

Module 11: The Forces in Creation - Part 1

Vocabulary:

Centripetal Force - The force necessary to make an object move in a circle. It is directed perpendicular to the velocity of the object, which means it points toward the center of the circle.

Insolation – is described as energy from the sun.

Perturbations – are variations in motion caused by force.

Force is an integral to motion and physics. The mechanics of force, the concepts, ideas and existence are demonstrated in Creation in multiple ways, besides motion~ yet they are relative.

There are 4 Fundamental Forces:

➡ Gravitational, Electromagnetic, Weak, and Strong.

All forces in creation can be traced to these four fundamental forces.

Characteristics of each force:

Gravity:

Attractive
Weakest force
Easy to recognize
Any 2 objects that have mass are attracted to each other by this force.(p.255)

Electromagnetic:

Force between electrically charged particles
Attractive or repulsive(dependant on charge)
+charge and + charge= a repelled force
+charge and – charge= an attractive force

Weak:

Hardest force to understand
Relates to Atoms
Governs the radioactive process in Atoms
It is a facet of electromagnetic force called “electroweak force”

Strong:

Strongest force
Has a small range
Applicable to the particles of an atom’s nucleus
It is the force that holds the nucleus of an atom together

● Gravitational Force

➡ It is important to note that there are 2 existing theories relating to Gravitational force.

1. Newton’s Universal Law of Gravitation
2. Einstein’s General Theory of Relativity

This article does a good job explaining both:

<http://www.britannica.com/EBchecked/topic/242404/gravitation>

Another website shares on the topic: <http://csep10.phys.utk.edu/astr162/lect/cosmology/gravity.html>

Let's discuss the force:

This force applies to both large and small objects. Figure 1.1 illustrates a concept Isaac Newton experimented with by dropping an apple from a tree. But it also illustrates that gravity is not only working on the Apple when it is dropped (and consequently the ground coming up to meet the apple) but the pull of the earth and moon upon each other.

Isaac Newton developed the **Universal Law of Gravitation**. It is considered universal, obviously, because it applies to everything in the universe that has mass. The principles of this law are as follows:

1. All objects with mass are attracted to one another by the gravitational force.
 2. The gravitational force between two masses is directly proportional to the mass of each object.
 3. The gravitational force between two masses is inversely proportional to the square distance between those 2 objects.
- The first principle tells us that matter is attracted to matter. – *What is matter?*
Matter is anything that has mass.
 - All things which have matter are attracted to something (other matter) as well as the earth.
 - The second principle tells that the strength of the force increases as the mass increases. – *What is the factor by which the gravitational force changes?*
The same factor as the amount of change in mass.
 - As the mass of an object goes up, the strength of the gravitational force between two objects will increase. The gravitational force changes by the proportion of the change in the mass. For example if the mass is 4x larger then the gravitational force will be 4x stronger, etc.
 - The 3rd principle gives us a reference and an equation stating that gravitational force is Inversely Proportional to the square of distance of the objects. – *What does inversely proportional mean?*
When something is in its inverse state it is opposite, turned upside down, or reverse. For example the we use the inverse (or reciprocal) in math when we isolating the variables in an algebra equation. $3/7$ has an inverse of $7/3$
Proportion means part or related to a whole like in a ratio, symmetry, and dimensions.
 - When the distance increases by some factor, the GF decreases by the square of that factor.
 - When the distance decreases by some factor, the GF increases by the square of that factor.

Big Distance = small gravitational force

Small Distance = large gravitational force

The mathematics of the 3rd principal look are illustrated on Multimedia CD and in the example found on 11:1.

Look at the On Your Own Problem 11:1, it says:

The gravitational force between two objects (mass₁= 10kg, mass₂=6kg) is measured when the objects are 10 centimeters apart. If the 10 kg mass is replaced with a 20 kg mass, and the 6 kg mass is replaced with a 3 kg mass, how does the new gravitational force compare to the first one that was measured?

$$10 \times 2 = 20 \text{-----} gf \times 2$$
$$6 \div 2 = 3 \text{-----} gf \div 2$$

Gravitational force stays the same.

- Gravitational Force is so weak it can not overcome friction.
- We notice the strength of gravitational force when studying objects of greater mass.

Look at figure 11:2:

The gravitational force between objects is mutual.

This states that 2 objects exert equal gravitational force on each other. This principle of force also illustrates Newton's 2nd and 3rd Laws of Motion in that every action results in an equal but opposite reaction and the size of an object and the rate of speed in its motion is proportional.

● Force and Circular Motion

Look at the definition for Centripetal Force from page 261 in your text book.

Centripetal Force - The force necessary to make an object move in a circle. It is directed perpendicular to the velocity of the object, which means it points toward the center of the circle.

Think of Newton's 1st Law which states an object at motion or rest stays in motion or rest unless acted upon by another force.

- Circular motion happens when the outside force is perpendicular to the velocity of the object. (p.262)

The 3 Principles of Centripetal Force

1. Circular motion requires centripetal force.
2. The larger the centripetal force, the fast an object travels in a circle of a given size.
3. At a given speed, the larger the centripetal force, the smaller the circle.

- The important thing to note here is that a force will turn when its velocity (remember there is speed and direction in this vector quantity) is perpendicular to the force applied causes the object to accelerate in speed.

● The Frictional Force

(note to student: Read this section closely!)

Dr. Wile explains in this section that there is a frictional force in creation called, Centrifugal Force, which is often confused with circular motion. He states that centrifugal force is merely a result of force, friction, and velocity (direction).

The term comes from the Latin meaning “fleeing the center”.

Consider the example of a Centrifuge. This machine separates liquids and solids while utilizing force of a spinning circular motion. The force is perpendicular to the acceleration and this in turn caused the cellular components in blood separate from the blood plasma.

<http://hyperphysics.phy-astr.gsu.edu/hbase/corf.html>

<http://phun.physics.virginia.edu/topics/centrifugal.html>

Two other practical examples of a centrifuge in operation are a Washer and a Dryer. Both devices use circular motion to take the water out of the clothes. Obviously the dryer also uses heat to evaporate the water, however, they both use circular motion in their operation.

● Our Created Solar System

The Solar System displays gravitational and centripetal force. The reason the planets do not fall into the sun is because their velocities are perpendicular to the sun's gravitational force. We can see the concepts function of force and motion displayed in the Solar System.

We see the effect of Centripetal Force in the attraction of the Earth to the Sun. Because the mass of the sun is so much larger than that of the Earth, we are pulled into an elliptical orbit due to the perpendicular location which then forces the circular motion of our orbit. Because the distance of the sun to the planets, the speed at which they travel around the sun is relative to Newton's 3rd principle of gravity.

The inner planets, mostly composed of rock, and the outer planets, composed of gases, each have their own orbits that have satellites (bodies which orbit other planets).

- What keeps each satellite surrounding each specific planet?
- Why are they all surrounding the sun?
-

Asteroids, meteors and meteoroids are all bodies which orbit in the sun based on the same gravitational force that keeps the planets in the solar system. The Asteroids become meteoroids when they are pulled from their orbit and hurled into space due to perturbations, variance in motion, that disturb the regular path they are following.

➔ Why don't we see the impact of meteoroids on earth like other planets?

The atmosphere of a planet affects the insolation(energy received from the sun) of that planet. Atmosphere also creates a barrier that protects a planet from the effects of the meteoroids which are being pulled towards them. We see the force of friction, which slows the object down and effectively diminishes the size and mass of the object.

Gravity is also at work on comets, pulling the icy snowballs near to the sun. The Gravitational Force moving the comet closer to the sun is the reason we can glimpse their magnificence. The comet does not glow or have a tail when it isn't close to the sun.

Comets are transient and do not last forever because each trip around the sun decreases the amount of mass. If you look carefully at example 11.8 you can see the path that the comet "Kohoutek" took in 1974.

➔ Why do we need to study the forces of the Solar System or Comets?

The evidence we gather in our studies help to examine the age of the earth. By looking at the processes needed to create the disturbances that cause asteroids to leave their orbit, or the size and location of the origin of the comets help to understand the age of the solar system. Looking at page 272 gives a more detailed explanation of this idea.

- ➔ Take note of the classifications for a planet listed on page 273.
 1. A planet must be in orbit around the sun.
 2. A planet must be nearly round in shape.
 3. A planet must have "cleared the neighborhood" its orbit.
- ➔ Consider the definition of a dwarf planet.
 1. A dwarf planet must be in orbit around the sun.
 2. A dwarf planet must be nearly round in shape.
 3. A dwarf planet has not "cleared the neighborhood" around its orbit.
 4. A dwarf planet is not a satellite.

Read carefully through the 2 ruling theories listed in Chapter 11 for Gravitational Force.

- ➔ Einstein's Theory of Relativity-
 - Time and space are bent and this causes the orbit of the planetary bodies.
 - Gravitational Force is not actually a force but the result of something else.
- ➔ The Graviton Theory of Gravity

- All other forces result from this theory.
- Review of the History of our Solar System
 - ➔ You should be able to clearly understand these:
 - ➔ What is the geocentric view?
 - ➔ What is the heliocentric view?

The concept that you need to consider is that most theories in science are considered ruling theories. They are built upon theories suggested prior to their own existence. Many scientists have chosen to break out of conformity and decide to learn, seek and know more. These individuals proved the ruling theories wrong and established a new set of ideas and theories to contemplate.

Truth lies in the identity of Christ. It is in studying His Word and knowing Him more that we can reason rightly.

Psalm 19:1 says “The heavens display the glory of God, the skies proclaim his handiwork.” Isaiah 1:18 reminds us that we should think and reason rightly.

Websites:

- ➔ Calculate Gravitational Force: <http://www.1728.org/gravity.html>
- ➔ Diagram of Solar System: <http://ssd.jpl.nasa.gov/?orbits>,
http://www.windows2universe.org/our_solar_system/solar_system.html
- ➔ Comets, Kuiper Belt, Oort Cloud.: <http://creation.com/cometsportents-of-doom-or-indicators-of-youth>, <http://ssd.jpl.nasa.gov/?comets>,
<http://www.answersingenesis.org/articles/tj/v15/n2/oort>
- ➔ Age of the Solar System: <http://www.answersingenesis.org/get-answers/topic/young-age-evidence>
- ➔ Centripetal Force (great info for Experiment 11.1):
http://www.phy.ntnu.edu.tw/oldjava/circularMotion/circular3D_e.html
- ➔ Pluto: <http://www.skyandtelescope.com/news/home/3728231.html>,
<http://www.skyandtelescope.com/news/home/3805531.html>
- ➔ Galileo: <http://galileo.rice.edu/chron/galileo.html>, <http://www.catholic.com/tracts/the-galileo-controversy>
- ➔ Newton’s Laws: <http://csep10.phys.utk.edu/astr161/lect/history/newtongrav.html>,
- ➔ Dwarf Planets: <http://www.solstation.com/stars/dwarfpla.htm>
- ➔ Einstein’s Theory of Relativity:
<http://csep10.phys.utk.edu/astr162/lect/cosmology/gravity.html>

Module 12: The Forces in Creation – Part 2

Vocabulary:

Photon - A small “package” of light that acts like a particle

Charging by conduction – Charging an object by allowing it to come into contact with an object that already has an electrical charge.

Charging by induction – Charging an object without direct contact between the object and a charge.

Electrical Current – The amount of charge that travels past a fixed point in an electric circuit each second.

Conventional Current – Current that flows from the positive side of the battery to the negative side. This is the way current is drawn in circuit diagrams, even though it is wrong.

Resistance – The ability of a material to impede the flow of charge.

Open circuit - A circuit that does not have a complete connection between the two sides of the power source. As a result, current does not flow.

● **Electromagnetic Force is:**

- the force which makes electricity
- flows through a circuit
- holds the atom together
- creates lightning
- rules a compass
- causes magnets to attract.

➤ *Research James Clerk Maxwell.*

● *Modern Physics= J. Maxwell*

Maxwell is known as the father of modern physics.

- He demonstrated magnetism and electricity are the same force.
- His partnership with Michael Faraday, inventor of electric generator, forever altered science.
- He studied science in order to bring Glory to God. He inscribed Psalm 111.2 above his laboratory door.

“Great are the words of the Lord; they are pondered by all who delight in them.”

● *The three principles of Electromagnetic Force:*

1. Like charges repel; opposites attract
 2. Force = the amount of charge
 3. Force = the square of the distance between two objects.
- Note how similar the 2&3 are to the principles of gravitational force and Newton's Universal Law of Gravitation.
 - This similarity gives credence to the Graviton Theory.
- ➔ What do you think about coincidences in Creation?

● *Photons and Electromagnetic Force*

Look at the definition of a Photon. —————> Photons are small packages of light that act like particles.

- Ⓢ We can see the exchange of photons in electromagnetic force.
- ✓ This is validated by the 3 principles of magnetic force.

● *How objects become electrically charged*

(Review Atoms from Module 3) Atoms = Neutrons (no charge), protons (+ charge), and electrons (- charge)

- When the amount of protons are greater, the atom is considered a positive ion. The atom has then lost electrons.
 - When the amount of electrons are greater, the atom is considered a negative ion. The atom has now gained electrons.
- Atoms can gain or lose electrons in 3 ways:
1. Chemical reactions
 2. Charging by conduction; which means touching an electrically charged object to an object with no charge... thus the object gets the same charge.
 3. Charging by induction; which means there is indirect contact between an object and its charge... thus the object gets an opposite charge.

We see the explanations of #2 & 3 in the experiment you performed for 12.2, this shows how the electrons move around the atoms in the objects you were studying. You can see that in the first part the foil received the same charge as the balloon. In the second part the foil got rid of the electrons and obtained an opposite charge of the balloon.

● *Electrical Circuits*

- Electricity is the flow of electrons.
- Batteries store electric charges; both positive and negative.

- Voltage measures how hard electrons are pushed through a circuit.
 - IMPORTANT: The electrons flow from the Negative to the Positive side in a circuit.

➔ Why do we want to push the electrons through?

For the purpose of moving the electrons through is to move energy.

➤ Look at the definition of an Electrical Current : the amount of charge passing a fixed point/second which is measured in amperes. (amps)

Knowing the current and voltage tells you what a circuit is capable of.

- ✓ Look at figure 12.4 and the illustration of a simple circuit and then look at the abbreviated drawing of a circuit in 12.5. The abbreviated drawing shows you how scientists annotate circuits in their data. The longer horizontal line denotes a positive charge while the shorter horizontal line denotes a negative charge. This explains why these ends are typically never labeled when studying electric circuits. This is a key point to memorize if you haven't already.
- ✓ Pay attention to the illustration and description of the Conventional Current in an electrical circuit in figure 12.6 on page 298-299. Although it is technically inaccurate, as the current flows from the negative terminal to the positive terminal, scientist have a hard time breaking with tradition and have kept it the same as was the accepted theory when Benjamin Franklin contemplated his own ideas about electricity.
- Research Benjamin Franklin's history with electricity.

● Resistance

Resistance is the ability of a material to impede the flow of charge.

- ⓐ Consider what the word resistance means. To resist something means you will attempt to stop the forward movement of that object. Even to resist an idea, which seems as if there is not a force involved, is your effort to stop the advancement of something you disagree with. Right? 😊

When electricity moves, or the electrons flow in metal, there is a reaction with the electrons in the metal. This causes both heat and light to be produced. In the experiment from 12.3 you felt the heat rather than saw it. If you look at figure 12.7 you can see the change in the burner as it heats up , and alternately you would be able to feel it if you touched it. (Don't do that .. Please!)

Look at the characteristics of metal with regard to resistance:

1. Metal resists electron flow. (heat and light are produced)
2. Each metal reacts differently (we see the resistance in some and feel the resistance in others.)

Examples where we can either see and/or feel the resistance of metals are:

- Toasters- the flow of electrons produces mostly heat and some light
- Light bulbs – the flow of electrons produces mostly light, not heat.

● *Switches and Circuits*

When we look at a diagram of a circuit we can see that it is a flow of electricity. The circuits can be further classified by how they work.

- Open Circuits, Series Circuits, & Parallel Circuits
- An Open circuit does not have a complete connection from both sides of the power source.
 - ➔ The current does not flow in this type of a circuit.
 - An open circuit needs a switch to connect the lines and allow the electrons to flow from one end to the other.
- A series circuit places all devices, which are operated by the flow of electrons, on one circuit.
- A Parallel circuit allows each device to work independently because they are each connected separately.
 - ➔ Which is more desirable?
 - The parallel circuit has more potential for favorable outcomes because on in a series circuit if one of the devices is inoperable then it will affect the successful operation of the other devices.
 - ➔ Can you tell me what situations each circuit would be used in?

● *Magnetism*

Dr. Wile states “ All magnetic force results from the movement of charged particles” (¶ #2 page. 305)

- Magnetic force is created when electrons flow in one general direction.
- Most material is not composed this way so the movements of random charged particles, matter, cancel each other out.
- Iron can always be made into a magnet because of the make-up of this material.
- Many materials do not align the electrons so they can not respond to the pull of magnetism.
- Refrigerator magnets work because of the electrical flow. The motions in the atoms are arranged in a particular way. They flow like electrons in a circuit.

● *Permanent Magnets*

Permanent magnets have 2 sides: A north pole and a south pole.

- Like Magnets, poles with the same charge repel each other. While poles with opposite charges attract each other.
 - ➔ Why is a magnet called a dipole?

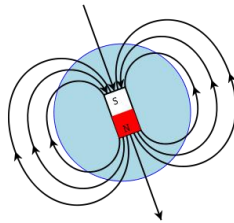
Magnets are dipoles because they always have a north and a south pole. Even if you break a magnet in half it will still have a north and a south pole.

Look at figure 12.11 which shows you this fact—you can never split a magnet into 2 separate poles.

The magnetic nature, caused by the alignment of atoms, doesn't have to be done by all the atoms. Only a fraction is necessary to make it magnetic.

- Like Gravitational and Electrical Force.. Magnetic force follows principles.
 1. The force of a magnet is directly proportional to the strength of each pole.
 2. The strength of the force is inversely proportional to the square of the distance.

● *Magnetic Field Lines*



Magnetic field lines show the direction of magnetic force. When you put iron shavings on top of a magnet, you should be able to see the magnetic field lines. The magnetic field line is referred to as “an idea that is visualized”, especially using the iron shavings on the magnet. Magnetic Field lines do not cross each other.

<http://www.walter-fendt.de/ph14e/mfbar.htm> this is an applet that shows how the compass and magnet display the magnetic field lines.

<http://www.youtube.com/watch?v=uj0DFDfQajw> this site has the experiment mentioned with the shavings and does a great job explaining magnetic field lines.

<http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/elemag.html>

Websites:

James Maxwell bio: http://www.answersingenesis.org/home/area/bios/jc_maxwell.asp

Michael Faraday bio: http://www.creationsafaris.com/wgcs_3.htm#faraday

Electroscope: <http://www.engr.uky.edu/~gedney/courses/ee468/expmnt/escope.html>

Conductors: http://www.allaboutcircuits.com/vol_1/chpt_1/2.html

Circuits: http://www.ngfl-cymru.org.uk/vtc/learnpremium/electric_circuits/Introduction/default.htm

Generators: <http://science.howstuffworks.com/transport/engines-equipment/vdg.htm>

Magnetism: <http://www.crystalinks.com/magnetism.html>