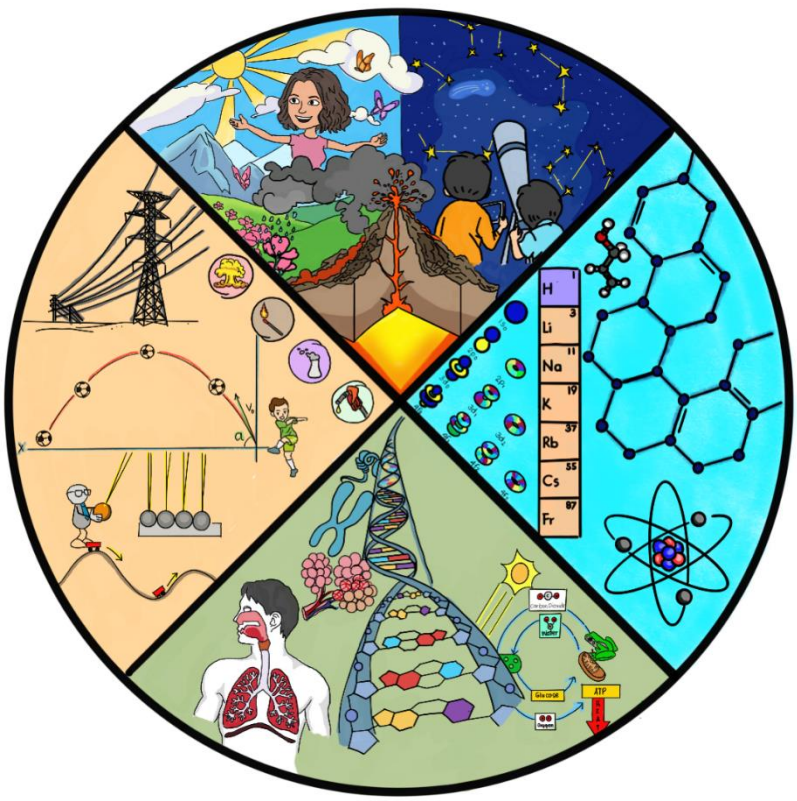
9

Department of Education
National Capital Region
SCHOOLS DIVISION OFFICE
MARIKINA CITY

Science

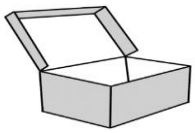
Quarter 3 - Module 4

Factors Affecting the Climate



Mark John D. Bello

City of Good Character
DISCIPLINE • GOOD TASTE • EXCELLENCE



What I Need to Know

The purpose of this module is to help you differentiate climate from weather, discover the factors that affect the climate and why climate differs in every country.

This module contains one lesson: Factors Affecting the Climate

After going through this module, you are expected to **explain how different factors affect the climate of an area. S9ES-IIIE-29**

Specifically, you should be able to:

- differentiate climate from weather;
- explain how altitude affects the climate;
- explain how land topography affects the climate; and
- explain how ocean surface and circulation directly affect the pattern of climate around the world.

What I Know

Read and understand each question and encircle the letter of the correct answer.

1. Which of the following BEST describes a climate?
   A. The weather that occurs in the atmosphere within a day.
   B. The pattern of weather that occurs in a region over a long period of time.
   C. The pattern of weather that occurs in a region over a short period of time.
   D. The disturbance in the atmosphere that happens in a long period of time.

2. City A is surrounded by bodies of water and has a moderate climate. It is located near the equator. What will most likely affect the climate of the city?
   A. Altitude B. Latitude C. Topography D. All of these

For Nos. 3-4. Refer to the table below.

CITY/COUNTRY	ALTITUDE (m)	TEMPERATURE (^{0}C)
A. Malaysia	110	30 to 28
B. Manila	8	33 to 22
C. Japan	438	26 to 5
D. Russia	1, 800	18 to -8

3. Which city/country had the lowest temperature?

4. Which city/country had the highest temperature?

5. What climate is experienced by regions receiving vertical rays of sunlight?

A. cool climate
B. hot climate
C. moderate climate
D. temperate climate

6. Why do places of the same latitude but different altitudes experience a different climate?

A. The amount of heat received varies.
B. The amount of precipitation differs.
C. Higher altitudes have lower temperature.
D. Higher altitudes have higher temperature.

7. Why are the coldest places on earth found at the poles?

A. less amount of thermal radiation is received by these areas
B. great amount of thermal radiation is received by these areas
C. great amount of gaseous particles trap heat from the surface
D. less amount of gaseous particles trap heat from the surface

8. How does the distance of a place from the sea affect the climate during summer?

A. Cool breezes will cool both the coast and further inland.
B. Warm breezes will bring cool air to the coast whilst inland will be warmer.
C. Cool breezes will bring cooler air to the coast whilst inland will be warmer.
D. Warm breezes will bring warm air to the coast whilst inland will be cooler.

9. Which side of the mountain often receives the most precipitation?

A. Leeward B. Rain Shadow C. Summit D. Windward

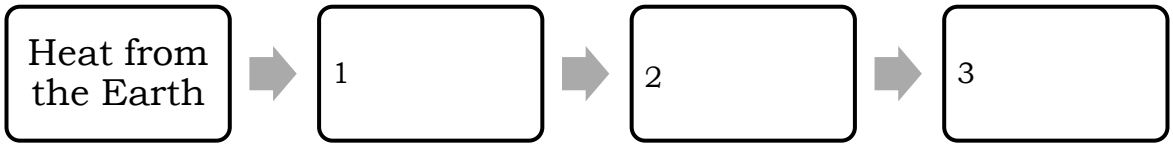
10. How does prevailing wind affect climate?

A. Prevailing wind bring heat and moisture to certain region.
B. Prevailing wind describes the speed of the wind in a particular place.
C. Prevailing wind is the amount of moisture that can be found in an area.
D. Prevailing wind shows the main direction that wind comes from and can bring mild, wet weather if it blows over warm oceans.

Lesson Factors Affecting the Climate

What's In

Show how the heat from the Earth is used as a source of electricity in a geothermal power plant by completing the flow chart. Choose from the box below.



- Generator changes the mechanical energy to electrical energy.
- Heat causes the water to turn into steam.
- Steam causes the turbine to turn.

What's New

Find the words being described by each statement below. The words maybe hidden in any direction on the puzzle grid.

_____1. It is a short-term state of the atmosphere.
_____2. It is the average daily weather for a certain point of time at a particular location.

R	G	V	R	E	O	I	F	J	L	C	A	W	E	T	O	R	C
A	H	U	I	R	H	L	X	T	I	S	E	O	M	I	C	E	I
P	U	H	P	O	I	B	Z	R	P	A	E	O	X	Y	L	E	M
H	E	R	T	I	S	A	E	P	T	O	S	C	I	S	T	O	O
Y	I	I	H	D	M	H	I	H	I	P	R	U	I	N	X	D	N
U	G	P	J	Y	P	C	E	R	N	H	O	M	E	V	Z	V	O
P	N	K	S	S	V	R	X	A	E	C	O	N	O	M	R	N	R
T	O	N	O	I	T	A	R	T	S	I	N	I	M	D	A	E	T
E	M	M	Y	I	S	T	A	R	T	U	P	S	O	M	A	P	S
C	T	G	O	P	E	E	T	A	M	I	L	C	E	H	I	T	A

What Is It

Figure 1. PAGASA Weather Forecast
https://bit.ly/3b6GSej

Meteorologists use several devices to gather data about the weather elements. Weather satellites collect better and accurate observations about the air beyond the earth. Different weather stations all over the country or worldwide investigate and interpret these observations. **PAGASA** *(Philippine Atmospheric, Geophysical and Astronomical Services Administration*) is the national institution that gives official weather forecasts which are televised daily nationwide in the Philippines. **Weather** is the temporary condition of the atmosphere which may change from time to time. **Climate** is the total condition of the atmosphere over a long time. The scientists who specialize in the study of climate are called **climatologists.** They learn the climate of a place by analyzing its weather from season to season and year to year. Temperature, humidity, precipitation, air pressure, cloudiness, and wind are factors that affect the weather and climate of an area.

FACTORS AFFECTING CLIMATE

1. LATITUDE

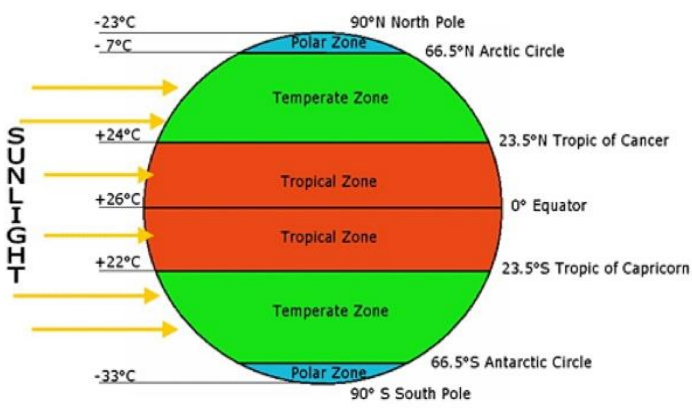


Figure 2. Sun Ray's and Earth
https://bit.ly/3e0AHeJ

Your location on the earth's surface in relation to the sun influences the climate you have. The main reason that affects the climate of any place is its **distance from the equator.** This gap is measured in degrees of latitude; the equator is 0 degrees latitude. The Philippines is placed close to the equator. At the equator, the sun is certainly not very far from being directly above at noon. The sun's rays reached the earth most directly at the equator. So, these areas are warm all year. At morning and late

afternoon, the beams of the sun are diagonal. The energy from the sun is much fewer these periods of time. But at noon, the sun is directly overhead. You get vertical rays this time, so the heat is concentrated. During the months of March, April and May, the Philippines gets vertical rays. You feel a hot climate or experience summer months. For six months, the North and South Pole experienced cold climates. In some places at the middle latitudes such as California and Japan, the sun is elevated during summer. These places have hot summers because they also have prolonged daytime. At winter, the sun is at a low level in the sky. These places get diagonal rays; so, they come up with cold winters. They also have longer nights and shorter daytime.

2. ALTITUDE

Figure 3. Mt. Pulag
https://bit.ly/3kBcaya

Have you ever been to Baguio City? All throughout the year, this place has a cold climate, even during summer months. This is the reason why Baguio City becomes the "Summer Capital of the Philippines". Why? Baguio City is about 2,300 feet directly above sea level. The height or elevation of the area influences its climate. Temperature becomes lower as the altitude above sea level goes higher. Temperature becomes lower because the height above water level goes higher. Temperature decreases as altitude increases. At high altitudes, the air does not absorb and hold the maximum amount heat; it's less dense. Climatologists have discovered that temperature drops about 2˚ Celsius for each 300 meters or 1,000 feet of altitude.

3. TOPOGRAPHY

Mountain ranges also affect the circulation of precipitation. For example, hot air from the ocean moves east, blows the mountains, and rise. As the air rises, it cools, affecting it to rain on the western area of the mountain. When the air gets the eastern region of the mountain it is dry. This effect is known as a rain shadow.

4. OCEAN CURRENT

Great flows of water running in the oceans are called ocean currents. Some currents bring warm water to cool areas. Warm ocean currents stream from the tropical seas toward the polar areas. Other ocean currents bring cool water to warm areas. These currents influence climate in many parts of the world.

5. WIND SYSTEMS

People residing nearby oceans and lakes feel the breeze. There are two types of breeze – **land breeze and sea breeze.**

During the day, warm air over the land rises and is exchanged by the cool air over the water. This is called a sea breeze. During the night, the land turns out to be cooler than water. Warmer air over the water increases and is replaced by cooler air from the land. This is called a land breeze. On big surfaces, continents heat and cool faster than oceans. A center of low pressure builds over the continent while high pressure builds over the nearby ocean. These make wind systems known as seasonal winds or monsoons.

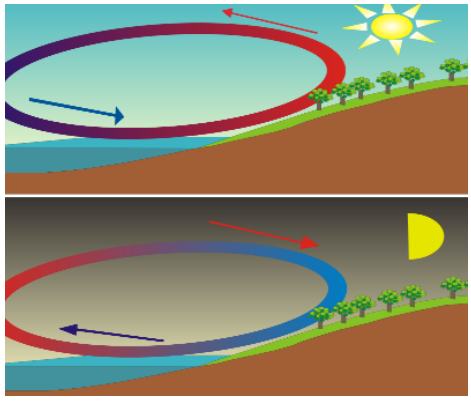


Figure 4. Land Breeze and Sea Breeze
https://bit.ly/307Cq9Y

The Philippines is influenced by these following wind systems:

NORTHEAST MONSOON

From October to February, a high-pressure region builds over Southern Siberia and India in winter because of the cold air over these areas. This mass of cold air goes in the direction of the Pacific Ocean. It reaches the Philippines from a northeasterly direction, as a result, the name northeast monsoon. This monsoon gives cold mornings and strong rainfall along the eastern coastal regions of the Philippines.

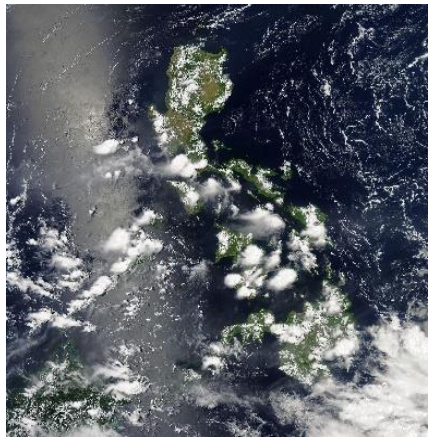


Figure 5. Philippines Affected by Monsoon
https://bit.ly/3sDrTjd

SOUTHWEST MONSOON

From June to September, the continent of Asia turns out to be warmer than the oceans nearby. A cold air mass builds over the Pacific Ocean. It goes toward the Asian continent from a southwest direction. Southwest monsoon gives heavy rainfall along the western coastal regions of the Philippines.

6. EARTH'S MOVEMENT AFFECTS CLIMATE

The earth spins on its axis every day. One side of it faces the sun and is completely lighted while the other side is in darkness, as it rotates. The earth's axis is inclined at 23 ½ degrees. Because of this, some portions of the earth receive vertical rays while other parts receive diagonal rays.

Regions on earth that receive vertical rays have hot climate roughly all year round. Those which get diagonal rays have cooler climate. The earth also revolves around the sun. One revolution takes the earth 365 ¼ days. As the earth revolves, its inclination shifts. During some months, it is inclined around the sun. Areas on this side of the earth get hot season or summer. Those places which are tilted away from the sun get cold season or winter. Because the earth rotates, people in several places have different sunrise and sunset, too. During summer months, daytime is lengthier because the sun rises earlier and sets later than typical. So, you feel hot climate during these months. During cold months, the sun rises a lot later and sets much earlier.

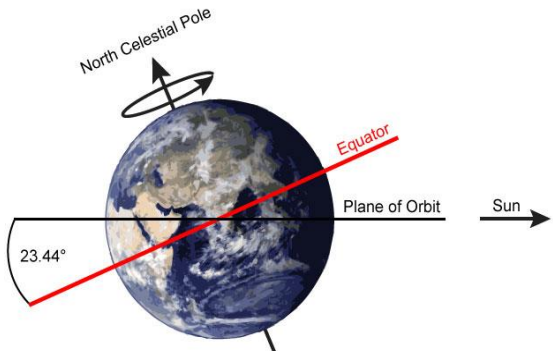


Figure 6. Earth's Tilt and Movement
https://bit.ly/2NXpzVn

What's More

Activity 1.1 Weather or Climate?

Objective: Differentiate climate from weather.

What to do: Differentiate weather from climate. Write **CLIMATE** if the statement/ phrase describes climate and write **WEATHER** if it describes weather on the space provided on the hexagon.

1. It takes place every day. _____
2. The atmospheric condition of a place may vary every minute. _____
3. The atmospheric condition over a long period of time in a specific area. _____
4. It is affected by temperature which is the amount of moisture present in the air. _____
5. The experts looking at averages of precipitation. _____
6. It tells you what to wear each day. _____
7. It tells you what types of clothes you have in your closet. _____
8. How much rain or snow typically falls. _____
9. Three-decade averages of weather observations. _____
10. The total weather of a certain place over a year is called weather. _____

Guide Question:

1. How do you differentiate weather from climate?

_____

_____

Activity 1.2 How Latitude Affects Climate?

Objective: Explain how latitude affects climate.

What to do: Study the diagram below and answer the guide questions.

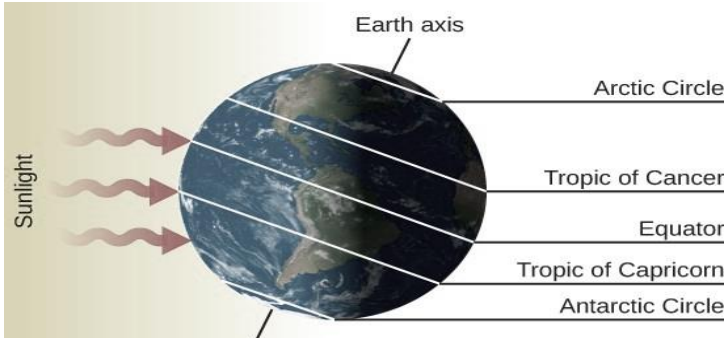


Figure 7. How Latitude affects Climate
https://bit.ly/37dcs8U

Guide Questions:

1. Why are places found at the equator experience high temperature?

_____

2. Which part of the earth receives the least sun's rays?

_____

3. How does latitude affect climate?

_____

Activity 1.3 How Altitude Affects Climate?

Objective: Explain how altitude affects climate.

What to do: Study the diagram below and answer the guide questions.

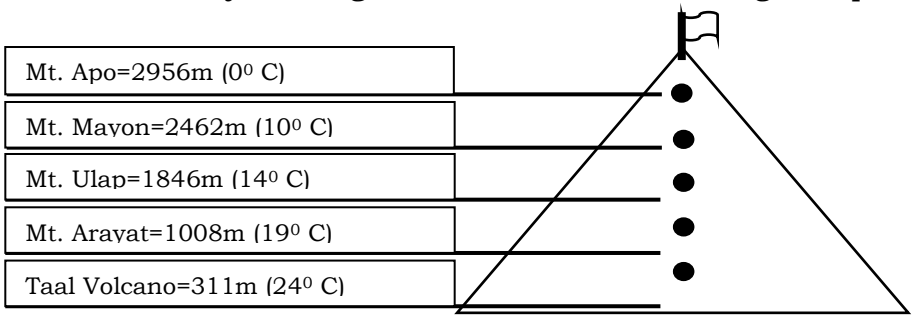


Figure 8. Height and Temperature of Different High Lands in the Philippines

Guide Questions:

1. Which mountain/volcano is the coldest?

_____

2. What temperature of the mountain/volcano is the hottest?

_____

3. How is the altitude of a place related to its temperature?

_____

Activity 1.4 How Topography Affects Climate?

Objective:

- Differentiate windward and leeward sides of the mountain.
- Explain how topography affects climate.

What to do: Study the diagram below then answer the guide questions.

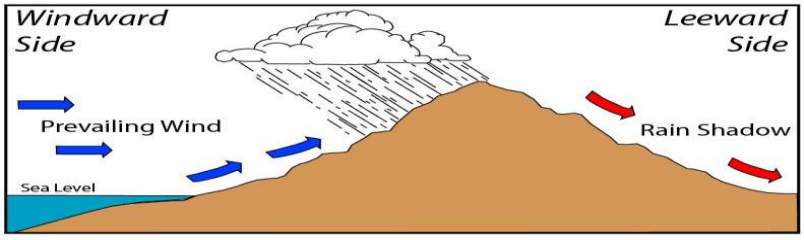


Figure 9. Windward and Leeward Side of the Mountain
https://bit.ly/3albn0P

Guide Questions:

1. Which side of the mountain experiences low temperature?

_____

2. Which side of the mountain experiences high temperature?

_____

3. What happens when air becomes warmer and drier as it moves down the leeward side?

_____

4. How does topography affect climate?

_____

Topography is another factor that influences the climate of a particular place. Mountainous regions greatly affect the volume of precipitation in some region. The region in which the wind blows is called the windward side. Here, the wind is stopped by the mountain, pushing it to move uphill. As it goes up, the water vapor condenses and forms clouds. This will cause in precipitation on the windward side. The air goes down to the opposite region called leeward side. The cold air mass begins to absorb heat and becomes warm and dry. As an outcome, the area close to the leeward side becomes dry and has a lesser amount of precipitation. The dry area on the leeward side is called rain shadow.

Activity 1.5 How Ocean Current Affects Climate?

Objective: Explain how ocean current affects climate.

What to do:

1. Study the diagram below.

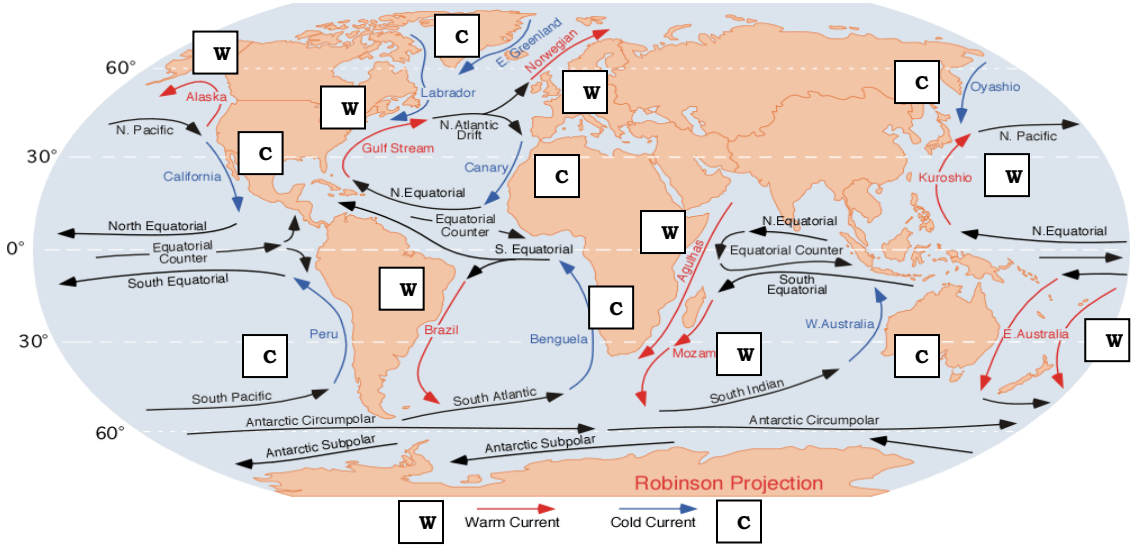


Figure 10. Ocean Currents
https://bit.ly/2LTNXX6

2. From the diagram above (figure 5), Fill-out the table below, give at least three examples of ocean currents that carry cold **(C)** and warm(**W)** water then answer the guide questions.

	WARM CURRENT	COLD CURRENT
OCEAN CURRENT		

Guide Questions:

1. What kind of ocean current is shown in Brazil based on the illustration?

_____

2. How do Oyashio Current and Kuroshio Current affect the Northeastern part and Southern part of Japan?

_____

3. How do ocean currents affect climate?

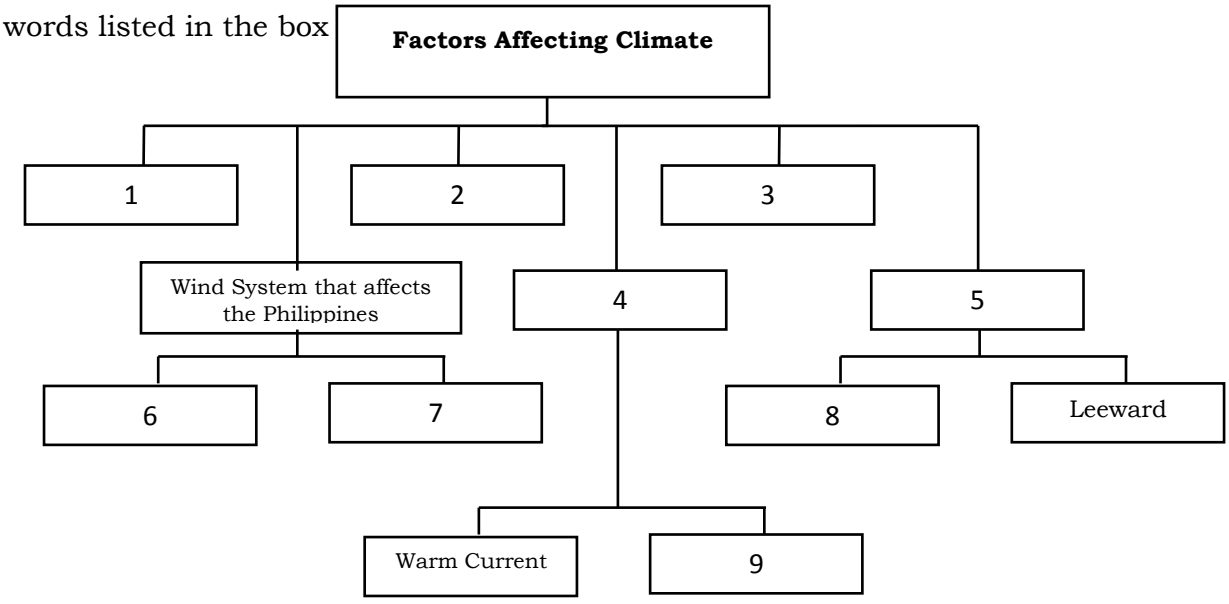
_____

You learned that ocean currents play an important role in the climate of a particular region. It also influences the temperature of the nearby land area. Warm currents move from the equator to the poles carrying warm water. On the other hand, cold currents move from the poles to the equator carrying cold water.

What I Have Learned

Fill in the concept map with word or group of words to complete the chart. Use the words listed in the box

Ocean Current	Windward	Northeast Monsoon
Cold Current	Latitude	Southwest Monsoon
Topography	Earth's Movement	Altitude



What I Can Do

Answer the following situations related on the real-life application of the factors that affect the climate. Write a brief statement on the space provided below.

1. The Department of Agriculture has 230,000 strawberry seedlings. What advice you can give them, where will be the best location of planting strawberries to help the farmers generate income?

_____

_____

2. The Banaue rice terraces in the Philippines is one of the world's marvels and had been proclaimed by UNESCO as a world cultural heritage place. Golden rice fields and apparently endless rice terraces add magnificence to the landscape. Rice is also the country's staple food. Though rice is generated throughout the country, the Central Luzon and Cagayan Valley are the major rice growing regions. What season is suitable for growing rice in the Philippines?

_____

_____

Assessment

Read and understand each question and encircle the letter of the correct answer.

1. Which refers to the atmospheric condition of a place over a long period of time?
   A. Climate B. Monsoon C. Topography D. Weather

2. During summer, many people visit Baguio because of the cold weather. What do you think makes Baguio cold?
   A. The altitude
   B. The latitude
   C. The topography
   D. The distance from the ocean

3. How does the windward side differ from the leeward side of a high land?
   A. The windward receives more precipitation than the leeward.
   B. The windward side receives more heat than the leeward side.
   C. The leeward side has more vegetation than the windward side.
   D. The leeward side receives more precipitation than the windward side.

4. What happens to the temperature of air when altitude increases?
   A. decreases B. increases C. varies D. remains the same

5. The following are factors that affect the climate except
   A. Altitude
   B. Earth's Movement
   C. Mountain Ranges
   D. Sandstorm

Additional Activities

INFOGRAPHICS: Create an infographic on a long bond paper about the factors affecting the climate using recycled materials. Write all the details and information about each factor. You can print or draw and be creative in making your own infographics. Follow the rubrics below as your criteria in grading your output.

CATEGORY	4	3	2	1
Accuracy and Relevance of the content	All graphics in the infographic are accurate and related to the topic.	Most graphics in the infographic are accurate and related to the topic	Some graphics in the infographic are accurate and related to the topic.	The graphics in the infographic are neither nor relate to the topic.
Creativity and Originality	All the graphics used on the infographic reflect an exceptional degree of student ingenuity in their creation.	Most of the graphics used on the infographic reflect student ingenuity in their creation.	The graphics were made by the student but were copied from the designs or ideas of others.	The graphics were not made by the student.
Proper use of recycled materials	All the materials used are recycled	Most of the materials used are recycled	Few of the materials used are recycled	All the materials used are not recycled.
Required Elements	The infographic includes all required elements as well as additional information.	All required elements are included.	Few required elements are included.	Required elements are missing.

Posttest

Read and understand each question and encircle the letter of the correct answer.

For Nos. 1-2. Refer to the table below.

CITY	ALTITUDE (m)	TEMPERATURE (^{0}C)
A. Malaysia	110	30 to 28
B. Manila	8	33 to 22
C. Japan	438	26 to 5
D. Russia	1, 800	18 to -8

1. Based on the table above, which city had the highest altitude?
2. Based on the table above, which city had the lowest altitude?

3. Which side of the mountain often receives the most precipitation?
   A. Leeward B. Rain Shadow C. Summit D. Windward

4. Why do places at the same latitude but different altitudes have different climate?
   A. Amount of heat received varies.
   B. Amount of precipitation differs.
   C. Higher altitudes have lower temperature.
   D. Higher altitudes have higher temperature.

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   C. It is the amount of moisture that can be found in an area.
   D. It shows the main direction that wind comes from and can bring mild, wet weather if it blows over warm oceans.

7. City A is surrounded by bodies of water, has a moderate climate, and is located near the equator. What will most likely affect the climate of the city?
   A. Altitude B. Latitude C. Topography D. All of these

8. What climate is experienced by regions receiving vertical rays of sunlight?
   A. cool climate C. moderate climate
   B. hot climate D. temperate climate

9. Why are the coldest places on earth found at the poles?
   A. Less amount of thermal radiation is received by these areas.
   B. Great amount of thermal radiation is received by these areas.
   C. Great amount of gaseous particles trap heat from the surface.
   D. Less amount of gaseous particles trap heat from the surface.

10. Which of the following BEST describes climate?
   A. The weather that occurs in the atmosphere within a day.
   B. The pattern of weather that occurs in a region over a long period of time.
   C. The pattern of weather that occurs in a region over a short period of time.
   D. The disturbance in the atmosphere that happens in a long period of time.

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Answer Key

Activity 1.4
Guide Question:
1. The windward side.
2. The leeward side.
3. It rises up the atmosphere.
4. Moist wind coming from the sea flow up the mountain. Because temperature falls with altitude, water vapor eventually condenses and there is precipitation.

Activity 1.5
Warm Current: Alaska, Gulf Stream, Norwegian, Brazil, Mozambique, Aguihas, Kuroshio, and E. Australia

Cold Current: W. Australia, Oyashio, Benguela, E. Greenland, Labrador, Canary, California, and Peru
Guide Question:
1. Warm Current
2. Oyashio Current brings cold water to the northeastern part of Japan making the temperature lower. Kuroshio Current brings warm water towards southern part of Japan making the temperature higher.
3. Ocean currents either warm or cool the air above them. When ocean currents that bring cold water move towards a coastal region, the temperature of that area decreases. When the ocean currents that take along warm air go to a land mass, the temperature of that place rises.

What I Have Learned:
1. Latitude
2. Altitude
3. Earth's Movement (nos. 1-3 In any order)
4. Ocean Current
5. Topography
6-7. Northeast Monsoon and Southwest Monsoon (Any Order)
8. Windward
9. Cold Current

What I Can Do:
(Answers may vary)

Assessment:
1. A 2. A 3. A 4. A 5. D

Additional Activities:
(Follow Rubrics for Assessing the output)

What's In
1. Heat causes the water to turn into steam.
2. Steam causes the turbine to turn.
3. Generator changes the mechanical energy to electrical energy.

What's New
1. Weather
2. Climate

What's More:
Activity 1.1
1. √ 3. X 5. X 7. X 9. X
2. √ 4. √ 6. √ 8. X 10. X

Guide Question:
1. Weather is the condition of the atmosphere everyday while climate is the condition of the atmosphere over a long period of time.

Activity 1.2
Guide Question:
1. Equator
2. Due to the tilting of the earth's axis, places near the equator receive more heat making the air temperature higher.
3. When the area is farther from the equator, the air temperature is lower resulting in a cold climate. When the place is closer to the equator, the air temperature is higher which results in a warm climate.

Activity 1.3
Guide Question:
1. Mt. Apo
2. 0°C
3. As the altitude increases, the temperature decreases.

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