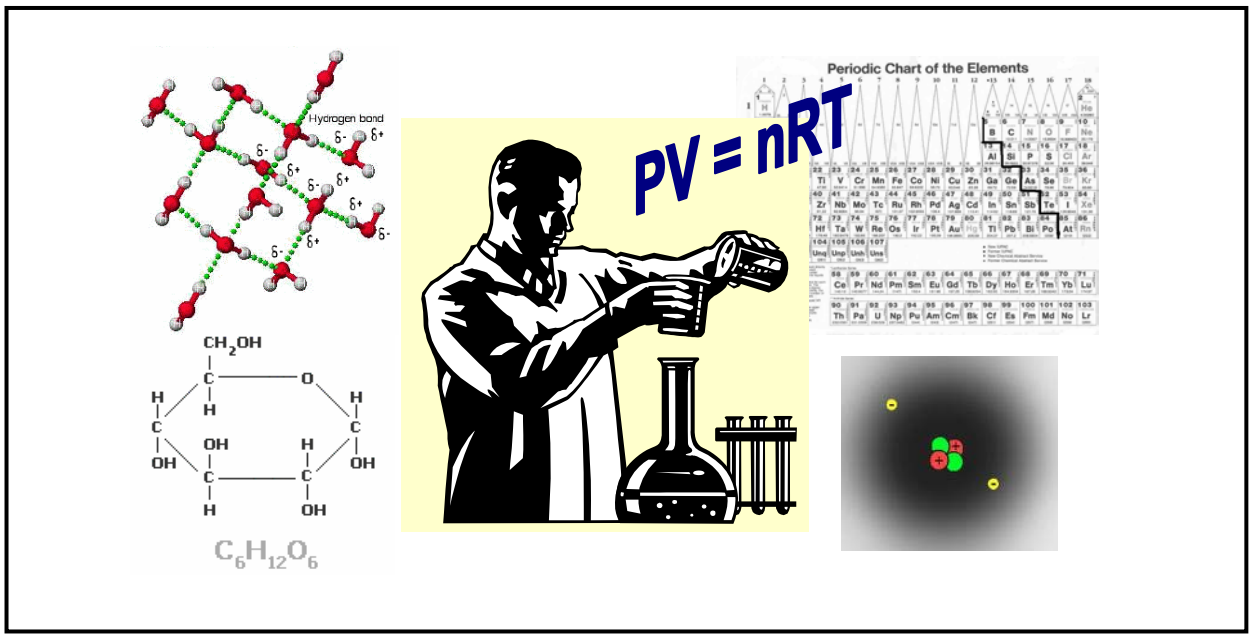
Project EASE

(Effective Alternative Secondary Education)

CHEMISTRY



MODULE 3

Classifying Matter as Pure Substances

BUREAU OF SECONDARY EDUCATION
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Module 3
Classifying Matter as Pure Substances

What this module is about

Have you been to SM super mall, Robinson's department store, Walter Mart's furniture shop, or any mall near your area? Do you know that going to the mall is very much like going to the market? People go to market (or to the mall) to buy stuff like chicken, fish, meat, eggs, vegetables, noodles, clothes, shampoo, oil, vinegar, puto, detergent and many other things that are basic to our everyday life. In science, these numerous things around us that we see, use and even eat are referred to as matter. Do you want to know more about matter?

This module is designed to guide you in defining matter and in classifying different samples of matter as pure substances. It also intends to assist you in grouping pure substances into elements and compounds. So, have fun while reading and learning the following lessons:

- **Lesson 1 – Defining Matter**
- **Lesson 2 – Classifying Matter**
- **Lesson 3 – Pure Substances: Elements or Compounds?**

What you are expected to learn

After going through this module, you should be able to:

1. define matter;
2. give examples and non-examples of matter;
3. identify the characteristics of pure substances that make them different from other kinds of matter;
4. differentiate elements from compounds;
5. classify the element as a metal, nonmetal or metalloid based on observable characteristics; and
6. distinguish acids from bases using common indicators.

How to learn from this module

To learn most from this module, here are some tips that you have to remember.

1. Before proceeding to the lessons, don't forget to take the pretest. Your score in the test will give you an idea how much time you need to devote to each lesson.
2. Read the instructions and bear in mind precautionary measures.
3. Make sure that the needed materials are already prepared before doing any of the activities.
4. Always answer the Self-Test and compare your answers to the key to correction.
5. For you to know how much you have learned from the module, answer the post-test!

Enjoy reading!

What to do before (Pretest)

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following best describes matter?
   a. It has weight.
   b. It occupies space.
   c. It is a form of energy.
   d. It has a definite shape.

2. Which is a non-example of matter?
   a. fire
   b. clay
   c. light
   d. human heart

3. Which statement is **TRUE** regarding pure substances?
   a. Pure substances maybe homogeneous or heterogeneous.
   b. Pure substances have definite boiling and melting points.
   c. Pure substances are physical combinations of two or more elements.
   d. Pure substances can be further broken down into simpler substances.

4. At sea level, an odorless and colorless Liquid A boils at 100˚C and melts at 0˚C. What inference can be drawn from this observation?
   a. Liquid A is a metal.
   b. Liquid A is a mixture.
   c. Liquid A is a nonmetal.
   d. Liquid A is a pure substance.

5. Which of the following are pure substances?
   1. tin 2. brass 3. fog 4. lime

   a. 1 and 2
   b. 1 and 3
   c. 1 and 4
   d. 2 and 3

6. Which of the following statements is true for both elements and compounds?
   a. They are homogeneous.
   b. They are the simplest form of matter.
   c. They are commonly found free in nature.
   d. They can be broken down into simpler substances.

7. Copper, aluminum and gold are metals. Which **incorrectly** describes a metal?
   a. Metals are ductile.
   b. Metals are malleable.
   c. Metals are good insulators.
   d. Metals are good conductors of heat.

8. Sulfur, carbon and the noble gases are nonmetals. Which of the following best distinguishes a nonmetal from a metal?
   a. Its homogeneity.
   b. Its boiling point.
   c. Its brittleness.
   d. Its ductility.

9. All of the following will change blue litmus paper to red **except**
   a. vinegar
   b. kalamansi juice
   c. Sprite or Seven-up
   d. detergent solution

10. Your chemistry teacher asked you to test Substance Y using a litmus paper. You have noted that the red litmus paper turned to blue. This observation indicates that the substance is
   a. metallic
   b. neutral
   c. acidic
   d. basic

Key to answers on page 18.

Lesson 1. Defining Matter

Do you know that chairs, plates, air, wood, water, mud, sea and birds have one thing in common? They are all classified as matter! So, what is matter? Can we say that all the things around us are examples of matter? To answer these questions, let us perform Activity 1.1.

Figure 1.1 Varied examples of matter

What you will do

Activity 1.1

Materials Needed: scratch papers, pencil/ball pen
glass, water, 2 small stones

Procedure:

1. Proceed to your kitchen and take a closer look at the objects/things that you see. On your paper, write five of the items that you see in the kitchen.
2. Go to the bathroom and then again list 5 items that you find there.
3. This time, go to your backyard. List 5 more items that you can find in the area.
4. At this point, there should be a total of 15 items in your list. Now, go over your list and try to identify which is the heaviest among the objects. Identify also which is the lightest.
5. Then, rank the objects 1-15. Rank 1 will be for the lightest object while rank 15 will be for the heaviest.
6. Half-fill a glass with water. Then, put some stones in it. Observe what will happen to the water level as stones are added into the glass.

Have you done Activity 1.1? If yes, then let us analyze your observations.

What items have you included in your list? In your kitchen, did you notice the table salt, oil, vinegar, table, chair, plate, glass, frying pan, spoon and fork? What about inside your bathroom, did you include soap, detergent, towel, pail, shampoo or water in your list? And when you went to your backyard, what did you see? Are you not amazed of the numerous things that are around us? Now, when you ranked the 15 items from the lightest to the heaviest, what generalization have you thought of? Right! The things that you have listed have mass! It may either be light or heavy! Can we say that all the objects listed above have mass, too? Yes, all of them have mass.

In Procedure 6, did you notice that the water level rose when 2 small stones were added? Why? The water level rose because just like water, the stones occupied space.

And since the space being occupied by water cannot be occupied by the two stones at the same time, the water level had to rise. To explain this further, let us use an analogy. If you are seated in a bus with two of your friends, can another friend of yours seat on where you are seated? Of course not! For your friend to sit on that same spot where you are seated you have to stand and let your friend occupy the space. In the same way, the water level rose to give way to the stones that were placed in the glass. The amount of water displaced was the space occupied by the two small stones. Thus, water and stones occupy space. In science, space occupied is referred to as **volume**.

In Procedures 1, 2 and 3, you have discovered that there are a lot of things around us. In Procedure 4 and 5, you have learned that these objects around us have mass. They are either light or heavy. In Procedure 6, you have shown that objects occupy space or they have volume. Now, how do we call the objects or things around us that have mass and occupy space? In science, these things are called matter!

So, is radio an example of matter? Yes, it is! How about the sound coming out of the radio, is it matter? Let us see……Does sound occupy space? No, it doesn't! Is sound heavy or light? No, it isn't! Therefore, is sound an example of matter? No, it is not. Sound, as you have learned in Science 1, is a form of energy!

What you will do

Self-Test 1.1

1. Which of the following are non-examples of matter?
    a. air
    b. water
    c. light
    d. fire
    e. heat

2. Name at least 10 examples of matter.

Key to answers on page 18.

Remember!

Matter is anything that has mass and occupies space.

Lesson 2. Classifying Matter

Chemistry is one of the branches of physical sciences that deals with the study of matter and its changes. Thus, the numerous kinds of matter around us are the same things that chemists study. Due to the enormous variety of matter, chemists realized the need to group them together so that it would be easier to study them as groups rather than as individuals. How can we group samples of matter together? To give you an idea on how enormous examples of matter are classified, let us do Activity 2.1!

What you will do

Activity 2.1

If your family owns a sari-sari store, how will you arrange the following items in your store?

How did you group the items in your store? Let us check if your groupings are the same as mine. Vinegar, soy sauce and fish sauce are all condiments so all will be put in the same location. Chocolate drinks, orange juice and soft drinks should be grouped together whereas wafer and loaf bread should form another group. And of course, bubble gums and candies will form another group.

Now, what was your basis in grouping the materials above? Right! The materials above are grouped together based on their characteristics. Similarly, different samples of matter can be grouped together or classified based on properties that they share.

Matter can be classified based on its composition. On the next page is a schematic diagram showing this classification:

Based on the diagram, the major groupings of matter are pure substances and

mixtures. Copper, water, table sugar, and salt are examples of pure substances while salt solution, sugar solution, mayonnaise and halo-halo are examples of mixtures. Since mixture is best defined as the physical combination of two or more pure substances in varying proportions then to understand mixtures, we must first have a clear understanding of pure substances. Thus, this module will be focusing on pure substances. In Module 3, you will be learning more about mixtures. It is therefore advised that you study this module intently before going to Module 3.

As seen in the diagram, pure substances are homogeneous. What do we mean when we say that a substance is homogeneous? Let us take a closer look at the different samples of pure substances right at your very house.

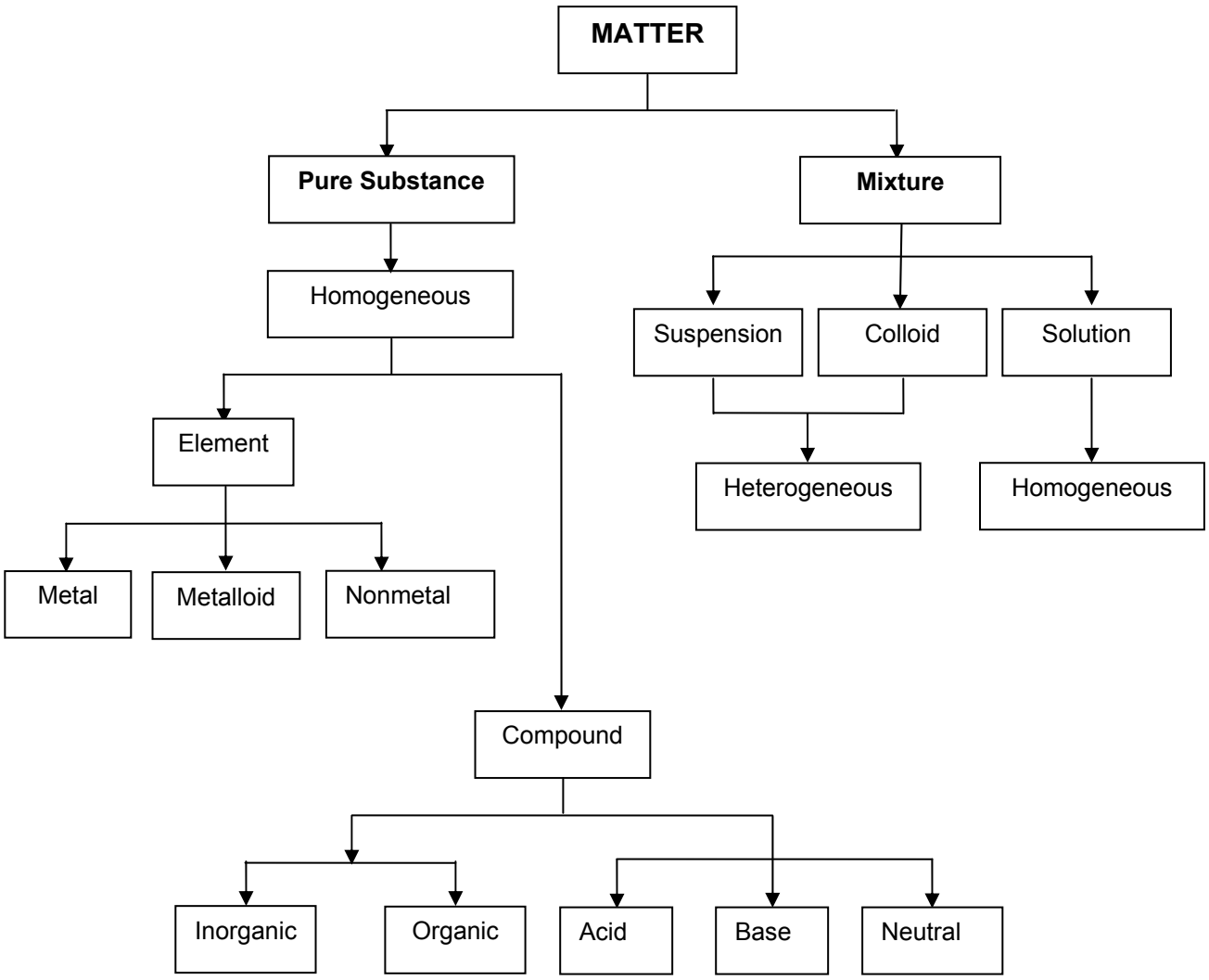


Figure 2.1 Classification of Matter

What you will do

Activity 2.2

Materials Needed: glass, plate, pinch of sugar, pair of scissors, water, pinch of salt, copper wire

Procedure:

1. Examine carefully each of the following: water in a glass, sugar and salt on a plate and the copper wire. Identify the number of phases in each of these pure substances:
   _____
   _____\
2. Drink the water. How does it taste? _____
3. If you'll be getting another glass of water from the faucet, will it taste the same as the water in the first glass? _____
4. Taste the pinch of salt. How does it taste? Do you expect the taste of salt to be always the same? _____
5. Taste the pinch of sugar. How does it taste? Do you expect the taste of sugar to be always the same? _____
6. Get a piece of copper wire. Cut it into pieces. Compare the pieces of copper wires, what do you notice? _____

Have you noticed that sugar is composed of only one phase of matter? In the same way that salt, copper wire and water are all composed of just one phase. The activity shows that the characteristics of the pure substances are the same throughout its samples. This means that potable water is always colorless, tasteless and odorless. Sugar is always sweet while salt is always salty. Likewise, the properties of the pieces of copper wire are just the same as the properties of the original wire. What does this imply? It implies that all pure substances are homogeneous. When we say homogeneous, we are speaking of a one phase system whose properties are the same the whole time.

Why are all pure substances homogeneous? All pure substances are homogeneous because they are made up of only one kind of matter. In addition, the characteristics of different samples of a pure substance are the same because all pure substances have a definite composition. For instance, the water in America will have the same characteristics as the water in the Philippines. Why is this so? This is because water, in any part of the world, is always made up of water molecules, having two hydrogen (H) atoms and one oxygen (O) atom. Ooops! The word atom and molecule maybe new to you, but don't panic! You will learn more about atoms and molecules as we progress with our discussion

of chemistry. For the time being, what I want you to understand is the definite composition of pure substances. Let us then have an analogy to let you better understand this characteristic of pure substances. We know that a family is always composed of a father, a mother and their children (or child). In the same way that a water molecule will always be made up of two atoms of hydrogen and an atom of oxygen. If we only have one atom of hydrogen and one atom of oxygen, will it give us a water molecule? You are right! Since the composition of water is fixed then to have water there should be two atoms of hydrogen and an atom of oxygen in its molecule. On the other hand, copper is also a pure substance but it is only made up of copper atoms. But just the same, like water, its composition is fixed!

Other Distinguishing Characteristics of Pure Substances

What other distinguishing characteristics of pure substances will help us better differentiate them from mixtures. To find out, let us perform Activity 2.3.

What you will do

Activity 2.3

Materials Needed: casserole, water, thermometer, glass

Procedure:

1. Fill a glass with water. Then, transfer the water into a casserole.
2. When the water is already boiling, get the temperature of the water. The temperature is the water's boiling point.
3. Repeat Steps 1-3, but this time boil two glasses of water.

Caution: Be careful when heating! Do not leave the casserole while you are boiling water. When you are through make sure that the source of heat is put off.

Use a laboratory thermometer. You may borrow one from school. Be extra careful if you would be using a thermometer with mercury. If you accidentally break it, do not touch the silvery substance (that's mercury!). Mercury is hazardous to your health.

What have you discovered in the activity? Is the boiling point of one glass of water the same as the boiling point of two glasses of water? Yes, you are right! The boiling point of water is constant. If you will boil water at sea level, its boiling point is 100ºC, in the same way that the melting point and freezing point of water is always at 0ºC!

Unlike mixtures, the boiling points and melting points of pure substances are definite!

What you will do

Self-Test 2.1

Which of the following samples of matter will you classify as a pure substance?

1. Sample A is a colorless and odorless liquid that boils at 100ºC.
2. Sample B is made up of two liquids. One of the liquids is colorless while the other is yellowish.
3. Sample C is composed of a white solid that dissolves in water. When Sample C is heated, its boiling point ranges from 100ºC to 110 ºC.

Key to answers on page 18.

Remember!

- Pure substances are always homogeneous.
- Pure substances are made up of only one kind of matter.
- Pure substances have definite composition.
- Pure substances have definite melting and boiling points.

Lesson 3. Pure Substances: Elements or Compounds

As earlier mentioned, copper and water are both pure substances. But why is it that copper is made up of copper atoms only whereas water is made up of molecules, and each molecule of water is composed of one atom of oxygen and two atoms of hydrogen? This is because pure substances can be further classified as compounds and elements. Copper is an example of an element while water is an example of a compound. Notice that water is made up of elements, hydrogen and oxygen. Thus, before we study compounds, let us first take a closer look at the pure substances that make up a compound ---- the elements!

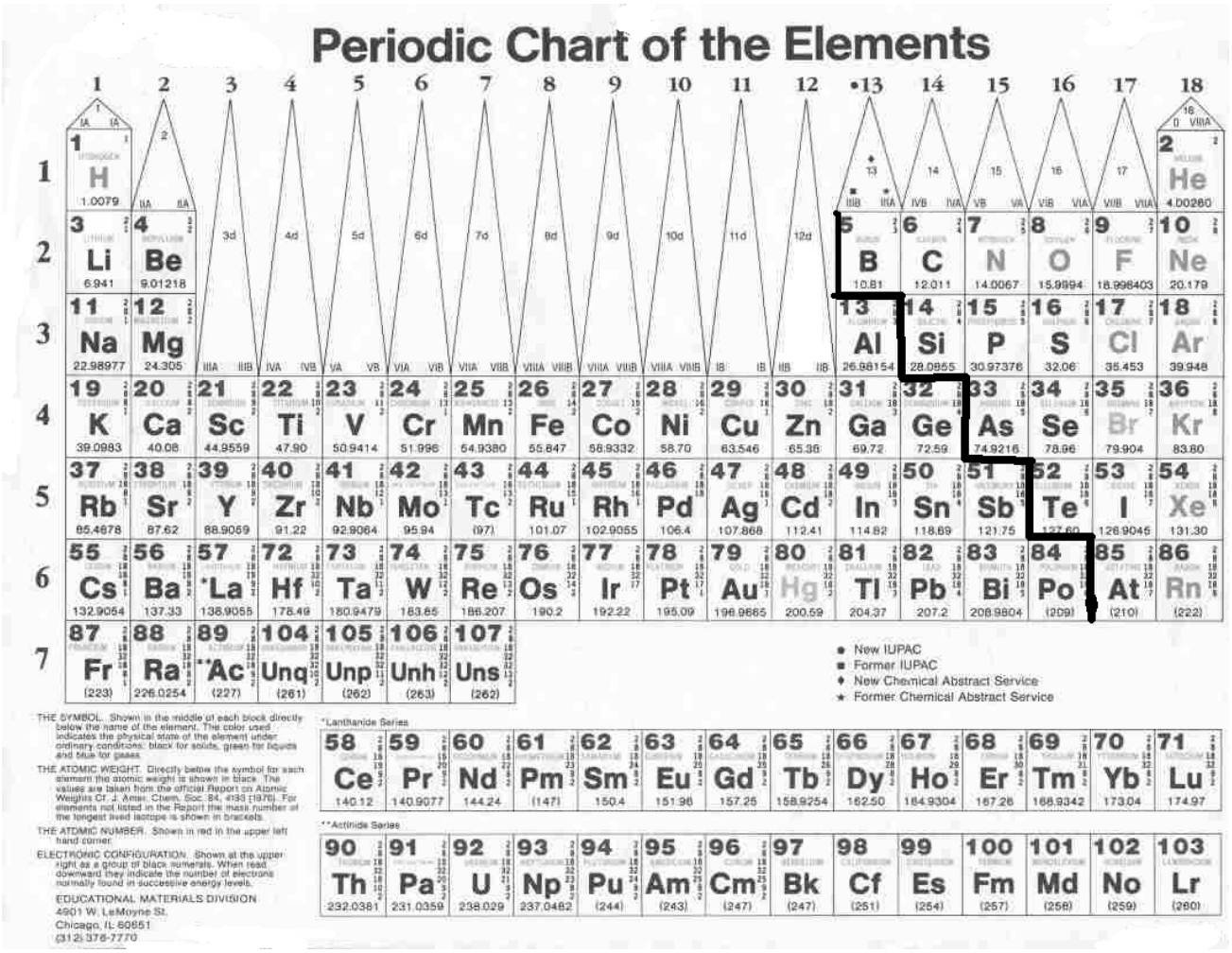
All about Elements

Elements are said to be the building blocks of matter. It cannot be broken down into simpler substances simply because it is the simplest form of matter. To date, there are about 116 elements. Most of these elements are naturally occurring and only a small percentage of elements are man-made. But with the advent of new technology, more and more elements are being synthesized inside the laboratory.

The periodic table of elements gives us various information regarding the simplest

form of matter. The elements in the table are arranged according to increasing atomic number.

Examine the periodic table below. Did you notice the lines that look like a ladder?



The ladder helps us to distinguish the location of the metals and nonmetals in the periodic table. Metals, nonmetals and metalloids are classifications of elements. Remember that the elements to the right of the ladder are nonmetals whereas those to the left are metals. This will give you an idea that 75% of the elements are metals. On the other hand, the metalloids or semi-metals are those in the ladder.

Did you notice as well that the elements are being represented by chemical symbols? Hydrogen is symbolized by capital letter H, helium with He, carbon with C, boron with B and calcium with Ca. H, He, C, B, and Ca are what we refer to as chemical symbols. Can you identify the chemical symbols of the most common elements?

What you will do

Self-Test 3.1

A. Using the periodic table of elements, identify the symbols of the following:
   1. Iron 2. Copper 3. Sodium 4. Magnesium 5. Gold

B. Based on the location of the element in the periodic table, identify if the element in A is a metal, a nonmetal or a metalloid.

Key to answers on page 18.

Now, how do we distinguish a metal from a nonmetal? Activity 3.1 will give you an idea on how these two can be differentiated.

What you will do

Activity 3.1

Materials Needed: iron nails
charcoal (2 chunks will do)
hammer
magnet

Procedure:

1. Examine closely an iron nail and a chunk of charcoal. What differences can you notice?
   _____
   _____
2. Hammer the iron nail and do the same to the chunks of charcoal. What did you notice?
   _____
   _____
3. Determine which will be attracted by a magnet- the charcoal or the iron nail._____

Based on Activity 3.1, what are the characteristics of metals? What about the nonmetals?

Let us see…..In Procedure 1, did you notice that unlike nonmetals, the metals are shiny? They are lustrous (or they possess luster)!

Procedure 2 shows that metals are hard while nonmetals are brittle. The charcoal easily breaks. On the other hand, you can actually hammer metals into sheets without

breaking. This characteristic of metal is known as malleability. Aside from this, metals exhibit ductility, which is the ability to be drawn into wire.

Procedure 3 showed that metals are attracted to a magnet while nonmetals are not.

Another characteristic of metals is its ability to conduct heat and electricity. As a proof, look at your frying pan; it is made of metal. Inside the black cable that is responsible for the conduction of electricity is copper, which is also a metal! On the other hand, nonmetals are good insulators since they are not good conductors of heat and electricity.

What about the metalloids? The **metalloids** have the characteristics of metals and nonmetals. If the position of the metalloid in the periodic table is nearer the nonmetal, then it has more nonmetallic characteristics compared to its metallic properties and vice versa.

Element + Element = Compound?

Does the combination of an element plus an element always result to a compound? No, it doesn't! Why? If two metals are just physically combined, it will result to the formation of an alloy. Alloy is not a compound; it is just a mixture because it is just a physical combination of two pure substances, in this case - elements. So, how then do we describe a compound? A **compound** is a combination of elements. This is right! But remember that a compound is a chemical combination of two or more elements. A chemical combination results to a formation of a new substance. What does this mean? To elaborate, let us take sodium chloride (NaCl) or table salt as our example.

Table salt is made up of two elements namely: sodium and chlorine. Sodium is a very reactive metal. Once you have placed even a pea-size of this metal in water, a violent reaction occurs! On the other hand, chlorine exists as chlorine gas, which is used as a warfare gas during the war. This implies that it is as well a "not-so-friendly" substance. But when a chemical combination transpires between the two, it would result to the formation of a new substance. And this new substance has a new set of characteristics that are quite different from the characteristics of the elements comprising it…..Can you name some characteristics of table salt that are the same as the properties of the elements comprising it? Does salt violently react with water? Is it toxic? Of course, if taken in excess, it would as well be bad for the health. But, table salt is part of our everyday life since we always use it as a seasoning.

Now, how do we separate the components of compound? For instance, can we separate the components of water by just boiling it? Let us try.

What you will do

Activity 3.2

Materials Needed: casserole, water

Procedure:

1. Put some water in a casserole.
2. Let the water boil. When it is already boiling, observe what happens.

_____

_____

Were you able to separate the water into its components – hydrogen gas and oxygen gas? No, you were not able to do so! The water simply evaporated. It just changed its phase from liquid to gas but the gaseous substance was still water! What does this imply? This implies that physical processes cannot be used to separate the components of water. Since water is a chemical combination of elements in a definite proportion by mass, then to separate its components, a chemical process has to be employed.

Electrolysis, which makes use of direct electric current, is being used to separate the components of both sodium chloride and water.

Remember that compounds can only be formed if the right amounts of its components are present. Compounds are only formed when elements are present in a definite proportion by mass!

What you will do

Self-Test 3.2

Which of the following can be classified as a compound?

1. carbon dioxide
2. ice
3. salt solution
4. wine
5. lime (apog)

Key to answers on page 18.

Acidic or Basic?

Compounds may be further classified as an acid, base or neutral. The easiest way to distinguish these three is through the use of indicators. The most common indicator in the classroom is litmus paper. How do we distinguish acids from bases using a litmus paper?

Let us then perform Activity 3.3?

What you will do

Activity 3.3

Materials Needed: Detergent solution
Apog in water
Kalamansi juice
Seven-up or Sprite

Procedure:

1. Divide the red and blue litmus papers into four equal parts.
2. Put a red and blue litmus paper on top of the spoon. Then, get another spoon and get a sample of detergent solution (detergent dissolved in water). Put some drops of the solution on both the blue and red litmus paper. Observe what happens.

   _____
   _____
3. Do Procedure 2 using other samples: kalamansi juice, apog in water and Seven-up or Sprite. Record all observations.

   _____
   _____

Caution: The samples that you are going to test are corrosive. Avoid contact with your skin and eyes. If the sample comes into contact with your skin or eyes, wash it right away with water!

Before doing this activity, make sure that you have a litmus paper. Ask for two strips (one red and one blue) from you teacher.

Are you done with Activity 3.3? Then, let us discuss your observations……The detergent solution and that of the apog in water changed the red litmus paper to blue. On the other hand, Seven-up or Sprite and kalamansi juice changed the blue litmus paper to red.

When the red litmus paper changes to blue, the sample tested is said to be basic. **(R-B-B)** Thus, detergent solution and apog in water are both basic. On the other hand, when the blue litmus paper turns red, the sample tested is acidic **(B-R-A)**. Kalamansi juice and Sprite or Seven-up are both acidic.

Remember that apog in water is not a base since it is not a compound. Apog is the compound and it is the substance that is present in the mixture (apog in water) that makes it basic.

What you will do

Self-Test 3.3

Which of the following are expected to change the blue litmus paper to red?

1. vinegar
2. kamias juice
3. ammonia in water
4. soap
5. dalandan juice

Key to answers on page 19.

Let's Summarize

I hope that you had a great time reading and learning from this module. But more importantly, I hope that you learned great things about matter. So that you'll remember and cherish what you have learned, I summarized them for you:

1. Matter is anything that has mass and volume.
2. Matter may be classified according to its composition. Under this classification scheme, matter may be classified as pure substances or as mixtures.
3. Pure substances are always homogeneous. They are made up of only one kind of matter and have a definite composition.
4. Pure substances have definite melting and boiling points.
5. Pure substances are further classified as an element or a compound.
6. Element is the simplest of matter since it cannot be broken down into simpler substances.
7. Compound is the chemical combination of two or more elements in a definite proportion by mass.

Posttest

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following incorrectly describes matter?
   a. It has mass.
   b. It has volume.
   c. It occupies space.
   d. It has a definite shape.

2. Which is an example of matter?
   a. fire
   b. sound
   c. light
   d. heat

3. Which statement is **NOT TRUE** regarding pure substances?
   a. Pure substances are homogeneous.
   b. Pure substances have definite boiling and melting points.
   c. Pure substances are made up of only one kind of matter.
   d. Pure substances can be further broken down into simpler substances.

4. At sea level, an odorless and colorless Liquid A boils at a range of 100^{o}C to 105^{o}C. What inference can be drawn from this observation?
   a. Liquid A is a metal.
   b. Liquid A is a mixture.
   c. Liquid A is a nonmetal.
   d. Liquid A is a pure substance.

5. Which of the following are pure substances?
   1. gold 2. tin 3. fog 4. alloy

   a. 1 and 2
   b. 1 and 3
   c. 1 and 4
   d. 2 and 3

6. Which of the following statements is true for both elements and compounds?
   a. They are homogeneous.
   b. They are the simplest form of matter.
   c. They are commonly found free in nature.
   d. They can be broken down into simpler substances.

7. Copper, aluminum and gold are metals. Which **incorrectly** describes a metal?
   a. Metals are ductile.
   b. Metals are malleable.
   c. Metals are good insulators.
   d. Metals are good conductors of heat.

8. Sulfur, carbon and the noble gases are nonmetals. Which of the following best distinguishes a nonmetal from a metal?
   a. Its homogeneity.
   b. Its boiling point.
   c. Its brittleness.
   d. Its ductility.

9. All of the following will change red litmus paper to blue **except**
   a. lime water
   b. detergent solution
   c. ammonia in water
   d. Seven-up or Sprite

10. Your chemistry teacher asked you to test Substance Y using a litmus paper. You have noted that the blue litmus paper turns to red. This observation indicates that the substance is
   a. metallic
   b. neutral
   c. acidic
   d. basic

Key to answers on page 19.

Key to Answers

Pretest

1. b
2. c
3. b
4. d
5. c
6. a
7. c
8. c
9. d
10. d

Lesson 1

Self-Test 1.1

1. Light and heat are non-examples of matter while air, water and fire are examples of matter.
2. Answers may vary. The list may include pillows, candies, human beings, cats, dogs (animals in general), bed, television and many more. As long as the object occupies space and has mass then it is an example of matter.

Lesson 2

Self-Test 2.1

Of the samples, only Sample A is a pure substance. Based from its description, its boiling point is definite. In addition, Sample A is a homogeneous system.

Sample B is not a homogeneous system while the boiling point of Sample C is not definite.

Lesson 3

Self-Test 3.1

	A	B
1.	Fe	metal
2.	Cu	metal
3.	Na	metal
4.	Mg	metal
5.	Au	metal

Self-Test 3.2

1, 2 and 5 are compounds.

Self-Test 3.3

1, 2 and 5 are expected to change blue litmus paper to red.

Posttest

1. d
2. a
3. d
4. b
5. a
6. a
7. c
8. c
9. d
10. c

References

Books:

Araneta, F.L., Catris, L.V. & Deauna, M.C. (2002). *The world of chemistry III.* (2nd ed.) Quezon City: SIBS Publishing House, Inc.

Chang, R. (2005). *Chemistry.* (8th ed.) New York: Mc Graw-Hill Companies.

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http://www.surfacing-tada.com/Colour%20Summer%202003/pages/21_Dress_Hunt.htm

http://mirel.esmartdesign.com/pages/source/9.htm

www.visionairy.com/store/foo1.html

http://www.monroetwp.k12.nj.us/es/whitehall/classroom.sites/wh.classroom.htm

http://www.naturalsci.gardner-webb.edu/Faculty/sparrish/periodic.htm

http://www.ci.shreveport.la.us/dept/dos/graphics/house%20and%20rooms/kitchen/vinegar.htm

japanweb.aboho.com/soy.htm

foodgoat.blogspot.com/2003/02

http://simplyorangejuice.com/news.shtml

spaghoops.com/squelch/cadbisc.htm

www.deadbus.org/archives/articles

www.venetianglassart.com/thestore/prods/SLEC-PES.html

www.pulaskiacademy.org/bone/Why%20do%20we%20chew%20gum.htm

www.abcusd.k12.ca.us/dist_info/nutr/A_La_Carte.html

www.bisondip.com/milk.asp