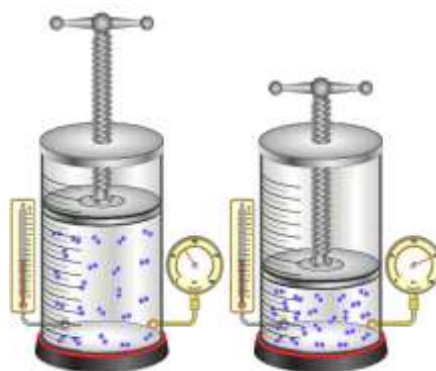
If the light is entering the substance at a greater angle, the amount of refraction will also be more noticeable. On the other hand, if the light is entering the new substance from straight on (at 90° to the surface), the light will still slow down, but it won't change direction at all.

Unit 3 Pressure Changes, Volume Changes / Unit 4 A Bag of Chips

Boyle's Law

Boyle's law is an experimental gas law that describes how the pressure of a gas tends to increase as the volume of the container decreases. As the volume decreases, the pressure increases in proportion, and vice versa. For example, when the pressure halves, the volume doubles.

Suppose you have a tank that contains a certain volume of gas at a certain pressure. When you decrease the volume of the tank, the same number of gas particles is now contained in a smaller space. Therefore, the number of collisions increases. Therefore, the pressure is greater.



How Does Air Pressure Affect Weather?

Atmospheric pressure is an indicator of weather. When a low-pressure system moves into an area, it usually leads to cloudiness, wind, and precipitation. High-pressure systems usually lead to fair, calm weather.

In addition, changes in air pressure could have a big effect on climate. Air pressure controls the atmosphere's circulation, and therefore influences how moisture moves. Changes in circulation can alter rainfall, temperature, winds and storminess. For instance, changes in an air-circulation pattern called the North Atlantic Oscillation have been implicated in recent increases in rainfall over Scotland, reduced rain in Spain, and a drop in the number of cold snaps in France.

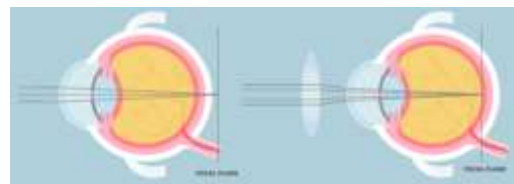
Unit 5 Two Different Lenses / Unit 6 Telescopes, Microscopes, and More!

Convex and Concave Lens

A convex lens is thicker in the middle and thinner at the edges. It converges the incident rays toward the axis. In contrast, a concave lens is thinner in the middle and thicker at the edges. It diverges the incident rays away from the axis.

Uses of Convex Lenses

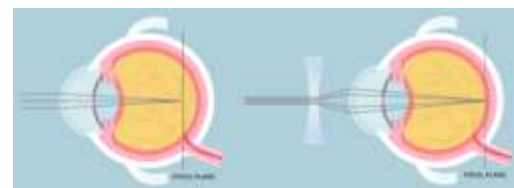
1. Eyeglasses: Convex lenses are used in eyeglasses for correcting farsightedness, where the distance between the eye's lens and retina is too short and the focal point lies behind the retina. Convex lenses increase refraction, and reduce the focal length.



2. Magnifying glass: When light rays pass through a magnifying glass, the convex lens bends the parallel rays so that they converge and create a virtual image on your eyes' retinas. It can even start fire when you put it under the sun. The sun rays pass through the lens of the glass focusing the heat at one specific point where the fire begins after producing some smoke.

Uses of Concave Lenses

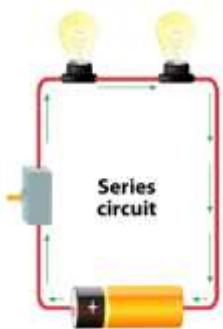
1. Eyeglasses: The eyeball of a person who has myopia is too long, and the images of faraway objects fall short of the retina. Therefore, concave lenses are used in glasses which correct the shortfall by spreading out the light rays before it reaches the eyeball.



2. Flashlight: The light rays fall on the hollowed side of the lens, and the light rays diverge on the other side. This increases the radius of the light source and thus provides a wider beam.

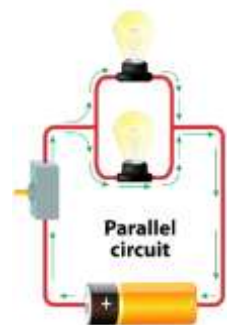
Unit 7 The Flow of Electricity / Unit 8 All of the Lights

In order for electrons to flow, they need a closed circuit. An electric circuit provides a complete, closed path for electricity. The parts of a circuit consist of a load or resistance, wires, and a switch. The source of energy can be a battery, photocell, or an electric generator.



There are two types of electric circuits, the series and parallel circuit. A **series circuit** has only one path for the electrons to flow. The main disadvantage of a series circuit is that if there is a break in the circuit the entire circuit is open and no current will flow. An example of a series would be the lights on many inexpensive Christmas trees. If one light goes out, all of them will.

In a **parallel circuit**, the different parts of the electric circuit are on several different branches. There are several different paths that electrons can flow. If there is a break in one branch of the circuit, electrons can still flow in other branches. Your home is wired in a parallel circuit so if one light bulb goes out the other will stay on.



Electricity in Your Home

Electricity comes alive when a fuel cell, solar cell, or a battery is available to act as a source. If the electricity provided is desired to do work, the appliance can be placed at the middle of the electric circuit. A light bulb for instance will begin to shine instantaneously. The same is also applicable to televisions, fans, and radios. The outlets are supplied with electricity that has been generated by solar energy, wind power and hydro power.



Unit 9 More Batteries / Unit 10 Electricity Everywhere

Electrical Safety Tips



1. Replace or repair damaged power cords

If you see the protective coating on a wire is stripped away, be sure to replace it or cover it with electrical tape as soon as possible.



2. Don't overload your outlets

Every outlet in your home is designed to deliver a certain amount of electricity. By plugging too many devices into it at once, you could cause a small explosion or a fire.



3. Avoid extension cords as much as possible

Running extension cords through the house can trip up residents. This can cause injury and damage to the wire or outlet if it causes the cord to be ripped out of the wall.



4. Keep electrical equipment or outlets away from water

Water conducts electricity, so even the slightest exposure to this dangerous mix can lead to injury. Make sure you wipe up any spills to ensure that plugs don't get wet.



5. Protect small children from hazards

Parents of small children should put safety caps on all unused electrical outlets. In addition, all loose cords should be tidied up and put out of reach to avoid kids tugging on them.

Unit 11 Sea Breeze and Land Breeze / Unit 12 Flying a Kite

Sea and Land Breezes



In the day, when the sun is up, the land heats up very quickly, and the air above it warms up a lot more than the air over the water. The warm air over the land is less dense and begins to rise. Low pressure is created. The air pressure over the water is higher with colder dense air, which moves to occupy the space created over the land. The cooler air that comes along is called a sea breeze.



In the night, the reverse happens. The land quickly loses its heat while the water retains its warmth. That means the air over the water is warmer, less dense, and begins to rise. Low pressure is created over the water. Cold and dense air over the land begins to move to the water surface to replace the warmer rising air. The cool breeze from the land is called a land breeze.

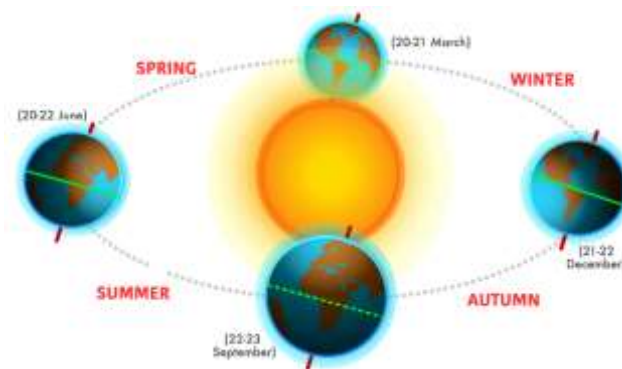
Sea breeze reduces the temperature and flows faster. It carries moisture while blowing over water. Contrary to this, land breeze generally has no effect on temperature and it flows much slower than the sea breeze. Also, it is drier because it blows from the land.

Unit 13 The Height of the Sun / Unit 14 The Length of the Day

The Angle of the Radiation and Temperature

When the sun's rays strike Earth's surface near the equator, the incoming solar radiation is more direct (nearly perpendicular or closer to a 90° angle). Therefore, the solar radiation is concentrated over a smaller surface area, causing warmer temperatures. At higher latitudes, the angle of solar radiation is smaller, causing energy to be spread over a larger area of the surface and cooler temperatures. Because the angle of radiation varies depending on the latitude, surface temperatures on average are warmer at lower latitudes and cooler at higher latitudes.

What Causes Seasons?



The Earth's axis is tilted no matter where Earth is in its orbit. Because of this, the distribution of the Sun's rays changes. In June, in the northern hemisphere summer, the Sun's rays — and warmth — reach all the way to the north pole. In December, in the northern hemisphere winter, the north pole is tilted away from the incoming sunshine.

The “fixed” tilt means that, during our orbit around our Sun each year, different parts of Earth receive sunlight for different lengths of time. It also means that the angle at which sunlight strikes different parts of Earth's surface changes through the year. Areas that receive more scattered sunlight receive less energy from our Sun. All of these factors combine to give Earth its annual cycle of seasons.

Unit 15 Electricity From the Sun

Solar Power

Solar power is energy from the sun that is converted into thermal or electrical energy. Solar energy is the cleanest and most abundant renewable energy source available, and the U.S. has some of the richest solar resources in the world. Solar technologies can harness this energy for a variety of uses, including generating electricity, providing light or a comfortable interior environment, and heating water for domestic, commercial, or industrial use.

What Do Solar Engineers Do?

Solar engineers plan, design, and implement solar energy projects. They may manage anything from large-scale municipal projects to home rooftop installations. The engineer typically begins with a client consultation, site assessment, and financial assessment, which help him or her understand the project's context. The engineer then designs an appropriate plan that takes all relevant factors into account. He or she may also oversee or manage implementation of the plan. Solar engineers may also need to report on the efficiency, cost, and safety of the project.

Solar engineers may also conduct financial reviews, ensure regulatory compliance, inspect installation sites, and write technical reports. Computer skills are essential for creating designs and testing photovoltaic systems.

Unit 16 Web Developer

Web Developer

A web developer or programmer is someone who takes a web design - which has been created by either a client or a design team - and turns it into a website. They do this by writing lines and lines of complicated code, using a variety of languages. Web developers have quite a difficult job, because they essentially have to take a language we understand, such as English, and translate it into a language that a computer understands, such as Python or HTML.

As you can imagine, this can take a lot of time and effort and requires an intricate understanding of various programming languages and how they are used. Different types of developers specialize in different areas, which means that large web projects are usually a collaboration between several different developers.

Difference between Web Designer and Web Developer

The web designer is the person who is responsible for the creation of the website concept. They might decide that it needs to be a certain color, with certain content and pages. They may do things like creating infographics, logos, and videos, and they tell the developer where these things have to be put on the web page. However, they don't take part in the construction of the website or the underlying code.

The web developer takes the designer's concepts and creates the code that is used to turn them into a website and bring them to people like you and me. It is important to realize that, although the web developer and the designer may be the same person - there is almost always some overlap between design and front-end development - the roles are different.