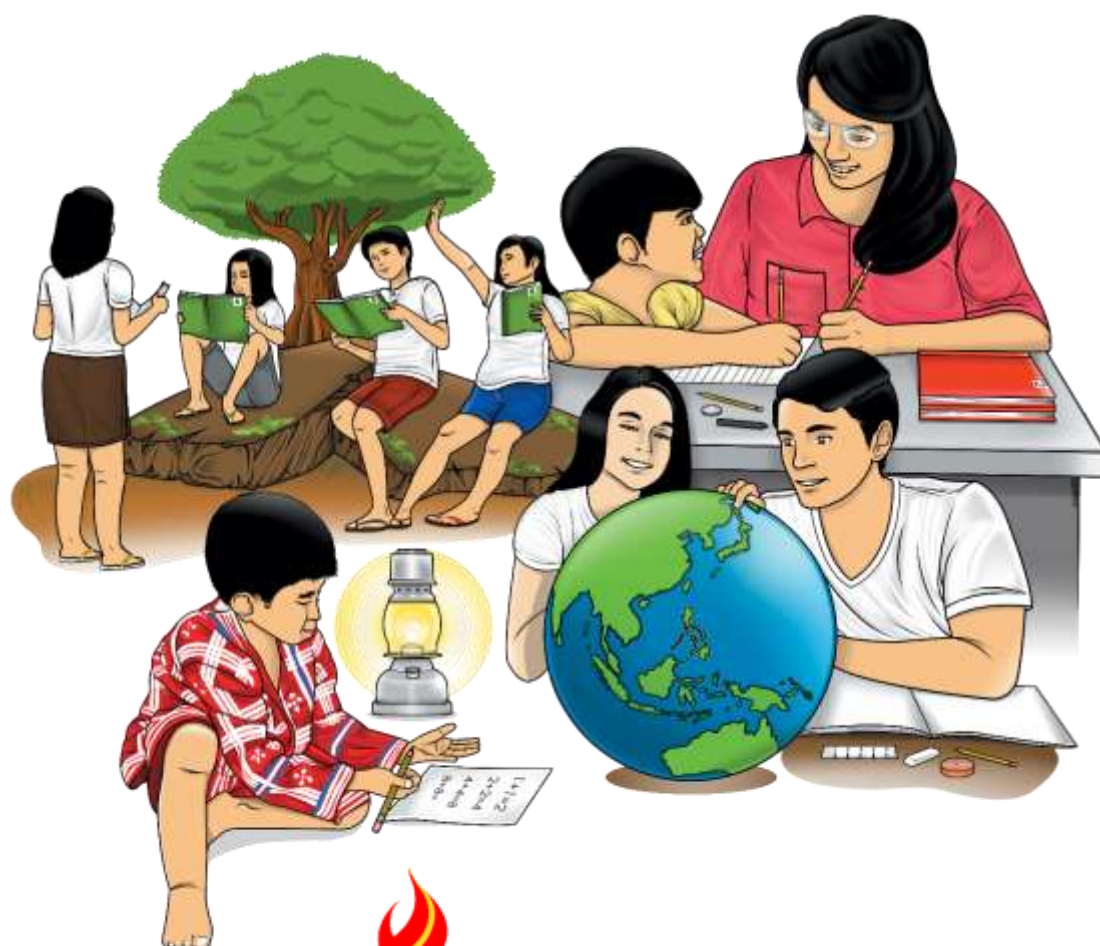


# Science

## Quarter 3 – Module 4: Periodic Table of Elements



**Science – Grade 8**  
**Alternative Delivery Mode**  
**Quarter 3 – Module 4: Periodic Table of Elements**  
**First Edition, 2020**

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# **Science**

## **Quarter 3 – Module 4:**

### **Periodic Table of Elements**

## **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.

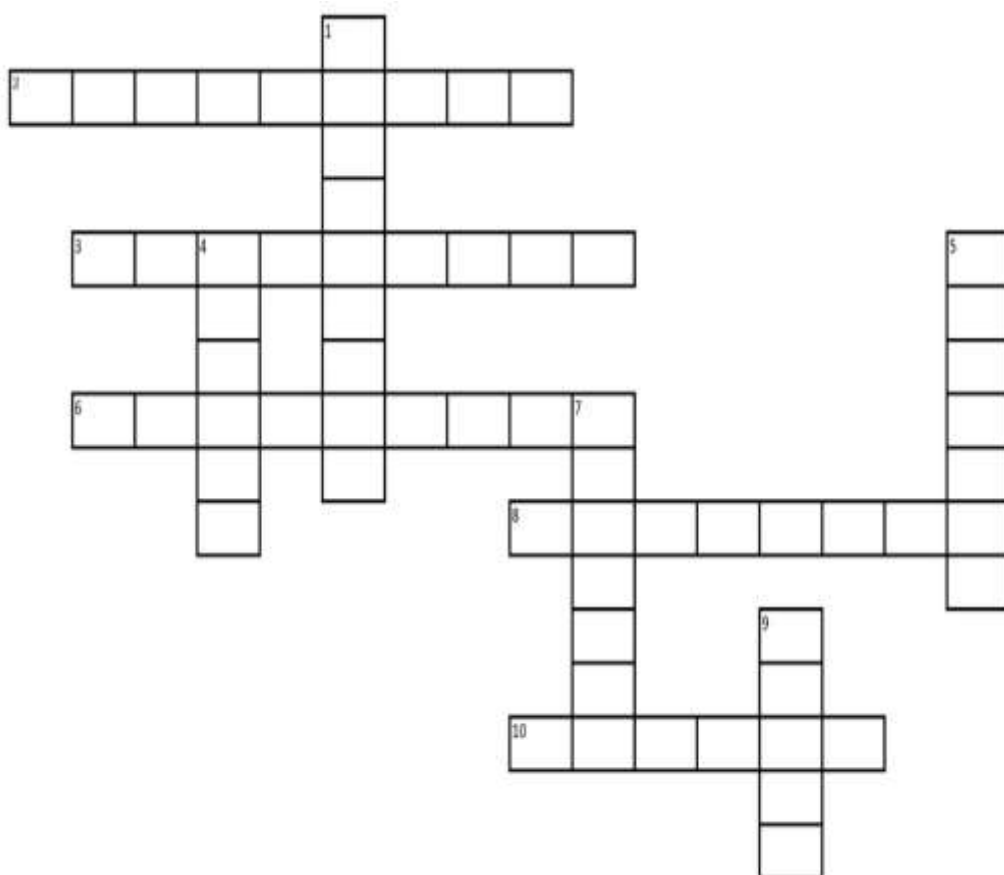
This lesson will help you find out more about the properties of elements. You will see that majority of them are metals, some are non-metals, and few are metalloids.



### ***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

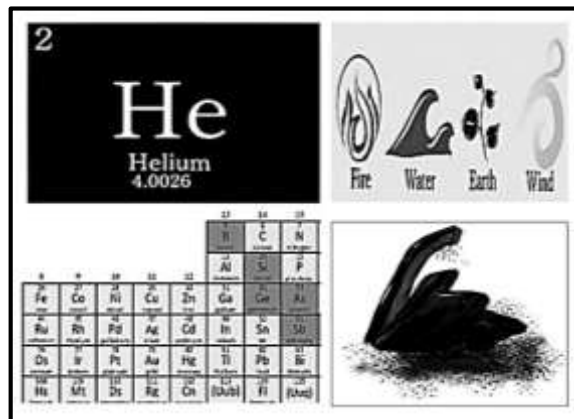


## What's New

### 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.

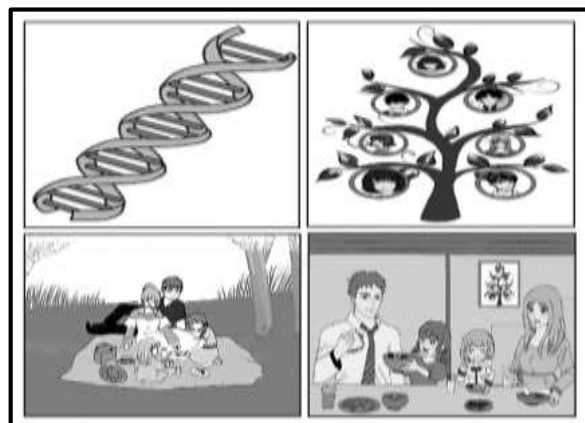
1.



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**E M T**

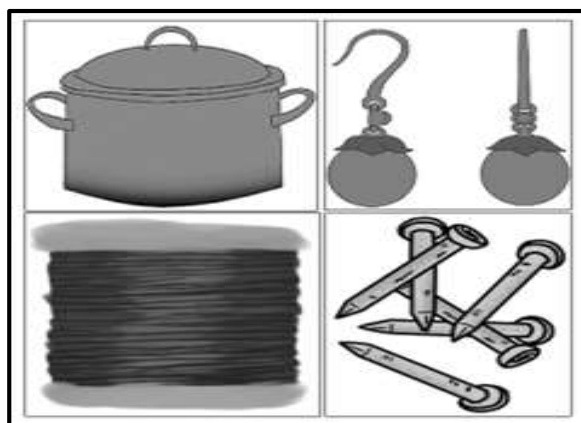
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**P R**

3.



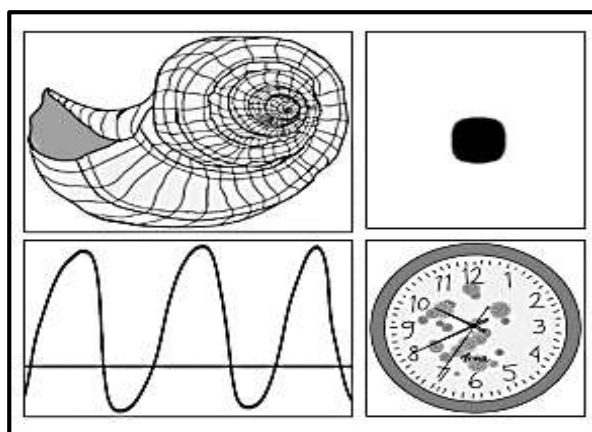
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**M**

**A**

— — — — —

4.



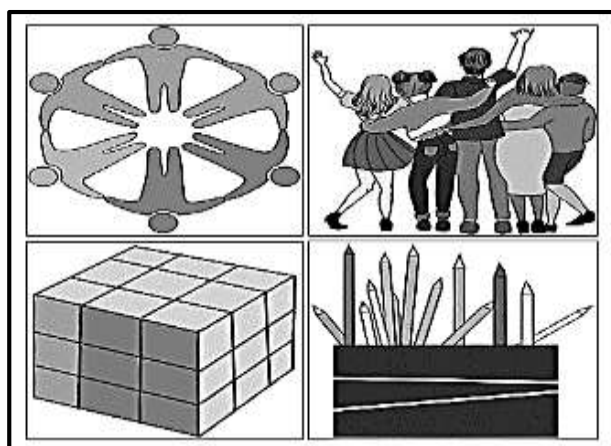
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**P**

**R**

— — — — —

5.



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**G**

**P**

— — — — —



## What is It

### Arrangement of Elements

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

The periodic table is organized into groups (columns) and periods (rows). Groups are labeled with Roman numerals and letters (A, B) at the top. Elements are arranged in order of increasing atomic number. The Lanthanide series (La to Lu) and Actinide series (Ac to Lr) are shown separately below the main table.

*Illustrated by Rosa Mia L. Pontillo*

*Figure 1. The Periodic Table of Elements*

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

The periodic table is shown with a large arrow pointing to the fifth period, which includes elements from Rubidium (Rb) to Xenon (Xe). The Lanthanide series (La to Lu) and Actinide series (Ac to Lr) are also shown below the main table.

*Illustrated by Rosa Mia L. Pontillo*

*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.

1 1A H	2 2A He																	13 3A B	14 4A C	15 5A N	16 6A O	17 7A F	18 8A Ne
3 Li	4 Be																	5 Al	6 Si	7 P	8 S	9 Cl	10 Ar
11 Na	12 Mg	13 Sc	14 Ti	15 V	16 Cr	17 Mn	18 Fe	19 Co	20 Ni	21 Cu	22 Zn	23 Ga	24 Ge	25 As	26 Se	27 Br	28 Kr						
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr						
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe						
55 Cs	56 Ba	57-71 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn						
87 Fr	88 Ra	89-103 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og						

La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Illustrated by Rosa Mia L. Pontillo

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

1	H Hydrogen 1.008
3	Li Lithium 6.941
11	Na Sodium 22.990
19	K Potassium 39.098
37	Rb Rubidium 85.468
55	Cs Cesium 132.905
87	Fr Francium 223.020

Illustrated by Rosa Mia L. Pontillo

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

4	Be Beryllium 9.012
12	Mg Magnesium 24.305
20	Ca Calcium 40.078
38	Sr Strontium 87.62
56	Ba Barium 137.328
88	Ra Radium 226.025

Illustrated by Rosa Mia L. Pontillo

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

5	B Boron 10.811
13	Al Aluminum 26.982
31	Ga Gallium 69.723
49	In Indium 114.818
81	Tl Thallium 204.383
113	Nh Nihonium [284]

Illustrated by Rosa Mia L. Pontillo

Figure 6. Boron Group

### Group 14: Carbon Group

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

6	C Carbon 12.011
14	Si Silicon 28.086
32	Ge Germanium 72.631
50	Sn Tin 118.710
82	Pb Lead 207.2
114	Fl Flerovium [289]

Illustrated by Rosa Mia L. Pontillo

Figure 7. Carbon Group

### Group 15: Nitrogen Group

- known as Pnictogen group
- with five valence electrons

7	N	Nitrogen	14.007
15	P	Phosphorus	30.974
33	As	Arsenic	74.922
51	Sb	Antimony	121.760
83	Bi	Bismuth	208.980
115	Mc	Moscovium	(289)

Illustrated by Rosa Mia L. Pontillo

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

8	O	Oxygen	15.999
16	S	Sulfur	32.065
34	Se	Selenium	78.971
52	Te	Tellurium	127.6
84	Po	Polonium	(209-210)
116	Lv	Livermorium	(293)

Illustrated by Rosa Mia L. Pontillo

Figure 9. The Chalcogen Family

### Group 17: Halogens

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

9	F	Fluorine	18.998
17	Cl	Chlorine	35.453
35	Br	Bromine	79.904
53	I	Iodine	126.904
85	At	Astatine	(210-211)
117	Ts	Tennessine	(294)

Illustrated by Rosa Mia L. Pontillo

Figure 10. The Halogen Family

### Group 18: Noble Gases

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

2	He	Helium	4.003
10	Ne	Neon	20.180
18	Ar	Argon	39.948
36	Kr	Krypton	84.796
54	Xe	Xenon	131.294
86	Rn	Radon	(222-226)
118	Og	Oganesson	(294)

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

3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 9	10 VIII 10	11 IB 1B	12 IIB 2B
21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.703	29 Cu Copper 63.546	30 Zn Zinc 65.38
39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411
57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.084	79 Au Gold 196.967	80 Hg Mercury 200.59
89-103	104 Rf Rutherfordium 261	105 Db Dubnium 262	106 Sg Seaborgium 266	107 Bh Bohrium 264	108 Hs Hassium 277	109 Mt Meitnerium 276	110 Ds Darmstadtium 285	111 Rg Roentgenium 282	112 Cn Copernicium 285

Illustrated by Rosa Mia L. Pontillo

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**.

Lanthanide series	57 La Lanthanum 138.905	58 Ce Cerium 140.12	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.967
Actinide series	89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium 252.083	100 Fm Fermium 257.095	101 Md Mendelevium 258.10	102 No Nobelium 259.101	103 Lr Lawrencium 262

Illustrated by Rosa Mia L. Pontillo

Figure 13. Lanthanides and Actinides Series



## Metals, Nonmetals, and Metalloids

The periodic table is divided into three main regions based on the properties of the elements:

- Metals:** Located on the left side of the periodic table, including elements like Lithium (Li), Sodium (Na), Potassium (K), Calcium (Ca), and Iron (Fe).
- Nonmetals:** Located on the right side of the periodic table, including elements like Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), and Neon (Ne).
- Metalloids:** Located along the diagonal line separating metals and nonmetals, including elements like Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te), and Polonium (Po).

The periodic table also includes the Lanthanide series and Actinide series at the bottom.

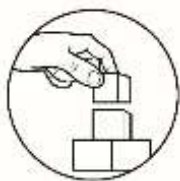
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Figure 14. Location of metals, nonmetals, and metalloids

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.

1 IA H Hydrogen 1.008	2 IIA Li Lithium 6.941	3 III Be Beryllium 9.012	4 Mg Magnesium 24.305	5 Al Aluminum 26.982	6 Si Silicon 28.086	7 P Phosphorus 30.974	8 S Sulfur 32.06	9 Cl Chlorine 35.453	10 Ar Argon 39.948	11 K Potassium 39.098	12 Ca Calcium 40.078	13 Sc Scandium 44.956	14 Ti Titanium 47.88	15 V Vanadium 50.942	16 Cr Chromium 51.996	17 Mn Manganese 54.938	18 Fe Iron 55.845	19 Co Cobalt 58.933	20 Ni Nickel 58.693	21 Cu Copper 63.546	22 Zn Zinc 65.38	23 Ga Gallium 69.723	24 Ge Germanium 72.63	25 As Arsenic 74.922	26 Se Selenium 78.971	27 Br Bromine 79.904	28 Kr Krypton 83.798	29 Rb Rubidium 85.468	30 Sr Strontium 87.62	31 Y Yttrium 88.906	32 Zr Zirconium 91.224	33 Nb Niobium 92.906	34 Mo Molybdenum 95.94	35 Tc Technetium 98.907	36 Ru Ruthenium 101.07	37 Rh Rhodium 102.906	38 Pd Palladium 106.42	39 Ag Silver 107.868	40 Cd Cadmium 112.411	41 In Indium 114.818	42 Sn Tin 118.71	43 Sb Antimony 121.757	44 Te Tellurium 127.6	45 I Iodine 126.905	46 Xe Xenon 131.29	47 Cs Cesium 132.905	48 Ba Barium 137.327	49 La Lanthanum 138.905	50 Ce Cerium 140.12	51 Pr Praseodymium 140.908	52 Nd Neodymium 144.24	53 Pm Promethium 144.913	54 Sm Samarium 150.36	55 Eu Europium 151.964	56 Gd Gadolinium 157.25	57 Tb Terbium 158.925	58 Dy Dysprosium 162.50	59 Ho Holmium 164.930	60 Er Erbium 167.259	61 Tm Thulium 168.934	62 Yb Ytterbium 173.055	63 Lu Lutetium 174.967	64 Fr Francium 223.019	65 Ra Radium 226.025	66 Ac Actinium 227.033	67 Th Thorium 232.038	68 Pa Protactinium 231.036	69 U Uranium 238.029	70 Np Neptunium 237.048	71 Pu Plutonium 244.064	72 Am Americium 243.061	73 Cm Curium 247.070	74 Bk Berkelium 247.070	75 Cf Californium 251.080	76 Es Einsteinium 252.083	77 Fm Fermium 257.085	78 Md Mendelevium 258.10	79 No Nobelium 259.10	80 Lr Lawrencium 262.10	81 Hf Hafnium 178.49	82 Ta Tantalum 180.948	83 W Tungsten 183.85	84 Re Rhenium 186.207	85 Os Osmium 190.23	86 Ir Iridium 192.22	87 Pt Platinum 195.08	88 Au Gold 196.967	89 Hg Mercury 200.59	90 Tl Thallium 204.383	91 Pb Lead 207.2	92 Bi Bismuth 208.980	93 Po Polonium 209	94 At Astatine 210	95 Rn Radon 222.018	96 Ac Actinium 227.028	97 Th Thorium 232.038	98 Pa Protactinium 231.036	99 U Uranium 238.029	100 Np Neptunium 237.048	101 Pu Plutonium 244.064	102 Am Americium 243.061	103 Cm Curium 247.070	104 Bk Berkelium 247.070	105 Cf Californium 251.080	106 Es Einsteinium 252.083	107 Fm Fermium 257.085	108 Md Mendelevium 258.10	109 No Nobelium 259.10	110 Lr Lawrencium 262.10	111 La Lanthanum 138.905	112 Ce Cerium 140.12	113 Pr Praseodymium 140.908	114 Nd Neodymium 144.24	115 Pm Promethium 144.913	116 Sm Samarium 150.36	117 Eu Europium 151.964	118 Gd Gadolinium 157.25	119 Tb Terbium 158.925	120 Dy Dysprosium 162.50	121 Ho Holmium 164.930	122 Er Erbium 167.259	123 Tm Thulium 168.934	124 Yb Ytterbium 173.055	125 Lu Lutetium 174.967	126 Ac Actinium 227.028	127 Th Thorium 232.038	128 Pa Protactinium 231.036	129 U Uranium 238.029	130 Np Neptunium 237.048	131 Pu Plutonium 244.064	132 Am Americium 243.061	133 Cm Curium 247.070	134 Bk Berkelium 247.070	135 Cf Californium 251.080	136 Es Einsteinium 252.083	137 Fm Fermium 257.085	138 Md Mendelevium 258.10	139 No Nobelium 259.10	140 Lr Lawrencium 262.10	141 La Lanthanum 138.905	142 Ce Cerium 140.12	143 Pr Praseodymium 140.908	144 Nd Neodymium 144.24	145 Pm Promethium 144.913	146 Sm Samarium 150.36	147 Eu Europium 151.964	148 Gd Gadolinium 157.25	149 Tb Terbium 158.925	150 Dy Dysprosium 162.50	151 Ho Holmium 164.930	152 Er Erbium 167.259	153 Tm Thulium 168.934	154 Yb Ytterbium 173.055	155 Lu Lutetium 174.967	156 Ac Actinium 227.028	157 Th Thorium 232.038	158 Pa Protactinium 231.036	159 U Uranium 238.029	160 Np Neptunium 237.048	161 Pu Plutonium 244.064	162 Am Americium 243.061	163 Cm Curium 247.070	164 Bk Berkelium 247.070	165 Cf Californium 251.080	166 Es Einsteinium 252.083	167 Fm Fermium 257.085	168 Md Mendelevium 258.10	169 No Nobelium 259.10	170 Lr Lawrencium 262.10	171 La Lanthanum 138.905	172 Ce Cerium 140.12	173 Pr Praseodymium 140.908	174 Nd Neodymium 144.24	175 Pm Promethium 144.913	176 Sm Samarium 150.36	177 Eu Europium 151.964	178 Gd Gadolinium 157.25	179 Tb Terbium 158.925	180 Dy Dysprosium 162.50	181 Ho Holmium 164.930	182 Er Erbium 167.259	183 Tm Thulium 168.934	184 Yb Ytterbium 173.055	185 Lu Lutetium 174.967	186 Ac Actinium 227.028	187 Th Thorium 232.038	188 Pa Protactinium 231.036	189 U Uranium 238.029	190 Np Neptunium 237.048	191 Pu Plutonium 244.064	192 Am Americium 243.061	193 Cm Curium 247.070	194 Bk Berkelium 247.070	195 Cf Californium 251.080	196 Es Einsteinium 252.083	197 Fm Fermium 257.085	198 Md Mendelevium 258.10	199 No Nobelium 259.10	200 Lr Lawrencium 262.10	201 La Lanthanum 138.905	202 Ce Cerium 140.12	203 Pr Praseodymium 140.908	204 Nd Neodymium 144.24	205 Pm Promethium 144.913	206 Sm Samarium 150.36	207 Eu Europium 151.964	208 Gd Gadolinium 157.25	209 Tb Terbium 158.925	210 Dy Dysprosium 162.50	211 Ho Holmium 164.930	212 Er Erbium 167.259	213 Tm Thulium 168.934	214 Yb Ytterbium 173.055	215 Lu Lutetium 174.967	216 Ac Actinium 227.028	217 Th Thorium 232.038	218 Pa Protactinium 231.036	219 U Uranium 238.029	220 Np Neptunium 237.048	221 Pu Plutonium 244.064	222 Am Americium 243.061	223 Cm Curium 247.070	224 Bk Berkelium 247.070	225 Cf Californium 251.080	226 Es Einsteinium 252.083	227 Fm Fermium 257.085	228 Md Mendelevium 258.10	229 No Nobelium 259.10	230 Lr Lawrencium 262.10	231 La Lanthanum 138.905	232 Ce Cerium 140.12	233 Pr Praseodymium 140.908	234 Nd Neodymium 144.24	235 Pm Promethium 144.913	236 Sm Samarium 150.36	237 Eu Europium 151.964	238 Gd Gadolinium 157.25	239 Tb Terbium 158.925	240 Dy Dysprosium 162.50	241 Ho Holmium 164.930	242 Er Erbium 167.259	243 Tm Thulium 168.934	244 Yb Ytterbium 173.055	245 Lu Lutetium 174.967	246 Ac Actinium 227.028	247 Th Thorium 232.038	248 Pa Protactinium 231.036	249 U Uranium 238.029	250 Np Neptunium 237.048	251 Pu Plutonium 244.064	252 Am Americium 243.061	253 Cm Curium 247.070	254 Bk Berkelium 247.070	255 Cf Californium 251.080	256 Es Einsteinium 252.083	257 Fm Fermium 257.085	258 Md Mendelevium 258.10	259 No Nobelium 259.10	260 Lr Lawrencium 262.10	261 La Lanthanum 138.905	262 Ce Cerium 140.12	263 Pr Praseodymium 140.908	264 Nd Neodymium 144.24	265 Pm Promethium 144.913	266 Sm Samarium 150.36	267 Eu Europium 151.964	268 Gd Gadolinium 157.25	269 Tb Terbium 158.925	270 Dy Dysprosium 162.50	271 Ho Holmium 164.930	272 Er Erbium 167.259	273 Tm Thulium 168.934	274 Yb Ytterbium 173.055	275 Lu Lutetium 174.967	276 Ac Actinium 227.028	277 Th Thorium 232.038	278 Pa Protactinium 231.036	279 U Uranium 238.029	280 Np Neptunium 237.048	281 Pu Plutonium 244.064	282 Am Americium 243.061	283 Cm Curium 247.070	284 Bk Berkelium 247.070	285 Cf Californium 251.080	286 Es Einsteinium 252.083	287 Fm Fermium 257.085	288 Md Mendelevium 258.10	289 No Nobelium 259.10	290 Lr Lawrencium 262.10	291 La Lanthanum 138.905	292 Ce Cerium 140.12	293 Pr Praseodymium 140.908	294 Nd Neodymium 144.24	295 Pm Promethium 144.913	296 Sm Samarium 150.36	297 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258.10	379 No Nobelium 259.10	380 Lr Lawrencium 262.10	381 La Lanthanum 138.905	382 Ce Cerium 140.12	383 Pr Praseodymium 140.908	384 Nd Neodymium 144.24	385 Pm Promethium 144.913	386 Sm Samarium 150.36	387 Eu Europium 151.964	388 Gd Gadolinium 157.25	389 Tb Terbium 158.925	390 Dy Dysprosium 162.50	391 Ho Holmium 164.930	392 Er Erbium 167.259	393 Tm Thulium 168.934	394 Yb Ytterbium 173.055	395 Lu Lutetium 174.967	396 Ac Actinium 227.028	397 Th Thorium 232.038	398 Pa Protactinium 231.036	399 U Uranium 238.029	400 Np Neptunium 237.048	401 Pu Plutonium 244.064	402 Am Americium 243.061	403 Cm Curium 247.070	404 Bk Berkelium 247.070	405 Cf Californium 251.080	406 Es Einsteinium 252.083	407 Fm Fermium 257.085	408 Md Mendelevium 258.10	409 No Nobelium 259.10	410 Lr Lawrencium 262.10	411 La Lanthanum 138.905	412 Ce Cerium 140.12	413 Pr Praseodymium 140.908	414 Nd Neodymium 144.24	415 Pm Promethium 144.913	416 Sm Samarium 150.36	417 Eu Europium 151.964	418 Gd Gadolinium 157.25	419 Tb Terbium 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237.048	461 Pu Plutonium 244.064	462 Am Americium 243.061	463 Cm Curium 247.070	464 Bk Berkelium 247.070	465 Cf Californium 251.080	466 Es Einsteinium 252.083	467 Fm Fermium 257.085	468 Md Mendelevium 258.10	469 No Nobelium 259.10	470 Lr Lawrencium 262.10	471 La Lanthanum 138.905	472 Ce Cerium 140.12	473 Pr Praseodymium 140.908	474 Nd Neodymium 144.24	475 Pm Promethium 144.913	476 Sm Samarium 150.36	477 Eu Europium 151.964	478 Gd Gadolinium 157.25	479 Tb Terbium 158.925	480 Dy Dysprosium 162.50	481 Ho Holmium 164.930	482 Er Erbium 167.259	483 Tm Thulium 168.934	484 Yb Ytterbium 173.055	485 Lu Lutetium 174.967	486 Ac Actinium 227.028	487 Th Thorium 232.038	488 Pa Protactinium 231.036	489 U Uranium 238.029	490 Np Neptun
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## ***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**

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**B. Metals**

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## 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.

Periodic Table of the Elements																																																																																																			
<div>Atomic Number</div> <div>Symbol</div> <div>Name</div> <div>Atomic Mass</div>																																																																																																			
<table><tr><td>1</td><td>2</td><td colspan="14"></td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr><tr><td>IA</td><td>IIA</td><td colspan="14"></td><td>IIIA</td><td>IVA</td><td>VA</td><td>VIA</td><td>VIIA</td><td>VIIIA</td></tr><tr><td>1A</td><td>2A</td><td colspan="14"></td><td>3A</td><td>4A</td><td>5A</td><td>6A</td><td>7A</td><td>8A</td></tr></table>																		1	2															13	14	15	16	17	18	IA	IIA															IIIA	IVA	VA	VIA	VIIA	VIIIA	1A	2A															3A	4A	5A	6A	7A	8A																
1	2															13	14	15	16	17	18																																																																														
IA	IIA															IIIA	IVA	VA	VIA	VIIA	VIIIA																																																																														
1A	2A															3A	4A	5A	6A	7A	8A																																																																														
<table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr><tr><td>H</td><td>He</td><td>Li</td><td>Be</td><td>B</td><td>C</td><td>N</td><td>O</td><td>F</td><td>Ne</td><td>Na</td><td>Mg</td><td>Al</td><td>Si</td><td>P</td><td>S</td><td>Cl</td><td>Ar</td></tr><tr><td>Hydrogen</td><td>Helium</td><td>Lithium</td><td>Beryllium</td><td>Boron</td><td>Carbon</td><td>Nitrogen</td><td>Oxygen</td><td>Fluorine</td><td>Neon</td><td>Sodium</td><td>Magnesium</td><td>Aluminum</td><td>Silicon</td><td>Phosphorus</td><td>Sulfur</td><td>Chlorine</td><td>Argon</td></tr><tr><td>1.008</td><td>4.003</td><td>6.941</td><td>9.012</td><td>10.811</td><td>12.011</td><td>14.007</td><td>15.999</td><td>18.998</td><td>20.180</td><td>22.990</td><td>24.305</td><td>26.981</td><td>28.086</td><td>30.974</td><td>32.06</td><td>35.453</td><td>39.948</td></tr></table>																		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	H	He	Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar	Hydrogen	Helium	Lithium	Beryllium	Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon	Sodium	Magnesium	Aluminum	Silicon	Phosphorus	Sulfur	Chlorine	Argon	1.008	4.003	6.941	9.012	10.811	12.011	14.007	15.999	18.998	20.180	22.990	24.305	26.981	28.086	30.974	32.06	35.453	39.948										
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(Source: <https://sciencenotes.org/periodic-table-black-white-wallpaper>)

### Questions:

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

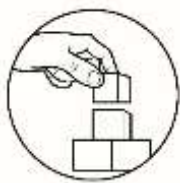
### The Activity Series of Metals

<u>Element</u>	<u>Symbol</u>	<u>Group No.</u>	
Potassium	K	1	<div>Most reactive</div> <div>↓</div> <div>Decreasing chemical reactivity</div> <div>↑</div> <div>Least reactive</div>
Sodium	Na	1	
Lithium	Li	1	
Calcium	Ca	2	
Magnesium	Mg	2	
Aluminum	Al	3	
Zinc	Zn	Transition metal	
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	

### 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<sub>2</sub>O). 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 | 6. Na with H <sub>2</sub> O |
| 2. Ag with HCl | 7. Cu with H <sub>2</sub> O |
| 3. Cu with HCl | 8. Sn with H <sub>2</sub> O |
| 4. Au with HCl | 9. Pt with H <sub>2</sub> O |
| 5. Na with HCl | 10. K with H <sub>2</sub> O |
| 5. Na with HCl |                             |

### 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. <b>Iron (III)</b> oxide	Magnesium	
2. <b>Copper (II)</b> sulfate	Zinc	
3. Potassium	<b>Aluminum</b> nitrate	
4. Gold	<b>Silver</b> chloride	
5. Calcium	<b>Sodium</b> 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?

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

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## Answer Key

### Lesson 1

**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'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's New**

Activity 2.

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

**What's More**

Activity 3.

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

**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

## Lesson 2

**What's In**  
Activity 5.

A. Boron  
Germanium  
Antimony  
Silicon  
Astatine

B. Iron  
Magnesium  
Silver  
Nickel  
Lithium

**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 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 I Have Learned**

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

**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.

**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

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