Department of Education
Region X - Northern Mindanao
DIVISION OF CAGAYAN DE ORO
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Learning Activity Sheets in Physical Science

SHARED OPTIONS

Senior High Alternative Responsive Education Delivery

Competence.Dedication.Optimism

Preface

It has been elaborated in research and literature that the highest performing education systems are those that combine quality with equity. Quality education in the Department of Education (DepEd) is ensured by the learning standards in content and performance laid in the curriculum guide. Equity in education means that personal or social circumstances such as gender, ethnic origin or family background, are not obstacles to achieving educational potential and that inclusively, all individuals reach at least a basic minimum level of skills.

In these education systems, the vast majority of learners have the opportunity to attain high-level skills, regardless of their own personal and socio-economic circumstances. This corresponds to the aim of DepEd Cagayan de Oro City that no learner is left in the progression of learning. Through DepEd's flexible learning options (FLO), learners who have sought to continue their learning can still pursue in the Open High School Program (OHSP) or in the Alternative Learning System (ALS).

One of the most efficient educational strategies carried out by DepEd Cagayan de Oro City at the present is the investment in FLO all the way up to senior high school. Hence, Senior High School Alternative Responsive Education Delivery (SHARED) Options is

operationalized as a brainchild of the Schools Division Superintendent, Jonathan S. Dela Peña, PhD.

Two secondary schools, Bulua National High School and Lapasan National High School, and two government facilities, Bureau of Jail Management and Penology-Cagayan de Oro City Jail and Department of Health-Treatment and Rehabilitation Center-Cagayan de Oro City, are implementing the SHARED Options.

To keep up with the student-centeredness of the K to 12 Basic Education Curriculum, SHARED Options facilitators are adopting the tenets of Dynamic Learning Program (DLP) that encourages responsible and accountable learning.

This compilation of DLP learning activity sheets is an instrument to achieve quality and equity in educating our learners in the second wind. This is a green light for SHARED Options and the DLP learning activity sheets will continually improve over the years.

Ray Butch D. Mahinay, PhD
Jean S. Macasero, PhD

Acknowledgment

The operation of the Senior High School Alternative Responsive Education Delivery (SHARED) Options took off with confidence that learners with limited opportunities to senior high school education can still pursue and complete it. With a pool of competent, dedicated, and optimistic Dynamic Learning Program (DLP) writers, validators, and consultants, the SHARED Options is in full swing.

Gratitude is due to the following:

- Schools Division Superintendent, Jonathan S. Dela Peña, PhD, Assistant Schools Division Superintendent Alicia E. Anghay, PhD, for authoring and buoying up this initiative to the fullest;
- CID Chief Lorebina C. Carrasco, and SGOD Chief Rosalio R. Vitorillo, for the consistent support to all activities in the SHARED Options;
- School principals and senior high school teachers from Bulua NHS, Lapasan NHS, Puerto NHS and Lumbia NHS, for the legwork that SHARED Options is always in vigor;
- Stakeholders who partnered in the launching and operation of SHARED Options, specifically to the Bureau of Jail Management and Penology-Cagayan de Oro City Jail and the Department of Health-Treatment and Rehabilitation Center-Cagayan de Oro City;

- Writers: Dyna F. Gorre, Leneth G, Udarbe, Mercygel R. Dangel and validators of the DLP learning activity sheets, to which this compilation is heavily attributable to, for their expertise and time spent in the workshops;
- Alternative Learning System implementers, for the technical assistance given to the sessions;
- Reproduction (LRMDS) Gemma P. Pajayon and Lanie M. Signo
- To all who in one way or another have contributed to the undertakings of SHARED Options.

Mabuhay ang mga mag-aaral! Ito ay para sa kanila, para sa bayan!

Ray Butch D. Mahinay, PhD
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MONITORING OF ACCOMPLISHED LEARNING ACTIVITY SHEETS

PHYSICAL SCIENCE

ACTIVITY NUMBER	LEARNING ACTIVITY TITLE	DATE	SCORE	ITEM
1	Formation of the light elements in the Big Bang Theory			
2	Evidence for the formation of heavier elements			
3	Nuclear fusion in stars			
4	Formation of elements heavier than Iron			
5	Ancient Greeks idea on the Atom			
6	Ancient Greeks idea on the Elements			
7	Contribution of Alchemists to Chemistry			
8	Structure of Atom and its subatomic particles			
9	Understanding the Structure of the Atom			
10	The nuclear model of the atom			
11	Synthesis of new elements			
12	Writing Nuclear Reaction			
13	John Dalton's Chemical Atomic Theory			
14	Other Discoveries after John Dalton proposed his Chemical Atomic Theory			
15	Polarity of a Molecule based on its Structure			
16	Relationship of Molecule's Polarity to its Properties			
17	Intermolecular Forces			
18	Effect of Intermolecular Forces on the Properties of Substances			
19	Properties of Materials used in Medical Implants and Prostheses			
20	Properties of Silly Putty (a construction supply) based on its Structure			
21	Basic Structure of Macromolecules			
22-23	Effects of Concentration on the Rate of Reaction			
24	Effects of Temperature on the Rate of Reaction			
25	Effects of Particle Size on the Rate of Reaction			
26	Catalyst and Its Effect to Reaction Rate			
27	Reactants and Products			
28	Percent Yield of a Reaction			
29	Limiting Reactants			
30	Energy and Chemical Reaction			
31	Harnessing Energy			
32	Contributions of Chemistry to Household and Personal Care Products			
33	Uses of Ingredients in Cleaning Agents			

ACTIVITY NUMBER	LEARNING ACTIVITY TITLE	DATE	SCORE	ITEM
34	Common Examples of Personal Care Products			
35	Major Ingredients of Cosmetics			
36	Precautionary Measures in Handling Cleaning Products and Cosmetics			
37	Types of Terrestrial Motion			
38	Greeks View on Earth's Shape			
39	Plato's Model of the Universe			
40	Comparing and Contrasting the Different models of the Universe			
41	Astronomical Phenomena before the Advent of Telescopes			
42	Models of Astronomical Phenomena			
43	Galileo's Astronomical Discoveries and Observations			
44	Brahe's Innovations in Observational Astronomy			
45	Kepler's 3rd Law of Planetary Motion of Objects			
46	Aristotelian vs Galilean Concept of Motion			
47	How Galileo used his Discoveries in Mechanics			
48	The Universal Laws of Physics			
49	Acceleration			
50	Newton's Three Laws of Motion			
51	Laws of Motion			
52	Law of Acceleration vs. Law of Universal Gravitation			
53	The Universal Laws in Physics			
54	Mass, Momentum and Energy Conservation			
55	Law of Conservation of Momentum			
56	How light is reflected, refracted, transmitted and absorbed			
57	Emergence of Light			
58	The Wave Theory of Light			
59	The Particle Theory of Light			
60	The Photon Theory of Light			
61	Wavelength, frequency, and energy relation			
62	The wavelength –speed-frequency relation			
63	Speed of light			
64	Wave-like Properties of Electrons			
65	Dispersion and Scattering			
66	Various light phenomena			
67	Electricity and Magnetism			
68	Hertz			
69	Special Relativity and the Big Bang			
70	Evolution of our Universe			

71	Doppler Effect			
72	Pluto			

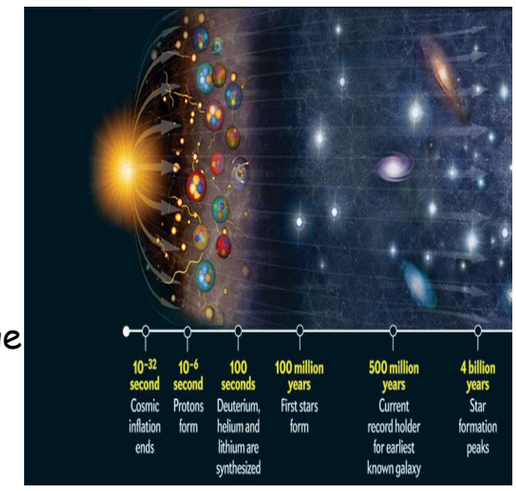
Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Formation of the Light Elements		
Learning Competency: Give evidence for and explain the formation of the light elements in the Big Bang theory		
References: Physical Science by CHED/PNU		LAS No.: 1

CONCEPT NOTES

Big Bang Theory – It was first proposed by George Lemaître and Edwin Hubble. The key stages of the Big Bang Theory explain how the elements were initially formed. These stages includes: (1) the universe may have begun as an infinitely hot and dense initial ***singularity***, a point with all of space, time, matter, and energy. (2) All of it then began to rapidly expand in the process known as ***inflation*** (3) As it expanded, the universe cools down. An excess of matter (electrons, protons, neutrons, and other particles) came to be highly energetic. Protons and neutrons come together to form different type of nuclei by ***nucleosynthesis or nuclear fusion*** (4) electrons started to bind to ionized protons and nuclei forming neutral atoms in the process called ***recombination***.

Evidences of the formation of light element

1. Redshift - when the light from a galaxy which is moving away from you is observed the wavelength of the observed light appears longer, it moves towards the red end of the spectrum.
2. Relative abundance of He and H did not change much until today. Due to rapid cooling due to expansion, nucleosynthesis occurred and left us with mostly H isotopes (p, D, and T).
3. Cosmic microwave background (CMB) is a thermal radiation left as a result of recombination.



Exercise: Arrange the following stages of the Big Bang theory. Use 1 as the first stage and 5 as the last stage.

_____ 1. Electrons bind to ionized protons and nuclei to form neutral atoms.
_____ 2.As it expanded, the universe cools down.
_____ 3.Protons and neutrons come together to form nuclei by nucleosynthesis.
_____ 4.The universe may have begun as an infinitely hot and dense initial singularity.
_____ 5. After the Big Bang, all of it then began to rapidly expand in the process known as inflation.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Evidence for the formation of Heavier Elements		
Learning Competency: Give evidence for and describe the formation of heavier elements during star formation and evolution		
References: Physical Science by CHED/PNU		LAS No.: 2

CONCEPT NOTES

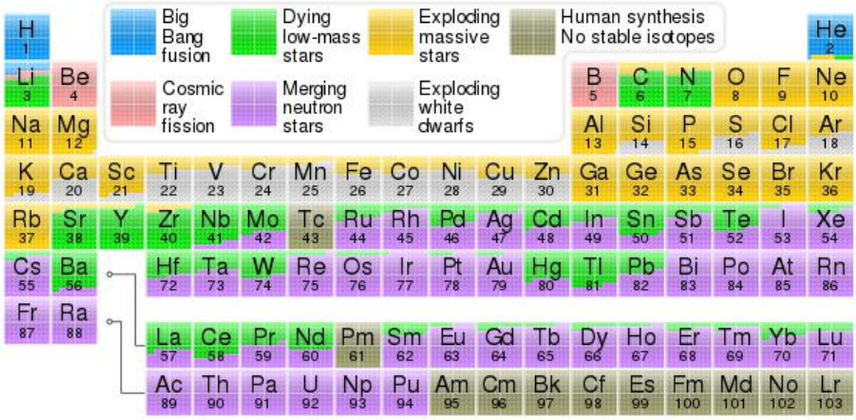
Nucleosynthesis - is the process of creating new atomic nuclei from preexisting nucleons (protons and neutrons).

Stellar evolution – is a process by which a star changes over the course of time

Stellar nucleosynthesis - is the process by which elements are created within stars by combining the protons and neutrons together from the nuclei of lighter elements. Main-sequence stars are formed from the first fusion process that occurs in the hydrogen core of stars.

Types of nuclear fusion reaction to produce heavier elements

1. Proton-proton chain – deuterium is produced by the weak interaction in a quark transformation which converts one of the protons to a neutron.
2. Triple Alpha process – is defined as the fusion of three alpha particles to form carbon.
3. Carbon-Nitrogen-Oxygen Cycle (CNO) – is a process of stellar nucleosynthesis in which stars on the *Main Sequence* fuse hydrogen into helium via a six-stage sequence of reactions.



Exercises: Encircle the letter of the correct answer.

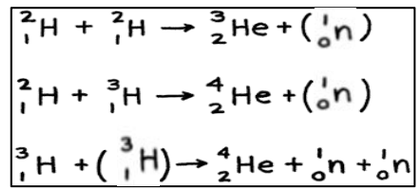
1. The proton-proton chain reaction is a fusion reaction that enables small stars like the sun to generate energy. Which statement is NOT true about proton-proton chain?
   A. Hydrogen nuclei fuse to produce carbon atoms.
   B. The p-p process occurs in three steps.
   C. Hydrogen nuclei combined to form helium atom.
   D. Four hydrogen nuclei are converted to one helium atom.
2. How many helium nuclei are involved in the triple alpha process?
   A. 1 B. 2 C. 3 D. 4
3. It is the process in which stars on the main sequence fuse hydrogen into helium via a six-stage sequence of reactions.
   A. CNO cycle C. Proton-proton chain
   B. Carbon fusion D. Triple alpha process

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Nuclear fusion in stars		
Learning Competency: Write the nuclear fusion reactions that take place in stars, which lead to the formation of new elements		
References: Physical Science for SHS by: Baya-ong, et.al		LAS No.: 3

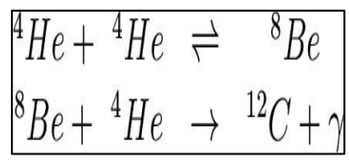
CONCEPT NOTES

Types of nuclear fusion in stars

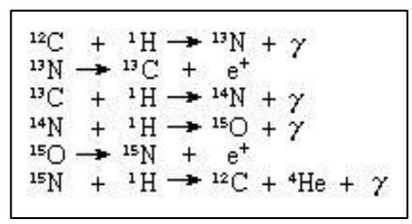
1. **Proton-proton chain**
   According to Beck (2006), the sun converts six million tons of hydrogen into helium every second. The formation is describe by the equation



2. **Triple Alpha process** – more and more alpha particles are fused to create heavier elements all the way to iron, making the core and star more massive.



3. **Carbon-Nitrogen-Oxygen Cycle (CNO)** – is a process of stellar nucleosynthesis in which stars on the *Main Sequence* fuse hydrogen into helium via a six-stage sequence of reactions.



Exercises: Answer the items below. Choose from the box the item that best completes each equation.

$^{7}_{4}Be$	$^{30}_{15}P$	$^{12}_{6}C$	γ	$^{27}_{12}Mg$	$^{19}_{9}F$

1. $^{3}_{2}He + {}^{4}_{2}He \longrightarrow$ _____ +
2. $^{27}_{13}Al + {}^{1}_{0}n \longrightarrow$ _____ + $^{1}_{1}H$
3. $^{12}_{6}C \longrightarrow {}^{12}_{6}C +$ _____
4. $^{27}_{13}Al + {}^{4}_{2}He \longrightarrow$ _____ + $^{1}_{0}n$
5. $^{18}_{8}O + {}^{1}_{1}H \longrightarrow \gamma +$ _____

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Formation of Elements Heavier than Iron		
Learning Competency: Describe how elements heavier than iron are formed		
References: Physical Science for SHS by Baya-ong, et.al		LAS No.: 4

CONCEPT NOTES

The *triple alpha process* (TAP) explains how elements up to iron are formed but beyond iron TAP could not account the formation of heavier elements. Neutron capture via the ***r and s – process*** explains the formation of elements heavier than iron.

Neutron capture – is a nuclear reaction in which an atomic nucleus collides with one or more neutrons to create heavier elements.

$$^{56}X_{26} + {}^{1}n_0 \longrightarrow {}^{57}X_{26}$$

s process – "slow process" if the time between neutron capture reaction is long compared to the time for the beta decay to occur.

$$^{59}Fe(\text{stable}) + {}^{1}n_0 \longrightarrow {}^{60}Fe(\text{stable})$$

$$^{60}Fe(\text{stable}) + {}^{1}n_0 \longrightarrow {}^{61}Fe(\text{stable}) \longrightarrow {}^{61}Co$$

r process – "rapid process" if the time between neutron capture is short compared to the time for the beta decay to occur.

$$^{59}Fe(\text{stable}) \longrightarrow {}^{59}Co$$

Exercises: In the space provided, write **TRUE** if the statement is correct and **FALSE** if NOT.

_____1. The triple alpha process explains the formation of elements heavier than iron.

_____2. If the time between neutron capture reactions is long compared to the time for the beta decay to occur the process is called the s-process.

_____3. The r-process is a process when the time between neutron capture reactions is short compared to the time for the beta decay to occur.

_____4. $^{62}Ni + {}^{1}n_0 \longrightarrow {}^{63}Ni$

_____5. Neutron capture is a nuclear reaction in which an atomic nucleus collides with one or more protons to create heavier elements.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Ancient Greeks Idea about the Atom		
Learning Competency: Describe the ideas of the Ancient Greeks about the atom		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 5

CONCEPT NOTES

The word atom comes from "atomos", an ancient Greek word meaning indivisible. The ideas on how atoms evolved from the era of ancient Greeks are as follows;

1. Leucippus and Democritus – claimed that everything is made up of indivisible particles called *atoms*.
2. John Dalton – provides several ideas based on his atomic theory.
3. J.J. Thomson – discovered the electron. He also suggested a model of the atom as a sphere of positive matter in which electrons are positioned by electrostatic forces.
4. Ernest Rutherford – believed that the atom had a central positive nucleus.
5. James Chadwick – proved the existence of neutrons.
6. R.A. Milikan – determined the unit charge of the electron in his oil drop experiment.
7. H.G.J. Moseley – proposed that electrons orbit the nucleus in defined energy level.
8. Niels Bohr – developed the wave mechanic theory that improves the physical nature of the atomic scale.
9. Louis de Broglie – discovered the quantum mechanics.
10. Werner Heisenberg – describes the location and energy level of an electron.

Exercises: Find and circle the Greek Philosophers' last names in the puzzle. Find them in all direction.

A	A	S	U	P	P	I	C	U	E	L	B	C	D
E	T	B	H	E	I	S	E	N	B	E	R	G	E
X	D	O	R	U	T	H	E	R	F	O	R	D	M
F	H	H	M	I	L	I	K	A	N	M	O	X	O
E	L	R	E	M	C	F	C	V	H	S	T	E	C
D	E	B	R	O	G	L	I	E	R	T	O	N	R
M	C	E	S	S	J	O	W	E	L	E	C	T	I
E	X	C	B	E	N	K	D	A	L	T	O	N	T
M	O	S	E	L	E	Y	A	E	N	E	R	G	U
C	L	I	N	Y	D	C	H	L	E	V	E	Y	S
H	A	N	I	S	N	U	C	L	E	U	S	E	E

Bohr

- Milikan
- Chadwick
- Dalton
- Moseley
- Heisenberg
- De Broglie
- Democritus
- Leucippus
- Rutherford

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Ancient Greeks ideas about Elements		
Learning Competency: Describe the ideas of the Ancient Greeks on the elements		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 6

CONCEPT NOTES

Ancient Greeks on the Elements

Democritus – thought that there were only four basic substances; air, water, earth, and fire, formed by a large number of very small particles called **atoms**.

- Air – atoms of air carry lightness and dryness
- Water – atoms of water takes the properties of "heaviness" and "wetness"
- Earth – bears the properties of "heaviness" and "dryness"
- Fire – were thought to be very mobile, "slippery and hot"

Greek Philosopher attempted to explain various transformations of matter as result from the mixture of atoms constituting matter. They assumed that the material of a growing plant is composed of water and earth atoms provided by the soil and atoms of fire provided by the rays of the sun.

Exercises: Encircle the letter of your answer.

1. Ancient Greeks believed that matter was composed of four basic elements. Which one of the following was NOT one of the four?
   A) Earth B) fire C) Gold D) Water
2. It bears the properties of heaviness and wetness.
   A) Air B) Earth C) Fire D) Water
3. These substance was thought to be very mobile.
   A) Air B) Earth C) Fire D) Water
4. Atoms of these substances where thought to be light and dry.
   A) Air B) Earth C) Fire D) Water
5. Atoms of these substances bear the property of being heavy and dry.
   A) Air B) Earth C) fire D) Water

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Contribution of Alchemists to Chemistry		
Learning Competency: Describe the contributions of the alchemists to the science of chemistry		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 7

CONCEPT NOTES

Alchemy played an important role in the evolution of modern science. It was a philosophical and spiritual field of study that combine chemistry with metalwork. Its goal were to: (1) find the elixir of life (2) find or make the substance called the "philosopher's stone", (3) discover the relationship of humans to the cosmos and use that understanding to improve the human spirit.

Development of Alchemy

- In the East, in India and China, Alchemy started before the Common Era (CE). It began with meditation and medicine to purify the spirit and body.
- In the West, alchemy evolved from Egyptian metallurgy.
- **Aristotle** (384-322BCE) believed all matter is made of the four elements.
- **Jabir ibn Hayyan** believed that the key difference between metals was how much mercury and sulphur they contained.
- **Paracelsus** proposed that a balance of mercury, sulfur, and salt was necessary to maintain health.
- **Robert Boyle** (1662) studied the transmutation of elements through changing gold into mercury by means of "quicksilver".
- Late 18th century, the field of chemistry had fully separated from traditional alchemy. **Antoine Lavoisier** wrote his first true chemistry book and Dmitri Mendeleev organize all elements in the periodic table.

Exercise: In the space provided, write **True** if the statement is correct and **False** if not.

_____1.Alchemy is philosophical and spiritual field of study that combine chemistry with metalwork.
_____2.In the East, alchemy was used in metallurgy.
_____3.Robert Boyle studied the transmutation of elements by means of quicksilver.
_____4.Jabir ibn Hayyan believed that a balance of mercury, sulfur, and salt was necessary to maintain health.
_____5.The field of chemistry had fully separated from traditional alchemy in the early 18th century.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Structure of the Atom and its Subatomic Particles		
Learning Competency: Point out the main ideas in the discovery of the structure of the atom and its subatomic particles		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 8

CONCEPT NOTES

Atom is defined as the smallest particle of an element that retains the chemical properties of the element. It is made up of two regions: the nucleus and the electron cloud. The nucleus is located near the center of an atom. The subatomic particles are: (1) proton – positively charged particles (2) electron – negatively charged particle (3) neutron – neutral particle.

The first subatomic particle was discovered by Joseph John Thomson in his cathode ray tube experiments. He was able to measure the ration of the charge of the cathode ray particles to their mass.

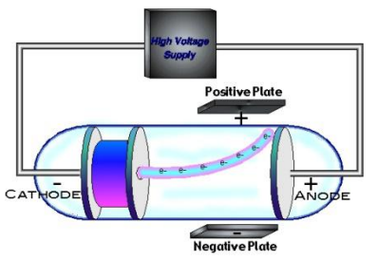


Table 2.1 Subatomic Particles

Particle	Symbol	Approximate Relative Mass	Relative Charge	Location in Atom
Proton	p^+	1	1+	Inside nucleus
Neutron	n	1	0	Inside nucleus
Electron	e^-	0.000545	1−	Outside nucleus

Exercises: Encircle the letter of your answer.

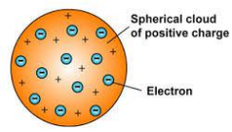
1. The negatively charged particle of the atom is _____.
   A. electrode B. electron C. neutron D. proton
2. He discovered the electron through a cathode ray tube to study the nature of the electric discharges.
   A. James Chadwick C. J.J. Thompson
   B. John Dalton D. Neils Bohr
3. All of the following are the subatomic particles except
   A. electrode B. electron C. neutron D. proton
4. Which subatomic particles are located in the nucleus of a carbon atom?
   A. Protons and electrons C. electrons and neutrons
   B. protons and neutrons D. neutrons only
5. Which subatomic particle has no charge?
   A. Alpha particle C. electron
   B. Beta particle D. neutron

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Understanding the Structure of the Atom		
Learning Competency: Cite the contributions of J.J. Thomson, Ernest Rutherford, Henry Moseley, and Niels Bohr to the understanding of the structure of the atom		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 9

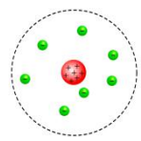
CONCEPT NOTES

The Structure of the Atom

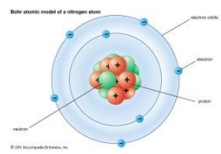
- Joseph John Thomson – He conducted a series of experiments to study the nature of electric discharge in a high-vacuum cathode ray tube. He suggested a model of the atom as a sphere of positive matter in which electrons are positioned by electrostatic forces.



- Ernest Rutherford – He conducted the *Gold foil experiment* in which alpha particles are fired into gas atoms, a few alpha particles were deflected, which implies a dense, positively charged central region containing most of the atomic mass.



- Henry Moseley – He used a self-built equipment to verify that every element's identity is distinctively determined by the number of protons it has.
- Neils Bohr –He developed and published his model of the atomic structure which depicts the atom as a small, positively charged nucleus surrounded by negatively-charged electrons that travel in circular orbits around the nucleus.



Exercises: Identify the scientist who made the following contribution on the structure of the atom.

Rutherford	Bohr	Moseley	Thomson	Democritus

_____**1.** The atom is a sphere of positive matter

_____ 2. His experiment implies that an atom has a dense, positively charged center in which most of the mass of the atom is contained.

_____3. The atom is a small, positively charged nucleus surrounded by negatively-charged electrons

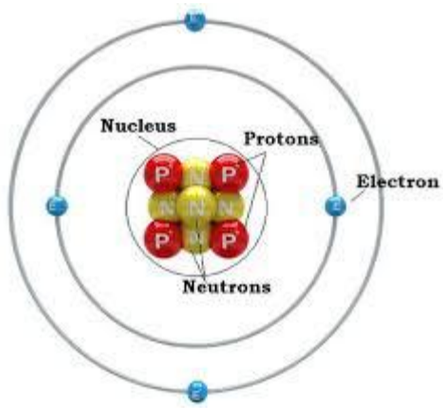
_____4. Every element's identity is distinctively determined by the number of protons it has

_____5. He conducted a series of experiments to study the nature of electric discharge in a high-vacuum cathode ray tube.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: The Nuclear Model of the Atom		
Learning Competency: Describe the nuclear model of the atom and the location of its major components (protons, neutrons, and electrons)		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 10

CONCEPT NOTES

The Nuclear Model of the Atom



- The atom consists of a dense positive center called the nucleus and is orbited by negatively charged electrons.
- The nuclear model of the atom was first proposed by Ernest Rutherford while working under JJ Thomson.
- Atom consists of three subatomic particles: proton, electron, neutron
- The center of the atom is called the nucleus. It contains most of the mass of an atom. It is composed of positively charged protons and neutrons which are neutral in charge.
- Negatively charged electrons orbit the nucleus at a great distance compared to the size of the nucleus.
- Most of the atom consists of an empty space.
- In a neutral atom, the number of positively charged proton is equal to the number of negatively charged electrons. Example: An atom of carbon has 6 protons and 6 electrons.

Exercises: Modified True or False.

Write True if the statement is correct. If false, **change** the underlined word or group of words to make the whole statement correct.

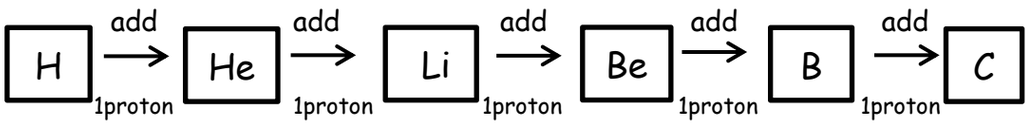
_____1. Most of the atom consists of an empty space.
_____2. The nucleus of the atom composed of the protons and neutrons.
_____3. The center of the atom is called nucleus.
_____4. J.J. Thomson proposed the nuclear model of the atom.
_____5. In a neutral atom, the number of protons is greater than the number of electrons.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: Synthesis of New elements		
Learning Competency: Explain how the concept of atomic number led to the synthesis of new elements in the laboratory		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 11

CONCEPT NOTES

- Moseley discovered using X-rays as a good fingerprint for any element in a sample that the basic difference between elements is the number of protons they have. He realized that an element is defined by its number of protons.

- Addition of proton produces a new element.



- The diagram above shows that hydrogen has one proton, so its' atomic number is one. Adding one proton makes it Helium with an atomic number 2. If another proton is added it will become Lithium with atomic number 3.

- Moseley arranged the elements in the periodic table by their number of protons rather than their atomic weights.

Exercise: Write **True** if the statement is correct and **False** if not.

_____1. The subatomic particle proton determines the identity of the element.
_____2. Moseley arranged the elements in the periodic table in increasing atomic weights.
_____3. Adding one electron on the atom produced a new element.
_____4. Moseley used X-rays as fingerprints for any elements present in the sample.
_____5. The basic difference between elements is the number of neutrons they Have.
_____6. Adding one proton on Hydrogen makes it Helium with atomic number 2.
_____7. An element is defined by its number of protons.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Nuclear Reactions in the Synthesis of New Elements		
Lesson Competency: Write the nuclear reactions involved in the synthesis of new elements. (S11/12PS-IIIb-12)		
References : Teaching Guide for Senior High School – Physical Sciences		LAS No.: 12

CONCEPT NOTES

In a balanced nuclear reaction, the sum of the mass numbers and the sum of the atomic numbers for the nuclei of the reactant and the product must be equal.

Balancing nuclear reaction:

Total mass number of reactant: 251

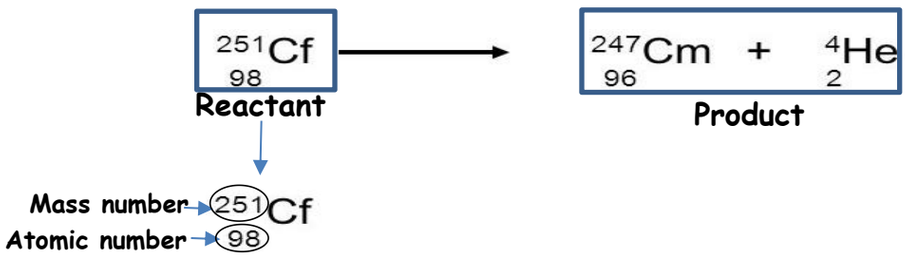
Total mass number of product: 247 + 4 = 251

$$^{251}_{98}Cf \longrightarrow {}^{247}_{96}Cm + {}^{4}_{2}He$$

Atomic number of reactant: 98

Atomic number of product: 96 + 2 = 98

Components of a nuclear reaction:



EXERCISES

Complete the nuclear reactions below by supplying the correct atomic and mass number of the underlined element.

1. $^{242}_{94}Pu \longrightarrow {}^{4}_{2}He + \underline{\quad U \quad}$

2. $\underline{\quad P \quad} \longrightarrow {}^{32}_{16}S + {}^{0}_{-1}e$

3. $^{252}_{98}Cf + \underline{\quad B \quad} \longrightarrow 3\,{}^{1}_{0}n + {}^{259}_{103}Lr$

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title :Understanding the Concept of Chemical Elements		
Lesson Competency: Cite the contribution of John Dalton toward the understanding of the concept of the chemical elements. (S11/12PS-IIIc-13)		
References : Teaching Guide for Senior High School – Physical Sciences pages 51-52		LAS No.: 13

CONCEPT NOTES

John Dalton (1766-1844), further develop the concept of the atom. His Chemical Atomic Theory (merged concepts of atom and elements) states that:

- Gases, and all chemically inseparable elements, are made of atoms.
- The atoms of an element are identical in their masses.
- Atoms of different elements have different masses.
- Atoms combine in small, whole number ratios.

EXERCISES

Write the word **TRUE** on the space provided if the statement is a concept of chemical elements based on John Dalton's Chemical Atomic Theory. Write the word **FALSE** if not.

_____1. Elements were made of the same atoms and had properties unique to the element, while chemical compounds were made of different combined or compounded atoms, and exhibited different sets of properties.

_____ 2. One could compute the weights of elements (and their atoms) by looking at comparable amounts of the compounds they formed.

_____3. One could compute atomic weights compared to a reference.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Discovery of Other Elements through Dalton's Theory		
Lesson Competency: Explain how Dalton's theory contributed to the discovery of other elements. (S11/12PS-IIIc-14)		
References : Teaching Guide for Senior High School – Physical Sciences pages 52-53		LAS No.: 14

CONCEPT NOTES

After John Dalton developed his Chemical Atomic Theory, more discovery arose. Some of it are the following:

- **Joseph Gay-Lussac** determined that oxygen gas was made of 2 atoms of oxygen and took the form of a molecule instead of an atom.

- **Amedeo Avogadro** (the man who conceptualized the mole) determined that equivalent volumes of two gases under similar conditions contained equal numbers of particles, and that differences in their masses was a result of a difference in their molecular mass.

- **Dmitri Mendeleev** published a periodic table of elements that ordered elements according to their atomic weights. He noted patterns in their properties that enabled him to predict the discovery of other elements. His table became the basis of the modern Periodic Table.

Many other scientists in the 19th century discovered more elements.

EXERCISES

Match the scientist to his discovery.

Scientist	Discovery
1. Joseph Gay – Lussac	a. Periodic Table of Elements
2. Amedeo Avogadro	b. Chemical formula O_2
3. Dmitri Mendeleev	c. Chemical Atomic Theory
	d. Mole concept

Name:	Date:	Score:
Subject :Physical Science		
Lesson Title : Structure of Polar and Non-polar Molecules		
Lesson Competency: Determine if a molecule is polar or non-polar given its structure. (S11/12PS-IIIc-15)		
References : Teaching Guide for Senior High School – Physical Sciences pages 71-72		LAS No.: 15

CONCEPT NOTES

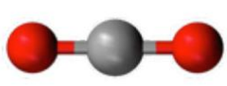
Polarity underlies several physical properties of molecules like surface tension, boiling point, melting point and solubility. Polarity of a molecule can be determined through its molecular structure.

Non polar molecule has a structure that is completely symmetrical. Symmetrical geometric shapes are linear, trigonal planar, tetrahedral and octahedral.

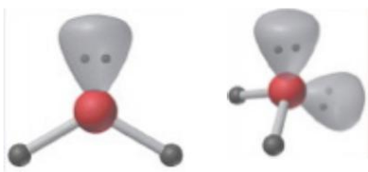
Polar molecule has a structure that is completely not symmetrical. Non symmetrical geometric shapes are bent and trigonal pyramidal.

EXERCISES

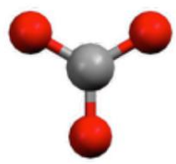
Given some molecular geometry, identify if it is a **polar molecule** or a **non polar molecule**. Write your answer on the space provided below each shape.



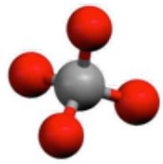
Linear



Bent

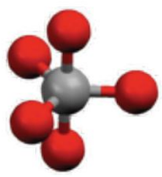


Trigonal Planar

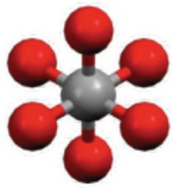


Tetrahedral

1. _____ 2. _____ 3. _____ 4. _____



Trigonal bipyramidal



Octahedral

5. _____ 6. _____

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Polarity of Molecules and Its Properties		
Lesson Competency: Relate the polarity of a molecule to its properties. (S11/12PS-IIIc-16)		
References : Teaching Guide for Senior High School – Physical Sciences page 75		LAS No.: 16

CONCEPT NOTES

Polarity underlies some properties of molecules. Practical manifestations of polarity is solubility and miscibility. **Solubility** refers to the ability of a solute to dissolve in a certain amount of solvent. **Miscibility** is the ability of two liquids to mix in all proportions.

General rule: "like dissolves like" or "like mixes with like." This refers to substances being able to mix due to their same polarity.

EXERCISES

Determine if the following paired substances will mix together or not. Write the word **Miscible** if the following paired substances can be mixed together **and Not Miscible** if they will not mix together. Write your answer on the space provided.

Given:

Water – polar
Vinegar – polar
Gasoline – non polar
Oil – non polar

_____ 1.Water + Vinegar
_____ 2. Gasoline + Oil
_____ 3. Water + Gasoline
_____ 4. Vinegar + Gasoline
_____ 5. Vinegar + Oil
_____ 6. Water + Oil

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Types of Intermolecular Forces		
Lesson Competency: Describe the general types of intermolecular forces. (S11/12PS-IIIc-17) Give the type of intermolecular forces in the properties of substances. (S11/12PS-IIId -e-18)		
References : Teaching Guide for Senior High School – Physical Sciences pages 83 – 88, 97 - 98		LAS No.: 17

CONCEPT NOTES

Intermolecular forces are forces that form between molecules, atoms, or ions.

Four main types of intermolecular forces:

1. **Ion-ion interaction** exists between oppositely charged ions. It occurs between ionic compounds. This is the strongest intermolecular force.
2. **Dipole-dipole interaction** occurs between polar molecules. This is due to the partial positive pole and the partial negative pole of the molecule.
3. **Hydrogen bond** is a very strong dipole-dipole interaction. Hydrogen bond occurs in polar molecules containing H and any one of the highly electronegative elements, in particular F, O, N.
4. **Dispersion Forces** or **London Forces** (in honor of Fritz London) is present in all molecules. It is the only force present in nonpolar molecules. Without dispersion forces substances would not be able to condense to liquid and solid phase.

EXERCISES

Determine the type of intermolecular force described. Write your answer on the space provided.

_____ 1. Force responsible for condensation.
_____ 2. Force exist when Na^{+1} and Cl^{-1} combined.
_____ 3. The strongest among the four main intermolecular force.
_____ 4. Occurs between polar molecules.
_____ 5. Force present in nonpolar molecules.
_____ 6. It has a strong dipole-dipole interaction.
_____ 7. Occurs in polar molecules containing hydrogen atom.
_____ 8. Occurs between ions with opposite charges.
_____ 9. Intermolecular force due to the partial positive pole and the partial negative pole of the molecule.
_____ 10. Intermolecular force existing in the molecule of HCl.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title :Effect of Intermolecular Forces on the Substance's Properties		
Lesson Competency: Explain the effect of intermolecular forces on the properties of substances. (S11/12PS-IIId -e-19)		
References : Teaching Guide for Senior High School – Physical Sciences pages 97 - 98		LAS No.: 18

CONCEPT NOTES

The following are some properties of substances related to its intermolecular forces.

1. **Boiling point** - solutions with stronger intermolecular forces (IMF) have higher boiling points than solutions with weaker intermolecular forces. The solutions with stronger IMF holds it molecules together stronger hence making it harder for the solution to evaporate and eventually boil.
2. **Surface tension** - this is a phenomenon wherein a liquid creates a seemingly thin film on its surface. The stronger the IMF, the stronger is its surface tension.
3. **Capillary action** - this is the ability of fluids to rise in narrow tubes. The IMF between the surface of the tube and the liquid allows the liquid to rise provided that the IMF between the surface and the liquid is stronger than the cohesive forces within the liquid.
4. **Viscosity** - this is the measure a liquid's resistance to flow. Generally, the stronger is the IMF in the liquid the more viscous it is.

EXERCISES

Identify what property is being exhibited by each phenomena. Write your answer on the space provided.

_____ 1. The ability of plants to deliver nutrients from roots to its leaves
_____ 2. Paper clip floating in water
_____ 3. Evaporation of water
_____ 4. Basilisk lizard walking in the surface of water
_____ 5. The property of honey once poured
_____ 6. Water striders striding in the surface of water

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Relating Properties of Matter with Its Structure		
Lesson Competency: Explain how the uses of the following materials depend on their properties: a.) medical implants, prosthesis b.) sports equipment c.) electronic devices d.) construction supplies for buildings and furniture e.) household gadgets. (S11/12PS-IIId -e-20)		
References : https://www.slideshare.net/JeromeJerome1/applications-of-chemistry-in-everyday-life		LAS No.: 19

CONCEPT NOTES

Nowadays, **material science and engineering** is a growing field, which takes the advantage of the physical and chemical properties of different materials.

Medical Implants and prostheses are designed to aid a person by acting as a substitute to a missing part, support an injured structure, or improve an existing part of the body. Examples of prostheses include artificial pacemaker, cochlear grafts, dental implants, and breast implants.

Materials used in making implants and prostheses should be inert to avoid adverse reactions in the body. Most importantly, implants for support must have a strong intermolecular forces to be durable.

The type of breast implant depends on the filler material; some have saline solution as the filler, while others have silicon gel. For **saline filled implants**, ion-dipole force exist. For **silicon gel-based implants**, dipole-induced- dipole intermolecular force of attraction are present; this is because silicon is semi-metal.

EXERCISES

1. Give at least three important purposes of medical implants and prostheses.
2. Give at least 3 examples of prosthesis.
3. What should the materials in making implants and prostheses must possess?

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Effect of the Structure of Matter to its Properties		
Lesson Competency: Explain how the properties of the materials for medical implants, prosthesis, sports equipment, electronic devices, construction supplies for buildings and furniture and household gadgets are determined by their structure. (S11/12PS-IIId -e-21)		
References : Teaching Guide for Senior High School – Physical Sciences page 106		LAS No.: 20

CONCEPT NOTES

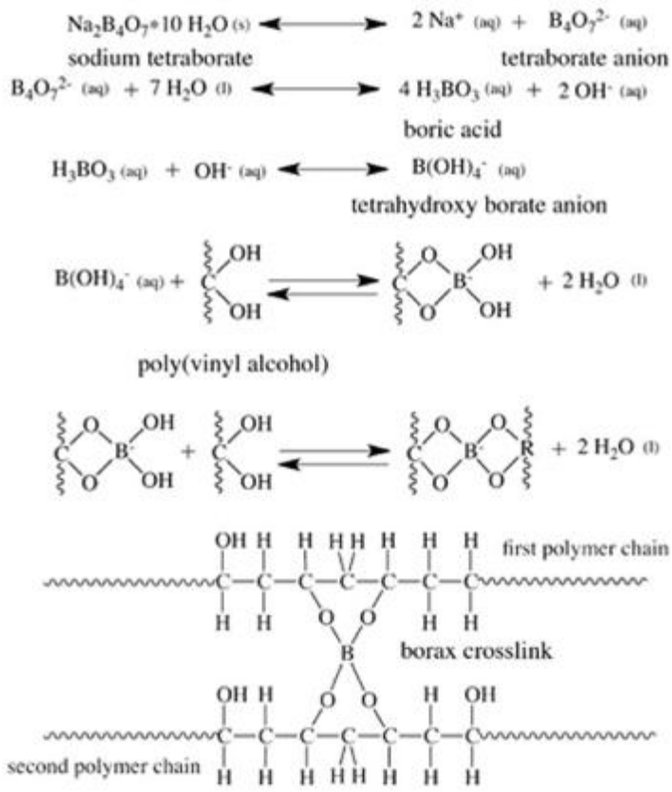
Silly Putty was invented during World War II by **James Wright** of General Electric while trying to make synthetic rubber. During the war, there was lack of rubber supply. There was a need in the US to produce more rubber for boots and tires. His discovery did not meet the standard but it was a hit with children as a toy.

The mixture of glue and borax creates a polymer. The borax creates crosslinks between PVA polymer chains allowing it to change its properties.

EXERCISES

Copy the following chemical reactions and structures on the formation of Silly Putty.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Effect of the Structure of Matter to its Properties		
Lesson Competency: Explain how the properties of the materials for medical implants, prosthesis, sports equipment, electronic devices, construction supplies for buildings and furniture and household gadgets are determined by their structure. (S11/12PS-IIId -e-21)		
References : Teaching Guide for Senior High School – Physical Sciences page 106		LAS No.: 20



Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Structures, Properties and Functions of Biological Macromolecules		
Lesson Competency: Explain how the structures of biological macromolecules such as carbohydrates, lipids, nucleic acid, and proteins determine their properties and functions. (S11/12PS-IIId -e-22)		
References : Teaching Guide for Senior High School – Physical Sciences page 106		LAS No.: 21

CONCEPT NOTES

Carbohydrates are the primary energy source of the human body. The different saccharides that humans eat are converted to glucose which can be readily used by the body.

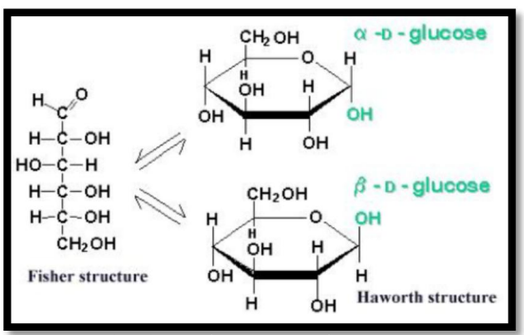
Proteins are composed of four elements, namely, carbon, hydrogen, oxygen and nitrogen. Proteins are made up of amino acids. An amino acid is a molecule that has an amine and a carboxyl group.

Lipids are a family of biomolecules having varied structures. They are grouped together simply because of their hydrophilic property (water-fearing).

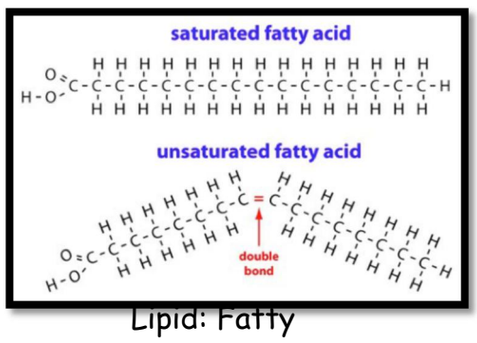
Nucleic acids play an essential role in the storage, transfer, and expression of genetic information. If carbohydrates are composed of saccharide units, proteins of amino acids, and lipids of fatty acids, nucleic acids are composed of nucleotides. A nucleotide has three parts: Nitrogenous base, Five-carbon carbohydrate or sugar; and Phosphate group.

EXERCISES

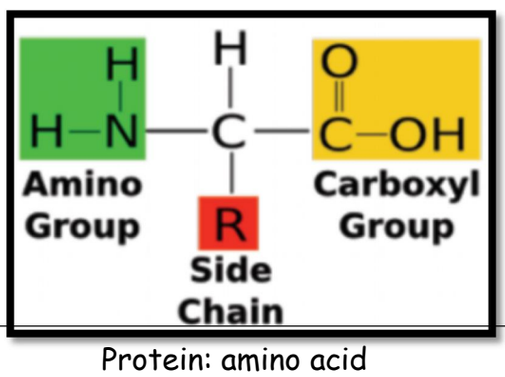
Draw some common / basic structure of the four biomolecules.



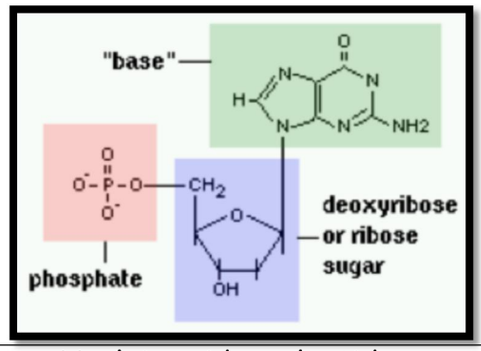
Carboydrates: glucose



Lipid: Fatty



Protein: amino acid

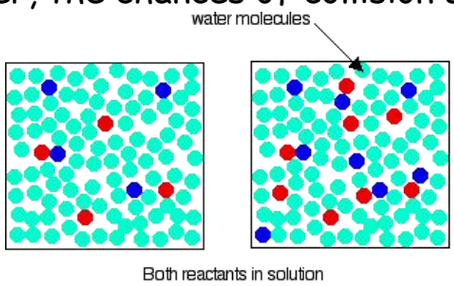


Nucleic acid: nucleotide

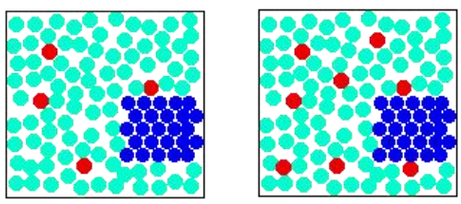
Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Effects of Concentration on the Rate of Reaction		
Lesson Competency : Use the simple collision theory to explain the effects of concentrations on the rate of reaction		
References : https://education.seattlepi.com/examples-strong-effect-temperature-chemical-reactions-4731.html		LAS No. 22

CONCEPT NOTES

For many reactions involving liquids or gases, increasing the concentration of the reactants increases the rate of reaction. In a few cases, increasing the concentration of one of the reactants may have little noticeable effect of the rate. In collisions involving two particles, the same argument applies whether the reaction involves collision between two different particles or two of the same particle. In order for any reaction to happen, those particles must first collide. This is true whether both particles are in solution, or whether one is in solution and the other a solid. If the concentration is higher, the chances of collision are greater.



Both reactants in solution


One reactant is a solid

EXERCISES:

Write T if the statement is TRUE and F if the statement is FALSE.

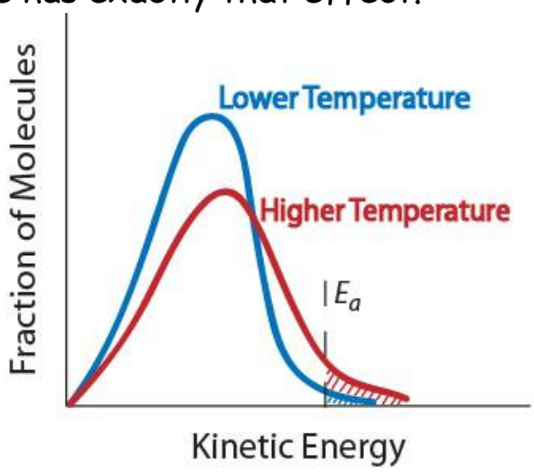
__1.The higher the concentration of a solution, the greater is the rate of reaction.
__2.The greater is the collision of particles, the slower is the rate of reaction.
__3.The lower is the water concentration in a salt solution, the smaller is the rate of reaction.
__4.The greater is the collision of particles in a solution, the higher is the rate of reaction.

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Effects of Concentration on the Rate of Reaction		
Lesson Competency : Use the simple collision theory to explain the effects of concentrations on the rate of reaction		
References : https://education.seattlepi.com/examples-strong-effect-temperature-chemical-reactions-4731.html		LAS No. 22

CONCEPT NOTES

As you increase the temperature, the rate of reaction increases. As a rough approximation, for many reactions happening at around room temperature, the rate of reaction doubles for every 10°C rise in temperature. Almost any other reaction you care to name will happen faster if you heat it - either in the lab, or in industry. Particles can only react when they collide. If you heat a substance, the particles move faster and so collide more frequently. That will speed up the rate of reaction.

To speed up the reaction, you need to increase the number of the very energetic particles, those with energies equal to or greater than the activation energy. Increasing the temperature has exactly that effect.



EXERCISES:

` Write T if the statement is TRUE and F if the sentence is FALSE.

__1. An increase in temperature will raise the average kinetic energy of the reactant molecules.

__2. A greater proportion of molecules will have the minimum energy necessary for an effective collision to occur.

__3. Reactions occur when two reactant molecules effectively collide, each having minimum energy and correct orientation.

__4. As you heat a substance, its molecules move slower and are more likely to react.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Effects of Concentration on the Rate of Reaction		
Lesson Competency : Use the simple collision theory to explain the effects of concentrations on the rate of reaction		
References : shorturl.at/emop6 shorturl.at/mnxA7		LAS No.: 23

CONCEPT NOTES

For many reactions involving liquids or gases, increasing the concentration of the reactants increases the rate of reaction. In a few cases, increasing the concentration of one of the reactants may have little noticeable effect of the rate.

EXERCISES

Investigate the effect of concentration on the rate of a reaction. Use the different concentrations of vinegar and baking soda for these reaction.

1. In one cup, use pure vinegar (3mL) and place one spoonful of baking soda.
2. In another cup, add pure vinegar (1.5mL) and water (1.5 mL) before you add the spoon full of baking soda.
3. Make an observation.

Questions

1. Which reaction had the fastest rate?

Answer: _____

2. Explain what could be occurring at the molecular level in each example. (How are the molecules moving or acting?)

Answer: _____

3.Why are high concentration reactions faster than low concentrations?

Answer: _____

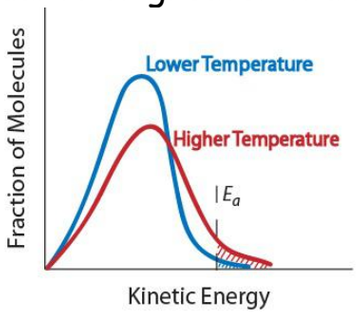
Additional activity: Watch the simulation of this activity using the link,
http://www.freezeray.com/flashFiles/RatesOfReactionConc.swf

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Effects of Temperature on the Rate of Reaction		
Lesson Competency : Use the simple collision theory to explain the effects of temperature on the rate of reaction		
References : https://www.chemguide.co.uk/physical/basicrates/temperature.html https://opentextbc.ca/introductorychemistry/chapter/factors-that-affect-the-rate-of-reactions-2/		LAS No. 24

CONCEPT NOTES

As you increase the temperature, the rate of reaction increases. As a rough approximation, for many reactions happening at around room temperature, the rate of reaction doubles for every 10°C rise in temperature. Almost any other reaction you care to name will happen faster if you heat it - either in the lab, or in industry. Particles can only react when they collide. If you heat a substance, the particles move faster and so collide more frequently. That will speed up the rate of reaction.

To speed up the reaction, you need to increase the number of the very energetic particles, those with energies equal to or greater than the activation energy.



EXERCISES:

I.Write T if the statement is TRUE and F if the sentence is FALSE.

__1. An increase in temperature will raise the average kinetic energy of the reactant molecules.

__2. A greater proportion of molecules will have the minimum energy necessary for an effective collision to occur.

__3. As you heat a substance, its molecules move slower and are more likely to react.

__4. Collisions tend to be more effective at higher temperatures because the molecules strike each other at higher velocities.

II. Label the following as fastest, fast, or slowest in terms of reaction rate.

_____a. Hot water (70-80°C))

_____b. Room temperature water (30-35°C)

_____c. Cold water (water with ice)

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Effects of Particle Size on the Rate of Reaction		
Lesson Competency : Use the simple collision theory to explain the effects of particle size on the rate of reaction		
References : http://teachtogether.chedk12.com/teaching_guides/view/276#section5		LAS No, 25

CONCEPT NOTES

The effective radius in collision theory is given by the sum of the participating reactant's radiuses. Thus, reaction rate is linearly dependent on particle size. Smaller reactant particles provide a greater surface area which increases the chances for particle collisions so the reaction rate increases. An experiment would show that more crushed eggshells reacted with HCl than the uncrushed eggshells. Therefore, it can be concluded that decreasing particle size or increasing surface area results to faster reaction rate. In collision theory, an increase in surface area relates to more particles being available for collision.

EXERCISES

Supply the missing link by choosing from the options inside the box.

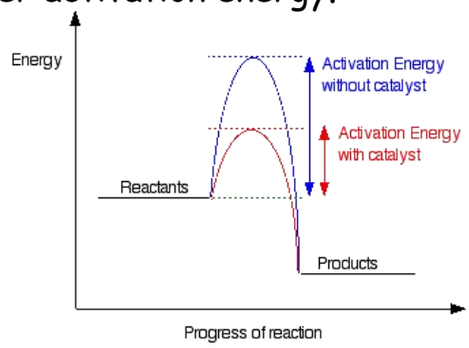
Collisions
Surface area
Rate of reaction
Effective
Kinetic energy
Size particles

The effect of particle size reduces the (1)_____, increases the (2) _____, increases the number of (3) _____per second, increases the number of (4) _____collisions, thereby increasing the (5)_____.

CONCEPT NOTES

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Catalyst and Its Effect to Reaction Rate		
Lesson Competency : Define a catalyst and describe how it affects reaction rate		
References : https://study.com/academy/practice/quiz-worksheet-catalysts-reaction-rates.html https://www.chemguide.co.uk/physical/basicrates/catalyst.html		LAS NO. 26

A catalyst lowers the activation energy, speeds up the reaction, takes part in the reaction, but comes out unchanged. When the reaction has finished, you would have exactly the same mass of catalyst as you had at the beginning. A catalyst provides an alternative route for the reaction with lower activation energy.



EXERCISES

1. A homogenous catalyst
   a.is in the same phase as the reactants
   b.is in the same phase as the products
   c.is in a different phase as the reactants
   d.is in a different phase as the products
   e.none of these options
2. The Activation Energy of a reaction
   a.is the overall energy change of a reaction
   b.is the energy barrier that has to be crossed to initiate a reaction
   c.is affected by catalysts
   d.is unaffected by catalysts
   e.both the energy barrier that has to be crossed to initiate a reaction and is affected by catalysts
3. Define in your own words what the role of a catalyst is. How does it affect the rate of reaction.

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Reactants and Products: Calculating the amount of substances used or produced in a chermical reaction		
Lesson Competency : Calculate the amount of substances used or produced in a chemical reaction		
References : http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch3/equations.html		LAS NO. 27

CONCEPT NOTES

Because atoms are neither created nor destroyed in a chemical reaction, the total mass of products in a reaction must be the same as the total mass of the reactants. Chemical reactions are described by chemical equations.

Example: The reaction between hydrogen and oxygen to form water is represented by the following equation.

$2\ H_2 + O_2 \text{-----} > 2\ H_2O$

Chemical equations must be balanced -- they must have the same number of atoms of each element on both sides of the equation. On the atomic scale, the following equation is balanced because the total mass of the reactants is equal to the mass of the products.

$$2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$$
$$2 \times 2\ \text{amu} + 32\ \text{amu} \quad 2 \times 18\ \text{amu}$$
$$36\ \text{amu} \qquad 36\ \text{amu}$$

On the macroscopic scale, it is balanced because the mass of two moles of hydrogen and one mole of oxygen is equal to the mass of two moles of water.

$$2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$$
$$2 \times 2\ g + 32\ g \quad 2 \times 18\ g$$
$$36\ g \qquad 36\ g$$

EXERCISES

Write a balanced equation for the reaction that occurs when ammonia burns in air to form nitrogen oxide and water.

_____ NH_3 + _____ O_2 _____ NO + _____ H_2O

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Percent Yield of a Reaction		
Lesson Competency : Calculate the percent yield of a reaction		
References : https://study.com/academy/lesson/how-to-calculate-percent-yield-definition-formula-example.html		LAS No. 28

CONCEPT NOTES

In chemistry, we have theoretical yield, which is the amount of the product calculated from the limiting reactant. The limiting reactant is the reactant in the chemical reaction which limits the amount of product that can be formed. The actual yield is the actual amount produced when the experiment or reaction is carried out.

The discrepancy between the theoretical yield and the actual yield can be calculated using the percent yield, which uses this formula:

$$\%\ Yield = \frac{Actual\ Yield}{Theoretical\ Yield} \times 100\%$$

:

Magnesium carbonate (MgCO3) decomposed to form 15 grams of MgO in the actual experiment. If the theoretical yield is 19 grams, what is the percent yield of MgO?

$$MgCO_3 \rightarrow MgO + CO_2$$

In this problem, you need to calculate the percent yield of magnesium oxide. To do this, you need to know the actual and theoretical yields of magnesium oxide. Both these values are already given to you in the question, so the only thing you need to do is to plug these values in the percent yield formula:

$$\%\ Yield = \frac{Actual\ Yield}{Theoretical\ Yield} \times 100\%$$

$$\%\ Yield = \frac{15\ g\ MgO}{19\ g\ MgO} \times 100\% = 79\ \%$$

$$\%\ \boldsymbol{Yield = 79\ \%}$$

EXERCISES

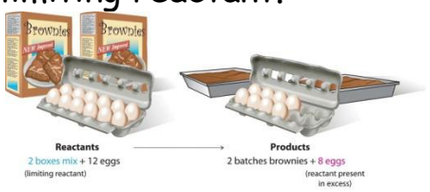
If the reaction of 30 grams of calcium carbonate ($CaCO_3$) produces 20 grams of calcium oxide (CaO), what is the percent yield for the following reaction?

$$CaCO_3 \rightarrow CaO + CO_2$$

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Limiting Reactants		
Lesson Competency : Determine the limiting reactant in a reaction and calculate the amount of product formed		
References https://chem.libretexts.org/LibreTexts/College_of_Marin/Marin%3A_CHEM_114_-_Introductory_Chemistry_(Daubenmire)/08%3A_Quantities_in_Chemical_Reactions/8.5%3A_Limiting_Reactant%2C_Theoretical_Yield%2C_and_Percent_Yield		LAS NO. 29

CONCEPT NOTES

More often, however, reactants are present in mole ratios that are not the same as the ratio of the coefficients in the balanced chemical equation. As a result, one or more of them will not be used up completely but will be left over when the reaction is completed. In this situation, the amount of product that can be obtained is limited by the amount of only one of the reactants. The reactant that restricts the amount of product obtained is called the limiting reactant.



As an example consider the balanced equation

$$4C_2H_3Br_3 + 11O_2 \rightarrow 8CO_2 + 6H_2O + 6Br_2 \quad (8.5.5)$$

What is the limiting reactant if 76.4 grams of $C_2H_3Br_3$ reacted with 49.1 grams of O_2?

Solution

Using Approach 1:

Step 1: Balance the chemical equation.

4 mol $C_2H_3Br_3$ to 11 mol O_2 to 6 mol H_2O to 6 mol Br_2

Step 2: Convert all given information into moles.

$$76.4g\ C_2H_3Br_3 \times \frac{1mol\ C_2H_3Br_3}{266.72g\ C_2H_3Br_3} = 0.286mol\ C_2H_3Br_3$$

$$49.1gO2 \times \frac{1molO_2}{32.00gO_2} = 1.53molO_2$$

Step 3: Calculate the mole ratio from the given information. Compare the calculated ratio to the actual ratio. Assuming that all of the oxygen is used up,

$$1.53molO_2 \times \frac{4mol\ C_2H_3Br_3}{11molO_2} = 0.556\ mol\ C_2H_3Br_3 \text{ are required.}$$

Conclusion: Because 0.556 moles of $C_2H_3Br_3$ required > 0.286 moles of $C_2H_3Br_3$ available, $C_2H_3Br_3$ is the limiting reactant.

EXERCISES

In the reaction of magnesium metal and oxygen, calculate the mass of magnesium oxide that can be produced if 2.40 g Mg reacts with 10.0 g O_2.

$$2\ Mg\ (s) + O2\ (g) \rightarrow 2\ MgO\ (s)$$

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Energy and Chemical Reaction		
Lesson Competency : Recognize that energy is released or absorbed during a chemical reaction		
References : https://www.siyavula.com/read/science/grade-11/energy-and-chemical-change/12-energy-and-chemical-change-01		LAS NO. 30

CONCEPT NOTES

All chemical reactions involve energy changes. In some reactions, we are able to observe these energy changes as either an increase or a decrease in the overall energy of the system.

In some reactions, the energy that must be absorbed to break the bonds in the reactants, is less than the energy that is released when the new bonds of the products are formed. This means that in the overall reaction, energy is released as either heat or light. This type of reaction is called an **exothermic reaction**.

In other reactions, the energy that must be absorbed to break the bonds in the reactants, is more than the energy that is released when the new bonds in the products are formed. This means that in the overall reaction, energy must be absorbed from the surroundings. This type of reaction is known as an **endothermic reaction**.

EXERCISES

I.Classify the following processes as either endothermic or exothermic reaction.

_____1.Photosynthesis
_____2.Respiration
_____3.Combustion
_____4.Decomposition of limestone

II. State whether energy is absorbed in or released in each of the following situations:

_____1. The bond between hydrogen and chlorine in a molecule of hydrogen chloride breaks.
_____2. A bond is formed between hydrogen and fluorine to form a molecule of hydrogen fluoride.
_____3. A molecule of nitrogen (N2) is formed.
_____4. A molecule of carbon monoxide breaks apart.
_____5. Reactants react to give products and energy.

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Harnessing Energy from Different Sources		
Lesson Competency : Describe how energy is harnessed from different sources		
References : https://www.teachengineering.org/lessons/view/cub_environ_lesson09 https://www.factmonster.com/science/energy/types-energy		LAS NO. 31

CONCEPT NOTES

Energy is the power we use for transportation, for heat and light in our homes and for the manufacture of all kinds of products. There are two sources of energy: renewable and nonrenewable energy. The Sun is by far the most important source of natural energy on Earth. Most of the energy we use comes from fossil fuels, such as coal, natural gas and petroleum. Fossil fuels are put through a process called combustion in order to produce energy. Nuclear energy is derived from the conversion of matter into energy and has a very high energy density.

Renewable resources include solar energy, wind, geothermal energy, biomass and hydropower.

Solar energy comes from the sun. Some people use solar panels on their homes to convert sunlight into electricity.

Wind turbines, which look like giant windmills, generate electricity.

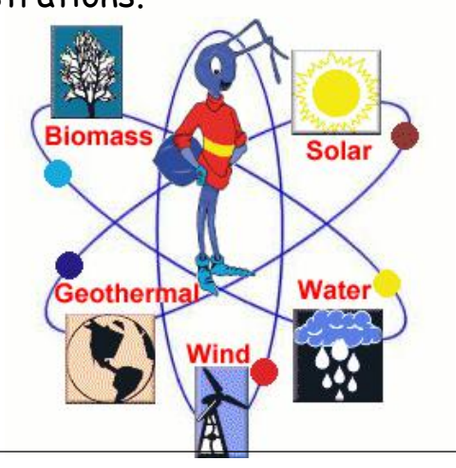
Geothermal energy comes from the Earth's crust. Engineers extract steam or very hot water from the Earth's crust and use the steam to generate electricity.

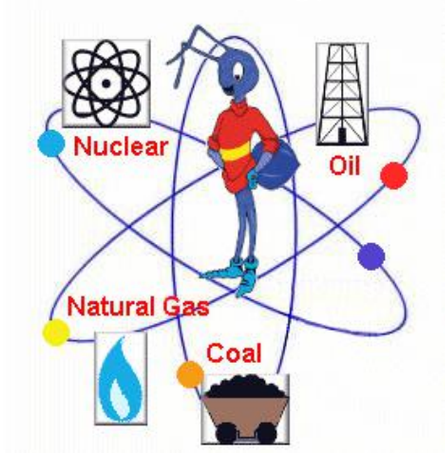
Biomass includes natural products such as wood, manure and corn. These materials are burned and used for heat.

Dams and rivers generate hydropower. When water flows through a dam it activates a turbine, which runs an electric generator.

EXERCISES

Draw and label completely as renewable or nonrenewable energy source based on the following illustrations.





Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Chemistry in Household and Personal Care Products		
Lesson Competency : Give common examples of cleaning materials for the house and for personal care		
References : https://brainly.ph/question/1382801		LAS NO.32

CONCEPT NOTES

(1) Safety - knowledge in Chemistry would help one to identify chemicals and how safe they are. For example bleach, stain removers, and other cleaners are corrosive and therefore must be used with care and stored appropriately.

(2) Storage - determine where household items must be kept. Perishable goods such as meat, fruits, vegetables, and milk must be kept refrigerated to avoid spoilage. Various substances must also be kept away from heat or sunlight.

(3) Health - product labels contain ingredients to show what they used in manufacturing them. Most especially, people with allergies must pay attention to the ingredients. It also contains information like amount of fat, sugar, salt, etc. to see how it could affect our health.

EXERCISES

Classify the following items of cleaning materials as <u>house care</u> or <u>personal care.</u>

_____1. Facial cleanser
_____2. Detergent powder
_____3. Baking Soda
_____4.Ethyl alcohol
_____5. Mosquito repellent lotion
_____6. Dishwashing Paste
_____7.Muriatic Acid
_____8. Ascorbic Acid
_____9. Fluoride Toothpaste
_____10.Shampoo
_____11. Mouthwash
_____12. Paint
_____13. Thinner
_____14.Nail Polish
_____15. Bleach

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Uses of Ingredients in Cleaning Agents		
Lesson Competency : Identify the active ingredients from product labels of cleaning products used at home; give the use of the other ingredients in cleaning agents		
References : http://www.healthycleaning101.org/types-of-household-cleaning-products/		LAS No. 33

CONCEPT NOTES

Cleaning house means cleaning surfaces like floors, walls, windows, rugs and appliances. Except for rugs and upholstery, most household surfaces are "hard." Technically, household cleaning is "hard surface cleaning." No single product can provide optimum performance on all surfaces and all soils. Thus, it is not surprising that many different household cleaners are available in the marketplace. They are formulated to clean efficiently and conveniently in the many different situations found in the home. Some are designed for more general use, such as all-purpose cleaners, while others are designed to work best on specific surfaces and/or soils.

ACTIVE INGREDIENTS IN HOUSEHOLD CLEANERS

a. Sodium hydroxide – present in soaps
b. Acetic Acid-present in vinegar
c. Sodium Bicarbonate- Baking Soda
d. Antimicrobial agents-present in disinfectants
e. Abrasives- present in metal cleaners
f. Sodium Hypochlorite- is contained in bleaches
g. Surfactants- present in glass cleaners

EXERCISES

Give the use of the following ingredients in cleaning agents whether it act as a surfactant, abrasive, or antimicrobial agent, acids, sodium hydroxide, sodium bicarbonate, preservatives, bleaching agents, colourants or enzymes based on the following situations.

_____1. Cleaning wounds
_____2. Beautifying landscapes
_____3.Washing of clothes
_____4. Draining solid particles
_____5. Adding color to products
_____6.Stain remover
_____7. Removal of solid grease
_____8.Breaks down soil into simpler forms
_____9.Prevents decay
_____10.Provides alkalinity

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Common Examples of Personal Care Products		
Lesson Competency : Give common examples of personal care products used to enhance the appearance of the human body		
References : https://www.google.com/search?q=personal+care+products&source=lnms&tbm=isch&sa=X&ved=0ahUKEwi3jtGwhY_eAhWFTbwKHWC2AZgQ_AUIDigB&biw=1024&bih=440		LAS No. 34

CONCEPT NOTES

Under the law, some of the products commonly referred to as "personal care products" are cosmetics. These include, for example, skin moisturizers, perfumes, lipsticks, fingernail polishes, eye and facial makeup preparations, shampoos, permanent waves, hair colors, toothpastes, and deodorants. Some, however, are regulated as drugs. Among these are skin protectants (such as lip balms and diaper ointments), mouthwashes marketed with therapeutic claims, antiperspirants, and treatments for dandruff or acne.

EXERCISES

Draw and label at least 6-8 personal care products based on the given pictures below.

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Major Ingredients of Cosmetics		
Lesson Competency : Identify the major ingredients of cosmetics		
References : https://www.science.org.au/curious/people-medicine/chemistry-cosmetics		LAS No. 35

CONCEPT NOTES

Cosmetics are products designed to cleanse, protect and change the appearance of external parts of our bodies. The key ingredients present in most cosmetics include water, emulsifiers, preservatives, thickeners, moisturisers, colours and fragrances. Ingredients can be naturally occurring or artificial, but any potential impact on our health depends mainly on the chemical compounds they are made of. The doses of potentially dangerous chemicals found in cosmetics are considered too small to pose a risk to human health.

EXERCISES

Identify the cosmetics which are shown below.


1._____


2._____


3._____


4._____


5._____


6._____

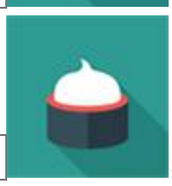
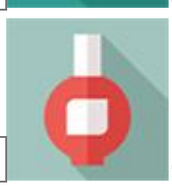

7._____


8._____


9._____

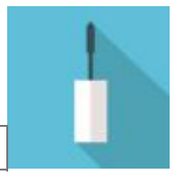

10._____

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Major Ingredients of Cosmetics		
Lesson Competency : Identify the major ingredients of cosmetics		
References : https://www.science.org.au/curious/people-medicine/chemistry-cosmetics		LAS No. 35

- ☐  PERFUME
- ☐  SUNSCREEN
- ☐ BLUSH
- ☐ MASCARA
- ☐  TONER
- ☐  SHAVECREAM
- ☐  COLOGNE
- ☐  POWDER
- ☐  BODYWASH
- ☐  HAIRSPRAY

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Major Ingredients of Cosmetics		
Lesson Competency : Identify the major ingredients of cosmetics		
References : https://www.science.org.au/curious/people-medicine/chemistry-cosmetics		LAS No. 35


CLEANSER


EYE LINER

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Precautionary Measures in Handling Cleaning Products and Cosmetics		
Lesson Competency : Explain the precautionary measures indicated in various cleaning products and cosmetics		
References : https://djeraldbautista.wordpress.com/2017/11/19/the-precautionary-measures-indicated-in-various-cleaning-products-and-cosmetics/		LAS No. 36

CONCEPT NOTES

When choosing a personal care product, the following precautionary measures must be observed.

a. Learn to read the labels.

b. Be aware of toxic substances that may be found in the product you want to buy.

c. When draining substances, make sure it is safe for the environment.

d.Storage Instructions: Products contain information about specific storage instructions to keep their functionality.

e. Directions for Use: Products such as pesticides have specific instructions to better use the product while maintaining the health of the user and the materials which these household products are applied to.

f. Manufacturing and Expiration Date: Keeping track of the expiration date has obvious reasons. You would not want the product to be expired before using it. However, the manufacturing date is also important to keep track of. In the event of an incident (poisoning, etc.), manufacturers can track the product down in order to make sure that the batch of products is recalled for further testing and analysis.

EXERCISES

Identify and explain the precautionary measure being illustrated below.

1.  _____

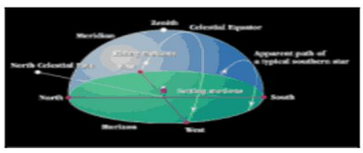
2.  _____

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : 3 Types of Terrestrial Motion		
Lesson Competency : Explain what the Greeks considered to be the three types of terrestrial motion		
References : https://www.google.com/search?q=activity+sheet+and+concept+notes+on+3+types+of+terrestrial+motion&tbm		LAS No. 37

CONCEPT NOTES

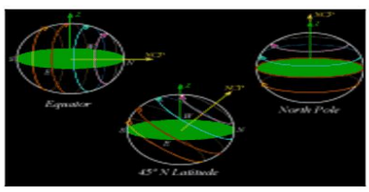
Three types of Terrestrial Motion

1. **Diurnal Motion**



Diurnal motion is the daily motion of stars and other celestial bodies across the sky. This motion is due to the Earth's rotation from west to east, which causes celestial bodies to have an apparent motion from east to west.

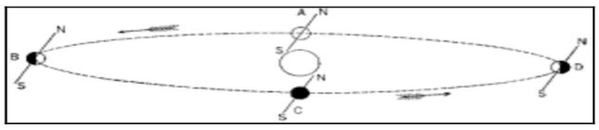
2. **Annual Motion**



We must now explain the motion of the earth in its orbit round the sun. This is called its *annual motion*, because it takes a year to complete one revolution.

Over the course of a year, the Sun appears to move a little towards the East each day as seen with respect to the background stars. This daily eastward drift is <1° per day (there are 365 days in a year, but only 360° in a circle). This apparent **motion** is a reflection of the Earth's **annual** orbit around the Sun.

Reflection of the Earth's Orbital Motion

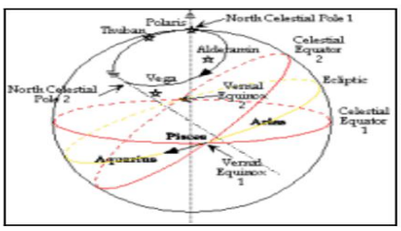


Ecliptic: The Path of the Sun

Zodiacal Constellations

Solstices & Equinoxes

3. **Procession of Equinoxes**



The precession of the **equinoxes** refers to the observable a cycle which spans a period of (approximately) 25,920 years, over which time the constellations appear to slowly rotate around the earth, taking turns at rising behind the rising sun on the vernal **equinox**.

EXERCISES

Identify the type of terrestrial motion being described below.

_____1. Rotation of Earth on its own axis

_____2. Revolution of Earth around the Sun

_____3. Over the course of a year, the Sun appears to move a little towards the East each day as seen with respect to the background stars.

_____4. Movement in westward direction along the ecliptic relative to the fixed stars

_____5. Responsible for the daily rising and setting of the sun and the stars

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Greeks View on Earth's Shape		
Lesson Competency : Explain how the Greeks knew that the Earth is spherical		
References : http://practicalphysics.org/greek-evidence-earths-shape-and-spin.html		LAS No. 38

CONCEPT NOTES

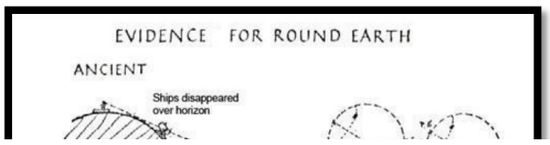
Pythagoras' pupils, if not the great man himself, knew that the Earth is round. Traveller's tales of ships disappearing over the horizon and the Pole Star shifting to a higher position in the sky as one journeyed north, suggested a curved Earth.

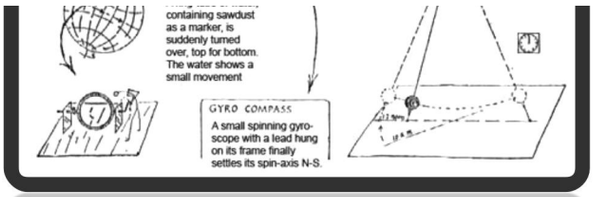
Aristotle (about 340 BC), two centuries later, supported the idea of a spherical Earth, Moon and planets because:

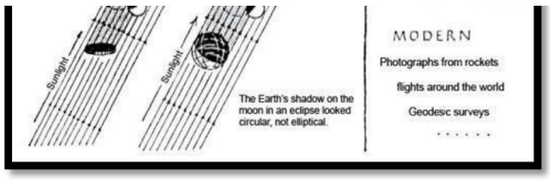
- the sphere is a perfect solid and the heavens are a region of perfection
- the Earth's component pieces, falling naturally towards the center, would press into a round form
- in an eclipse of the Moon, the Earth's shadow is always circular: a flat disc would cast an oval shadow
- even in short travels northwards the Pole Star is higher in the sky.

This mixture of dogmatic reasons and experimental common sense was typical of him and he did much to set science on its feet.

A spinning Earth







EXERCISES

Draw the illustrations above and label them correctly and properly. A rubric will be used in rating your output.

Rubric:			
	Creativity	-	5
	Neatness & Correct Labelling	-	5
	Impact	-	5
	Total		15

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Plato's Model of the Universe		
Lesson Competency : Explain how Plato's problem of "Saving the Appearances" constrained Greek models of the Universe		
References : https://brainly.ph/question/1306892		LAS No. 39

CONCEPT NOTES

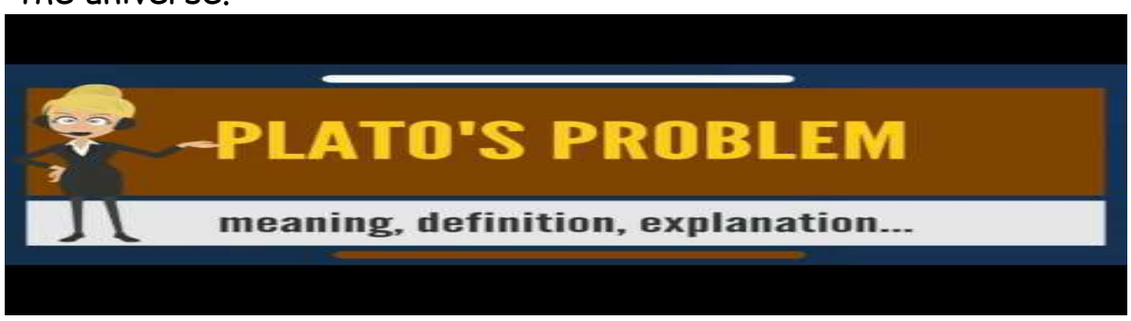
Plato's problem of the "saving the appearances" became an obstacle to the Greeks' models of the universe as Plato gave a challenge to astronomers to explain the non-regular motions (combination of circular motions and constant speed of rotation) of planets, sun, and moon.

In particular, Plato challenged his students with this problem: "What circular motions uniform and perfectly regular, are to be admitted as hypothesis so that it might be possible to save the appearances presented by the planets?" This challenge is known as "Plato's Saving the Appearances" in the history of astronomy. The fact remains, however, that a task was set for astronomers; the task was generally accepted; and the task was pursued for nearly two thousand years, from the Greeks in the fourth century B.C. to Copernicus and the European Renaissance in the sixteenth and seventeenth centuries A.D.

The curious problem of astronomers is the following: First, they provide themselves with certain hypotheses: Starting from such hypotheses, astronomers then try to show that all the heavenly bodies have a circular and uniform motion, that the irregularities which become manifest when we observe these bodies—their now faster, now slower motion; their moving now forward, now backward; their latitude now southern, now northern; their various stops in one region of the sky; their at one time seemingly greater, and at another time seemingly smaller diameter—that all these things and all things analogous are but appearances and not realities.

EXERCISES

Explain in 5 sentences how Plato's problem of "Saving the Appearances" forced Greek models of the universe.



Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Comparing and Contrasting the Different models of the Universe		
Lesson Competency : Compare and contrast the models of the universe by Exodus, Aristotle, Aristarchus, Ptolemy, and Copernicus		
References : https://lagmandana.wordpress.com/2017/11/24/the-models-of-the-universe-eudoxus-aristotle-aristarchus-ptolemy-and-copernicus/		LAS No. 40

CONCEPT NOTES

Eudoxus', Aristotle's, and Ptolemy's models have the Earth as the center of the universe while Aristarchus' and Copernicus' models have the Sun as the center.

- Eudoxus' model has 27 concentric spheres for the Sun, Moon, planets, and the stars whose common center is the Earth.
- Aristotle's model of the universe is composed of 56 spheres guiding the motion of Sun, Moon and the five known planets.
- Aristarchus said that smaller celestial bodies must orbit the larger ones and since the Sun is much larger than the Earth, then the Earth must orbit around the Sun.
- Ptolemaic model introduced the concepts of epicycle, deferent, and equant to explain the observed "imperfect" motions of the planets.
- Copernicus' model recognized that the Earth rotates on its axis, revolves around the Sun, and undergoes precession.

EXERCISES

Copy the pattern of the table provided below. Complete the information pertaining to the models of the Universe of the specified scientists.

Name of the Proponent/Scientist	Views of their model of the Universe
Eudoxus	
Aristotle	
Aristarchus	
Ptolemy	
Copernicus	

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Astronomical Phenomena before the Advent of Telescopes		
Lesson Competency :Cite examples of astronomical phenomena known to astronomers before the advent of telescopes		
References : https://lagmandana.wordpress.com/2017/11/24/astronomical-phenomena-known-to-astronomers-before-the-advent-of-telescopes/		LAS No. 41

CONCEPT NOTES

Even before the invention of the telescope, ancient people have already observed different astronomical phenomena. The most observable objects in the sky are the sun and moon. By looking at the shadows that the gnomon casts, they were able to observe that the sun rises in the eastern part of the sky, reaches its highest point in midday, and sets in the western part of the sky. Also, they recorded that the points where the sun rises and sets on the horizon varies over a year and these variations happen periodically.

Ancient people have observed that the moon changes its path and its appearance within a period of 29.5 days. They observed that the moon changes its appearance from thin semi-circular disk to full circular disk. These phases of the moon are the basis of ancient calendars. A lunar eclipse occurs when the Earth casts its shadow on the moon when the Earth is between the Sun and the Moon.

A phenomenon such as this is known as a lunar eclipse wherein the moon changes into a dark or blood red color. Aside from lunar eclipse, the occurrence of a solar eclipse was also observed. It was also observed that the stars appear to be attached to a celestial sphere that rotates around an axis in one day. Also, the constellations' positions in the night sky vary depending on the time of the year.

Astronomers have discovered that Mercury, Venus, Mars, Jupiter, and Saturn are planets because they have noticed that the stars are in a fixed position with respect to each other. But there are very bright stars that change positions periodically which are called "wanderers" or planetes in Greek terms.

EXERCISES

Put a checkmark (/) if the following descriptions are examples of astronomical phenomena prior to the advent of telescope and put an **X** if it does not.

___1. rising and setting of the Sun
___2.Phases of the moon
___3.lunar eclipse
___4.solar eclipse
___5. daily and annual motion of the stars
___6. Mercury, Venus, Mars, Jupiter, and Saturn
___7.appearance of a comet
___8. Existence of asteroid belt

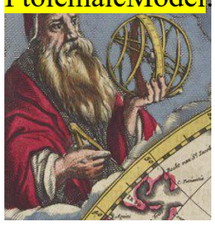
Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Models of Astronomical Phenomena		
Lesson Competency : Compare and contrast explanations and models of astronomical phenomena (Copernican, Ptolemaic, and Tychonic)		
References : https://brainly.ph/question/1370540#		LAS No. 42

CONCEPT NOTES

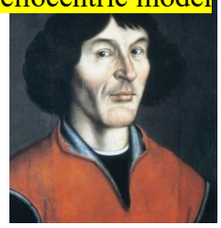
Today, the Solar System consists of eight planets namely Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. All these planets revolve around a massive ball of helium and hydrogen known as the Sun. There are other bodies within the Solar System such as moons that revolve around the planets, asteroids, and planetoids.

Jumping ahead in time, the systems of three astronomers were prominent in Kepler's day (around the turn of the 17th century). They were: Claudius Ptolemy, who developed the mathematics for an earth-centered planetary model in the second century AD, Nicolaus Copernicus, who is famous for introducing (in modern times) the idea that the sun is the center of the planetary system, and Tycho Brahe, a well-to-do Danish nobleman who understood the importance of advancing the observational techniques behind astronomy, if the science was to truly progress.

PtolemaicModel



Heliocentric model



Tychonic Model

EXERCISES: Complete the paragraph by indicating the name of the Astronomer.

According to _____, the sun is should be positioned motionless near the center of the universe. Earth and all the planets surround it, rotating around the sun in some circular paths that can be modified by uniform speed and epicycles.

According to _____, the sun, moon, and planets like Mars orbit the earth. He thought that stars move around our planet earth every day and the motion of the biggest star - the sun, and the moon, as well as the planets was added to that first common motion of the entire universe or heavens.

However, according to Danish astronomer, _____ it was actually a combination of Copernican and Ptolemaic. He believed that the planets in the heavens of solar system revolve only around the sun but our planet is the center of the universe.

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Galileo's Astronomical Discoveries and Observations		
Lesson Competency : Explain how Galileo's astronomical discoveries and observations helped weaken the support for Ptolemaic model		
References : https://brainly.ph/question/1250001		LAS No. 43

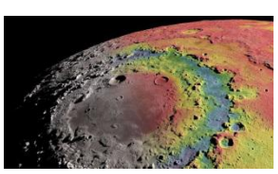
CONCEPT NOTES

History had claimed that a refracting telescope was accidentally invented by a Dutch lensmaker, Hans Lippershey, in 1608. Galileo, upon hearing of this invention without having seen it, made his own telescope and aimed it to the skies. The following lists some of the things that he saw with his telescope, all of which greatly contradicted the models of Ptolemy and Aristotle and provided new data that supported Copernican model.

- The moon has mountains, valleys, and craters. This suggested that the moon is not so different from Earth implying that something in the celestial realm is barelydistinguishable from objects that belong to the terrestrial realm.
- The surface of the sun has some blemishes, which are now called sunspots. This contradicted the Greek concept of the sun as being a perfect celestial body.
- Jupiter has four moons revolving around it. This showed that not all heavenly bodies have to revolve around Earth. There are other centers of revolution that are themselves revolving.
- Venus has phases similar to the moon. This showed that Venus is just illuminated by the light form the sun and that it is revolving around the sun. The Ptolemaic model can only account for the crescent phase of Venus, not the full range of phases observed by Galileo.
- Many stars' faint to be seen by the naked eye become visible with his telescope. The Milky Way was simply made of individual stars. Even when viewed through a telescope, the stars still appeared to be point of light. This provided evidence that the stars are extremely far away and that it was extremely difficult to observe stellar parallax.

EXERCISES: Label the following pictures with specific names or descriptions.

1._____ 2. _____ 3._____ 4._____ 5._____



Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Brahe's Innovations in Observational Astronomy		
Lesson Competency : Explain how Brahe's innovations and extensive collection of data in observational astronomy paved the way for Kepler's discovery of his laws of planetary motion		
References : http://teachtogether.chedk12.com/teaching_guides/view/267		LAS No. 44

CONCEPT NOTES

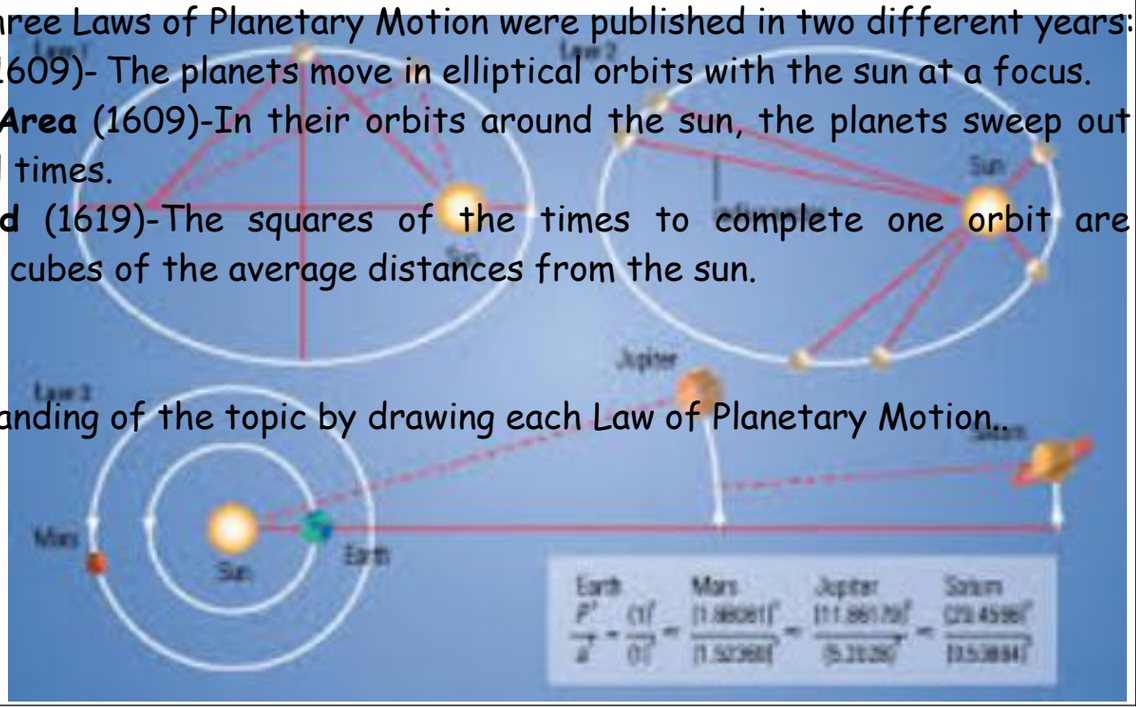
Brahe became famous through his observations: (a) Supernova explosion of 11 Nov 1572 — named "Nova Stella", now SN 1572 (b) Comet in 1577.Kepler was hired as sort of "research assistant" by Brahe primarily to prove that Brahe's model (geoheliocentric model) which emphasize that the Earth was at rest, the sun went around the Earth and the planets all went around the sun - an intermediate picture between Ptolemy and Copernicus. Kepler needed Brahe's data to do mathematical analysis while Brahe needs Kepler to make mathematical calculations to prove that the model satisfies the observed data. Brahe died before his model is proven. Kepler inherited vast data set that will prove crucial for developing his Three Laws of Planetary Motion later.

It took Kepler many more years trying out many possible models to fit the available data being concerned largely on the philosophical implications of his models and the belief that there has to be simple numerical relationships among phenomena like the Pythagoreans. Only after about 20 years or so working with the data he got from Brahe, the Three Laws of Planetary Motion were published in two different years:

(1) **Law of Orbit** (1609)- The planets move in elliptical orbits with the sun at a focus.

(2) **Law of Equal Area** (1609)-In their orbits around the sun, the planets sweep out equal areas in equal times.

(3) **Law of Period** (1619)-The squares of the times to complete one orbit are proportional to the cubes of the average distances from the sun.



EXERCISES

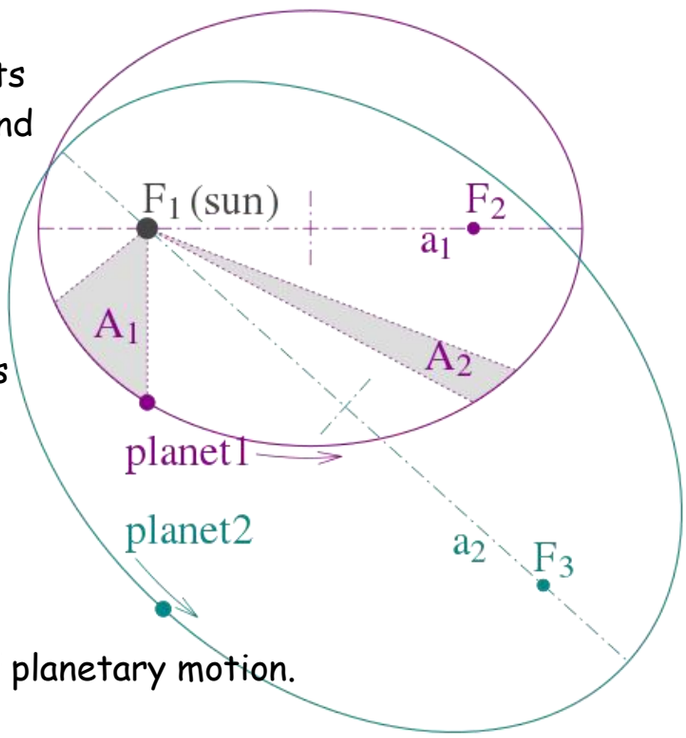
Show your understanding of the topic by drawing each Law of Planetary Motion..

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Kepler's 3rd Law of Planetary Motion of Objects		
Lesson Competency : Apply Kepler's 3rd Law of Planetary Motion to objects in the Solar System		
References : https://www.britannica.com/science/Keplers-laws-of-planetary-motion		LAS No. 45

CONCEPT NOTES

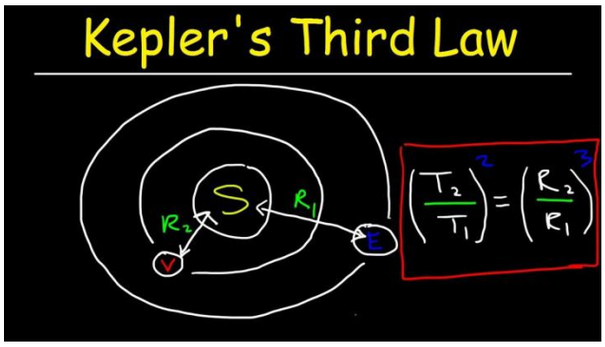
Kepler's three laws of planetary motion can be stated as follows: (1) All planets move about the Sun in elliptical orbits, having the Sun as one of the foci. (2) A radius vector joining any planet to the Sun sweeps out equal areas in equal lengths of time. (3) The squares of the sidereal periods (of revolution) of the planets are directly proportional to the cubes of their mean distances from the Sun.(i.e. $T2 \propto a3$)

- The orbits are ellipses, with focal points F1 and F2 for the first planet and F1 and F3 for the second planet. The Sun is placed in focal point F1.
- The two shaded sectors A1 and A2 have the same surface area and the time for planet1 to cover segment A1 is equal to the time to cover segment A2.
- The total orbit times for planet1 and planet2 have a ratio (a1a2)32.



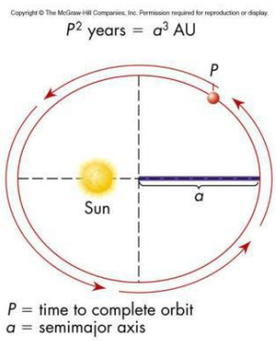
EXERCISES

Derive the equation for Kepler's third law of planetary motion.



Kepler's 3rd Law

- The amount of time a planet takes to orbit the Sun is related to its orbit's size
- The square of the period, P, is proportional to the cube of the ***semimajor axis,*** a



c

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Aristotelian vs. Galilean Views of Motion		
Lesson Competency: Compare and contrast the Aristotelian and Galilean conceptions of vertical motion, horizontal motion, and projectile motion. (S11/12PS-IVc -46)		
References : http://www.hep.wisc.edu/~herndon/107-0609/lectures_files/Phy107Fall06Lect02.pdf https://www.slideshare.net/marielmelon/aristotle-vs-galileo-72409122		LAS No.: 46

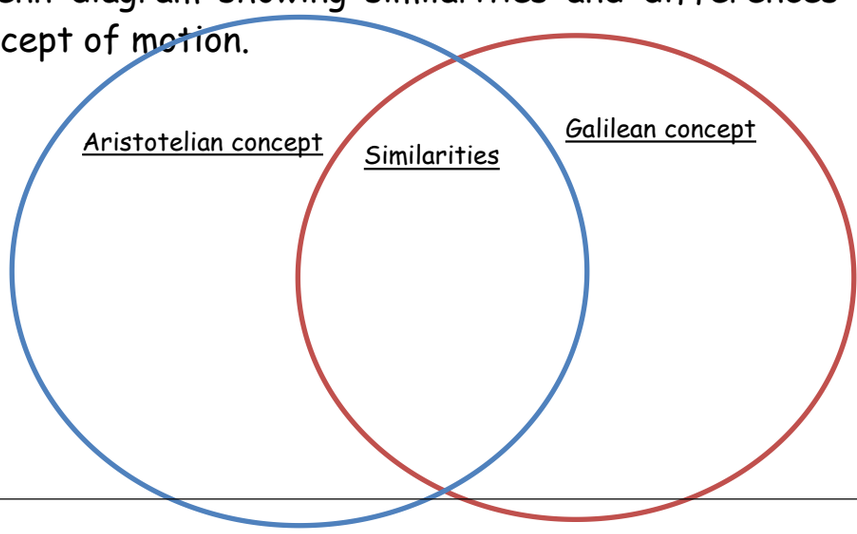
CONCEPT NOTES

Aristotle and Galileo were two of the most important historical figures in physics. They may have opposing views regarding motion, but they helped science progress.

Motion	Aristotelian Concept	Galelian Concept
Horizontal motion	Bodies seem to need push or pull to maintain horizontal motion.	Object moving on level surface moves in unchanging direction at constant speed unless disturbed.
Vertical motion	Heavier objects should fall vertically faster than lighter ones. The element earth moves down toward its natural resting place.	Objects move downward because gravity disturbs their motion. The rate of fall or acceleration of an object is independent of their mass.
Projectile motion	A cannonball when fired by a canon moves in a straight horizontal line because of a force called impetus made it move.	When you fire a canon, the cannonball moves two-dimensional motion.

EXERCISES

Make a Venn diagram showing similarities and differences of Aristotelian and Galilean concept of motion.



Name:	Date:	Score:
Subject : Physical Science		
Lesson Title: How Galileo used his Discoveries in Mechanics to Address Objections to Copernican Model		
Lesson Competency: Explain how Galileo inferred that objects in vacuum fall with uniform acceleration, and that force is not necessary to sustain horizontal motion. (S11/12PS-IVc-47)		
References : https://jenniferpadlanramos02.wordpress.com/2017/11/18/how-galileo-inferred-that-objects-in-vacuum-fall-with-uniform-acceleration/		LAS No.: 47

CONCEPT NOTES

Galileo Galilei, is an Italian scientist, renowned for his contributions to physics, astronomy, and scientific philosophy. He is regarded as the chief founder of **modern science.**

On his experiment on free fall, he observed the following:

- A ball rolling down an inclined plane increases its speed by the same value after every second.
- As the inclined plane becomes steeper, the acceleration of the rolling ball increases.
- The maximum acceleration of the rolling ball was reached when the inclined plane was positioned vertically as if the ball is simply falling.

These observations lead Galileo to conclude that regardless of the mass of objects and air resistance, falling objects would always have uniform acceleration.

EXERCISES

Do the procedure. Then answer the following questions.

1. Hold a book and a paper at the same height. Drop them simultaneously. Which falls to the ground faster? Book or paper?

2. Crumple the paper. Again, hold the book and the crumpled paper at the same height. Drop them simultaneously. Which falls to the ground faster? Book or paper?

3. Now, hold a book and a ballpen then drop them simultaneously. Which falls to the ground faster? Book or ballpen?

4. What can you infer out from the activity?

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : The Universal Laws of Physics		
Lesson Competency: Explain how the position vs. time, and velocity vs. time graphs of constant velocity motion are different from those of constant acceleration motion. (S11/12PS-IVc-48)		
References : https://sciencing.com/difference-graph-position-time-graph-8472236.html		LAS No.: 48

CONCEPT NOTES

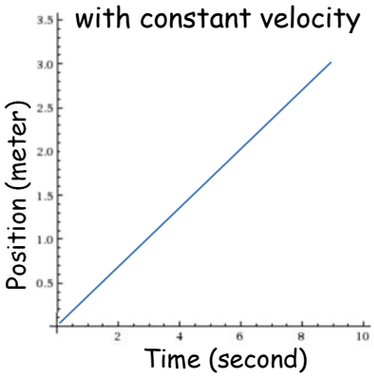
The **position-time graph** describes the motion of an object over a period of time. Time in seconds is conventionally plotted on the x-axis and the position of the object in meters is plotted along the y-axis.

The **velocity-time graph** of an object reveals the speed at which an object is moving at a given time and whether it is slowing down or speeding up. Time in seconds is usually plotted on the x-axis while the velocity in meters per second is usually plotted along the y-axis.

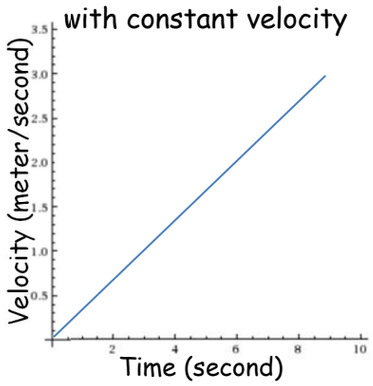
An **acceleration vs. time graph** plots acceleration values on the y-axis, and time values on the x-axis.

EXERCISES

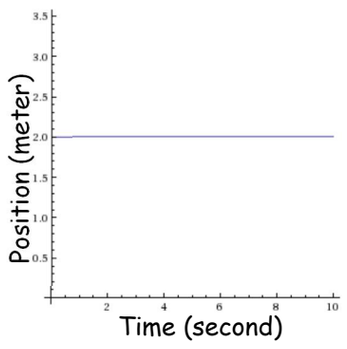
Position-time graph
with constant velocity



Velocity-time graph
with constant velocity



Acceleration-time graph
with constant acceleration



Describe each graph.

a. Position-time graph with constant velocity
b. Velocity – time graph with constant velocity
c. Acceleration – time graph with constant acceleration

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title :Acceleration		
Lesson Competency: Recognize that the everyday usage and the physics usage of the term "acceleration" differ: In physics an object that is slowing down, speeding up, or changing direction is said to be accelerating. (S11/12PS-IVc-49)		
References : https://www.khanacademy.org/science/physics/one-dimensional-motion/acceleration-tutorial/a/acceleration-article https://www.scribd.com/document/362255491/Acceleration-in-Everyday-Usage		LAS No.: 49

CONCEPT NOTES

- In **everyday terms**, acceleration refers to objects which are moving so fast. An object slowing is not accelerating.

- **In physics**, an object that moves fast may not be accelerating. Also, an object that moves slowly maybe accelerating. **Acceleration** is the name we give to any process where the **velocity changes**. Since velocity is a speed and a direction, there are only two ways for you to **accelerate**: **change your speed** or **change your direction**—or **change both**.

EXERCISES

Identify the motion of the car on different situation. Write **accelerating** or **not accelerating** depending on the usage per situation.

Situation	Everyday usage	Physics usage
A car slowing as it approach a pedestrian lane.		
A car moving fast, trying to pass another car.		
A car doing a U – turn.		
A car moving with a constant velocity in a highway.		

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Newton's Laws of Motion		
Lesson Competency: Explain each of Newton's three laws of motion. (S11/12PS-IVd-50)		
References: https://www.faa.gov/education/educators/activities/highschool/media/Easy-as-1-2-3.pdf https://www.livescience.com/46558-laws-of-motion.html		LAS No.: 50

CONCEPT NOTES

Sir Isaac Newton's three laws of motion describe the motion of massive bodies and how they interact.

1. **Newton's First Law** states that an object will remain at rest or moving at constant speed unless an external force will act on it.The tendency to stay at rest or, once moving, in motion, is called **INERTIA**. Things move or stop only if acted upon by another force.

2. **Newton's Second Law** states that acceleration is produced when there is an unbalanced force acting on an object. The more mass an object has, the more net force there should be in order for it to move.

3. **Newton's Third law** states that for every action there is an opposite and equal reaction.

EXERCISES

Situation	Law of Motion involved	Brief explanation
If you roll a ball and eventually stops because of friction or if it hits something.		
It is easy to push an empty cart than a cart with full stuff.		
When you punch a wall and directly you feel hurt. The harder you punch, the more it hurts you.		

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Newton's Laws of Motion		
Lesson Competency: Explain the subtle distinction between Newton's 1st Law of Motion (or Law of Inertia) and Galileo's assertion that force is not necessary to sustain horizontal motion. (S11/12PS-IVd-51)		
References: http://zonalandeducation.com/mstm/physics/mechanics/forces/galileo/galileoInertia.html https://www.physicsclassroom.com/class/newtlaws/Lesson-1/Inertia-and-Mass		LAS No.: 51

CONCEPT NOTES

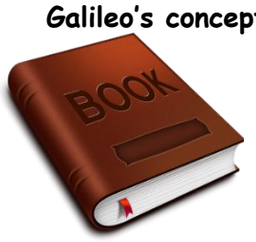
Galileo Galilei believed that when the push on the chair is taken away, the chair should ***continue*** to move along without any assistance. The chair stops because the chair is entirely left alone. By ***'left alone'*** we mean that nothing pushes or pulls on the chair, no forces acting on it.

Isaac Newton built on Galileo's thoughts about motion. His idea based on his first law of motion is that, when you slide a book across a table and watch it slide to a rest position, the book in motion on the table top does not come to a rest position because of the *absence* of a force; rather it is the *presence* of a force - that force being the force of friction - that brings the book to a rest position.

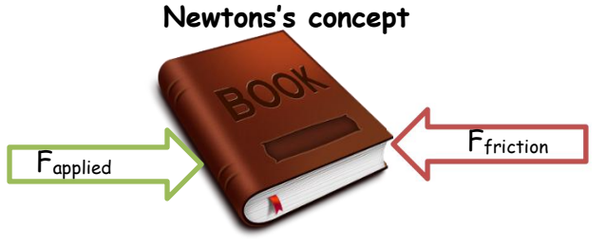
EXERCISES

Differentiate Galileo and Newton's concept why moving object tends to go to a rest position. Arrows represent forces acting on the object. Equal size of the arrow means equal amount of force. Direction of the arrow means direction of the force.

Galileo's concept



Newtons's concept



Questions	Galileo's Concept	Newton's concept
1. What forces are acting on the book?		
2. What is the direction of the forces?		
3. Compare the magnitude of the force?		
4. Are the forces balanced or unbalanced?		
5. When does an object comes to its rest position?		

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Law of Acceleration and Newton's Law of Universal Gravitation		
Lesson Competency: Use algebra, Newton's 2nd Law of Motion, and Newton's Law of Universal Gravitation to show that, in the absence of air resistance, objects close to the surface of the Earth fall with identical accelerations independent of their mass. (S11/12PS-IVd-52)		
References: https://www.jove.com/science-education/10325/newton-s-law-of-universal-gravitation		LAS No.: 52

CONCEPT NOTES

Newton's Law of Universal Gravitation is mathematically expressed as **F = $Gm_1 m_2 / r^2$, (Equation 1).** (The gravitational force **F** between two masses m_1 and m_2, with their centers of mass separated by a distance **r** and *G* is the universal constant of proportionality)

Newton's second law is mathematically expressed as **F = *ma* (Equation 2)** (the force on the mass *m* due to the Earth's gravity)

Canceling the mass *m* on both sides of the equation; substituting *g* for ***a***; and noting that the distance between the objects' centers of mass is just the radius of the Earth, r_E, the magnitude of the downward force can be rewritten as:

$$g = G\, m_E / r^2_E. \textbf{ (Equation 3)}$$

EXERCISE

Try to rewrite how Equation 3 was derived out from Equation 1 (Newton's Law of Universal Gravitation) and Equation 2 (Newton's Second Law of Motion). Show a more detailed derivation of Equation 3.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Universal Laws in Physics		
Lesson Competency: Explain the statement "Newton's laws of motion are axioms while Kepler's laws of planetary motion are empirical laws." (S11/12PS-IVe-53)		
References: https://prezi.com/xye1d2vvyxvj/use-algebra-newtons-2nd-law/		LAS No.: 53

CONCEPT NOTES

An **axiom** is a proposition regarded as self-evidently true without proof.
Empirical laws are verifiable or provable by means of observation or experiment.

Newton's Laws

First Law: Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.
Second Law: Object's acceleration is directly proportional to the net force but inversely to its mass.
Third Law: For every action there is an equal and opposite reaction.

Kepler's Law

The Law of Ellipses: The path of the planets about the sun is elliptical in shape, with the center of the sun being located at one focus.
The Law of Equal Areas: An imaginary line drawn from the center of the sun to the center of the planet will sweep out equal areas in equal intervals of time.
The Law of Harmonies: The ratio of the squares of the periods of any two planets is equal to the ratio of the cubes of their average distances from the sun.

EXERCISES

Explain briefly.

"Newton's laws of motion are axioms while Kepler's laws of planetary motion are empirical laws"

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Mass, Momentum and Energy Conservation		
Lesson Competency: Explain the contributions of scientists to our understanding of mass, momentum, and energy conservation. (S11/12PS-IVe-54)		
References: https://maryjanebeltran.wordpress.com/2017/11/19/mass-momentum-and-energy-conservation/		LAS No.: 54

CONCEPT NOTES

Mass, **momentum**, and **energy** are three quantities that can be conserved. In Physics, when we say a quantity is conserved, it means that after an interaction or a reaction, no part of that quantity is lost.

The **law of conservation of mass** states that mass in an enclosed system is neither created nor destroyed by a chemical reaction. Thus, in a chemical reaction, the mass of the reactants must be equal to the mass of the products.

The **law of conservation of energy** states that energy cannot be created or destroyed. It can only be transformed from one form to another. Hence, the total energy of an isolated system never change.

The **law of conservation of momentum** states that the total momentum of an object does not change (i.e it remains at rest or in motion with constant velocity) if there are no external forces acting on it.

EXERCISES

With your research assignment on scientists who contributed to the development of the mass, momentum and energy conservation, you will be making a timeline for the three laws.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Law of Conservation of Momentum		
Lesson Competency: Use the law of conservation of momentum to solve one dimensional collision problems. (S11/12PS-IVe-55)		
References:		LAS No.: 55

CONCEPT NOTES

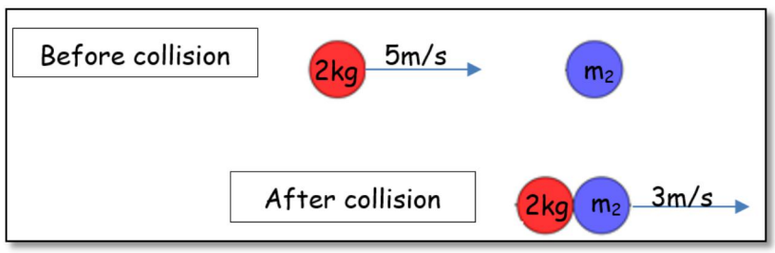
If two object collides, **the momentum will be conserved.** This is based on the **Law of conservation of momentum.**

Hence, the total momentum before collision should be equal to the total momentum after the collision. This gives the equation Total P_i= Total P_f, Total initial momentum is equal to the Total final momentum. Where P (momentum) can be calculated by multiplying the mass and velocity of the object (P = mv).

Therefore the final formula involving the conservation of momentum in a one dimensional collision is $m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$ (v' denotes final velocity).

EXERCISE: If a red ball with a mass of 2 kg, moving with a velocity of 5 m/s hits a stationary blue ball, determine the mass of the blue ball if the two ball stuck together and moves 3m/s after collision.

Illustration



Complete the solution by filling in missing variables. Refer to the given at the left.

Given:
m_1 = 2kg
v_1 = 5m/s
m_2 =?
v_2 = 0
v_1' =3m/s
v_2'=3m/s

Solution:

Total P_i = Total P_f

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

(2kg)(____) + (m_2)(_____) = (____)(____) + (m_2)(3m/s)

10kgm/s + 0 = 6kgm/s + 3m/s (m_2)

_____ = 6kgm/s + 3m/s (m_2)

_____ - 6kgm/s = + 3m/s (m_2)

$\frac{4\text{kgm/s}}{3\text{m/s}} = \frac{(3\text{m/s})(m_2)}{3\text{m/s}}$

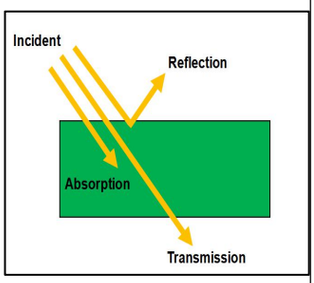
_____ kg = m_2

(Note: You may check your answer by doing the same process in the solution part, but this time fill up the unknown (m_2) with your answer. If both sides obtain the same total, then your answer is correct.)

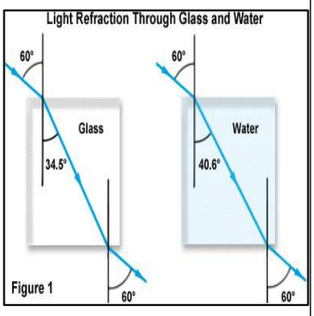
Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: How light is reflected, refracted, transmitted, and absorbed		
Learning Competency: Describe what happens when light is reflected, refracted, transmitted, and absorbed		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 56

CONCEPT NOTES

Light is a form of electromagnetic radiation that is the only visible portion of the electromagnetic spectrum, is usually described as though it is a wavelengths and frequencies. Light travels in *straight path.* When light rays encounters a surface, one or more of the following three things occur, the light ray: (1) Reflects off the surface and travels off in a different direction (2) Passes from one medium into the other and continues on a new, straight line path (3) Is absorbed.



Light rays that reflect follow the ***Law of Reflection*** which states that the angle of reflection is equal to the angle of incidence. Light rays that pass through an object without being absorbed are ***transmitted rays***. These rays bend. This bending is called ***refraction.*** Light rays are *refracted* when it passes through different media or materials with different densities. Light is ***absorbed*** if it passes through a medium with the same natural frequency. As light travels through a medium, a portion of it is absorbed.



Exercises: Encircle the letter of the correct answer.

1. What happens when light rays bounce off the surface of an object? Light is
   A. absorbed B. reflected C. refracted D. transmitted
2. Light rays are _____ when it passes through different materials with different densities.
   A. absorbed B. reflected C. refracted D. transmitted
3. When light is refracted this means that light _____
   A. Bend B. bounced off C. curved D. reflect
4. How does light travel?
   A. in a wavy path C. in a straight path
   B. in a zigzag path D. in all direction
5. Seeing your face in the mirror is an example of
   A. absorption B. reflection C. refraction D. transmission

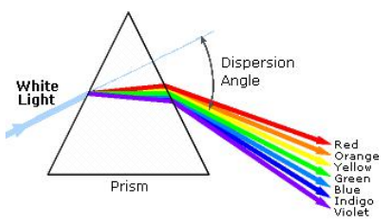
Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: The Emergence of Light		
Learning Competency: Explain how Newton and Descartes described the emergence of light in various colors through prisms		
References: https://bit.ly/2CUkXbF		LAS No.: 57

CONCEPT NOTES

The color of the objects we see in the natural world is a result of the way objects interact with light. When light strikes an object, it is absorbed, reflected, or refracted by the object.

Rene Descartes, he studied the refraction and emergence of colors of light in a prism. He observed that the different colors of light refracted at varying degrees. He explained that when these particles passed through the prism and encountered a slit on the edge, their rotational speed would change. This change resulted in the emergence of a color. He noted that the red light refracted more than the blue light.

Sir Isaac Newton studies the emergence of colors as light passed through a prism. He saw that the red light refracted the least while the violet light refracted the most. This difference in refraction occurred due to the differences in the mass of the colors of light. For instance, a particle of red light has more mass than those of violet light. Therefore, red light was deflected less than the violet light. Newton introduced the term "colour spectrum" or "visible spectrum". He showed that every colour has a unique angle of refraction that can be calculated using a suitable prism.



Exercises: Encircle the letter of the correct answer.

1. Newton discovered that light was made of color which he called the visible ___.
   A. Color world B. Light C. Rainbow D. Spectrum
2. According to Descartes, red light is refracted more than the _____ light.
   A. blue B. green C. yellow D. white
3. In his experiment, Newton saw that red light refracted the least while the _____ light refracted the most.
   A. blue B. orange C. violet D. white
4. A triangular piece of glass or plastic that bends light is _____
   A. microscope B. mirror C. prism D. spectrum
5. What do light rays do as they pass from one transparent material to another?
   A. absorb B. bend C. disappear D. reflect

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: The Wave Theory of Light		
Learning Competency: (1) Describe how the propagation of light, reflection, and refraction are explained by the wave model of light (2) Cite example of waves		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 58

CONCEPT NOTES

Sound, string, radio, water, microwaves, stadium, earthquake waves are some example of waves in our daily encounter. All waves are generated through disturbance. In Physics, wave is a periodic disturbance which is propagated through a particular medium. It is classified into: (1) mechanical waves (transverse and longitudinal) (2) Electromagnetic waves (3) Matter wave.

Wave Theory of Light

- Proposed by Hooke and improved by Huygens.
- Huygens' Principle – each point on a wave, behaves as a point source for waves in the direction of wave motion. Huygens' wave model of light explains reflection, refraction, diffraction of light but had difficulty in explaining the rectilinear propagation of light.
- Reflection – when light bounces off an object.
- Refraction – is the bending of wave when it enters a medium where its speed changes. If light slows down, it will refract towards the normal line. If light speeds up, it will refract away from the normal line. Refraction is responsible for the image formation by the lenses and the eye.
- Diffraction – is the slight bending of light as it passes around the edge of an object which depends on the relative size of the wavelength of light to the size of the opening.

Exercises: Encircle the letter of the correct answer.

1. The following propagation of light can be explained in the wave theory EXCEPT.
   A. Diffraction B. Reflection C. Refraction D. Rectilinear propagation
2. The wave theory of light was first proposed by_____
   A. Einstein B. Hooke C. Huygens D. Newton
3. Transverse wave is an example of _____
   A. Electromagnetic wave C. Mechanical wave
   B. Matter wave D. Thermal wave
4. The bending of light when it enters a medium where its speed changes is called _____
   A. Diffraction B. Reflection C. Refraction D. Interference

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: The Particle Theory of Light		
Learning Competency: Describe how the propagation of light, reflection, and refraction are explained by the wave model of light.		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 59

CONCEPT NOTES

The Corpuscular (particle) Theory – Newton's Theory

- Rectilinear propagation – light travels in a straight line. A ball thrown does not have rectilinear propagation. Newton explains why light did not behave in the same way. He felt that the speed of light is extremely high, and so deviation from rectilinear motion was not noticeable.
- Diffraction - is the slight bending of light as it passes around the edge of an object. Newton felt that light does not travel around corners. He explained that any observed effect of this caused by the interaction of particles when they run into each other at the edges of the objects.
- Reflection – the bouncing of light as it hits a surface. Newton demonstrated that in perfectly elastic collision, the laws of reflection could be derived from the laws of motion.
- Dispersion – the separation of light into colors. Newton explained that particles of different mass would be affected differently when refracted.
- Refraction – the bending of light. Newton believed increase in speed of the light particles would cause the particles' path to bend towards the normal.

Exercises: Match column A with column B. Write the letter on the space provided before each number.

Column A	Column B
_____1. Refraction	A. Reflection
_____2. The path of light	B. The bending of light
_____3. The slight bending of light	C. Dispersion
_____4. The separation of light into colors	D. Straight line
_____5. The bouncing of light as it hits the object.	E. Diffraction

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: The Photon Theory of Light		
Learning Competency: Explain how the photon theory of light accounts for the atomic spectra.		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 60

CONCEPT NOTES

PHOTON THEORY OF LIGHT

Newton thought that light was made of particles (corpuscles) that emanated from the light source. Light can be described as a quanta, or packet, of energy that behaves as if they were particles. Light quanta are called photons. Photons are emitted when electrons of an atom are excited.

When light is shown on an atom, its electrons absorb photon which causes them to gain energy and jump to a higher level. Since an electron can only exist at certain energy levels, it can only emit photons of certain frequencies. The emitted light can be observed as a series of colored lines called ***a line or atomic spectra***. Each element produces a unique set of spectral line.

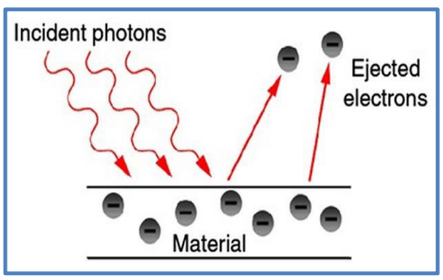


Fig. 1 Excited electrons of an atom

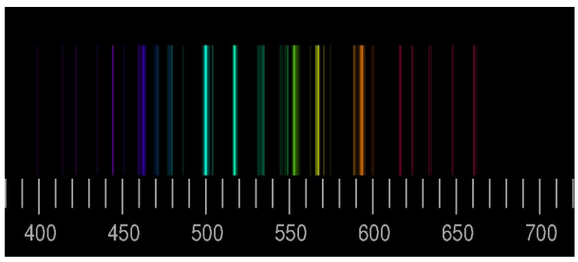


Fig. 2 Atomic spectra

Exercises: Write TRUE if the statement is correct and FALSE if NOT.

_____1. The colored line observed when electrons are excited is called line spectra.
_____2. Light can be described as a packet of energy.
_____3. Einstein believed that light behaves like a particle.
_____4. Two elements can have the same spectral lines.
_____5. When light is shown on an atom, its electrons absorb photon which causes them to gain energy and jump to a higher level.

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: Wavelength, frequency, and energy relation		
Learning Competency: Explain how the photon concept and the fact that the energy of photon is directly proportional to its frequency can be used to explain why red lights are used in dark rooms…		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 61

CONCEPT NOTES

Why Red Light is used in Photographic Dark Rooms?

Darkrooms used red lighting to allow photographers to control light carefully, so that light sensitive photographic paper would not become overexposed and ruin the pictures during the developing process. Red light in the visible region of the spectrum has the longest wavelength.

Why do we get easily sunburned in ultraviolet light but not in visible light?

The sun is a source of the full spectrum of the ultraviolet radiation which is divided into three regions: UVA, UVB, and UVC. The UVC is the most harmful. The UVB rays are responsible for causing us sunburn. Exposure to UVB rays increases the risks of DNA and other cellular damage in living organisms. This UV light has shorter wavelength than visible light, therefore it has higher frequency and energy.

Energy, frequency, and wavelength relation

The relationship between energy and frequency is given by the equation, $E = hv$, where h is Planck's constant equal to 6.63×10^{-24} Joules-second. A direct relationship exists; electromagnetic radiation with a higher frequency is more energetic. The shorter the wavelength, the larger the frequency, greater the energy. Thus, red light is used in darkrooms since it has longer wavelength, its frequency is low and its energy also low, and therefore it does not affect the photo developing process.

Exercises: Write TRUE if the statement is correct and FALSE if NOT.

_____1. Red light is used in darkroom because red in the spectrum has shorter wavelength.

_____2. UVC is the most harmful ultraviolet radiation.

_____3. Energy of light is directly proportional to its frequency which means the lower the frequency, the lower the energy.

_____4. According to the equation E = hv, the longer the wavelength, the larger the frequency, greater the energy.

_____5. The main source of the full spectrum of ultraviolet radiation is the sun.

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: The Wavelength-Speed-Frequency Relation		
Learning Competency: Apply the wavelength-speed-frequency relation		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 62

CONCEPT NOTES

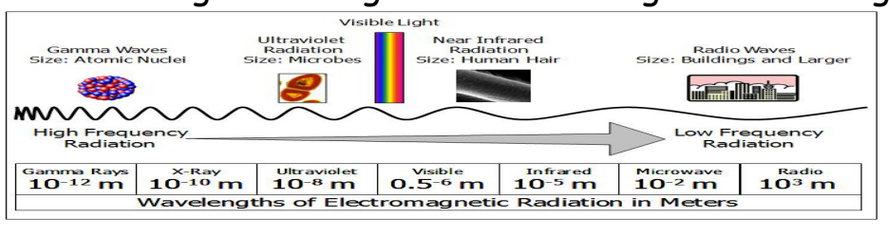
The relationship between the frequency (the number of wave crests that pass by a certain point in a given amount of time) and wavelength is defined by the formula

C is the speed of light
f is frequency
λ (lambda) is wavelength

Wavelength $\lambda = \frac{C}{f}$ Frequency $f = \frac{C}{\lambda}$

C = 299,727,738 meters/sec (the speed of light at Earth's surface - through air)
C = 299,792,458 meters/sec (in a vacum).

The inverse relationship between wavelength and frequency means that the wavelengths increases, frequency decreases. For this reason, within the visible spectrum, shorter wavelength blue light is more energetic than longer wavelength red light.



Example: The light blue glow given off by mercury street lamps has a wavelength of λ = 436nm. What is the frequency?

Given:
λ = 436nm = 4.36×10^{-7}m
c = 3.00×10^{8} m/s
1nm = 1×10^{-9}m

Solution:
$f = \frac{c}{\lambda} = \frac{3.00 \times 10^{8}\,m/s}{4.36 \times 10^{-7}\,m}$
$= 6.88 \times 10^{14}/s$

Exercises: Encircle the letter of the correct answer.

1. Which of the following correctly expresses the relationship between frequency and wavelength?
   A. frequency increases as wavelength increases
   B. frequency is equal to wavelength
   C. frequency decreases as wavelength increases
   D. frequency and wavelength are unrelated
2. What is the frequency of red light with a wavelength of 690 nm?
   A. $4.34 \times 10^{5}/s$ B. $4.34 \times 10^{14}/s$ C. 230/s D. $2.3 \times 10^{-6}/s$
3. In the visible light spectrum, which of the following has the greatest energy?
   A. gamma rays B. Infrared rays C. Visible rays D. X-rays

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: Speed of light		
Learning Competency: Describe how Galileo and Roemer contributed to the eventual acceptance of the view that the speed of light is finite.		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 63

CONCEPT NOTES

Most of the Greek Astronomers believed that the speed of light is infinite. However, two great scientists Galileo and Roemer made experiment to determine the speed of light. With their discovery, the idea that the speed of light is finite has been accepted.

1638 Galileo: Speed of light at least 10 times faster than sound

Galileo and his assistant made an experiment to determine the speed of light using lamp. Galileo would uncover his lamp and as soon as his assistant saw the light he would uncover his. Galileo was able to determine the speed of light knowing the distance between the lamps and the time the light travel from his position to his assistant's position. His conclusion: "If not instantaneous it is extraordinary rapid", he also deduced that Speed of light at least 10 times faster than sound.

1675 Ole Roemer: 200,000Km/sec

Ole Roemer determine the approximate speed light while observing Jupiter's moon Io. He observed that the number of times of the eclipses of the moon of Jupiter depend on the relative position of Jupiter and Earth. If Earth was closer to Jupiter, the orbits of its moons appeared to speed up. If the Earth is far from Jupiter, they seemed to slow down. He deduced that the apparent change must be due to the extra time for light to travel when Earth was more distant from Jupiter. He concluded that light must traveled at 200 000 km/s.

Today: the adapted value **299,792.458 km/sec** at the General Conference of weights and measures in October 21, 1983.

Exercises: Write **TRUE** if the statement is correct and if NOT.

_____ 1. Galileo determine the speed of light through observing Jupiter's moon Io.

_____ 2. According to Roemer, if Earth was close to Jupiter, the orbits of its moon appeared to speed up.

_____ 3. Today the adopted value of the speed of light as of October 1983 is 299,729.458 km/s.

_____ 4. Galileo concluded that the speed of light is, "If not instantaneous, it is extraordinary rapid".

_____ 5. Roemer concluded that light must have traveled at 200,000 km/s.

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: Wave-Like Properties of Electron		
Learning Competency: Cite experimental evidence showing that electrons can behave like waves.		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 64

CONCEPT NOTES

Einstein (and others) showed that electromagnetic radiation has properties of matter as well as waves. This is known as the **Wave-particle duality** for light.

The photoelectric effect of Einstein is perhaps the most direct and convincing evidence of the existence of photons and the 'corpuscular' nature of light and electromagnetic radiation.

Lois de Broglie, combine Einstein's equation $E=mc^2$, Plank's equation $E=hv$, and the relationship between wave speed, frequency, and wavelength $c=f$ and derive the formula $\lambda = h/mv$

Heisenberg Uncertainty Principle determined that it is impossible to experimentally determine both the position and the speed of the electron at the same time.

Erwin Schrodinger pursued de Broglie's idea on electron. He was the first person to write down such a wave equation. This idea agreed with Bohr's idea on quantized energy level: only certain energies and therefore, wavelengths would be allowed in the atom. He also set out to make a mathematical model that assumed the electron was standing wave around the nucleus.

Exercises: Encircle the letter of the correct answer.

1. The wave-particle duality of light was proposed by
   A. De Broglie B. Einstein C. Plank D. Schrodinger
2. It was impossible to experimentally determine both the position and the speed of the electron at the same time was stated in the principle called __
   A. Heisenberg Uncertainty C. Quantum mechanical energy
   B. Pauli's Exclusion principle D. Wave-duality principle
3. The wave equation to figure out the probability of where an electron might be was derived by
   A. Einstein B. Heisenberg C. Plank D. Schrodinger
4. He pursued de Broglie's idea of the electron having wave properties
   A. Einstein B. Heisenberg C. Plank D. Schrodinger
5. The photoelectric effect was proposed by
   A. Einstein B. Heisenberg C. Plank D. Schrodinger

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: Dispersion and Scattering		
Learning Competency: Explain various light phenomena		
References: Physical Science for SHS by Bayo-ang, et.al		LAS No.: 65

CONCEPT NOTES

Scattering of light

The amount of scattering depends on how big the particle is compared to the length of light that is hitting it. Smaller wavelength are scattered more.

Why is the sky BLUE?

Light from the sun is made up of all the colors of the visible light. During daytime, when the sun is up smaller wavelength blue light is scattered in all direction as it hits the particles of air more than any other color.

Why are sunsets RED?

When the sun appears low in the sky, the red light waves is scattered least by atmospheric gas molecules. During sunrise and sunset, when the sunlight travels a long path through the atmosphere to reach our eyes, the blue light has been mostly removed, leaving mostly red and yellow light remaining.

Mirages – is refraction phenomena in which the image of some object appears displaced from its true position.

Rainbow – is an excellent demonstration of the dispersion of light and one more piece of evidence that visible light is composed of a spectrum of wavelengths, each associated with a distinct color.

Halo – is a ring around the moon or sun produced by refraction of light through a thin cloud of ice crystals.

Sundogs – are bright spots that appear on either side of the sun when there are thin layers of high ice crystal clouds otherwise known as Cirrus Clouds. This can also happen at night. These are called moon dogs.

Exercises: True or False. Write TRUE if the statement is correct and FALSE if not.

_____ 1. Rainbow demonstrates the dispersion of light.

_____ 2. Light is made up of all the colors of the visible light.

_____ 3. Halo is produced by reflection of light through a thin cloud of ice crystals.

_____ 4. During daytime, the sky appears blue cause by the smaller wavelength blue light is scattered more than any other color.

_____ 5. A mirage is an example of diffraction of light.

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: Various Light Phenomena		
Learning Competency: Explain various light phenomena		
References: Physical Science for SHS by Bayo-ang, et.al shorturl.at/cqMNP		LAS No.: 66

CONCEPT NOTES

Hazy Arc-It is a strange aura was spotted from the Golden Gate bridge in San Francisco. It looked like a fully white rainbow. Like rainbow, this phenomenon created by the refraction of light through water droplets in the clouds, but, unlike the rainbow,because of the small size of the droplets of the fog color as it is not enough. So it turns out rainbow is colorless, just white. Sailors often referred to them as "sea wolves" or "misty arc".

Allogeneically arc-This phenomenon is also known as "fire rainbow". Is created in the sky when light refracts through ice crystals in Cirrus clouds. The phenomenon is very rare, since the ice crystals and the sun must stand exactly on the horizontal line to such a dramatic refraction.

Okoloserdecna arc- It is produced from the refraction of sunlight through horizontal ice crystals in specific cloud forms. The phenomenon is concentrated at the Zenith, parallel to the horizon, the range of colors — from blue near Zenith and red towards the horizon.

Ghosting- It is one of the most well-known and common optical phenomena, they occur under a variety of guises. The most common phenomenon of the solar halo, caused by refraction of light by ice crystals in Cirrus clouds at high altitude, and the specific form and orientation of the crystals can create variation in the appearance of the halo.

Iridescent clouds-When the sun is exactly at a right angle behind the clouds, droplets of water refract the light, creating intense stretching train.

Exercises:

Browse the internet through this link:
https://steemit.com/nature/@krasotka/20-most-incredible-light-phenomena
and watch for some incredible light phenomena. Look for some other light phenomena which are not mentioned above. Briefly describe each of them.

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: Electricity and Magnetism		
Learning Competency: Explain the contributions of Franklin, Coulomb, Oersted, Ampere, Biot-Savart, Faraday, and Maxwell to our understanding of electricity and magnetism		
References: https://bit.ly/2DVuDln		LAS No.: 67

CONCEPT NOTES

Electricity – is the presence and flow of electric charge.

Magnetism - refers to physical phenomena arising from the force caused by magnets, objects that produce fields that attract or repel other objects.

Contributions of Scientists to Electricity and Magnetism

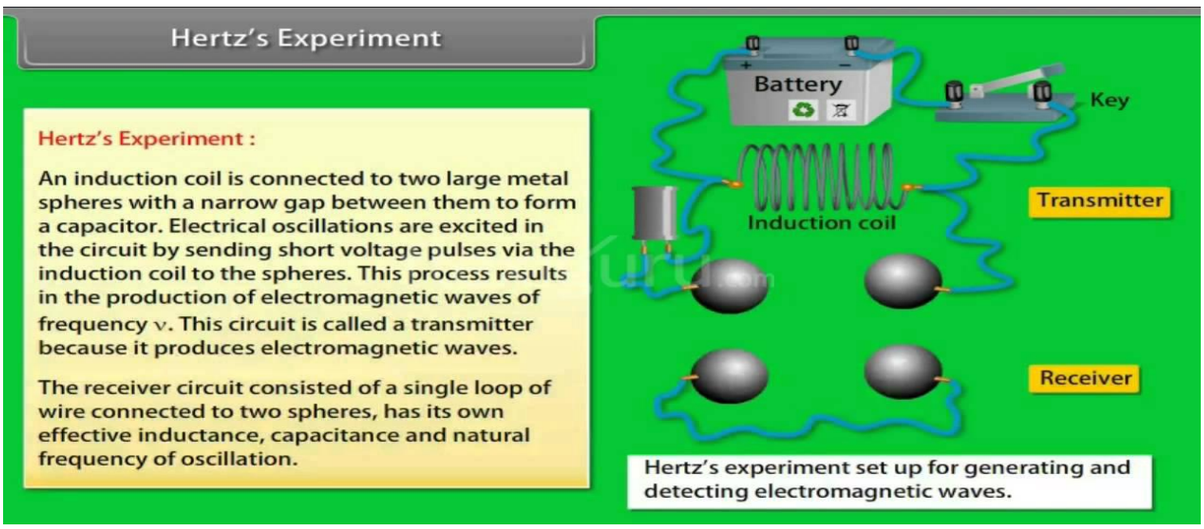
1. Benjamin Franklin - discovered that electricity is not generated by rubbing two objects, but is rather transferred from one object to the other. He also discovered that positive and negative charge is always balanced in all objects in nature.
2. Charles-Augustin de Coulomb – proposed the Coulomb's Law which states that the magnitude of the electrostatic force of interaction between two point electrical charges (q1, q2) is directly proportional the magnitudes of electrical charge and inversely proportional to the square of the distance (r) between them.
3. Hans Christian Ørsted – proposed the Oersted's Law states that when a steady electric current passes through a wire it creates a magnetic field around it.
4. André-Marie Ampère - Ampere's Law states Law states that for any closed loop path, the sum of the length elements times the magnetic field in the direction of the length element is equal to the permeability times the electric current enclosed in the loop.
5. Michael Faraday's law of induction is one of the important concepts of electricity that changing magnetic fields can cause current to flow in wires.
6. Jean-Batiste Biot and Felix Savart - in their Biot-Savart Law which provides a quantitative relationship between an electric current and the magnetic field it produces.
7. James Clerk Maxwell – use mathematical equations to describe the relationship between electricity and magnetism.

Name:	Date:	Score:
Subject : Physical Sciences		
Lesson Title: Hertz		
Learning Competency: Describe how Hertz produced radio pulses		
References: https://bit.ly/2DVuDln, https://bit.ly/2TBS9JC		LAS No.: 68

CONCEPT NOTES

Heinrich Hertz

- He became the first person to transmit and receive controlled radio waves.
- He clarified and expanded the electromagnetic wave theory of Maxwell.
- He proved the existence of electromagnetic waves using instrument to transmit and receive radio pulses.
- His apparatus consists of an induction coil, a capacitor, and two plates separated by a small air or gap.
- Hertz was not only able to detect the waves; he was able to measure their wavelength and velocity.



Credits: https://bit.ly/2TBS9JC

EXERCISES: True or False: Write TRUE if the statement is correct and FALSE if NOT.

_____ 1. Hertz experiment is set to generate and detect electromagnetic waves.
_____ 2. Instead of using a capacitor Hertz uses an induction coil that serves as capacitor in the set up.
_____ 3. In his experiment, Hertz does not only detect the waves but also was able to measure the wavelength and speed of the waves.

Name:	Date:	Score:
Subject: Physical Science		
Lesson Title : Special Relativity and the Big Bang		
Lesson Competency : Explain how special relativity resolved the conflict between Newtonian mechanics and Maxwell's electromagnetic theory (3 hours)		
References : https://www.quora.com/How-does-special-relativity-resolve-the-conflict-between-Newtonian-mechanics-and-Maxwell-s-electromagnetic-theory		LAS No. 69

CONCEPT NOTES

Before we get to Newtonian mechanics (F = ma) and electromagnetism (Maxwell's equations) we first need to know what Galileo said about referential frames.

Newtonian mechanics is consistent with the Galilean relativity, and is said to be invariant under Galilean transformations. With Maxwell's equations however there is a problem. The equations are not invariant under such transformations. Meaning that either these equations are wrong or the Galilean transformations are wrong.

Since Maxwell's equations are very well verified by the experiments, some physicists (Lorentz, Poincaré, Einstein) tried to find other transformations that would keep Maxwell's equations invariant. These transformations are Lorentz transformations, and are at the core of the theory of special relativity.

Newtonain mechanics is based on the assumption of absolute space and time. This means that the distance between two points and the time that passes between two events doesn't depend on the coordinate system you choose. Therefore, a coordinate transformation must leave them invariant.

Maxwell's equations predict a value of for the speed of light in an inertial reference frame, c=1μ0∈0√. On the other hand, the Galilean transformations predict that the speed of light in an inertial reference frame moving with relative velocity v is c'=c+v. This is obviously a contradiction to the Galilean relativity.

The principle of relativity postulates that all physical laws are identical in all inertial reference frames, and therefore, physical laws must be invariant under Poincaré transformations. This is the essence of special relativity. Special relativity 'resolves' the conflict between Newtonian mechanics and electrodynamics by dubbing Newtonian mechanics wrong.

EXERCISES

Explain in your own words how special relativity resolved the conflict between Newtonian mechanics and Maxwell's electromagnetic theory.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Evolution of the Universe		
Lesson Competency: Explain how we know that we live in an expanding universe, which used to be hot and is approximately 14billion years old. (S11/12PS-IVj-73)		
Reference:https://www.nasa.gov/mission_pages/spitzer/multimedia/timeline-2006121889912.html		LAS No.: 70

CONCEPT NOTES

The term "evolution" usually refers to the biological evolution of living things. But the processes by which planets, stars, galaxies, and the universe form and change over time are also types of "evolution." The idea of our universe also undergo evolution.

EXERCISE

Open the website written on the reference above. Print and paste here, the picture of the "timeline of the universe". Give a brief discussion for each period of the timeline.

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Doppler Effect		
Lesson Competency: Explain how Doppler shifts and transits can be used to detect extra solar planets. (S11/12PS-IVj-74) Explain how the speeds and distances of far-off objects are estimated (e.g., Doppler effect and cosmic distance ladder). (S11/12PS-IVj-72)		
References: http://lasp.colorado.edu/education/outerplanets/exoplanets.php		LAS No.: 71

CONCEPT NOTES

The **Doppler technique** is a good method for discovering exoplanets (planets orbiting another star and not the sun). It uses the **Doppler effect** to analyze the motion and properties of the star and planet. Both the planet and the star are orbiting a common center of mass. This means that the star and the planet gravitationally attract one another, causing them to orbit around a point of mass central to both bodies.

EXERCISES

Paste an article about discovering exoplanets using Doppler technique or the use of Doppler technique in discovering exoplanets. In the article, highlight the mechanism of how Doppler shifts and transits used in detecting exoplanets. You may open the website written on the reference part or this website http://users.physics.harvard.edu/~schwartz/15cFiles/Lecture21-Doppler.pdf

Name:	Date:	Score:
Subject : Physical Science		
Lesson Title : Pluto		
Lesson Competency: Explain why Pluto was once thought to be a planet but is no longer considered one. (S11/12PS-IVj-75)		
References: Physical Science for Senior High School by Bayo-ang, et.al.		LAS No.: 72

CONCEPT NOTES

Pluto was once considered as a planet. It was the ninth planet of the solar system. Later it was downgraded as a dwarf planet and no longer consider as a planet.

EXERCISE

Paste an article about Pluto. On your article emphasize the reason why Pluto was first considered as a planet and the reasons why it was not considered today a planet. You will do this by highlighting the phrases that give reasons. Blue color for the reasons why Pluto was first considered as a planet and red for the reasons why it was not considered today a planet.