

CHAPTER 1 → EARTH, MOON & SUN... LESSON 1

STARS	MOON	PLANETS	METEORS	COMETS
<p>→ Stars = giant ball of hot gas</p> <ul style="list-style-type: none"> ▪ 2000-3000 stars just w/ your eyes <p>→ Constellation = pattern or group of stars that people thought represent figure, animal or object.</p> <ul style="list-style-type: none"> ▪ 88 constellations ▪ Polaris also called "North Star" ▪ Big Dipper (is part of constellation Ursa Major "Great Bear") 	<p>Moon</p> <p>.....Is Earth's only "Natural Satellite" (it is <i>NOT man made</i>)</p>	<p>-Planets = object that orbits the sun & is large enough to have become rounded by its own gravity, & has cleared the area of its orbit.</p> <ul style="list-style-type: none"> ▪ 8 planets in our solar system ▪ We see Mercury, Venus, Mars, Jupiter & Saturn w/out a telescope ▪ Venus is called the "Morning/ Evening Star"..... It is brightest star in night sky... besides the moon!! 	<p>Meteors - streak of light made when a small object (rock) burns up when entering Earth's atmosphere.</p> <p>- Did you see the Perseid Meteor shower 2 weeks ago?</p>	<p>Comets - cold mixture of dust & ice that gives up a long trail of light as it approaches the sun.</p>

1. STARS & SUN "appear" to move from EAST to WEST ...this is because Earth is spinning from West to East.
2. Constellations that you can see vary from season to season. (Ex: Orion is in eastern sky during winter & western sky by spring)
 - a. Caused by Earth's orbit around the Sun
 - b. CIRCUMPOLAR CONSTELLATIONS.... stars you see all year long- they circle around north pole (EX: Big Dipper, Little Dipper, Polaris)
3. Mercury appears low in sky & can see for short time around sunrise or sunset.

LESSON 2: EARTH IN SPACE

EARTH'S MOVEMENTS.....

ROTATION	REVOLUTION
<p>→ spinning of Earth on its axis</p> <ul style="list-style-type: none"> - Causes DAY & NIGHT - Takes 24 hours 	<p>→ Movement of one object around another</p> <ul style="list-style-type: none"> - Takes 1 year - Orbit = Earth path... its an ellipse (flattened oval) <div style="text-align: center;">  </div>

Calendars:

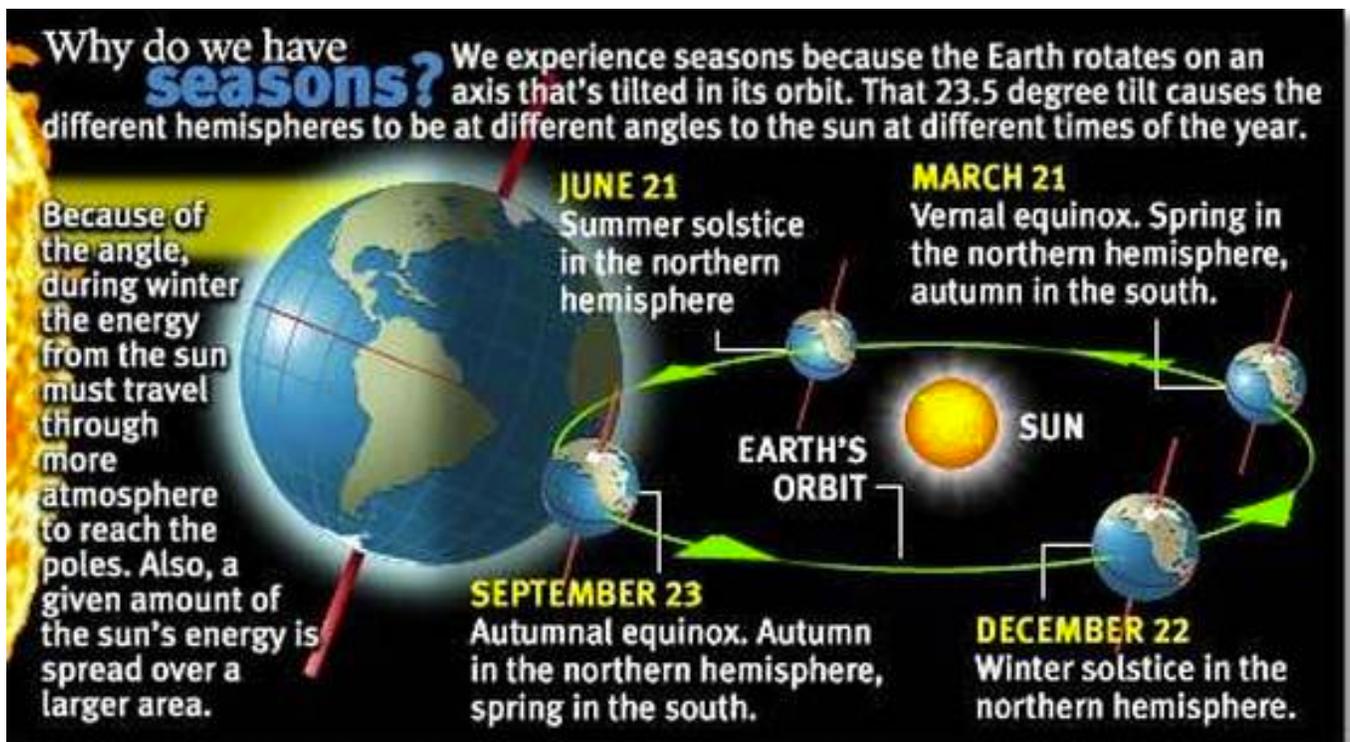
- **Egyptians** created one of 1st calendars
- **Romans** adjusted Egyptian calendar and added leap years
- **Gregorian calendar- tweaked by pope and is calendar we use today**

SEASONS.....

→ At equator sunlight hits directly.. that's why they have year round warm weather

→ Earth is tilted 23.5 degrees....

- **SEASONS are caused by Earth's tilt as it revolves around Sun.**



Solstice = sun appears farthest north of equator once a year

- Summer Solstice= about June 21 = longest day & Winter Solstice= about Dec. 21= shortest day

Equinox = noon sun is directly overhead at equator, rises due east and sets due west.... Means "equal night"

- **Day & night are equal** 12 hrs long everywhere
- Spring equinox = around March 21 & Fall equinox = around Sept. 22

LESSON 3: GRAVITY & MOTION

Gravity = force which attracts all objects toward each other

- **Law of Universal Gravitation** = every object in universe attracts another object.
 - **Isaac Newton** discovered in 1600s that there must be a **force**= (push or pull) that kept moon orbiting around Earth

STRENGTH OF GRAVITY depends on:

MASSES OF THE OBJECTS:	DISTANCE BETWEEN OBJECTS:
<p>→ Mass = amount of matter in an object... your mass does NOT change from planet to planet</p> <p>→ Weight = amount of force of gravity on an object.... Your weight CAN change depending on your location.</p>	<p>→ Force of gravity DECREASES as distance INCREASES.</p> <p>Ex: the farther away from Earth you get... less gravity you feel</p>

WHY DOESN'T EARTH CRASH INTO THE SUN???

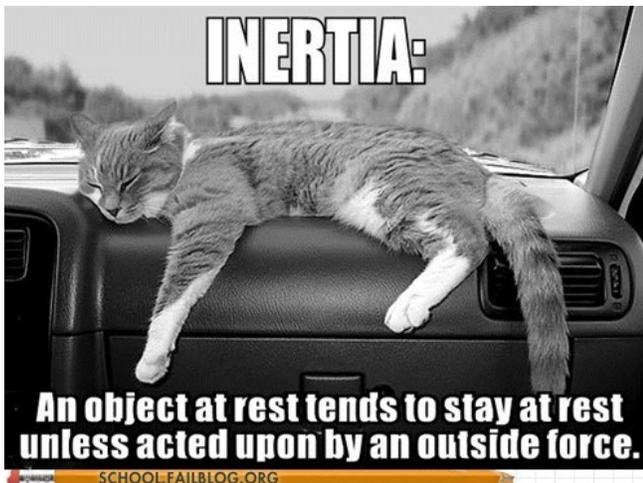
Because we have....

INERTIA

**** when object resists change in motion** (Ex: car stops → you slam into seatbelt)

- More mass = greater inertia...
harder to start or stop

- **Newton's First Law of Motion =**
Object at rest will stay at rest and
an object in motion will stay in
motion with a constant speed and
direction unless acted upon by a
force.



ORBITAL MOTION.. we orbit the Sun

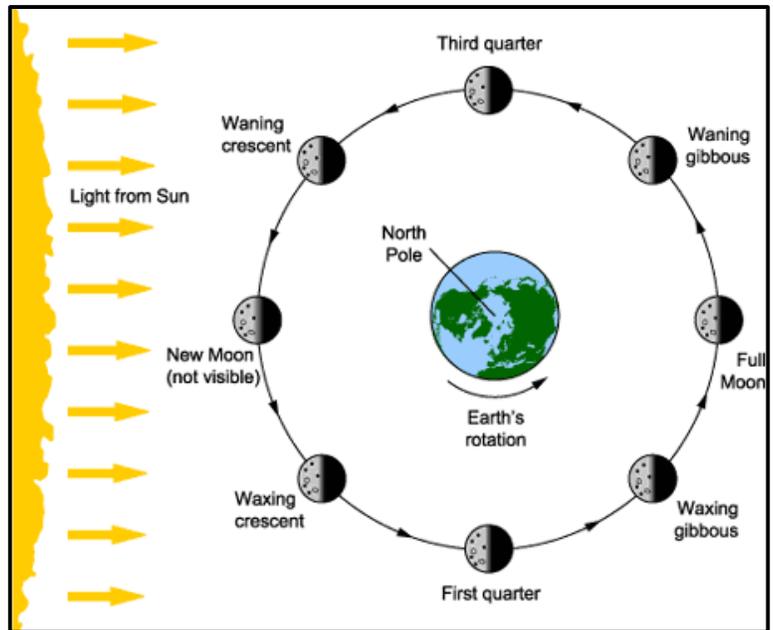
**Newton said inertia & gravity
combine to keep Earth in orbit
around Sun & moon in orbit
around the Earth.**

LESSON 4: Moon PHASES & ECLIPSES

-Moon ROTATES & REVOLVES around the EARTH!!

a. You always only see same side of moon

- New Moon = moon is NOT lit
- Waxing Phases = lit side is INCREASING (first $\frac{1}{2}$ of month)
- Waning Phases = lit side is DECREASING (last $\frac{1}{2}$ of month)



WAX ON.....WANE OFF

SOLAR ECLIPSE.. "SME"	LUNAR ECLIPSE... "SEM"
<p>→ Happens in daytime & moon's shadow hits Earth & blocks Sun</p> <p>(NOT TO SCALE)</p> <p>Did you see this year's solar eclipse??</p>	<p>→ Happens at a full moon when Earth is directly btwn moon & sun.</p> <p>The geometry of a lunar eclipse</p> <p>Next total lunar eclipse in N. America: Jan 31, 2018</p>

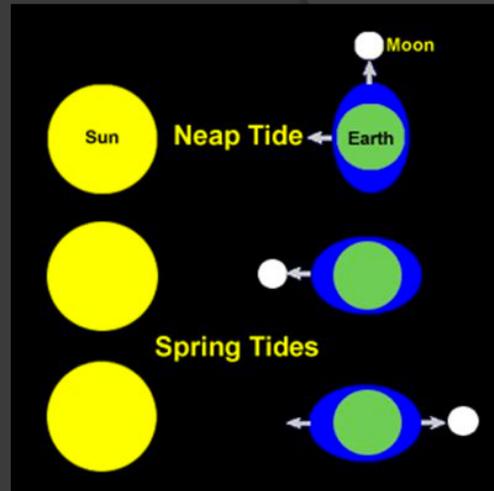
→ **Umbra = darkest part** of the eclipse shadow.....**Penumbra = eclipse shadow that is dark**, but not as dark as the umbra portion

LESSON 5: TIDES

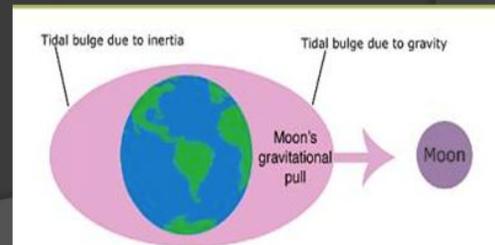
Tide = rise & fall of the ocean water

The Cause of Tides

- Most coastal locations will experience **two high tides** every day because of this and **two low tides**.
- High tides are spaced 12 hours apart because the Earth rotates a full revolution in 24 hours.
- In 24 hours, you would pass through the tidal bulge 2 times.



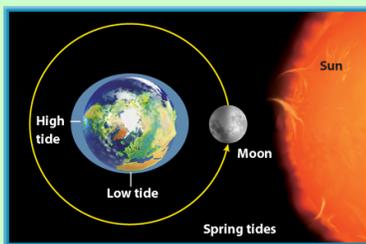
Gravitational pull of the Moon
On Earth's oceans



SPRING TIDE

-largest difference between high & low tide

Sun --- Moon --- Earth (**all in a row- during new moon & full**)

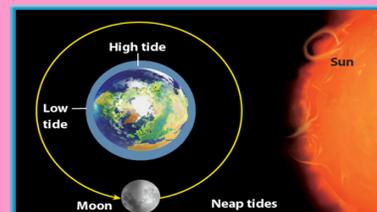


NEAP TIDE

- least difference between high & low tide...happens during first & third quarter moons)

Sun --- Earth

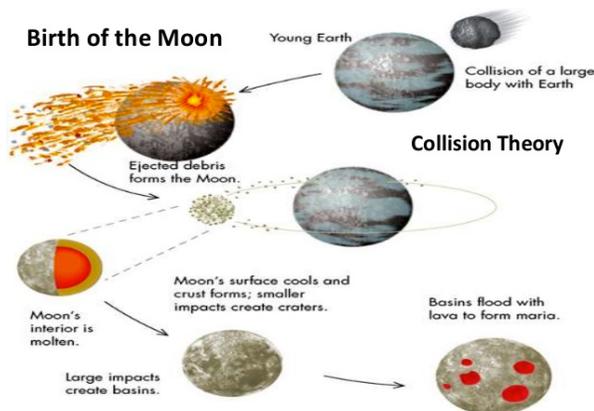
Moon (at **90 degree right angle**)



LESSON 6: EARTH'S MOON

MOON SIZE	MOON GRAVITY	FEATURES	TEMP	WATER
1/4 size of Earth	1/6 gravity of Earth	a) Maria- dark & flat areas b) Craters c) Highlands- light colored mountain areas	266 F...day -274 F... night... has NO ATMOSPHERE	Thin layer in soil... discovered in 2009

→ **South Pole-Aitken Basin** – found on S. pole.. is largest & deepest impact crater known in solar system.



Collision Theory → object hit Earth & chunk broke off... and formed ring... gravity made it clump together == MOON

1. Moon Explorations

1994 Clementine probe - looked for different minerals on moon	1998 Lunar Prospector - entire moon mapped... found possible ice frozen at the poles in craters.	2009 Lunar Crater Observation Sensing Satellite LCROSS- blasted a crater & then analyzed debris for water & ice.	April 2014 LADEE - was purposely crashed into Moon's surface to help study Moon's thin atmosphere
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CHAPTER 2: EXPLORING SPACE

LESSON 1: SCIENCE OF ROCKETS

Rocket = device that expels gas in one direction to move rocket in the other (Newton's 3rd Law of Motion)

How do Rockets Engines Work?

- It's kind of like the balloon
- Burning the fuel creates gas
- The rocket pushes on the gas (action)
- The gas pushes back on the rocket and propels it forward



The diagram shows a rocket engine with a red nozzle. Two arrows originate from the nozzle: a yellow arrow pointing left labeled 'ACTION' and a red arrow pointing right labeled 'REACTION'. The text '©2003 HowStuffWorks' is visible on the engine.

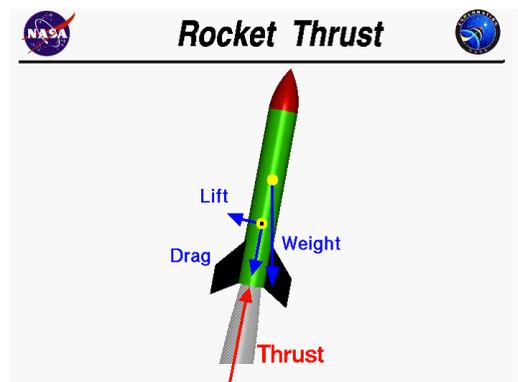
→ Originated in China in 1100's (called fire arrows) (military & fireworks)

→ British improved rockets in 1800s (used against USA in War of 1812)... Star Spangled Banner written about rockets.

MODERN ROCKET CREATORS:

Konstantin Tsiolkovsky Early 1900s (said how rockets work & proposed designs)	Robert Goddard 1915 (father of modern rocketry)	Wernher von Braun After World War 2 (made V2 rocket for Germans).. brought to USA
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1. Thrust = force that propels a rocket forward
2. Velocity = speed in a given direction
3. Rocket Fuels (pg. 48)... Solid, Liquid & Ion



4. Rockets move more than 11 km (6.6 miles) per SECOND!!



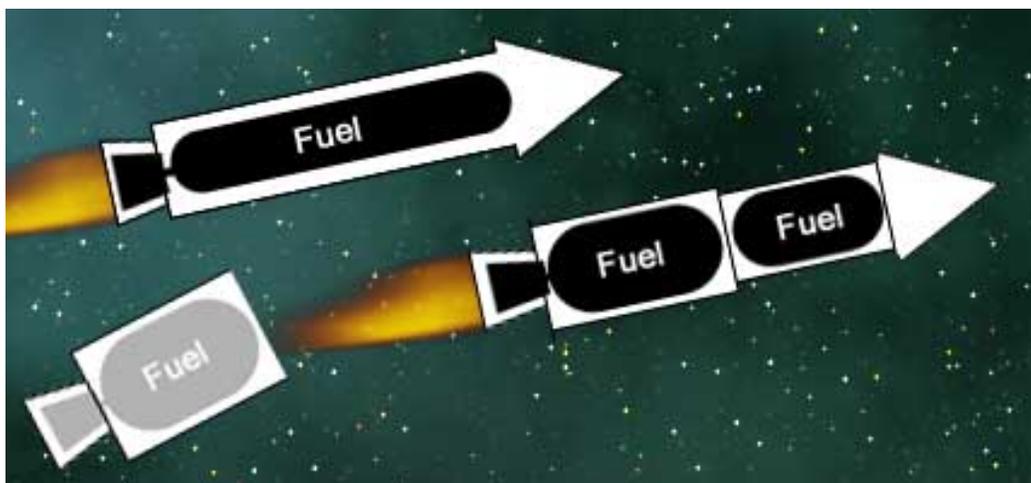
Velocity

- Rockets must reach a certain velocity in order to go into **orbit**
- **Orbital Velocity** – velocity a rocket must achieve to establish an orbit around Earth
- **Escape Velocity** – velocity a rocket must reach to fly beyond a planet's gravitational pull.
 - Rockets needs to leave Earth in 40,200 km per hour



TODAY WE USE MULTISTAGE ROCKETS!!

- Total weight of rocket is greatly REDUCED as it rises**
- First stage is largest rocket (has most fuel)
 - Used in 1960s to send astronauts to moon
 - Now used to launch satellites & space probes



CHAPTER 2

LESSON 2: HISTORY OF SPACE EXPLORATION

THE SPACE RACE!!

1. Rivalry btwn the **USA and Soviet Union** to explore space
→ Started with 1957 **Sputnik 1 (Russian) satellite (1st one in space)**
2. First artificial Satellites
 - a. **Satellite** = object that revolves around another object in space
 - i. 1958 Explorer 1 (USA) satellite
 - b. 1958 NASA created**
3. Humans in Space
 - a. April 1961 **Yuri Gagarin** (Russian) **first human to orbit around Earth** in Vostok 1
4. Apollo Program- steps to land us on moon & return to Earth

Project Mercury = orbit a piloted spacecraft around Earth

→ May 5, 1961 **Alan Shepard 1st US citizen in space** in Freedom 7

→ 1962 **John Glenn 1st US citizen to orbit Earth** in Friendship 7

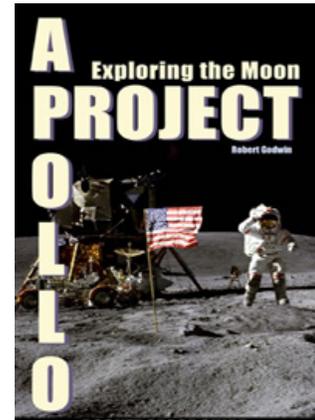
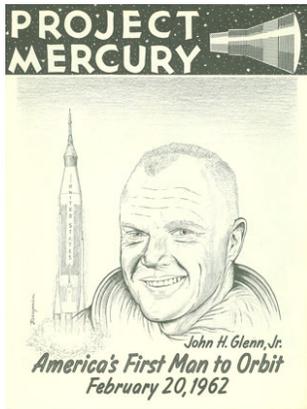
Project Gemini = 1 team met and connected w/ another spacecraft in orbit, and also find out the effects of space travel on the human body.

In 1966 the **probe Surveyor** was **sent to the moon to prove it could support spacecraft & humans.**

Project Apollo = July 20, 1969 Apollo 11 landed on Moon's surface.

→ **Neil Armstrong was 1st human on the Moon**

→ Have been 6 lunar landings!!

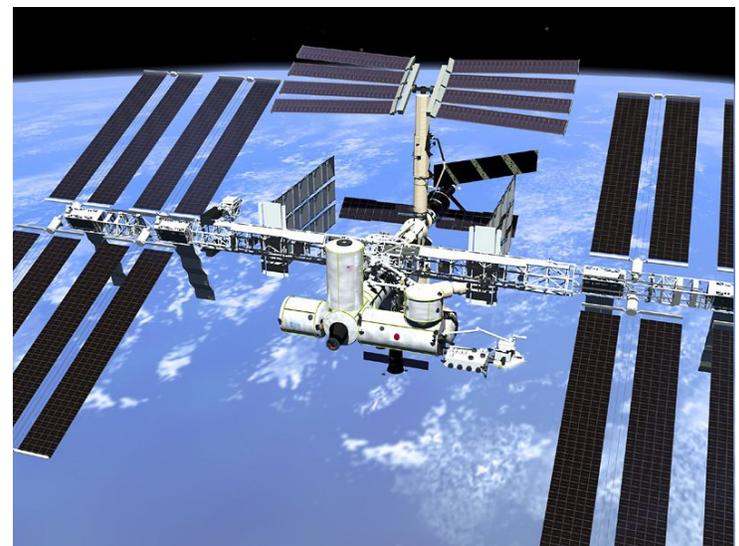


Space Shuttles & Space Stations

- a. Space shuttle = spacecraft that carried crew into space, returned and was reused.
 - i. All of NASA shuttles were retired in 2011... can now see them in museums !!
 - ii. Now private companies will provide them for our astronauts.. now we go up w/ Russians

b. Space Station = large artificial satellite on which people can live & work for a long time.

- 1) 1998 ISS was placed in orbit
- 2) Main source of power for ISS is solar energy
- 3) \$\$ 150 billion... will last until 2024???



6. Space Probe Uses

a. Space Probe = spacecraft that carries scientific instruments that can collect data, but has no human crew.

- Collect data about the solar system and sends it back to Earth
- Probes can be orbiters or landers.

→ rover = small robot on a probe that can move around on surface of object & collect data

Cassini 10 Years at Saturn BY THE NUMBERS

2 MILLION
COMMANDS
executed

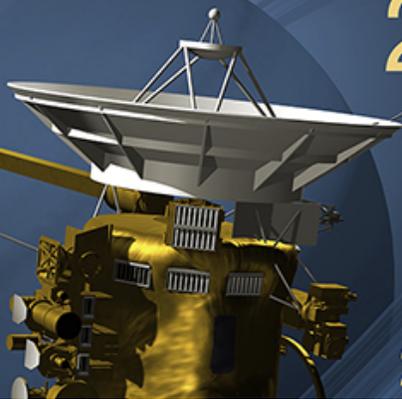
2 BILLION
MILES TRAVELED
since arrival

514 
SCIENCE DATA
collected

3039
SCIENCE PAPERS
published

7 MOONS
discovered

206 ORBITS
completed



1) **New Horizons probe**
-reached Pluto in July 2015.. Now headed to Kuiper's Belt (belt of comets past Neptune's orbit)

2) **Cassini probe**- went for 20 yrs.. was crashed into Saturn - Sept 15, 2017

CHAPTER 2 LESSON 3: USING SPACE SCIENCE ON EARTH

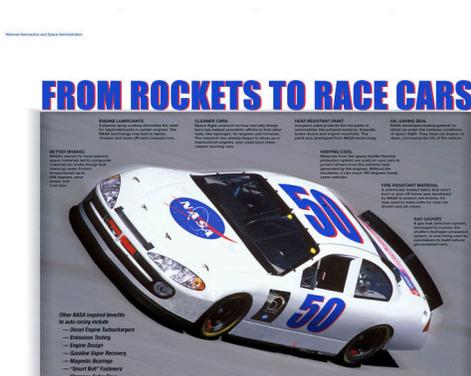
A. What are Conditions Like in Space?

1. Vacuum = place empty of all matter
 - a. No air or oxygen in space
 - b. In direct sun spacecraft heats up a lot and in shadow it gets super cold.. must insulate craft to protect astronauts.
2. Microgravity= feeling of weightlessness
 - a. **Mass is same but weight isn't**



B. Space Technology Benefits

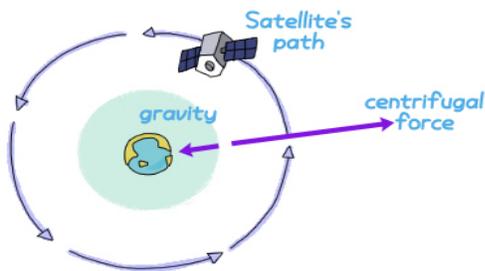
- a. Consumer Products (Text pg. 64)
- b. New Materials (Pg. 65)
- c. Medical Devices (pg. 65)



C. Uses of Satellites Orbiting Earth

1. For communication, collecting weather data & other scientific data
2. Observation Satellite uses:
 - a. Tracking weather systems
 - b. Mapping Earth
 - c. Seeing changes in earth's environment

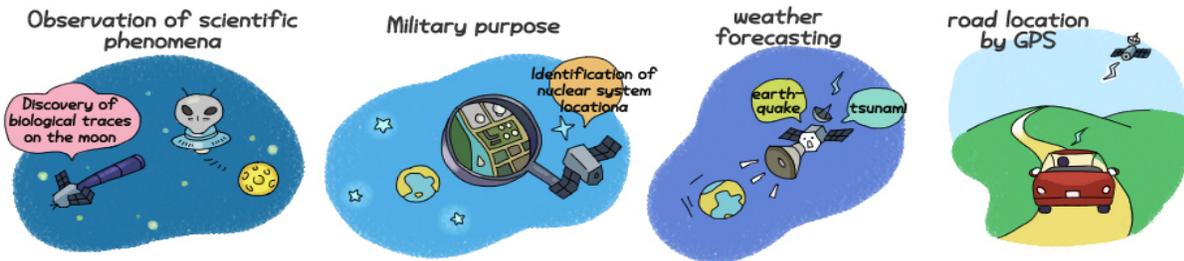
Uses of satellites



The satellite permanently drops towards the moon, but the moon surface is proportionally bent. So, the satellite permanently floats at a certain height from the surface. This path in which the satellite travels is its orbit.

The types of satellites are determined according to their purposes.

Satellites are used to observe and study scientific phenomena, perform military missions, and observe and forecast the earth's weather so as to prevent major damages from unforeseen weather conditions. They are recently being used in land surveying, GPS navigation and other relevant fields.



3. Communications satellites (cell phone, DISH network, etc.)

- a. Geostationary orbit = when satellite orbits Earth at same rate Earth rotates.. stays over same place over equator all the time.

i. BENEFITS: Make repeated observations over a specific area.

