Earth

**Day & Night**

The Earth rotates or spins around its axis. The **axis** is an imaginary line running through the center of the earth from the North Pole to the South Pole. This rotation takes 24 hours causing the sun to rise and set (night and day). Earth’s axis tilts **23.5 degrees**.

1 rotation = 24 hours or 1 day

**Year & Seasons**

It takes **365 1/4 days** or **one year** for the Earth to complete one revolution around the Sun. However because of its tilt, the Sun’s rays hit the Northern Hemisphere longer and more directly in the summer the in the winter. When it’s summer in the **Northern Hemisphere**, it is winter in the **Southern Hemisphere**.

**Seasons – caused by tilt of the axis**

One hemisphere is **Tilted** away from the Sun and receives less direct solar rays from the Sun. The area around the **Equator** isn’t affected by Earth’s **Tilt**. Because it’s in the middle, it will always have direct solar rays all year round. And this is the **reasons for the seasons** in the Northern and Southern Hemispheres. Around the equator there’s only one season, Summer.
Phases of the Moon

Earth, Moon & Sun

<table>
<thead>
<tr>
<th>Phases</th>
<th>Description of Lunar Phases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New Moon</strong></td>
<td>The lighted side of the Moon faces away from the Earth. This means that the Sun, Earth, and Moon are almost in a straight line.</td>
</tr>
<tr>
<td><strong>First Quarter</strong></td>
<td>The right half of the Moon appears lighted and the left side of the Moon appears dark.</td>
</tr>
<tr>
<td><strong>Full Moon</strong></td>
<td>The lighted side of the Moon faces the Earth. This means that the Earth, Sun, and Moon are nearly in a straight line, with the Earth in the middle.</td>
</tr>
<tr>
<td><strong>Last Quarter</strong></td>
<td>Sometimes called Third Quarter. The left half of the Moon appears lighted, and the right side of the Moon appears dark.</td>
</tr>
</tbody>
</table>
8.8A describe components of the universe, including stars, nebulae, and galaxies, and use models such as the Hertzsprung-Russell diagram for classification.

### Components of the Universe

<table>
<thead>
<tr>
<th>Nebulae</th>
<th>Huge clouds of dust and gas.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asteroids</td>
<td>Large rock that orbits the sun</td>
</tr>
<tr>
<td>Comet</td>
<td>Made of ice, dust &amp; small rock.</td>
</tr>
<tr>
<td>Star</td>
<td>A star is ball of hydrogen and helium fueled by fusion.</td>
</tr>
</tbody>
</table>

### Types of Galaxies

<table>
<thead>
<tr>
<th>Galaxy</th>
<th>A collection of stars held together by the gravity. Our Solar System is in the Milky Way Galaxy (Spiral).</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Types of Galaxies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spiral</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Elliptical</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Irregular</strong></td>
<td></td>
</tr>
</tbody>
</table>
Star Classification

Stars are classified by their *spectra* (the elements that they absorb) and *surface temperature*. There are seven main types of stars. In order of decreasing temperature, O, B, A, F, G, K, and M. O and B stars are uncommon but very bright; M stars are common but dim. An easy way to remember is: "Oh Be A Fine Girl (or guy) Kiss Me."

<table>
<thead>
<tr>
<th>Class</th>
<th>Brightness</th>
<th>Temperature</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Brightest</td>
<td>30,000-60,000</td>
<td>Blue</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>10,000-30,000</td>
<td>Blue-White</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td>7,5000-10,000</td>
<td>White</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td>6,000-7,5000</td>
<td>Yellow-White</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td>5,000-6,000</td>
<td>Yellow</td>
</tr>
<tr>
<td>K</td>
<td></td>
<td>3,500-5,000</td>
<td>Orange</td>
</tr>
<tr>
<td>M</td>
<td>Very Dim</td>
<td>2,000-3,000</td>
<td>Red</td>
</tr>
</tbody>
</table>

Hertzsprung – Russell Diagram

The H-R Diagram is a graph that plots stars color (spectral type or surface temperature) vs. its luminosity (brightness). This diagram shows 3 different types of stars:

1. Most stars, including the sun, are "main sequence stars," fueled by nuclear fusion converting hydrogen into helium. For these stars, the hotter they are, the brighter.

2. As stars begin to die, they become *giants and supergiants* (above the main sequence). These stars have depleted their hydrogen supply and are very old.

3. Smaller stars (like our Sun) eventually become faint *white dwarfs* (hot, white, dim stars) that are below the main sequence. These hot, shrinking stars have depleted their nuclear fuels and will eventually become cold, dark, black dwarfs.
Plate Tectonics

Plate Tectonics is the movement of large sections of the Earth’s crust called Tectonic Plates. The plates are like the skin of the planet. They constantly move. When we say moving, we’re talking centimeters each year.

The tectonic plates are floating on top of magma which causes them to move. Tectonic plates collide with one another along the Plates Boundaries. There are several types of plate boundaries.

1. Transform
2. Divergent
3. Convergent

Caused by convection currents in the magma.
### Transform Boundary

<table>
<thead>
<tr>
<th>Type of boundary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transform</td>
<td>Where the two plates slide against each other in a sideways motion. Occasionally this energy is released suddenly in the form of large earthquakes.</td>
</tr>
</tbody>
</table>

![Transform Boundary Diagram](image)

### Divergent Boundary

<table>
<thead>
<tr>
<th>Type of boundary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divergent</td>
<td>Where two tectonic plates are moving away from one another.</td>
</tr>
</tbody>
</table>

![Divergent Boundary Diagram](image)

#### Examples:
- mid-ocean ridge
- fault block mountains
- rift valleys
### Convergent Boundary

<table>
<thead>
<tr>
<th>Type of boundary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convergent</td>
<td>Where two plates push against each other. As two plates rub against one another, a number of small and large earthquakes are common near convergent boundaries.</td>
</tr>
</tbody>
</table>

There are 3 kinds of Convergent Boundaries:

A. Ocean Plate to Ocean Plate
B. Ocean Plate to Continental Plate
C. Continental Plate to Continental Plate

#### A. Convergent Boundary: Ocean Plate to Ocean Plate

<table>
<thead>
<tr>
<th>Kind of Convergent Boundary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean Plate to Ocean Plate</td>
<td>When two oceanic plates converge, one is usually <strong>subducted</strong> under the other, and in the process a <strong>trench</strong> is formed.</td>
</tr>
</tbody>
</table>

#### B. Convergent Boundary: Ocean Plate to Continental Plate

<table>
<thead>
<tr>
<th>Kind of Convergent Boundary</th>
<th>Description of Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean Plate to Continental Plate</td>
<td>When an oceanic plate and continental plate converge, one is usually subducted under the other causing <strong>volcanoes</strong> and mountains.</td>
</tr>
</tbody>
</table>
### C. Convergent Boundary: Continental to Continental Plate

<table>
<thead>
<tr>
<th>Kind of Convergent Boundary</th>
<th>Description of Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental to Continental Plate</td>
<td>When two continental plates converge, one is usually subducted under the other causing mountains.</td>
</tr>
</tbody>
</table>

![Diagram of continental-continental convergence](image)

A. Core  
B. Asthenosphere  
C. Lithosphere  
D. Atmosphere
Topographic Maps

Topographic Maps are 2-D drawings of 3-D land features.

A topographic map is often a very large scale map that shows the shape of the land’s surface. Contour lines are imaginary lines that connect places of equal elevation. If you were taking a hike along a hillside and not walking either uphill or downhill, you would be walking on a contour line. When contour lines are close together, the slope is very steep. When contour lines are far apart, the slope is very shallow. This type of map is helpful when planning a hike. It is also used when planning the site for a building or the path of a new road. Contour lines sometimes called "level lines" because they show points that are at the same level.

Scenario A: Look at diagram below to answer the questions that follow.

The top of this drawing is a topographic map showing the hills that are illustrated at the bottom. On this map, the vertical distance between each contour line is 10 feet.

1. Which is higher, hill A or hill B?___________
2. Which is steeper, hill A or hill B?__________
3. How many feet of elevation are there between contour lines?__________
4. How high is hill A?______________
5. How high is hill B?______________
6. Are the contour lines closer together on hill A or hill B?__________
**Scenario B: Satellite Views / Erosion**

Satellite views - Images taken over time that can be used for comparison and interpretation of erosional features such as these taken of the Yellow River Delta. What happened to the land between 1989 and 2009?

![Satellite Images]

1989 2009

**Scenario C:**

Study the diagram above showing an island before and after a hurricane. What most likely caused the changes to the island seen in the diagram?

A. The rainwater from the hurricane raised the level of the ocean.
B. The island sank deeper into the ocean during the hurricane.
C. Ocean waves caused by the hurricane eroded sand from the beaches.
D. Rivers on the island deposited new sand on the beach.

**Scenario D:**

Define and give examples of erosion, decomposition, and weathering.
8.7C relate the position of the Moon and Sun to their effect on ocean tides

Tides

Tides are the periodic rise and fall of the ocean waters. They are caused by the gravitational pulls of the Moon and Sun, as well as the rotation of the Earth. The Sun and Moon pull on the Earth, the water, even you!

Spring Tide

Neap Tide

The Sun

New Moon

The Earth

Full Moon

Third Quarter Moon

First Quarter Moon

High Tide

Low Tide
8.8B recognize that the Sun is a medium-sized star near the edge of a disc-shaped galaxy of stars and that the Sun is many thousands of times closer to Earth than any other star.

Did you know?

Our Sun is a medium size yellow star near the edge of a disc-shape galaxy of stars. The Sun is many thousands of times closer to Earth than any other star.

Electromagnetic Spectrum

Electromagnetic Waves have different wavelengths. Waves in the electromagnetic spectrum vary in size. All electromagnetic waves travel at the same speed - the speed of light.

Radio waves and visible light are types of electromagnetic waves. They differ from each other in wavelength. Wavelength is the distance between one wave crest to the next. Other examples are microwaves, infrared, ultraviolet, X-rays and gamma-ray.

Each type of wave on the spectrum has a different effect and use. Scientists use the electromagnetic radiation given off by components in the universe to measure distances in space and the composition of objects in our universe.

Radio Waves

Radio telescopes look at planets, comets, giant clouds of gas, stars and galaxies. By studying the radio waves originating from these sources astronomers can learn about their composition, structure, and motion. Radio astronomy has the advantage because sunlight, clouds, and rain do not affect observations.
Electromagnetic waves are important because they provide scientists with important information about components of our universe. Electromagnetic waves are also used to measure distance in space.

**How the EM spectrum can be use to gain in information about the Properties of Components in the Universe**

Images from telescopes engineered to detect different types of electromagnetic radiation show the same astronomical object in different ways. Skilled observers can recognize certain properties of the object from these images. For instance, in the case of a nebula, the gaseous remnant of an exploding star, the color and intensity of visible light and other portions of the spectrum indicate which elements are present and in what quantity. Infrared images provide information about planets, comets, newly forming stars, and other relatively cool bodies. X-ray telescopes capture and show radiation from very hot regions in stars and from violent events like explosions or collisions.

### Light Waves

**Visible light waves** are the only electromagnetic waves we can see. We see these waves as the colors of the rainbow. Each color has a different wavelength. Red has the longest wavelength and violet has the shortest wavelength. When all the waves are seen together, they make white light. **Visible light helps scientists understand the chemical composition of stars.**
8.8D model and describe how light years are used to measure distances and sizes in the universe

<table>
<thead>
<tr>
<th>Light Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distances in space are SO large that it does not make sense to use a typical unit such as kilometers or miles when measuring distances. Instead, astronomers use a special unit called a <strong>light-year</strong> to measure the <strong>distance</strong> between stars and galaxies. A light-year is the distance that light travel in one year. Proxima Centauri is 4.3 light-years away. It takes 4.3 years for light from this star to travel the distance needed to reach Earth. Speed of light = 300 million meters per sec or 186,282 miles per sec!</td>
</tr>
</tbody>
</table>

**Did you know?** If a star located 65 light-years away from Earth stops giving off light energy at this very moment, it would take 65 years after the star disappeared before we would even know it! The light takes that long to reach us.

8.9A describe the historical development of evidence that supports plate tectonic theory

<table>
<thead>
<tr>
<th>Theory of Continental Drift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory of Continental Drift was proposed by Alfred Wegener in the early 1900's. Theory stated that the <strong>continents</strong> were once joined in a <strong>large land mass called Pangaea</strong>. They have been drifting away from each other for millions of years.</td>
</tr>
</tbody>
</table>

**Pangaea**

Pangaea -This super-continent was made up of all the continents on Earth. Over time, these continents have broken apart, and slowly drifted away from one another. This drift continues today.

**Evidence of Continental Drift**

4 Pieces of Evidence Supported Wegener's Theory

1. The continents fit together like puzzle pieces.
2. Similar fossils were found on opposite continents.
3. Similar land features (like mountain ranges) were found on opposite continents.
4. Tropical regions have evidence of once being arctic glaciers, which suggests the continents have moved over time.
Unequal Heating in the Oceans and Atmosphere
The source of almost all Earth’s heat energy is the Sun. The Sun gives off its heat in the form of electromagnetic radiation, which travels through space. The Sun’s heat is distributed throughout the atmosphere, land, and the oceans by radiation, conduction, and convection, providing the energy to make weather.

Ocean Currents
Ocean currents are mainly caused by wind and differences in temperature. Currents are responsible for a vast amount of movement of the water found in the Earth’s oceans. The ocean plays a starring role in whatever happens with the environment. One big part of its role is to soak up energy (heat) and distribute it more evenly around the Earth. Ocean currents influence the weather in coastal areas.

Wind Currents
Wind can be defined as air moving from an area of high pressure to an area of low pressure in the atmosphere. The greater the difference between high and low pressures, the faster the air moves. If all areas across Earth’s surface had the same air pressure, there would be no wind. The Sun, however, heats some parts of Earth more than others, creating pressure differences. Thus, winds are driven by solar energy.
Cold Front

Forms at the surface of Earth when a cold, dry air mass overtakes a warmer, humid air mass.

Cold fronts are fast moving with steep frontal boundary that force the warm air to rise quickly, resulting in rapid phase changes. Cold fronts are characterized by dramatic storms, cumulonimbus clouds, thunder, lightning and sometimes tornadoes.

Precipitation occurs at the frontal boundary and tends to be heavy but of short duration; local air temperature changes from warm to cool after the front passes.

Weather Map

A weather map or chart shows the weather conditions at a specific point in time over

8.10B identify how global patterns of atmospheric movement influence local weather using weather maps that show high and low pressures and fronts.
Warm Front
Forms at the surface of Earth when a warm, moist air mass overtakes a cool, dense and dryer air mass

Precipitation occurs ahead of the frontal boundary and tends to be prolonged but gentle; local air temperature changes from cool to warm after the front passes.

Oceans Affect Climate On Land

When the sunrays hit the surface of the Earth, it is heated. However, there is big a difference between how fast the land and the sea are heated. The land is heated a lot faster than the sea. The air above land is heated faster than the air above the sea. The hot air above land rise high into the sky, where it cools off. High in the sky the cold air now moves out over the sea. Here it sinks down pressing cool air towards land. The air moving towards land is what we know as wind (convection current). At night the opposite happens. That means it is the sun that makes the wind blow.
Oceans Affect Climate On Land

Warm air holds more water vapor than cold air does. When warm, moist air is cooled, clouds form and can produce precipitation (rain or snow). This warm air can be cooled by rising into the colder upper atmosphere, by moving over cold ocean or lakes or by mixing with colder air. Example: A Front Boundary – The edge where cool, dry air meets warm, moist air often causes stormy weather.

Warm front

Cold front

Stationary front

Hurricanes

Hurricanes get their energy from warm ocean waters. As ocean water increases in temperature, it slowly turns into water vapor. The warmer the water temperature is, the higher the water vapor rises. After the water vapor has risen, it begins condensing into rain in the form of clouds. When the clouds release the rain, heat is released as well. When this heat stays in the same area, the eye of the hurricane is formed.
Watershed

**Watershed** - An area of land where all water from rain and melted snow that is under land or drains off of land goes into a larger body of water.

<table>
<thead>
<tr>
<th>Parts</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface Water</strong></td>
<td>Water above the Earth’s surface that eventually moves into a river, stream, or lake.</td>
</tr>
<tr>
<td><strong>Ground Water</strong></td>
<td>Water that seeps into the ground but eventually moves into a river, stream, or lake.</td>
</tr>
<tr>
<td><strong>Aquifer</strong></td>
<td>A groundwater reservoir that can store and release large amounts water below the surface</td>
</tr>
<tr>
<td><strong>Infiltration</strong></td>
<td>The process of surface water entering the soil</td>
</tr>
</tbody>
</table>
### Human Effects on Watersheds

<table>
<thead>
<tr>
<th>Overdraft</th>
<th>Over-use or overdraft can cause problems to humans &amp; the environment. One big problem is a lowering of the water table beyond the reach of existing wells.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidence</td>
<td>Subsidence occurs when too much water is pumped out from underground causing the ground to actually collapse. Causes <strong>sinkholes</strong>.</td>
</tr>
<tr>
<td>Pollution</td>
<td>Pollution of groundwater from pollutants released to the ground can work their way down into groundwater and contaminant an aquifer.</td>
</tr>
</tbody>
</table>

### Newton’s Law of Universal Gravitation

The law that says every object in the universe attracts every other object

**Gravity** is a force of attraction between two or more masses. Everything that has mass has gravity. **The more mass you have, the stronger the gravitational force you give off.**

For example, Earth has more mass than the Moon, so its gravitational field is stronger.

Our solar system resides in the Milky Way galaxy and is made up of the Sun, eight planets, and many moons, asteroids, meteoroids, and comets. All of the celestial bodies in the solar system move in predictable patterns known as orbits, and this motion is controlled by gravity.

In addition, as the distance between two masses increases, the gravitation attraction between them decreases.

For example, Earth’s gravitation pull on us is strongest when we are standing on its surface compared to if we were floating in space, thousands of miles away.
The celestial body in our solar system with the most mass and hence strongest gravitational force is the Sun. Because the Sun has the strongest gravitation field, it has the strongest influence on the motion of the other bodies in the solar system (i.e., planets).

Celestial objects, such as planets, moons, asteroids, comets, meteors, and even satellites, move within the solar system, around more massive objects (e.g., the Sun), along paths known as orbits. These paths are determined by the momentum with which these objects are travelling and by the gravitational force they experience from other, more massive objects.

For example, Earth’s orbit around the Sun is determined by the balance of the Sun’s gravitational pull on Earth and Earth’s momentum as it travels around the Sun.

Without the Sun’s gravitational pull, Earth would not move in a circle around the Sun, but would continue moving straight throughout the Milky Way. Without Earth’s momentum, the Sun would pull Earth into it. YIKES!