Senior High School

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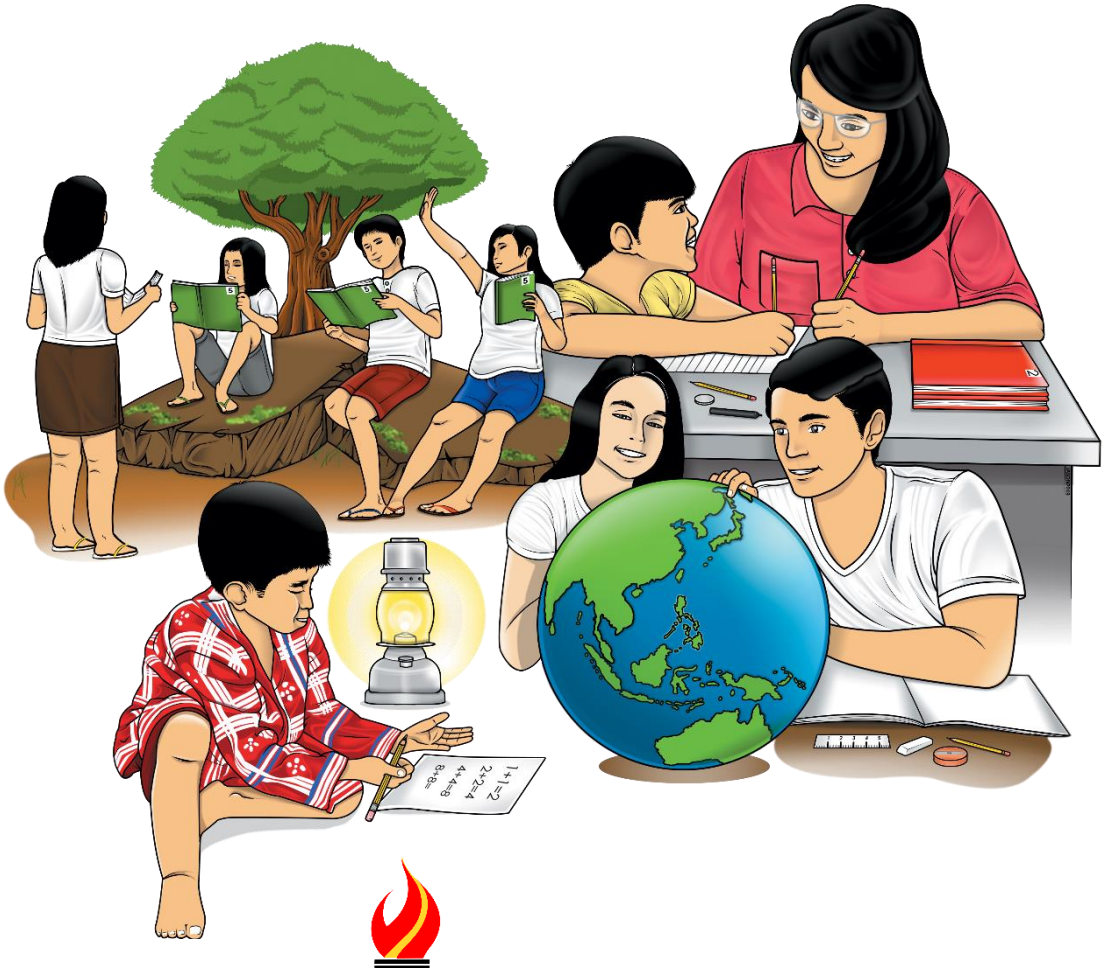
DEPARTMENT OF EDUCATION

Earth Science for Stem

Quarter 1 – Module 6:
Ore Minerals: How they are Found, Mined, and Processed for Human Use



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ADM

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Senior High School

Earth Science for STEM

Quarter 3 – Module 6:
Ore Minerals: How they are Found, Mined, and Processed for Human Use

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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.

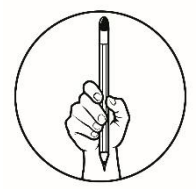
Thank you.

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 Biology. 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.

After going through this module, you are expected to:

1. describe how ore minerals are found.
2. identify the different mining method; and
3. explain the different steps in mineral processing.



What I Know

Read and analyze the following questions/statements. Choose and write the letter that best describe the following statements.

1. Which of the following is not a mineral ore?
   a. a rock with fossilized insect
   b. a rock combined with copper
   c. a sediment that has gold traces
   d. a rock that contains valuable mineral

2. How do modern miners determine the prospective mineral ore body?
   I. using geophysical techniques
   II. determining the elevation of the area
   III. measuring the magnetic reading of the area
   IV. determining the sonic responses of the location

   a. I, II and III b. I, II and IV c. II, III and IV d. III, IV and I

3. Nickel is an important ingredient in the production of stainless steel. In the Philippines, CARAGA region has the most numbered nickel mining site where miners remove a thin parallel strip of soil to extract the ore deposits. Which mining method did the miners use?
   a. Dredging
   b. Open-pit mining
   c. Strip mining
   d. Underground mining

4. Which of the following mining methods are used in mining gravel?
   a. Dredging
   b. Open-pit mining
   c. Strip mining
   d. Underground mining

5. Sand is composed of mineral grains that are widely used as a construction material. Which of the following method is the most applicable way to mine sand? 1. Open-pit mining 2. Strip Mining 3. Dredging

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

6. Which of the following is the correct step by step process in mineral processing?
   a. comminution, dewatering, crushing, grinding and analysis
   b. sampling, analysis, comminution, filtration and dewatering
   c. sampling analysis, comminution, concentration and dewatering
   d. dewatering, comminution, analysis, sampling and surface mining

7. Which of the following is **not** included in the group?
   a. Dredging
   b. Open-pit mining
   c. Strip mining
   d. Underground mining

8. What method of mining involves digging of tunnels to extract the ore deposits?
   a. deep mining
   b. pit mining
   c. underground mining
   d. surface mining

9. Which mineral mining process involves filtration and sedimentation of the mining water and drying of the solid minerals harvested from the suspension?
   a. comminution b. concentration c. dewatering d. sampling

10. Randie examined the ore sample from the undeveloped mining site in Batangas. He tested the chemical, mineral and particle size of the mineral sample from a site. What mineral processing did he perform?
   a. analysis b. comminution c. dewatering d. sampling

11. Which of the following statement/s is/are correct?
   1. Surface and underground mining use explosives.
   2. Underground mining is cheaper than surface mining
   3. Open pit mining is the most common type of surface mining

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

12. Which of the following is the final step in mineral processing?
   a. Analysis b. Comminution c. Dewatering d. Sampling

13. Which is not true about surface mining?
   a. It is the most dangerous method of mining.
   b. It is used to extract ore minerals near the surface of the earth.
   c. Surface mining can be done through open pit, dredging and strip mining.
   d. In surface mining, the soil and rock that covered the ores are removed through blasting.

14. Engr. Atienza took a sample of mineral from the prospective mineral deposit. What mineral processing did he do?
   a. analysis b. sampling c. comminution d. dewatering

15. Which of the following processes involved crushing and grinding of mineral ore?
   a. analysis b. sampling c. comminution d. dewatering

Lesson 6 Ore Minerals: How They Are Found, Mined, and Processed for Human Use

What's In

Look at the illustration below. List down at least 5 ways minerals are important to society as shown in the illustration. Write your answer on a separate sheet of paper.

Illustration 1 Importance of mineral

Notes to the Teacher

As facilitator kindly asks the learner to share the insights, he/she has gained during his/her to the activities.

What's New

Read the situation below and answer the guide questions. Write your answer on a separate sheet of paper.

Minerals have been extracted from the earth since prehistoric times and the history of civilization and industrial advancement has been linked with man's ability to harness and use the minerals available. Once a mineral deposit has been found, it has to be extracted from the ground to access the valuable minerals it contains. Use the idea of this bowl as layers of rocks. In these layers of rocks are mineral deposits.

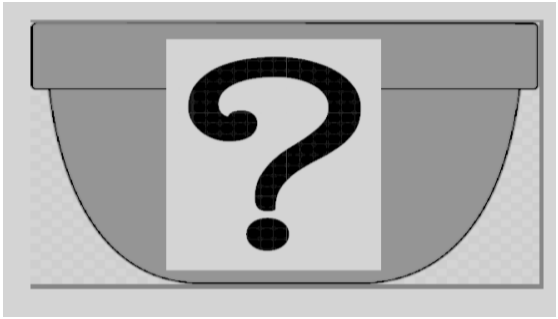


Illustration 2

Guide questions:

1. What do you think are the mineral deposit present in these layers of rocks?

_____

2. Since we cannot see what underlies beneath, how can you suggest minerals can be found?

_____

3. How will you separate each mineral component?

_____

What is It

Mining is the process of mineral extraction from a rock seam or **ore** –a natural rock or sediment containing one or more valuable mineral. The minerals can range from precious metals and iron to gemstones and quartz. Modern mining technology

uses geophysical techniques that involve measuring the magnetic, gravity and sonic responses of rocks above and around a prospective mineral ore body.

There are two methods of mining:

A. Surface Mining – is used to extract ore minerals near the surface of the earth. The soil and rocks that covered the ores are removed through blasting. Blasting is a controlled use of explosives and gas exposure to break rocks. Some examples of surface mining are:

1. **Open-pit mining -** This is the most common type of surface mining. Open pit means a big hole (or pit) in the ground. The pit in mine is created by blasting with explosives and drilling. It is used to mine gravel and sand and even rock.

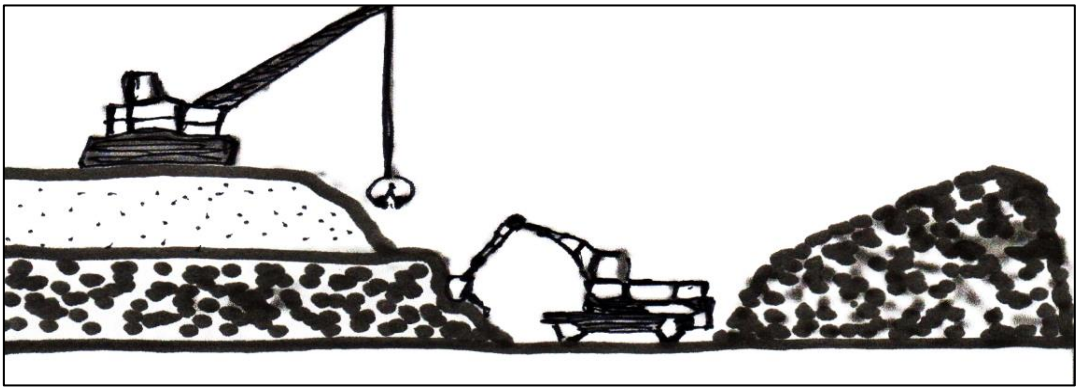


Illustration 3.1 Open-pit Mining

2. **Strip mining –** This mining type involves the removal of a thin strip of overburden (earth or soil) above a desired deposit, dumping the removed overburden behind the deposit, extracting the desired deposit, creating a second, parallel strip in the same manner and depositing the waste materials from that second (new) strip onto the first strip. This mining method is used for coal, phosphates, clays, and tar mining.

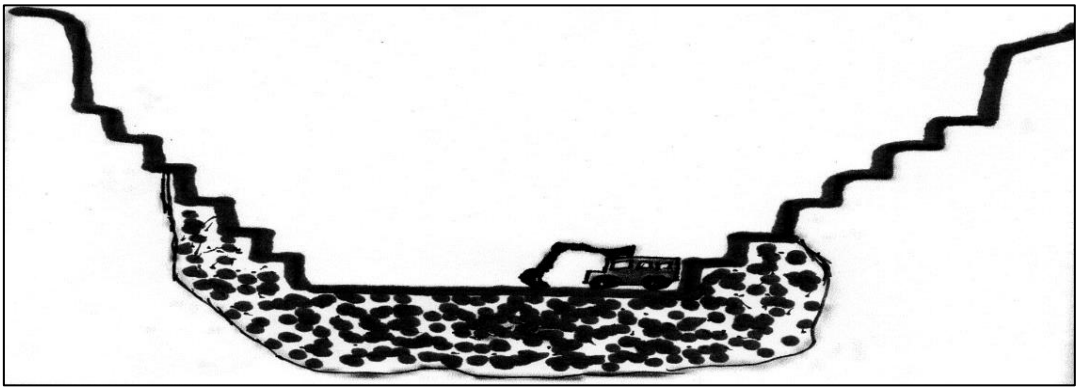


Illustration 3.2 Strip Mining

3. **Dredging** – This is the process of mining materials from the bottom of a body of water, including rivers, lakes, and oceans.

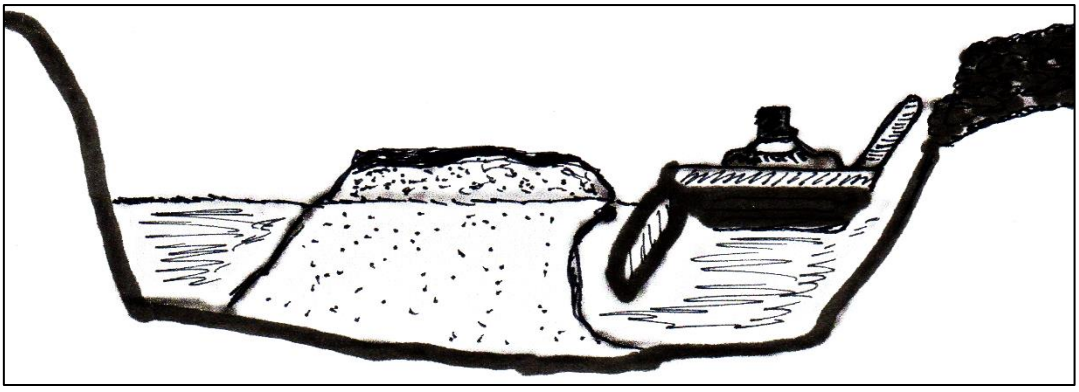


Illustration 3.3 Dredging

B. Underground mining – is used to extract the rocks, minerals and other precious stories that can be found beneath the earth's surface. In underground mining, miners need to create a tunnel so they can reach the ore minerals. This kind of mining is more expensive and dangerous as compared to surface mining because miners need to use explosive devices to remove the minerals from the rocks that cover them.

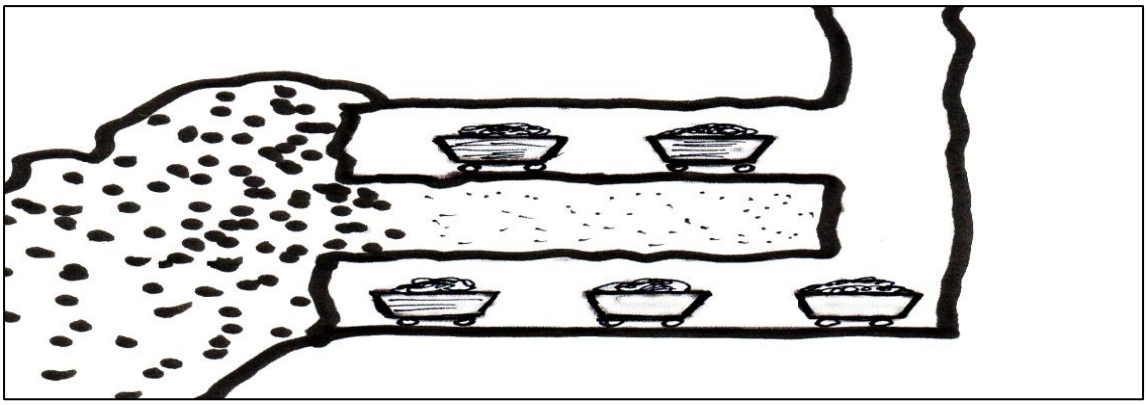
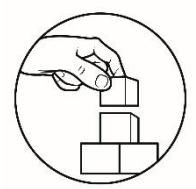


Illustration 3.4 Underground Mining

Mineral processing is the process of extracting minerals from the ore, refining them, and preparing these minerals for use. The primary steps involved in processing minerals include:

1. **Sampling –** is the removal of a portion which represents a whole needed for the analysis of this material.
2. **Analysis –** is important to evaluate the valuable component in an ore. This includes chemical, mineral and particle size analysis.
3. **Comminution –** is the process where the valuable components of the ore are separated through crushing and grinding. This process begins by crushing the ores to a particular size and finishes it by grinding the ores into a powder form.
4. **Concentration –** involves the separation of the valuable minerals from the raw materials
5. **Dewatering –** uses the concentration to convert it to usable minerals. This involves filtration and sedimentation of the suspension and drying of the solid materials harvested from this suspension.



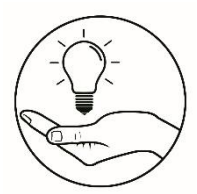
What's More

Write T if the statement is true and F if the statement is false. Then choose the word/s that make the statement false. Write your answer on a separate sheet of paper.

1. Underground mining is more expensive and dangerous than surface mining.
2. Dredging is an example of underground mining.
3. In surface mining, miners need to create a tunnel so they can reach the ore minerals.
4. Modern mining technology uses geophysical techniques to locate prospective mineral ore deposit.
5. Both surface and underground mining uses explosives.

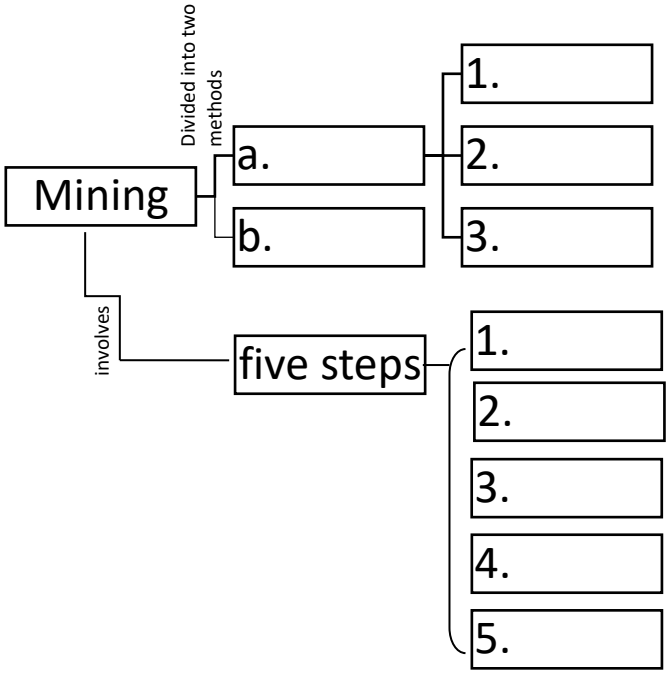
Match each statement in Column A with the correct mining process in Column B. In Column C, arrange column B in chronological order using numbers 1, 2, 3, 4 and 5. Write your answer on a separate sheet of paper.

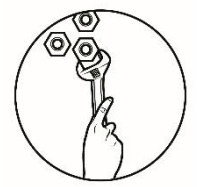
Column A	**Column B**	**Column C**
6. It involves the separation of the valuable minerals from the raw materials.	A. dewatering	11. _____
7. This is the removal of a portion which represents a whole needed for the analysis of this material.	B. sampling	12. _____
8. This process begins by crushing the ores to a particular size and finishes it by grinding the ores into a powder form.	C. comminution	13. _____
9. It uses the concentration to convert it to usable minerals.	D. analysis	14. _____
10. It is important to evaluate the valuable component in an ore.	E. concentration	15. _____



What I Have Learned

Using the concept learned, complete the concept map with the correct word/s or phrases. Write your answer on a separate sheet of paper.





What I Can Do

Read an article about how mining can be sustainable in the Philippines, then make a reaction on it. Write your answer on a separate sheet of paper. (You will be graded based on the given rubric)

My Reaction

_____

_____

_____.

Assessment

Multiple Choice. Read and analyze the following questions. Write the letter that best answers each question on a separate sheet of paper.

1. Which of the following is a mineral ore?
   1. a rock with fossilized insect
   2. a rock combined with copper
   3. a sediment that has gold traces
   4. a rock that contains valuable mineral

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

2. Which of the following mining methods is applicable in mining gravel?
   a. Dredging
   b. Open-pit mining
   c. Strip mining
   d. Underground mining

3. Chromite miners in the Philippines use drill or explosive to bore hole in the ground to extract the mineral deposits. Which mining method did the miners use?
   a. Dredging
   b. Open-pit mining
   c. Strip mining
   d. Underground mining

4. The following are the processes done by modern miners to determine the prospective mineral ore body except
   a. using geophysical techniques
   b. determining the elevation of the area
   c. measuring the magnetic reading of the area
   d. determining the sonic responses of the location

5. Black sand is mined at sea and coastline in some areas in the Philippines. Which method is applicable to mine black sand?
   a. Dredging
   b. Open-pit mining
   c. Strip Mining
   d. Underground mining

6. Which of the following is not included in the group?
   a. Dredging
   b. Open-pit mining
   c. Strip mining
   d. Underground mining

7. A geologist examined the ore sample from unidentified mining site. He tested the chemical, mineral and particle size of the mineral sample. What mineral processing did he perform?
   a. Analysis
   b. Comminution
   c. Dewatering
   d. Sampling

8. What method of mining involves digging of tunnels to extract the ore deposits?
   a. Deep mining
   b. Open - pit mining
   c. Surface mining
   d. Underground mining

9. Which mineral process involves filtration and sedimentation of the mining water and drying of the solid minerals harvested from this suspension?
   a. Comminution
   b. Concentration
   c. Dewatering
   d. Sampling

10. Which of the arrangement of mineral processing is correct?
   a. comminution, dewatering, crushing, grinding and analysis
   b. sampling, analysis, comminution, filtration and dewatering
   c. sampling analysis, comminution, concentration and dewatering
   d. dewatering, comminution, analysis, sampling and surface mining

11. Which is true about surface mining?
   a. It is the most dangerous method of mining.
   b. Surface mining is expensive type of mining.
   c. Surface mining can be done through creating a tunnel.
   d. It is used to extract ore minerals near the surface of the earth.

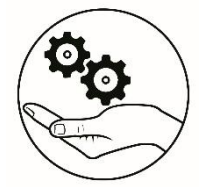
12. Which of the following is the first step in mineral processing?
   a. Analysis
   b. Comminution
   c. Dewatering
   d. Sampling

13. Which of the following processes involved crushing and grinding of mineral ore?
   a. Analysis
   b. Comminution
   c. Dewatering
   d. Sampling

14. What mineral processing did a geologist perform if he took a sample of mineral from the prospective mineral deposit?
   a. Analysis
   b. Comminution
   c. Dewatering
   d. Sampling

15. Which of the following statement/s is/are incorrect?
   1. Surface and underground mining use explosives.
   2. Underground mining is cheaper than surface mining
   3. Open pit mining is the most common type of surface mining

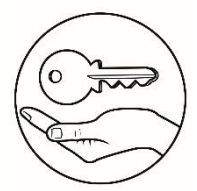
   a. 1 only b. 2 only c. 1 and 2 d. 1 and 3



Additional Activities

Explain the quotation given by Gina Lopez on the proposal to lift and review the open-pit mining ban in the Philippines. Write your answer on a separate sheet of paper.

"Mining is not a right. It's a privilege. It's a privilege granted on certain conditions. But the Filipinos' right to our water, our air, our rivers, our streams is not only constitutional, it's God-given. And it's the duty of government to protect the rights of the Filipino".



Answer Key

What I Know

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

What's More

1. T
2. F - Dredging
3. F – surface mining
4. T
5. T
6. E
7. B
8. C
9. A
10. D
11. 5
12. 1
13. 3
14. 2
15. 4

Assessment

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

Rubrics in making a reaction from an article

Criteria	5 points	3 points	1 point
Ideas	Establishes a clear focus Provides relevant information Communicates creative ideas	Develops a focus Details support idea Communicates original ideas	Attempts focus Ideas not fully developed
Organization	Demonstrates an orderly flow of ideas	Evidence of logical sequencing	Sequencing is attempted
Conventions	Few or no errors in: grammar, spelling, capitalization, punctuation	Some errors in: grammar, spelling, capitalization, punctuation	Has some difficulty in: grammar, spelling, capitalization, punctuation
Legibility	Easy to read Properly spaced	Readable with some spacing/forming errors	Difficult to read due to spacing/forming letter

References

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https://www.google.com/search?q=gina+lopez+quotes+about+nature+mining&prmd=inv&source=lnms&tbm=isch&sa=X7ved

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