

Senior High School

Department of Education
National Capital Region

**SCHOOLS DIVISION OFFICE
MARIKINA CITY**

Earth & Life Science

First Quarter-Module 6

Igneous Rocks

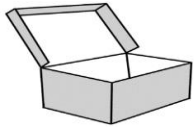


Evangeline C. Agtarap
Jeffrey G. dela Cruz



City of Good Character
DISCIPLINE • GOOD TASTE • EXCELLENCE

Government Property
NOT FOR SALE



What I Need to Know

This module was designed and written with you in mind. It is here to help you understand the formation of the different types of igneous rocks. This module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students.

The module has one lesson which is Formation of Igneous Rocks.

At the end of the module, you are expected to

1. describe igneous rocks;
2. name the different types of igneous rocks;
3. identify factors that help compare and contrast the formation of different types of igneous rocks; and
4. **compare and contrast the formation of the different types of igneous rocks. S11/12ES-Ic-18.**

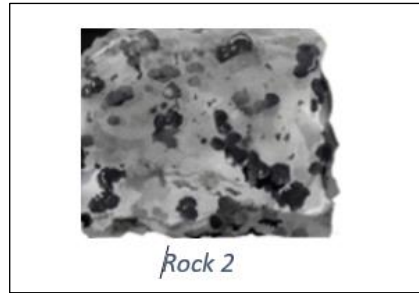
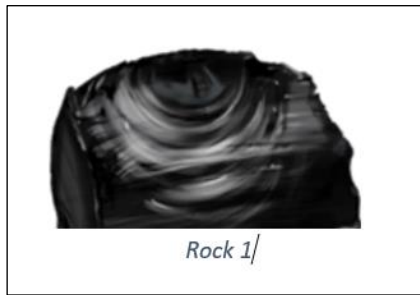


What I Know

Read the question carefully and encircle the letter of the correct answer.

1. How does igneous rock form?
 - A. Cooling and solidification of magma.
 - B. Accumulation or deposition of small particles.
 - C. Cementation of mineral or organic particles on the floor of oceans.
 - D. Transformation of rock due to heat, pressure or chemical conditions.
2. Which of the following is **NOT TRUE** about plutonic rocks?
 - A. They solidify and cool slowly.
 - B. The texture of these rocks is typically described as phaneritic.
 - C. They have crystals that are large enough to see with the naked eye.
 - D. They are formed when lava cools and solidifies on the earth's surface.
3. Which of the following describes the relationship between rate of cooling and texture?
 - A. Faster cooling yields finer grain texture.
 - B. Faster cooling yields coarse-grain structure.
 - C. Plutonic rocks cooled faster than volcanic rock.
 - D. Faster cooling results in crystals that can be easily seen.
4. How will you compare volcanic rocks and plutonic rocks based on temperature?
 - A. The temperature difference is not significant.
 - B. Volcanic rocks are exposed to lower temperature.
 - C. Plutonic rocks are exposed to lower temperature.
 - D. Volcanic and plutonic rocks are exposed to the same temperature.

5. Look at the image below. What can you infer about the igneous rocks?




- I. Rock 1 cooled more slowly than Rock 2.
II. Rock 1 cooled more quickly than Rock 2.
III. Rock 1's texture is aphanitic while Rock 2's texture is phaneritic
IV. Rock 1's texture is phaneritic while Rock 2's texture is aphanitic.
- A. I and III. C. I and IV
B. II and IV D. II and III
6. Granite is an example of an intrusive felsic rock. It means the following **EXCEPT** one, which is it?
- A. It cooled slowly.
B. It has large crystals.
C. It contains feldspar and quartz.
D. It has high magnesium and iron content.
7. Rhyolite is shown below. Which of the following is **TRUE**?
- I. It is granitic.
II. It is basaltic.
III. It cooled quickly.
IV. It cooled slowly.
- A. I and III C. II and III
B. II and IV D. I and IV
8. The picture below shows gabbro and basalt. Which is **TRUE** about these rocks?
- 
- A photograph of a rock sample, likely gabbro or basalt, showing a crystalline texture. The rock is light-colored with visible dark mineral grains. It has a rough, angular shape.



Figure 1.5. Gabbro



Figure 1.6. Basalt

- I. They are both basaltic.
II. They are both granitic.
III. Gabbro is intrusive while basalt is extrusive.
IV. Gabbro is extrusive while basalt is intrusive.
- A. II and III
B. II and IV
C. I and III
D. I and IV

9. Diorite is a granitic intrusive rock while Rhyolite is a granitic extrusive rock. How will you compare the two?
- Diorite is light colored while rhyolite is dark colored.
 - Diorite is dark colored while rhyolite is light colored.
 - Diorite has fine grains while Rhyolite has coarse grains.
 - Diorite has coarse grains while Rhyolite has fine grains.
10. Granite is an example of an intrusive felsic rock. Rhyolite, on the other hand, is an extrusive felsic rock. How will you compare the two rocks?
- They contain Feldspar and Quartz
 - Granite has more Magnesium and Iron than Rhyolite.
 - Rhyolite has more Magnesium and Iron than Granite
 - They are both formed when magma cools and solidifies below the earth's surface.
11. When is a rock's texture considered phaneritic?
- The texture is fine grain.
 - The structure is coarse-grained.
 - Crystals formed is visible with the naked eye.
 - The texture is formed because of faster cooling.
- I and III
 - II and IV
 - II and III
 - I and IV
12. When is a rock's texture considered aphanitic?
- The texture is fine grain.
 - The structure is coarse-grained.
 - The texture is formed because of faster cooling.
 - The texture is formed because of slower cooling.
- I and IV
 - I and III
 - II and III
 - II and IV
13. When is rock considered mafic?
- It contains high amounts of Feldspar and Quartz.
 - It contains high amounts of Magnesium and Iron.
 - When it is formed when lava cools and solidifies on the earth's surface.
 - When it is formed when magma cools and solidifies below the earth's surface.
14. How do we compare the types of igneous rocks?
- According to color
 - According to texture
 - According to the place of formation
 - According to mineral/chemical composition
- I and II
 - III and IV
 - I, II, and III
 - I, II, III, and IV

15. How will you compare volcanic and plutonic rocks?

- I. Plutonic rocks are formed below the earth's surface while volcanic rocks are formed on the earth's surface.
 - II. Volcanic rocks are formed below the earth's surface while plutonic rocks are formed on the earth's surface.
 - III. Plutonic rocks have coarse grain structure while volcanic rocks have fine grain structure.
 - IV. Volcanic rocks have coarse grain structure while plutonic rocks have fine grain structure.
- A. I and III
B. II and IV
C. II and III
D. I and IV

Lesson 1

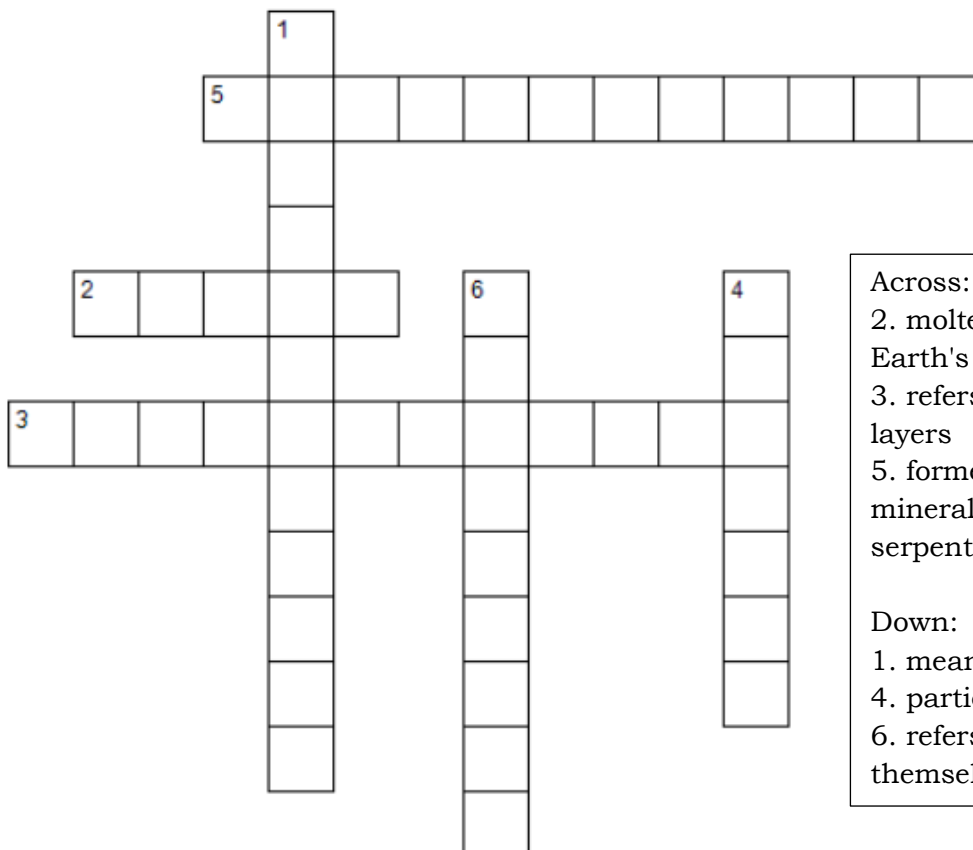
Formation of Igneous Rocks



What's In

Activity 1.1. Earth's Internal Heat Crossword

Answer the crossword puzzle below that contains important terms about Earth's internal heat.



Across:

- 2. molten material found below Earth's surface
- 3. refers to heat emitted from Earth's layers
- 5. formed when olivine and pyroxene minerals are transformed into serpentinite minerals

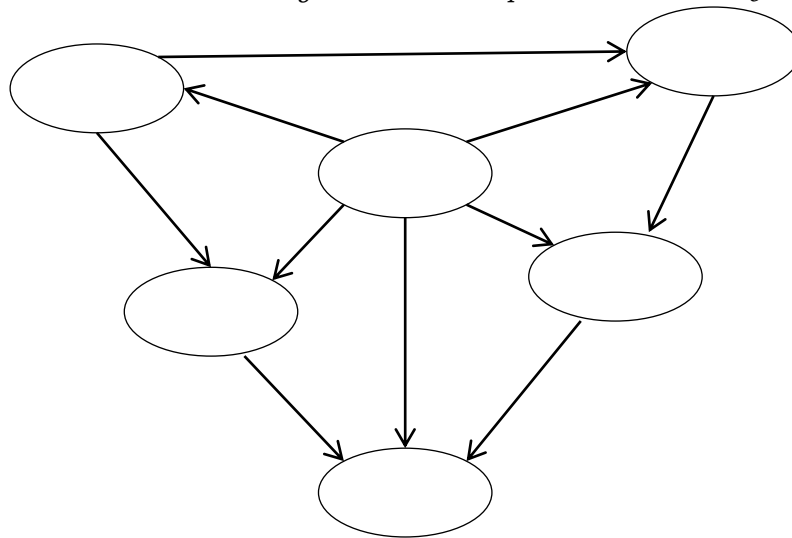
Down:

- 1. means change in form
- 4. particularly hot part of the mantle
- 6. refers to minerals aligning themselves due to pressure





Source: *Igneous Rocks. Haiku Deck. Accessed September 1, 2020.*
<https://www.haikudeck.com/igneous-education-presentation-4czli3dQTF#slide13>.



What Is It

Igneous rocks are rocks that cooled and crystallized from molten magma. Magmas that solidify and cool do so either slowly underground – often taking hundreds to thousands of years – or quickly above ground following an eruption. You can compare the formation of Volcanic and Plutonic Rocks by several factors. These are place of formation, temperature, rate of cooling, texture, composition, and color.

Place of Formation. Scientists classify igneous rocks as plutonic (formed when magma cools and solidifies below the earth's surface) or volcanic (formed when lava cools and solidifies on the earth's surface). Plutonic igneous rocks are also called intrusive igneous rocks. Volcanic igneous rocks are also called extrusive igneous rocks.

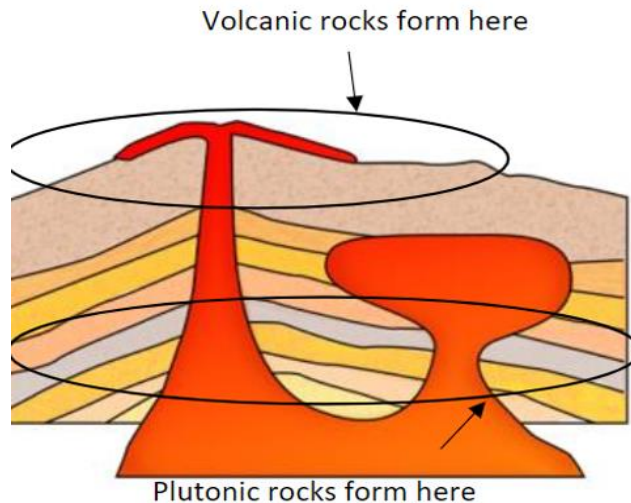


Figure 1.1 Volcanic and Plutonic Rocks.

Source: Volcanic and Plutonic Rocks. Digital Image. FrontLearners. Accessed September 1, 2020. www.frontlearners.com

Temperature. Since extrusive rocks are formed on the surface, they are exposed to lower temperature compared to the intrusive rocks formed deep within the earth.

Rate of Cooling. Since volcanic rocks formed outside volcanoes are exposed to lower temperature, they cool faster than plutonic rocks.

Texture. The rate of cooling also affects the texture of rocks. Faster cooling process yields to finer grain texture. Therefore, volcanic rocks have fine-grain texture. This type of texture is called: *Aphanitic*. On the other hand, plutonic rocks have coarse-grain structure. This texture is also known as *Phaneritic*.



Figure 1.2 Rate of Cooling and Texture.

Source: Rate of Cooling and Texture. Digital Image. FrontLearners. Accessed September 1, 2020. www.frontlearners.com

Mineral/Chemical Composition. Intrusive and extrusive rocks also vary in mineral and chemical composition. These rocks can either be *mafic* or *felsic*. Rocks containing magnesium and iron are called mafic rocks, while rocks containing feldspar and quartz are called felsic rocks. Granite is an example of an Intrusive Felsic Rock. Rhyolite, on the other hand, is an extrusive felsic rock.



Figure 1.3. Granite

Source: Granite. Wikimedia Commons.
Accessed September 1, 2020.
[https://commons.wikimedia.org/wiki/File:Granite_13_\(48673804363\).jpg](https://commons.wikimedia.org/wiki/File:Granite_13_(48673804363).jpg)



Figure 1.4. Rhyolite

Source: Rhyolite. Wikimedia Commons.
Accessed September 1, 2020.
https://commons.wikimedia.org/wiki/File:Rhyolite_2013.jpg

Color. Extrusive and intrusive rocks also vary in terms of color. Dark-colored rocks are called *basaltic rocks* while light-colored rocks are called *granitic rocks*.

An example of basaltic intrusive rock is Gabbro.



Figure 1.5. Gabbro

Source: Gabbro. Wikimedia Commons.
Accessed September 1, 2020.
[https://commons.wikimedia.org/wiki/File:Olivine_gabbro_\(Pigeon_Point_Sill,_Mesoproterozoic,_~1.1_Ga;_Pigeon_Point,_Minnesota,_USA\)_40770721514.jpg](https://commons.wikimedia.org/wiki/File:Olivine_gabbro_(Pigeon_Point_Sill,_Mesoproterozoic,_~1.1_Ga;_Pigeon_Point,_Minnesota,_USA)_40770721514.jpg)

Basalt is an example of basaltic extrusive rock.



Figure 1.6. Basalt

Source: Gabbro. Wikimedia Commons.
Accessed September 1, 2020.
[https://commons.wikimedia.org/wiki/File:Basalt_12_\(48674276333\).jpg](https://commons.wikimedia.org/wiki/File:Basalt_12_(48674276333).jpg)

An example of granitic intrusive rock is Diorite while Rhyolite is an example of granitic extrusive rock.

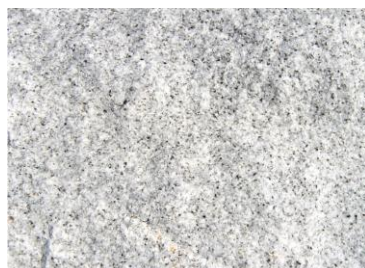
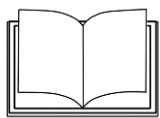


Figure 1.7 Diorite

Source: Diorite. Wikimedia Commons. Accessed September 1, 2020.
<https://commons.wikimedia.org/wiki/File:Diorite-light-granite.jpg>



What's More

Activity 1.3. Comparing Igneous Rocks

Use a Venn Diagram to compare volcanic and plutonic rocks.



What I Have Learned

Activity 1.4. Lesson Summary

Fill in the gaps. Answer on the given spaces.

Volcanic and plutonic rocks can be compared and contrasted by looking at several factors such as: _____, _____, _____, _____, and _____.

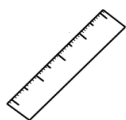


What I Can Do

Activity 1.5. Mafic and Felsic Igneous Rocks

Fill in the gaps with the best word/phrase to make the sentence correct. Copy and answer on a clean sheet of paper.

Mafic and felsic igneous rocks differ in their _____.
Mafic rocks contain _____ and _____.
Felsic rocks contain _____ and _____.



Assessment

Read the question carefully and encircle the letter of the correct answer.

1. How will you compare volcanic and plutonic rocks?
 - I. Plutonic rocks are formed below the earth's surface while volcanic rocks are formed on the earth's surface.
 - II. Volcanic rocks are formed below the earth's surface while plutonic rocks are formed on the earth's surface.
 - III. Plutonic rocks have coarse grain structure while volcanic rocks have fine grain structure.
 - IV. Volcanic rocks have coarse grain structure while plutonic rocks have fine grain structure.

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

2. How do we compare the types of igneous rocks?
 - I. According to color
 - II. According to texture
 - III. According to the place of formation
 - IV. According to mineral/chemical composition

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

3. When is rock considered mafic?
 - A. It contains high amounts of Feldspar and Quartz.
 - B. It contains high amounts of Magnesium and Iron.
 - C. When it is formed when lava cools and solidifies on the earth's surface.
 - D. When it is formed when magma cools and solidifies below the earth's surface.

4. When is a rock's texture considered aphanitic?
 - I. The texture is fine grain.
 - II. The structure is coarse-grained.
 - III. The texture is formed because of faster cooling.
 - IV. The texture is formed because of slower cooling.

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

5. When is a rock's texture considered phaneritic?
 - I. The texture is fine grain.
 - II. The structure is coarse-grained.
 - III. Crystals formed is visible with the naked eye.
 - IV. The texture is formed because of faster cooling.

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

6. Granite is an example of an intrusive felsic rock. Rhyolite, on the other hand, is an extrusive felsic rock. How will you compare the two rocks?
- They contain Feldspar and Quartz
 - Granite has more Magnesium and Iron than Rhyolite.
 - Rhyolite has more Magnesium and Iron than Granite
 - They are both formed when magma cools and solidifies below the earth's surface.
7. Diorite is a granitic intrusive rock while Rhyolite is a granitic extrusive rock. How will you compare the two?
- Diorite is light colored while rhyolite is dark colored.
 - Diorite is dark colored while rhyolite is light colored.
 - Diorite has fine grains while Rhyolite has coarse grains.
 - Diorite has coarse grains while Rhyolite has fine grains.
8. The picture below shows gabbro and basalt. Which is **TRUE** about these rocks?



Figure 1.5. Gabbro



Figure 1.6. Basalt

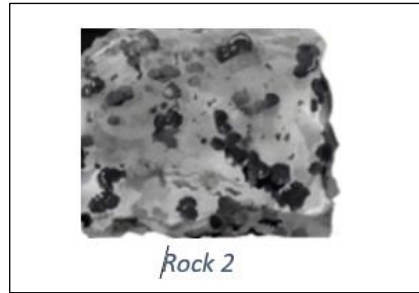
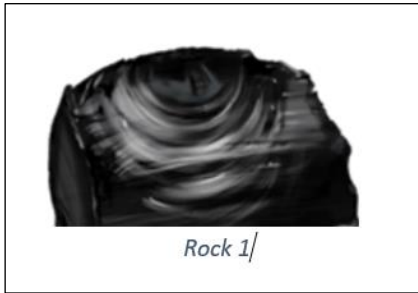
- They are both basaltic.
 - They are both granitic.
 - Gabbro is intrusive while basalt is extrusive.
 - Gabbro is extrusive while basalt is intrusive.
- II and III
 - II and IV
 - I and III
 - I and IV
9. Rhyolite is shown below. Which of the following is **TRUE**?



- It is granitic.
 - It is basaltic.
 - It cooled quickly.
 - It cooled slowly.
- I and III
 - II and IV
 - II and III
 - I and IV

10. Granite is an example of an intrusive felsic rock. It means the following **EXCEPT** one, which is it?
- It cooled slowly.
 - It has large crystals.
 - It contains feldspar and quartz.
 - It has high magnesium and iron content.

11. Look at the image below. What can you infer about the igneous rocks?

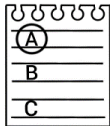


- I. Rock 1 cooled more slowly than Rock 2.
 - II. Rock 1 cooled more quickly than Rock 2.
 - III. Rock 1's texture is aphanitic while Rock 2's texture is phaneritic
 - IV. Rock 1's texture is phaneritic while Rock 2's texture is aphanitic.
- A. I and III.
B. II and IV
C. I and IV
D. II and III
12. How will you compare volcanic rocks and plutonic rocks based on temperature?
- A. The temperature difference is not significant.
B. Volcanic rocks are exposed to lower temperature.
C. Plutonic rocks are exposed to lower temperature.
D. Volcanic and plutonic rocks are exposed to the same temperature.
13. Which of the following describes the relationship between rate of cooling and texture?
- A. Faster cooling yields to finer grain texture.
B. Faster cooling yields to coarse-grain structure.
C. Plutonic rocks cooled faster than volcanic rock.
D. Faster cooling results in crystals that can be easily seen.
14. Which of the following is **NOT TRUE** about plutonic rocks?
- A. They solidify and cool slowly.
B. The texture of these rocks is typically described as phaneritic.
C. They have crystals that are large enough to see with the naked eye.
D. They are formed when lava cools and solidifies on the earth's surface.
15. How does igneous rock form?
- A. Cooling and solidification of magma.
B. Accumulation or deposition of small particles.
C. Cementation of mineral or organic particles on the floor of oceans.
D. Transformation of rock due to heat, pressure or chemical conditions.



Additional Activities

Use a Venn Diagram to compare rhyolite and basalt.



Answer Key

<p>What's In Activity 1.1 Across: 2. (magma) 3. (internal heat) 5. (serpentine) Down: 1. (metamorphism) 4. (hotspot) 6. (foliation)</p>	<p>What's New Activity 1.2 Answers may vary. Possible answers are: texture, color, mineral composition, temperature, rate of cooling, place of formation</p>	<p>What's More Activity 1.3 Both are igneous rocks. They cooled and crystallized from molten magma. Since volcanic rocks are formed on the surface, they are exposed to lower temperature compared to the plutonic rocks formed deep within the earth. Since volcanic rocks formed outside volcanoes are exposed to lower temperature, they cool faster than plutonic rocks. Volcanic rocks have fine-grain texture, plutonic rocks have coarse- grain structure.</p>
<p>What I Have Learned Activity 1.4 Volcanic and plutonic rocks can be compared and contrasted by looking at several factors such as: place of formation, temperature, rate of cooling, texture, mineral/chemical composition, and color.</p>	<p>What I Can Do Activity 1.5 Mafic and felsic igneous rocks differ in their mineral/chemical composition. Mafic rocks contain magnesium and iron. Felsic rocks contain quartz and feldspar.</p>	<p>Additional Activities Both are granitic. They are light colored. Diorite is intrusive while rhyolite is extrusive. Diorite has coarse grain while rhyolite has fine grain texture. Diorite's texture is aphanitic while rhyolite's texture is phaneritic.</p>



References

- (1) "Earth Rocks! | CCSF." CCSF CCSF. Accessed September 1, 2020. <https://www.ccsf.edu/academics/schools/stem/earth-sciences-department/earth-rocks>.
- (2) "Igneous." Haiku Deck: Presentation Software and Online Presentation Tools. Accessed September 1, 2020. <https://www.haikudeck.com/igneous-education-presentation-4czli3dQTF#slide13>.
- (3) "Volcanic Vs Plutonic Igneous Rocks: Definition and Differences." Study.com. Accessed September 1, 2020. <https://study.com/academy/lesson/volcanic-vs-plutonic-igneous-rocks-definition-and-differences.html>.
- (4) National Geographic Society. "Igneous Rocks." National Geographic Society. Last modified September 5, 2019. <https://www.nationalgeographic.org/encyclopedia/igneous-rocks/>.
- (5) Science and Technology Academic and Research-Based Openly Operated KioskS. Accessed August 11, 2020. <https://www.starbooks.ph>.

Development Team of the Module

Writers: Evangeline C. Agtarap (THS)
Jeffrey G. dela Cruz (PHS)

Editors: Reynald Alfred A. Recede (MHS)
Russel S. Berador (SEHS)
Maria Carmina R. Martin (MHS)
Emil Constantine P. Buguina (MHS)
Emily G. Santos (PSDS)
Jessica S. Mateo (EPS – Science)

Layout Artists: Christine Ann G. Faraon (BNHS)
Jemwel Dela Paz (CISSL)

Management Team:

Sheryll T. Gayola

Assistant Schools Division Superintendent
OIC, Office of the Schools Division Superintendent

Elisa O. Cerveza

Chief, Curriculum Implementation Division
OIC, Office of the Assistant Schools Division Superintendent

Jessica S. Mateo

Education Program Supervisor – Science

Ivy Coney A. Gamatero

Education Program Supervisor – Learning Resource Management Section

For inquiries or feedback, please write or call:

Schools Division Office- Marikina City
191 Shoe Ave., Sta. Elena, Marikina City, 1800, Philippines
Telefax: (02) 8682-2472 / 8682-3989
Email Address: sdo.marikina@deped.gov.ph

