PEAC
PRIVATE EDUCATION ASSISTANCE COMMITTEE
Trustee of the Fund for Assistance to Private Education

DepED
DEPARTMENT OF EDUCATION

2017

LEARNING MODULE

Science G9| Q2

Mole Concept

PEAC
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NOTICE TO THE SCHOOLS

This learning module (LM) was developed by the Private Education Assistance Committee under the GASTPE Program of the Department of Education. The learning modules were written by the PEAC Junior High School (JHS) Trainers and were used as exemplars either as a sample for presentation or for workshop purposes in the JHS In-Service Training (INSET) program for teachers in private schools.

The LM is designed for online learning and can also be used for blended learning and remote learning modalities. The year indicated on the cover of this LM refers to the year when the LM was used as an exemplar in the JHS INSET and the year it was written or revised. For instance, 2017 means the LM was written in SY 2016-2017 and was used in the 2017 Summer JHS INSET. The quarter indicated on the cover refers to the quarter of the current curriculum guide at the time the LM was written. The most recently revised LMs were in 2018 and 2019.

The LM is also designed such that it encourages independent and self-regulated learning among the students and develops their 21st century skills. It is written in such a way that the teacher is communicating directly to the learner. Participants in the JHS INSET are trained how to unpack the standards and competencies from the K-12 curriculum guides to identify desired results and design standards-based assessment and instruction. Hence, the teachers are trained how to write their own standards-based learning plan.

The parts or stages of this LM include Explore, Firm Up, Deepen and Transfer. It is possible that some links or online resources in some parts of this LM may no longer be available, thus, teachers are urged to provide alternative learning resources or reading materials they deem fit for their students which are aligned with the standards and competencies. Teachers are encouraged to write their own standards-based learning plan or learning module with respect to attainment of their school's vision and mission.

The learning modules developed by PEAC are aligned with the K to 12 Basic Education Curriculum of the Department of Education. Public school teachers may also download and use the learning modules.

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SCIENCE 9

Module 2. Matter

Lessons 1-2: Chemical Bonding and Variety of Carbon Compounds

INTRODUCTION AND FOCUS QUESTION(S):

Look around you. Do you think you see anything composed of just one element… any objects consisting only of carbon, or of gold, or of hydrogen? The correct answer is almost certainly no. Have you ever wondered why there are millions of chemical compounds out there? Have you tried making your own chemical substance? Have you ever tried to separate sheets of plastic that are stuck together? Did you dream of having a diamond but did not think how it is made up of? Did you come to think how atoms participate in forming compounds?

Understanding the bonding in compounds is essential to developing new chemical and technologies. These compounds are too complex to work on. You probably know that your mother's mother is your grandmother and that your grandmother's sister is your great aunt but what do you call your grandmother's brother's daughter? Naming these compounds requires set of rules, just as naming family relationships requires rules.

In this module, you will find out how atoms form compounds with another atom. Remember to search for the answer to the following question(s):

1. What holds atoms together in a chemical bond?
2. Why do atoms form single, double and triple covalent bonds?
3. How are compounds formed?

LESSONS AND COVERAGE:

In this module, you will examine this question when you take the following lessons:

Lesson 1.1 – Ionic Bonding and Metallic Bonding
- A. Ion Formation
- B. Lewis Structure of Ionic Compound

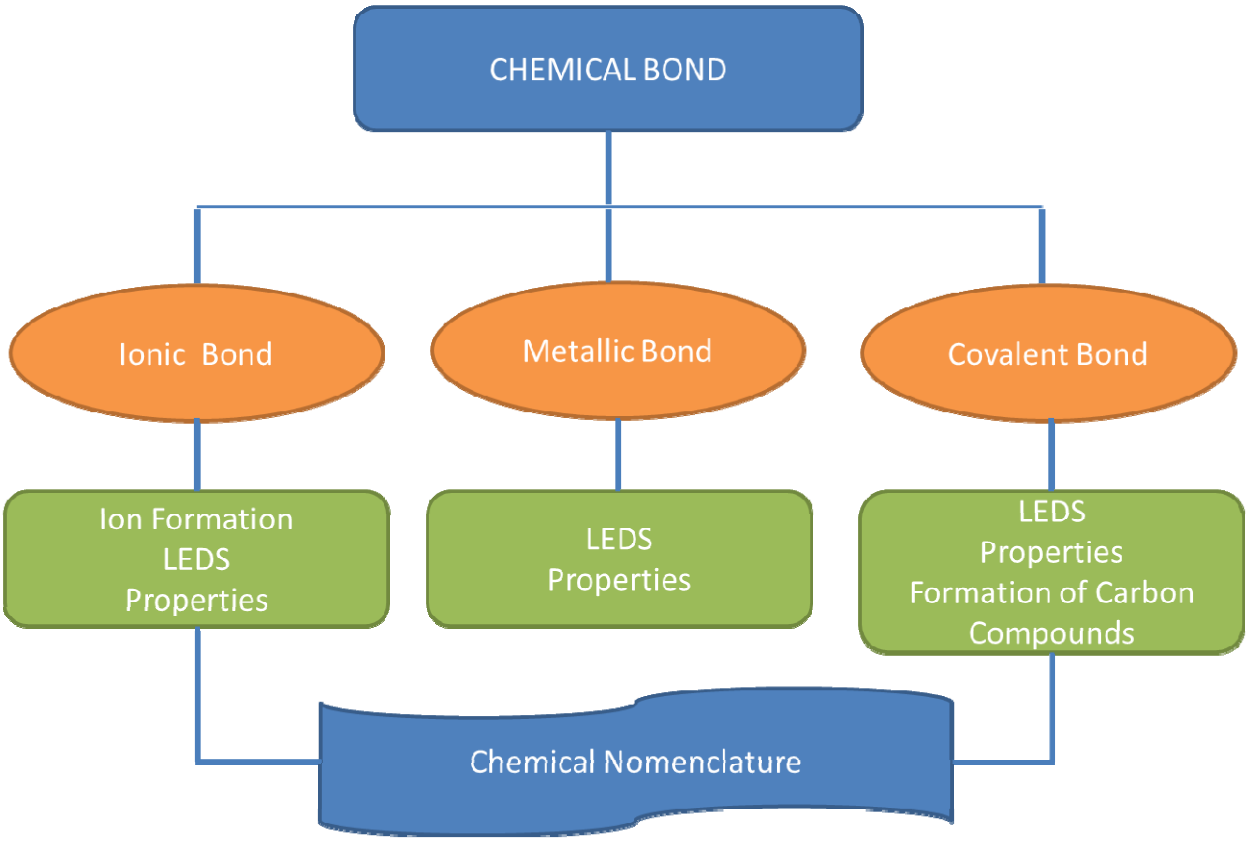
Lesson 1.2 – Covalent Bonding
- A. LEDS of Covalent Compound
- B. Polar and Nonpolar Compounds
- C. Chemical Nomenclature

Lesson 2.1 – Carbon and its Compound
- A. Carbon: Its Properties
- B. Families of Carbon

In these lessons, you will learn the following:

Lesson 1.1	Write the Lewis Structures of Ionic Compound.
Lesson 1.2	Name chemical compounds formed through chemical bonding.
Lesson 2.3	Make a compound through mini science investigatory project. Create a digital story of the uses of Carbon compounds.

MODULE MAP:
Here is a simple map of the above lessons you will cover:



EXPECTED SKILLS:
To do well in this module, you need to remember and do the following: (List key study skills and other actions that will help students succeed in doing the module)

1. *Read the instructions carefully.*
2. *Take down notes and copy some important link so that you could go back whenever you need information given in that site.*
3. *Go beyond the procedure given in the net. Explore more.*
4. *Do the web test for several times and don't forget to click on the correct answer for your reference.*

PRE-ASSESSMENT:

Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

1. Which two statements about covalent bond are correct?
   1. It can be formed between two metal atoms.
   2. It can be formed between two non-metal ions.
   3. It is formed by the transfer of electrons between atoms.
   4. It is formed by sharing of electrons between atoms.

   A. 1 and 3 **B. 2 and 3**
   C. 1 and 4 **D.** 2 and 4

2. Alkenes always contain a _____.

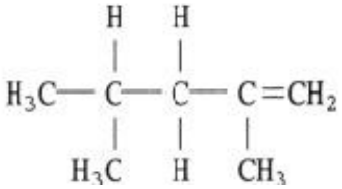
   A) C=C bond
   B) C≡C bond
   C) C-C bond
   D) C=H bond

3. Order the following by decreasing bond length: C≡C, C=C, C-C
   A. they are all the same
   B. C≡C, C=C, C-C
   C. C≡C, C-C, C=C
   D. C-C, C=C, C≡C

4. How many unpaired electrons are there in the Lewis structures of a N^{3-} ion?
   A. 0 **C**. 1
   B. 2 **D.** 3

5. Which of the following lists contains no ionic compounds?
   a. HCN, NO, $Ca(NO_3)_2$
   b. KOH, CCl_4, SF_6
   c. NaH, CaF_2, $NaNH_2$
   d. CH_2O, H_2S, NH_3

6. Give the simple base name of the molecular structure below:

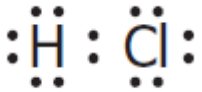


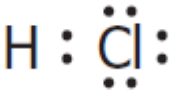
A. butene
B. pentane
C. pentene
D. pentyne

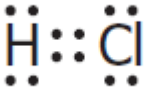
Find the longest continuous chain of carbon atoms, and use this chain as the base name

7. Which alkanes have largely replaced Freons as propellants in aerosol cans?
A. methane and ethane
B. propane and butane
C. pentane and hexane
D. nonane and decane

8. The stomach contains **hydrochloric acid** (HCl) strong enough to dissolve metal (pH about 1.5 to 3, usually around 2), which kills bacteria and helps denature the proteins in our food, making them more vulnerable to attack by pepsin. Which of the following is the correct Lewis structure of **hydrochloric acid**?

A 

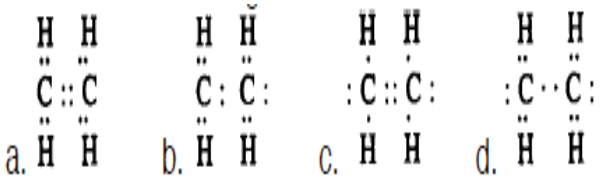
B 

C 

D 

9. Ethene is also used as a plant hormone to control the ripening and color development of fruit. The molecular structure of ethene is responsible for this property.

Which of the following is the correct electron dot formula of C_2H_4?

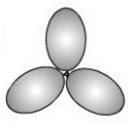


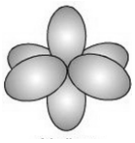
Chemistry Party

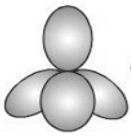
Your chemistry teacher will organize a chemistry party for the class. You will prepare the balloon needed for the party. The twist of the party is that you can only join the party if you'll design the balloons according to its molecular geometry/shape. Which of the following balloons will represent the compounds?

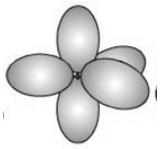
Use the following Legends:

3 - Balloons give a trigonal planar geometry
4 - Balloons give a tetrahedral geometry
5 - Balloons give a trigonal bipyramidal geometry
6 - Balloons give an octahedral geometry

A. 

B. 

C. 

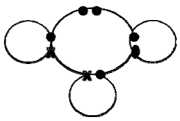
D. 

10. H_2O

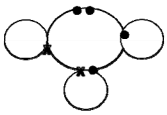
11. H_2CO

12. $SiCl_4$

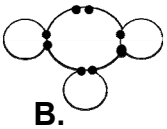
13. Elements **X** and **Y** combine to form covalently bonded molecule.
Show the Lewis structure of the molecule.



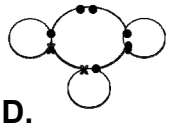
A.



C.



B.



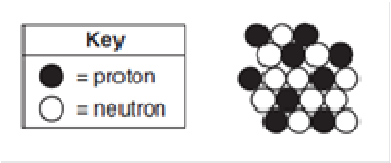
D.

14. Using the diagram below, which of the following LEDS is most like to receive electron/s?

methanol

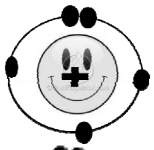
A. Element A
B. Element B
C. Element C
D. Element D

15. The diagram below represents the nucleus of an atom.



As the graphic artist of a book company, which LEDS will you illustrate based from the above information?

A.



B.

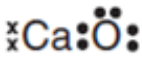
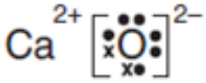
C.

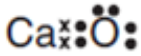
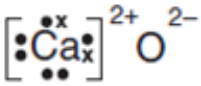
D.

16. In the Chemistry Lab, you obtained the following results in your experiment: You are asked to identify which is a covalent compound. What letter will you suggest to your group mates?

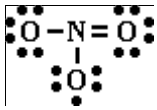
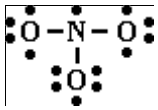
	Melting Point /^{0}C	Electrical Conductivity	
		Of solid	Of Liquid
A	-38	Conducts	Conducts
B	-7	Does not conduct	Does not conduct
C	801	Does not conduct	Conducts
D	1540	Conducts	Does not conduct

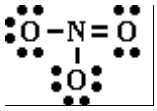
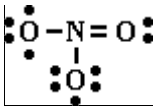
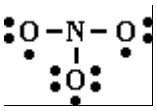
17. Lime is indispensable for use with mortar and plaster. Lime is used for medicinal purposes, insecticides and plant and animal food. It is used as a laboratory reagent for gas absorption, precipitation, dehydration etc. It is chemically called as calcium oxide, (CaO). As a member of IUPAC, you are asked to illustrate the Lewis Dot Strucure of CaO. Which of the following will you present to the members?

A.  **C.** 

B.  **D.** 

18. You are asked to show the LEDS of nitrate ion to the board. Which of the following is the correct Lewis structure for **NO_3^-**?

I)  II) 

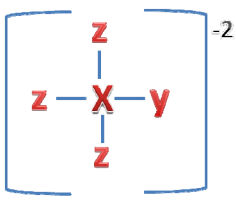
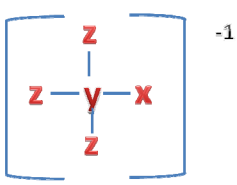
III)  IV)  V) 

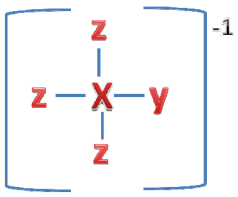
A. I & II **C**. V
B. III **D.** IV

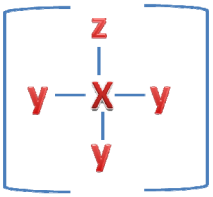
19. “We have discovered a new and important, atmospherically relevant oxidant,” said Mauldin. “Sulfuric acid plays an essential role in Earth’s atmosphere, from the ecological impacts of acid precipitation to the formation of new aerosol particles, which have significant climatic and health effects. Our findings demonstrate a newly observed connection between the biosphere and atmospheric chemistry.”

Being a member of the said Team, you are tasked by the Head to present the LEDS of the hypothetical compound. Which of the following will you present? The Newly Discovered compound is:

XYZ_3 wherein X has 4 v.e.
Y has 6 v.e.
Z has 7 v.e.

A.  C. 

B. 

D. 

20. Refer to the table:

Atom	H	C	N	O
Electronegativity	2.1	2.5	3.0	3.5

You are asked to form a polar covalent bond. Given the electronegativities above, which covalent single bond below do you need to bond?

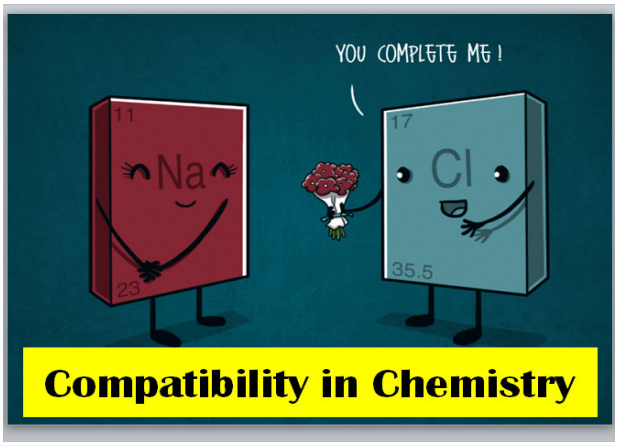
A. C-H
B. N-H
C. O-H
D. O-N

EXPLORE

ACTIVITY NO. 1: THOUSAND WORDS IN A PICTURE

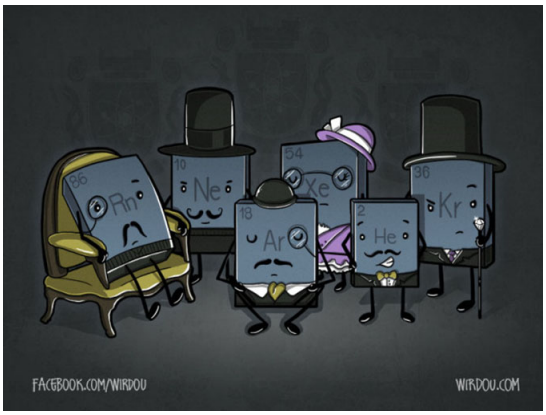
From the three pictures below, allow yourself to make your own interpretations of what a chemical bond is all about. Think of the importance the illustrations presented to you.

A. Do you have any idea why the element chlorine said this line to sodium?



B. Read the pick-up line below. How ions are formed?

C. Observe the noble gases. Why the artist illustrates the elements He, Ne, Ar, Kr, Xe and Rn in that way?



<u>ACTIVITY NO. 2:</u> WHAT KIND OF BONDS ARE THESE? (Video-Clip Presentation)

In order to understand the pictures above, you need to watch the video clip below. Be able to identify the meaning of the following terms: ionic bond, polar covalent bond, nonpolar covalent bond and electronegativity difference.

Chemical Bonds:

http://www.youtube.com/watch?v=oNBzyM6TcK8

PROCESS QUESTIONS:

1. What are the primary compositions of Sodium Chloride?
2. What are ions?
3. How does an atom form into an ion?
3. What is the role of noble gases in forming compounds?
4. How many valence electrons do noble gases have? What does it imply?
5. Why are elements stable on their own while others are more stable than in a compound?
6. How is a compound formed?

ACTIVITY NO. 3: ELICITING PRIOR KNOWLEDGE THROUGH I-R-F CHART

Given below is an IRF sheet. Fill in the first row with your answer to the question:

How is a compound formed?

Initial

Revised

Final

End of EXPLORE:

You have just given your initial ideas about how compounds are formed. Find out in the next section if your ideas are correct. What you learn in the next sections will also enable you to do the final project which involves creating a compound through scientific investigation.

Let's start by doing the next activity.

FIRM-UP

Even though a few elements, such as carbon and gold, are sometimes found in elemental form in nature, most of the substances we see around us consist of two or more elements that have combined chemically to form more complex substances called compounds.

Your goal in this section is to learn and understand the formation and development of chemical substances. You will explain how atoms are bonded differently.

ACTIVITY NO. 4: WRITING LEWIS STRUCTURES

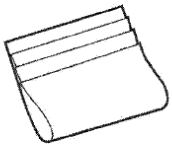
One popular method of representing atoms and compounds is through Lewis Electron Dot Structure (LEDS). It is composed of a symbol which surrounded with dots.
In LEDS, only the symbol for the element and the electrons in its outermost energy level (valence electrons) are shown.

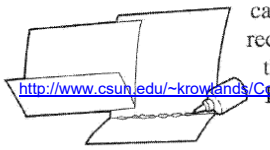
Study the figure below:

Use also the link to further see other samples of LEDS:
http://www.middleschoolchemistry.com/multimedia/chapter4/lesson6#lewis_dot_diagrams

Layered-Look Book

Stack two or more sheets of paper so that the top edges are an equal distance apart. Bring the bottom edges up and align the sheets so that all of the layers (or tabs) are the same distance apart. Fold and crease well to form the Layered-Look Book. Use glue or staples to hold the sheets together. Students can label the tabs and record information inside the Layered-Look Book.





http://www.csun.edu/~krowlands/Content/Academic_Resources/Foldables/Basic%20Foldables.pdf

Be sure to take note of the important terms that you will encounter along the activities. Do the foldable on the left side. Use the foldable when taking down notes and present it to the teacher at the end of this module.

In this module, love your foldable!

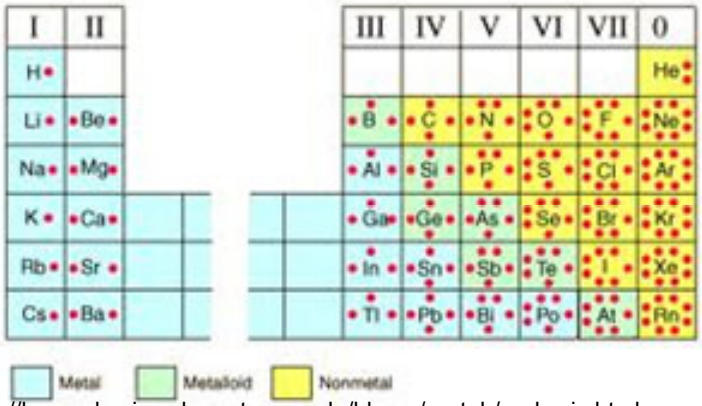
Process Questions:
1. What does the symbol of the element represent in the LEDS?
2. What is accountable for the valence electrons in the LEDS?
3. The number of dots near hydrogen and helium are the same as in the energy level chart. Why?

Allow yourself to practice writing the Lewis Electron Dot.
DO Worksheet #1.

WORKSHEET #1: VALENCE ELECTRONS AND LEDS:
Apply your knowledge of valence electrons, Lewis dot structures and the octet rule to complete the table below.

ELEMENTS	VALENCE ELECTRONS	LEDS	HOW TO ACHIEVE THE OCTET?
1. Hydrogen			
2. Magnesium			
3. Aluminum			
4. Oxygen			
5. Nitrogen			
6. Bromine			
7. Neon			

For LEDS: Refer to the picture below.



http://hyperphysics.phy-astr.gsu.edu/hbase/pertab/perlewis.html

After completing the worksheet, what learning/insights did you learn from the activity? **(Use your foldable.)**

_____
_____
_____

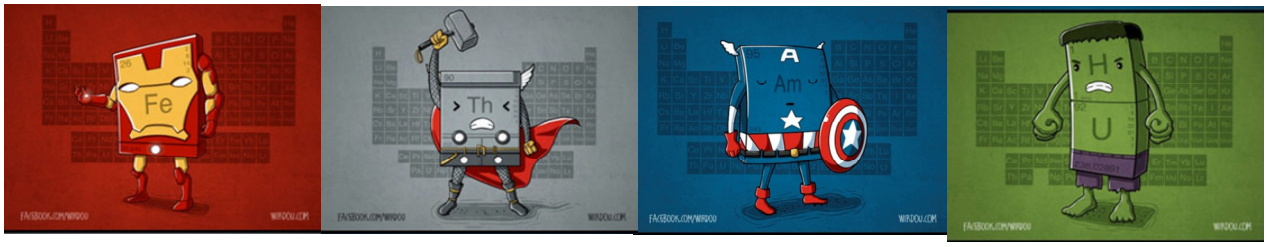
Understanding the Lewis Structure will help you identify the number of valence electrons and the number of electrons needed to complete the octet in the next activity. Make sure to familiarize how many electrons are needed/given up in forming ions.

ACTIVITY NO. 5: The CHEMICAL AVENGERS

Welcome! You are invited to be part of

Please meet the following super heroes:

Iron Man Thor-ium Captain Americium and Hulk



"When an unexpected enemy emerges that threatens global safety and security, Nick Fury, Director of the international peacekeeping agency known as S.H.I.E.L.D., finds himself in need of a team to pull the world back from the brink of disaster. Spanning the globe, a daring recruitment effort begins. " He figured out that the superheroes above were outnumbered. Thus, he needs another one.. and I guess it's YOU! Yes! You! As an aspiring wannabe superhero, Nick Fury wants to test your superpower. So what he is asking you to do is to CONVERT neutral atoms into Cations and Anions!

To help you form the ions, please click the link: http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa_pre_2011/atomic/ionicrev1.shtml

To really test if you can be part of Do the worksheet #2

Worksheet #2: **Monoatomic Ions**
Use a periodic table to complete the table below:

Element Name	Element Symbol	Ion Name	Ion Formula
1. sodium			
2. bromine			
3. magnesium			
4. chlorine			
5. oxygen			
6. boron			
7. lithium			
8. neon			
9. phosphorus			
10.aluminum			

Submit your answers and assess yourself. If your score is:
10 – Congratulations! You belong to the superheroes undoubtedly.
9-8 – Good Job! You are Next in line!
7-6 - You are such a wannabe! You are in the waiting list.
Below 5 - More training! Read the link below for more practice.
http://itc.gsw.edu/faculty/speavy/spclass/chemistry/ions.htm

Process Questions:
1. Can atoms lose electrons? Gain electrons? Explain.
2. What are ions?
3. Differentiate a cation and an anion.
4. How is the Lewis dot configuration used to represent atoms?
5. How are ions formed?

*How do you find the worksheet? Look at the items you missed**. Go back to your notes** and review the terms or concepts you missed.*

You learned how ions are formed. In the next activity, you will be using this to visualize how ionic compounds are formed.

ACTIVITY NO. 6: Ionic Bond: Taken Not Shared

Atoms are held together in compounds by the forces of attraction which result in formation of **chemical bonds**. The formation of chemical bonds results in the lowering of energy which is less than the energy the individual atoms. The resulting compound is lower in energy as compared to sum of energies of the reacting atom/molecule and hence is more stable. In this activity, you get to learn on one kind of bond, that is ionic compound.

One type of chemical bond is the ionic bond. To understand how an ionic bond works and its properties, click the link below: http://www.education.uoit.ca/lordec/ID_LORDEC/ionic_compounds/law_ionic_compounds.swf

Note down concepts/terms presented from the link in your foldable.

PROCESS QUESTIONS:

1. Name the two types of ions present in NaCl.

2. What are the components of an ionic bond?

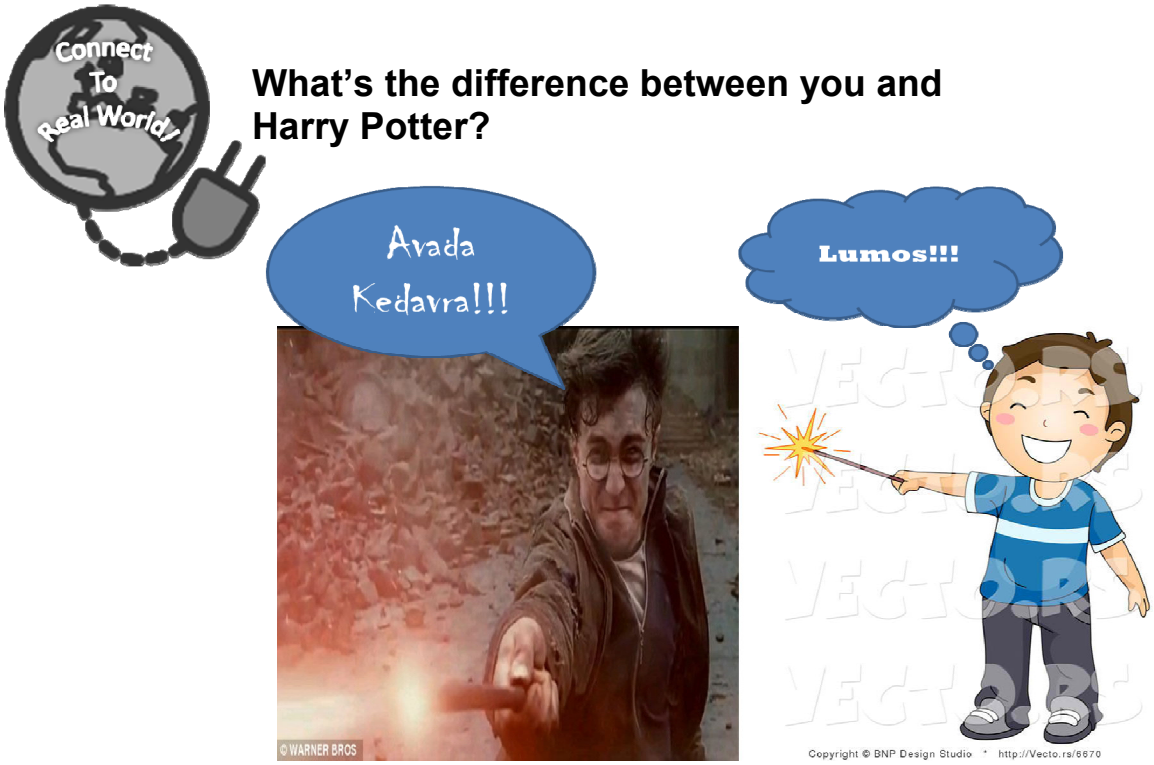
3. What is the final product of Na^+ ion and Cl^-?

4. What is the number of electrons present in Cl^- ion?

5. In a sodium chloride lattice, how many Cl^- ions surround each Na+ ion?

6. How is an ionic compound formed?

What are the essential concepts that you gathered?
What can help you more easily remember these terms? Look back at your notes and try to cluster related concepts.



Oh well, Harry has a wand and a spell while you have only a SPARKLER and a spell!

For Info:

- *Magic:* A wand is a unique spell/charm caster that every wizard must have to be powerful. Once a wizard holds the right one, sparks may potentially fly from the tip. When casting spells and charms, light, noise and smoke emerge from the wand.
- *Science:* Perhaps these wands are similar to sparklers. Sparklers are unique to the fabricator, produce sparks, light, noise and smoke. The only difference is that you cannot levitate or expel anyone or anything with a sparkler.

Research about sparklers by clicking the website below. Look into the composition of sparklers.

http://www.ehow.com/info_8299010_composition-sparklers.html

What is it made up of? What kind of compounds are these?

Conclusion:

ACTIVITY NO. 7: IONIC BONDING GAME

You learned from the previous activity how ionic bond is formed. In this game, you are challenged to create compounds by combining ions

http://www.learner.org/interactives/periodic/groups_interactive.html

Answer the Process Questions below:

1. What were the compounds that you'd created?
2. What are the main components of an ionic bond?
3. How is a compound formed?

Let's check if you have learned something from the previous activities. Do the quiz below:

Quiz #1
http://highered.mcgraw-hill.com/sites/0072402334/student_view0/quiz-ionic_bonding.html

Where can you find ionic compounds? Are these substances rare? The next activity will help you hunt for these compounds.
All you need is to look for it… so Let the hunting begin:

ACTIVITY NO. 8: The Search for Ionic Compounds

You have learned that ionic compounds are basically defined as being compounds where two or more ions are held next to each other by electrical attraction. One of the ions has a positive charge (called a "cation") and the other has a negative charge ("anion"). Cations are usually metal atoms and anions are either nonmetals or polyatomic ions (ions with more than one atom). Think back to grade school: The same thing that makes the positive and negative ends of a magnet stick to each other is what makes cations and anions stick to each other.

Now try to review the ionic compound below:

http://mrcramssciencespot.blogspot.com/2011/04/chemistry-ionic-covalent-bond-quiz.html

1) What type of bond is shown in the cartoon above? How do you know?
2) How many valence electrons is each "Cl" atom receiving? Why is each "Cl" receiving this amount of electrons?
3) Copper (Cu) is not in group 1A or 2A, but it is behaving like metal. How many valence electrons does Copper (Cu) lose?
4) What will the charge on the Cu atom be after it gives its valence electrons away?
5) What will be the charge on each Cl atom after they receive their valence electrons?
6) What are the uses of $CuCl_2$?

Read out loud the discussion below:

Usually, when we have ionic compounds, they form large crystals that you can see with the naked eye. Table salt is one example of this - if you look at a crystal of salt, chances are you'll be able to see that it looks like a little cube. This is because salt likes to stack in little cube-shaped blocks.

Sometimes when you see a salt, it looks like a powder instead of a cube. This doesn't mean that the salt is not a crystal - it means that the crystals are just so small that you can't see them with the naked eye. If you were to put the powder under a microscope, chances are that you would see little geometric block.

Now let's search for the many Ionic Compounds! What to do? Research for ionic compounds (as many as you can) and complete the table below in terms of its properties.

Worksheet # 3: Table Completion

Ionic Compounds	Properties	Uses

Process Questions:

1. What properties are common to these ionic compounds?
2. How will you use these properties in identifying these compounds?
3. How are the subscripts helpful in the formation of these compounds?

In the previous activity, we saw how atoms could achieve a complete shell of electrons by losing or gaining one or more electrons, to form **ions**. There is another way atoms can satisfy the **octet rule**. The next activity will explain what covalent bonding is.

ACTIVITY NO. 9: Interactive Webpage Reading – Covalent Bond

In this activity, we will study about another kind of bonding called *covalent bonding*. Covalent bonding is helpful in understanding the formation of molecules. Let us now see how these molecules are formed.

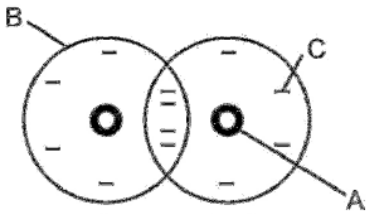
Click the animation below. The animation discusses how covalent bond is formed. Write down the important concepts that you will gather in your foldable.

http://www.pbslearningmedia.org/asset/lsps07_int_covalentbond/

Study the notes you have and apply it in **Worksheet #4: Understanding Covalent Bond**

The drawing at right represents a covalent compound. Study this diagram then answer the following process questions:

https://my23.sd23.bc.ca/personal/sd23_darren.banting/science9/resources/Documents/Bonding%20Booklet.pdf



In an O_2 molecule, two pairs of electrons are shared.

1. What does the small circle (A) represent?

_____

2. What does the larger circle (B) represent?

_____

3. What does the dash (C) represent?

_____

4. The large circles overlap. What does this represent?

_____

_____

5. Why are there four dashes inside the overlapped area?

_____

6. How many electrons are in the outer shell of the oxygen atom on the left?_____

7. How many electrons are in the oxygen atom on the right?

_____

(https://my23.sd23.bc.ca/personal/sd23_darren.banting/science9/resources/Documents/Bonding%20Booklet.pdf)

So, how did you go far? Did you get to understand how covalent bond is formed? What are the important concepts you had written down in your **foldable?**

After learning the properties of ionic and covalent bonds, the next activity will provide the many ways you can differentiate the two bonds. Furthermore, this will help you even remember terms related to ionic and covalent bonds.

ACTIVITY NO. 10: The Singing Bond (Band)!

Let's try to loosen up with the technicalities of chemical bonds. The link below will lead you to a song that may not be within your genre but it's a very common song because maybe, you've heard it in radio stations, videoke bar or hummed by you mom. Join with the music just for fun!

Chemical Bond Song (To the tune of Dancing Queen)

http://www.youtube.com/watch?v=BCYrNU-7SfA

First we'll start with ionic bonds,
A metal and nonmetal are involved.
The metal gives over electrons, the nonmetal ... it receives.
The atoms become IONS!

Metals might have 1,2 or 3
Electrons for the nonmetal to receive
It all depends on what's needed, to make the number 8
For the nonmetals' outer shell.

AND IF IT HAPPENS FOR THEM ...
They both become IONS ..... CHARGED ATOMS .... They become IONS!
The metal's positive, the nonmetal's negative,
They become IONS, oh yeah.
The metal's plus, the nonmetal minus, and opposites they do attract.
So what you get, when they come together, is an IONIC BOND.

So what about those covalent bonds?
It's not about loss and gain of electrons.
Valence electrons they are shared, to complete the outer shells
Of the nonmetals set to bond.

IT'S WHEN NONMETALS JOIN ... to make covalent bonds
With shared electrons ,,,, they're covalent bonds.
Not a transfer, instead they share valence electrons, oh yeah!

Ionic bonds ... covalent bonds ... both of them chemical bonds.

How are they made? What's the difference? Play the song again !
Ionic bonds, covalent bonds ..... both chemical bonds!

Based from the song, complete the table below by differentiating an ionic bond from covalent bond:

Characteristics	Ionic Bond	Covalent Bond

Process Questions:

1. What composes a covalent bond?
2. How did the valence electrons in a covalent compound achieve the octet?
3. How will you differentiate an ionic compound from a molecular compound?
4. How compound is formed?

Now you have a clear picture on how ionic bond differs from covalent bond. Did you add something in your **foldable**?

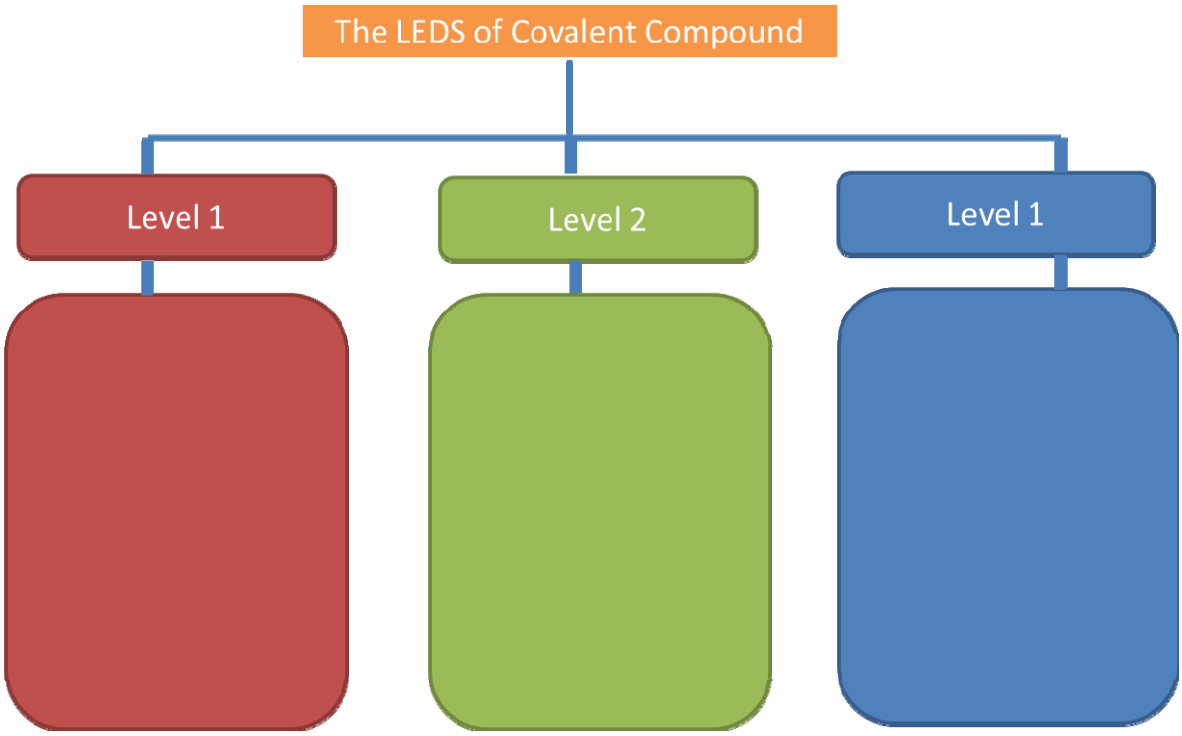
The next activity will help you imagine how a compound or substance looks like. Focus on the following: Dots and Dashes. The next activity indicates the difference of molecular compound.

ACTIVITY NO. 11: The LEDS Of Covalent Compound

It is best to represent the formation of covalent bonds through the Lewis Electron Dot Structure.

The link below shows how to bond molecular (covalent) compound:
http://www.kentchemistry.com/links/bonding/covalentlewisdot.htm

Give your own steps on how to show the LEDS of a covalent compound in each level:



Now, answer the process questions below:
1. What are levels 1,2 and 3 represent?
2. What is the first thing to consider in forming the LEDS of covalent bond?
3. If it is a polyatomic ion, what do you do with the electrons?
4. How compound is formed?

Below is a **Guided Worksheet#5**:
(http://washburnsciencelies.pbworks.com/w/file/fetch/71090437/Covalent%20Bonding%20Worksheet1.pdf)

Covalent bonding occurs when two or more NON_METALS share electrons, attempting to attain a stable octet (8 outer electrons)in their outer shell for at least part of the time. Draw a Lewis dot diagram for each element listed. Circle the unpaired electrons that will be shared between the elements.

1.) H_2 hydrogen is diatomic

H + H ⟶ H⊙H ⟶ H-H Single Bond

2.) F_2 fluorine is diatomic

F + F ⟶ :F⊙F: ⟶

3.) O_2 oxygen is diatomic

O + O ⟶ ⟶ O=O Double Bond

4.) N_2 nitrogen is diatomic. Is this a triple bond?

N + N

5.) BF_3 you need 3 fluorine atoms here

B + F

6.) Ammonia NH_3 hint: how many hydrogen atoms are needed?

N + H

7.) Carbon dioxide CO_2

O + C + O

8.) Methane CH_4 careful here 4 hydrogen atoms needed

C + H

9.) Dihydrogen monoxide: the most dangerous substance on the planet. It has killed more people than any other substance known to mankind!!

H + O + H

10.) SO_2 hint: one pair of electrons from sulfur must be slit up for this one to work.

O + S + O

Quiz #2 Do as Directed:

A. Identify if the following would form a covalent bond.

1. H + Cl _____
2. Ca + Cl _____
3. N + Br _____
4. P + F _____
5. Al + I _____
6. C + Cl _____
7. N + O _____
8. S + Br _____
9. Te + F _____
10. K + F _____
11. C + Rn _____
12. P + F _____
13. Al + Te _____
14. Rb + O _____

B. Using Electron dot diagrams, draw the covalent bonds of the following.

15. H + Cl ---------

16. C + Cl ---------

17. N + Br ----------

18. P + S ----------

19. H + O ----------

How did you go so far? Did you learn how to show the LEDS of covalent bonds? The next activity will allow you to further analyze the properties of water. Try to figure out what makes water unique with other substances.

ACTIVITY NO. 12: Water Love Story

Did you ever wonder how water is formed? What type of bond does it work on? To find out, click the website below:

The Love Story of Hydrogen Bond – Animation

http://programs.northlandcollege.edu/biology/Biology1111/animations/hydrogenbonds.html

Write down in your **foldable** the concepts learned in the animation above.

Process Questions

1. What polarity of water means?

2. How polarity makes water behave strangely?

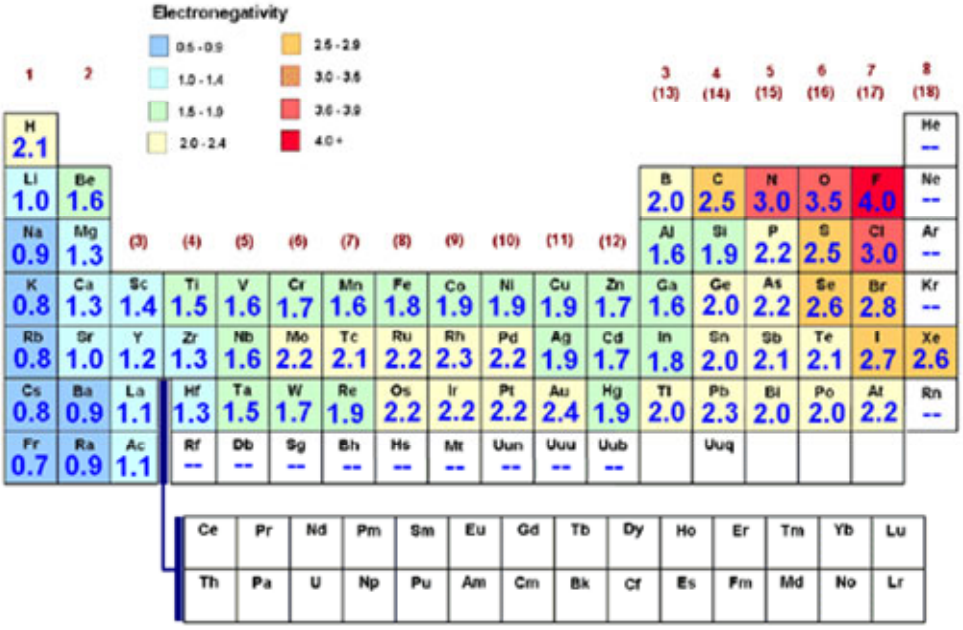
3. How water is formed?

When the atoms bind together their electron clouds interact with one another and if this interaction is 'favorable' then bonding occur. On the next topic, you will get to encounter the two types of covalent.

Activity No. 13: Polar or NonPolar: That is the Question

The video differentiates polar and nonpolar compounds:
http://www.youtube.com/watch?v=9XUsOLaz3zY

Below is the electronegativity of elements in the periodic table.



Difference in electronegativity

4.0 **1.7** **.40**

Ionic	**Polar-covalent bond**	**Non-polar covalent bond**

100% **50%** **5%** **0%**

Percentage Ionic character

Using the periodic table above and electronegativity, complete the table below:

Worksheet #6: Polar or Non Polar

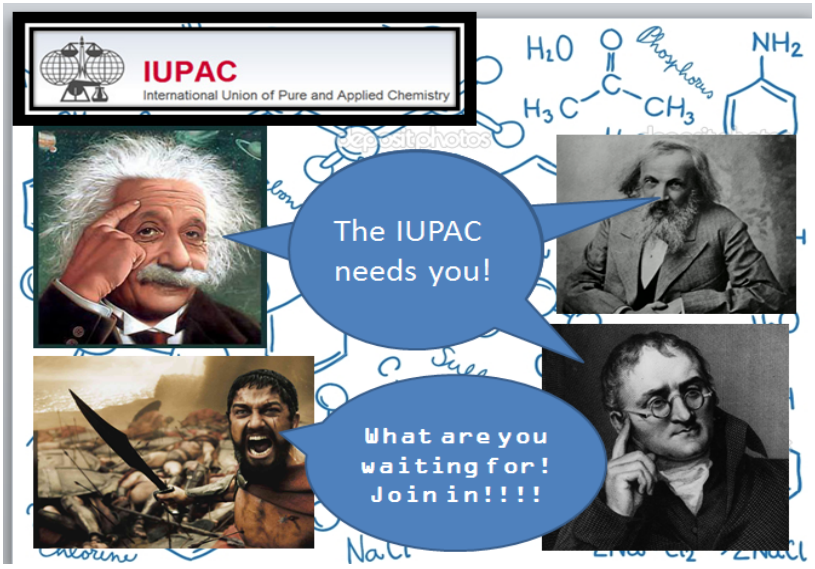
Bonding between	More electronegative element and value	Less electronegative element and value	Difference in electronegativity	Bond Type
Sulfur and Hydrogen				
Sulfur and Cesium				
Chlorine and Bromine				
Calcium and Chlorine				

Oxygen and hydrogen				
Nitrogen and hydrogen				
Iodine and Iodine				
Copper and Sulfur				
Hydrogen and fluorine				
Carbon and oxygen				

After learning the how ionic and molecular compound are formed, it is important in Chemistry to name the compounds. We don't just name according to how we feel naming it. Compounds are named from different rules according its composition.

ACTIVITY No. 14: IUPAC Initiation Test!

Chemists around the world need to communicate with other chemists so they developed a set of rules of naming compounds.
http://www.mediacamp.com/lessons-for-silicon-valley-from-einstein/



http://chemistry.about.com/od/historyofchemistry/ig/Pictures-of-Famous-Chemists/Dmitri-Mendeleev.htm
http://bencurtisjones.com/project/300/
http://www.biography.com/people/john-dalton-9265201
http://www.glogster.com/80jester/dmitri-mendeleev/g-6mftrpc0sgos9varpnqt7a0

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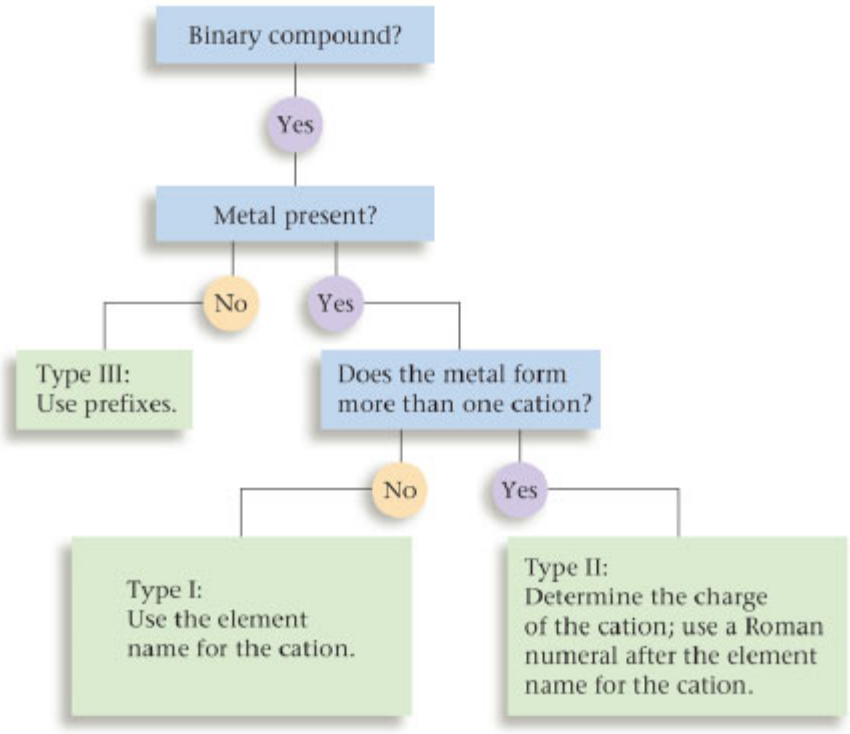
"In 2003, almost 5000 chemists from 66 countries registered as Affiliates. Included in this number are nearly 400 sponsored (free) Affiliate memberships for chemists, aged 35 years or less, from developing and economically disadvantaged countries."

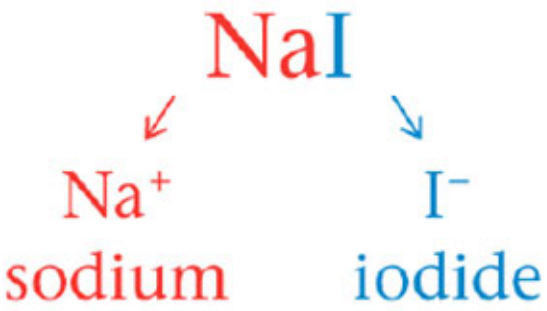
As an aspiring chemist, you wish to be a member of the IUPAC, for greater opportunities are waiting for you… and you wish to be part of the mission of the organization: IUPAC advances the worldwide role of chemistry for the benefit of Mankind.

So to be part of the said organization you have to undergo series of tests. So, are YOU ready?!

To guide you in naming the compounds, follow the concept map below:



Test I: Analyze the part below.



Create the Rules in naming this compound:

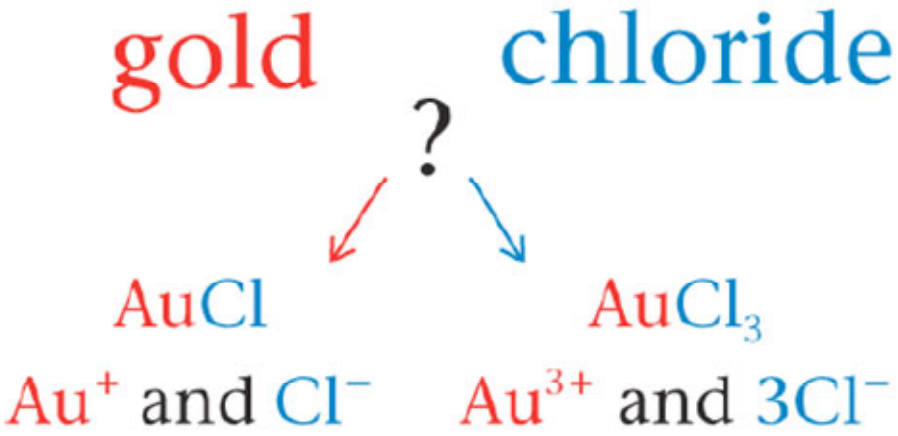
Want some more practice? Click the website below:

This is **quiz #4** on naming formula and vice versa:

http://quizlet.com/7663255/flashcards

Test II. Study and Analyze the name of the compound below:

A. Try to check the oxidation states of Gold in the Periodic Table:
What seems to be the problem in working with the sample below?



B. What does the table imply? When do you use it?

TABLE 4.2

Common Type II Cations

Ion	Systematic Name	Older Name	Ion	Systematic Name	Older Name
Fe^{3+}	iron(III)	ferric	Sn^{4+}	tin(IV)	stannic
Fe^{2+}	iron(II)	ferrous	Sn^{2+}	tin(II)	stannous
Cu^{2+}	copper(II)	cupric	Pb^{4+}	lead(IV)	plumbic
Cu^{+}	copper(I)	cuprous	Pb^{2+}	lead(II)	plumbous
Co^{3+}	cobalt(III)	cobaltic	Hg^{2+}	mercury(II)	mercuric
Co^{2+}	cobalt(II)	cobaltous	Hg_2^{2+*}	mercury(I)	mercurous

*Mercury(I) ions always occur bound together in pairs to form Hg_2^{2+}.

Create the Rules in naming this compound:

C. Let's try the other way around. Study the rules below:
Are you ready to name this type of compound?

Rules for Naming Type III Binary Compounds

1. The first element in the formula is named first, and the full element name is used.
2. The second element is named as though it were an anion.
3. Prefixes are used to denote the numbers of atoms present. These prefixes are given in **Table 4.3.**
4. The prefix *mono-* is never used for naming the first element. For example, CO is called carbon monoxide, *not* monocarbon monoxide.

TABLE 4.3

Prefixes Used to Indicate Numbers in Chemical Names

Prefix	Number Indicated
mono-	1
di-	2
tri-	3
tetra-	4
penta-	5
hexa-	6
hepta-	7
octa-	8

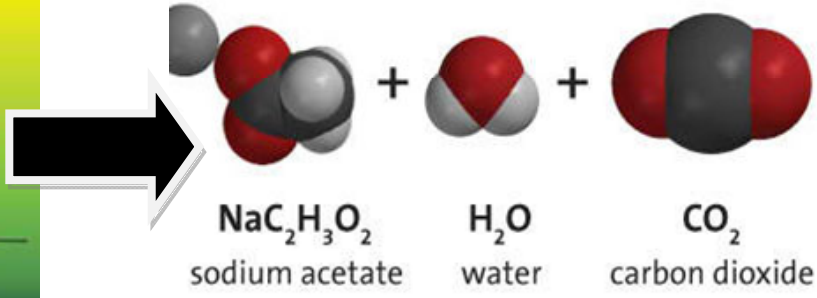
Complete the worksheet below:

Worksheet # 6: Naming Binary Compounds
Name each of the following compounds:

1. AsF_3
2. BF_3
3. BrF_5
4. $BrCl$
5. ClF
6. Cl_2O_6
7. IF_5
8. KrF_2
9. NI_3
10. N_2O_3
11. I_2O_4
12. P_2Cl_4
13. $SeCl_2$
14. SiO_2
15. SO_3

Final Test:

Can you do the activity as shown in the picture below?



http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson2

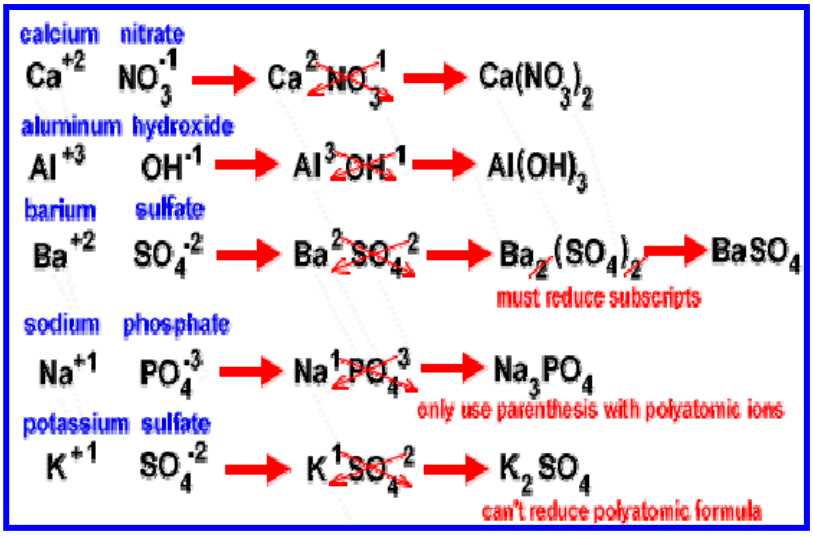
Read aloud the products formed based from the picture above.

Study the picture A and Picture B

Picture A

Common Polyatomic Ions			
$C_2H_3O_2^-$	acetate	OH^-	hydroxide
NH_4^+	ammonium	ClO^-	hypochlorite
CO_3^{2-}	carbonate	NO_3^-	nitrate
ClO_3^-	chlorate	NO_2^-	nitrite
ClO_2^-	chlorite	$C_2O_4^{2-}$	oxalate
CrO_4^{2-}	chromate	ClO_4^-	perchlorate
CN^-	cyanide	MnO_4^-	permanganate
$Cr_2O_7^{2-}$	dichromate	PO_4^{3-}	phosphate
HCO_3^-	bicarbonate	SO_4^{2-}	sulfate
HSO_4^-	bisulfate	SO_3^{2-}	sulfite
HSO_3^-	bisulfite		

Picture B



Now, how are you going to name salts?

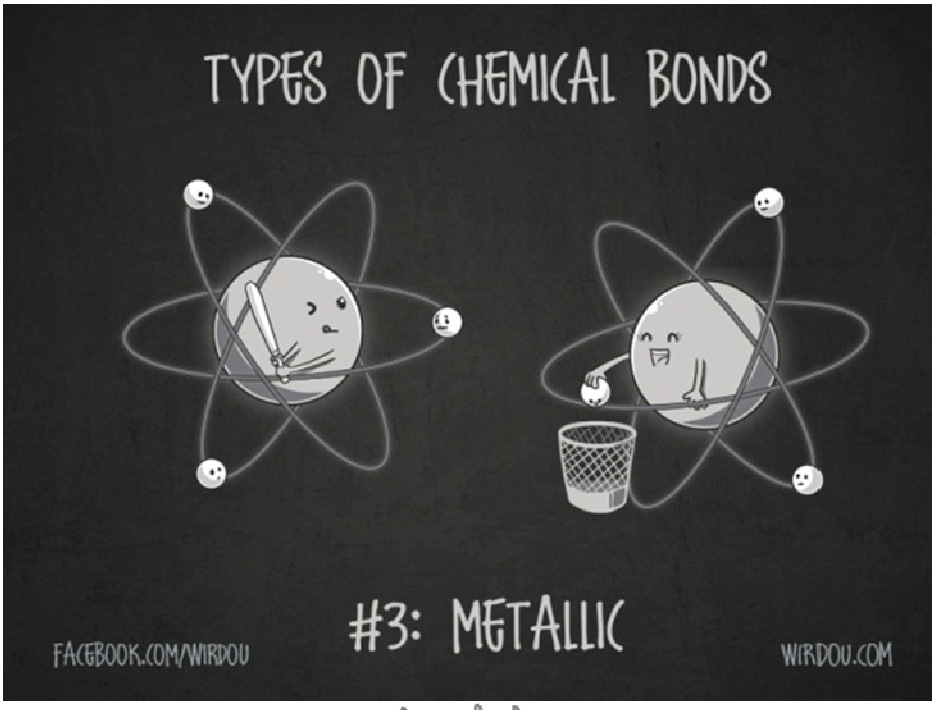
Quiz #5

Do the Interactive Quiz Below:
http://www.chemistrywithmsdana.org/wp-content/uploads/2012/07/ionic.html

So, do you think you are qualified to be part of the IUPAC team? If not, review naming compounds through this videoclip:
http://www.youtube.com/watch?v=9XUsOLaz3zY (Naming Tutorial)

For the next activity, you will get to understand how aluminum cans are made and reasons why jewelry is beautifully shaped.

ACTIVITY NO. 15: Metallic Bond



Oh no, what happens to the electron?

Do you really wanna know what happens to the electrons? Click the animations below:

A. http://www.drkstreet.com/resources/metallic-bonding-animation.swf
B. http://www.youtube.com/watch?v=srxNJ03W_qM (This explains why metal is malleable.)

Now, let's see the details of metallic bonding by reading the page below:
http://www.chemguide.co.uk/atoms/bonding/metallic.html

Process Questions:

1. What do you mean by sea of electrons?
2. Describe the movement of electrons when potential difference is applied.
3. When does the electrons delocalized?
3. How is metallic bond formed?

Since bonding of atoms is essential in the formation of compound, the next activity can lead you to form new substances by investigating scientifically.

ACTIVITY NO 16: HOW TO CONDUCT A SCIENTIFIC INVESTIGATION?

Scientists act like detectives. They work also by piecing together clues to learn and create something new. One way that scientists gather clues is by carrying out experiments. An experiment tests an idea in a careful, orderly manner. Although experiments do not all follow the same steps in the same order, many follow a pattern similar to the one described here.

To learn about conducting scientific investigation, read the webpages provided for you below:

Webpage Reading #1: How to Conduct a Scientific Investigation?
http://www.usca.edu/biogeo/researchguide/investigation.html
Webpage Reading #2: Designing an Experiment
http://www.longwood.edu/cleanva/images/sec6.designexperiment.pdf
Webpage Reading #3: Tips about Scientific Investigation
http://coseenow.net/mare/scientific-investigations/

Process Questions

1. What are scientific investigations?

2. What processes used by scientist in solving problems that you can be used when doing science investigations? Explain.

3. What are the components of a scientific investigation?

4. How important are the scientific investigations? Discuss.

Below is a sample on how to design an experiment for scientific investigation:
http://www.longwood.edu/cleanva/images/sec6.designexperiment.pdf

Example of an Experimental Design Diagram

Title

The Effect of Type of Insulation Wrap on Temperature of Water in a Jar

Hypothesis

If jars of water in the sun are wrapped with different types of insulation, then the temperature of the water in the jars will increase by different amounts.

Independent Variable

Type of insulation

Levels of Independent Variable and Numbers of Repeated Trials

No insulation (**Control**)	Cotton	Wool	Nylon
3 jars	3 jars	3 jars	3 jars

Dependent Variable and How Measured

Change in temperature of water in jar, measured in degrees Celsius

Constants

1. All jars are identical
2. All jars are fitted with the same plastic lids
3. All jars half-filled with water
4. All jars placed in direct sunlight

Worksheet # 6: Experimental Design Diagram

Using the guide below, Complete the general lay-out using the following topics: (Choose only one.)

A. Does the kind of water affect how long it takes to boil?

B. Does the temperature of the water affect how fast an Alka-Seltzer tablet will dissolve?

General Layout for an Experimental Design Diagram

TITLE

The Effect of _____ (Independent Variable)
on _____ (Dependent Variables)

HYPOTHESIS

If _____ (planned change in independent variable),
then _____ (predicted change in dependent variables).

INDEPENDENT VARIABLE

_____

LEVELS OF INDEPENDENT VARIABLE AND NUMBERS OF REPEATED TRIALS

Level 1 (**Control**)	Level 2	Level 3	Level 4
Number of trials	Number of trials	Number of trials	Number of trials

DEPENDENT VARIABLE AND HOW MEASURED

_____

CONSTANTS

1.

2.

3.

4.

Having made your lay-out for experimental design, rate yourself on how capable you are in designing and experiment: Bad in designing an experiment and as Best in designing an experiment. Use this scale below.

The chemical compounds of life are known as *organic compounds*. Organic compounds, which are the compounds associated with life processes, are the subject matter of organic chemistry. Among the numerous types of organic compounds, four major categories are found in all living things: carbohydrates, lipids, protein, and nucleic acids. The next activity will explain to you the main composition of organic compounds. As you go along with the activity, try to recognize what type of bond is formed from carbon.

Activity No. 17: The Element of Life

You have learned about the metals and non-metals. Carbon is an important non –metallic element. The chemistry of carbon and its compounds is an equally important field about which you will learn in this lesson. Carbon is the sixth most abundant element in the universe. It can exist in the free state or in the form of its compounds.

To learn more about the uniqueness of carbon. Watch the 3 videoclips below:

The video clip #1 describes the characteristics and properties of carbon.
http://www.youtube.com/watch?v=1H02SkLEr4E

Q: What do you know about the element carbon?

Q: What biological processes involve carbon compounds?

Video clip #2 Are Diamonds Forever?
http://www.youtube.com/watch?v=KB9FtcNvS6o

Q: How are diamonds formed?

Q: Why carbon is an important element?

Video Clip #3
Elements of Chemistry Carbon: The Element of Life
http://www.youtube.com/watch?v=1ypuSYEa9lY

Q. Why carbon has been called the element of Life?

Q. How did the carbon form compound with other elements?

Q. How do compounds formed?

What important concepts can you write down in your foldable? Now can you make a generalization out of the three video clips?

Now that you had a glimpse of how carbon form compounds with other elements, try to observe the many substances that carbon can bring on the next activity.

ACTIVITY NO #18: It's A Family Thing

You have learned that in hydrocarbons, carbon atoms are linked only to other carbon atoms or hydrogen atoms. Carbon atoms can also form strong covalent compounds with other elements.

This music - video clip tells about the Classes of Organic Compounds:
http://www.youtube.com/watch?v=mAjrnZ-znkY

This is a tutorial video clip about the functional groups:
http://www.youtube.com/watch?v=C5ZK6nPPAbo

Process Questions:
1. What are functional groups?

2. What are examples of functional groups?

3. Give the uses for each of the functional groups.

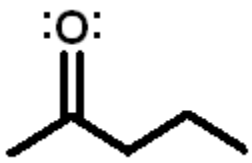
4. How are these groups formed?

In your **foldable**, write down what you know about these functional groups. Then, let's check you Understanding by doing the worksheet below:

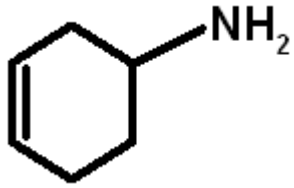
Worksheet # 7: Functional Groups

1. Identify the functional groups in each of the following organic compounds:

1)



2)



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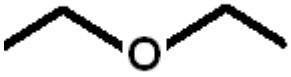
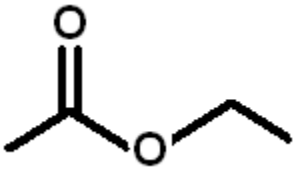
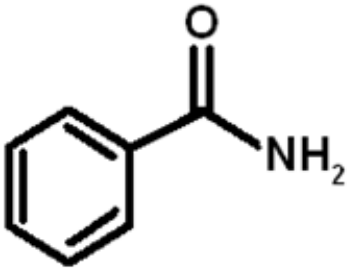


4)



5)



How did you go about all the activities that you worked on? Did you get to understand the formation of the chemical substances that you've been using in your day to day life? Then, try to reflect on the question below:

Given below is an IRF sheet. Fill in the second row with your answer to the question:

How is compound formed?

Initial

Revised

Final

End of FIRM UP:

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? What new learning goal should you now try to achieve?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

Now that you have learned about the chemical bonds, it's time for you to analyze and assess chemical substances that are formed from particles. You are also going to learn about molecular shapes of different substances.

Your goal in this section is to take a closer look at these aspects of the topic.

ACTIVITY NO. 19: Metallic Properties

Although metals are not ionic, they share several properties with ionic compounds. Metals often form lattices in the solid state. View the website below to explain further the metallic bonding:

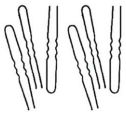
http://safeshare.tv/w/SfdicjauSG

For centuries, people have treated metals with heat to change their properties. The final properties of metal depend on the temperature to which the metal is heated and the rate at which it cools.

Do the activity below:

Materials:
Hairpins
Forceps
Burner

Recognizing Cause and Effect:



People have treated metals with heat for many centuries. Different properties result when the metal is slowly or rapidly cooled. In this experiment you will investigate the effects of heat-treating on the properties of iron.

Materials:

- bunsen burner, striker, crucible tongs, hairpins (4-5), 250-mL beaker filled with ice water

Procedure:

1. Examine a property of spring steel by trying to bend open one of the hairpins. Record your observations.

2. Hold each end of the hairpins with forceps. Place the curved central loop in the top of the burner's flame. When it turns red, pull it open into a straight piece of metal. **CAUTION: Do not touch hot metal.** Allow the hairpins to cool as you record your observations. Repeat this procedure for all hairpins.

3. To make softened steel, use forceps to hold all hairpins vertically in the flame until they grow red all over. Slowly raise the three hairpins straight up and out of the flame so they cool slowly. Slow cooling results in the formation of large crystals. *The process of heating followed by slow cooling is called* ***annealing*** *("making soft").* After cooling, bend each of the three hairpins into the shape of the letter J. Record how the metal feels as you bend it. Do the wires bend more easily now after they have been heated? Are they as springy as they were before? Take one of the wires and bend it back and forth in the same place. How often can you bend it before it breaks?

5. To harden the steel, use tongs to hold two of the bent hairpins in the flame until they are glowing red all over. Quickly plunge the hot hairpins into a 250-mL beaker containing approximately 200 mL of cold water. Quick cooling causes the crystal size to be small. *The process of heating followed by rapid cooling is called* ***hardening****.*

Remove one of the hooks from the water. Try bending it repeatedly in the same spot. Does it bend as easily as before? How often can you bend it before it breaks? Attempt to straighten one of the bends. Record your observations.

The hairpin must **not** be heated to red hot, so keep it out of the hottest region of the flame. Allow the hook to cool slowly. Repeat this with another hook.

Try bending one of the hooks. Is it brittle or bendable? How often can you bend it before it breaks?

*The process of gentle warming is called **tempering**. It removes the brittleness and returns the spring to hardened steel.*

Discard the broken hook into a trash can. Record your observations.

Analysis and Conclusions

You may need to perform some library and/or Internet research to answer the following questions (esp. #1 and #2d). Your answers should be one to two pages long on a separate sheet of paper.

1. Describe what is happening on the microscopic level during annealing, hardening and tempering.

2. Apply your observations to the following situations:

   a. a large building built on a framework of steel beams burns (e.g. the World Trade Center)

   b. firefighters use cold water to put out the fire

   c. you pour cold water onto the engine block of your car to cool it

   d. the manufacture of swords or horseshoes (smithing)

Can you reflect on the activity that you did a while ago? What insights can you add to your foldable?

Chemical substances are just everywhere. These are materials with known compositions. The existence of these substances can be purposeful or can bring threat to life. The next activity will allow you to reflect on how these substances can be of great help.

ACTIVITY NO 20: Who's The Culprit?

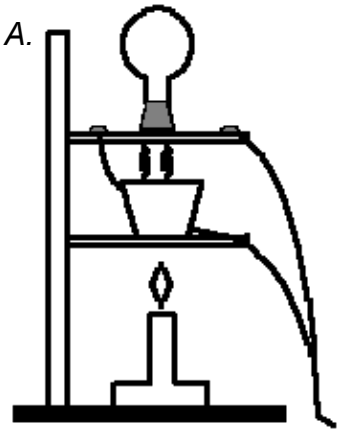
Headline News!!!
One man died through electrocution! The investigators said that there's nothing wrong with the electrical connection. The only materials present were salt solution and sugar. How did it happen?

As a forensic scientist, you are asked to solve the case. So you decide to conduct an investigation.

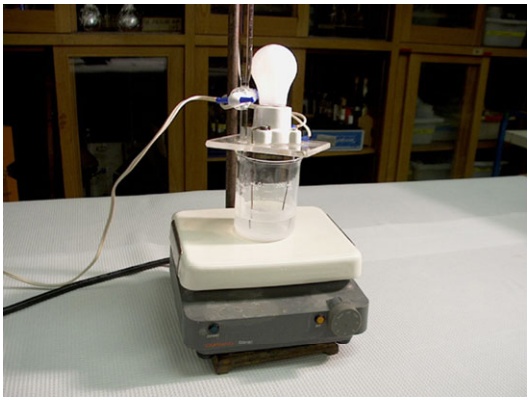
You will the following materials:
Electrical conductivity apparatus (commercial or home-made)
50-mL, or 2-oz. wide-mouth bottles
Solid sodium chloride, NaCl, and sucrose, $C_{12}H_{22}O_{11}$ (common table sugar)
2 or 3 Small glass saucers
Ringstand, ring, triangle
0.1 M Solutions of NaCl and sucrose (5.6 g NaCl/100 mL solution and 3.4 g sucrose/100 mL solution)

Safety
If the conductivity tester used is powered by a 120-V source, then use caution to prevent electric shock.
To avoid electrical shock, always turn off the switch or pull the plug while cleaning or rinsing the electrodes or changing the solutions.

You may ask assistance from a hardware store to prepare any of the following **set up**:

A. 

B. 

C. 

A. Half fill a 50-mL beaker with solid NaCl and a second 50-mL beaker with solid sucrose. Test the electrical conductivity of the solid NaCl with the tester. Clean the electrodes and then test solid sucrose.
Write your observations on the table below.

B. Half fill two 50-mL beakers with the two solutions and a third with distilled water. First test the electrical conductivity of the distilled water.
Then test the electrical conductivity of each of the two
solutions in turn. Write your observations on the table below.

*Repeat the procedure for trials 2 and 3.

SET UP	OBSERVATIONS:		
	Trial 1	Trial 2	Trial 3
A			
B			

Conclusion:

_____
_____
_____

Discussion:

The results can be conveniently used to define an electrolyte and a nonelectrolyte (the former exists as ions in water solution while the latter does

not). The solids do not conduct since the ions in sodium chloride are not mobile and cannot move toward the electrodes and act as charge carriers.

Sucrose is a molecular solid and does not have ions present in either the solid or solution. The melted silver nitrate conducts because the ions are able to move to the electrodes and act as charge carriers. This emphasizes that an ionic solid consists of ions and not molecules.
Do not get involved in a discussion of electrical conductivity now, since the students' backgrounds are probably insufficient for understanding. The point is to distinguish between electrolytes and nonelectrolytes and to show that ionic solids exist as ions in the solid state. If students ask about the lack of conductivity of distilled water, you can test the conductivity of tap water.

Tap water conducts because there are ions present in it but not in the distilled water.

Process Questions:

1. What are the independent variables? Dependent Variables? Constant Variables?
2. What are we trying to derive from the activity?
3. How can you possibly tell that the solution is an electrolyte or non-electrolyte?
4. How do electrolytes formed?

So how did you do in this activity? What insights did you learn from it? Write in your foldable what you feel in working the activity:

I Feel… Therefore I learn:

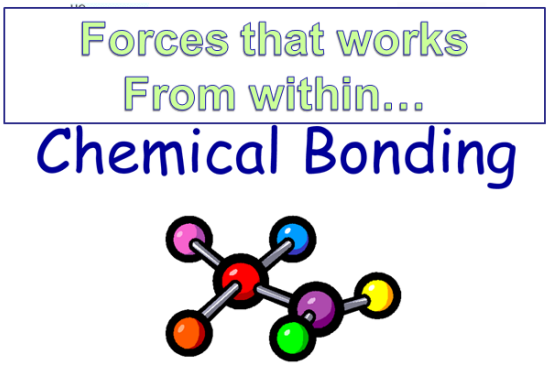
Can you imagine the molecular structure of the diamond? How about Oxygen molecules? Sulfur Dioxide? The next activity shows the beautiful arrangement of the elements in a compound.

ACTIVITY NO # 21: VSEPR

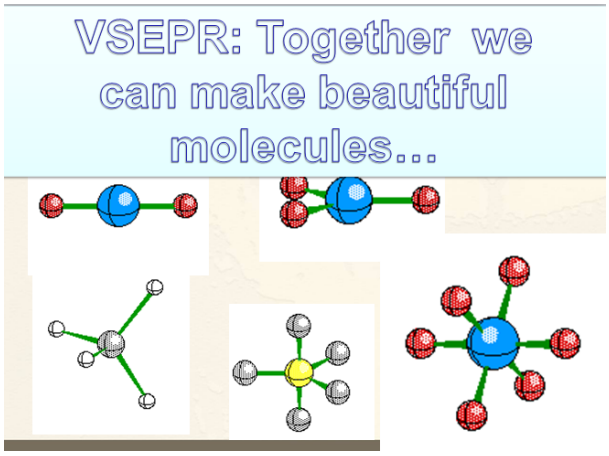
Are you familiar with the different taglines of the famous product companies in the Philippines in order to catch the attention of the consumers? Take a Glimpse of the following:

Smart: Live More
KFC: It's finger lickin good!
Metrobank: You're in good hands!

What about in Chemistry? Can a tagline be helpful in remembering the concepts within? Let's go along with this:



And for VSEPR?

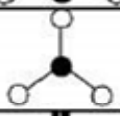
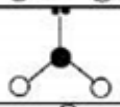
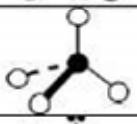
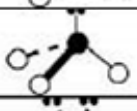
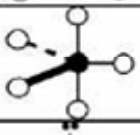
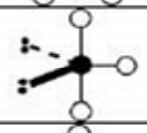
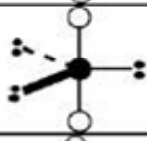
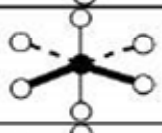
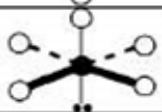
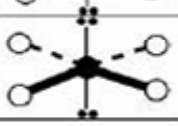


Why do you think that the tagline is suited for the topic VSEPR?

Lewis structure can help in determining the molecular geometry of a molecule. The model used to determine the molecular shape is referred to as the **V**alence **S**hell **E**lectron **P**air **R**epulsion. To further explore VSEPR, click the website below:
http://www.chem.ox.ac.uk/vrchemistry/vsepr/intro/vsepr_splash.html

Now try to study the table below:

VSEPR SUMMARY

Number of electron pairs around central atom		Full description of the molecule					
BONDING (B)	LONE (E)	Example	Bond angles °	Geometry of Electron Pairs	Geometry of Atoms	3D Shape	Type
2	0	$BeCl_2$	180	Linear	**Linear**		AB_2
3	0	BF_3	120	Trigonal planar	**Trigonal Planar**		AB_3
2	1	SO_2	Slightly less than 120	Trigonal planar	**Bent or V Shaped**		AB_2E
4	0	CH_4	109.5	Tetrahedral	**Tetrahedral**		AB_4
3	1	NH_3	107.5	Tetrahedral	**Trigonal Pyramidal**		AB_3E
2	2	H_2O	104.5	Tetrahedral	**Bent or V Shaped**		AB_2E_2
5	0	PCl_5	120 in plane. 90 perpendicular to plane	Trigonal bipyramidal	**Trigonal Bipyramidal**		AB_5
4	1	SF_4	Complex	Trigonal bipyramid	**Seesaw**		AB_4E
3	2	ClF_3	Approx. 90	Trigonal bipyramidal	**T-Shaped**		AB_3E_2
2	3	XeF_2	180	Trigonal bipyramid	**Linear**		AB_2E_3
6	0	SF_6	90	Octahedral	**Octahedral**		AB_6
5	1	BrF_5	Approx. 90	Octahedral	**Square Pyramidal**		AB_5E
4	2	XeF_4	90	Octahedral	**Square Planar**		AB_4E_2

Process Questions:
1. How many bonding pairs does central atom have?
lone pairs? Angle?

2. How does the change of an atom to an unshared pair change the structure? Predict bond angle more, less, stay the same? Now how about two unshared pairs?

3. Why does this form a 180 degree bond?

4. What happens to the structure if an atom were removed from the expanded octet? Which atom would you remove? Why?

Read aloud the article/topic below taken from “Chemistry: Matter and Change” from Glencoe.

Connection to Biology:

The shape of food molecules is important to our sense of taste. The surface of your tongue is covered with taste buds, each of which contains from 50 to 100 taste receptor cells. Taste Receptor cells can detect five distinct tastes __ sweet, bitter, salty, sour and umami (the taste of MSG, monosodium glutamate) but each receptor cell responds best to only one taste.

The shapes of food molecules are determined by their chemical structures. When a molecule enters a taste bud, it must have the correct shape for the nerve in each receptor cell to respond and send a message to the brain. The brain then interprets the message as a certain taste. When such molecules bind to sweet receptors, they are sensed as sweet. The greater the number of food molecules that fit a sweet receptor cell, the sweeter the food tastes. Sugars and artificial

sweeteners are not the only sweet molecules. Some proteins found in fruits are also sweet molecules.

Why do you think that the tagline is suited for the topic VSEPR?

Worksheet #8: VSEPR
Lewis Structures, VSEPR, Polarity, IM Forces

For each of the following molecules, draw the Lewis structure and indicate the following:

A. How many central atom?
B. How many Bonded atoms?
C. How many lone pairs
D. What formula type?
E. Give the molecular shape.

1) carbon tetrafluoride
2) BF_3
3) NF_3
4) H_2CS
5) carbonate ion
6) CH_2F_2
7) nitrate ion
8) O_2
9) PF_3
10) H_2S

<u>ACTIVITY NO #22:</u> Another Carbon Compound Story

All of us who are fans of forensic TV shows have seen the CSI hero (in obligatory sunglasses of course) dim the lights and spray the 'magical' substance over the carpet and dramatically reveal the blood splatter of many a poor victim. How do they do that you may wonder? It all has to do with some interesting chemicals we come into contact with every day in carpet cleaning:

The Chemical Reaction

The "central" chemical in this drama is **luminol** ($C_8H_7O_3N_3$), a powdery compound made up of nitrogen, hydrogen, oxygen and carbon. The CSI mix the luminol powder with a liquid containing hydrogen peroxide (H_2O_2), and other chemicals, and pour the liquid into a simple spray bottle. The hydrogen peroxide and the luminol are actually the principle players in the chemical reaction, but in order to produce a strong glow, they need a catalyst, in this case the iron in the victim's blood.

So, are you ready to create your own story?

As a crime novelist, you are asked by your boss to create a short story about forensics. In your story, you have to make use any carbon compounds that can lead to solve a crime.

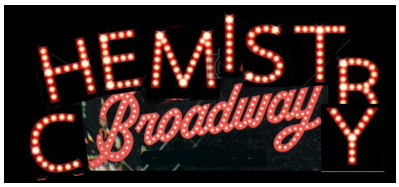
Write Your Story!

To guide you further in writing a digital Story, use the link below:

http://www.web2teachingtools.com/my-storymaker.html

After the tutorial, create your digital story in this website:
http://www.clpgh.org/kids/storymaker/embed.cfm

ACTIVITY NO 23: Carbon is a Girl's Best Friend



Welcome to Chemistry Broadway!!!
You are asked to be part of the broadway… so to prepare yourself… you get to practice the following piece:
http://www.youtube.com/watch?v=JH96P4Lpobc

1. What makes Carbon as nature's best friend?

2. What makes Carbon as girl's best friend?

So are you ready to sing out loud your piece? But aside from that, you are asked also to make your own song. The lyrics should be based from the following video clips:

Versatility of Carbon:
http://www.youtube.com/watch?v=XKh3mjBaimY&list=PLF2604402E8E8F4D9

Classes of Carbon Compounds:
http://www.youtube.com/watch?v=ZrCSc8csdhY

To let your group join with your song, create your own videoke and share it with them. Use the Karaoke Video Creator:

http://www.powerkaraoke.com/src/prod-karaoke-video-creator.php

After learning the properties of carbon, try to do the following tasks in a way to understand how of carbon compounds are bonded to form a substance.

Task A

The table on the right shows the names of some alkanes, the number of carbon atoms in their molecules, and their boiling points. The boiling points are measured in **kelvin** (K) to avoid negative numbers.

1. On graph paper, plot a graph of boiling point against number of carbon atoms.
   - Put the boiling points up the side. Go from 0K to 700K, and use 1 small square (2mm) for each 10K. Your axis will be 14cm long.
   - Put the number of carbon atoms along the bottom. Go from 0 to 20, and use 3 small squares (6mm) for each atom. Your axis will be 12cm long.

name of alkane	number of carbon atoms	approximate boiling point (K)
methane	1	110
ethane	2	185
propane	3	230
butane	4	275
pentane	5	310
hexane	6	340
heptane	7	370
octane	8	400
nonane	9	425
decane	10	445
undecane	11	470
dodecane	12	490
hexadecane	16	560
eicosane	20	615

2. Look carefully at your graph.
Write down what happens to the boiling point as the number of carbon atoms goes up.

Answer the following Questions:
1. Room temperature is about 300K.
Any alkanes with a boiling point less than this will be gases. Which alkanes are gases?
2. Alkanes with more than 14 carbon atoms are usually solids. Which alkanes are solids?
3. Any alkanes that are not in your answers to a) or b) are liquids. Which alkanes are liquids?

http://www.creative-chemistry.org.uk/gcse/documents/Module6/N-m06-18.pdf

1.

2.

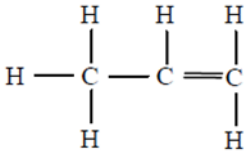
3.

Task B
Read the information in the box, then answer question 4.

Long alkanes with lots of carbon atoms are not very good as fuels. If they are heated strongly on a catalyst, they can be broken into smaller molecules, which do make good fuels. This reaction is called **cracking**. Some of the smaller molecules are **alkenes**. Alkenes are like alkanes, but two of their carbon atoms are joined by two bonds (a **double bond**), not just one bond.

4. a) What is “cracking”?
b) What is the difference between alkanes and alkenes (apart from their name!)?
c) What is a “double bond”?

5. The structural formula of propene is and its molecular formula is C_3H_6.



Draw the **structural formulae** and **molecular formulae** for the first seven alkenes (from ethene with 2 carbon atoms to octene with 8 carbon atoms – methene does not exist).

Write down the **names** of the molecules (naming them is similar to alkanes, but the names end in **ene**, not **ane**).
6. Work out the molecular formula for eicosene (20 carbon atoms).
Process Questions:

1. What makes carbon as versatile compound?
2. How would you classify compounds as alkanes, alkenes and alkynes?
3. What are household materials/substances that have carbon compounds?
4. How are carbon compounds formed?

How did you go along with all the activities? Did you see a connection between one topic to another? Share your insights in what you have learned and the difficulties that you encountered:

Looking back from the activities that you had worked on, which do you find very interesting? Do you consider yourself ready for trying all the concepts you learned into a more challenging one? Make one general statement in your foldable about the activities you worked with?
After working on the properties of carbon compounds, you learned that there are so many substances formed from carbon. Bonding of compounds is essential. The next activity will lead you to recognize that new substances are formed from reactions substances.

ACTIVITY NO. 24: ARTICLE ANALYSIS

Article 1: A Superstrong Biomimetic Tape Inspired By Gecko Feet

http://www.fastcodesign.com/1671053/a-superstrong-biomimetic-tape-inspired-by-gecko-feet

Process Questions:
1. What part of the Gecko feet is discovered to give a superstrong grip?

2. What is it made up of?

ARTICLE 2: Accidental Inventor!

http://discovermagazine.com/1996/oct/theaccidentalinv893#.UyMUo6L3uu4

Process Questions:
1. What is the greatest triumph of synthetic polymer chemistry to date?

2. How does Teflon differ from nylon?

3. What are the uses of Teflon?

4. How was Teflon formed?

ARTICLE 3: Pioneering Scientists Discover New Material
http://www.manchester.ac.uk/aboutus/news/display/?id=4353

Process Questions:
1. How was graphene discovered?

2. What are the possible uses of grapheme?

After reading the three articles, you discovered that new substances are formed. Investigate how these new substances formed. Create an experimental procedure about formation of new substance.

"How are the substances discovered?" Generate a conclusion based on the question and place your insights in the:
http://www.fodey.com/generators/newspaper/snippet.asp

Given below is an IRF sheet. Fill in the third row with your answer to the question:
How is compound formed?

Initial
Revised
Final

End of DEEPEN:

What new realizations do you have about the topic? What new connections have you made for yourself? What helped you make these connections? Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY NO. 24: Building A Compound

To start the activity, read the discussion below:

Discussion:

If you live in a place that has lots of snow and ice in the winter, then you have probably seen the highway department spreading salt on the road to melt the ice. You may have also used salt on ice when making home-made ice cream. Salt lowers the freezing/melting point of water, so in both cases the idea is to take advantage of the **lower melting point**.

http://www.mortonsalt.com/for-your-business/snow-and-ice-control

Situation:

With freezing rain and winter storms coating roads with ice throughout central and northern New Jersey, a state of emergency has been declared across the state, reports Townsquare news staff in an article appearing on New Jersey 101.5. Making matters worse, a shortage of salt could leave roads dangerously slippery, as Michael George and Brian Thompson write for 4 New York.

What's your Solution?

Sodium chloride is not the only ionic compound that forms from sea water. Identify four other compounds that could be formed that contain the sodium. In order to help the community of New Jersey, you are asked to help the production of salt in order to lower the freezing point.

Design your own experiment in producing salt.

Process Questions:

1. What salt did you produce?

2. What substances did you use in forming salt?

3. What type of substances are these salt formers?

4. How did you produce the salt?

5. How compounds are formed?

ACTIVITY NO. 25: CONCEPT MAP

You are almost done with the module. Try to summarize everything you learned through a concept map. Try to connect one concepts to another.

ACTIVITY NO. 26: SMARTER PHILIPPINES

The DOST is sponsoring an activity with the theme "Science, Technology and Innovation: The Road to a Smarter Philippines,". The annual NSTW 2014 gives

emphasis on the role of science and technology in making a better future for Filipinos through its projects and services that spur socio-economic development. As an aspiring scientist, you are asked to present a sample of compound that can be produced from an investigative experiment. You must present a "sample" of this compound to the assembly with its specific uses in the community. The production of the compound must convince the group of DOST scientists that proper procedures have been followed, and that you understand the physical and chemical characteristics of the new compound. The sample presentation will be judged based on the following: Scientific Thought, Scientific content and accuracy, impact to the community and presentation.

CRITERIA	Outstanding 4	Satisfactory 3	Developing 2	Beginning 1	RATING
Scientific Thought	Followed the scientific method in a detailed way in order to perform the experiment.	Followed the Scientific method	Minimal use of Scientific method. Some steps are incorrectly done.	Did not follow the scientific method	
Scientific content and accuracy	The content is thorough and complete. It is accurate.	The content is substantial and generally accurate.	The content is partial/ incomplete and inaccurate. Numerous errors detract from the result.	The content contains misunder-standings and serious misconcep-tions. It has major inaccuracies and significant errors throughout.	
Impact to the Community	The sample product is highly useful and highly commendable.	The sample product is useful ~~and commendable.~~	The sample product is useful but needs further study.	The sample product is not useful and commen-dable.	
Presentation	Was engaging, provocative, unique manner	Was well done and interesting to	Was at times interesting and was presented	Was not organized	

	and captured the interest of the audience and maintained this throughout the entire presentation; great variety of visual aids and multimedia; visual aids were colorful and clear.	the audience; was presented organized manner; visual aids were used	clearly and precisely; was clever at times and was organized in a logical manner; limited variety of visual aids and visual aids were not colorful or clear	effectively; was not easy to follow and did not keep the audience interested; no use of visual aids	
				OVERALL RATING	

End of TRANSFER:

How did you find the performance task? How did the task help you see the real world use of the topic? You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

POST-ASSESSMENT:

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

1. Which two statements about ionic bond are correct?
   1. It can be formed between two opposite charge ions.
   2. It can be formed between two non-metal ions.
   3. It is formed by the transfer of electrons between atoms.
   4. It is formed by sharing of electrons between atoms.

   A. 1 and 3 **B. 2 and 3**
   C. 1 and 4 **D.** 2 and 4

2. Alkynes always contain a _____.

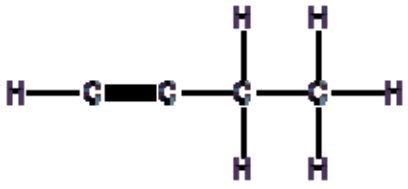
A) C=C bond
B) C≡C bond
C) C-C bond
D) C=H bond

3. Order the following by increasing bond length: C≡C, C=C, C-C
   A. they are all the same
   B. C≡C, C=C, C-C
   C. C≡C, C-C, C=C
   D. C-C, C=C, C≡C

4. How many unpaired electrons are there in the Lewis structures of a P^{3-} ion?
A. 0 **C**. 1
B. 2 **D.** 3

5. Which of the following lists contains no ionic compounds?
a. CO_2, NO, $Mg(NO_3)_2$
b. NaOH, CF_4, SF_6
c. NaH, CaF_2, Na_3N
d. H_2O, H_2S, NH_3

6. Give the simple base name of the molecular structure below:



A. butyne
B. butane
C. pentene
D. pentyne

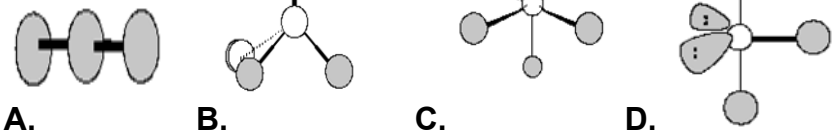
7. Luminol ($C_8H_7N_3O_2$) is a versatile chemical that exhibits chemiluminescence, with a striking blue glow, when mixed with an appropriate oxidizing agent. What kind of compound is Luminol?

A. Ionic Compound
B. Salt
C. Molecular Compound
D. Metallic Compound

8. Ion X has a charge of 2+, and ion Y has a charge of 1-. What is the correct formula of the compound formed?

A. XY_2 **C.** $(XY)_2$
B. X_2Y **D.** X_2Y_2

For items **9-10**, please refer to the following molecular models.



A. **B.** **C.** **D.**

As a chemistry student, you are asked by your teacher to regroup your molecular models according to following questions:

9. Which shows a molecular geometry of **ClF_3?**

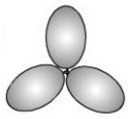
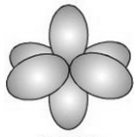
10. Which is octahedral?

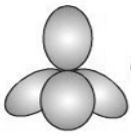
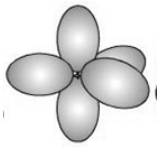
Chemistry Party

Your chemistry teacher will organize a chemistry party for the class. You will prepare the balloon needed for the party. The twist of the party is that you can only join the party if you'll design the balloons according to its molecular geometry/shape. Which of the following balloons will represent the compounds?

Use the following Legends:
3 - Balloons give a trigonal planar geometry
4 - Balloons give a tetrahedral geometry

5 - Balloons give a trigonal bipyramidal geometry
6 - Balloons give an octahedral geometry

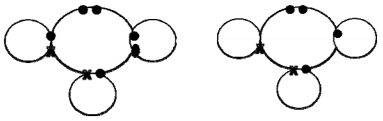
A.  B. 

C.  D. 

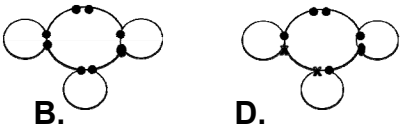
11. CH_4

12. CCl_4

13. Elements **X** and **Y** combine to form covalently bonded molecule.
Show the Lewis structure of the molecule.

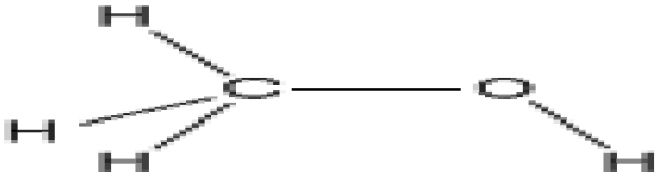


A. **C.**



B. **D.**

14. Using the diagram below, which of the following LEDS is most like to form Na^+ ion?



A. Element A
B. Element B
C. Element C
D. Element D

15. Element C (electronic configuration 2,8,18,8,2) and element E (electronic configuration 2,7) react to form an ionic compound, CE_2.

I True II False (Circle if the statement is true or false)

What do you think is the reason why the statement is correct or incorrect?

A. An atom of C will share one pair of electrons with each atom of E to form a covalent molecule, CE_2.
B. A macromolecule consists of covalently bonded atoms of C and E.
C. Atoms of C will each lose two electrons and twice as many atoms of E will each gain one electron to form an ionic compound CE_2.
D. An atom of C will lose one electron to an atom of E to form an ionic compound CE.

16. SGS's food chemical testing services use state of the art equipment and apply intricate analytical techniques in testing your food products. As chemical analyst of the said company you are asked to analyze organic or inorganic compounds to determine chemical or physical properties, composition, structure, relationships, or reactions.

As the chemical analyst, you are asked to give the systematic name of substances below present in different commercialized products for your report to the company's chemists.

Saltpeter, KNO_3	Lime, CaO
Soda Ash, Na_2CO_3	muriatic acid, HCl
Epsom salts, $MgSO_4$	milk of magnesia, $Mg(OH)_2$

Which of the following choices of systematic names will you give to the company's chemist?

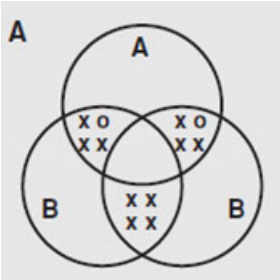
A. Potassium nitrate, Sodium bicarbonate
Magnesium sulfate, Calcium oxide
Hydrochloric acid, Magnesium hydroxide
B. Potassium nitrate, Sodium carbonate
Magnesium sulfate, Calcium oxide
Hydrochloric acid, Magnesium hydroxide
C. Potassium nitrite, Sodium bicarbonate
Magnesium sulfate, Calcium oxide
Hydrochloric acid, Magnesium hydroxide
D. Potassium nitrate, Sodium bicarbonate
Magnesium sulfate, Calcium oxide
Chloric acid, Magnesium hydroxide

17. An atom of element A has two electrons in its outermost shell while an atom of
element B has five electrons in its outermost shell. When A reacts with B, the compound will be:

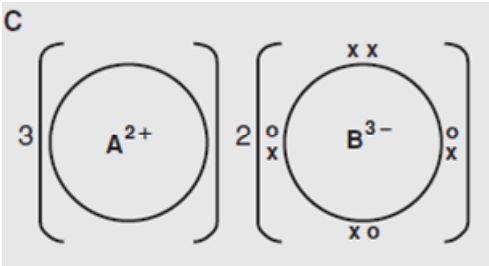
A. covalent
B. Diatomic
C. ionic
D. element

18. Based from number 17, you are asked to illustrate the reason for your answer. Which of the following will you represent?

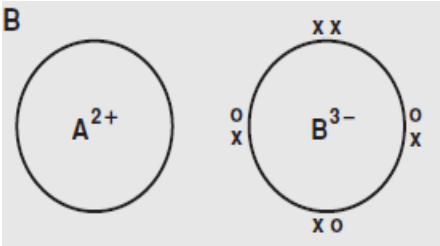
A



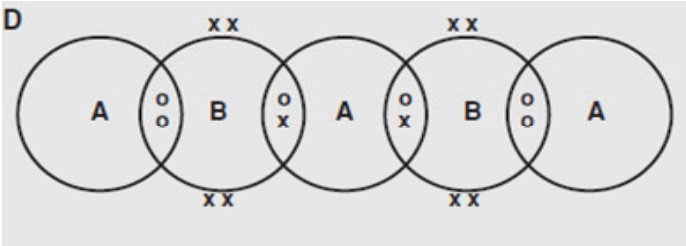
C



B



D



19. Sodium chloride, NaCl, exists as a molecule. Please encircle.

I True **II** False

Which of the following is the best reason for your answer:

A The sodium atom shares a pair of electrons with the chlorine atom to form a simple molecule.
B After donating its valence electron to the chlorine atom, the sodium ion forms a molecule with the chloride ion.
C Sodium chloride exists as a lattice consisting of sodium ions and chloride ions.
D Sodium chloride exists as a lattice consisting of covalently bonded sodium and chlorine atoms.

20. A typographical error on an exam produced the formula, P_4Se_7, in one of the questions. How would you name this compound?

A. tetraphosphorus hexaselenide
B. tetraphosphorus heptaselenide
C. phosphorus heptaselenite
D. phosphorus(IV) selenide

GLOSSARY OF TERMS USED IN THIS LESSON: (List in alphabetical order the key terms and give their definitions)

Anion - A negatively charged ion. It is formed by receiving electrons from another atom to achieve the octet

Cation - A positively charged particle. It is formed by losing electrons to achieve the octet.

Chemical Bond - The force that holds two atoms together

Covalent Bond - It forms a molecular compound. Electron sharing.

Electronegativity - It is the ability of an element's atoms to attract electrons in a chemical bond.

Ions - Charged particle

Ionic Bond - The electrostatic force that holds oppositely charged particles together in an ionic compound.

Ionic Compound - Compounds that contain ionic bonds.

LEDS (Lewis Electron Dot Structure) - A model that uses electron dot structures to show how electrons are arranged in molecules.

Monoatomic Ion - An ion formed from only one atom.

Nonpolar Covalent Bond - A type of bond that forms when electrons are shared equally

Oxidation State - The positive and negative charge of a monoatomic ion

Polar Covalent Bond - A type of bond that forms when electrons are not shared equally

Valence Electrons - Electrons in an atom's outermost orbitals; determine the chemical properties of an element.

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

Book

Chemistry: Matter and Change, Buthelezi et.al, Phoenix Publishing House.

http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson2

Connect to the Real World Clip art

http://www.clker.com/clipart-8214.html

Sparkler Clip art

http://www.clipartof.com/portfolio/bnpdesignstudio/illustration/boy-holding-out-a-new-year-or-fourth-of-july-sparkler-1049870.html

Happy Potter picture

http://www.dailymail.co.uk/tvshowbiz/article-1391176/Harry-Potter-And-The-Deathly-Hallows-posters-revealed.html

Chemical Bonds:

http://www.youtube.com/watch?v=oNBzyM6TcK8

Ions: Practice Activity

http://itc.gsw.edu/faculty/speavy/spclass/chemistry/ions.htm
Samples of LED

http://www.middleschoolchemistry.com/multimedia/chapter4/lesson6#lewis_dot_diagrams

VSEPR Table

http://www.lifesmith.com/VHS%20Web/chemistry.html

VSPER Worksheet

https://www.google.com.ph/?gfe_rd=ctrl&ei=hWIJU-bHK6mL8Qerp4DQBg&gws_rd=cr#q=vsepr+worksheet

CHEMISTRY INTERACTIVES

http://bio-alive.com/animations/chemistry.htm

Naming binary covalent

http://www.sciencegeek.net/Chemistry/taters/Unit4BinaryNomenclature.htm

Making Models of Matter

http://apliense.xtec.cat/arc/sites/default/files/student.pdf

Webpage Reading about ionic and Covalent with animation

http://www2.nl.edu/jste/bonds.htm

Picture baby

http://www.hdwallpapers.in/little_cute_baby-wallpapers.html

Chemmodule

http://www.nios.ac.in/media/documents/secscicour/English/Chapter-7.pdf

Dancing Queen: Chemical Bonds

http://www.youtube.com/watch?v=DD6uh01X7Gg&list=PL574EB8B52AE5EF36

What are ionic Bonds?

http://www.youtube.com/watch?v=zpaHPXVR8WU

What kinds of bonds are these?

http://www.youtube.com/watch?v=oNBzyM6TcK8

Metallic Bonding

http://www.youtube.com/watch?v=Bi0rUNV8mEw

Chemistry graphics

http://wirdou.com/tag/chemistry/

Chemical Bonding - Webpage

http://www.scienceclarified.com/everyday/Real-Life-Chemistry-Vol-2/Chemical-Bonding.html

Interactive Periodic Table/ionic bonding

http://www.learner.org/interactives/periodic/groups_interactive.html

The Bonding Game

http://www.powayusd.com/pusdphs/webquests/chemwebquest/chemsite.htm#BondingGame

Rags to Riches Quiz

http://www.quia.com/rr/1079.html?AP_rand=1738890253

adhesives

http://www.youtube.com/watch?v=PpyKN2O5LI0

Chocolate: The New Health Food. Or Is It?

http://www.acs.org/content/dam/acsorg/education/resources/highschool/chemmatters/chocolate-the-new-health-food-or-is-it.pdf

Quiz on Naming Ionic

http://www.chemistrywithmsdana.org/wp-content/uploads/2012/07/ionic.html

Complete the notetaking guide:

http://www.gpb.org/files/pdfs/gpbclassroom/chemistry/note_ep603.pdf

Dice Template

http://www.gpb.org/files/pdfs/gpbclassroom/chemistry/labDiceTemplate.pdf

IUPAC logo

http://www.iupac.org/home/about/affiliate-membership-program.html

Web 2.0: Digital StoryTelling

http://www.clpgh.org/kids/storymaker/embed.cfm

STEEL LAB

http://bartrug-tamhigh.weebly.com/chemical-bonding.html

Electrocuted Man clip art

http://www.picturesof.net/pages/100112-052675-088042.html

Alkanes Worksheet # 7

http://www.creative-chemistry.org.uk/gcse/documents/Module6/N-m06-18.pdf

VSEPR

http://www.chem.ox.ac.uk/vrchemistry/vsepr/intro/vsepr_splash.html

Building Molecules – Modelling VSEPR

http://yhsscience.net/lvena/Dec%20pdf%20files/molecularmodelslab.pdf

Lesson 3: Mole Concept

INTRODUCTION AND FOCUS QUESTION(S):
Have you tried counting the number of grains of rice in a gallon container? It is difficult to do so because rice particles are very small and numerous. Chemists face a similar problem when they try to count atoms. Atoms are too small to be counted one at a time. Because they are so small, it is difficult to measure the mass of each atom.

In this module you will find out how chemists overcome the problems of counting tiny particles of the atoms and molecules and measuring the moles, mass, and number of particles and relate to one another.

Remember to search for the answer to the following questions:

1. Why is the mole an important measurement in chemistry?
2. How are the quantity and the composition of substance determined?
3. Why the mole concept is an important concept in industry for production of consumer goods?

LESSONS AND COVERAGE:
In this module, you will examine this question when you take the following lessons:

Lesson 1 – Chemical Bonding

A. *Ionic and Covalent Bonding*
B. *Metallic Bonding*
1.

Lesson 2 – The Variety of Carbon Compounds

A. Carbon Atoms
B. Organic Compounds
2.

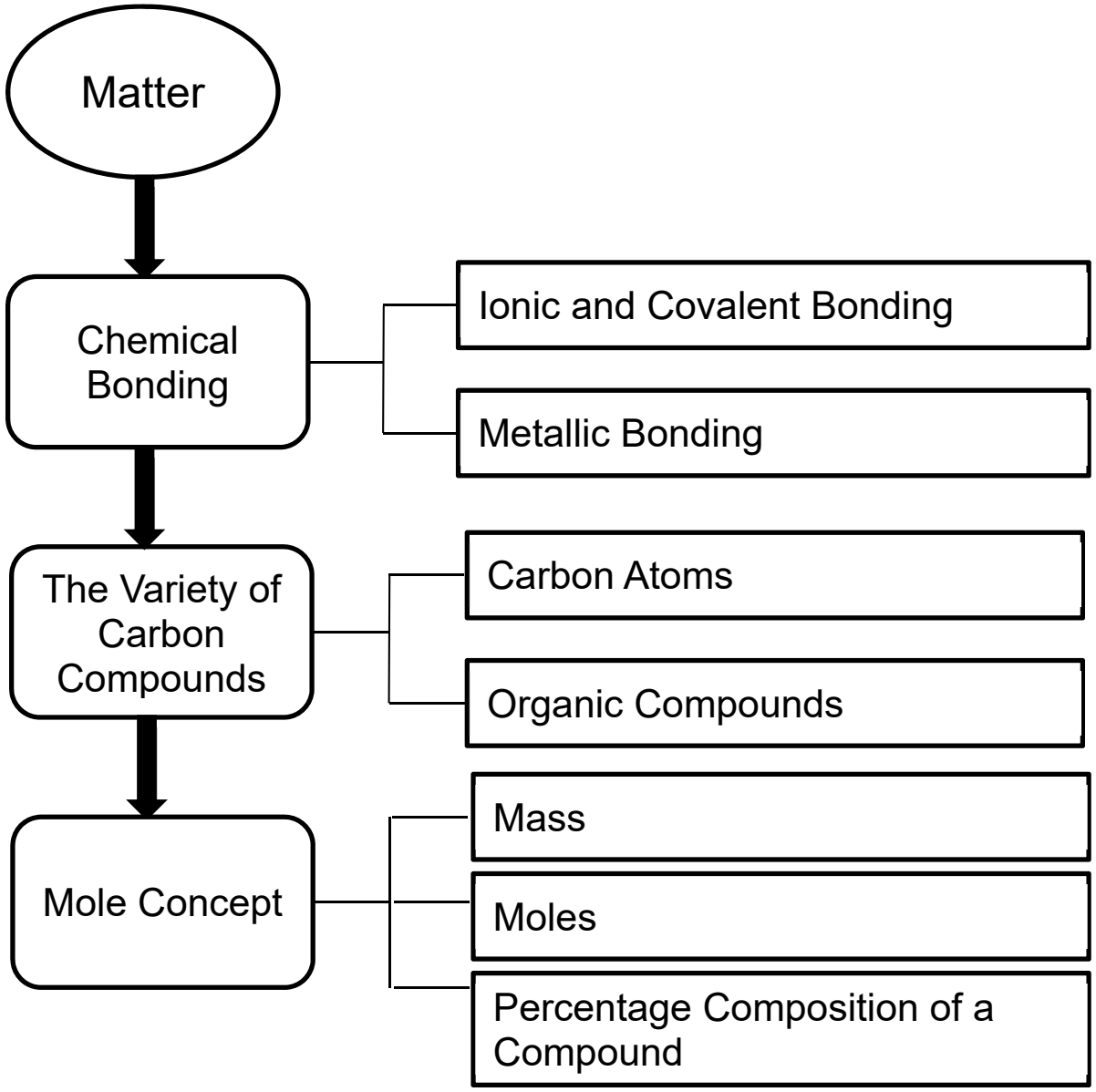
Lesson 3 – Mole Concept

A. Mass
B. Moles
C. Percentage Composition of a Compound

In these lessons, you will learn the following:

Lesson 1	Write in bulleted form Performance Objectives.
Lesson 2	Write in bulleted form Performance Objectives.
Lesson 3	The Learner: 1. Use the mole concept to express mass of substances 2. Determine the percentage composition of a compound given its chemical formula and vice versa.

MODULE MAP:
Here is a simple map of the above lessons you will cover:



EXPECTED SKILLS:

To do well in this module, you need to remember and do the following:)

1. *Read the instructions carefully.*
2. *Take down notes and copy some important link so that you could go back whenever you need information given in that site.*
3. *Go beyond the procedure given in the net. Explore more.*
4. *Do the web test for several times and don't forget to click on the correct answer for your reference.*

LESSON 3: MOLE CONCEPT

In this lesson, you will:

1. Use the mole concept to express mass of substances
2. Determine the percentage composition of a compound given its chemical formula and vice versa.

PRE-ASSESSMENT:

1. Which of the following represents a mole?
   a. 6.02×10^{22} Pb atoms
   b. 6.02×10^{23} F atoms
   c. 3.01×10^{23} CH_4 molecules
   d. 1.63×10^{21} Si atoms

2. Which of the following choices is equivalent to one mole of CH_4?
   a. 16 g; 6.02×10^{23} particles
   b. 32 g CH4; 12.02×10^{23} particles
   c. 32 g CH4; 6.02×10^{23} particles
   d. 64 g CH4; 6.02×10^{23} particles

3. How many moles are contained in 36g of NH_4?
   a. 1 mol b. 2 mol c. 3 mol d. 4 mol

4. Which of the following is the correct percentage composition of water in $Na_2CO_3.10H_20$
   a. 2.93% b. 33.93% c. 62.93% d. 93.93%

5. What is the percent composition of oxygen in MgO?
   a. 10% b. 20% c. 30% d. 40%

6. An organic compound contains 12.8% C, 1.1% H and 17% O by mass. What is its empirical formula?
   a. CHO b. CH_2O c. CHO_2 d. $C_2H_2O_2$

7. What information is needed to calculate the percent composition of a compound?

   a. the density of the compound and Avogadro's
   b. the weight of the sample to be analyzed and its density.
   c. the weight of the sample to be analyzed and its molar volume
   d. the formula of the compound and the gram atomic mass of its elements

8. Which of the following is the percentage by mass of elements in Na_2CO_3?

   a. Na = 43.39%
      C = 11.32%
      O = 45.28%

   b. Na = 44.39%
      C = 12.32%
      O = 46.28%

   c. Na = 44.39%
      C =11.00%
      O = 44.28%

   d. Na = 43.93%
      C = 11.23%
      O = 45.82%

9. Which statement is correct about the molar mass of substance?
   a. 4 g of CH_4 is equal to 4 moles of CH_4
   b. 4 g of CH_4 is equal to 1 mole of CH_4
   c. 4 moles of CH_4 is equal to 16 g of CH_4
   d. 4 moles is equal to 64 g of CH_4

10. If we breathed in 2.107×10^{21} molecules of air pollutant, nitrogen oxide (NO_2), how many grams of NO_2 would we breathe in?
    a. .160 g b. .161g c. .162g d. .163g

11. What is the mass of one-half mole of CO_2?
    a. 6 g b. 12 g c. 22 g d. 44 g

12. How many hydrogen atoms are there in 72 mol of H atoms?

    a. 6.02×10^{23}
    b. 12.04×10^{24}
    c. 4.3×10^{25}
    d. 6.02×10^{46}

13. Which statement is NOT correct regarding the molecule $C_5H_8O_6$?
    a. One mole of $C_5H_8O_6$ contains 6.02×10^{23} particles.
    b. One mole of $C_5H_8O_6$ is equal to 168 g of $C_5H_8O_6$.
    c. The molar mass of $C_5H_8O_6$ is equal to one mole of $C_5H_8O_6$.
    d. 84 g of $C_5H_8O_6$ contains 6.02×10^{23} molecules.

14. Which of the following statements is **NOT** true about mole?
    a. One mole of a substance contains a fixed number of particles.
    b. One mole each of different substances has different masses and different number of particles.
    c. One mole each of different substances has the same number of particles but they have different masses.
    d. The formula weight of the compound is equal to one mole of that substance.

15. On a clean and dry bowl, mix 0.665 mol hard and soft flour ($C_4H_8O_4$) together with 5.5 x 10^{21} formula units of sodium hydrogen carbonate ($NaHCO_3$) and with 5. 42 x 10 ^{21} formula units sodium chloride (NaCl). Calculate the exact standard cooking measurement in mass?
    a. Flour = 74 g
    3. Baking soda = .2g
    4. Salt = .5g
    5.
    b. Flour = 76 g
    6. Baking soda = .4 g
    7. Salt = .5g
    c. Flour = 78 g
    Baking soda = .6 g
    Salt = .5g
    d. Flour = 80 g
    Baking soda = .8 g
    Salt = .5g

16. How many molecules are there in 2 moles of H_20_2?
    a. 2 x 10^{23} b. 6.02 x 10^{23} c. 12.04 x 10^{23} d. 6.02 x 10^{46}

17. From the balanced equation: $CS_2 + 2CaO \rightarrow CO_2 + 2CaS$
    How many moles of CO_2 are obtained from the reaction of 2 moles of CaO?
    a. 0.5 mol b. 1.0 mol c. 1.5 mol d. 2.0 mol

18. Which of the following cookies made by spreading a thin batter onto a baking sheet and moulding the cookies into shape?
    a. Icebox cookie
    b. Pressed cookie
    c. Rolled cookie
    d. Wafer cookie

19. At what temperature should you bake the cookies?
    a. 305 ^{0}F b. 315 ^{0}F c. 350 ^{0}F d. 375 ^{0}F

20. Which ingredient does the chef NOT use to make his cookies?
    a. baking powder b. flour c. salt d. sugar

EXPLORE

Let's start the module by exploring the mole concept on how mole concept useful in understanding compounds? Why was Avogadro's concept so important to chemistry? How are moles related to the mass or volume of an element or compound and Avogadro's number of particles? How are the quantity and the composition of substance determined?

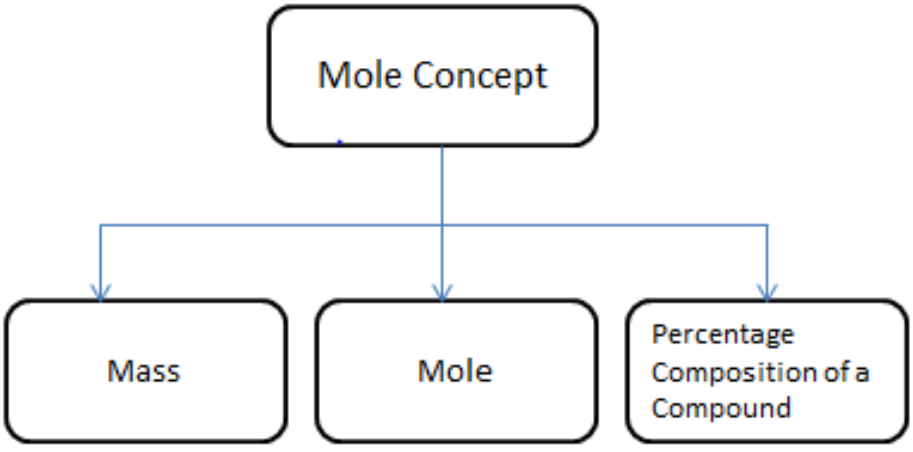
ACTIVITY NO. 1: **SONG ANALYSIS**

Listen and analyze the song entitled "Avogadro's number song" by clicking on the link provided below. The song is a catalyst to understand the concept of mole in chemistry. http://www.youtube.com/watch?v=R76zj9Y6zxI

PROCESS QUESTIONS:

1. Based on the song what questions come to your mind about the mole?
2. How does the Avogadro's number help us understanding the mole concept in chemistry?
3. How are moles related to the mass or volume of an element or compound and Avogadro's number of particles?

Here is a simple map of the lessons you will cover:



ACTIVITY NO. 2: **I-R-F CHART**

Before you begin with this lesson, Fill in the table: Provide answers in the first two columns on the mole concept: Write your answers in your notebook.

Statements about Mole	Agree or Disagree	Initial Explanation	Revised Explanation	Concluding Explanation
1. Equal volumes or equal masses of different substances contain the same number of moles (or atoms/molecules/formula units).				
2. A mole is just a number of molecules				
3. One mole of various substances may contain different numbers of units of those substances				
4. Mole is similar to molecular, molar and molecule. 8.				
5. The number of moles of reactants must equal the number of moles of products 9.				

http://intro.chem.okstate.edu/chemsource/moles/mole16.htm

As you go on to the succeeding activities you will find out the answer of the above statements.

Process Questions:

1. Why is understanding the mole important in chemistry and to living organism?
2. Does the mole concept important in industry for production of consumer goods?
3. How are the quantity and the composition of substances determined?

ACTIVITY NO. 3: **FUN WITH MOLES**

You are now about to learn the mole concept in chemistry. As you explore this concept, do remember the various study skills and strategies that are mention initially in this module such as solving problems, downloading videos, exporting a web page to PDF, taking screen shots, screen recording, taking down notes, and many more.

In this activity you will check your understanding by answering the problems below. Write and show your solution in your notebook. Solve the problem to identify mystery words from each problem. When you get the answer refer it to the problem code. Write the Mystery word on the first column and put your calculated answer on the third column. Find the mystery sentence.

Word	Problem	Answer
	How many moles of Pb are in 2.3456 g of Pb	
	How many atoms are present in 4.80 mol of Fe?	
	How many moles of K are in 5.7×10^{23} atoms?	
	Calculate the number of atoms in 7.50 mol of S?	
	What is the molar mass of Na_2SO_4	
	What is the molar mass of $C_6H_{12}O_6$	
	How many moles are in 1459 g of erbium?	

Adapted source: http://www.nclark.net/ChemicalQuantities

Answer:
PROBLEM CODE

Word	Answer	Word	Answer
Saturn	142 g/mol	Scorpion(s)	*1.2 g*
Ion	180 g/mol	Vampires	*227.8 g*
Eat	3.01×10^{23} particles	Bad	*4860 g*
Kittens	190.5 g Cu	Ms. Piller	*0.01132 ml*
And	0.4796 mol	Owns	*2.9×10^{24}*
Puppies	0.58 mol	A	*.95 moles*
Don't	151.9	Red	*4.5×10^{24}*
Breakfast	126 g	Dead	*0.500 mol*
For	0.0638 mol	Really	*998.54 g*
Very	616 g	Okay?	*8.7 mol*
They	9.03×10^{24}	Smell	*1,371.5 g*

Mystery Sentence:
Ms. Piller owns a red Saturn ion, okay?

In the activity, the reverse conversion from mass to mole also involves the molar mass as a conversion factor, but it is the reverse of the molar mass that is used. Can you explain why? *To convert a mass in grams to mole, the reverse molar mass is used so that the unit of grams cancels.*

End of EXPLORE:
You just tried finding out how mole an important measurement in chemistry. Let's find out how your other classmates answered the first column of the IRF chart. You can make use the Round-Robin Discussion to communicate with your classmates. Compare their ideas to your own.

What you learn in the next sections will also enable you to do the final project.

Your understanding of the mole will be increased as you study the lessons and perform the activities in the FIRM UP phase.

Let's start gathering information by proceeding to the next part.

FIRM-UP

Your goal in this section is to learn and understand the unit mole quantitatively measure the number of very small particles. You will determine and relate the mass, moles, and number of particles to one another. The competencies you are to learn are listed in the checklist below. Monitor your accomplishment in these competencies.

CHECKLIST OF COMPETENCIES	
	Use the mole concept to express mass of substances
	Determine the percentage composition of a compound given its chemical formula and vice versa.

ACTIVITY NO. 4: LET'S REVIEW

When you were in the 8th grade, you were asked to make a chart, poster or multimedia presentation of elements, ions and compounds that are important to living organisms. Let's review the atoms, molecules, and the chemical reactions between them by watching this video. Click on the link. https://www.youtube.com/watch?v=vlSOESXQI7o Atoms are basic building blocks of any matter. Combinations of these atoms are molecules.

PROCESS QUESTIONS:

1. What is an atom?
2. How are atoms and molecules related?
3. How will you describe the internal structure of an atom?

Now that you've learned information about atom and molecules, before we get into the use of Avogadro's number. The next part will be about knowing the size of moles and calculating their sizes. Why is the mole so important in chemistry? And how is it used in calculations?

The purpose of calculating the mole concept in chemistry is to allow scientists, students, etc., to bridge the gap by relating he numbers of elementary entities (usually atoms or molecules) in a certain mass of a given substance.

Click the link below about the application of moles in concrete terms
https://ph.answers.yahoo.com/question/index?qid=20080915132541AAQtjFu

ACTIVITY NO. 5: **HOW BIG IS A MOLE?**
In previous activity you explore the mole concepts, to enhance your understanding and to gather information about mole concepts you need to watch a video clip below. Learn the incredible magnitude of the mole and how something so big can help us calculate the tiniest particles in the world,
http://www.youtube.com/watch?v=TEl4jeETVmg

PROCESS QUESTIONS:
After watching, try to find answers to the following questions:

1. What were the views illustrated in the animation?
2. What was contribution of Avogadro in the field of Chemistry?
3. How do you use mole to the tiniest particles in the world
4. Why a substance so big can help us calculate the tiniest particles in the world.
5. How are the quantity and the composition of substance determined?

ACTIVITY NO. 6: **PICTURE ANALYSIS**
In the previous activity you learned that atoms are tiny particles and counting these tiny particles is as difficult as counting grains of sand in a desert.

Adapted Source: http://www.slideshare.net/entranceisolutions/mole-concept-ok1294991357

PROCESS QUESTIONS:

1. Based on the picture, what questions come to your mind about mole concept?
2. How big is this number 6 x 10^{23}?
3. How will you compare Avogadro's number to the number of grains of sand in the Sahara Desert?
4. What is the implication of mole concept to the tiny particles?
5. Why is the understanding of the tiny particles of mole significant to living organisms?

The concept of mole is very important in chemistry, almost all the calculations, at least in general chemistry, involve this concept. Here you will able to count atoms, molecules, and ions through the vehicle of mole. The mole is a fundamental unit in the SI units to measure the amount of substance.

Before you get into the Avogadro's number problems, take a look in the following examples. This will intensify your knowledge on mass to mole conversion which can be facilitated by employing the molar mass as a conversion ratio.

Example 1:

Convert 18 grams of water to moles of water.

Solution: The molar mass of water is 18 g/mol. Therefore:

$$18 \text{ g } H_2O \times \frac{1\ mol}{18\ g\ H_2O} = 1.0 \text{ mol } H_2O$$

Example 2:

If you have 34.5 g of NaCl, how many moles of NaCl do you have?

Solution:

$$34.5 \text{ g Na Cl} \times \frac{1\ mol\ NaCl}{58.4\ g\ NaCL} = 0.591 \text{ moles NaCl}$$

If the foregoing problem doesn't make sense, you should review these links: http://www.chem1.com/acad/webtext/intro/int-2.html. - Introduction to the mole concept in Chemistry

https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/mass-relationships-and-chemical-equations-3/molar-mass-41/converting-between-moles-and-atoms-221-3702/ - Understanding the relationship between moles and Avogadro's number

https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/mass-relationships-and-chemical-equations-3/molar-mass-41/converting-between-mass-and-number-of-moles-222-3700/ - Mass and the number of atoms in a given sample

Look at the items you missed. Go back to your notes and review the terms or concepts you missed.

ACTIVITY NO.7: **WHAT SUBSTANCE AM I?**

In this activity you will have the opportunity to relate quantities of atoms, elements or molecules to real-world measurable quantities. You will enhance your understanding of the mole by using masses and a periodic table to determine unknown substances. As a hands-on activity, this will ensure you to make the connection between moles and molar mass.

You are a chef in big trouble! You have an important restaurant reviewer coming to your restaurant but someone has taken off all the labels from your bottles! How will you know which one is the salt you need for cooking and which bottles contain substances the reviewer will probably find hazardous to have in the kitchen?

In front of you are 6 bottles with the label removed. Each contains one mole of an unknown substance. Using only an electronic balance and your periodic table, classify and label the unknown substance.

Clues:

** four of the six are elements, 2 are compounds. The compounds are in bottles A and B and are either NaCl, FeS, or $CaCO_3$.
** the mass of each bottle is: 105.19g
** n = m / M Since there is only one mole of each substance, the mass is also the molar mass.

Instructions:

1. Find the mass of each bottle with substance. Record the mass in the table provided. The mass of the bottle itself is 105.19g. Use this information to determine the mass of the substance alone.
2. Using the mass of the substance, determine the molar mass
3. Determine which bottles contain elements and which elements they are.

4. Two of the substances are compounds of either NaCl, FeS, or $CaCO_3$. Determine which bottles contain which compounds.

BOTTLE	MASS OF BOTTLE AND SUBSTANCE (g)	MASS OF SUBSTANCE (g)	ATOMIC MASS OF SUBSTANCE	SUBSTANCE?
A (compound)				
B (compound)				
C				
D				
E				
F				

Adapted source: Mole Scavenger Hunt

PROCESS QUESTIONS:

1. How is the mole concept useful in understanding compounds?
2. Why is mole an important measurement in chemistry?
3. How are the quantity and the composition of substance determined?
4. How does calculating the moles help one achieve a real world task such as in the above situation?

Furthermore, use the following links to enhance your learning to relate the mole concept and molar mass in real life.

- https://ph.answers.yahoo.com/question/index?qid=20111215145527AAqGgYS Mole concept relate to real life
- and http://wiki.chemprime.chemeddl.org/index.php/The_Molar_Mass_in_Everyday_Life The Molar Mass in Everyday Life

ACTIVITY NO. 8: **RELATIONSHIP BETWEEN MOLES AND AVOGADRO'S NUMBER**

You learned from the previous activity on how something so big can help us calculate the tiniest particles in the world. The mole can be used to relate masses of substances to the quantity of atom, molecules and particles. It can be expressed as 6.02×10^{23} known as Avogadro's number. This is very important in relation to determine how much of one substance can react with a given amount of another substance. Click this site http://prezi.com/auxqhdeiro1k/the-mole-concept/ to enhance the learning about mole conversion.

PROCESS QUESTIONS:

1. Describe the relationship between Avogadro's number to the molar mass according to conversion?

2. How an Avogadro's number can be used in converting an amount of substance from one measurement to another?

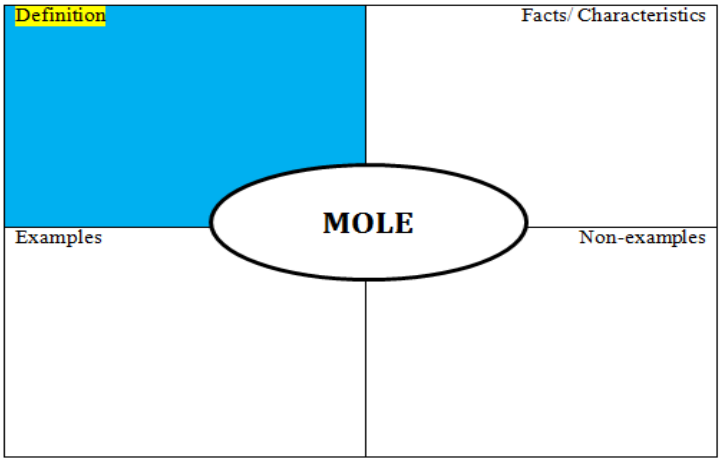
3. How was your idea about difficulty on mole conversions corrected in the lesson?

ACTIVITY NO. 9: **HOW TO USE THE MOLE?**

Now that you understand the moles and Avogadro's number $6.02x10^{23}$ as a unit of measurement in chemistry, you will now get to know the important terms that you will encounter. Click the links below:

http://www.youtube.com/watch?v=JC76NR8EtTQ this video will help you grasp your knowledge about mole. Then click this webpage to understand mole concept.

Read the article found in this link: http://www.chemistryexplained.com/Ma-Na/Mole-Concept.html. Make a list of the important words, terms, or ideas that you got from the article. From the list, come up with phrases or statements which you think define or describe MOLE. Write your completed definition in the appropriate column of the Frayer model:



PROCESS QUESTIONS:

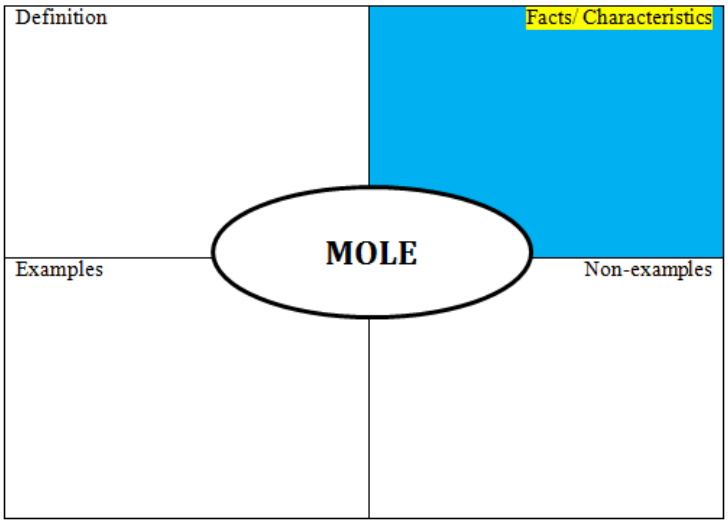
1. What is a mole?
2. What is the important role that the mole plays in determining the entities of the particles and how does it relate to Avogadro's number?
3. What can you learn from looking at our environment?

ACTIVITY NO. 10: **VIDEO LECTURE**

In previous activity you learned the role and importance of mole. In this short video lecture course on the mole concept converting mass to moles, mass to atoms, moles to Avogadro's number, molecules to mass. Learn more facts about mole and discover its many facets by watching the videos found in the following

links:http://www.youtube.com/watch?v=AsqEkF7hcII - The Mole and Avogadro's Number
http://www.youtube.com/watch?v=6Yuy6jCSh-0 – Mass and Mole relationship

What are the facts and characteristics of mole that you gathered from the videos you watched? Write them in the Facts/Characteristics box of the Frayer model.



PROCESS QUESTIONS:

1. Classify difficult concepts you gathered and in your own content explain the concept.
2. What is the value of Avogadro's number? Explain its relevance to moles.
3. What are the methods involved in converting mass to moles, mass to atoms, moles to Avogadro's number, molecules to mass? Explain briefly how they solve percentage composition?

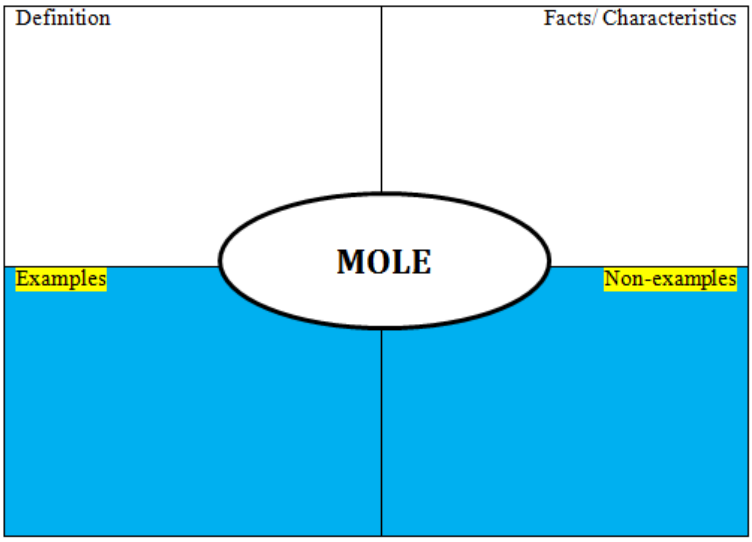
ACTIVITY NO. 11: **RESEARCH STUDY**
In the previous activity you learned that the mole Click on the link below to read an article: *"Teaching about amount of substance and the mole"*. Use the information found in the article to enhance your understanding about the language associated with its use in the mole concept.
http://www.ulster.ac.uk/scienceinsociety/research_into_teaching_about_the_mole_(pages_6-7).pdf

PROCESS QUESTIONS:

1. What are the difficulties encountered by the students in studying the mole concepts?
2. Do you have the same perceptions of the difficulties on mole concept?
3. What are the ways to conquer the difficulties in order to promote better understanding of mole?

After reading the article, you will also give your own hypothesis after finding out important ideas with regard to this research.

What are the examples and non-examples of mole that you gathered from the article? Write them in the Examples and Non-example boxes of the Frayer model.



Check your understanding by answering the problems below. Write and Show your solution in your notebook.

ACTIVITY NO. 12: **DRILL**
You learned how to do conversion according to the number of particles that the substance contains. In this drill you are challenged to perform mole, mass, and molecule conversions below:

Question	Answer
1. How many moles of Na are in 42 g of Na?	
2. What is the mass of 1.2×10^{25} molecules of CO?	
3. How many molecules are there in 52 g of CO?	
4. What is the mass of 1.20×10^{25} atoms of sulfur?	
5. How many atoms are in 36 g of bromine?	

Review the previous interactive site; pausing it every now and then so you can take down notes.

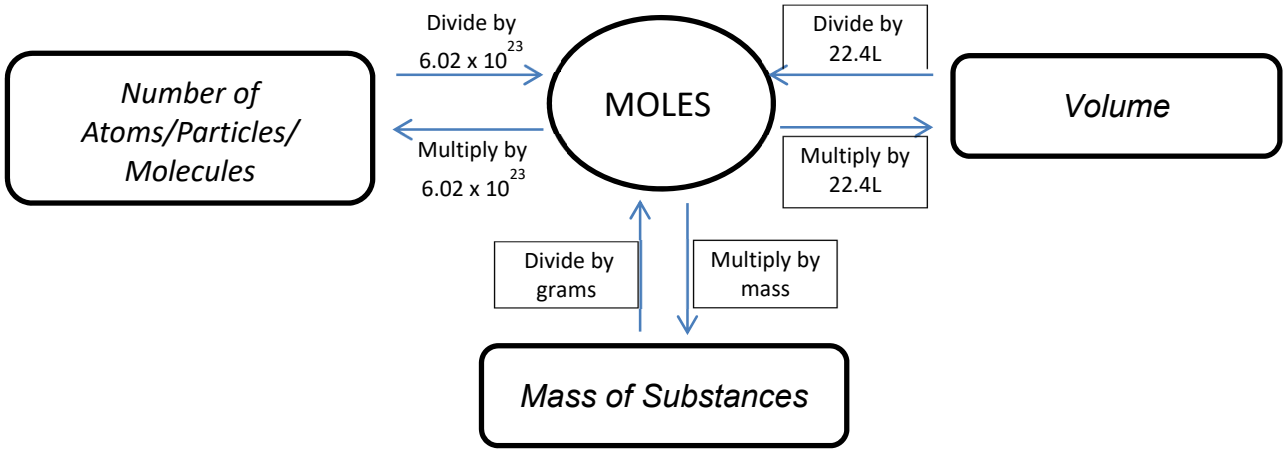
PROCESS QUESTIONS:
Go back to the previous section and compare your computation with the discussion.

1. How will you assess your performance in solving the problems?
2. What do you think was the cause of your mistakes in your calculation? Go back to your notes and review the terms or concepts you missed.
3. Cite an example for the way you use mole in your everyday life. Explain your answer
4. How are chemists able to keep track of the number of particles (atoms, or molecules) that enter a chemical reaction?
5. How are the quantity and the composition of substances determined?

All of the previous problems have involved single–step conversions between moles, mass, volume, or number of particles. The following is a summary of the conversion factors needed:

CONVERSION	CONVERSION FACTOR
MOLES ⟷ NUMBER OF PARTICLES	$\frac{5.02 \times 10^{23} \text{ particles}}{1 \text{ mol}}$ or $\frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ particles}}$
MOLES ⟷ MASS	$\frac{(\text{ molar mass }) \text{ g}}{1 \text{ mol}}$ or $\frac{1 \text{ mol}}{(\text{ molar mass }) \text{ g}}$
MOLES ⟷ VOLUME (gases @ STP)	$\frac{22.4 \text{ L}}{1 \text{ mol}}$ or $\frac{1 \text{ mol}}{22.4 \text{ L}}$
MOLECULES ⟷ ATOMS	$\frac{(\text{atom count}) \text{ atoms}}{1 \text{ mol}}$ or $\frac{1 \text{ mol}}{(\text{atom count}) \text{ atoms}}$

The following flow chart will help to simply calculations that involve multiple conversions.

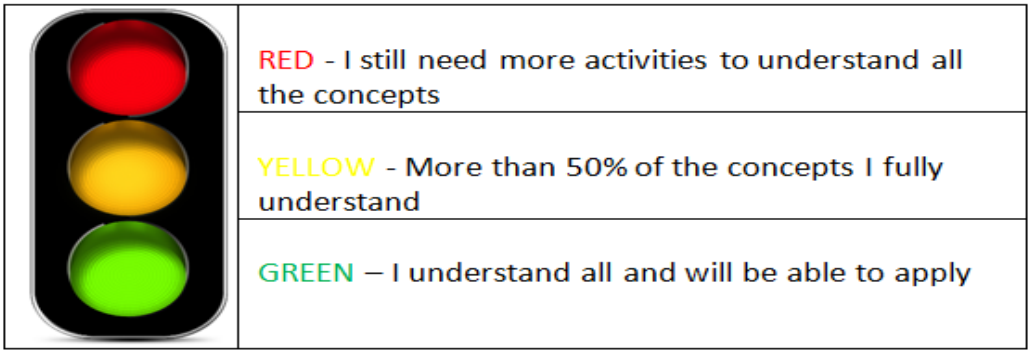


Now that you have practiced conversions between mass, moles, and representative particles, you probably realize that the mole is at the center of these calculations. Mass must be converted to moles before being converted to atoms and atoms must similarly be converted to mole before calculating their mass.. The flow chart above shows the steps to follow as you complete these conversions. In the Example problems, two steps were used to convert either mass to moles to atoms, or atoms to moles to mass. Instead of two separate steps, these conversions can be made in one step. Observe the examples

EXAMPLE	MOLE CALCULATIONS INVOLVING MULTIPLE CONVERSIONS
Problem :	(a) What is the volume occupied by 50.0 g of $NH_3(g)$ at STP? (b) What is the mass of 1.00×10^{12} atoms of Cl? 11. (c) How many oxygen atoms are contained in 75.0 L of SO_3 (g) at STP?
Solution :	(a) MASS → MOLES → VOLUME $? \text{ L} = 50.0 \text{ g} \times \frac{1 \text{ mol}}{17.0 \text{ g}} \times \frac{22.4 \text{ L}}{1 \text{ mol}} =$ **65.9 L** (b) ATOMS → MOLES → MASS $? \text{ g} = 1.00 \times 10^{12} \text{ atoms g} \times \frac{1 \text{ mol}}{}$

	atoms x $\frac{35.5\ g}{1\ mol}$ x $\frac{6.02 \times 10^{23}}{}$ = **5.90×10^{-11} g** (d) VOLUME → MOLES → MOLECULES → ATOMS of O ? O's = 75.0 L x $\frac{1\ mol}{22.4\ L}$ x $\frac{6.02 \times 10^{23}\ SO_3}{1\ mol}$ x $\frac{3O's}{SO_3}$ **= 6.05×10^{24} O's**

ACTIVITY NO. 13: **SKILLS READINESS CHECK**:
Reflection to the level of your performance for this lesson. Check the color of the light that measures your understanding: Red - if you need more practice or activities, Yellow – 50% of the concepts understand, and Green – understand all and will be able to apply.



ACTIVITY NO.14: PERCENTAGE COMPOSITION
In the previous activity, you learned the relationship between Avogadro's number and mass of a substance. Now, the mass of each element present in one mole of compound can be compared to the mass of one mole of compound, based on the chemical formula of the compound. The value obtained, multiplied by 100%, is called the percentage composition. The mass percent of a compound is calculated this way:

$$Mass\ percent\ of\ element = \frac{mass\ of\ element\ present\ in\ one\ mole\ of\ compound}{mass\ of\ one\ mole\ of\ compound}\ x\ 100$$

To determine the mass percent of $Al(OH)_3$, the following steps can be followed:

STEP 1: Calculate molar mass of $Al(OH)_3$

$$\text{g Al} = \frac{27\ g\ Al}{mol\ Al}\ x\ 1\ mole\ Al = 27\ g$$

$$\text{g O} = \frac{16\ g\ O}{mol\ O}\ x\ 3\ moles\ O = 48\ g$$

$$\text{g H} = \frac{1\ g\ H}{mol\ H}\ x\ 3\ moles\ H = 3\ g$$

Molar mass =78 g

STEP 2: Determine mass percent of each element

$$\%\ \text{Al} = \frac{27\ g\ Al}{78\ g\ Al(OH)_3}\ x\ 100\ = 34.62\ \%$$

$$\%\ \text{O} = \frac{48\ g\ O}{78\ g\ Al(OH)_3}\ x\ 100 = 61.53\ \%$$

$$\%\ \text{O} = \frac{3\ g\ H}{78\ g\ Al(OH)_3}\ x\ 100 = 3.85\ \%$$

Total = 100 %

The mass percentages of all elements in a compound add up to 100%. In some cases, the sum of the mass percentages in a compound is not exactly 100% due to the rounding of values.

Sample Problem

Find the percentage composition of Vitamin E ($C_{29}H_{50}O_2$)
Solution

1. Analyze: Given: Formula $C_{29}H_{50}O_2$
   29 mole C
   50 mole H
   2 mole O
   Find: % of each element

2. Plan: a. Get molar mass of $C_{29}H_{50}O_2$
   C = 12 g/mole C
   H = 1 g/mole H
   O = 16 g/mole O

   b. Calculate percentage composition

3. Calculate
   STEP 1: Determine molar mass of $C_{29}H_{50}O_2$

$$\text{g C} = 29\ mole\ C\ x\ \frac{12\ g\ C}{mol\ C} = 348\ g\ C$$

$$\text{g H} = 50\ mole\ H\ x\ \frac{1\ g\ H}{mol\ H} = 50\ g\ H$$

$$\text{g O} = 2\ mole\ O\ x\ \frac{16\ g\ O}{mol\ O} = 32\ g\ O$$

Molar mass = 430 g

STEP 2: Calculate percentage composition of $C_{29}H_{50}O_2$

$$\%\ \text{C} = \frac{348\ g\ C}{430\ g\ \text{C}_{29}\text{H}_{50}\text{O}_2}\ x\ 100 = 80.93\ \%$$

$$\%\ \text{H} = \frac{50\ g\ H}{430\ g\ \text{C}_{29}\text{H}_{50}\text{O}_2}\ x\ 100 = 11.63\ \%$$

$$\%\ \text{O} = \frac{32\ g\ O}{430\ g\ \text{C}_{29}\text{H}_{50}\text{O}_2}\ x\ 100 = 7.44\ \%$$

4. Evaluate — Add the percentage to check if the sum is 100 %
   80.93% + 11.63% + 7.44% = 100%

   In this case, the percentages add up to 100%.

Check your understanding by answering the problems below. Write and Show your solution in your notebook.

SELF-ASSESSMENT

Recall what you have learned in the lesson, you will solve on your own the percentage composition of the following compounds

1. Determine the percentage composition of CH_3COOH
2. Which of the following which are used as fertilizers, would be cheaper source of nitrogen if the cost per kilogram of the given compounds is the same? Show your calculation.
   a. Urea, N_2H_4CO
   b. Ammonium nitrate, NH_4NO_3
   c. Ammonium sulfate, $(NH_4)_2SO_4$

Process Question:

1. How is percent composition determined?

2. How percent composition data for a compound are related to the masses of the elements in the compound? *Percent composition is numerically equal to the mass in grams of each element in a 100.0 g sample.*

3. What are your common mistakes in solving the problem?

4. How are the quantity and the composition of substances determined?

Look at the items you missed. Go back to your notes and review the process you missed.

ACTIVITY NO. 15: EMPIRICAL FORMULA VS MOLECULAR FORMULA

A. Determining the Empirical Formula Adapted source from Science Impact Chemistry

Now you learned to calculate the percentage composition, in this activity, you will determine the empirical formula that gives the simplest whole-number ratio of atoms in a compound, expressed as a ratio of elements in the compound.

Sample problem 1:

Determine the empirical formula for a compound made up of 71.65% Cl, 24.27% C and 4.07% H.

Solution:

1. Analyze — Given: % Cl, %C, and %H
   Find: Empirical formula for the compound

2. Plan
   a. Convert % to mass of element
   b. Change mass to moles
   c. Find simplest whole number ratio of moles
   d. Write the empirical formula

3. Compute
   a. Find number of moles

$$\text{mole Cl} = 71.65\ \text{g Cl}\ \text{x}\ \frac{1\ mole\ Cl}{35.5\ g\ Cl} = 2..02$$

$$\text{mole C} = 24.28\ \text{g C}\ \text{x}\ \frac{1\ mole\ C}{12.0\ g\ C} = 2..02$$

$$\text{mole H} = 4.07\ \text{g H}\ \text{x}\ \frac{1\ mole\ H}{1.0\ g\ H} = 4..07$$

b. Divide each mole value by the smallest mole value

$$\text{mol Cl} = \frac{2.02\ mol\ Cl}{2.02} = 1.0\ mol\ Cl\ atoms$$

$$\text{mol C} = \frac{2.02\ mol\ C}{2.02} = 1.0\ mol\ C\ atoms$$

$$\text{mol H} = \frac{4.07\ mol\ H}{2.02} = 2.01\ or\ 2\ mol\ H\ atoms$$

The simplest whole number ratio of the elements in the compound is 1 mole chlorine atoms is to 1 mole carbon atoms is to 2 moles hydrogen atoms

c. The empirical formula for the compound is CH_2Cl

If the composition of the compound is given in terms of the masses of the elements in the sample, convert the given masses into moles and reduce the mole ration simple whole numbers.

Sample problem 2:

A new compound is found to contain 0.2322 g C, 0.05848 g H, and 0.3091 g O. Calculate the empirical formula for the compound.

Solution:

1. Analyze
   Given: 0.2322 g C
   0.05848 g H
   0.3091 g O
   Find: empirical formula for compound

2. Plan
   a) Change g to moles
   b) Convert mole values to simple whole number ratios
   c) Write empirical formula

3. Compute

a. no. of moles of each element

$$\text{mol C} = .02322\ \text{g C}\ \text{x}\ \frac{1\ mole\ C}{12.0\ g\ C} = 0..019$$

$$\text{mol H} = 0.05848\ \text{g H}\ \text{x}\ \frac{1\ mole\ H}{1.00\ g\ H} = 0.058$$

$$\text{mol O} = 0.3091\ \text{g O}\ \text{x}\ \frac{1\ mole\ O}{16.0\ g\ O} = 0.019$$

b. simplest mole ratio

$$\text{mol C} = \frac{0.019\ mol\ C}{0.019} = 1.0$$

$$\text{mol H} = \frac{0.058 mol\ H}{0.019} = 3.05\ or\ 3$$

$$\text{mol O} = \frac{0.019\ mol\ O}{0.019} = 1.0$$

c. Empirical formula of compound: CH_3O

Check your understanding by answering the problems below. Write and Show your solution in your notebook.

SELF-ASSESSMENT
Recall what you have learned in the empirical formula, you will solve on your own

1. A platinum (II) compound, which is used to treat tumors, contains 65.0%Pt, 23.6% Cl, 9.35% N, and 2.05% by mass. Calculate the empirical formula.

2. Determine the empirical formula for the compound containing 72.25% Mg and 27.75% N.

B. Determining the Molecular Formula Adapted source from Science Impact Chemistry

In the previous activity you learned to formulate the empirical formula, in this activity you will determine a molecular formula, first determine the empirical formula for the compound as shown in the section above and then determine the molecular mass. Next, divide the molecular mass by the molar mass of the empirical formula (calculated by finding the sum the total atomic masses of all the elements in the empirical formula). Multiply the subscripts of the molecular formula by this answer to get the molecular formula.

This can be shown as:

$$\frac{Molar\ mass}{Empirical\ formula\ mass} = n$$

Where *n* stands for the number of units present in the molecular formula of the compound.

Sample Problem:
An unknown sugar compound has a mass of 180 g/mol and a chemical composition of 40% C, 6.67% H, and 53.33% O. What is the molecular formula for the sugar compound?

Solution:

Analyze Given % Composition of compound

40% C, 6.67% H, 53.33% O
Find: Molecular Formula

Plan
a. determine the empirical formula
b. calculate the empirical mass
c. calculate the molecular mass

STEP 1: Determine the empirical formula

$$\text{mol C} = 40\ g\ C\ \ x\ \ \frac{1\ mol\ C}{120\ g\ C} = 3.33$$

$$\text{mol H} = 6.67\ g\ H\ \ x\ \ \frac{1\ mol\ H}{1.0\ g\ H} = 6.67$$

$$\text{mol O} = 53.33\ g\ O\ \ x\ \ \frac{1\ mol\ O}{16.0\ g\ C} = 3.33$$

Smallest mole ratio

$$\text{mol C} = \frac{3.33}{3.33} = 1$$

$$\text{mol H} = \frac{6.67}{3.33} = 2$$

$$\text{mol O} = \frac{3.33}{3.33} = 1$$

Therefore empirical formula is CH_2O

STEP 2: Calculate the empirical mass

$$\text{g C} = 1\ mol\ C\ \ x\ \ \frac{12\ g\ O}{mol\ C} = 12.0$$

$$\text{g H} = 2\ mol\ H\ \ x\ \ \frac{1.0\ g\ H}{mol\ H} = 2.0$$

$$\text{g O} = 1\ mol\ O\ \ x\ \ \frac{16\ g\ O}{mol\ O} = 16.0$$

Therefore empirical mass = 30.0 g

STEP 3: Compare the molar mass with the empirical mass

$$\frac{Molar\ mass}{Empirical\ mass} = \frac{180\ g}{30\ g} = 6$$

The molecular formula for the sugar compound is $(CH_2O)_6$ or $C_6H_{12}O_6$

SELF-ASSESSMENT
Solve on your own:

1. A sodium metaphosphate, used in detergents, is composed of 22.5% Na, 30.4% P, and 47.1% O. The formula mass of the compound is 612 g. What is the formula of the compound?

Process Questions:

1. Can empirical formula affect the Molecular formula? Explain
   Empirical Formula: a GENERAL formula of a compound in its most simplified whole # ratio of atoms. Molecular Formula: A SPECIFIC non-simplified formula of a compound.

2. Would you expect an empirical formula to be the same even though different masses used? Cite an example
   Yes, if we're talking about different masses of the same compound. This is because an empirical formula is the simplest whole number ratio of elements in a compound.

   Example water contains 2 hydrogen atoms for every one oxygen atom.

   18 grams of water, I have 2 mol H and 1 mol O. The empirical formula is H_2O.

3. What is your conclusion about the relationship between empirical formula and molecular formula? *The molecular formula is equal to twice the empirical formula.*
4. How are the quantity and the composition of substances determined?

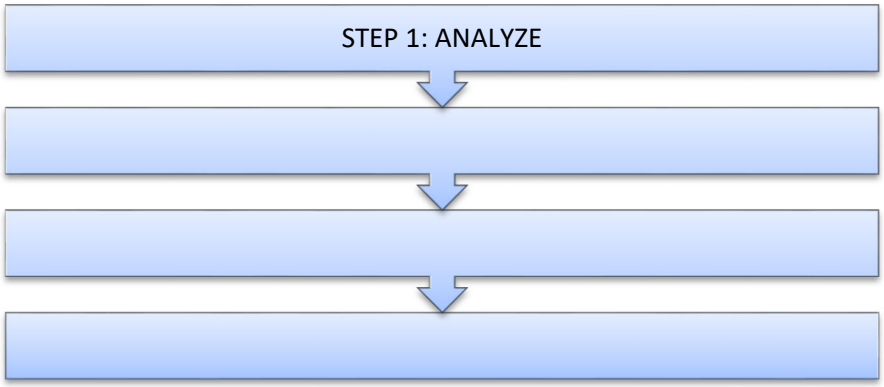
ACTIVITY NO. 16: **SKILLS READINESS CHECK**: Reflection to the level of your performance for this lesson. Check the first column if you need more practice or the second column if you are ready to move on the next activity.

I need more practice (If most of your answers are incorrect)	I am ready to move on to the next activity (if you incur only few errors in the first three skills practice)
⬇	⬇

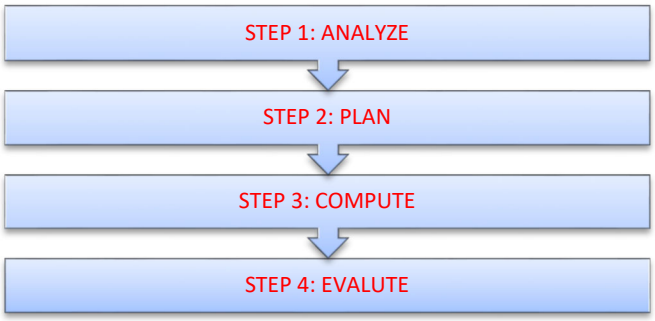
Go back to the videos you have viewed to review the input and examples. Then answer again the three skills practice	You may proceed to the next activity

Click SAVE if you done this part before moving to the next activity.

Recall what you have learned in the previous section of this lesson. Based from the drill, what are your operational plans or steps in converting mass, mole and numbers of particles to get a realistic answer?



Answers:



Synthesis Question: What are the different ways that you need to consider in solving mole concepts?

How was your experience about conversion according to the number of particles and the operational plans in converting mass, mole and numbers of particles?

Share your experience and answer to these questions by creating an Org chart with http://www.gliffy.com/uses/org-chart-software/. Submit your chart by sharing the link in this portal.

ACTIVITY NO. 17: **MOLE COMPUTATION**
One of our main concerns in the mole concept is doing conversions between grams, moles, and Number of Atoms/Particles/ Molecules. Open and read this web page: http://www.austincc.edu/dlyon/introsp04/Intro%20Chem%20ch7%20the%20mole%20and%20percent%20comp.pdf. and http://crescentok.com/staff/jaskew/isr/chemistry/class13.htm. These sites feature the procedures on mole calculations. After reading the latter site, for **skill-building exercise** click mole calculation to solve some problems.

How did you perform mole calculations exercise? Look at the items you missed. Go back to your notes and review the terms or concepts you missed.

ACTIVITY NO. 18: **ONLINE QUIZ**
Check your understanding from the previous activity you have learned
Review the terms and concepts learned in the previous activity by taking the online quiz found in the link below.
http://www.glencoe.com/qe/science.php?qi=978 online quiz about mole

How did you perform in the quiz? Look at the items you missed. Go back to your notes and review the terms or concepts you missed.

ACTIVITY NO. 19: **Reviewing Prior Knowledge through I-R-F Chart**
You have just learned the use the mole concept to express mass of substances and the percentage composition of a compound given its chemical formula and vice versa. Let's re-examine the I-R-F to answer the third column the revised explanation part.

You were given this question in the previous activity: Why is understanding the mole important in chemistry and to living organism? Does the mole concept important in industry for production of consumer goods? How are the quantity and the composition of substances determined?

Statements about Mole	Agree or Disagree	Initial Explanation	Revised Explanation	Concluding Explanation
1. Equal volumes or equal masses of different substances contain the same number of moles (or atoms/molecules/formula units).				

2. A mole is just a number of molecules				
3. One mole of various substances may contain different numbers of units of those substances				
4. Mole is similar to molecular, molar and molecule.				
5. The number of moles of reactants must equal the number of moles of products				

http://intro.chem.okstate.edu/chemsource/moles/mole16.htm

As you go on to the succeeding activities you will find out the answer of the above statements.

Open this video: http://www.youtube.com/watch?v=xPdqEX_WMjo this video will enrich your learning about mole conversion.

Be sure to take note of the important method of mole conversion that you will encounter.

What are the techniques of mole conversion you gathered? Are you familiar about the method used in the mole conversion? Look back at your notes and try to cluster related concepts.

End of FIRM UP:
In this section, the discussion was all about mole concept and how a mole can be used in converting an amount of substance from one measurement to another

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? What new learning goal should you now try to achieve? Go back to your checklist of learning competencies and how much you've accomplished:

CHECKLIST OF COMPETENCIES	
	Use the mole concept to express mass of substances
	Determine the percentage composition of a compound given its chemical formula and vice versa.

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

Now that you have learned to express mass of substances, it's time for you to analyze and assess the percentage composition of a compound given its chemical formula and vice versa

Your goal in this section is to take a closer look at some aspects of the topic on mole conversion, common misconceptions and understand the mole concept and its significance to the quantitative analysis of chemical reactions.

ACTIVITY NO. 20: **PERCENT SUGAR IN GUM** (Lab. Activity)
This is activity you will perform to understand what is meant by percent composition by mass of a compound and determine the percent composition by mass of a compound. Open this webpage, http://www.gpb.org/files/pdfs/gpbclassroom/chemistry/sugarInGumLab.pdf this site will enrich your learning about the percent composition of a substance.

PROCESS QUESTIONS:

1. How do you find percent composition from the activity?
2. How is the mass percentage of an element in a compound determined from its formula?
3. How are the quantity and the composition of substance determined?

Generalization:
Based on the experimentation, fill in the "Connections to Life" box of our Think Pad. Write or illustrate how the activity might apply to real life situation in the contemporary world

WORDS	PICTURE
CONNECTIONS TO LIFE	SYMBOL

In your notebook, write a brief reflection on your experience about how did you go along all with all the activity? Did you see a connection between one topic to another? Share your insights in what you have learned and the difficulties that you encountered:

To know more on percent and the calculation of percent which is essential in daily life, click on this link

- http://www.800mainstreet.com/2/002-13.htmlcomposition of compounds
- https://ph.answers.yahoo.com/question/index?qid=20100616093530AAJ0Lpo some uses of percent composition in everyday life

ACTIVITY NO. 21: **CHALK ACTIVITY**
In this activity, you will look back on the skills you learned and determine which of these you would use to meet the requirements of the given task.

You are asked to calculate moles of chalk (calcium carbonate $CaCO_3$), atoms of elements in the compound (chalk) and number of atoms of each element in the chalk, left on a sidewalk after a piece of chalk is used to write or draw their name, symbol or personal message on a sidewalk using a piece of chalk. You will perform the experiment as scientist. The goal of this activity is to calculate moles using mass and chemical formula. You will produce a summary of the labeled calculations of moles and atom. The data will be submitted to your teacher.
Open this webpage to perform the activity:
http://www.learner.org/workshops/chemistry/support/act1_d2.pdf this site will enrich your skills in calculating grams and moles

PROCESS QUESTIONS:

1. What have learned about the activity?

2. How is the mole concept useful in understanding compounds?
3. How the mole concepts become beneficial to living organisms?
4. How are the quantity and the composition of substances determined?

Now fill in the "WORDS" part of your Think Pad by writing the descriptive characteristics of mole that you have encountered in the activity and the "PICTURE" part by visualizing mole in a given situation.

WORDS	PICTURE
CONNECTIONS TO LIFE	SYMBOL

Looking back from the activities that you had worked on, which do you find very interesting? Do you consider yourself ready for trying all the concepts you learned into a more challenging one? Make one general statement in your notebook about the activities you worked with.

After working on the mole of compounds and the percentage composition of a compound given its chemical formula, you learned that it is convenient to use the mole to measure amounts of substances. The next activity will lead to recognize that new substances are formed from mole

ACTIVITY NO. 22: **CHEMISTRY COOKIE**
Now that you understand the mole concept the next activity will assess how you can apply your skill to mole conversion in baking cookies.

In this activity, you will be converting a recipe from moles to standard cooking measurements and then using that recipe to bake some cookies. Open this webpage:
http://www.pleasanton.k12.ca.us/fhsweb/hansen/chemlab/CookieChocolateChip.pdf this site will give you a task which will demonstrate your skill on mole concept.
Fill in the table about properties of the cookies:

PROPERTY	DESCRIPTION
Moisture	
Texture	
Consistency	
Height	
Taste	

PROCESS QUESTION:

1. How does baking the moles affect your cookies product?
2. How are the quantity and the composition of substance determined?

12.

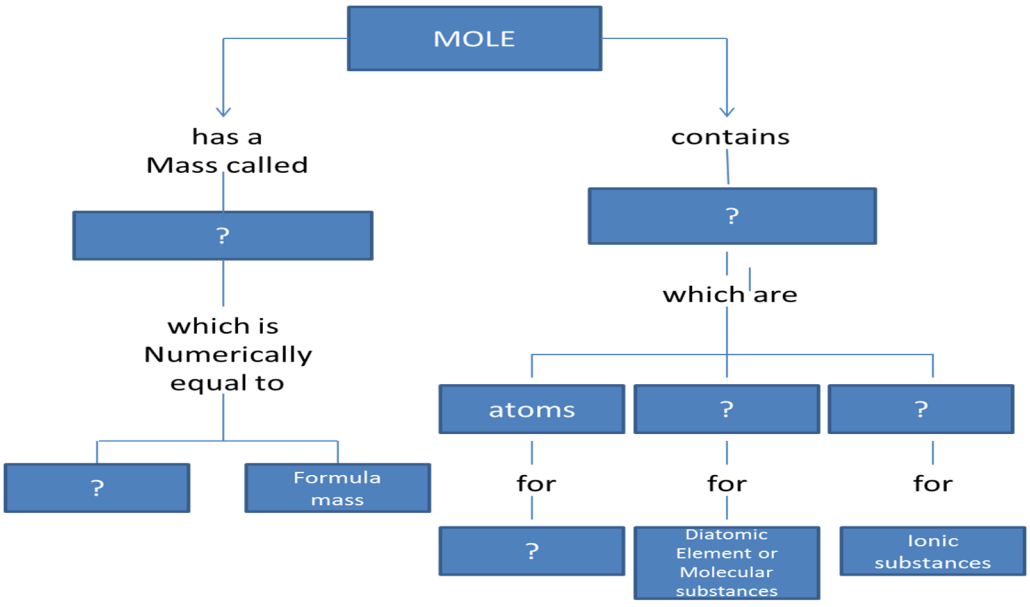
Now that you have enough knowledge about mole, fill in the “SYMBOL” part of your Think Pad by creating one or more symbols that might capture the key theme of the activity

WORDS	PICTURE
CONNECTIONS TO LIFE	SYMBOL

ACTIVITY NO. 23: **CONCEPT MAP**

In this activity you need to review the previous activities to organize how ideas are connected to one another about mole. Click http://www.gliffy.com/examples/ . https://www.gliffy.com/go/html5/launch?app=1b5094b0-6042-11e2-bcfd-0800200c9a66. Click the org. chart icon from the overview page to create your concept map. Submit your output to your OHSP teacher.

Model diagram .



Adapted source: Prentice Hall connections to our changing world second edition

Answers:

Row 2: Molar mass; 6.02 x 10^{23} particles

Row 3: Atomic mass; Molecules; Formula units
Row 4: Elements

Process Questions:

Based on the concept map:

1. How is the mole organized?
2. How did you review the concepts related to mole?
3. How do you assess our own learning and understanding about the mole?

Go back to your notes and review the terms or concepts you missed.
In your notebook, write a brief reflection on your experience about how did you go along all with all the activity? Did you see a connection between one topic to another? Share your insights about what you have learned and the difficulties that you encountered:

ACTIVITY NO. 24: ARTICLES OF FOOD AND NUTRITION

In the previous sessions and exercises how did you perform computation in the percent composition? You will read or view that the percentage compositions are part of our daily nutrition and learn that natural products are made of chemicals: the food we eat, the air we breathe, the clothes we wear, and even our own bodies.

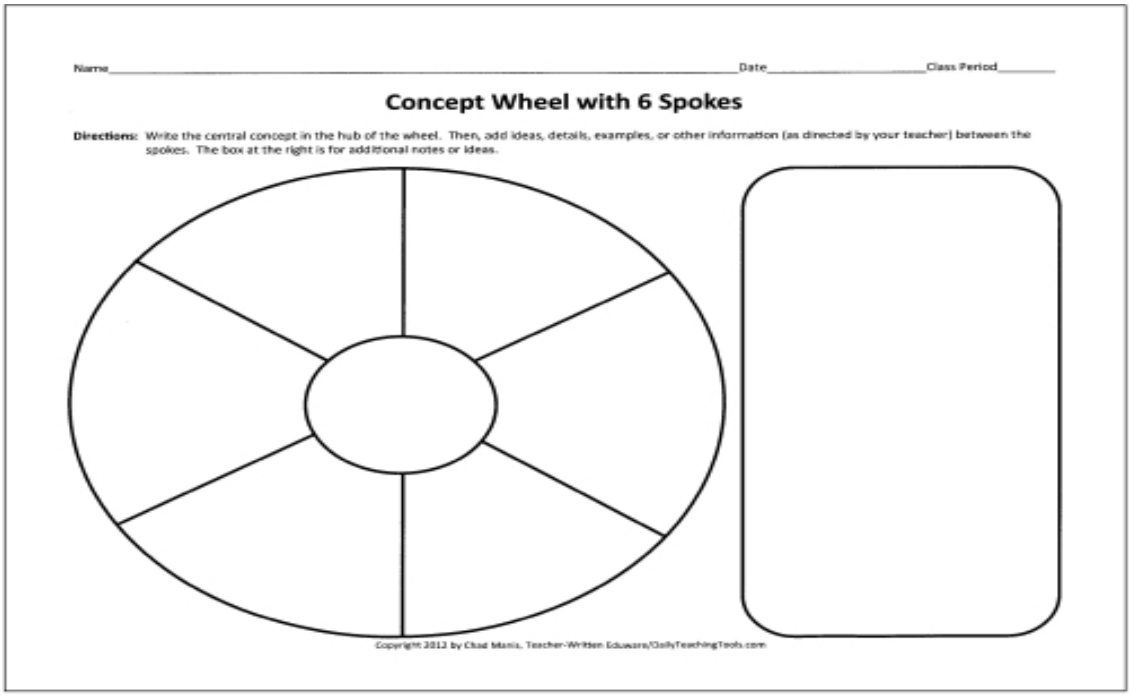
In this activity, you will read 4 articles related to percent composition part of our daily nutrition and how does it affects to humans. You will be asked to summarize each article.

Article 1: *Recovering your Nutrition*

Click the link below to know more.
www.aw-bc.com/info/hopson/assets/pdf/chapter8.pdf the study of how people consume and use the nutrients.

Read the article keep in mind that as you encounter the highlighted key words and the vocabulary, review and repeat these key words to yourself by saying them out loud. You may also keep writing down these key words and their meaning until you remember them.

After reading, accomplish the Concept Wheel with 6 Spokes graphic organizer. Write the evidence within each spoke with a short description. Use the box at the right for additional information or ideas. Then submit your work.


Name_____ Date_____ Class Period_____

Concept Wheel with 6 Spokes

Directions: Write the central concept in the hub of the wheel. Then, add ideas, details, examples, or other information (as directed by your teacher) between the spokes. The box at the right is for additional notes or ideas.

Source: Source: http://www.dailyteachingtools.com/images/ConceptWheel6.jpg

Guide Questions:

1. How does your diet influence your person health and lifestyle?
2. How does healthy eating affect mental and emotional health?
3. How are the quantity and the composition of substances determined?

Article 2: *Food Science*

Click this link to read the first article.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3951542/ Comparative study on nutrient composition, phytochemical, and functional characteristics of raw, germinated, and fermented *Moringa oleifera* seed flour written by: Oluwole S. Ijarotimi, Oluwole A. Adeoti, and Oluwaseun Ariyo All Authors, 21 OCT 2013

Sum It Up Instructions:

- Read the article and, as you read, list the main idea words on the “Sum It Up” sheet.
- Write a summary of the article using as many words of the main idea words as possible. Put one word in each box under the “Text Summary”. Imagine that you have only $2.00 and that each word you use is worth 10 cents.
- Finally, you’ll sum it up in 20 words.

Sum It Up!	
Name:	Date:
Title of the Article:	
Main Idea Word Bank	

Text Summary (10 cents per word)				
Sum it up for $2.00				

Submit your Sum It Up sheet.

PROCESS QUESTIONS:

1. What was the most significant discovery about the *Moringa oleifera*?
2. How can we benefit from this "miracle tree"?
3. How do nutritional values of *Moringa oleifera* affect humans?

Article 3: *Skimmed Powder in Fortified*

Click this link to read the second article.
http://jn.nutrition.org/content/138/1/145S.full The Use of Whey or Skimmed Milk Powder in Fortified Blended Foods for Vulnerable Groups written by: Camilla Hoppe, Gregers S. Andersen, Stine Jacobsen, Christian Molgaard, Henrik Friis, Per T. Sangild, and Kim F. Michaelsen, 2008 American Society for Nutrition

After reading the article, answer this question: How are the recipes developed to provide a balance intake of essential nutrients for growth and development of young and for malnourished individuals?

Connect your learning to the previous activity on how to compute for moles.

To know more by learning from the expert links to molecular gastronomy which a lot of chefs now do. See

- http://www.molecularrecipes.com/molecular-gastronomy/ new innovative dishes and
- https://illumin.usc.edu/147/from-chemistry-labs-to-the-kitchen-molecular-gastronomy/ *the culinary world*

To guide you in answering that question, fill in the POW + Tree Activity that might capture the key theme of the activity

Strategy	Activity
Pick an idea or opinion	Formulate an opinion and state that opinion clearly _____ _____ _____
Organize and generate notes and ideas for each part of the TREE.	Organize notes by completing a graphic organizer

<table>
<tr><td rowspan="4">  </td><td>Topic Sentence</td><td>Formulate a topic sentence expressing an opinion
_____
_____
____</td></tr>
<tr><td>Reason</td><td>Give at least three reasons to support the topic sentence
1.
2.
3.</td></tr>
<tr><td>Explanation</td><td>Explain your reasons
_____
_____
_____</td></tr>
<tr><td>Ending</td><td>Formulate a statement to summarize
_____
_____
_____</td></tr>
<tr><td colspan="2">Write and say more
_____
_____</td><td>Write a complete paragraph. Follow the plan developed using the TREE strategy</td></tr>
</table>

Source: http://iris.peabody.vanderbilt.edu/module/pow/cresource/how-might-ms-price-provide-help-to-meet-the-individual-needs-of-all-her-students-including-those-with-disabilities/pow_04/

PROCESS QUESTIONS:

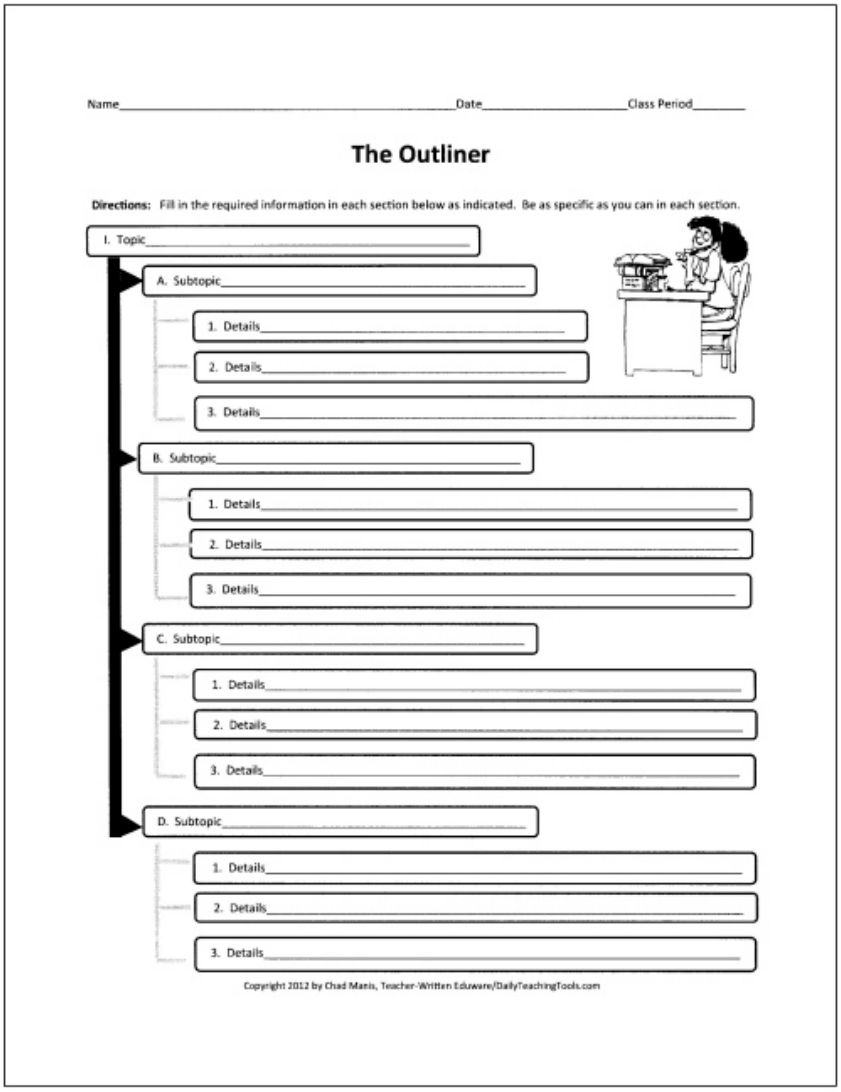
1. What is the main difference between whole milk powder and the other powdered products?
2. How are infants and young children vulnerable to malnutrition?
3. How will the result of this study be of use to humans?

Compress your summary part of the POW + TREE in one sentence then create your own speaking avatar using this link, http://www.voki.com/create.php. Email or submit the speaking avatar to your teacher.

Article 4: *The Determinants of Food Choice*

Click this link to read the second article.
http://www.eufic.org/article/en/expid/review-food-choice/ The determinants of food choice (EUFIC) by: EUFIC REVIEW 04/2005Reviewed by Dr France Bellisle, INRA, France

Summarize the article by listing down the determinants of food choice with a focus on those that are amenable to change and discusses some successful interventions. As you identify the intervention, write the details or give a specific example for each strategy. Use the “Outliner” sheet to accomplish this task then submit your work.



Name_____Date_____Class Period_____

The Outliner

Directions: Fill in the required information in each section below as indicated. Be as specific as you can in each section.

I. Topic_____

A. Subtopic_____
1. Details_____
2. Details_____
3. Details_____

B. Subtopic_____
1. Details_____
2. Details_____
3. Details_____

C. Subtopic_____
1. Details_____
2. Details_____
3. Details_____

D. Subtopic_____
1. Details_____
2. Details_____
3. Details_____

Source: http://www.dailyteachingtools.com/images/Outliner.jpg

Process Questions:

1. What foods do you eat that contain sugar?
2. What types of food and ingredients, if consumed in excess, can lead to diet related diseases?
3. If you're looking on the nutrition label, will sugar and sweeteners always be labeled as sugar?
4. Why would eating out at restaurants and other retailers be of concern to public health professionals?
5. How are the quantity and the composition of substance determined?

ACTIVITY NO. 25: **COMPLETE ME! IRF CHART COMPLETION**

Let us go back to the I-R-F. Let's re-examine the mole concepts on mole conversion for the concluding explanation columns. Let's find out how your other

classmates answered the Concluding Explanation column of the IRF chart. Write your answers in your notebook. This will go through as your check up quiz.

You can make use of the *Discussion Forum* to communicate with your classmates. Compare their ideas to your own.

Statements about Mole	Agree or Disagree	Initial Explanation	Revised Explanation	Concluding Explanation
1. Equal volumes or equal masses of different substances contain the same number of moles (or atoms/molecules/ formula units).				
2. A mole is just a number of molecules				
3. One mole of various substances may contain different numbers of units of those substances				
4. Mole is similar to molecular, molar and molecule. 13.				
5. The number of moles of reactants must equal the number of moles of products 14.				

End of DEEPEN:
In this section, the discussion was about mole concept on mole conversion, common misconceptions.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? What new learning goal should you now try to achieve? Go back to your checklist of learning competencies and see how much you have accomplished:

CHECKLIST OF COMPETENCIES	
	Use the mole concept to express mass of substances
	Determine the percentage composition of a compound given its chemical formula and vice versa.

Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

Your goal in this section is to analyze the percentage composition of food products and apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding

ACTIVITY 26: THE CHEMICAL COMPOSITION
In previous activities of this module, you've watched, heard and read about the use of concept of mole by converting mass to moles, mass to atoms, moles to Avogadro's number, molecules to mass and analyze percentage compositions of different substances using mole concepts that are all beneficial to humans.

In this activity, you will be a given a chance to create a plan for the improvement of nutrients in the body.

Now that you have learned mole concept you may want to review the skills you've learned in previous activities and figure out how to come up a nutrition plan

Read the details about Rappler's report and Action plan of the government as shown below. Click the adapted source links

<table>
<tr><th colspan="3">Policy - National Nutrition Action Plan 2012 - 2017</th></tr>
<tr><td colspan="2">Start date: 2012

Published by: Ministry of Public Health and Sanitation

Is the policy document adopted?: No / No information</td><td>End date: 2017

Published year: 2012

Type of policy: National Nutrition Policy, Strategy or Action Plan</td></tr>
<tr><th>Goals</th><th>Strategies</th><th>M&E Indicators</th></tr>
<tr><td colspan="2">Goals, objectives or targets related to nutrition:</td><td>Purpose:

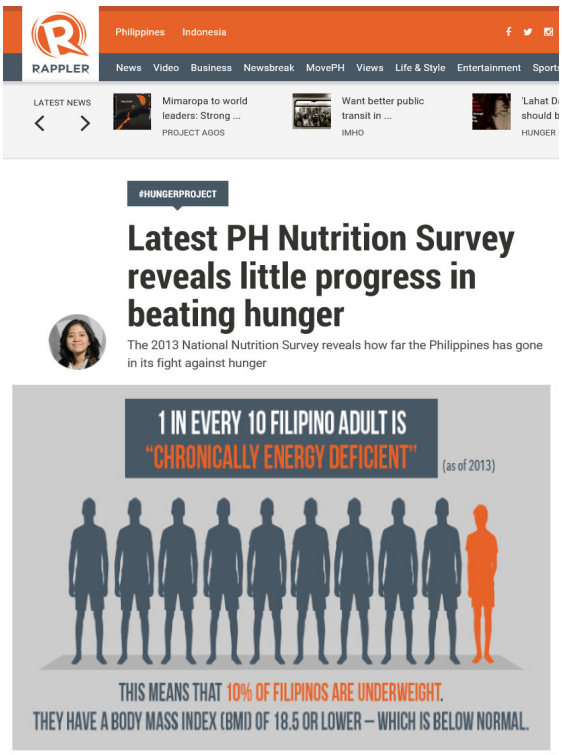
This Plan has been developed to operationalize the strategies outlined in the Food Security and Nutrition policy 2012. It serves as a road map for coordinated implementation of nutrition interventions by the government and nutrition stakeholders across development sectors for maximum impact.

Objectives:
1. To improve the nutritional status of women of reproductive age (15-49 years)
2. To improve the nutritional status of children under 5 years of age
3. To reduce the prevalence of micronutrient deficiencies in the population
4. To prevent deterioration of nutritional status and save lives of vulnerable groups in emergencies
5. To improve access to quality curative nutrition services
6. To improve prevention, management and control of diet related NCDs
7. To improve nutrition in schools, public and private institutions
8. To improve nutrition knowledge attitudes and practices among the population
9. To strengthen the nutrition surveillance, monitoring and evaluation systems</td></tr>
</table>

	10. To enhance evidence-based decision-making through research 11. To strengthen coordination and partnerships among the key nutrition actors and mobilize essential resources

Adapted source: http://scalingupnutrition.org/wp-content/uploads/2013/02/Kenya_KNN_Action-Plan_2012_2017.pdf

The excerpts report from Rappler Philippines, Jul 10, 2014: The 2013 National Nutrition Survey: How far the Philippines has gone in its fight against hunger



HUNGER, POVERTY. Many Filipino households living under poverty worry about putting food on their plates on a daily basis. File photo by Rappler

Aged 0-5	
Prevalance of underweight children	
2008	**2013**
20.7%	19.8%

Prevalance of stunting	
2008	**2013**
32.3%	30.3%

In 2013, stunted Filipinos aged 10-19 decreased from 35.7% in 2011 to 31.5% in 2013.

Prevalence of wasted Filipinos aged 5-19, however, remained virtually unchanged.

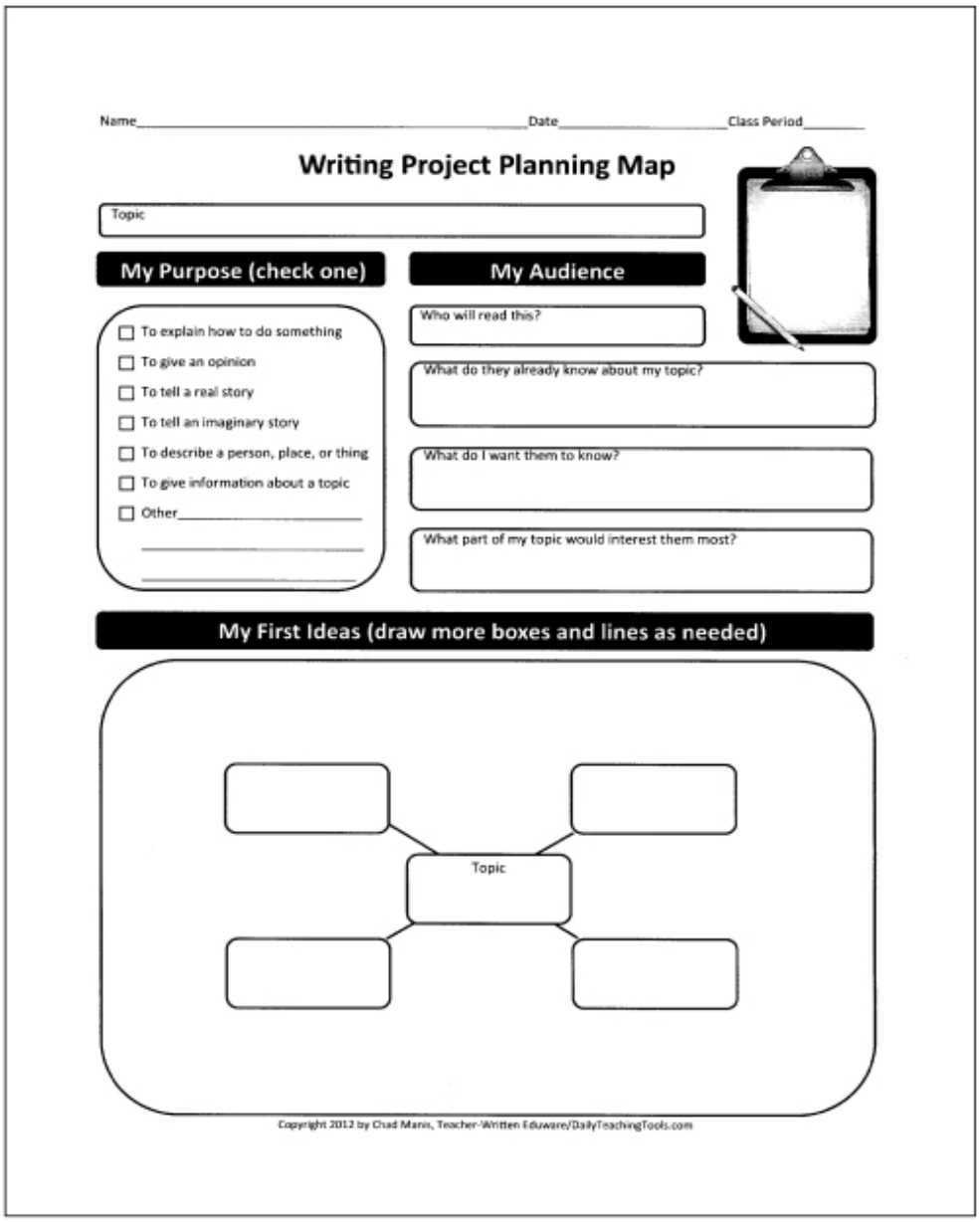
5-19 year olds		**10-19 year olds**	
2008	**2013**	**2008**	**2013**
8.1%	8.6%	12.4%	12.4%

Adapted source: http://www.rappler.com/move-ph/issues/hunger/61824-2013-national-nutrition-survey

You can read more from the links provided. There are also other available resources online about this National Nutrition Policy in the Philippines which you may access.

Collaborate with the members of your group, brainstorm, solicit their ideas for this task, and assign roles. Each group should have a coordinator, a researcher, and a multimedia designer. Everyone should be involved in making the plan.

After studying the facts about the Latest Philippine Survey on nutrition and Policy-National Nutrition Action Plan of 2012-2017. Use the Writing Project Planning Map to help you organize your ideas.



Name_____ Date_____ Class Period_____

Writing Project Planning Map

Topic

My Purpose (check one)

- ☐ To explain how to do something
- ☐ To give an opinion
- ☐ To tell a real story
- ☐ To tell an imaginary story
- ☐ To describe a person, place, or thing
- ☐ To give information about a topic
- ☐ Other_____

My Audience

Who will read this?

What do they already know about my topic?

What do I want them to know?

What part of my topic would interest them most?

My First Ideas (draw more boxes and lines as needed)

Topic

Source: http://www.dailyteachingtools.com/images/WritingProjectPlanMap.jpg

Then organize and present your Nutrition plan using www.canva.com. When your Canva presentation is done, export it as a PDF then upload to www.slideshare.net. Set the privacy settings to public in Slideshare then submit the link in the OHSP portal. You need to create a free account for each app.

PROCESS QUESTIONS:

1. If National Statistical Coordination Board made a clear Policy - National Nutrition Action Plan 2012 – 2017, why there are many people and even children begging in the street?
2. What should a good Action Plan contain?
3. What is your opinion about the statement: **What you eat is what you are"**
4. How are the quantity and the composition of substances determined?

ACTIVITY NO. 27: DIFFERENTIATED TASK

You are now ready to make the task for this module on percentage composition of food products in preparation for the final performance. You will be given three options for your product. You only need to choose and make one.

Option 1: Dietician

The department of Health has alarmed about malnourished issue have been increasing in a certain barangay. Data of barangay health have shown that malnourish children in that community are susceptible of that condition due to lack of balance nutritional value of food intake. As a dietician, you are invited by barangay officials to reach out and give information drive in the form of multimedia presentation to the constituent in the barangay.

- ❑ Make a multimedia presentation showing the product has the appropriate percentage composition or nutritive value.
- ❑ Create a hand-out about food product that has the appropriate percentage composition or nutritive value.
- ❑ Conduct a seminar to promote dissemination of information on healthy food that improves the health welfare of the people.

Option 2: Chef

In celebration for the obesity month (September), you are a Chef by profession and a part time news anchor in one of the broadcasting network. As a part time news anchor you are given a task for the network management to deliver a health tip program on proper diet that is relevant to the times. The purpose of this program is on the awareness of the rise of obesity. As a Chef by profession you were asked to showcase balance diet that will analyse on nutritive value.

- ❑ Create a screenplay for the news that will show the effects of nutritional value of food to avoid obesity.
- ❑ Select a Web 2.0 application that will deliver the message to as many individuals as possible. (e.g., www.emaze.com, www.prezi.com)
- ❑ Make a multimedia to analyze the quantity and the percentage composition of food and to showcase a balance diet**.**

Option 3: Food Chemist

We've all heard about how microwaving food removes some nutritional value, but is it true? Is something bad happening to our food behind that microwave glass? As a renowned Food chemist of the country, you are invited by media men to clarify the matter. The public expects your point to be presented in any medium they are commonly exposed to. You may:

- ❑ Write a column in a newspaper explaining in details the percentage composition of different brand of two food products on whether the public needs to be scared or not in using microwave glass.

- ❑ Appear in a live interview in a morning TV show telling the people the facts of the matter. (Web 2.0) or www.powtoon.com
- ❑ Write a script for a scientific cartoon showing the details of the microwaving and nutritional value.

Process Questions:

1. Look at your answers to the essential question in the table above. What do all the answers have in common?

2. Are the experts' shows the same style to conduct the quantity and the composition of substances? If yes, explain. If not why are the styles different?

3. Complete the following statement and support your answer with example from the above experts.

   The quantity and the composition of substances is …..

Now that you have a real world view of the topic, you are ready to do the final tasks in the next section.

ACTIVITY NO. 28: **PERFORMANCE TASK**
In this section as a closing session, your final task is to apply your knowledge and understanding about the mole.

In support of the United Nation's campaign against poverty by helping communities value nutrition, the Food and Drugs Administration (FDA) has been tasked to make a comparative study on the quantity and the chemical composition of two food products. Being the resident chemist, you will spearhead the study which covers analysis percentage composition of these products. You will present the analysis to the industry partners involved in food distribution during the annual food meeting. Based on the result of your study, the partners will decide which product has the appropriate percentage composition or nutritive value. The study will be presented via power point and evaluated according to its Content, Organization, Research, and Delivery.
Rubrics for the Performance Task:

CATEGORY	Outstanding (4)	Commendable (3)	Developing (2)	Beginning (1)
Content 15.	All content about the computation is qualitatively accurate. Subject knowledge is deep	The content about computation is qualitatively accurate. Subject knowledge is good.	Some computation is partially inaccurate.	Content about computation is confusing contains multiple fact errors.
Organization	All information about mole concept are presented in logical and detailed	Most information about mole concept is generally logical and understandable .	Some ideas not presented in proper order, information seem out of place.	Ideas are not presented in proper order: no clear plan for the organization of information
Research	Uses a variety of updated and standard sources in reaching accurate conclusions	Uses a variety of standard sources in reaching conclusions	Presents only evidence that supports a preconceive d point of view	Does not justify conclusions with research evidence
Delivery	Student maintains eye contact with audience, seldom returning to notes.	Student maintains eye contact most of the time but frequently sometimes returns to notes/report.	Student occasionally uses eye contact, but still reads most of report.	Student reads all of report with no eye contact.
Voice Quality	Voice was clear and engaging.	Voice is engaging.	Quality of voice.is partially engaging.	Quality of voice.is not engaging.

Before you go to the post-assessment, write a reflection in your synthesis journal about your experiences in the entire lessons. You may choose to answer one, or all of these guide questions:

1. What have you learned about the entire lesson? Is it challenging to see the world you live in?
2. Did you have initial difficulty understanding the mole concept?
3. What would our life be if mole conversion was not discovered by the scientists?
4. How the mole concepts become beneficial to living organisms?
5. What other task you would like to work on in the future that could be beneficial in human and in environment?

End of TRANSFER:
In this section, your task was to analyze the percentage composition of different brand of two food products and decide on products on appropriate percentage composition.

How did you find the performance task? How did the task help you see the real world use of the topic?

Have a final assessment of your accomplishment of the goals for this lesson (Assessment of Goals, 3rd column). Then, give this form to your teacher so he/she can give his/her assessment of you. Finally, summarize what you have accomplished for this unit by filling up the bottom part of the learning log

LEARNING LOG			
GOALS		**ASSESSMENT OF GOALS**	
Unit Goal	*My Personal Goal*	*My personal Assessment*	*Teacher's Assessment*
In summary, what have I learned from this module?			

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

POST-ASSESSMENT

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

1. What relationship exists between the mole and Avogadro's number?
   a. Avogadro's number contains .20 moles of matter.
   b. a mole contains 6.02×10^{23} units.
   c. a mole contains Avogadro's number of units of matter.
   d. There exists no relationship between Avogadro's number and the mole.

2. Which is equivalent to one mole?
   a. 37.0 g aluminum pan
   b. 0.18 g diamond
   c. 3.50 g silicon chip
   d. 24.0 g magnesium ribbon

3. What is the mass of 1.5 moles of SiH_4?
   a. 16 g b. 24 g c. 32 g d. 48 g

4. What is the percent composition of sulfur in $MgSO_4$?
   a. 19 % b. 27% c. 45% d. 33%

5. Which among these compounds has the greatest oxygen composition?
   a. $Mg(OH)_2$ b. LiOH c. Na_3PO_4 d. K_2SO_4

6. What is the mass in grams of a single chlorine atom? Of a single molecule of oxygen gas
   a. 5.81×10^{-22} g/atoms, 5.31×10^{-22} g/molecules
   b. 5.81×10^{22} g/atoms, 5.31×10^{22} g/molecules
   c. 5.81×10^{-23} g/atoms, 5.31×10^{-23} g/molecules
   d. 5.81×10^{23} g/atoms, 5.31×10^{23} g/molecules

7. The percent composition of an unknown element X in CH_3X is 32%. Which of the following is element X?
   a. Cl b. F c. H d. Li

8. What is the percent composition of oxygen of potassium chromate, $KCrO_4$ if K is 25.16 % and Cr is 33.55%?
   a. 4 x 16 = 64
   b. 40.3 + 26.8 = 67.1
   c. 100 – (25.16 + 33.55) = 41.29
   d. The mass of the sample is needed to finish the calculation.

9. Which statement is correct?
   a. 4 g of NH_3 is equal to 4 moles of NH_3
   b. 4 g of NH_3 is equal to 1 mole of NH_3
   c. 4 moles of NH_3 is equal to 17 g of NH_3
   d. 4 moles of NH_3 is equal to 68 g of NH_3

10. How many moles of CO_2 are obtained from the reaction of 2 moles of C_3H_8?
    a. 1.5 mol b. 3.0 mol c. 4.5 mol d. 6.0 mol

11. How many grams of C_3H_8 are obtained if 44 g of CO_2 is produced? (*Note: refer the chemical equation in No. 10*)
    a. 14.7 g b. 72g c. 144 g d. 288 g

12. A balance equation verifies the law of conservation of matter because
    a. The molar masses of all the substances are the same.
    b. The coefficients on both sides of the equations are the same.
    c. The mass of the reactants equals the mass of the products.
    d. The mass of the products equals 100 grams.

13. Which statement is correct regarding the molecule H_2O?
    a. one mole of H_2O contains 18.06×10^{23} particles
    b. one mole of H_2O is equal to twice its molar mass
    c. one mole of H_2O has 18 particles
    d. one mole of H_20 contains 6.02×10^{23} particles

14. Which statement is correct?
    a. One mole of different substances has the same masses and different number of particles.
    b. The formula weight of the compound determines the number of particles in a compound.
    c. One mole of a substance contains a fixed number of particles.
    d. One mole of a substance is not equal to 6.02×10^{23} things.

15. Baking is an exact science, less forgiving of imprecise measurements and incorrect techniques than, say, a pasta sauce. If a recipe calls for 100g butter, 100g sugar and 100g flour, what's that in ounces?
    a. About 2 oz of each c. About 5 oz of each
    b. About 4 oz of each d. About 7 oz of each

16. Honesto, Renz, and Nita are the only consumers in the market. Using the information in the above table, what is the market demand for chocolate chip cookies at Php 4.00?

Price in Peso	Renz's quantity demanded (Peso)	Nita's quantity demanded (Peso)	Honesto's quantity demanded (Peso)
2	9	5	7
3	7	4	6
4	4	2	5
5	1	0	3

a. 4 b. 11 c. 17 d. 21

17. In order to determine a household's budget line, you must know the:
    a. Prices of the goods bought, but not the household's income.
    b. Prices of the goods bought and the household's income.
    c. Household's income, but not the prices of goods bought.
    d. Household's income, prices of the goods bought, and the household's preferences.

18. This baking pan comes preloaded. What are you most likely to make with this kitchen item?

a. Cupcakes b. Macaroons c. Pie crust d. Pizza

19. Which of the following is NOT part of the causes why cookies spread and thin out while baking?
    a. Dough was properly chilled.
    b. Dough was placed on warm baking sheets.
    c. Baking pans were greased too much. Don't grease the cookie sheet unless the recipe calls for it.
    d. Pure cane sugar (sucrose) was not used; fructose sugar or a blend of sugars was substituted.

20. Which of the following product will be formed if beating together the materials at room temperature like butter, sugar and eggs until light and fluffy and gradually add mixed dry ingredients?
    a. biscuits b. cookies c. pancakes d. pizza dough

GLOSSARY OF TERMS USED IN THIS LESSON:

Atomic mass. The mass in atomic mass units (amu) of one mole of a substance.

Conversion Factor. A ratio equal to one that expresses the same quantity in two different ways

Formula mass. The mass of a molecular compound

Gram-mole: The mass of one mole, or 6.02×10^{23} particles, expressed in grams.

Mole. The quantity of a substance that has a mass, measured in grams, that is numerically equal to the molecular mass of that substance. Expressed as 6.02×10^{23} particles (Avogadro's number); mol is used in equations, mole is used in writing.

Molar Mass. The sum of all the atomic masses in a molecule or compound; the mass in grams of mole of a substance.

Representative Particles. The atoms, molecules, Ions, or formula units present in a substance.

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

http://www.youtube.com/watch?v=JC76NR8EtTQ - This is a brief introduction to the chemistry unit moles and Avogadro's number 6.02×10^{23}. The mole is nothing more than a unit of measurement in chemistry.

http://antoine.frostburg.edu/chem/senese/101/moles/faq/why-use-moles.shtml Webpage to understand mole concept

http://www.youtube.com/watch?v=TEl4jeETVmg - This video will help you understand the concept of the mole in chemistry. Learn the incredible magnitude of the mole--and how something so big can help us calculate the tiniest particles in the world.

http://www.youtube.com/watch?v=6Yuy6jCSh-0 - This short video lecture course on the Mole Concept includes introduction to the mole concept, converting mass to moles, mass to atoms, moles to Avogadro's number, molecules to mass.

http://chemistry.tutorvista.com/inorganic-chemistry/mole-chemistry.html - this vide is essential to enhance your learning all about moles.

http://www.glencoe.com/qe/science.php?qi=978 - online quiz about mole

http://www.gliffy.com/uses/org-chart-software/ - Web 2.0 a graphic organizer about mole conversion using Gliffy.com.

http://www.nclark.net/ChemicalQuantitie - Solving the problems to identify mystery words from each problem.

http://www.youtube.com/watch?v=xPdqEX_WMjo - This video will enrich your learning about mole conversion.

http://prezi.com/auxqhdeiro1k/the-mole-concept/ - To enhance the learning about mole conversion.

http://www.austincc.edu/dlyon/introsp04/Intro%20Chem%20ch7%20the%20mole%20and%20percent%20comp.pdf. – Webpage for mole conversion

http://crescentok.com/staff/jaskew/isr/chemistry/class13.htm - skill-building exercise for mole calculation

http://www.gpb.org/files/pdfs/gpbclassroom/chemistry/sugarInGumLab.pdf - this site will enrich your learning about the percent composition of a substance.

http://www.gliffy.com/examples/ - Web 2.0 flowchart about the steps in performing a unit conversion.

http://www.ulster.ac.uk/scienceinsociety/research_into_teaching_about_the_mole_(pages_6-7).pdf – Webpage research article: *"Teaching about amount of substance and the mole"*. Use the information found in the article to enhance your understanding in the mole concept.

http://www.learner.org/workshops/chemistry/support/act1_d2.pdf - enrich your learning to gain experience in calculating grams and moles

http://www.pleasanton.k12.ca.us/fhsweb/hansen/chemlab/CookieChocolateChip.pdf - A recipe from moles to standard cooking measurements and then using that recipe to bake some cookies.