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Science

Quarter 3 – Module 4:
Periodic Table of Elements

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Quarter 3 – Module 4: Periodic Table of Elements
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Science

Quarter 3 – Module 4:
Periodic Table of Elements

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you master the arrangement of elements, the reactive and nonreactive metals. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module contains:

- **Lesson 1** - Arrangement of Elements
- **Lesson 2** - Reactive and nonreactive metals

After going through this module, you are expected to:

1. Identify the groups and periods of the elements;
2. Describe metals, nonmetals, and metalloids;
3. Compare the relative reactivity of metals; and
4. Use the Periodic Table of Elements to predict the chemical behavior of an element. *(MELC Week 7-8 S8MT-IIIi-j-12)*

What I Know

Directions: Choose the letter of the correct answer. Write your answers on a separate sheet of paper.

1. Which term is used to the vertical columns of the periodic table?
   A. group
   B. line
   C. rows
   D. table

2. What are Group 1 elements known as?
   A. Alkali metals
   B. Transition elements
   C. Representative elements
   D. Inner transition elements

3. Which element is found in period 6, group 4?
   A. Cr
   B. Hf
   C. Pb
   D. Ti

4. Elements in the same group have the same number of _____.
   A. protons
   B. neutrons
   C. electrons
   D. valence electrons

5. In which period and group is Silver (Ag) located?
   A. Period 2, Group 1
   B. Period 3, Group 8
   C. Period 4, Group 2
   D. Period 5, Group 11

6. How are elements arranged in the Periodic Table?
   A. increasing atomic radii
   B. increasing atomic masses
   C. decreasing atomic masses
   D. increasing atomic numbers

7. Why do elements of the same group have similar chemical properties?
   A. They have different atomic masses.
   B. They have one electron in the outer shell.
   C. They have different number of electrons in the outermost shell.
   D. They have the same number of electrons in the outermost shell.

8. In which arrangement of elements will reactivity generally become lesser?
   A. left to right
   B. bottom to top
   C. top to bottom
   D. both A and B

For questions, 9-11, use the list of elements in decreasing order of reactivity as shown in the box.

K, Na, Ca, Mg, Zn, Fe, H, Cu

9. Which statement about the reactivity of these metals is correct?
   A. Zinc is less reactive than Iron.
   B. Sodium is less reactive than Calcium.
   C. Copper is more reactive than Potassium.
   D. Calcium is more reactive than Magnesium.

10. Based on the reactivity series, which metal is the most reactive?
   A. Copper
   B. Lithium
   C. Sodium
   D. Zinc

11. Which of the following sets of metals is arranged according to increasing reactivity?
   A. K, Mg, Na, Li
   B. Mg, Li, Na, K
   C. Mg, Na, Li, K
   D. Na, Li, Mg, K

12. Which one of the following metals reacts most vigorously with cold water?
   A. Copper
   B. Iron
   C. Magnesium
   D. Sodium

13. Which set of substances would allow rusting to take place the fastest?
   A. Iron, salt and water
   B. Steel, salt and water
   C. Steel, salt and weak acid
   D. Iron, salt and weak acid

14. If the metal is more reactive, the metal in the compound replaces the less reactive metal. Based on this, which of the following statements is true?
    A. The less reactive metal repels the more reactive metal from its compound.
    B. The more reactive metal bonds with the less reactive metal from its compound.
    C. The more reactive metal pushes out or displaces the less reactive metal from its compound.
    D. The less reactive metal pushes out or displaces the more reactive metal from its compound.

15. Which metal is preferred to be used for water pipes? ~~because it is unreactive~~?
    A. Copper
    B. Gold
    C. Iron
    D. Potassium

Lesson 1 Arrangement of Elements

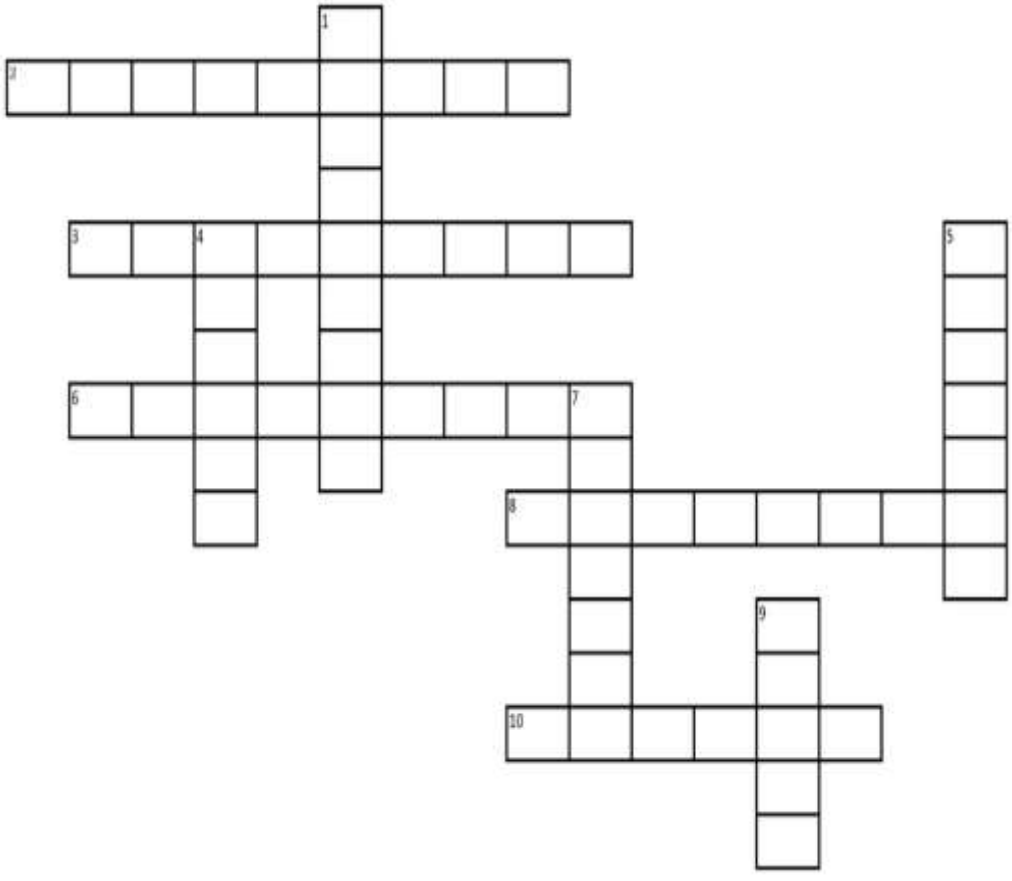
All the known chemical elements are arranged on The Periodic Table of Elements in an informative array. There are already 118 elements discovered as of 2019. These elements are arranged from left to right and from top to bottom in an increasing order of atomic numbers.

This lesson will help you find out more about the properties of elements. You will see that majority of them are metals, some are non-metals, and few are metalloids.

What's In

Activity 1. Crossword Puzzle

Directions: Complete the crossword puzzle below. Write your answers on a separate sheet of paper.



Across

2. They are elements in Group 16.
3. A property of metal that is capable of being hammered into thin sheets without breaking.
6. An element that has the properties of metals and nonmetals.
8. It is a series of radioactive metallic elements.
10. It is the horizontal row of the Periodic Table of Elements.

Down

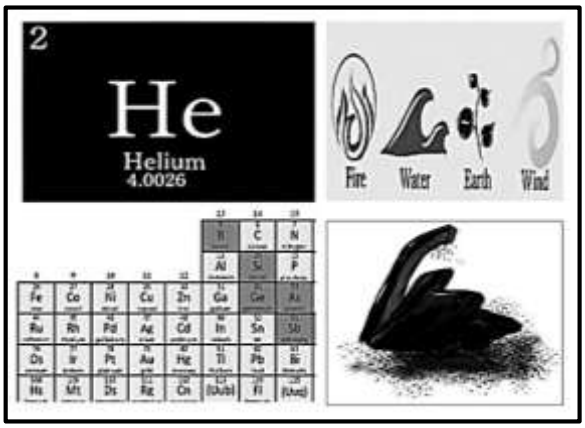
1. They are generally poor conductors of heat and electricity.
4. It refers to the brightness that a shiny surface has.
5. It is the name of the group of very reactive nonmetals and often used as disinfectant.
7. It is a physical property that is able to draw out into a thin wire.
9. The column of elements on the periodic table

What's New

Activity 2, 4 Pics One Word

Directions: Reveal the word by analyzing the given set of pictures and letters. Write your answers on a separate sheet of paper.

1.



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E M T

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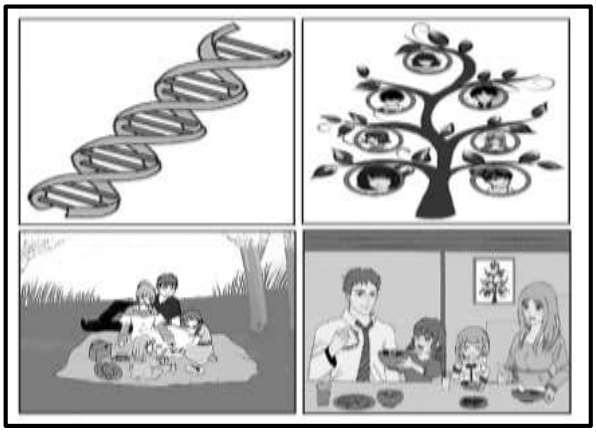
2.



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P R

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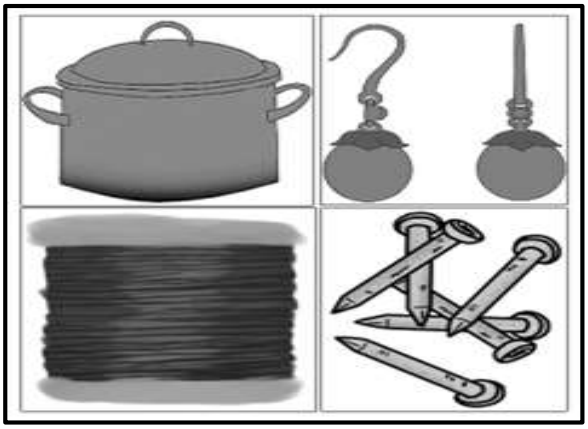

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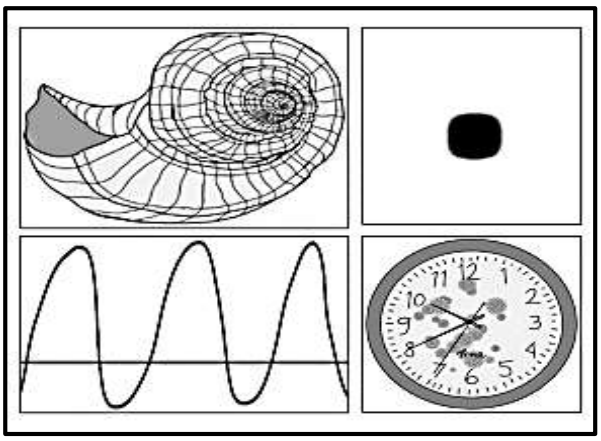
M A

4.



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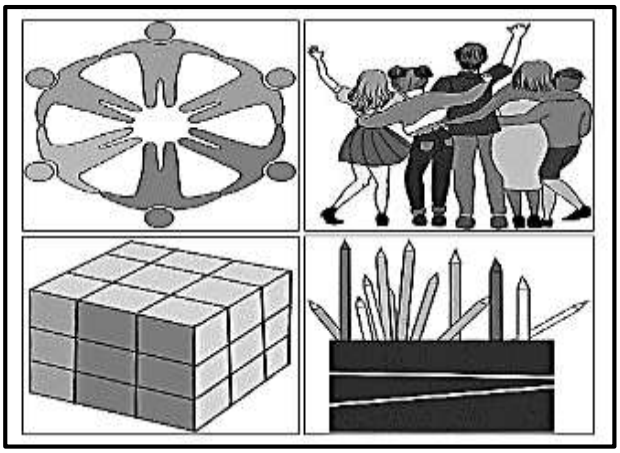
P R

5.



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G P

What is It

Arrangment of Elements

Figure 1 shows the elements on the modern periodic table which are organized based on similarities of properties of elements.

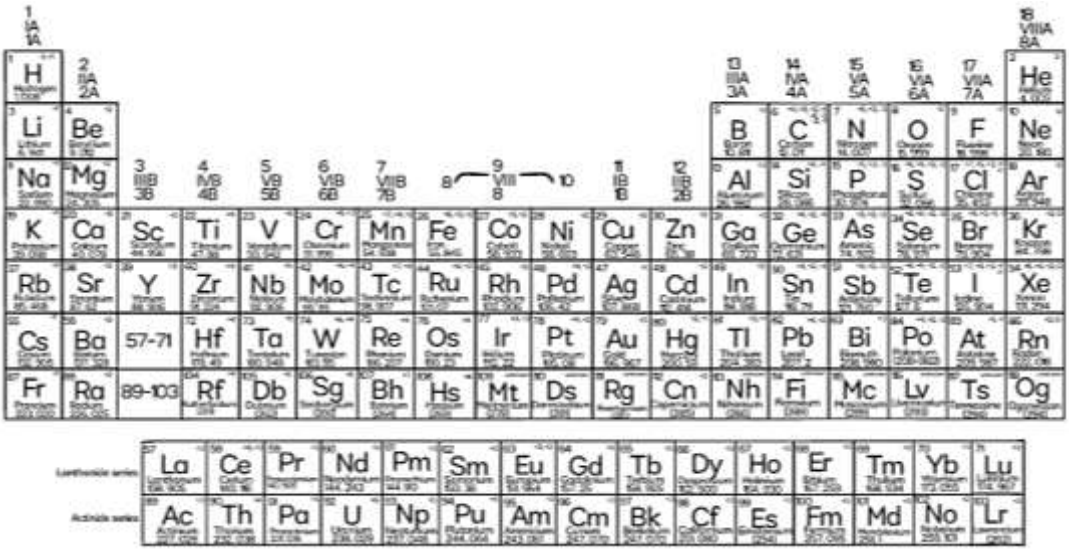

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Figure 1. The Periodic Table of Elements

Figure 2 shows the horizontal rows of the periodic table, called **periods.**

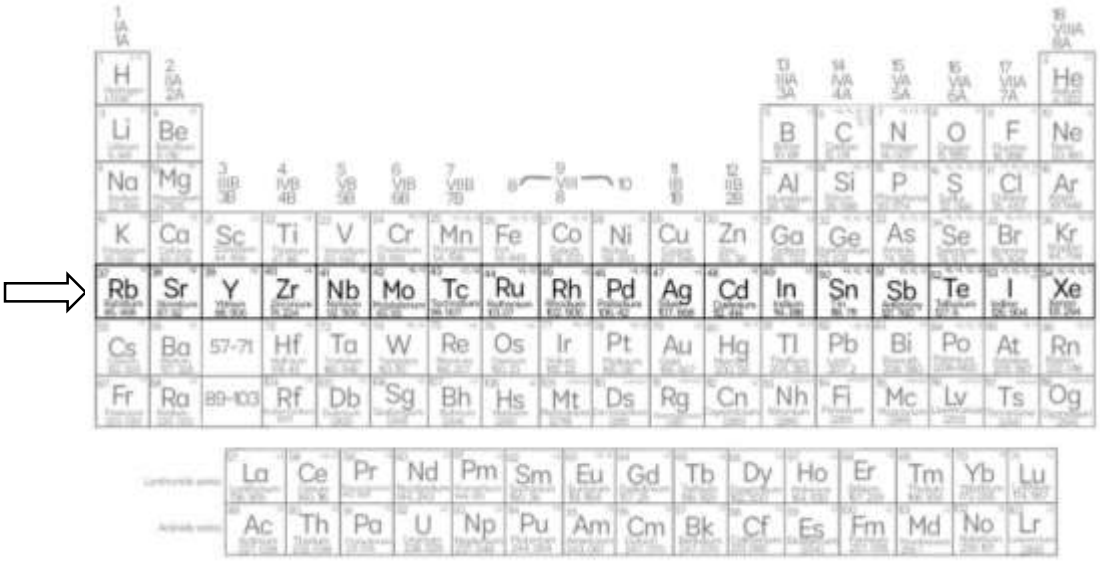

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Figure 2. Elements in Period 5

The vertical columns of the periodic table are called **groups** or **families** as illustrated in figure 3. The group number corresponds to the number of electrons in their outermost shell. These outermost electrons are called **valence electrons**. The elements in group of the periodic table have similar chemical properties.

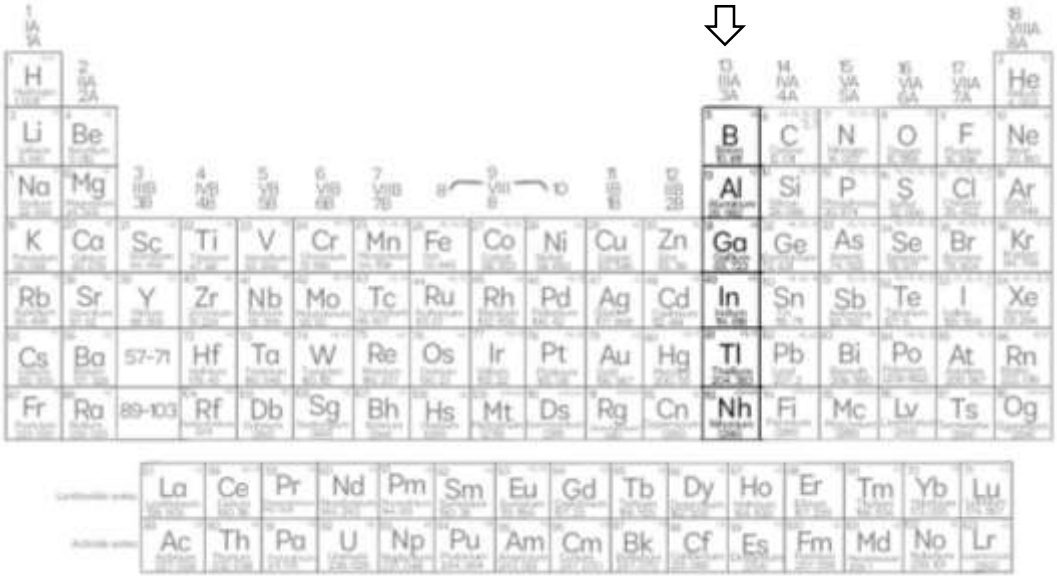

Figure 3. Elements in Group 13

FEATURES OF GROUPS or FAMILIES OF ELEMENTS

Elements from the taller columns which are the Groups 1, 2, and 13 through 18 are called **representative elements** or main groups of the periodic table.

Group 1: Alkali Metals

- very reactive, soft, malleable, and ductile
- good conductors of heat and electricity
- with only one valence electron

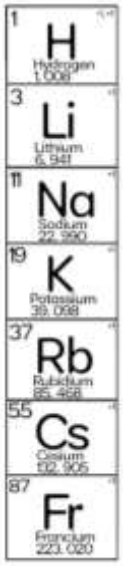

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Figure 4. Group 1, the Alkali Metals

Group 2: Alkaline Earth Metals

- second most reactive elements
- malleable, ductile, and good conductors of heat and electricity but not as soft as Group 1 elements
- with two valence electrons

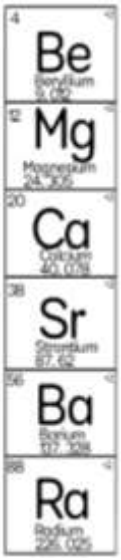

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Figure 5. Group 2.

Group 13: Boron Group

- are post-transition metals, except for Boron which is a metalloid and Nihonium which is a synthetic chemical element that is extremely radioactive
- with three valence electrons

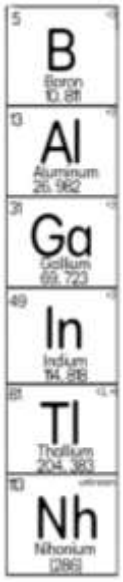

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Figure 6. Boron Group

Group 14: Carbon Group

- also known as the Carbon family, or the tetrels
- elements in this family are the key importance for semiconductor technology
- with four valence electrons

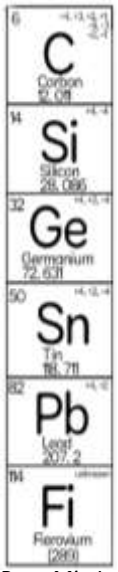

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Figure 7. Carbon Group

Group 15: Nitrogen Group

- known as Pnictogen group
- with five valence electrons

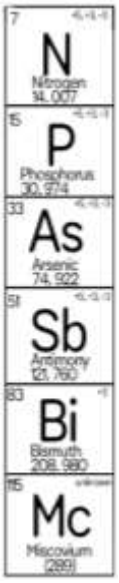

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Figure 8. Nitrogen group

Group 16: Chalcogens

- Chalcogen is the new trivial name recognized by the International Union of Pure and Applied Chemistry
- widely known as Oxygen group
- generally nonmetals
- with six valence electrons

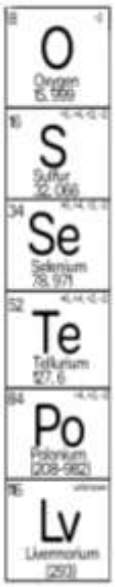

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Figure 9. The Chalcogen Family

Goup 17: Halogens

- salt former
- exist in all three states of matter
- with seven valence electrons

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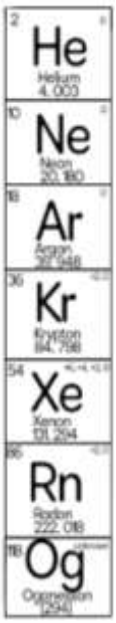
Figure 10. The Halogen Family

Group 18: Noble Gases

- stable gases
- non-reactive or inert elements
- with eight valence electrons except Helium



Illustrated by Rosa Mia L. Pontillo

Figure 11. The Noble Gases Family

Groups 3-12: Transition Metals

- hard (with Mercury as an exception)
- malleable, ductile, and good conductors of electricity
- with one and/or
  two valence electrons

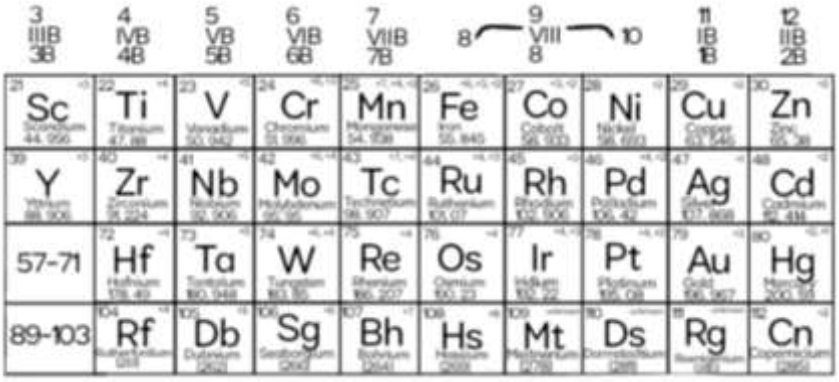


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Figure 12. Transition metals

Figure 13 shows the **lanthanides** and **actinides** series. They are special series of elements but are also part of the transition block. They are also called the **inner transition elements**.

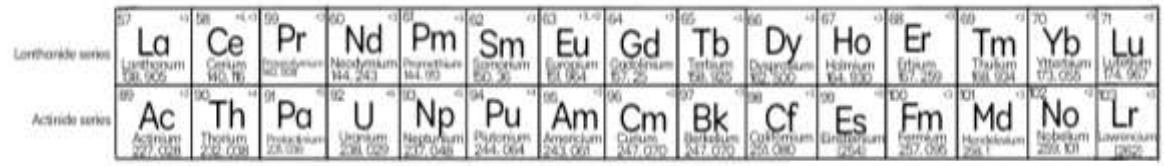

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Figure 13. Lanthanides and Actinides Series

Metals, Nonmetals, and Metalloids

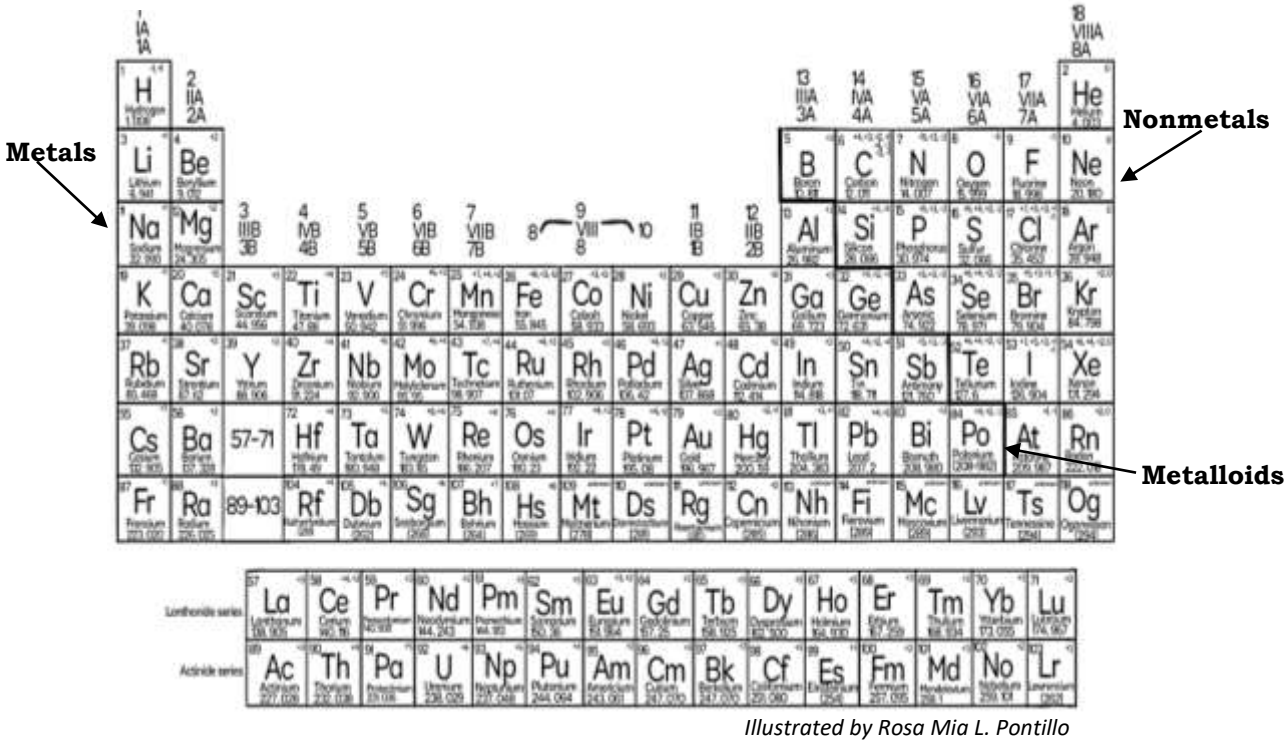
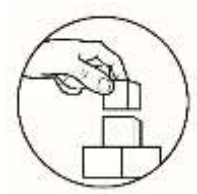


Figure 14. Location of metals, nonmetals, and metalloids

In the above figure, **metals** are located on the left side of the Periodic Table of Elements. Most of the elements are metals which are solids at room temperature except Mercury. Elements that are found far right of the periodic table are called **nonmetals** which may be solids, liquids or gases. A stair-step line on the table separates the metals from nonmetals. The elements along this line are called **metalloids**. Metalloids exhibit the properties of metals and nonmetals. The seven elements commonly regarded as metalloids are silicon, germanium, arsenic, antimony, tellurium, and polonium.

Table 1. Summary of Properties of Elements

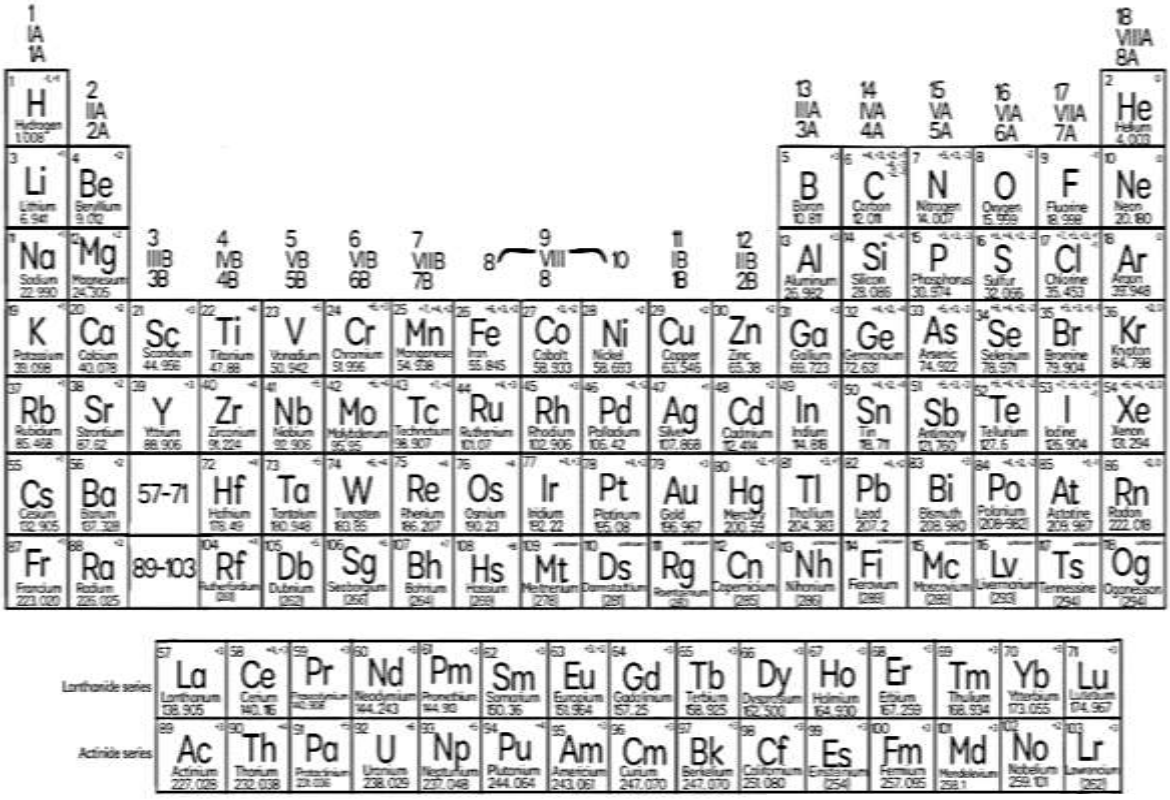
Classification of Elements	Properties
Metals	Lustrous (shiny), malleable, hard, ductile Good conductors of heat and electricity
Nonmetals	Dull in appearance, brittle Poor conductors of heat and electricity
Metalloids	Have some properties of metal but behave chemically like a nonmetal in certain instances Some are semiconductors,which means they will insulate and conduct electricity



What's More

Activity 3. The Missing Element

Directions: Fill in the missing information below by using the Periodic Table of Elements. Write your answers on a separate sheet of paper.



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Element Name	Symbol	Group Number	Period Number	Identify if Metal (M), Nonmetal (NM) or metalloid (Met)
Boron		13		
	Al		3	
Tin	Sn			
Helium		18		
	Ne	18		
	Ca		4	
Francium		1		
	Au		6	

What I Have Learned

Activity 4. Fill me Up!

Directions: Fill in the blanks with missing word/s. Write your answers on a separate sheet of paper.

Elements within the modern periodic table are organized in the simplest way so that information about the elements and their compounds are easily revealed. The vertical columns of the periodic table are called **1.**_____. It identifies the **2.**_____ of elements. The horizontal rows of the periodic table, called **3.**_____ are numbered from top to bottom.

There are 18 groups in the Periodic Table of Elements. Group 1 is named as Alkali Metals, Groups 2 as **4.**_____, and Group 16 as **5.**_____. Groups 3-12 are called as **6.**_____. The lanthanides and actinides are special series of elements but are also part of the transition block. They are also called as inner transition elements. Groups 1, 2, 13-18 are called as representative elements.

There are three classifications of elements, namely: metals, **7.**_____, and metalloids. The majority of the elements on the left side of the periodic table are **8.**_____. The nonmetals are confined to the right side of the table. **9.**_____show both properties of metals and nonmetals. The physical properties of metals include luster, and **10.**_____.

Lesson 2 Reactive and Nonreactive Metals

There are more than a hundred chemical elements listed on the Periodic Table. Most of these elements are metals which have also been crucial in the development of human civilization. It is therefore important to know something about them.

All metals share many features, and we start by looking at these. But they also vary greatly in how reactive they are to combine with other elements to form compounds.

What's In

Activity 5. Choose-It-Out

Directions: A. From the box below, choose the elements that are metalloids. Write your answers on a separate sheet of paper. Look for applications of these elements in real life.

Argon	Antimony
Boron	Mercury
Calcium	Zinc
Germanium	Silicon
Selenium	Astatine

B. Choose the elements that are metals. Write your answers on a separate sheet of paper. Look for applications of these elements in real life.

Carbon	Oxygen
Iron	Carbon
Magnesium	Nickel
Silver	Chlorine
Sulfur	Lithium

A. Metalloids

_____
_____
_____
_____
_____
_____

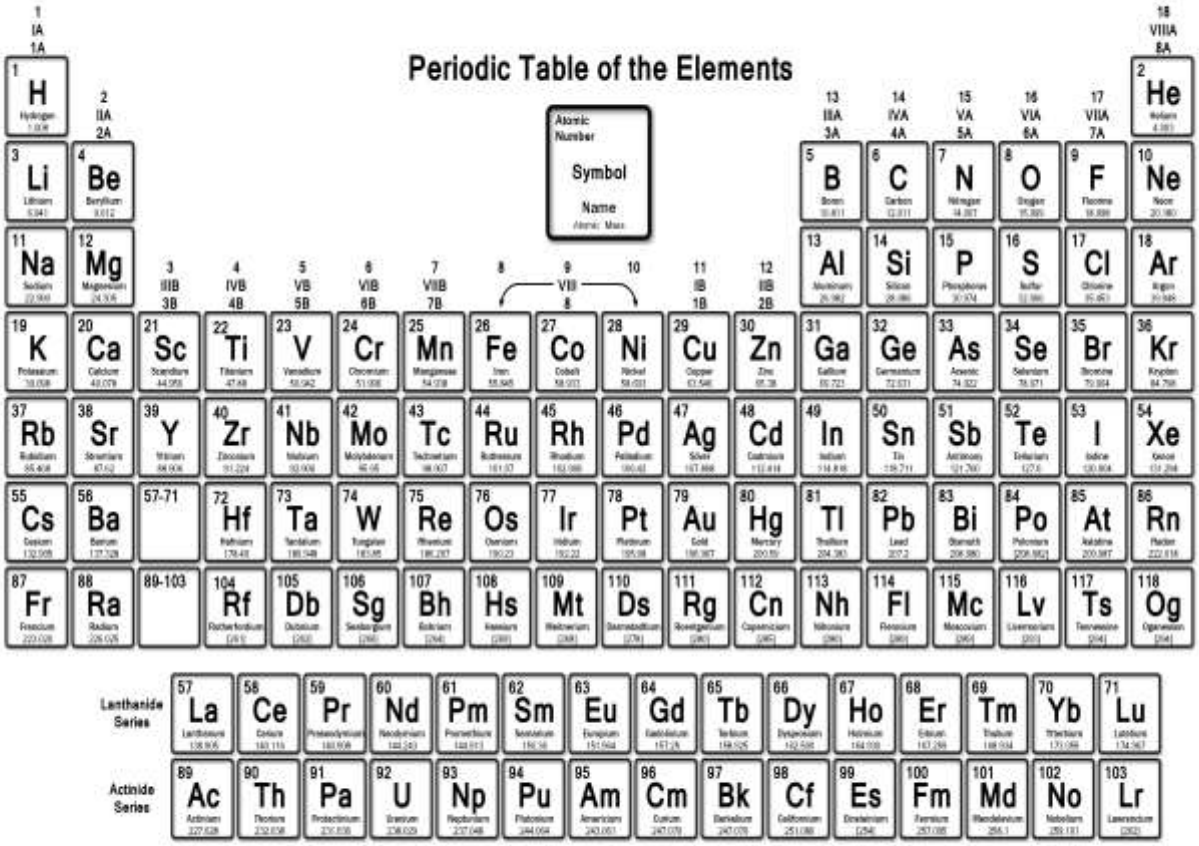
B. Metals

_____
_____
_____
_____
_____
_____

What's New

Activity 6. Check this out

Directions: Look at the Periodic Table of Elements below and answer the given questions. Write your answers on a separate sheet of paper.



(Source:https://sciencenotes.org/periodic-table-black-white-wallpaper)

Questions:

1. In a period, the reactivity of metals decreases from left to right. Arrange the given elements in decreasing order: Fe, K, Ca, and Cu _____
2. In a group, the reactivity of metals increases from top to bottom. Arrange the given elements in increasing order: Na, K, Li, and Rb _____
3. Which element is found in period 6, group 14? _____
4. In which period and group is Aluminum (Al) is located? _____
5. In which period and group is Platinum (Pt) is located? _____

What Is It

A reaction does not always happen between a metal and a compound. There is an existing definite order of reactivity among metals and hydrogen according to their ability to displace one another. A less reactive metal cannot replace a more reactive metal; hence no reaction will occur. On the other hand, a more reactive metal can replace a less reactive metal and will produce a reaction. To determine the less or more reactive metals refer to the Activity Series of Metals.

The Activity Series of Metals

Element	Symbol	Group No.	
Potassium	K	1	Most reactive
Sodium	Na	1	
Lithium	Li	1	
Calcium	Ca	2	
Magnesium	Mg	2	
Aluminum	Al	3	
Zinc	Zn	Transition metal	Decreasing chemical reactivity
Iron	Fe	Transition metal	
Tin	Sn	4	
Lead	Pb	4	
[Hydrogen]	H	Non-metal	
Copper	Cu	Transition metal	
Silver	Ag	Transition metal	
Gold	Au	Transition metal	
Platinum	Pt	Transition metal	Least reactive

Activity 7. In or Out

Directions: Write **In** if the statement is True and **Out** if the statement is False. Write your answers on a separate sheet of paper.

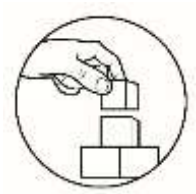
_____1. Potassium, Sodium, and Lithium are metals belonging to Group 1. In this group, its reactivity increases from top to bottom on the Periodic Table.

_____2. Sodium, Magnesium, and Aluminum belong to Period 2. In a period, its reactivity decreases from left to right.

_____3. Aluminum is more reactive than Lead.

_____4. Silver replaces Iron in Iron (II) chloride.

_____5. The more reactive metal displaces the less reactive metal from its compound.



What's More

Activity 8. Which is which?

Directions: Indicate whether the metal is **Reactive** or **Nonreactive** with Hydrogen in Hydrochloric acid (HCl) or water (H_2O). Please refer to the Activity Series of Metals. Write your answers on a separate sheet of paper.

Example: Li with HCl - Reactive

1. Mg with HCl
2. Ag with HCl
3. Cu with HCl
4. Au with HCl
5. Na with HCl
5. Na with HCl
6. Na with H_2O
7. Cu with H_2O
8. Sn with H_2O
9. Pt with H_2O
10. K with H_2O

Activity 9. Will the reaction take place?

Directions: Analyze the given reactants below, Can the highlighted metal in the compound be replaced by the metal reactant? Write **YES** if a reaction will take place and **NO** if the reaction will not. Write your answers on a separate sheet of paper.

Reactants		Reactions (YES/NO)
1. **Iron (III)** oxide	Magnesium	
2. **Copper (II)** sulfate	Zinc	
3. Potassium	**Aluminum** nitrate	
4. Gold	**Silver** chloride	
5. Calcium	**Sodium** bromide	

What I Have Learned

Directions: Fill in the blanks with the correct answers. Write your answers on a separate sheet of paper.

Metals react differently to other substances. Chemists can list **1._____** according to how quickly they undergo chemical reactions, such as burning or dissolving in acids. The result is called a **2._____** series. Metal at the **3._____** of the series generally reacts more vigorously than those that are **4._____** it in the series. Therefore, a **5._____** reactive metal cannot replace a more reactive metal; hence no **6._____** will occur. However, a more reactive metal can **7._____** a less reactive metal producing a reaction. Using the periodic table of **8._____**, one can see a trend in reactivity. In a group, reactivity **9._____** as you go from top to bottom, while in a period, reactivity **10._____** from left to right.

What I Can Do

Activity 10. Which and Why?

Directions: Read the given situation and answer the question that follows. Write your answers on a separate sheet of paper.

Mary has a bestfriend named Joan who is celebrating her 15th birthday. Mary wanted to buy Joan a bracelet as a gift. In the gift shop, the saleslady presented Mary with three types of bracelets made of the following: Brass (an alloy of Copper and Zinc), Steel (an alloy of Iron and Carbon), and pure Silver. If you were Mary, which bracelet will you buy for Joan? Why?

Scoring Rubrics

3 – Discussions do not have misconceptions; with complete scientific evidence.
2 – Discussions do not completely show scientific evidence.
1 – Discussions do not show complete scientific evidence; with misconceptions.
0 – There is no discussion shown.

Assessment

Directions: Choose the letter of the correct answer. Write your answers on a separate sheet of paper.

1. Which of the elements does NOT belong to the same period?
   A. Ag
   B. Co
   C. I
   D. Xe

2. Which of the following belongs to the same family of element Phosphorus?
   A. Carbon
   B. Magnesium
   C. Nitrogen
   D. Oxygen

3. In what period is Manganese located?
   A. four
   B. nine
   C. seven
   D. two

4. The following elements belong to the same group EXCEPT?
   A. Argon
   B. Calcium
   C. Helium
   D. Krypton

5. Which of the following BEST describes metals?
   A. Metals are dull and brittle.
   B. Metals are insulators and poor conductors of heat.
   C. Metals are lustrous, malleable, ductile, and good conductors of heat and electricity.
   D. Metals are dull, brittle, malleable, ductile, and good conductors of heat and electricity.

6. Which of the following statements are NOT TRUE for metalloids?
   I. They are all semiconductors.
   II. They are all good conductors of heat and electricity.
   III. Some of these elements are Boron, Silicon, and Germanium.
   IV. They are borderline elements that exhibit both metallic and nonmetallic properties to some extent.

   A. I and II B. II and III C. I and III D. II and IV

7. Which metal will most likely replace Copper in Copper(II) chloride?
   A. Aluminum
   B. Iron
   C. Platinum
   D. Silver

8. Which metal is found at the bottom of the activity series of metals?
   A. Copper
   B. Gold
   C. Iron
   D. Platinum

9. Which metal is widely used as jewelry?
   A. Aluminum
   B. Gold
   C. Potassium
   D. Zinc

10. Which one of the following transition metals reacts the least with water?
   A. Copper
   B. Gold
   C. Platinum
   D. Silver

11. Which one of the following metals reacts most violently with cold water?
   A. Aluminum
   B. Copper
   C. Lithium
   D. Zinc

12. Which of the following is arranged according to increasing reactivity?
   A. Fe, Cu, K, Ca
   B. Cu, Fe, Ca, K
   C. Cu, Ca, Fe, K
   D. Ca, Fe, Cu, K

13. In which arrangement of elements will reactivity generally become greater?
   A. left to right
   B. bottom to top
   C. top to bottom
   D. both A and C

14. Which sets of metals follows the trend of reactivity in a group?
   A. K, Li, Na, Rb
   B. Li, K, Na, Rb
   C. Li, Na, K, Rb
   D. Na, Li, K, Rb

15. Sodium, Magnesium, and Aluminum belong to period 2. Which of the following statements is correctly stated?
   A. Aluminum repels Magnesium from its compound.
   B. Sodium bonds with Aluminum from its compound.
   C. Aluminum displaces Sodium from its compound.
   D. Sodium pushes out Aluminum from its compound.

Additional Activities

Activity 11. Thinking out of the box

Directions: Think about the changes that you have observed around you, particularly those involving metals. Write your answers on a separate sheet of paper.

1. What harmful effects could happen when a metal mixes with acids?

_____
_____
_____

2. What are some ways of preventing metals from corrosion?

_____
_____
_____

Answer Key

Lesson 1

What's New

Activity 2.

1. ELEMENTS
2. FAMILY
3. METALS
4. PERIOD
5. GROUP

What's In

Activity 1.

ACROSS

2. CHALCOGEN
3. MALLEABLE
6. METALLOID
8. ACTINIDE
10. PERIOD

DOWN

1. NONMETALS
4. LUSTER
5. HALOGEN
7. DUCTILE
9. GROUP

What I Know

1.A
2.A
3.B
4.D
5.D
6.D
7.D
8.D
9.D
10.D
11.A
12.C
13.B
14.C
15.A

What I Have Learned

Activity 4

1. Groups
2. Families
3. periods
4. Alkaline earth metals
5. Chalcogens
6. Transition metals
7. Nonmetals
8. Metals
9. Metalloids
10. Conductivity

What's More

Activity 3.

Element Name	Symbol	Group Number	Period Number	Identify if Metal (M), Nonmetal (NM) or metalloid (Met)
Boron	***B***	13	***2***	Met
Aluminum	Al	***13***	3	M
Tin	Sn	***14***	***5***	M
Helium	***He***	18	***1***	NM
Neon	Ne	18	***2***	NM
Calcium	Ca	***2***	4	M
Francium	***Fr***	1	***7***	M
Gold	Au	11	6	M

Lesson 2

Assessment

1. B
2. C
3. A
4. B
5. C
6. A
7. A
8. D
9. B
10. D
11. C
12. B
13. C
14. C
15. D

What's More

Act 8.
1. Reactive
2.Non-reactive
3. Non-reactive
4. Non-reactive
5. Reactive

Activity 9.
1. Yes
2. Yes
3. Yes
4. No
5. No

What's New

Activity 6.

1. K, Ca, Fe, Cu
2. Rb, K, Na, Li

What is It

Activity 7.

1. In
2. In
3.In
4. Out
5. In

What's In

Activity 5.

A. Boron
Germaniu
Antimony
Silicon
Astatine

B. Iron
Magnesium
Silver
Nickel
Lithium

What I Can Do

Activit 10.

I will choose Silver because according to the Activity series of metals, it is the least reactive of the three given metals.

Additional Activities

Activity 11.

1. It will corrode metals. It will make it weak.

2. By adding a less reactive metal(alloy). Soaking it in oils/grease. Cover it in paint.

What I Have Learned

1.metals
2. reactivity
3. top
4. below
5. less
6. reaction
7. replace
8. elements
9. increases
10. decreases

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