Chapter 18.1 – Final Exam Study Guide (pgs. 554-557)

Astronomers

**Name: Ptolemy** In 140 CE, Ptolemy, a Greek astronomer, wrote a book that combined all of the ancient knowledge of astronomy that he could find. He expanded ancient theories with careful mathematical calculations in what was called the Ptolemaic theory. Ptolemy thought that the Earth was at the center of the universe and that the other planets and the sun revolved around the Earth. Although the Ptolemaic theory, shown in Figure 2, was incorrect, it predicted the motions of the planets better than any other theory at the time did. For over 1,500 years in Europe, the Ptolemaic theory was the most popular theory for the structure of the universe.

**Name: Copernicus** Copernicus: A Sun-Centered Universe In 1543, a Polish astronomer named Copernicus published a new theory that would eventually revolutionize astronomy. According to his theory, which is shown in Figure 3, the sun is at the center of the universe, and all of the planets—including the Earth—orbit the sun. Although Copernicus correctly thought that the planets orbit the sun, his theory did not replace the Ptolemaic theory immediately. When Copernicus’s theory was accepted, major changes in science and society called the Copernican revolution took place.

**Name: Brahe** In the late-1500s, Danish astronomer Tycho Brahe (TIE koh BRAW uh) used several large tools, including the one shown in Figure 4, to make the most detailed astronomical observations that had been recorded so far. Brahe favored a theory of an Earth-centered universe that was different from the Ptolemaic theory. Brahe thought that the sun and the moon revolved around the Earth and that the other planets revolved around the sun. While his theory was not correct, Brahe recorded very precise observations of the planets and stars that helped future astronomers.

**Johannes Kepler: Laws of Planetary Motion** After Brahe died, his assistant, Johannes Kepler, continued Brahe’s work. Kepler did not agree with Brahe’s theory, but he recognized how valuable Brahe’s data were. In 1609, after analyzing the data, Kepler announced that all of the planets revolve around the sun in elliptical orbits and that the sun is not in the exact center of the orbits. Kepler also stated three laws of planetary motion. These laws are still used today.

**Galileo: Turning a Telescope to the Sky** In 1609, Galileo Galilei became one of the first people to use a telescope to observe objects in space. Galileo discovered craters and mountains on the Earth’s moon, four of Jupiter’s moons, sunspots on the sun, and the phases of Venus. These discoveries showed that the planets are not “wandering stars” but are physical bodies like the Earth.
**Isaac Newton: The Laws of Gravity** In 1687, a scientist named Sir Isaac Newton showed that all objects in the universe attract each other through gravitational force. The force of gravity depends on the mass of the objects and the distance between them. Newton’s law of gravity explained why all of the planets orbit the most massive object in the solar system—the sun. Thus, Newton helped explain the observations of the scientists who came before him.

**Name: Hubble** Before the 1920s, many astronomers thought that our galaxy, the Milky Way, included every object in space. In 1924, Edwin Hubble proved that other galaxies existed beyond the edge of the Milky Way. His data confirmed the beliefs of some astronomers that the universe is much larger than our galaxy. Today, larger and better telescopes on the Earth and in space, new models of the universe, and spacecraft help astronomers study space. Computers, shown in Figure 5, help process data and control the movement of telescopes. These tools have helped answer many questions about the universe. Yet new technology has presented questions that were unthinkable even 10 years ago.

**Year:** Time required for earth to orbit once around the sun

**Day:** Time required for earth to rotate once on its axis

**Month:** Division of year based on orbit of moon around earth
Chapter 19.3 – Final Exam Study Guide (pgs. 596-599)

Galaxies

3 Types

SPIRAL

Center Bulge

New stars located here

Oldest stars located here

Spiral Arms

Oval or Snowball Shaped

Some of the largest – very little gas & dust

No Clear Shape

Located near spiral galaxies

ELLIPtical
Vocabulary Word | Definition
--- | ---
galaxies | A collection of stars, dust, and gas bound together by gravity
nebula | A large cloud of gas and dust where stars are born
globular cluster | A tight group of stars that looks like a snowball and can contain up to 1 million stars
open cluster | A group of stars that are close together and can contain 100 to 1,000 stars in the group

Chapter 19.4 – Final Exam Study Guide (pgs. 600-603)

**Formation of the Universe**

- The study of the origin, structure, and future of the universe is called **COSMOLOGY**
- To understand how the universe formed **SCIENTISTS STUDY THE MOVEMENT OF GALAXIES**
- Careful measurements have shown that **MOST GALAXIES MOVE APART**, therefore the universe is **EXPANDING** today.
- The theory that the universe began with a huge explosion is called the **BIG BANG THEORY**.
- Minutes after the Big Bang the following things formed:
  - universe expanded rapidly
  - matter came together
  - galaxies formed
- **Two pieces of evidence** that prove the Big Bang happened:
  - COSMIC BACKGROUND RADIATION
  - THERMAL ENERGY
- Everything in the **Universe has a specific structure**, they are not just scattered around:
  - A planet is **A SINGULAR BODY IN THE PLANETARY SYSTEM**
  - A planetary system is **MANY PLANETS TOGETHER**
  - A galaxy is **A COLLECTION OF STARS DUST AND GAS BOUND TOGETHER BY GRAVITY**
Structure of the Universe

UNIVERSE

UNIVERSE

GALAXY

SOLAR SYSTEM

EARTH

Chapter 20.4 – Final Exam Study Guide (pgs.630-633)

Planetary Motion

REVOLUTION

ROTATION

ORBIT
Kepler’s 3 Laws of Planetary Motion

➢ Kepler’s 1\textsuperscript{st} Law

- Planets revolve around the Sun in an elongated circle. Called an \textit{Ellipse}.

➢ Kepler’s 2\textsuperscript{nd} Law

- Planets move \textit{FASTER} in some parts of their orbit when they are closer to the sun.
Kepler’s 3rd Law
• A planet that is further from the Sun will have a longer ORBIT longer period of revolution.

Gravitational Attraction

The closer together they are, the mass increases the gravitational pull.

The farther apart they are, the mass decreases the gravitational pull.

RESULTING PATH

FORWARD MOTION

PULL OF GRAVITY
Our Solar System

- Our solar system includes our **SUN**, the **PLANETS**, and their **SMALLER BODIES**
- Astronomers measure long distances in space using **ASTRONOMICAL UNITS**
- To measure distances within our Solar System we use two other units:
  1. **LIGHT MINUTES**
  2. **LIGHT HOURS**
- One (1) Astronomical unit is the **AVERAGE DISTANCE BETWEEN SUN AND EARTH**
- 1 AU is equal to **150,000,000 km**
- Another way to measure distances is by using the **SPEED OF LIGHT**. Light travels at about **300,000 km per sec or 18,000,000 km in one minute**
- Light from the sun takes **8.3 minutes** to reach the Earth, therefore Earth is _____ **8.3** light-minutes from the sun.
The Inner Planets

- The inner planets are:
  1. _MERCURY_
  2. _VENUS_
  3. _EARTH_
  4. _MARS_

- They are called ___TERRISTRIAL___ Planets because they all have the same ___DENSITY AND ROCKINESS___ as Earth.

- The inner planets are ___SMALLER___, ___DENSER___, and more ___ROCKIER___ than the outer planets.

- The amount of time it takes a planet to rotate once on its axis is called ___ROTATION______

- The time it takes a planet to orbit the sun once is called ___REVOLUTION____

Mercury
- Mercury rotates on its axis more ___SLOWLY___ than Earth.
- Mercury’s period of revolution is about ___59___ Earth days.

Venus
- Venus is almost the ___SAME___ size as Earth.
- Venus has a ___RETROGADE___ rotation which means it spins ___CLOCKWISE___ on its axis.
- Venus has a very thick ___ATMOSPHERE___ made up of carbon dioxide and sulfuric acids causing a ___GREENHOUSE EFFECT___.

Earth
- Earth is the ___only___ planet at this time known to ___LIFE____
- Earth has a ___PROGADE___ rotation which means it spins ___COUNTER CLOCKWISE___ on its axis.
- Earth is ___CLOSE___ enough to the sun that all of the ___FREEZE___ and ___COOL___ enough away that all of the ___water does not BOIL AWAY__ away.

Mars
- Mars has a ___THINNER___ atmosphere than Earth and is ___GREATER DISTANCE___ from the sun so the temperature is much colder than Earth.
- Mars has two ___POLAR ICE CAPS___ which is where most of the ___FROZEN WATER___ on mars is located.
- Mars may have been warmer at one time because there is evidence of ___DEPOSITION OF SETTLEMENT IN A LAKE___ on the surface of mars.
- Mars also has the remains of a giant ___VOLCANO___ that once was active in the past.
The Outer Planets

- The outer planets are:
  5. __JUPITER__
  6. SATURN
  7. ___URANUS__
  8. NEPTUNE

- They are called __GAS GIANTS__ because they are very _DEEP_ and have __MASSIVE_ atmospheres of gas with very little rock material on their surfaces.

Jupiter
- Jupiter is the __LARGEST__ planet in our solar system.
- Jupiter’s period of __ROTATION__ is only 10 hours long.
- Jupiter is made of ___HYDROGEN__ and __HELIUM__.

Saturn
- Saturn is the _SECOND_ largest planet in the solar system.
- Saturn gives off more ____ENERGY_ than it receives from the sun.
- Saturn is best known for its ___RINGS which are made from _ICY PARTICLES_ and _DUST_.

Uranus
- Uranus is so far from the __SUN____ that it does not reflect much __SUNLIGHT__.
- Uranus is ___TILTED_ on its side _90_ degrees because of a __COLLISION______ with a massive object.

Neptune
- Before scientists discovered Neptune they knew it was there because Uranus did not ___FULLY COMPLETE__ in its orbit as they ___PREDICTED
The Moons & Eclipses

What are Moons?
- ___SATELLITES____ are natural or artificial (Man Made) bodies that revolve around larger bodies.
- All of the planets in our solar system have natural satellites called __MOONS____ except ___MERCURY___ and ___VENUS____.

Chapter 21.4 – Final Exam Study Guide (pgs. 660-667)

Earth’s Moon
- Much of what we know about our Moon comes from the discoveries when we _____STUDIED LUNA__________________ the moon.
- The moon is almost as old as the Earth.
- Our moon is covered in ___CRATERS___ from objects hitting it. The craters are still there because it does not have an ___ATMOSPHERE______.

Phases of the Moon
- The moon orbits around the earth once every ___27__ days.
- The moon also ___ROTATES___ on its axis at the same speed as Earth. This is why we always see the same ____SIDE____ of the moon.
- The moon does not always look the same because we cannot see the part of the moon that is ___FACING AWAY FROM THE__ light. This is because of the position of the ____EARTH___ and ___MOON____ relative to the Sun.
- The different shapes of the moon are called ___PHASES____.

________________
What is an Eclipse?

- An eclipse happens when the _SHADOW_ of one body falls on another.
- A _SOLAR_ eclipse happens when the Moon comes between the Sun and the Earth.
- A _LUNAR_ eclipse happens when the Earth comes between the Sun and the Moon.
- Eclipses do not happen every _MONTH_ because the moon’s orbit is slightly _TILTED_ compared to Earth’s orbit.
Small Bodies of the Solar System

Comets
- A comet is a small, loosely packed body of __ICE ROCK__, ____________________, and ___COMIC DUST_________.
- The nucleus or core of the comet is made of rock, metal and ___DUST_____.
- The ion tail is pushed by the solar wind and always points _AWAY_______ from the sun.
- Scientists think that comets come from the ____OORT____ cloud far beyond the orbit of ____SPHERICAL REGION___.

What are Asteroids?
- Asteroids are small rocky bodies that revolve around the _____SUN_____.
- Most asteroids are located in the _____ASTEROID BELT_____ between Mars and Jupiter.

What are Meteoroids?
- Meteoroids are pieces of dust and debris from ____ASTEROIDS _______ and ___COMETS_____.
- Friction with the atmosphere heats up Meteoroids causing them to _LIGHT UP_______ brightly.
- The glowing trails that form when Meteoroids burn up in the atmosphere are called ___METEOR_____.
- Sometimes larger Meteoroids enter the Earth’s atmosphere and pass through it without ______MELTING___ completely. When they reach the Earth’s surface they are called ________________________.
3.1 Minerals – Final Exam Study Guide (pgs. 66-69)

- The **four features** of a mineral are:

<table>
<thead>
<tr>
<th>Solid</th>
<th>Inorganic</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINERALS</td>
<td>MINERAL IS NOT</td>
</tr>
<tr>
<td>CANNOT BE GASES OR LIQUIDS</td>
<td>MADE OF LIVING THINGS</td>
</tr>
</tbody>
</table>

**Crystalline Structure**

<table>
<thead>
<tr>
<th>Crystalline Structure</th>
<th>Naturally Formed</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINERALS ARE</td>
<td>CRYSTALINE</td>
</tr>
<tr>
<td>CRYSTALS, HAVE</td>
<td>MATERIALS MADE</td>
</tr>
<tr>
<td>REPEATING INNER</td>
<td>BY PEOPLE ARENT</td>
</tr>
<tr>
<td>STRUCTURE REFLECTED</td>
<td>CLASSIFIED AS</td>
</tr>
<tr>
<td>IN A SHAPE OF A MINERAL</td>
<td>MINERALS</td>
</tr>
</tbody>
</table>

- A pure substance that cannot be broken down is called an **ELEMENT**
- An **ATOM** is the smallest part of an element that has all of the properties of that element.
- A substance made of two or more elements and have been chemically joined or bonded is called a **COMPOUND**
- Minerals that contain silicon and oxygen are called **NONSILICATE MINERALS**
- Minerals that do not contain silicon and oxygen are called **SILICATE MINERALS**
- The five properties used to identify a mineral are:

3.2 Identifying Minerals – Final Exam Study Guide (pgs. 70-73)

**Luster**

- HOW MINERALS REFLECT LIGHT

**Streak**

- _COLOR OF MINERAL IN POWDERED FORM_

**Density**

- PROPERTY OF ALL MATTER THAT IS THE RATIO OF AN OBJECTS MASS TO ITS VOLUME

**Hardness**

- _MEASURE OF THE RESISTANCE OF A MINERAL TO BEING STRETCHED_
Cleavage
THE TENDENCY TO BREAK ALONG FLAT, EVEN SURFACES

Fracture
UNEVEN BREAKAGE OF A MINERAL
To determine the hardness of a mineral, scientists use:

### Moh’s Hardness Scale

<table>
<thead>
<tr>
<th>Hardness Ranking</th>
<th>Mineral Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TALC</td>
</tr>
<tr>
<td>2</td>
<td>Gypsum</td>
</tr>
<tr>
<td>3</td>
<td>CALCITE</td>
</tr>
<tr>
<td>4</td>
<td>FLUORITE</td>
</tr>
<tr>
<td>5</td>
<td>Apatite</td>
</tr>
<tr>
<td>6</td>
<td>Orthoclase</td>
</tr>
<tr>
<td>7</td>
<td>QUARTZ</td>
</tr>
<tr>
<td>8</td>
<td>Topaz</td>
</tr>
<tr>
<td>9</td>
<td>Corundum</td>
</tr>
<tr>
<td>10</td>
<td>DIAMOND</td>
</tr>
</tbody>
</table>
Igneous rock begins as ___MAGMA____.

There are three ways magma can form:
  o ___PRESSURE_____
  o COMPOSITION
  o ___TEMPERATURE__

Igneous rock is classified by ___TEXTURE____ and ___COLOR____

There are two types of Igneous rock formations:
  o ___INTRUSIVE IGNEOUS ROCK_____ where rock is cooled and solidified beneath the Earth’s surface.
  o _____EXTRUSIVE IGNEOUS ROCK____ where rock cools at the Earth’s surface from volcanic activity.
Wind, water, ice, sunlight and gravity all cause rock to physically **WEATHER** into fragments. Through the process of **EROSION** these rocks and mineral fragments, called **SEDIMENT**, are moved from one place to another. Eventually over time the sediment is deposited into **LAYERS**. Over time new layers are deposited over older layers where **SEDIMENTARY** rock is formed.

Sedimentary rock is classified by the way it forms:
- **CLASTIC SEDIMENTARY** is made from rock fragments cemented together by a mineral such as **CALCITE** or **QUARTZ**.
- **CHEMICAL SEDIMENTARY** is made by solutions of dissolved minerals and **SEA WATER**.
- **ORGANIC SEDIMENTARY** is made from the remains of fossils or dead ocean animals that once lived in the ocean.

The texture or mineral composition of a rock can **DETERMINE** when it surroundings change. If the **TEXTURE** or **MINERAL COMPOSITION** of the new environment is different the rock will undergo **METAMORPHISM**.

One way rock can undergo metamorphism is by being **HEATED** by nearby magma. When **MAGMA** moves through the crust, the magma heats the surrounding rock and **CHANGES** it. This is called **CONTACT METAMORPHISM**.

Another way the texture or mineral composition of a rock can change is when **PRESSURE** builds up in a rock that is buried deep **INSIDE** other rock, or when large pieces of the Earth’s **CRUST** collide with each other. This is called **REGIONAL METAMORPHISM**.

The texture of metamorphic rock in which the mineral grains are arranged in bands is called **FOLIATED** metamorphic rock.

The texture of metamorphic rock when the mineral grains are not arranged in bands is called **NONFOLIATED** metamorphic rock.
Continental Drift: Hypothesis that states that the continents once formed one single landmass then broke up and drifted in their present locations.

Alfred Wegner came up with the theory of continental drift because of 3 pieces of evidence:

1. Fossils of the same species of plant and animal were found on two different continents
2. Similar types of rock were found on different continents
3. Antarctica had plant fossils that could have only existed if Antarctica was closer to the equator

Sea-floor spreading: Process where new oceanic lithosphere forms as magma rises toward the surface and solidifies.
7.3 Theory of Plate Tectonics – Final Exam Study Guide (pgs. 202-205)

**DIVERGENT** Boundary

The boundary formed when two tectonic plates separate from each other.

**CONVERGENT** Boundary:

The boundary formed when two tectonic plates collide with each other.

**TRANSFORM** Boundary:

The boundary formed when two tectonic plates slide past each other horizontally.

3 Types of Convergent Boundaries

1. CONTINENTAL CONTINENTAL
2. CONTINENTAL OCEANIC
3. OCEANIC OCEANIC
Types of Faults

NORMAL Fault:
The hanging wall moves down relative to the foot wall.
Stress Type TENSION

REVERSE Fault:
The hanging wall moves up relative to the foot wall
Stress Type COMPRESSION

STRIKESLIP Fault:
The rock moves past each other horizontally
Stress Type SHEARING
8.1 Earthquakes – Final Exam Study Guide (pgs. 224-229)

- An earthquake is the _SHAKING_ of the ground.
- Most earthquakes take place near edges of ____TECTONIC PLATES_____.

**Tectonic Plates and Earthquakes**

- A _FAULT___ is a break in the Earth’s __CRUST_____ along which blocks of crust __SLIDE___ relative to one another.
- ____DEFORMATION____ is the bending, tilting, and breaking of the Earth’s crust.
- The sudden return of elastically deformed rock to its original shape is called ____ELASTIC REBOUND____.
- A specific plate ____MOVEMENT___ takes place at different tectonic plate boundaries.

<table>
<thead>
<tr>
<th>Plate Motion</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSFORM</td>
<td>Strike-Slip Fault</td>
</tr>
<tr>
<td>CONVERGENT</td>
<td>Reverse Fault</td>
</tr>
<tr>
<td>DIVERGENT</td>
<td>Normal Fault</td>
</tr>
</tbody>
</table>
Waves of energy that travel through the Earth are called **BODY** waves.

Waves that cause rock to move back and forth are called **P** waves.

Waves that cause rock to move side to side are called **S** waves.

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9.1 Volcanoes – Final Exam Study Guide (pgs. 250-255)

- Magma that flows onto the Earth’s surface is called **LAVA**.
- Areas of Earth's surface through which magma and volcanic gases pass is called a **VOLCANOES**.
- There are two types of volcanic eruptions:
  - (**EXPLOSIVE**)
  - (**NONEXPLOSIVE**)
There are four types of lava:

- ______AA_________ pours out quickly and becomes jagged pieces as molten lava continues to flow underneath.
- _______PAHOEHOE____ flows slowly like wax and has a glassy surface with rounded wrinkles.
- ______PILLOW LAVA_____ erupts underwater and forms round lumps that are the shape of pillows.
- ____________BLOCKY LAVA__ oozes from the volcano and forms jumbled heaps of sharp-edged chunks.