Senior High School

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DEPARTMENT OF EDUCATION

Earth Science for STEM

Quarter 2 – Module 7: Structure and Evolution of Ocean Basins

ALTERNATIVE DELIVERY MODE
ADM

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Secretary: Leonor Magtolis Briones
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Development Team of the Module

Writers: May E. Taguinod

Editors: Randie B. Atienza and Adelinda A. Fajardo

Reviewers: Marionel U. Briz, Francia C. Silva, Eleneth D. Escalona, Jovy M. Perez, Cyrus T. Festijo, Rowena D. Cabanding

Illustrator: Patrick Lemuel V. Reyes

Layout Artist: Paulina S. Crescini, Leomar G. Paracha

Management Team: Francis Cesar B. Bringas
Job S. Zape Jr.
Ramonito O. Elumbaring
Reicon C. Condes
Elaine T. Balaogan
Fe M. Ong-ongowan
Sacoro R. Comia
Fe M. Fallurin
Marieta N. Perez

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Department of Education – Region IV-A CALABARZON

Office Address: Gate 2, Karangalan Village,Barangay San Isidro
Cainta,Rizal 1800
Telefax: 02-8682-5773/8684-4914/8647-7487
E-mail Address: region4a@deped.gov.ph

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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.

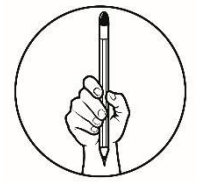
Thank you.

What I Need to Know

This module focusses on the evolution and structure of ocean basins. This aims to provide an overview of how ocean basins are formed over a million of years ago and what is their unique structure that geologist find most interesting. This includes pretest, procedure/learning experience/learning activities, reflection, and posttest. Read the directions carefully before doing all the exercises and activities.

At the end of this module, the successful learner will be able to:

1. Identify and describe the structure of the ocean basin.
2. Trace the stages of the evolution of the ocean basin.



What I Know

Read and analyze the following questions. Write your answer in a separate sheet of paper.

1. Which of the following structures of the ocean basin is partly a shallow extension of the continent underwater?
    a. Continental rise
    b. Continental shelf
    c. Continental slope
    d. Island

2. Which of the following best describes continental slope?
    a. It is the flattest part of the ocean.
    b. It is where the ocean begins.
    c. It starts from oceanic crust to continental crust.
    d. It is part of the ocean basin that extends up from the ocean floor.

3. Which of the following is the deepest part of the ocean?
    a. Abyssal plain
    b. Continental Slope
    c. Seamount
    d. Trench

4. Which of the following refers to the mountain system?
    a. Abyssal plain
    b. Continental Slope
    c. Mid-oceanic ridge
    d. Trench

5. Why are undersea mountain flat?
    a. because of earthquake
    b. because of large marine animal
    c. because of erosion caused by waves
    d. because of large ships that pass through it

6. Where does upwelling process most likely occur?
    a. Abyssal plane
    b. Mid-oceanic ridge
    c. Seamount
    d. Trench

7. What happens during embryonic stage of ocean basin?
    a. Formation of young to mature mountain belts
    b. Formation of narrow seas with matching coasts
    c. Formation of ocean basin with continental margins
    d. Formation of complex system of linear rift valleys on continents

8. What will most likely occur during juvenile stage of the ocean basin?
    a. Formation of young to mature mountain belts
    b. Formation of narrow seas with matching coasts
    c. Formation of ocean basin with continental margins
    d. Formation of complex system of linear rift valleys on continents

9. Which of the following is the ocean basin in mature stage?
    a. Atlantic Ocean
    b. East African Rift Valley
    c. Pacific Ocean
    d. Red Sea

10. An ocean basin formed a narrow, irregular seas with young mountains. What stage of the Wilson Cycle was exhibit?
    a. Juvenile
    b. Mature
    c. Suturing
    d. Terminal

11. How will you categorize the stages of the ocean basin that formed island arcs and trenches around basin edge?
    a. Declining
    b. Embryonic
    c. Juvenile
    d. Mature

12. Which stage of ocean basin forms a rift valley?
    a. Declining
    b. Embryonic
    c. Suturing
    d. Terminal

13. Which of the following is the correct sequence of the Wilson Cycle?
    I. Young to mature mountain belts
    II. Narrow seas with matching coasts
    III. Ocean basin with continental margins
    IV. Narrow irregular seas with young mountains
    V. Islands arcs and trenches around basin edge
    VI. Complex system of linear rift valleys on continent
    a. I,II,III,IV,V,VI
    b. VI,V,IV,III,II,I
    c. VI,II,III,V,IV,I
    d. I,V,VI,IV,III,II

14. Which of the following is the best example of ocean basin in Suturing stage?
    a. Atlantic Ocean
    b. Himalayan Mountains
    c. Pacific Ocean
    d. Red Sea

15. In which stage of ocean basin formation does divergence occur?
    a. Juvenile and Mature
    b. Embryonic and Juvenile
    c. Mature and Declining
    d. Terminal and Suturing

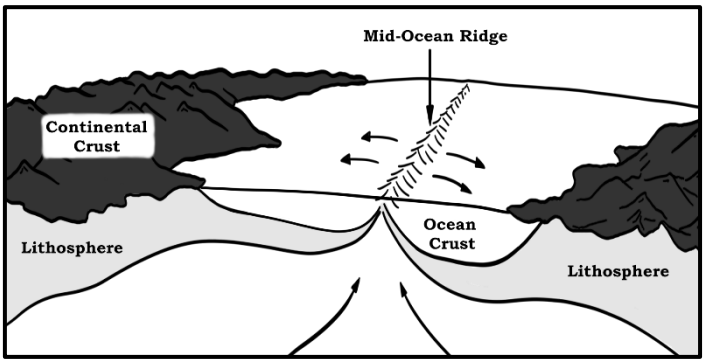
Lesson 7 Structure and Evolution of Ocean Basin

Over a long period of time, as plate tectonics meet and subduction occurs, a vast geologic basin that covers the large area of Earth's surface is formed called ocean basins. It has different structures that describe its unique feature. Living on an ocean planet, where 70% are covered with water, there are unseen creatures and astounding views and features that we can discover, and one of these is the ocean basins.

What's In

Stop , Look, and Observe!

Observe and analyze the given illustration. Answer the questions that follow. Write your answers in a separate sheet of paper.



1. Based on the illustration, what do you think causes the sea floor to spread?
2. What does the picture tell us about our ocean and continents?
3. What other things have you learned about sea floor spreading?

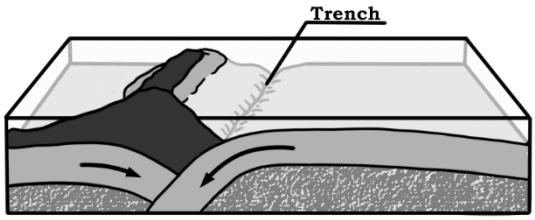
Notes to the Teacher

As a facilitator always instructed your learners to carefully read and analyze the content and activities written in the module. Asks them about knowledge they obtained and achieved as they go through the module.

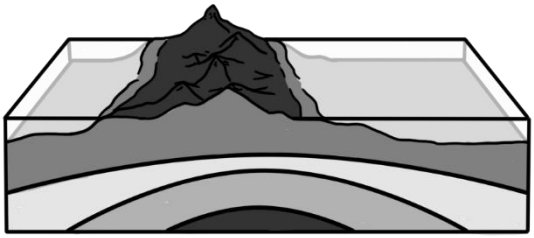
What's New

Jumbler Task

Arrange the following stages in chronological order. Write number 1 as the first step, number 2 as second and so on.

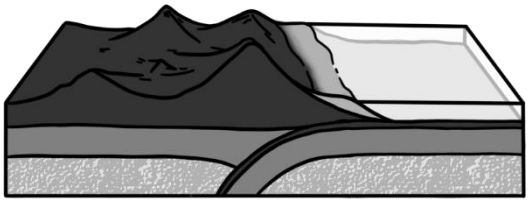


Formation of trenches

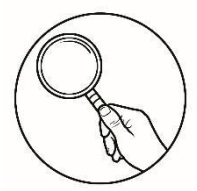


Bending of outermost crust

Dense lithosphere melts or slides beneath less- dense lithosphere



Two tectonic plates meet



What is It

Less than 100 million years ago the supercontinent **Pangea** had existed. Because of tectonic forces and processes, the supercontinent breaks apart and ocean basins are formed. The ocean basins cover the largest area of the earth's surface. All of the ocean basins were formed from volcanic rock that was released from the fissures that is located at the mid-ocean ridges, which is an underwater mountain range formed by plate tectonics. Through subduction process and high gravitational energy, oceanic lithosphere is forced to move under the mantle. Over years, ocean basins are continuously evolving as four major ocean subdivision is formed. The world ocean is divided into the North and South Pacific, North and South Atlantic, Indian, and Arctic Oceans. They are all distinct based on their stage of geological evolution.

Pacific Ocean basin is the largest, deepest, and oldest existing ocean basin. More trenches, and more frequent tsunamis happen here. It has been shaped by plate tectonics. The second largest ocean basin is the Atlantic followed by the Indian ocean basin. The smallest of the earth's ocean basins is Arctic and is covered by ice.

Through the formation of ocean basins, different features and structures are formed. See figure 2 below.

1. **Continental shelf**- Partly shallow extension of the continent underwater.
2. **Continental slope**- Transition zone of continental shelf and deep ocean floor. It starts from oceanic crust to continental crust.
3. **Continental rise**- It is where the ocean begins. All basaltic and oceanic rocks are found here. It is the place where the sediments from land are washed. The continental margin starts from continental shelf up to continental rise.
4. **Abyssal plain**- The flattest part of the ocean. 50 % of the earth's surface is being covered by this plain.
5. **Island**- It's not just a piece of land floating up in the middle of the sea, it is part of the ocean basin that extends up from the ocean floor.
6. **Seamount**- It is an undersea mountain. The erosion caused by waves destroyed the top of a seamount which caused it to be flattened.
7. **Trench**- It is the deepest part of the ocean.
8. **Mid-oceanic ridge**- The seafloor mountain system which is situated in the middle of the ocean basin. It is where upwelling of magma happens which causes the sea floor to spread.

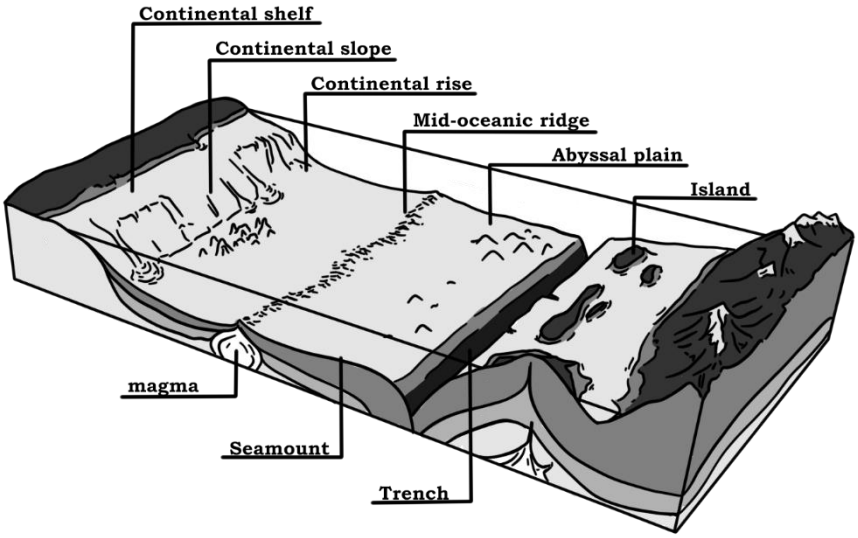


Figure 1. The ocean basin

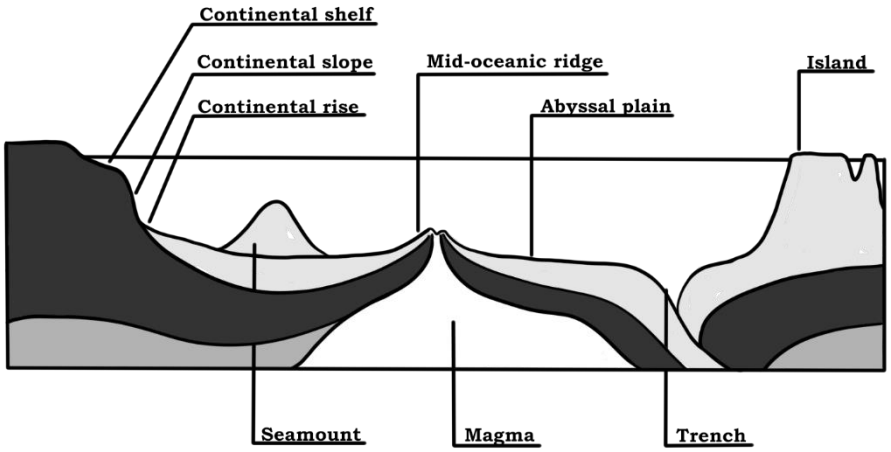


Figure 2. Cross section of ocean basin

Evolution of the Ocean Basin

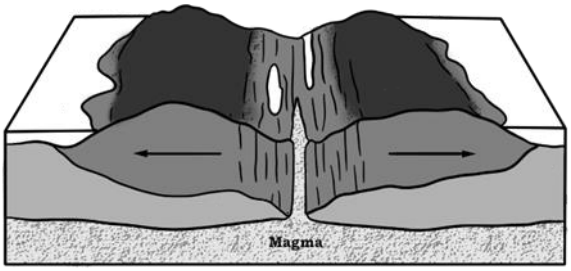
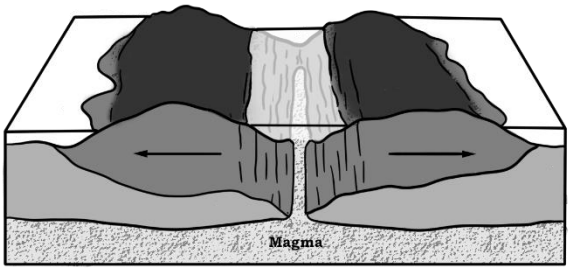
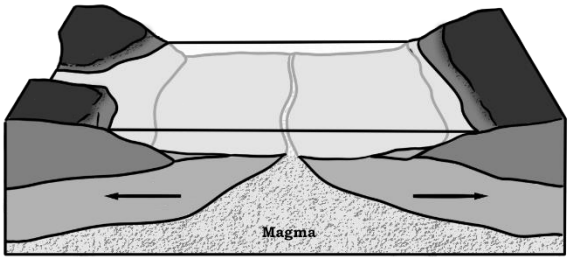
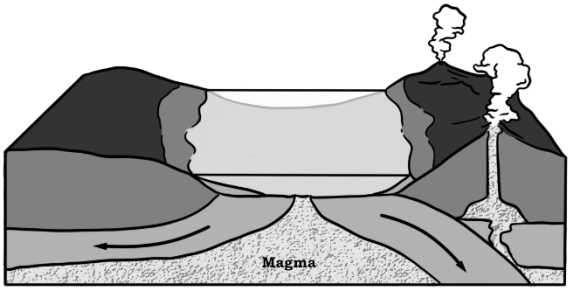
The **Wilson Cycle** explains the process of the opening (beginning) and the closing (end) of an ocean which is driven by **Plate Tectonics.** This process is named after the Canadian Geophysicist J. Tuzo Wilson (1908-1993).

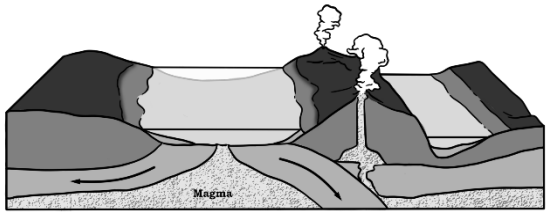
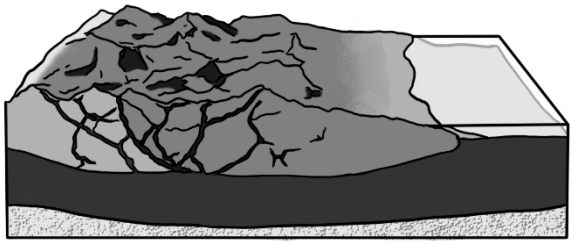
It is divided into 6 stages namely:

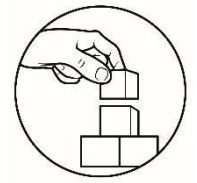
1. Embryonic Ocean Basin
2. Juvenile Ocean Basin
3. Mature Ocean Basin
4. Declining Ocean Basin
5. Terminal Ocean Basin
6. Suturing (Continental collision)

The table below gives details on each stage of Wilson Cycle

Table 1. Stages of Wilson Cycle

Stage	Description	Example
Embryonic 	• Motion: Uplift • Complex system of linear rift valleys on continent	East African Rift Valleys
Juvenile 	• Motion: Divergence (Spreading) • Narrow seas with matching coasts	Red Sea
Mature 	• Motion: Divergence (Spreading) • Ocean basin with continental margins	Atlantic and Arctic Oceans
Declining 	• Motion: Convergent (Subduction) • Islands arcs and trenches around basin edge	Pacific Ocean

Terminal 	• Motion: Convergent (Collision and Uplift) • Narrow, irregular seas with young mountains	Mediterranean Seas
Suturing 	• Motion: Convergence and Uplift • Young to mature mountain belts	Himalayas Mountains

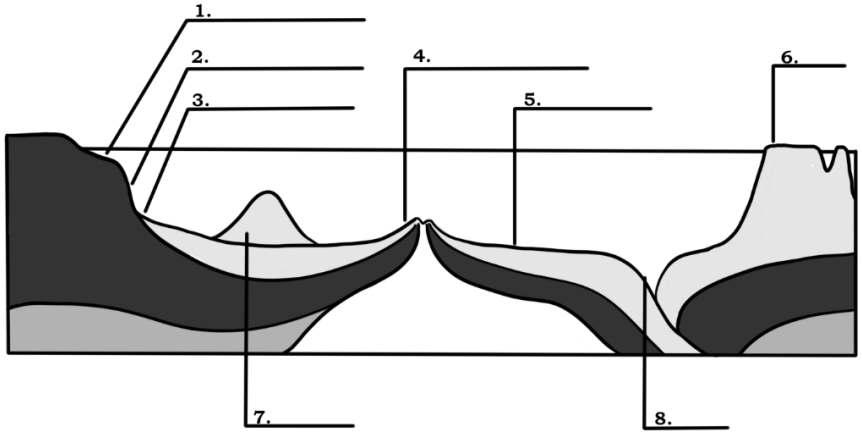


What's More

The Ocean Basin

Label the structures of ocean basin below. Choose your answer from the word bank provided.

Continental shelf	**Abyssal plain**	**Trench**
Island	**Continental rise**	**Mid-oceanic ridge**
Seamount	**Continental slope**	



What I Have Learned

Fill in the Table

Complete the table below. Use the details inside the box. Write your answers in a separate sheet of paper.

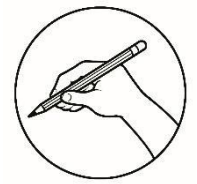
Uplift	Terminal	Pacific Ocean
Narrow seas	Himalayas Mountains	Spreading
Mature	Island Arcs and trenches	Young to mature mountains
Mediterranean Seas	Convergence and Uplift	Red Sea

Stages	Motion	Description	Example
1. Embryonic		Complex system of linear rift valleys	East African Rift Valleys
2. Juvenile	Divergence		
3.		Ocean basin with Continental Margins	Atlantic and Arctic Oceans
4. Declining	Subduction		
5.	Collision and Uplift	Narrow irregular seas with young mountains	
6. Suturing			

What I Can Do

"A Traveler"

Using Map, identify and locate at least five places where the six stages of Wilson Cycle occur.



Assessment

Select the letter of the best answer and write it in a separate sheet of

paper

1. Where does upwelling process most likely occur?
    a. Abyssal plane
    b. Mid-oceanic ridge
    c. Seamount
    d. Trench

2. What happens during embryonic stage of ocean basin?
    a. Formation of young to mature mountain belts
    b. Formation of narrow seas with matching coasts
    c. Formation of ocean basin with continental margins
    d. Formation of complex system of linear rift valleys on continents

3. Which of the following will most likely occur during juvenile stage of the ocean basin?
    a. Formation of young to mature mountain belts
    b. Formation of narrow seas with matching coasts
    c. Formation of ocean basin with continental margins
    d. Formation of complex system of linear rift valleys on continents

4. Which is an example of the ocean basin in mature stage?
    a. Atlantic Ocean
    b. East African Rift Valley
    c. Pacific Ocean
    d. Red Sea

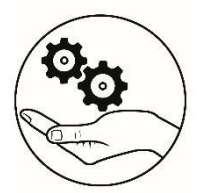
5. An ocean basin formed a narrow, irregular seas with young mountains. What stage of the Wilson cycle was exhibited?
    a. Juvenile
    b. Mature
    c. Suturing
    d. Terminal

6. Which of the following is the correct sequence of the Wilson Cycle?
    I. Young to mature mountain belts 6
    II. Narrow seas with matching coasts 2
    III. Ocean basin with continental margins 3
    IV. Narrow irregular seas with young mountains 5
    V. Islands arcs and trenches around basin edge 4
    VI. Complex system of linear rift valleys on continent 1
        a. I, II, III, IV, V, VI
        b. VI, V, IV, III, II, I
        c. VI, II, III, V, IV, I
        d. I, V, VI, IV, III, II
7. Which of the following is the best example of ocean basin in Suturing stage?
        a. Atlantic Ocean
        b. Himalayas Mountains
        c. Pacific Ocean
        d. Red Sea
8. In which stage of ocean basin formation does divergence occur?
        a. Juvenile and Mature
        b. Embryonic and Juvenile
        c. Mature and Declining
        d. Terminal and Suturing
9. Which of the following structures of the ocean basin is a partly shallow extension of the continent underwater?
        a. Continental rise
        b. Continental Shelf
        c. Continental slope
        d. Island
10. Which of the following best describes continental slope?
        a. It is the flattest part of the ocean.
        b. It where the ocean begins.
        c. It starts from oceanic crust to continental crust.
        d. It is part of the ocean basin that extends up from the ocean floor.
11. Which of the following is the deepest part of the ocean?
        a. Abyssal plain
        b. Continental slope
        c. Seamount
        d. Trench
12. Which of the following refers to the seafloor mountain system?
        a. Abyssal plain
        b. Continental slope
        c. Mid-oceanic ridge
        d. Trench
13. Why are undersea mountains flat?
        a. because of earthquake
        b. because of large marine animals

c. because of erosion caused by waves
d. because of large ships that pass through it

14. How will you categorize the stage of the ocean basin that formed island arcs and trenches around basin edge?
    a. Declining
    b. Embryonic
    c. Juvenile
    d. Mature

15. Which stage of ocean basin forms a rift valley?
    a. Declining
    b. Embryonic
    c. Suturing
    d. Terminal



Additional Activities

Watch the link below about Ocean Basins.

Grade 11 & 12 | Earth Science | Structure and Evolution of Ocean Basins | Theresa Reyes Q2 W6 - YouTube

Answer Key

What I Know

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

What's More

1. Continental Shelf
2. Continental slope
3. Continental Rise
4. Mid-oceanic ridge
5. Abyssal Plain
6. Island
7. Seamount
8. Trench

Assessment

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

What I have Learned

Stages	Motion	Description	Example
1. Embryonic	Uplift	Complex system of linear rift valleys	East African Rift Valleys
2. Juvenile	Divergence	Narrow seas	Red Sea
3.	Spreading	Ocean basin with Continental Margins	Atlantic and Arctic Oceans
4. Declining	Subduction	Island Arcs and trenches	Pacific Ocean
5.	Collision and Uplift	Narrow irregular seas with young mountains	Mediterranean Seas
6. Suturing	Convergence and Uplift	Young to mature mountains	Himalayas Mountains

What's New

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Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph *