To infinity and beyond!

Your guide for success for the Earth and Space

Name:
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What is Astronomy?

ASTRONOMY IS.....
### Telescope
- Instrument that ______________________ electromagnetic radiation from the _______ and ___________________________ it for better ___________________________.
- There are two basic types of telescopes: ______________ and non-________________________.

### Optical
- Most ______________________
- Used to study ____________________________.
- Collects visible light and focuses it to a _______ point for closer ________________.
- The bigger the __________________ lens, the more ____________________ it can gather.

### Non-Optical
- Detects ___________ not seen by the _____________ eye.
- Reveals more _______________ about the _____________.
- Place in _____________ to get above Earth’s _______________ and avoid ________________.

### 2 Types of Optical Telescopes:

#### Refracting:
- Uses ________________

**2 Disadvantages:**
1. Images are ________________.
2. Size is ________________.

#### Reflecting
- Uses ________________

**2 Advantages:**
1. Mirrors can be ________________.
2. Gathers more ________________.

### Current Telescopes can measure across the Electromagnetic Spectrum

#### Electromagnetic Spectrum:
- All of the ________________ or ________________ of electromagnetic ________________.
- Humans can only detect ________________ with the human eye.
  - Red (_________) ——> Blue (_________)
- Earth’s ________________ blocks most ________________ radiation from objects in space.
- Atmosphere serves as a ________________ shield around ________________.

### Types of Non-Optical Telescopes
- •
- •
- •
- •
**Size and Scale of the Universe/Doppler Effect**

**Chapter: 1 Section: 3 Pages: 18–20**

### Measuring Distance in Space:
- Stars are much ______ away than the planets are.
- Astronomers use a special unit of length to measure these distances: ________________.
- A light—year is a unit of length equal to the distance that ____________ travels in one ____________.
- One light year is equal to about _______ trillion kilometers

### Doppler Effect:
- A __________ change in the frequency of a wave as the _____________ between the source and the observer changes. For example, the sound of a siren on a moving vehicle appears to change as it approaches and passes an observer.
- We experience the Doppler Effect in two basic ways.
  - ___________ Shift = Moving ____________—There is a displacement in the spectral lines toward the __________ end indicating the source and the observers are moving __________ from one another. (_______________ wavelengths)
  - ___________ Shift = Moving ____________ - There is a displacement in the spectral lines toward the __________ end indicating the source and the observers are ________________ each other. (_______________ wavelengths)
- __________ discovered that the universe is ________________.
- Therefore the universe shows evidence of ________________.
1. Which category was the easiest to place in order? ____________________________________________________

2. Why?__________________________________________________________________________________________

3. Which category was the hardest to place in order? ____________________________________________________

4. Why?__________________________________________________________________________________________

5. What interesting fact did you learn today?
_______________________________________________________________________________________________
_______________________________________________________________________________________________
The _______________ of the star reveals its _________________.

- _______________ = Hottest Color
  - Example—_______________
  -
  -
  -
- _______________ = Coolest Color
  - Example—_______________

Stars are made up of different _______________ in the form of ________.

Inner Layer:
- 

Outer Layer: (Also known as the star’s atmosphere)
- Made up of _______________ gases.
- Produces a _________________
- Use a _________________ to identify _________________ and _________________ in a star’s spectrum.
- Each _________________ has a _________________ spectrum.

Stars are classified by _________________ and _________________.

Temperature differences result in _________________ differences.

Letters represent different temperature classifications:
- Type ___—(hottest, blue), B, A, F, G, K, _________ (coolest, red)

Brightness is classified by using negative (-) or positive (+) numbers.
- Negative numbers = _________________
- Positive numbers = _________________

Astronomers use two different classifications for brightness:
- Apparent brightness: _________________
- Absolute brightness: _________________
  - Uses _________________ and _________________ to calculate.
  - Example: Our sun—Apparent Magnitude = _______ and Absolute Magnitude = _______
Star Types – Color and Surface Temperature

Determine the color and letter of these stars:

<table>
<thead>
<tr>
<th>Star Name</th>
<th>Luminosity</th>
<th>Surface Temperature Kelvin</th>
<th>Color</th>
<th>Letter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our Sun</td>
<td>1</td>
<td>5,750</td>
<td>White-Yellow</td>
<td>G</td>
</tr>
<tr>
<td>Betelgeuse</td>
<td>16,000</td>
<td>3,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polaris</td>
<td>5,500</td>
<td>5,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Centauri</td>
<td>1,700</td>
<td>25,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antares</td>
<td>910</td>
<td>3,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spica</td>
<td>760</td>
<td>24,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aldebaran</td>
<td>160</td>
<td>3,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulus</td>
<td>160</td>
<td>13,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arcturus</td>
<td>100</td>
<td>4,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vega</td>
<td>50</td>
<td>11,300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sirius</td>
<td>20</td>
<td>10,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fomalhaut</td>
<td>12</td>
<td>9,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Altair</td>
<td>10</td>
<td>8,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procyon</td>
<td>6</td>
<td>6,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Centauri</td>
<td>2</td>
<td>6,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lacaille 8760</td>
<td>0.03</td>
<td>3,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 Eridani B.</td>
<td>0.01</td>
<td>9,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Life Cycle of Stars
Chapter: 2  Section: 2  Pages: 40-45

Classification of stars based on size:
- A star’s __________ classification changes throughout its __________ cycle.
- __________ star use their __________ supply much faster, therefore, they
  ____________ more __________ and do not have as long of “_________.”

Stage 1—A Star is Born
- Begins when _______ and ________ in a ______________ contract to form a ________________.
- ___________ pulls gas, dust together, ___________ gets denser, hotter.
- The process of __________________________ begins as ______________________ is changed to
  ________________________.

Stage 2—Main Sequence—Longest Stage
- ___________ is ______________________ in the core.
- Process releases an ________________ amount of ________________.
- Size changes very __________________ as long as there is a _________________ supply of
  ________________________.

Stage 3—Giant or Supergiant
- ________________ supply has been ____________________________.
- Core ________________.
- Outer layers grow very ________________________.
- Red giants grow ________________ bigger.
- Super giants grow ________________ bigger.

Stage 4—A Star’s Ending

Option A
- ________ Occurs
- Sun-sized and smaller become ________________.
- Can no longer generate ________________ by fusion.
- Can shine for billions of years before they _________ and become_____________________.

Option B
- ________________ Occurs
- Leftovers form a ______________ star.
- If it spins = ______________________

Option C
- ________________ Occurs
- Biggest of all stars - _________ the mass of the ________________.
- Forms a ________________.
- Detected by studying ______________ objects.
Hertzsprung–Russell Diagram (H–R Diagram)

An H–R diagram shows the relationship between a star’s surface _______________ and its absolute _______________. The diagram shows how stars change over time. Follow the instructions below to create your own H–R diagram on the next page. You may want to use colored pencils or crayons for this activity. Remember that a star’s brightness increases as you move toward the top of the H–R diagram.

1. Our sun is an average star. It should be located at about the center of the diagram. Draw and label the sun on the diagram.
2. Draw and label a red dwarf star on the diagram. Red dwarf stars are dim and have a low temperature.
3. Draw and label a white dwarf star on your diagram. White dwarf stars are dim and have a high temperature.
4. Draw and label a blue star on the diagram. Blue stars are very hot and bright.
5. Draw and label a red giant on the diagram. Red giants are cool and bright.
6. Most stars can be plotted along the main sequence of an H–R diagram. These stars range from very bright, very hot stars to dim, cool stars. Indicate and label on your diagram where the main sequence should go. What is the main sequence? __________________________________________________________________________
7. Which of the stars that you have plotted are included in the main sequence? __________________________________________________________________________
8. Imagine that you have discovered a new star in the night sky. Your measurements show that it has a surface temperature of 10,000°C and an absolute magnitude of +10. Based on your diagram, what type of star do you think it is? __________________________________________________________________________
Galaxies
Chapter: 2 Section: 3 Pages: 46-49

- Large groups of stars, dust and gas are called__________________.
- Which are classified by their______________________________.
- There are ___________ main types of classifications;
  - ________________
  - ________________
  - ________________

<table>
<thead>
<tr>
<th>Spiral</th>
<th>Elliptical</th>
<th>Irregular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huge ______ in the center.</td>
<td>More ___________ in appearance</td>
<td>The “__________”</td>
</tr>
<tr>
<td>________________ Arms</td>
<td>___________ Centers</td>
<td>Shape is ___________</td>
</tr>
<tr>
<td>Made up of__________ dust, and ________________</td>
<td>Very little _______ and gas</td>
<td>Do not fit into any other</td>
</tr>
<tr>
<td>________________</td>
<td>Contains mostly ______ stars.</td>
<td>__________.</td>
</tr>
<tr>
<td>Example: ________________</td>
<td></td>
<td>Close companions of large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>__________ galaxies.</td>
</tr>
</tbody>
</table>

Formation of the Universe
Chapter: 2 Section: 4 Pages 50-53

What do scientists study to understand how the universe formed?
- ________________ of galaxies.

What evidence do they use?
- The ________________ universe—__________ shift

What is the name of a current theory?
- Big ________ Theory

The BBT proclaims.....
- 13.7 billions of years ago all the ________________ of the universe was ________________ under extreme ________________, temperature, and density in a very ________________ spot. Then the universe ________________ rapidly.

How is the age of the universe calculated?
- Measure the ________________ from Earth to various galaxies.
- Calculate the ____________ of old, nearby stars.
History of the Universe

◆ Understanding Main Ideas

Write an answer for each of the following questions in the spaces provided.

1. In which direction are nearly all galaxies moving relative to Earth?

2. What is the general relationship between a galaxy’s distance from Earth and its speed?

Place the following events in the order in which they occurred. Place the order number (1 through 7) in the blank to the left of each event.

_______ 3. nebula shrinks to form a spinning disk

_______ 4. gravity pulls gases to center of the disk

_______ 5. big bang

_______ 6. the planets form

_______ 7. gas and dust accumulate as a nebula

_______ 8. matter separates into galaxies

_______ 9. gas at the center of the disk becomes hot and dense enough for nuclear fusion to begin

◆ Building Vocabulary

Write an answer for the following question in the space provided.

10. What is the big bang theory?

________________________

________________________

________________________
The _______________ needed for a ________ Solar System are found in nebulas.
Nebulas are vast clouds of __________ and dust.
The ingredients include: Hydrogen, ________, and Dust (made of Carbon and Iron).
Need help from two forces: ________________ and Pressure
With all these factors, a solar nebula is born. The density of a nebula _______________. This could be due to a collision with another nebula or a the explosion of a nearby star.

Step 1:

The young solar nebula begins to ________________.
Scientists estimate that the following process took approximately __________ million years.

Step 2:

The Solar Nebula ________________, flattens, and becomes ________________ near the center.

Step 3:

Planetesimals begin to ________ within the swirling disk.
Step 4:

- As the largest planetesimals grow in size, their \___________ attracts more gas and dust.

Step 5:

- Smaller planetesimals \___________ with larger planetesimals, and planets begin to \___________.
- Rocky planets formed because it was too \_______ for gases to remain that close to the sun therefore the rocky material was left for the inner planets to form.
- Gaseous planets formed because they were \_________ enough away from the sun that their gravities could attract the nebula gases.

Step 6:

- The center of the sun becomes so \_______ and dense that nuclear \___________ begins.
- A star \___________ and the remaining gas and dust are blown out of the new solar system.
**Fast Facts:**

- Energy from the sun _______________ and _______________ the Earth’s surface.
- Energy from the sun drives the _______________.
- The sun makes up more than _______________ of the Solar System’s mass.
- Nuclear Fusion is the process that produces the _______________.
- Albert Einstein helped scientists determine the sun’s energy source with his famous equation – _______________.
- The sun is a large ball of gas composed mainly _______________ and He and held together by gravity.
- It is _______________ solid.
- It takes light _______________ minutes to reach Earth.

**Structure of the Sun:**

- The _______________ forms the sun’s outer atmosphere.
- The _______________ is a thin region below the corona, only 30,000 km thick.
- The _______________ is the visible part of the sun that we can see from Earth.
- The _______________ is a region about 200,000 km thick where gases circulate.
- The _______________ is a very dense region about 300,000 km thick.
- The _______________ is at the center of the sun. This is where the sun’s energy is produced.

**Solar Activity:**

- Much of the solar activity is created due to the sun’s _______________ field.
- The magnetic field is generated by the _______________ of the sun’s gases and the sun’s rotation.
- This constant flow is referred to as the “______________.”
- The solar wind can reach _______________ into space, sometimes damaging satellites and disrupting tv signals.
- _______________ and Solar Flares are caused by the sun’s magnetic fields.

**Sunspots**

- Occur when the sun activity is _______________ down in the convective zone causing areas in the photosphere to become _______________ than surrounding areas.
- On an _______________ year cycle.
- May affect Earth’s _______________.

**Solar Flares**

- Regions of extremely _______________ temperatures and _______________ that develop on the sun’s surface.
- An eruption sends huge _______________ of electrically charged particles into the Solar System.
- Can _______________ radio communication on Earth.
An average star 93 million miles away

5 billion years old

A million planets
Earths could fit inside

Burns 700 million tons of hydrogen fuel every second

The source of energy for life on Earth

Mostly hydrogen and helium
The Earth Takes Shape
Chapter: 3 Section: 2 Pages: 68–73

Today...

- The Earth is mostly made of _______.
- Nearly __________ of its surface is covered with water.
- Our planet is surrounded by a ___________ atmosphere of N, O and Ar
- However, it has not always been this way!

Formation of Solid Earth...

- The Earth formed as planetesimals in the Solar System _______________ and combined.
- From what scientists can tell, the Earth formed within the first _____ million years of the collapse of the solar nebula.

The Effects of Gravity:
- As the planet gains more matter, the force of ___________ increases.
- When Earth reached a diameter of about 350 km, the force of gravity became _______________ than the strength of the rock.
- At this point, the rock at its center was _______________ by gravity and the planet started to become _______.

The Effects of Heat:
- As planetesimals continued to collide with the Earth, the energy of their motion _______________ the planet.
- _______________ material, which was present in the Earth as it formed, also heated the young planet.
- After Earth reached a certain size, the temperature rose faster than the interior could cool, and the rocky material inside began to _______________.
- Today, the Earth is still _______________ from the energy that was generated when it formed.
- Volcanoes, earthquakes, and hot springs are effects of this _______________ trapped inside the Earth.

Formation of Earth’s Layers

1. Materials in the early Earth are _______________ mixed.

2. Rocks melt, and denser materials (Fe and Ni) _______________ toward the center. Less dense elements _______________ and form layers.

3. According to composition the Earth is divided into ______ layers: the crust, the mantle, and the core.
- The ______ is the thin and solid outermost layer of the Earth above the mantle. It is 5 to 100 km thick.
- Crustal rock is made of materials that have ______ such as oxygen, silicon, and aluminum.
- The ______ is the layer of rock between the Earth’s crust and core. It extends 2,900 km below the surface.
- Mantle rock is made of materials such as magnesium and iron. It is ______ than crustal rock.
- The ______ is the central part of the Earth below the mantle. It contains the densest materials, including nickel and iron.
- The core extends to the _______ of the Earth—almost 6,400 km below the surface.
Earth’s Early Atmosphere:
- _______ and steamy...Scientists think that the atmosphere was a mixture of gases (CO₂ and H₂O Vapor) that were released as the Earth cooled.

Earth’s Changing Atmosphere:
- As the Earth cooled and its layers formed, the atmosphere changed again. This atmosphere probably formed from _______________ gases.
- Volcanoes released chlorine, nitrogen, and sulfur, in addition to large amounts of _______________ and water vapor. Some of this water vapor may have condensed to form the Earth’s first oceans.
- Comets, which are planetesimals made of _____, may have contributed to this change of Earth’s atmosphere.
- As they crashed into the Earth, comets brought in a _______________ of elements, such as carbon, hydrogen, oxygen, and nitrogen.
- Comets also may have brought some of the _______________ that helped form the oceans.

Ultraviolet Radiation:
- Scientists think that _______________ (UV) radiation helped produce the conditions necessary for life.
- UV light has a lot of energy and can _______________ apart molecules.
- Earth’s early atmosphere probably did not have the protection of the _______________ layer.
- Over time, broken down molecular material collected in the Earth’s waters, which offered _______________ from UV radiation.
- In these sheltered pools of water, chemicals may have combined to form the _______________ molecules that made life possible.
- The first life-forms were very _______________ and did not need oxygen to live.

The Source of Oxygen:
- Sometime before 3.4 bya, organisms that produced food by _______________ appeared.
- During the process _______________ was released.
- Played a major role in changing Earth’s atmosphere to become the _______________ of gases it is today.
- As oxygen levels increased, some of the oxygen formed a layer of _______________ in the upper atmosphere.
- The ozone blocked most of the _______ radiation and made it possible for life, in the form of simple plants, to move onto land about 2.2 billion years ago.

Formation of Oceans and Continents:
- Scientists think that the oceans probably formed during Earth’s _______________ atmosphere, when the Earth was cool enough for rain to fall and remain on the surface.
- After millions of years of rainfall, water began to cover the Earth. By _____ billion years ago, a global ocean covered the planet.

The Growth of Continents:
- After a while, some of the rocks were light enough to pile up on the surface. These rocks were the beginning of the earliest _______________.
- The continents gradually _______________ and slowly rose above the surface of the ocean. These continents did not stay in the same place, as the slow transfer of thermal energy in the mantle pushed them around.
- About 2.5 billion years ago, continents really started to _______________. By 1.5 billion years ago, the upper mantle had cooled and had become denser and heavier.
- At this time, it was easier for the cooler parts of the mantle to sink. These conditions made it easier for the continents to _______________ in the same way they do today.
Planetary Motion
Chapter: 3 Section: 4 Pages: 80–83

**Rotation:**
- Is the ______ of a body (an object) on its axis.
- Rotation Duration: ______ Hours
- Tilt: ______°
- Direction: ____________ Clockwise

**Revolution:**
- Is the motion of a body (an object) that travels around __________body in space; one complete trip along an orbit.
- An __________is the path a body follows as it travels around another body in space.
- Rotation Duration: ~ ________Days
- Shape: __________
- Direction: ____________ Clockwise

---

**Kepler’s 3 Laws of Motion:**

1. Planets move in an elongated circle called an ______.
   - An ellipse is a curved ______ drawn around _____ points.

2. Planets seem to move __________when they are ____________ to the sun and slower when they are farther away.

3. Planets that are ____________ away from the sun take ____________ to orbit the sun.

---

<table>
<thead>
<tr>
<th>Planet</th>
<th>$e$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>0.206</td>
</tr>
<tr>
<td>Venus</td>
<td>0.007</td>
</tr>
<tr>
<td>Earth</td>
<td>0.017</td>
</tr>
<tr>
<td>Mars</td>
<td>0.093</td>
</tr>
<tr>
<td>Icarus</td>
<td>0.83</td>
</tr>
<tr>
<td>Halley</td>
<td>0.968</td>
</tr>
</tbody>
</table>
1. In your own words, write a definition for each of the following terms: -revolution and rotation.

_______________________________________________________________________________________________

_______________________________________________________________________________________________

2. Kepler discovered that planets move faster when they
   a. are farther from the sun.
   b. are closer to the sun.
   c. have more mass.
   d. rotate faster.

3. On what properties does the force of gravity between two objects depend

_______________________________________________________________________________________________

4. How does gravity keep a planet moving in an orbit around the sun?

_______________________________________________________________________________________________

5. The Earth’s period of revolution is 365.25 days. Convert this period of revolution into hours. Show your work below.

6. If a planet had two moons and one moon was twice as far from the planet as the other, which moon would complete a revolution of the planet first? Explain your answer.

_______________________________________________________________________________________________

_______________________________________________________________________________________________

These two planetary motions cause:

1.  
2.  
3.  
4.  

Newton:

- Answered _____________ question: Why?
- Law of Universal Gravitation—States that the force of gravity depends on the product of the _____________ of the objects divided by the square of the _____________ between the objects.
- Newton also determined that _____________ and _____________ keep the planets in orbit.
- Inertia is an object’s resistance in speed or direction until an _____________ force acts on the object. (Newton’s ____________ Law)
Moon Phases

Chapter: 4 Section: 4 Pages: 112

**Cause of Moon Phases:**
- The moon’s __________________ position relative to __________ and the __________. The __________________ of sunlight that ______________ the side of ______________ changes.

**Duration of moon phase cycle:**
- 

**Difference between waxing and waning:**
- 

How does the moon’s phase differ, when seen from above?
- 

What is unique about the moon’s period of rotation and period of revolution?
- 

---

**Phases of the Moon**

![Diagram of Moon Phases]

---

24
Arranging the Moon

**Directions:** Cut out the phases of the moon and arrange them in order in the table below. After your teacher checks for accuracy, glue the pictures to the paper.

<table>
<thead>
<tr>
<th>New Moon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Moon Phases**

<table>
<thead>
<tr>
<th>14th Day Full Moon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
What causes an eclipse?
- 

Why aren’t eclipses visible every month?
- 

At what moon phase does a Solar Eclipse occur?
- 

At what moon phase does a Lunar Eclipse occur?
- 

What is the Umbra?
- 

What is the Penumbra?
- 

1. ___________ eclipse
   
   a. 
   b. 

2. ___________ eclipse
   
   Total eclipse
   
   a. 
   b. 

   Partial eclipse
CASTING SHADOWS

Have you ever seen the sun disappear? Or watched an eerie shadow move across the moon? Imagine what it was like for primitive people when the sky suddenly fell dark in the middle of the day! When three celestial objects fall into alignment, some great shadows are the result. These shadows are called eclipses of the moon or sun, and they’re pretty spectacular to watch! These eclipse-watchers have written down some information about eclipses. Do they have all their facts straight? Write T (true) or F (false) next to each statement.

1. A solar eclipse occurs when Earth falls between the sun and the moon. 11. A total lunar eclipse occurs when the moon passes through Earth’s penumbra.
2. All eclipses are visible. 12. Partial lunar eclipses occur more often than total eclipses.
3. All eclipses are total. 13. A solar eclipse may last over 3 hours.
4. The umbra is the inner part of the shadow. 14. A total solar eclipse is visible at all spots on Earth.
5. Eclipses of the sun occur 2–4 times a year. 15. All lunar eclipses are total.
6. A lunar eclipse occurs when the moon travels through the shadow of Earth. 16. In a total solar eclipse, the moon completely covers the sun.
7. There are about 2 lunar eclipses a year. 17. Lunar eclipses occur every 3 years.
8. A lunar eclipse can take place only when the moon is full. 18. A lunar eclipse may last over 3 hours.
9. A total solar eclipse lasts a few minutes. 19. The penumbra is the outer part of the shadow.
10. In a solar eclipse, no sunlight penetrates the umbra. 20. When the sun’s disk is covered in an eclipse, the corona is still visible.

Label the diagrams below solar eclipse or lunar eclipse.
Label Earth, moon, umbra, and penumbra on each diagram.
Tides

What causes tides?

How frequent do high and low tides occur?

Two times a month we have special tides called Spring Tides. How are these tides different?

Two times a month we have special tides called Neap Tides. How are these tides different?

Draw the phases of the moon around the earth below. Label neap tides with an N and spring tides with an S.
Types of Tides

Pictures are not to scale.

Name the moon phase for each one.

Using a blue crayon, fill in the tides for each one.

Spring or Neap Tide?

Spring or Neap Tide?

Shade in.

Spring or Neap Tide?

Shade in.
<table>
<thead>
<tr>
<th>Number of Seasons:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does distance to the sun affect seasons?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Angle of Incidence:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Why seasons occur:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Duration of Seasons:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Seasons</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Equinox: The ____________ is directly overhead at the ______________ at this time.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall -</td>
</tr>
<tr>
<td>Spring -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solstice: The __________ is directly overhead at ____________ north or ____________ at this time.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter-</td>
</tr>
<tr>
<td>Summer-</td>
</tr>
</tbody>
</table>
REASONS FOR SEASONS

What's with the seasons? How do they know when to come and go? It all has to do with the movements of Earth in relation to the sun. Here are some reasons. You fill in the blanks to tell what the reason explains.

1. Reason for _________________________________________:
   Because Earth is tilted $23\frac{1}{2}^\circ$ from a line perpendicular to its orbit, the length of daylight varies and because of the angle at which the sun's energy strikes a given location through the year.

2. Reason for ________________________________________ in the Northern Hemisphere:
   Because the Northern Hemisphere is tilted toward the sun for a few months.

3. Reason for __________ in the Northern Hemisphere and __________ in the Southern Hemisphere: Because Earth's tilt is sideways to the sun, and hours of daylight and darkness are the same in both hemispheres on about September 22.

4. Reason for ________________________________________ in the Northern Hemisphere:
   Because the North Pole is tilted almost directly toward the sun on about June 21.

5. Reason for ________________________________________ in the Southern Hemisphere:
   Because the South Pole is tilted away from the sun on about June 21.

6. Reason for ________________________________________ in the Southern Hemisphere:
   Because the Southern Hemisphere is tilted toward the sun for a few months.

7. Reason for ________________________________________ in the Northern Hemisphere:
   Because the South Pole is tilted almost directly toward the sun on about December 21.

8. Reason for __________ in the Northern Hemisphere and __________ in the Southern Hemisphere: Because Earth's tilt is sideways to the sun and hours of daylight and darkness are the same in both hemispheres on about March 20.

9. Reason for ________________________________________ in the Southern Hemisphere:
   Because the South Pole is tilted almost directly toward the sun on about December 21.

10. Reason for __________ hours of daylight at the South Pole:
    Because the South Pole is tilted directly toward the sun on about December 21.

On the diagram at the right, label winter solstice, summer solstice, fall equinox, and spring equinox for the Northern Hemisphere.

Word Bank:
Summer Summer Solstice Spring Equinox Fall Equinox Fall Equinox
Summer Winter Solstice Spring Equinox Seasons Spring Equinox
Summer Solstice Winter Solstice Fall Equinox 24 Winter Solstice
What is Geology?

Geology is......
### EARTH TIME SCALE

For the Earth Time Scale, you will need 5 meters of adding machine tape.

- Draw a continuous line down the middle of the tape.
- Draw a line across the **left** end of the tape.
- Label this line: **The Present**.
- From **The Present** line, draw five more lines exactly one meter apart.
- Label these lines **1 billion years ago, 2 billion years ago, etc.**
- Plot each **Event** and **Years Ago** from the following list onto the tape.
  
  (Example: The first event would be placed 60 cm past 4 billion years ago.)
- Draw in pictures (**10 minimum**) to illustrate the major events.
- Lightly shade each of the four major Eras a different color.
- **Label** each of the four Eras.

<table>
<thead>
<tr>
<th>Event</th>
<th>Years ago</th>
<th>Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth's beginning?????</td>
<td>4.6 billion</td>
<td>60 cm past 4 billion</td>
</tr>
<tr>
<td>Oldest microfossils</td>
<td>3.5 billion</td>
<td>50 cm past 3 billion</td>
</tr>
<tr>
<td>Oxygen created</td>
<td>2.5 billion</td>
<td>50 cm past 2 billion</td>
</tr>
<tr>
<td>End of Precambrian Era</td>
<td>600 million</td>
<td>60 cm from present</td>
</tr>
<tr>
<td><strong>Beginning of Paleozoic Era</strong></td>
<td>600 Million</td>
<td>60 cm from present</td>
</tr>
<tr>
<td>Trilobites abundant</td>
<td>570 million</td>
<td>57 cm from present</td>
</tr>
<tr>
<td>Fish abundant</td>
<td>500 million</td>
<td>50 cm from present</td>
</tr>
<tr>
<td>First forest fossils</td>
<td>390 million</td>
<td>39 cm from present</td>
</tr>
<tr>
<td>Continents collide forming Pangaea</td>
<td>280 million</td>
<td>28 cm from present</td>
</tr>
<tr>
<td>Appalachian Mts. form</td>
<td>280 million</td>
<td>28 cm from present</td>
</tr>
<tr>
<td>Trilobites die out</td>
<td>230 million</td>
<td>23 cm from present</td>
</tr>
<tr>
<td><strong>Beginning of Mesozoic Era</strong></td>
<td>225 million</td>
<td>22.5 cm from present</td>
</tr>
<tr>
<td>Pangaea breaks up</td>
<td>220 million</td>
<td>22 cm from present</td>
</tr>
<tr>
<td>forming Gondwanaland &amp; Laurasia</td>
<td>220 million</td>
<td>22 cm from present</td>
</tr>
<tr>
<td>Rocky Mts. form</td>
<td>190 million</td>
<td>19 cm from present</td>
</tr>
<tr>
<td>Dinosaurs abundant</td>
<td>180 million</td>
<td>18 cm from present</td>
</tr>
<tr>
<td>Ancient birds found</td>
<td>160 million</td>
<td>16 cm from present</td>
</tr>
<tr>
<td>Gondwanaland separates into Africa &amp; So. America</td>
<td>135 million</td>
<td>13.5 cm from present</td>
</tr>
<tr>
<td>Asteroid collision?????</td>
<td>66 million</td>
<td>6.6 cm from present</td>
</tr>
<tr>
<td>Dinosaurs die out</td>
<td>66 million</td>
<td>6.6 cm from present</td>
</tr>
</tbody>
</table>

| **Beginning of Cenozoic Era**              | 66 million  | 6.6 cm from present     |
| First abundant mammals & birds             | 60 million  | 6 cm from present       |
| Camels found in North America              | 20 million  | 2 cm from present       |
| Ice Age begins - super-large mammals       | 2 million   | 2 mm from present       |
| Last Ice Age ends                          | 10,000 years | 0.01 mm from present    |

---

**Extra Hints:**

Be Neat!

Use a ruler (SI Please)!

Tape the ends of your timeline down.

Use a variety of resources for your pictures. (Folder, Board, etc.)
2 Methods:

<table>
<thead>
<tr>
<th>Relative Dating:</th>
<th>Absolute Dating:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any _____________ of determining whether an ___________ or ___________ is ___________ or ___________ than other objects or events.</td>
<td>Any _____________ of measuring the _________ of an event or object in ___________.</td>
</tr>
</tbody>
</table>

These methods help geologists determine the age of rocks!

**Rock:** Naturally occurring solid ___________ of one or more ___________ or organic matter.

**Rock Cycle:** Series of ___________ in which a rock ___________, ___________ from one type to another, is _____________, and forms ___________ by geological processes.

**Ways in which rocks change:** (Processes)
1. __________________
2. __________________
3. __________________
4. __________________
5. __________________
6. __________________

**Rock Cycle**

- Weathering and erosion
- Heat and pressure
- Weathering and erosion
- Melting
- Cooling

Complete the missing information.
The Rock Cycle:

1. Sediments are transported or moved from their original source by a process called
   a. deposition.
   b. erosion.
   c. uplift.
   d. weathering.

2. Name four processes that change rock inside the Earth.

3. Name four processes that shape Earth’s surface.

4. Give an example of how texture can provide clues as to how and where a rock formed.

5. Explain how rock is continually recycled in the rock cycle.

Relative Dating: Which Came First?

7. List two events and two features that can disturb rock-layer sequences.

8. Explain how physical features are used to determine relative ages.

Absolute Dating: A Measure of Time

9. Rubidium-87 has a half-life of
   a. 5,730 years.
   b. 4.5 billion years.
   c. 49 billion years.
   d. 1.3 billion years.

10. Explain how radioactive decay occurs.

11. How does radioactive decay relate to radiometric dating?
## Inside the Earth

### Chapter: 4 Section: 1 Pages: 96–99

#### Layers by Composition:
- 
- 
- 
- 

#### Layers by Physical Properties:
- 
- 
- 
- 

### Crust:
- 2 Types:
  - 
  - 

### Mantle:
- 3 Main Layers:
  1. Lithosphere—
  2. Asthenosphere—
  3. Mesosphere—

### Core:
- 
- 
- 

### Outer Core:
- 
- 

### Inner Core:
- 
- 

---

**Earth’s Layers Foldable**
Inside the Earth

For each pair of terms, explain how the meanings of the terms differ.

1. crust and mantle

2. lithosphere and asthenosphere

3. The part of the Earth that is molten is the
   a. crust.  
   b. mantle.  
   c. outer core.  
   d. inner core.

4. Identify the layers of the Earth by their chemical composition.

5. Identify the layers of the Earth by their physical properties.

6. Explain the difference between the crust and the lithosphere.

Label, Label, Label!
Geologists measure _________________ waves.

______________ waves travel at different ___________________.

The ___________________ depends on the _______________________ and ______________________ of the material.

Waves travel faster through _________________ than liquids.

Tectonic Plate—______________of the _______________ that ________ around on top of the ____________________.

All plates have __________; major (______) and minor (__________).

Not all __________ are the same.

  • Some—_____________ crust only
  • Some—_______________ crust only
  • Some—___________

Tectonic Plates are made up of ____________________________, which is the crust plus the upper mantle.

Tectonic Plates—_______, touch______________.

Tectonic Plates (the lithosphere) __________ the layer beneath it, the ____________________________.

How do we know this is what Earth’s Interior Looks Like?

Geologists measure _________________ waves.

_______________ waves travel at different _________________________.

The ______________________ depends on the ___________________________ and ______________________ of the material.

Waves travel faster through _________________ than liquids.
Directions:
1. Label the 7 major plates.
2. Color the 7 major plates.
3. Label the 8 minor plates.
4. On what plate is most of the USA?
5. What part of the USA is NOT on that plate? On what plate is it?
6. What plate matches almost perfectly with the Ring of Fire, where most of the world’s earthquakes and volcanoes occur?
7. Which plates touch the Mid-Ocean Ridge that runs north and south and is found in the Atlantic Ocean?
8. Which plate is the largest
9. Which plate is the smallest?
10. Which layer of the Earth makes up the plates?
11. Which layer of the Earth do the plates float on?
Continental Drift—The idea that all________________________ had once been __________________ together and have since ______________ apart.

Early________________.

<table>
<thead>
<tr>
<th>Landforms</th>
<th>Fossils</th>
<th>Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1. Reptiles</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2. Plants</td>
<td>2.</td>
</tr>
</tbody>
</table>

- ______________ - Name given to the supercontinent—_______ mya

- Broke apart—_________mya
  - __________________ --> ______________ and Eurasia
  - __________________ --> Australia, ____________, Antarctica, and ______________.

- Wegener’s idea was ___________________. He could not explain __________ this was occurred.
Putting the Evidence Back Together

Directions: Match the descriptions in Column I with the terms in Column II. Write the letter of the correct term in the blank at the left.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. reptile fossil found in South America and Africa</td>
<td>a. Pangaea</td>
</tr>
<tr>
<td>2. fossil plant found in Africa, Australia, India, South America, and Antarctica</td>
<td>b. Appalachian</td>
</tr>
<tr>
<td>3. clues that support continental drift</td>
<td>c. continental drift</td>
</tr>
<tr>
<td>4. mountains similar to those in Greenland and western Europe</td>
<td>d. glacial deposits</td>
</tr>
<tr>
<td>5. Wegener’s name for one large landmass</td>
<td>e. Glossopteris</td>
</tr>
<tr>
<td>6. slow movement of continents</td>
<td>f. Mesosaurus</td>
</tr>
<tr>
<td>7. evidence that Africa was once cold</td>
<td>g. fossil, climate, and rock</td>
</tr>
</tbody>
</table>
Evidence for Sea-Floor Spreading

<table>
<thead>
<tr>
<th>Molten Material</th>
<th>Magnetic Stripes</th>
<th>Drilling Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>“________” - a small submersible, found ___________ that can only be formed when molten material ___________ and hardens very quickly underwater.</td>
<td>Magnetic North and South Poles have ___________ over time.</td>
<td>“__________” - determined the age of rocks.</td>
</tr>
<tr>
<td></td>
<td>___________ material contains magnetic material such as Iron.</td>
<td>___________ rocks were found closest to the ________.</td>
</tr>
<tr>
<td></td>
<td>The material ________ up with the ___________ of the magnetic field at that time.</td>
<td></td>
</tr>
</tbody>
</table>
|                 | A ___________ is preserved in the ocean floor, and the pattern is a ___________ image on each side of the ________.
Directions: Find the mistakes in the statements below. Rewrite each statement correctly on the lines provided.

1. During the 1940s and 1950s, scientists began using radar on moving ships to map large areas of the ocean floor in detail.

2. The youngest rocks are found far from the mid-ocean ridges.

3. The scientist Henry Hess invented echo-sounding devices for mapping the ocean floor.

4. As the seafloor spreads apart, hot saltwater moves upward and flows from the cracks.

5. As the new seafloor moves away from the ridge and becomes hotter, it moves upward and forms still higher ridges.

6. The research ship *Glomar Challenger* was equipped with a drilling rig that records magnetic data.

7. Rocks on the seafloor are much older than many continental rocks.

8. When plates collide, the denser plate will ride over the less-dense plate.

9. Earth’s magnetic field has always run from the north pole to the south pole.

10. The magnetic alignment in rocks on the ocean floor always runs from the north pole to the south pole.
Plate Tectonics = __________________________ + _____________________________ + Subduction
Subduction is the process by which the old ocean floor is _________________________. It is the _________________________ process for Sea Floor Spreading.
The place where two tectonic plates ________________ is called a plate ________________.
The type of _____________________________ depends on how the tectonic plate is ________________ relative to the one beside it.
_________________________ may occur at all ________________ types of plate boundaries.
Tectonic plate movement is measured in ______________________ per year.

### Plate Boundaries

<table>
<thead>
<tr>
<th>Type</th>
<th>Description of Boundary</th>
<th>Direction of Movement</th>
<th>Sketch of Boundary</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divergent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transform</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convergent Ocean-Ocean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convergent Ocean-Continental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convergent Continental-Continental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3 Possible Causes of Plate Motion:

1. **Ridge Push**—Occurs at a ____________, the oceanic lithosphere is _______________ and slides downhill due to ________________.
2. **Convection**—Hot rock ____________, cool rock ____________ causing the lithosphere to move side-ways from the MOR.
3. **Slab Pull**—Oceanic lithosphere is _______________, it sinks and _____________ the rest of the plate with it.
Giant Plates

Earth’s crust is made up of many huge pieces like a gigantic jigsaw puzzle. Each piece is a giant plate. Continents and oceans rest on these plates, which are always on the move. They are constantly being pulled apart or pushed together, or they are colliding with each other.

Fit together the puzzle pieces that belong. There are eleven pairs of matching terms and descriptions in the puzzle pieces below. For each number (1–22), list the matching puzzle piece.

1—__________
2—__________
3—__________
4—__________
5—__________
6—__________
7—__________
8—__________
9—__________
10—__________
11—__________
12—__________
13—__________
14—__________
15—__________
16—__________
17—__________
18—__________
19—__________
20—__________
21—__________
22—__________