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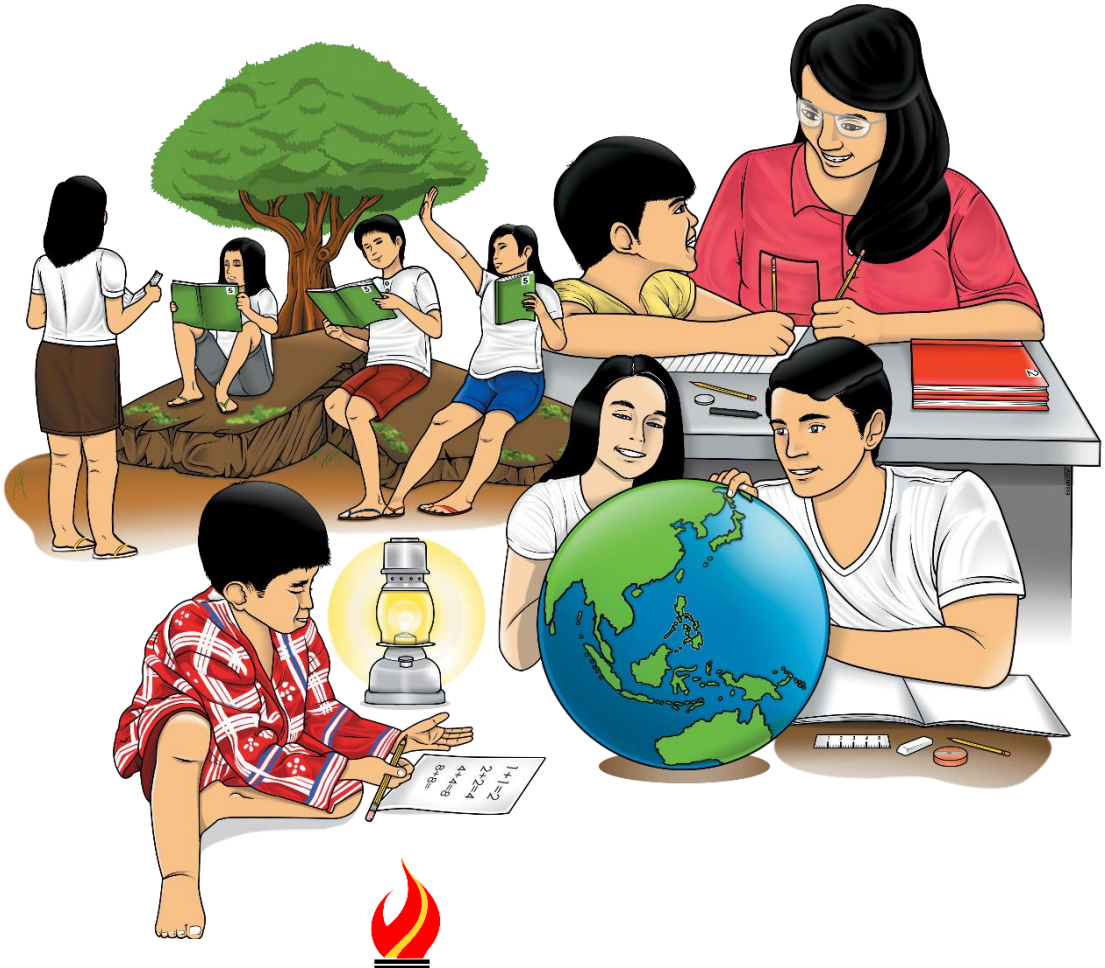
Science

Quarter 3 - Module 3:
Atoms - Inside Out



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Science

Quarter 3 – Module 3:
Atoms – Inside Out

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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

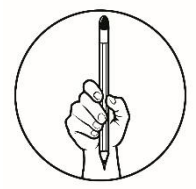
This module was designed and written with you in mind. It is here to help you master the nature of atomic structure. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to 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 is divided into three lessons, namely:

- **Lesson 1** – The Properties of Subatomic Particles
- **Lesson 2** – Plum Pudding and Nuclear Models of the Atom
- **Lesson 3** – The Number of Subatomic Particles in Atoms, Ions and Isotopes

After going through this module, you are expected to:

1. Name and describe the structure of atoms, including its mass, and locations of protons, neutrons, and electrons inside an atom;
2. Identify the electric charge of an atom and its subatomic particles;
3. Locate the atomic number in a periodic table of elements;
4. Identify the subatomic particles associated with mass number;
5. Determine the number of neutrons from the mass number;
6. Interpret shorthand notations for isotopes and atoms;
7. Infer that ions are formed from the removal or addition of electron/s;
8. Evaluate the net electric charge of an atom; and
9. Determine the number of protons, neutrons, and electrons in a particular atom. *(MELC Week 5-6 S8MT-IIIe-f-10)*



What I Know

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

1. Which subatomic particle is negatively charged?
   A. electron
   B. neutron
   C. positron
   D. proton

2. Which subatomic particles can be found in the nucleus of an atom?
   A. protons only
   B. neutrons only
   C. protons and electrons
   D. protons and neutrons

3. Which of the following is true when comparing the size and mass of the nucleus in reference to the entire atom? The nucleus is
   A. larger and contains little of the atom's mass.
   B. larger and contains most of the atom's mass.
   C. smaller and contains little of the atom's mass.
   D. smaller and contains most of the atom's mass.

4. Which subatomic particle has no charge?
   A. electron
   B. neutron
   C. positron
   D. proton

5. Who is the proponent of the "Plum Pudding Model" of an atom?
   A. Niels Bohr
   B. John Dalton
   C. Ernest Rutherford
   D. Joseph John Thomson

6. Which experiment proved that nucleus is dense and is positively charged?
   A. oil drop experiment
   B. gold foil experiment
   C. nuclear fission experiment
   D. cathode ray tube experiment

7. What happened to most of the alpha particles in Rutherford's experiments?
   A. They combined with the foil.
   B. They passed through the foil.
   C. They were absorbed by the foil.
   D. Most alpha particles were undeflected.

8. The nucleus accounts practically all the mass of an atom and possess a positive charge. Which statement explains why a nucleus has these properties?
   A. It is made of only protons.
   B. It is made of protons and electrons.
   C. It is made of protons and neutrons.
   D. It is made of neutrons and electrons.

9. In describing the atoms of a given element, which of the following is true when the number and type of particles are being considered?
   A. having the same mass number
   B. having the same number of protons
   C. having the same number of neutrons
   D. having equal number of protons and neutrons

10. An element has atomic number equal to 84 and a mass number of 210. Which of the following will correctly describe the element in terms of the number and type of particles present?
   A. 84 protons and 84 neutrons
   B. 84 protons and 210 neutrons
   C. 84 protons and 126 neutrons
   D. 84 protons and 126 electrons

11. What happens to the charge of an atom when it loses an electron?
   A. It remains neutral.
   B. It becomes positive.
   C. It becomes negative.
   D. It remains the same.

12. The element aluminum possesses 14 neutrons and 13 protons. What will be its mass number in the form of aluminum ion, Al^{3+}?
   A. 16
   B. 17
   C. 27
   D. 30

13. An atom X contains 30 protons, 35 neutrons and 31 electrons. Which of the following is the correct isotopic symbol for this atom?
   A. ${}^{30}_{65}X$
   B. ${}^{65}_{31}X$
   C. ${}^{65}_{30}X$
   D. ${}^{66}_{35}X$

14. In terms of subatomic particle composition, which of the following pairs are said to be isotopes?
    A. (24p, 24e, 24n) and (25p, 25e, 25n)
    B. (24p, 24e, 24n) and (24p, 24e, 28n)
    C. (24p, 24e, 28n) and (25p, 25e, 28n)
    D. (24p, 25e, 28n) and (25p, 25e, 26n)

15. Why are atoms considered as electrically neutral?
    A. It is because all atoms contain neutrons.
    B. It is because there is an equal number of protons and electrons.
    C. It is because all subatomic particles lose their charges once they enter an atom.
    D. It is because the number of subatomic particles in the nucleus is always an even number.

Lesson 1 Properties of Subatomic Particles

Atoms are present at the most basic level in everything we see around us. In fact, all living organisms as well as non-living things are composed of atoms. All matter is made up of atoms.

What's In

Activity 1. Everything is a Pile of Atoms

Objective: Explain that atoms are the smallest particles of matter and are made up of protons, neutrons and electrons

Directions: Look at the picture of an apple below. Slice an apple in two parts, and then slice the resulting halves into many slices. Answer the questions that follow. Write your answers on a separate sheet of paper.

Photo credits: Esperanza C. Lachica

Questions:

1. Are the smaller pieces of apple still similar to the original apple? Why?

   _____

2. Can you still slice these pieces into smaller ones?

   _____

3. Is it possible to keep on slicing and dividing these pieces? Why?

   _____

4. After slicing the apple many times, how can you be sure that this is still the same apple?

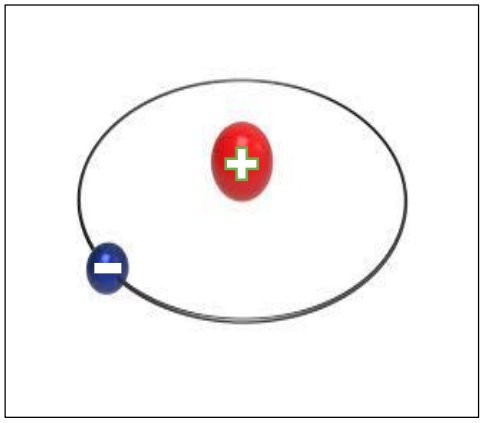
   _____

What's New

Activity 2. Charge It

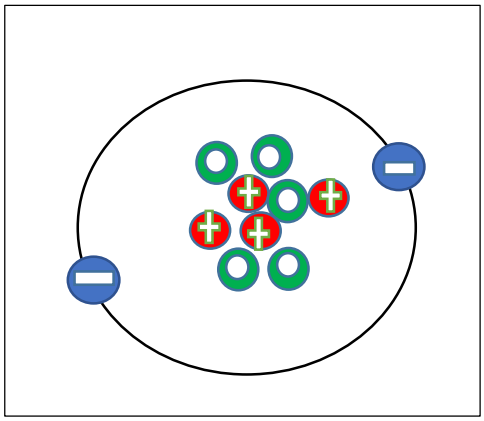
Directions: Study the drawings and answer the questions below. Write your answers on a separate sheet of paper.

Atom A



+ Proton
- Electron
0 Neutron

Atom B



Illustrated by: Esperanza C. Lachica

Questions:

1. How many protons are there in atom A? ____ What about in atom B? _____
2. How many electrons are there in atom A? ____ What about in atom B? _____
3. How many neutrons are there in atom A? ____ What about in atom B? _____

What is It

Subatomic Particles

Have you ever wondered what everything around you is made of?

Everything around us is made up of tiny particles called atoms.

What is an atom?

The word "atom" is derived from the Greek word, "atomos" or indivisible. Atom is the smallest unit of matter that retains the identity of the substance. Atom is thought to be the smallest particle of a given element.

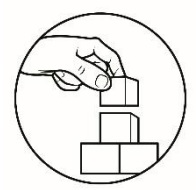
What are the subatomic particles and their properties?

Atoms are composed of three types of particles and these are the **protons, electrons, and neutrons**. These components of the atom are referred as **subatomic particles.** Table 1 shows the properties of these subatomic particles. The nucleus, which is found at the center of the atom contains protons (positively charged) and neutrons (no charge). The outermost regions of the atom contain the electrons (negatively charged).

Table 1. Properties of the three subatomic particles

Subatomic particle (symbol)	Charge	Mass in grams	Location in the atom
Electron (e^-)	-1	9.109×10^{-28}	Outside the nucleus
Proton (p^+)	+1	1.672×10^{-24}	In the nucleus
Neutron (n^0)	0	1.678×10^{-24}	In the nucleus

Atoms in their stable state are neutral; its number of protons and electrons are equal. The mass of an atom is solely due to the mass of the proton and neutron. The protons and neutrons are referred as **nucleons**. The **nucleons** which are tightly packed together, form the nucleus within the center of the atom. Thus, much of the mass of an atom is concentrated at the nucleus.

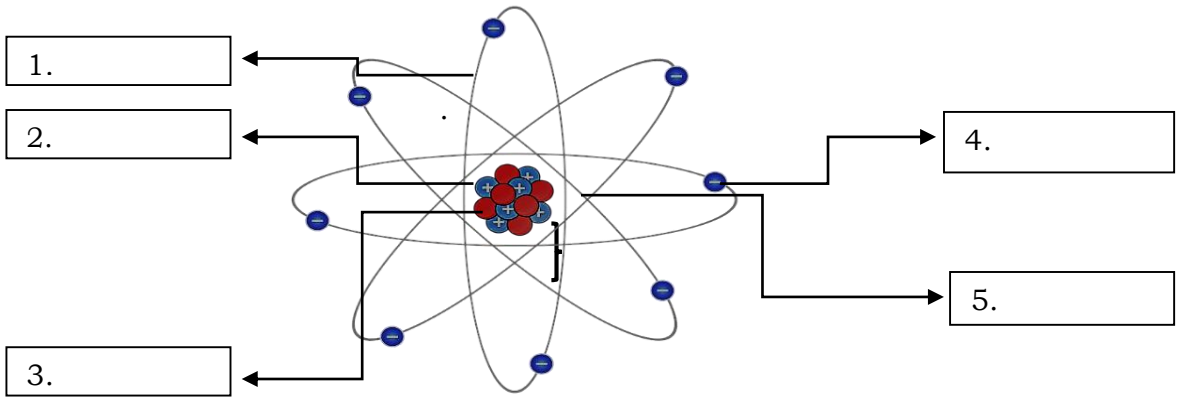


What's More

Activity 3. All About Atoms

Directions: Label the diagram by writing the correct term from the word bank. Write your answers on a separate sheet of paper.

Word Bank				
Nucleus	Proton	Electron	Neutron	Electron shell



Illustrated by: Esperanza C. Lachica

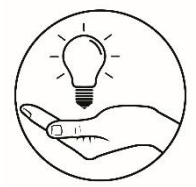
6. Which particle of an atom has a negative electric charge? _____

7. Which particle of the atom contains no electric charge? _____

8. Which particle of the atom features a positive electric charge? _____

Which two subatomic particles are located within the nucleus of an atom?

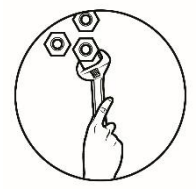
(9) _____ and (10) _____



What I Have Learned

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

An atom is 1. _____ in shape. It has three subatomic particles namely, the electrons, protons, and neutrons. A proton possesses 2. _____ charge. On the other hand, an electron is 3. _____ charged while neutron is said to be 4. _____. The lightest among the subatomic particles is the 5. _____ while the heaviest is the 6. _____ . Electrons can be found 7. _____ the nucleus while the protons and neutrons can be found 8. _____ in the nucleus. The nucleus is the 9. _____ part of the atom. The charge of the nucleus is 10. _____.



What I Can Do

Electric charge is a fundamental electrical property that is either of positive or negative type to which the mutual attractions or repulsions between protons or electrons is attributed. **Conductors** are materials that allow electrons to flow freely from atom to atom.

In contrast, **insulators** are materials that prevent the free flow of electrons from atom to atom. Electrical cords are usually made with both conductors and insulators.

Directions: Identify the word using the jumbled letters inside the parenthesis. Write your answers on a separate sheet of paper.

Examples of metals that are conductors:

1. _____ (IORN)
2. _____ (CPPOER)
3. _____ (AULIMUNM)

Examples of insulators:

4. _____ (RBBEUR)
5. _____ (WDOO)

Lesson 2 Plum Pudding and Nuclear Models of the Atom

The development of the atomic theory began with intuitive thought, when early Greek philosophers pondered on the nature of matter. It took centuries to develop a complete picture of the atom. There had been various models suggested at different periods of time. These **models** represent concrete expressions of theoretical assumptions. In this lesson, you will learn the most significant discoveries of the structure of the atom which led to creation of the two models of the atom.

What's In

Directions: Identify which subatomic particles match each of these descriptions. In one of the numbers, the answer box will have more than one answer.

Description	Particle(s)
1. They have a relative charge of +1	
2. They have a relative charge of -1	
3. They have no charge	
4. Located in the nucleus of an atom	
5. They have a much lower mass than the other two types of particles	

electron

proton

neutron

What's New

Activity 1. Small but Terrible

Objective: After performing the activity, you should be able to describe Thomson's Plum Pudding Model of the atom.

Have you eaten a watermelon? Did you notice the seeds that are embedded inside the fruit? Don't you know that Thomson's atomic model can be compared to a watermelon fruit with seeds described as the negatively-charged particles called **electrons**?

Procedure:

1. Look at the picture of a watermelon below. This will serve as your model of an atom.
2. Label the parts of an atom based on Thomson's atomic model.

Photo credits: Mary Lou A. Abamongga

Questions:

1. What does the whole watermelon fruit represent? _____
2. What do the seeds inside the watermelon fruit represent? _____

Activity 2. Beyond Our Imagination!

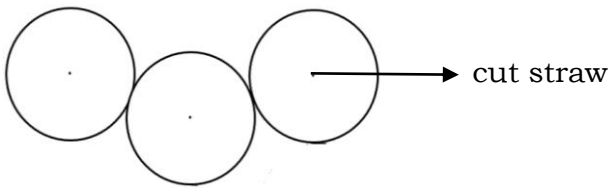
Objective: After performing the activity, you should be able to explain the Rutherford's Nuclear Model of an atom.

Materials:

a piece of bond paper (any size)	small stick / pencil / pen
small glass	drinking straw

Procedure:

1. Use the mouth of a small glass as your guide in drawing circles in a bond paper following the illustration below.

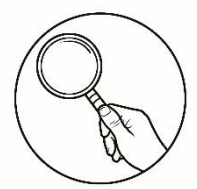


Illustrated by: Mary Lou A. Abamongga

2. Cut the straw into circular shapes. Paste the cut straw at the center of each drawn circle.
3. Place the bond paper on the floor with the drawn circles facing up.
4. Get a pen or small stick. Stand in front of the bond paper. Drop the pen or small stick to the circles of the bond paper.
5. If you are using a small stick, mark with a pencil or ballpen the part hit by the stick. Perform five (5) trials for each circle.

Questions:

1. What do you observe? What happened to the pen when it hit the plastic straw? _____
2. Where can you see most of the pen's markings? _____ _____



What is It

What did Joseph John Thomson discover? What is his atomic model called?

When the idea of the atom was first proposed by the ancient Greeks, they thought it was a particle with no parts. However, towards the 19th century, Joseph John Thomson discovered that atoms have negatively-charged particles, which he called **electrons**. This led him to propose a new model for the atom, which he called the **plum pudding model**.

Thomson proposed that the negatively-charged electrons were embedded in a cloud of positive charge, as shown in Figure 1. Since plums and puddings are not commonly known in the Philippines, it may work better for you to use the other name for the model, the **raisin bread model** or a watermelon fruit model.

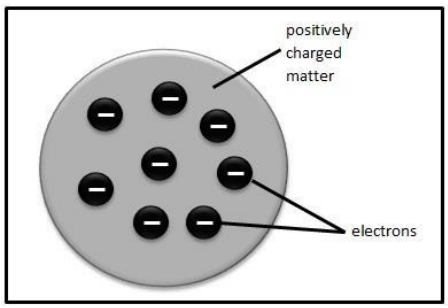


Figure 1. Plum Pudding Model

Source: Dept. of Education. Science & Technology III: Chemistry Textbook. Reprint edition, 2009

What is Rutherford's Nuclear Model?

A group of scientists composed of Ernest Rutherford, Johannes "Hans" Wilhelm Geiger and Ernest Marsden tested Thomson's model by bombarding a very thin sheet of gold foil with positively-charged alpha particles. Their experiment is referred to as the **alpha particle scattering** experiment.

Using a setup similar to Figure 2 below, Rutherford and his coworkers, after doing a series of experiments, observed the following:

- Most alpha particles were undeflected.
- Some are deflected at smaller angles.
- Few alpha particles deflected almost back towards the source.

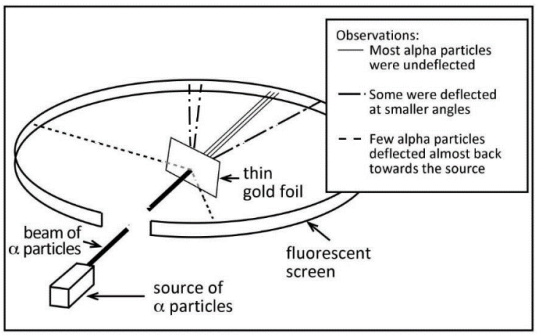


Figure 2. Gold foil experiment

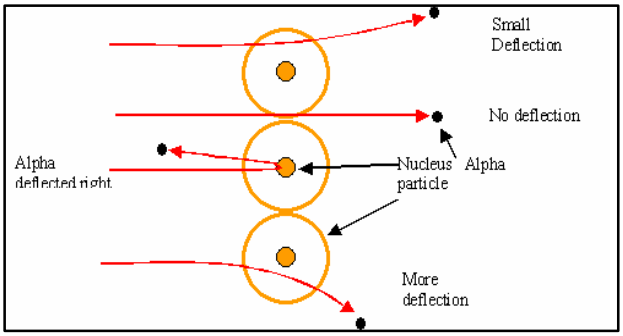


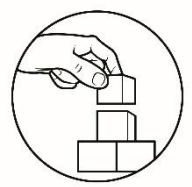
Figure 3. Rutherford's interpretations of the gold foil experiment results

Source: Department of Education, Project EASE, Module 10 Chemistry.

The particles in the atoms of the gold foil led Rutherford's team to propose another model called the nuclear atom.

In the raisin bread model, the electrons having a very small mass, are scattered in a cloud of positive charge. In this region where the electrons are found, there was no area with a similar charge to the alpha particles that can be found that can cause its deflection. To account for the few deflections and the rare occasions of very large deflections, Rutherford, in 1911, suggested a different structure of the atom where all the positive charge and nearly all the mass of the atom were concentrated in a very tiny region called the **nucleus,** which is found at the center of the atom. The rest of the atom, where the tiny electrons with very small mass moved, was largely empty space through which the alpha particles could travel undeflected.

This model replaced the one proposed by Thomson and is the model that we hold to this time, with respect to the placement of the nucleus in the atom.



What's More

Directions: Below is a representation of Rutherford's gold foil experiment. The paths of the alpha particles are represented with arrows. Use the diagram to answer the following questions. Write your answers in a separate sheet of paper.

1. Which of the following paths was most likely to occur?
   A. Path 1
   B. Path 2
   C. Path 3
   D. Path 4

2. Which of the following paths was least likely to occur?
   A. Path 1
   B. Path 2
   C. Path 3
   D. Path 4

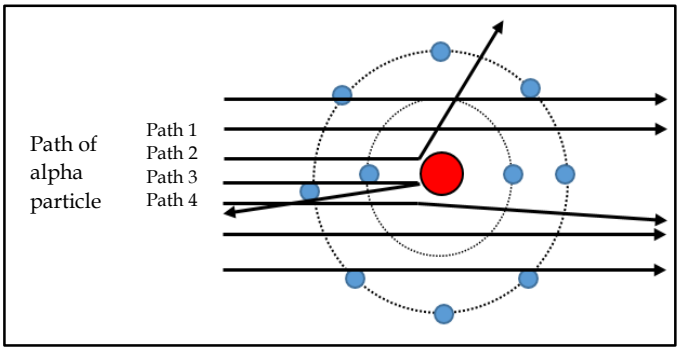


Figure 4. Rutherford's gold foil experiment representations

Illustrated by: Mary Lou A. Abamongga

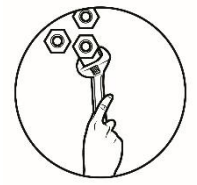
3. The charge on an alpha particle is positive. Based on this information, what must be the charge of the nucleus?
   A. neutral
   B. positive
   C. negative
   D. both positive and negative

4. According to Rutherford's experiment, the atom is composed largely of _____.
   A. empty space
   B. alpha particles
   C. a charged nucleus
   D. cannot be determined

What I Have Learned

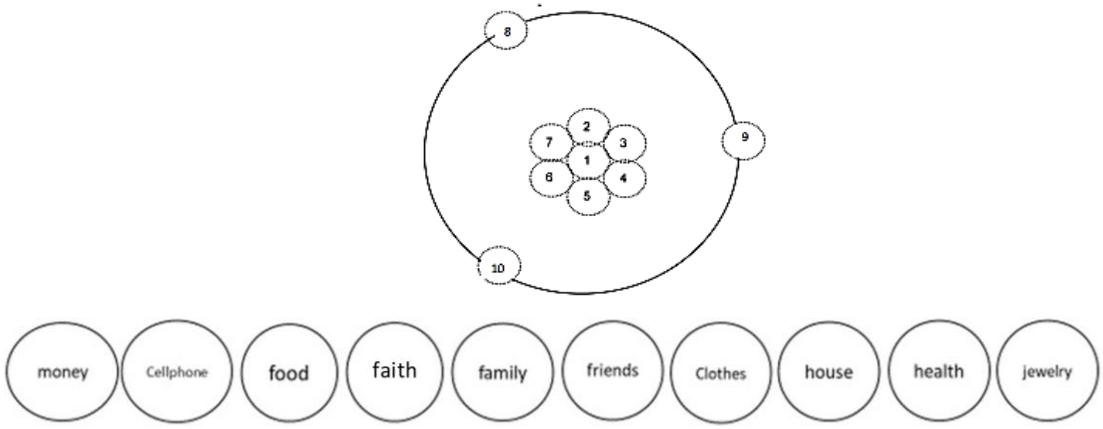
Directions: Fill in the blanks with the correct answer. Write your answers on a separate sheet of paper.

1. Towards the 19th century, Joseph John Thomson was able to discover that atoms have negatively charged particles, which he called _____. It led him to propose a new model for the atom, which he called the _____ model of the atom.
2. In the plum pudding model of the atom, negatively charged electrons were embedded in a cloud of _____ charge.
3. Ernest Rutherford and his team performed the _____experiment to test the model of Joseph John Thomson. They fired alpha particles on a thin sheet of gold foil.
4. Observations in the gold foil experiment are the following:
   - o Most of the alpha rays just _____ through the gold foil.
   - o A small portion of the alpha particles was deflected.
   - o An even smaller portion of the alpha particles bounced right back.
5. These observations suggested a different structure of the atom where all the positive charge and nearly all the mass of the atom were concentrated in a very tiny region called the _____ at the center of the atom.
6. The new model of the structure of the atom is called the _____. This model describes the atom as having a nucleus at its center.



What I Can Do

Directions: Below is a blank representation of an atom. If you compare your life to an atom, what will be the things/areas that you will place in the center of your life? Complete the atomic model below by placing the areas/things in your life either in the center or at the sides of the circle. Suggested answers are written inside the small circles below that serve as the subatomic particles.



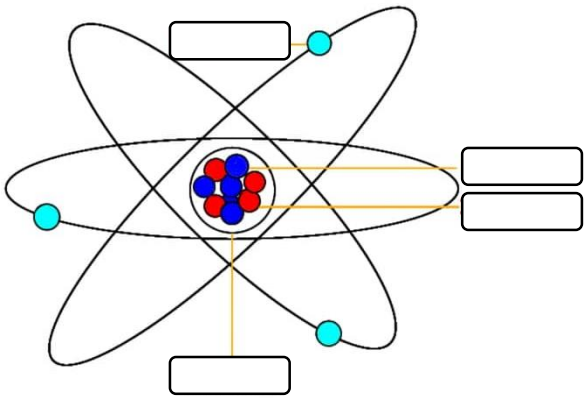
Illustrated by: Mary Lou A. Abamongga

Lesson 3 The Number of Subatomic Particles in Atoms, Ions and Isotopes

Previously, you have learned about the three subatomic particles; protons, electrons and neutrons; and how these are arranged in the currently accepted model of the atom. All atoms of an element contain the same number of protons in their nuclei. The number of protons in an atom of a given element is referred as **atomic number**, designated as **Z**. The number of protons must be equal to the number of electrons in an electrically neutral atom. However, when the number of protons and electrons is not equal, **ions** are formed.

What's In

A. Label the **proton, neutron**, and **electron** in the nuclear model of an atom. Place your answers in the box provided.



Illustrated by: Jeannie Janeth S. Antigro

B. Match the three subatomic particles of an atom in Column A to its charges in Column B.

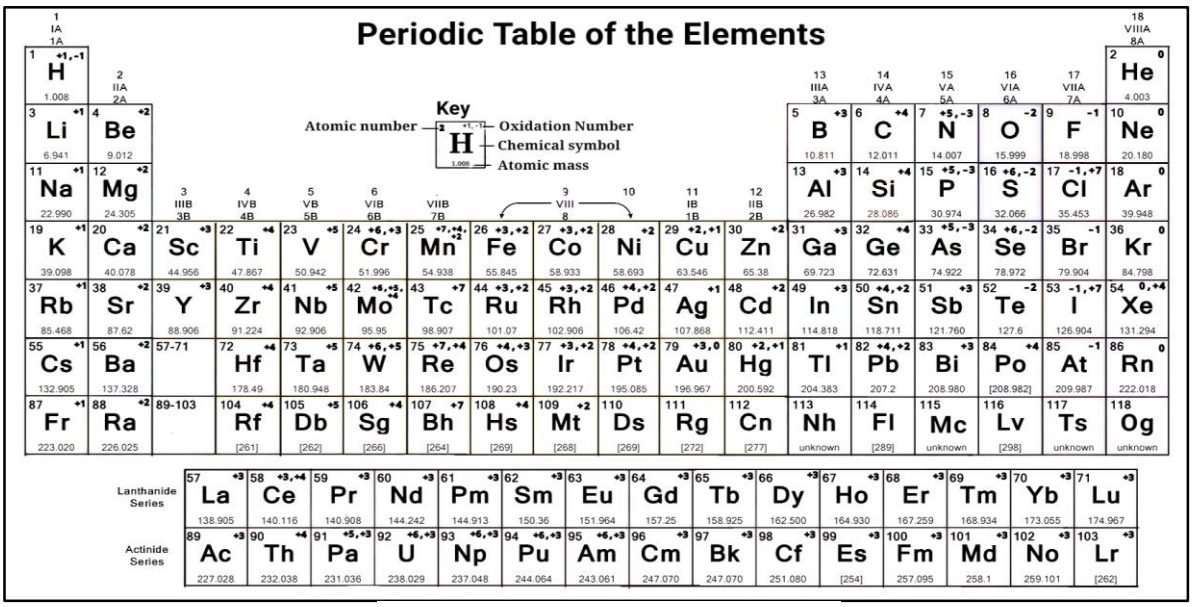
Column A	**Column B**
___ 1) proton	a) no charge/ zero charge (0)
___ 2) electron	b) positive charge (+)
___ 3) neutron	c) negative charge (-)

What's New

Activity 1. Find Me!

Materials: Periodic table, pen/pencil, and paper

Procedure: Refer to the periodic table below. Locate the **atomic number** and answer the questions on the next page. Write your answers on a separate sheet of paper.



Illustrated by: Jeannie Janeth S. Antigro

Questions:

1. What is the element with an atomic number of 15? _____
2. How many protons does the atom of this element have? _____
3. How many electrons are there in an atom of aluminum (Al)? _____
4. Among the elements in the periodic table, which has the smallest number of proton? _____

What is It

What are neutral atoms?

A single atom is said to be electrically neutral if its number of electrons (e^-) is equal to the number of protons (p^+). Thus, the atomic number (Z) of an element also specifies the number of electrons in neutral atom. Mathematically, for a neutral atom, $Z = p^+ = e^-$. Notice the atomic structure in Figure 6 on the next page. Do they have equal number of protons and electrons?

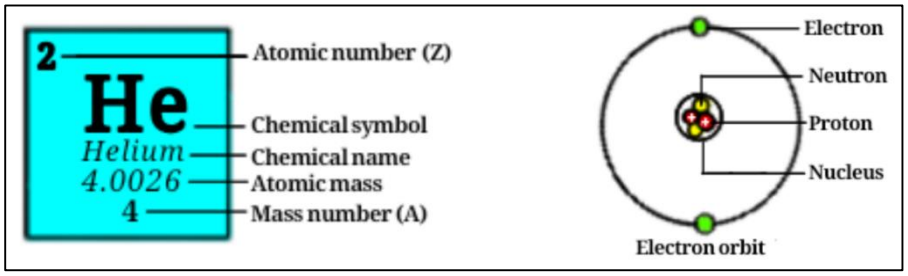


Figure 6. Symbol of Helium atom (left) and its atomic structure (right)
Illustrated by: Jeannie Janeth S. Antigro

Since the mass of an atom is concentrated in the nucleus, the *mass number* designated as ***A*** is equal to the sum of the masses of the protons and neutrons. That is,

Mass number (*A*) = number of protons (p^+) + number of neutrons (n^0)

For neutral atom,

Atomic Number (Z) = number of protons (p^+) = number of electrons (e^-)
Number of neutron (n^0) = mass number (A) – number of protons (p^+)

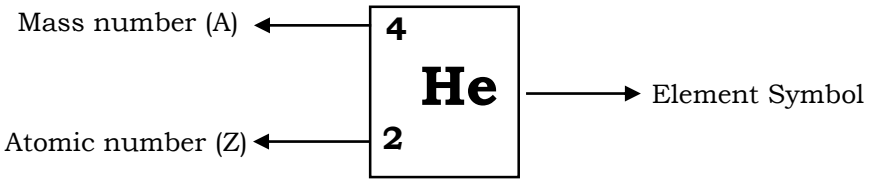


Figure 7. Shorthand notation of Helium atom
Illustrated by: Jeannie Janeth S. Antigro

Figure 7 shows the symbol of the element where the mass number (A) is written as superscript and atomic number (Z) is written as subscript.

Example 1: How many protons, electrons and neutrons are present in boron ($^{11}_{5}B$)?

Solution:

Mass number (A) = 11 and Atomic number (Z) = 5

Since,

Atomic number (Z) = number of protons (p^+) = number of electron (e^-)

p^+ = **5** and e^- = **5**

$n^0 = A - p^+$

$n^0 = 11 - 5 =$ **6**

What are ions?

Atoms may gain charges. This happens when electrons are lost or gained by the atom. When this happens, the atom becomes an **ion**. A negative charge ion (anion) has more electrons than protons. A positive charge ion (cation) has fewer number of electrons than protons. The net charge of an ion is the difference between the number of protons and the number of electrons.

charge of ion = number of protons (p^+) - number of electrons (e^-)

For example, a neutral lithium atom (atomic number 3) has 3 protons and 3 electrons. If the atom loses 1 electron, it becomes an ion (cation) with a charge of +1:

	Lithium atom	Lithium ion
No. of protons (+)	+3	+3
No. of electrons (-)	-3	-2
Net charge	0	+1
Symbol	**Li**	**Li^{+1}**

Table 2. Net charges of lithium atom and lithium ion

In some books the charge of an ion is written with the positive or negative sign after the number (as in 1+) and sometimes before it (as in +1). When the charge of an ion is +1 or -1, the number 1 is normally excluded, and the charge is written clearly as + or - .

Figure 8 shows the shorthand notation of lithium ion. The superscript at the right denotes the charge of the ion wherein the number of electrons may be determined. The charge is zero (0) when there is no superscript shown.

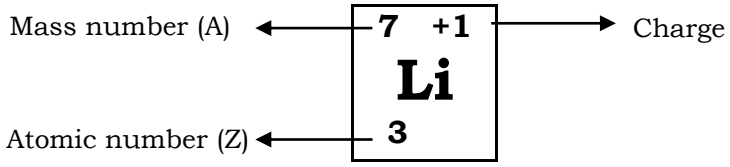


Figure 8: Shorthand notation of lithium ion

Illustrated by: Jeannie Janeth S. Antigro

Example 2: Determine the number of electrons, protons and neutrons of fluorine ion ($^{19}_{9}F^{-1}$).

Solution:

Given: A = 19, Z = 9 and charge of ion = -1 (means gain 1 e^-)

Number of protons (p^+) = **9**
Number of electrons (e^-) = **9** + 1 (gain 1 e^-) = **10**
Number of neutrons (n^0) = $A - p^+$ = 19 – 9 = **10**

What are isotopes?

Isotopes are atoms having the same atomic number but with different mass number. Notice the data in Table 3. What makes the three isotopes of hydrogen different from each other?

Table 3: Isotopes of hydrogen

Element	Atomic number (Z)	Mass number (A)	protons (p^+)	neutrons (n^0)	electrons (e^-)
H-1 (protium)	1	1	1	0	1
H-2 (deuterium)	1	2	1	1	1
H-3 (tritium)	1	3	1	2	1

Different isotopes can exist and these can be identified by its respective **mass number**. Mass number is the sum of the number of protons and the number of neutrons in an atom. For example, Tritium (H-3), has a mass number of 3. Referring to Table 3, its number of proton is 1 and 2 for neutrons, giving a total of three. Mathematically:

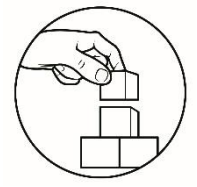
Mass number of tritium = $p^+ + n^0 = 1 + 2 =$ **3**

Example 3:

Table 4 shows the number of subatomic particles of carbon isotopes. Notice the differences in their number of neutrons, resulting to 3 different carbon isotopes.

Table 4: Isotopes of carbon

Isotopes	Atomic number (Z)	Mass number (A)	protons (p^+)	neutrons (n^0)	electrons (e^-)
Carbon-12	6	12	6	6	6
Carbon-13	6	13	6	7	6
Carbon-14	6	14	6	8	6



What's More

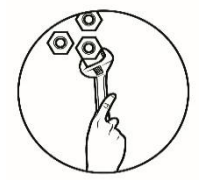
Directions: Complete the table below. Write your answers on a separate sheet of paper.

Isotope	**Element Name**	**Z**	**A**	**p^+**	**e^-**	**n^o**	**Charge**
B-11	Boron			5		6	0
	Chlorine		35			18	-1
Mg-24				12	10		
Al-27		13				14	+3
S-32				16			0

What I Have Learned

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

1. Only a change in the number of protons changes the identity of the _____.
2. Atoms of an element may have different number of protons or _____; and the net charge remains _____.
3. Ions are formed by the addition or removal of _____.
4. A/an _____ ion is formed when electrons are removed from an atom and the number of electrons becomes less than the number of protons, while a/an _____ ion is formed when electrons are added to an atom and the number of electrons becomes more than the number of protons.
5. The number of electrons in an atom does not affect its _____ since their contribution to the mass of the atom is negligible.
6. Atoms of the same element having different mass number are called _____.
7. The _____ is equal to the number of protons, which is also equal to the number of electrons in uncharged (electrically neutral) atoms.
8. Mass number is the sum of the number of protons and neutrons in the _____ of the atom.
9. The number of each subatomic particle of an element can be easily identified if we know the _____ and the atomic number.



What I Can Do

Directions: Below is a passage about the medical uses of some isotopes. Read the passage and the situation below then answer the questions that follow. Write your answers in a separate sheet of paper.

Some Isotopes can Save Lives! Isn't that Amazing?

If excessive radiation can kill, its sustained release can cure or treat disease. Radioactive isotopes (radioisotopes) of some elements have been used to detect and treat certain body ailments. **Chromium-151** is used for monitoring blood flow through the heart. **Cobalt-59** or **cobalt-60** is used for detecting and treating tumors. **Iodine-131** is used for treating thyroid disorders. A small quantity of the radioisotope is mixed with naturally occurring stable isotope of the same element. Both undergo the same reactions together. The radioisotope goes right to the problem area. For example, **I-131** concentrates in the thyroid where its radiation destroys fast growing cancer cells. Tumor cells grow rapidly than normal cells. The thyroid gland is then prevented from producing thyroxin, which causes the hyperactive condition.

Source: Dept. of Education. Science & Technology III: Chemistry Textbook. Reprint edition, 2009

Situation: Maria has an aunt who is suffering from a disease known as goiter. After studying about isotopes in Grade 8, she learned that iodine-131 is an isotope of iodine that can treat goiter.

Question:

If you were Maria, how would you tell your aunt the benefit of iodine-131 in treating goiter?

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.

Assessment

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

1. Which of the following subatomic particles determine the identity of an atom?
   A. protons
   B. neutrons
   C. protons plus neutrons
   D. electrons plus protons

2. An atom of an element is electrically neutral because the number of protons is equal to the number of _____.
   A. electrons
   B. neutrons
   C. nucleons
   D. nucleus

3. Which particles have approximately the same size and mass?
   A. protons and neutrons
   B. electrons and protons
   C. neutrons and electrons
   D. None because all are different in terms of size and mass

4. Which two particles would be attracted to each other?
   A. protons and neutrons
   B. electrons and protons
   C. electrons and neutrons
   D. All particles are attracted to each other.

5. Which of the following statements are TRUE about the subatomic particles?
   I. The charge of electron is opposite to the charge of proton.
   II. Proton has approximately the same mass with neutron.
   III. Electrons and protons are located within the nucleus.
   IV. The mass of an atom is concentrated at the nucleus.

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

6. What was Thomson's atomic model called?
   A. Spherical Model
   B. Solar System Model
   C. Plum Pudding Model
   D. Model of the Atomic Theory

7. Which of the following statements BEST describes the location of electrons in Rutherford's model of the atom?
   A. The electrons are inside the nucleus.
   B. The electrons are outside the nucleus.
   C. There are no electrons in the Rutherford Model.
   D. Electrons are both inside and outside of the nucleus.

8. How do we call the protons and neutrons that are found together in the nucleus?
   A. nuclei
   B. nucleons
   C. atomic mass
   D. mass number

9. What observations in the gold foil experiment made Rutherford conclude that atoms are mostly empty space?
   A. Some alpha particles were deflected at smaller angles.
   B. Most alpha particles passed through the gold foil undeflected.
   C. Few alpha particles deflected almost back towards the source.
   D. Very few particles were deflected from their path, indicating that the positive charge of the atom occupies very large space.

10. What conclusion did Rutherford's gold foil experiment lead to?
    A. Atoms are indivisible.
    B. Neutrons are located in the nucleus.
    C. Atoms contain a positively charged nucleus.
    D. Electrons move in definite energy levels called shells.

11. Which of the following statements concerning subatomic particles is correct?
    A. Three fundamental types exist, all of which are charged.
    B. Three fundamental types exist, one of which is charged.
    C. Three fundamental types exist, two of which are charged.
    D. Three fundamental types exist, none of which are charged.

12. One isotope of oxygen has the atomic number 8 and the mass number 18. An atom of this isotope contains _____.
    A. 8 protons
    B. 8 neutrons
    C. 9 neutrons
    D. 18 electrons

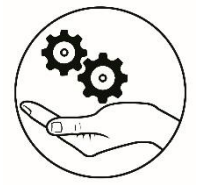
13. Element A has a mass number of 100 while element B has an atomic number of 118. What will be the number of electrons of element B?
    A. 59
    B. 60
    C. 118
    D. 120

14. How many protons, neutrons and electrons are in the neutral atom of $^{35}_{17}Cl$?
    A. 17 protons, 15 neutrons and 17 electrons
    B. 17 protons, 17 neutrons and 17 electrons
    C. 17 protons, 17 neutrons and 18 electrons
    D. 17 protons, 18 neutrons and 17 electrons

15. Which of the following statements CORRECTLY describes atoms, ions and isotopes?

    I. Neutral atom has equal number of protons, neutrons and electrons.
    II. Atoms are the smallest particles of matter that retain the characteristics of an element.
    III. Isotopes are atoms of the same element with unequal number of neutrons in the nucleus.
    IV. Ions are atoms with unequal number of protons and electrons and are formed when an atom loses or gains electrons.

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



Additional Activities

Directions: Identify what element is described using the data on the table below. Write your answers on a separate sheer of paper.

Element	e^-	n^0	p^+
A	6	6	6
B	6	7	8
C	6	8	6
D	7	8	7

1. It is an isotope of element A. _____
2. It is not electrically neutral. _____
3. It is positively charged element. _____
4. It has the same atomic number (Z) as element A. _____
5. It has same mass number (A) as element D. _____

Answer Key

Lesson 1

What I Know

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

What's In

1. Yes, because the atoms in smaller pieces are the same as that of the big original apple.
2. Yes
3. No, you reach a point where the pieces cannot be sliced nor divided anymore.
4. Only the size changed. Smell and taste are still the same. So is with atoms. It may not be seen but surely you know since the properties are evident.

What's New

1. 1, 4 2. 1, 2 3. 0, 5

What's More

1. Electron shell
2. Proton
3. Neutron
4. Electron
5. Nucleus
6. Electron

What I Have Learned

1. Spherical
2. Positive
3. Negatively
4. Neutral
5. Electron
6. Neutron
7. Outside
8. Inside
9. Heavier/Center
10. Positive

What I Can Do

1. Iron
2. Copper
3. Aluminum
4. Rubber
5. Wood

Lesson 2

What's In

1. proton, 2. electron, 3. neutron 4. proton & neutron, 5. electron

What's New

Activity 1

Labelling the watermelon model

1. atom
2. electron

Answers to questions:

1. An atom
2. Negatively charged particles called electrons

Activity 2:

1. There are markings of the pen inside the bond paper. However, when the pen hit the cut straw in the center, they just bounced back and no markings left.
2. Most of the markings are at the side of the circles. Few markings are found at the center.

What's More

Activity 1

1. A
2. C
3. B
4. A

What I Have Learned

1. electrons; Plum Pudding model
2. positive
3. gold foil
4. passed
5. nucleus
6. nuclear model

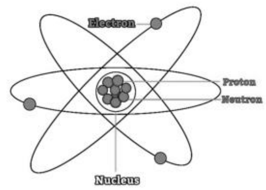
What I Can Do

1. Faith
2. Family
3. Health
4. Friends
5. Foods
6. House
7. Clothes
8. Money
9. Cellphone
10. Jewelry

Note: Nos. 2-5, 8-10 can be interchanged.

Lesson 3

What's In



A.
B. 1) b 2) c 3) a

What's New

1. Phosphorus
2. 15 protons
3. 13 electrons
4. Hydrogen

What I have learned

1. element
2. neutrons; the same
3. electrons
4. positive; negative
5. mass number
6. isotopes
7. atomic number
8. nucleus
9. subatomic

What I Can Do

1. Iodine-131
2. Xenon-133
3. Cobalt-60
4. Technitium-99
5. Chromium-151

Additional Activities

1. C
2. B
3. B
4. C
5. B

What's More

Isotope	Element Name	Z	A	p^+	e^-	n^o	Charge
B-11	Boron	**5**	**11**	5	**5**	6	0
Cl-35	Chlorine	**17**	35	**17**	**18**	18	-1
Mg-24	**Magnesium**	**12**	**24**	12	10	**12**	**+2**
Al-27	**Aluminum**	13	**27**	**13**	**10**	14	+3
S-32	**Sulfur**	**16**	**32**	**16**	16	**16**	0

Assessment

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

What I Can Do (Possible/suggested answer)

1. I will inform my aunt that iodine-131 is an isotope of iodine which can help treat goiter. It concentrates in the thyroid where its radiation destroys fast growing cancer cells. The thyroid gland is then prevented from producing thyroxin, which causes the hyperactive condition.

References

Books

Campo, Pia et al. *Science Grade 8 Learners Module* Pasig City, Metro Manila, Philippines: Department of Education 2014, 2016.

Magno, Marcelita C. et al. *Science and Technology III: Chemistry Textbook* Reprint Edition, Pasig City, Metro Manila, Philippines: Vibal Publishing House 2006, 2009.

Journal

Department of Education, "Project EASE (Effective Alternative Secondary Education) CHEMISTRY." In *Module 10: What's Inside the Atom,* 19. Pasig City, Metro Manila, Philippines: Bureau of Secondary Education n.d.

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