# Grade 4 Science

# Content Review Notes for Parents and Students

1st Nine Weeks
2017-2018

SUFFOLK
PUBLIC SCHOOLS

**Note: Fourth Grade material is tested on the Fifth Grade Standards of Learning test. Released questions in this review packet may refer to the Fifth Grade Standards of Learning test.**

# Grade 4 Science Content Review Notes
# for Parents and Students
## First Nine Weeks
## 2017-2018

**This resource is intended to be a guide for parents and students to improve content knowledge and understanding. The information below is detailed information about the Standards of Learning taught during the 1st grading period and comes from the *Science Standards of Learning Curriculum Framework,* Grade 4 issued by the Virginia Department of Education. The Curriculum Framework in its entirety can be found at the following website.**

**http://www.doe.virginia.gov/testing/sol/frameworks/science_framewks/2010/strikethrough/framewks_sci_4.pdf**

### Standard 4.1

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a) distinctions are made among observations, conclusions, inferences, and predictions;
b) objects or events are classified and arranged according to characteristics or properties;
c) appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units;
d) appropriate instruments are selected and used to measure elapsed time;
e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;
f) independent and dependent variables are identified;
g) constants in an experimental situation are identified;
h) hypotheses are developed as cause and effect relationships;
i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs;
j) numerical data that are contradictory or unusual in experimental results are recognized;
k) data are communicated with simple graphs, pictures, written statements, and numbers;
l) models are constructed to clarify explanations, demonstrate relationships, and solve needs; and
m) current applications are used to reinforce science concepts.

## Overview

The skills described in standard 4.1 are intended to define the "investigate" component of all of the other fourth-grade standards. The intent of standard 4.1 is that students will continue to develop a range of inquiry skills, achieve proficiency with those skills in the context of the concepts developed at the fourth-grade level, and strengthen their understanding of the nature of science.. It is also intended that by developing these skills, students will achieve greater understanding of scientific inquiry and the nature of science as well as more fully grasp the content-related concepts.

- The nature of science refers to the foundational concepts that govern the way scientists formulate explanations about the natural world. The nature of science includes the following concepts:
    a) the natural world is understandable;
    b) science is based on evidence, both observational and experimental;
    c) science is a blend of logic and innovation;
    d) scientific ideas are durable yet subject to change as new data are collected;
    e) science is a complex social endeavor

- Science assumes that the natural world is understandable. Scientific inquiry can provide explanations about nature. This expands students' thinking from just a knowledge of facts to understanding how facts are relevant to everyday life.
- Science demands evidence. Scientists develop their ideas based on evidence and they change their ideas when new evidence becomes available or the old evidence is viewed in a different way.
- An **observation** is what you see, feel, taste, hear, or smell. Scientists construct knowledge from observations and inferences, not observations alone. To communicate an observation accurately, one must provide a clear description of exactly what is observed and nothing more. Those conducting investigations need to understand the difference between what is seen and what inferences, conclusions, or interpretations can be drawn from the observation.
- An **inference** is a tentative explanation based on background knowledge and available data.
- A **scientific prediction** tells what may happen in some future situation. It is based on the application of scientific principles and factual information.
- Accurate observations and evidence are necessary to draw realistic and plausible conclusions. A **conclusion** is a summary statement based on the results of an investigation.
- **Conclusions** are drawn by making judgments after considering all the information you have gathered. Conclusions are based on details and facts.
- **Elapsed time** is the amount of time that has passed between two given times.

- An **experiment** is a fair test driven by a hypothesis. A fair test is one in which only one variable is compared.
- A **hypothesis** is a prediction about the relationship between variables. A hypothesis is an educated guess/prediction about what will happen based on what you already know and what you have already learned from your research. It must be worded so that it is "testable."
- In order to conduct an experiment, one must recognize all of the **potential variables** or changes that can affect its outcome.
- An **independent variable** is the factor in an experiment that is altered by the experimenter. The independent variable is purposely changed or manipulated.
- A **dependent variable** is the factor in an experiment that changes as a result of the manipulation of the independent variable.
- The **constants** in an experiment are those things that are purposefully not changed and remain the same throughout the experiment.
- In science, it is important that **experiments and the observations** recorded **are repeatable**.

- There are two different types of data – **qualitative and quantitative**. **Qualitative data** deal with descriptions and data that can be observed, but not measured. **Quantitative data** are data that can be counted or measured and the results can be recorded using numbers. Quantitative data can be represented visually in graphs and charts. Quantitative data defines whereas qualitative data describes. Quantitative data are more valuable in science because they allow direct comparisons between observations made by different people or at different times.

| **Example of Qualitative vs. Quantitative Data<br>Main Street Elementary School Science Club** | |
|---|---|
| **Qualitative** | **Quantitative** |
| • Friendly<br>• Likes science<br>• Positive about school | • 10 fourth-grade students and 12 fifth-grade students<br>• 14 girls, 8 boys<br>• 92 percent participated in the division wide science fair last year |

## Experimental Components:

| Question | Independent Variable (Factor that is purposely changed) | Dependent Variable (Factor that changes because of the manipulation of the independent variable) | Constants (Things that remain the same) |
|---|---|---|---|
| How much water flows through a faucet at different openings? | Water faucet opening (closed, half open, fully open) | Amount of water flowing measured in liters per minute | • The Faucet<br>• Water pressure, or how much the water is "pushing"<br><br>"Different water pressure might also cause different amounts of water to flow and different faucets may behave differently, so to insure a fair test I want to keep the water pressure and the faucet the same for each faucet opening that I test." |
| Does heating a cup of water allow it to dissolve more sugar? | Temperature of the water measured in degrees Centigrade | Amount of sugar that dissolves completely measured in grams | • Stirring<br>• Type of sugar<br><br>"More stirring might also increase the amount of sugar that dissolves and different sugars might dissolve in different amounts, so to insure a fair test I want to keep these variables the same for each cup of water." |

# Released Practice Items
# Virginia Standards of Learning Grade 5 Science Test

**Follow this link to find released tests:**

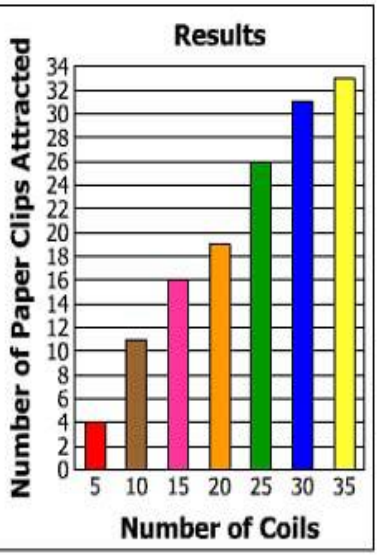
**http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml**

**1.**

**Electromagnet Investigation**

**Materials:**
- 1 9 volt battery
- 1 piece of insulated wire
- 1 steel nail
- 50 small paper clips

**Procedure:**
1. Coil the wire around the nail 5 times.
2. Attach the ends of the wire to the battery.
3. Test the electromagnet by seeing how many paper clips are attracted to it. Record results.
4. Repeat steps 1–3 with 10, 15, 20, 25, 30, and 35 coils.




**A student conducted an investigation testing the strength of an electromagnet. The dependent variable in this investigation was the —**

- **A** voltage of the battery
- **B** length of the insulated wire
- **C** number of paper clips attracted
- **D** number of times the wire was coiled

**Standard 4.7**

The student will investigate and understand the organization of the solar system. Key concepts include

a. the planets in the solar system;
b. the order of the planets in the solar system; and
c. the relative sizes of the planets.

**Overview**

This standard focuses on providing an introduction to our solar system. This includes the introduction to the planets in the solar system, their order in the solar system in relation to the sun, and the sizes of the planets in relation to the size of Earth.

Our **solar system** is ancient. Early astronomers believed that Earth was the center of the universe and all other heavenly bodies orbited around Earth. We now know that our sun is the center of our solar system and eight planets, a handful of dwarf planets, 170 named moons, dust, gas, and thousands of asteroids and comets orbit around the sun.

Our **solar system** is made up of **eight planets**: **Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.**

Mercury, Venus, Earth, and Mars are considered **terrestrial planets**. Jupiter, Saturn, Uranus, and Neptune are called **gas giants.**

**Planets:** (The pictures of the planets are not to scale)

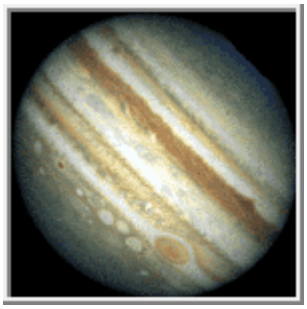
**Mercury** is closest to the sun and is a small, heavily cratered planet. Mercury looks like our moon. Since Pluto's reclassification from planet to dwarf planet, Mercury is now the smallest planet in our solar system.

**Venus** is second from the sun. It is similar to Earth in size and mass, and has a permanent blanket of clouds that trap so much heat that the temperatures on the surface of Venus are hot enough to melt lead.

**Earth** is third from the sun. Earth's atmosphere, the liquid water found on Earth, and its distance from the sun, among many other factors, make Earth a haven for life.

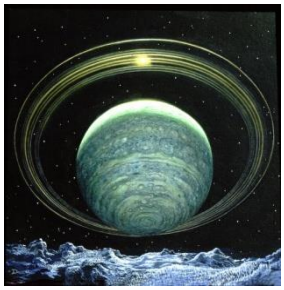
**Mars** is fourth from the sun. The atmosphere on Mars is thin and there is a vast network of canyons and riverbeds on the red planet. Scientists hypothesize that Mars once supported a wet, warm Earth-like climate.

**Jupiter** is fifth from the sun. Jupiter is the largest planet in the solar system and is considered a gas giant. Jupiter has no solid surface.

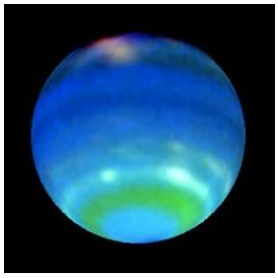


**Saturn** is sixth from the sun. Early scientists thought Saturn was the only planet with rings, but we now know that all four gas giants (Jupiter, Saturn, Uranus, and Neptune) have rings.

**Uranus** is seventh from the sun. Uranus is a gas giant.



**Neptune** is eighth from the sun. Neptune appears blue through telescopes and is a gas giant.



**The sequence of the eight planets** in the solar system **based on their position from the sun** is as follows:

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune

**The eight planets sorted by size** from largest to smallest are:

Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, and Mercury.

**Pluto** is no longer included in the list of planets in our solar system due to its small size and irregular orbit. Many astronomers questioned whether Pluto should be grouped with worlds like Earth and Jupiter. **Pluto** is smaller than seven of the moons in our solar system and cannot be seen without a telescope.

In 2006, this debate led the International Astronomical Union (IAU), the recognized authority in naming heavenly objects, to formally reclassify Pluto. **On August 24, 2006,** Pluto's status was officially changed from planet to **dwarf planet.**

A new distinct class of objects called **"dwarf planets"** was identified in 2006. It was agreed that "**planets" and "dwarf planets" are two distinct classes of objects.**

What differentiates a dwarf planet from a planet? For the most part, they are identical, but there is one key difference**: A dwarf planet** has not "cleared the neighborhood" around its orbit, which means **it has not become gravitationally dominant and it shares its orbital space with other bodies of a similar size.**

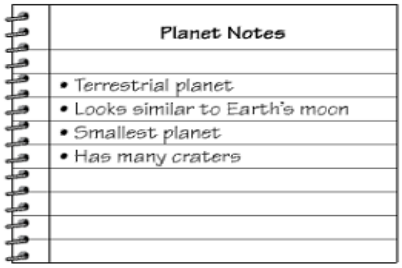
# Virginia Standards of Learning Grade 5 Science Test
# Released Practice Test Items

**Follow this link to find practice tests:**

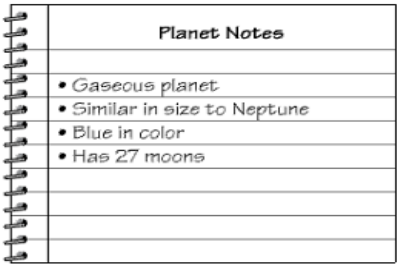
**http://www.doe.virginia.gov/testing/sol/practice_items/index.shtml#science**

**1.** Which set of notes describes Uranus?

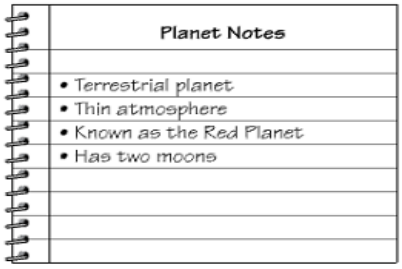
A



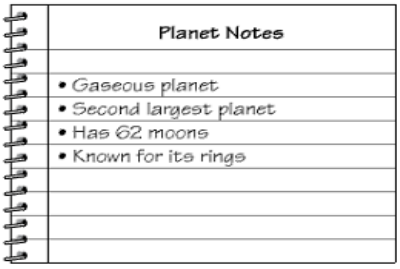

C




B




D




**2.** Name the planets in sequence using their position from the sun.

A. Mars, Venus, Earth, Mercury, Neptune, Uranus, Saturn, Jupiter

B. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

C. Mars, Mercury, Earth, Venus, Saturn, Jupiter, Uranus, Neptune

D. Mercury, Mars, Earth, Venus, Jupiter, Saturn, Neptune, Uranus

**Standard 4.8**

The student will investigate and understand the relationships among the Earth, moon, and sun. Key concepts include

a. the motions of Earth, the moon, and the sun;
b. the causes for Earth's seasons;
c. the causes for the phases of the moon;
d. the relative size, position, age, and makeup of Earth, the moon, and the sun; and
e. historical contributions in understanding the Earth-moon-sun system.

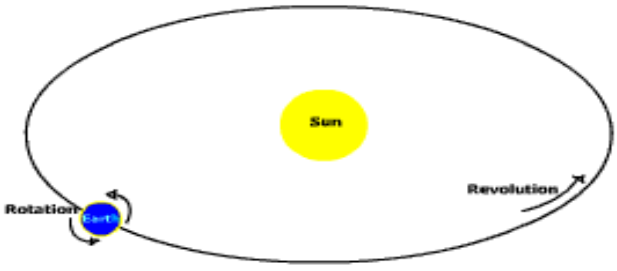
**Overview**

This standard focuses on the Earth-moon-sun system and includes knowledge related to the motions of this system and the results of our unique position in it. This includes the presence of an atmosphere, liquid water, and life.

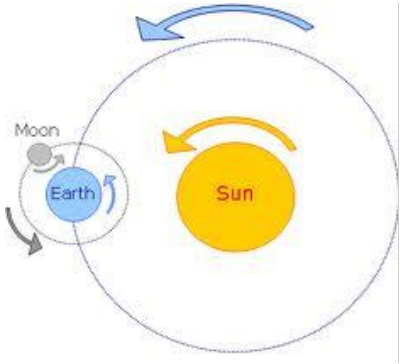
**Key Terms:**

**Revolution** and **rotation** are the terms we use to describe the motions of Earth and the moon.

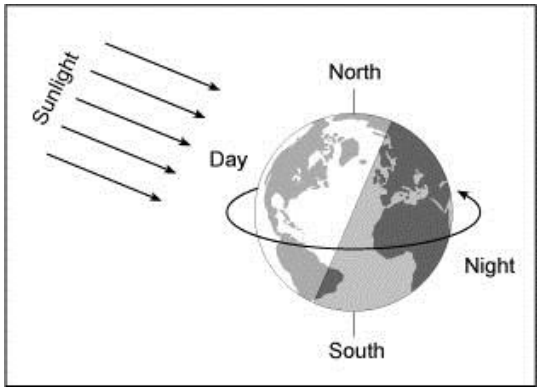
- **Revolution** is the movement of Earth in an orbit around the sun. Earth completes one revolution around the sun every 365 ¼ days.



- The moon revolves around Earth about once every month.

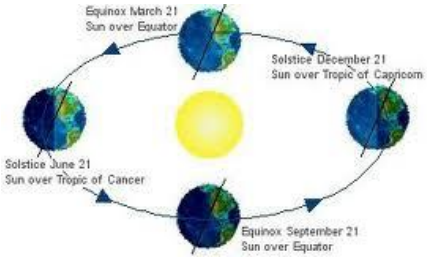


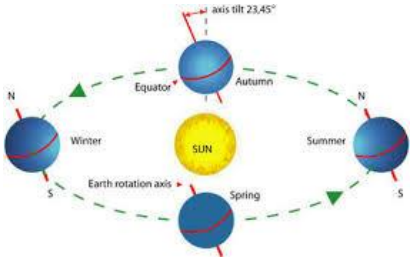

- **Rotation** is the turning of Earth on its axis, which causes day and night.




## Seasons

- Earth's **axial tilt** causes Earth to experience **seasons** as it revolves around the sun.



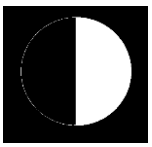
**Phases of the Moon**

- The phases of the moon are caused by its **position** relative to Earth and the sun.

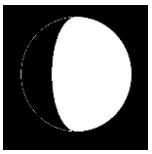
**The phases of the moon include:**

**New Moon -** The moon's unilluminated side is facing the Earth. The moon is not visible (except during a solar eclipse).

**Waxing Crescent** - The moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the moon's disk that is illuminated is increasing.

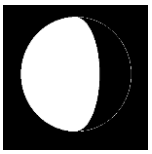


**First Quarter** – ½ of the moon appears to be illuminated by direct sunlight. The fraction of the moon's disk that is illuminated is increasing.

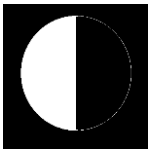


**Waxing Gibbous -** The moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the moon's disk that is illuminated is increasing.

**Full Moon -** The moon's illuminated side is facing the Earth. The moon appears to be completely illuminated by direct sunlight.



**Waning Gibbous -** The moon appears to be more than one-half but not fully illuminated by direct sunlight. The fraction of the moon's disk that is illuminated is decreasing.



**Last (third) Quarter –** 1/2 of the moon appears to be illuminated by direct sunlight. The fraction of the moon's disk that is illuminated is decreasing.

**Waning Crescent -** The moon appears to be partly but less than one-half illuminated by direct sunlight. The fraction of the moon's disk that is illuminated is decreasing.

- **Earth** is one of eight planets that revolve around the sun and make up the solar system. Earth is the third planet from the sun, is one of the four terrestrial inner planets. It is about 150 million kilometers from the sun. Earth is a geologically active planet with a surface that is constantly changing. It has large amounts of life-supporting water and oxygen-rich atmosphere. Earth's protective atmosphere blocks out most of the sun's damaging rays.

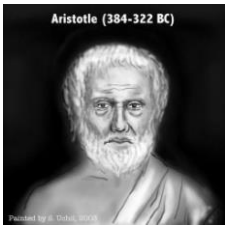
- The **moon** is a small rocky satellite of Earth, having about one-quarter the diameter of Earth and one-eighth its mass. It has extremes of temperature, virtually no atmosphere or life, and very little water.

- The **sun** is an average-size yellow star of hydrogen gas that serves as the center of our solar system and as our source of heat and light. It is about 110 times the diameter of Earth and is approximately 4.6 billion years old.

**Historical Contributions**

Try to analyze the differences in what Aristotle, Ptolemy, Copernicus, and Galileo observed and what influenced their conclusions.

**Aristotle - 370 BC Earth-centered View**

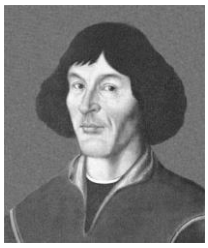



Earth is the center of the universe.
The earth is inside of a giant ball that turns
and the things in the sky are attached to the ball.
The earth doesn't move.

**Ptolemy - 100 AD Earth-centered View**

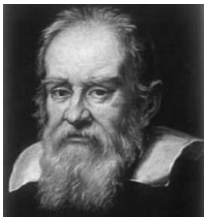
The earth is spherical (round) and the objects in space orbit the earth.
The earth doesn't move.

**Copernicus – 1480 Sun-centered View**



The earth is spherical (round).
The earth spins on its axis.
The earth and the other planets revolve around the sun.

**Galileo - 1575**



He proves that Copernicus' theory is correct.
Builds a **telescope** to study the moon.
Discovers that the moon is not flat – it has mountains and craters.

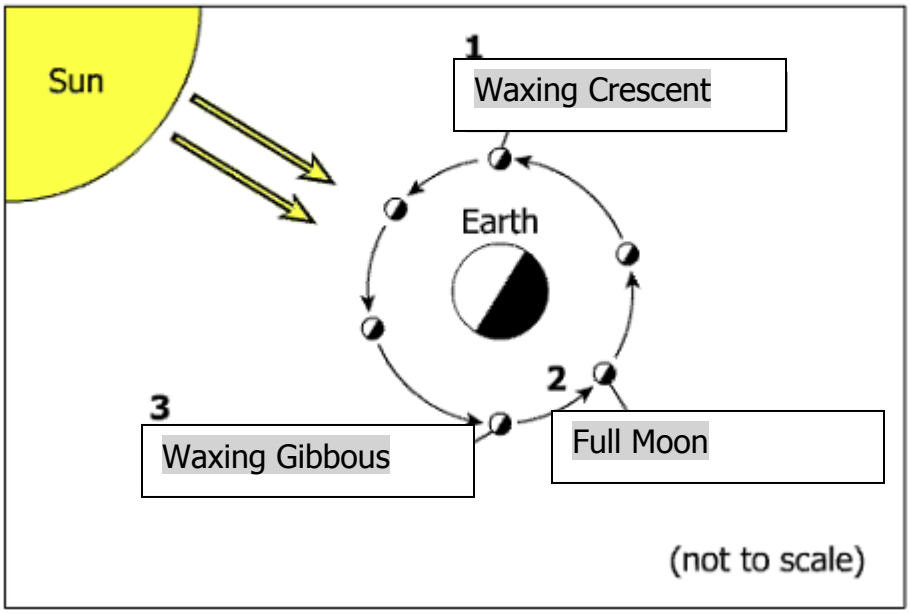
- The NASA Apollo missions added greatly to our understanding of the moon.
- Our understanding of the sun, moon, and the solar system continues to change with new scientific discoveries.

# Virginia Standards of Learning Grade 5 Science Test
# Released Practice Test Items

**Follow this link to find practice tests:**

http://www.doe.virginia.gov/testing/sol/practice_items/index.shtml#science

**Moon Phases as Seen on Earth at Night During Different Times of the Month**




1. What moon phase belongs in each of the boxes above?

**Characteristics of Objects in Our Solar System**

| Size | Color | Composition |
|---|---|---|
| (1) 1/4 of Earth's diameter | (4) Red | (7) Rock |
| (2) 11 times Earth's diameter | (5) Yellow | (8) Ice |
| (3) 110 times Earth's diameter | (6) Blue | (9) Gas |

2. Which numbered characteristics best describes the sun?
   A. 1,5,7
   B. 3,4,8
   C. 2,6,8
   D. 3,5,9

| | |
|---|---|
| **observation**<br>**4.1** | What you see, feel, taste, hear, or smell in an experiment. |
| **inference**<br>**4.1** | A tentative explanation based on background knowledge and available data. |
| **prediction**<br>**4.1** | Tells what may happen in some future situation. It is based on the application of scientific principles and factual information. |
| **conclusions**<br>**4.1** | Are drawn by making judgments after considering all the information you have gathered. Conclusions are based on details and facts. |
| **elapsed time**<br>**4.1** | The amount of time that has passed between two given times. |
| **experiment**<br>**4.1** | A fair test driven by a hypothesis. A fair test is one in which only one variable is compared. |

| | |
|---|---|
| **hypothesis**<br>**4.1** | A prediction about the relationship between variables. A hypothesis is an educated guess/prediction about what will happen based on what you already know and what you have already learned from your research. It must be worded so that it is "testable." |
| **independent variable**<br>**4.1** | The factor in an experiment that is altered by the experimenter; it is purposely changed or manipulated. |
| **dependent variable**<br>**4.1** | The factor in an experiment that changes as a result of the manipulation of the independent variable. |
| **constants**<br>**4.1** | Those things in an experiment that are purposefully not changed and remain the same throughout the experiment. |
| **quantitative data**<br>**4.1** | Data that can be counted or measured and the results can be recorded using numbers. |
| **qualitative data**<br>**4.1** | Data that deals with descriptions, and data that can be observed, but not measured precisely. |

| | |
|---|---|
| **Mercury**<br>4.7 | Mercury is closest to the sun and is a small, heavily cratered planet. Mercury looks like our moon. Since Pluto's reclassification from planet to dwarf planet, Mercury is now the smallest planet in our solar system. |
| **Venus**<br>4.7 | Venus is the second planet from the sun. It is similar to Earth in size and mass, and has a permanent blanket of clouds that trap so much heat that the temperatures on the surface of Venus are hot enough to melt lead. |
| **Earth**<br>4.7 | Earth is the third planet from the sun. Earth's atmosphere, the liquid water found on Earth, and its distance from the sun, among many other factors, make Earth a haven for life. One of the four terrestrial inner planets and is about 150 million kilometers from the sun. |
| **Mars**<br>4.7 | Mars is the fourth planet from the sun. The atmosphere on Mars is thin and there is a vast network of canyons and riverbeds on the red planet. Scientists hypothesize that Mars once supported a wet, warm Earth-like climate. |
| **Jupiter**<br>4.7 | Jupiter is the fifth planet from the sun. Jupiter is the largest planet in the solar system and is considered a gas giant. Jupiter has no solid surface. |
| **Saturn**<br>4.7 | Saturn is the sixth planet from the sun. Early scientists thought Saturn was the only planet with rings, but we now know that all four gas giants (Jupiter, Saturn, Uranus, and Neptune) have rings. |

| | |
|---|---|
| **Uranus**<br>4.7 | Uranus is the seventh planet from the sun. Uranus is a gas giant. |
| **Neptune**<br>4.7 | Neptune is the eighth planet from the sun. Neptune appears blue through telescopes and is a gas giant. |
| **Revolution**<br>4.8 | Revolution describes Earth's movement around the sun every 365 1/4 days. |
| **Rotation**<br>4.8 | Rotation describes the spinning of Earth on its imaginary axis, which takes about 24 hours to complete and causes day and night to occur. |
| **Seasons**<br>4.8 | Seasons are created by the tilt of Earth. Each period of the year has special climate conditions. |
| **Axial Tilt**<br>4.8 | Axial tilt describes the invisible axis that is slanted allowing for seasons to occur. |
| **Phases of the Moon**<br>4.8 | Phases of the moon are the different shapes of the moon you see from Earth caused by the position of Earth and the sun. |
| **Moon**<br>4.8 | The moon is a small rocky satellite that is about one-quarter the diameter of Earth and 1/8 its mass. It has extremes of temperature, virtually no atmosphere or life and very little water. |

| | |
|---|---|
| **Waxing Gibbous**<br>**4.8** | The waxing gibbous is the phase of the moon where more than ½ of the moon is visible and seems to be growing bigger. It occurs just before the full moon. |
| **Sun**<br>**4.8** | The sun is an average-sized yellow star about 110 times the diameter of Earth and is approximately 4.6 billion years old. |
| **Waning Gibbous**<br>**4.8** | The waning gibbous is the moon phase right after the full moon when the moon appears to be shrinking. |
| **New Moon**<br>**4.8** | The new moon is the moon phase that occurs when the moon is between Earth and the sun, at which point the moon cannot be seen because its lighted half is facing the sun and its dark side faces Earth. |
| **Waxing Crescent**<br>**4.8** | The waxing crescent is the moon phase that follows the new moon where a small lighted area appears to grow larger. |
| **First Quarter**<br>**4.8** | The first quarter is the phase of the moon in which the right side of the moon is visible. (looks like a "half moon") |
| **Full Moon**<br>**4.8** | The full moon is the moon phase when the moon is completely visible and perfectly round. |
| **Last Quarter**<br>**4.8** | The last quarter is the phase right after the full moon. It is when one-half of the moon's face appears to be illuminated by sunlight. |

| | |
|---|---|
| **Waning Crescent**<br>**4.8** | The waning crescent is the phase of the moon when a small lighted area appears to grow smaller. It appears before a new moon. |
| **Aristotle**<br>**4.8** | Aristotle is a Greek philosopher who believed that planets, the sun, the moon and the stars revolved around Earth. |
| **Galileo**<br>**4.8** | Galileo thought that the sun was the center of the universe. |
| **NASA Apollo**<br>**4.8** | The National Aeronautics and Space Administration Apollo missions aim was to land humans on the moon and bring them back safely. |