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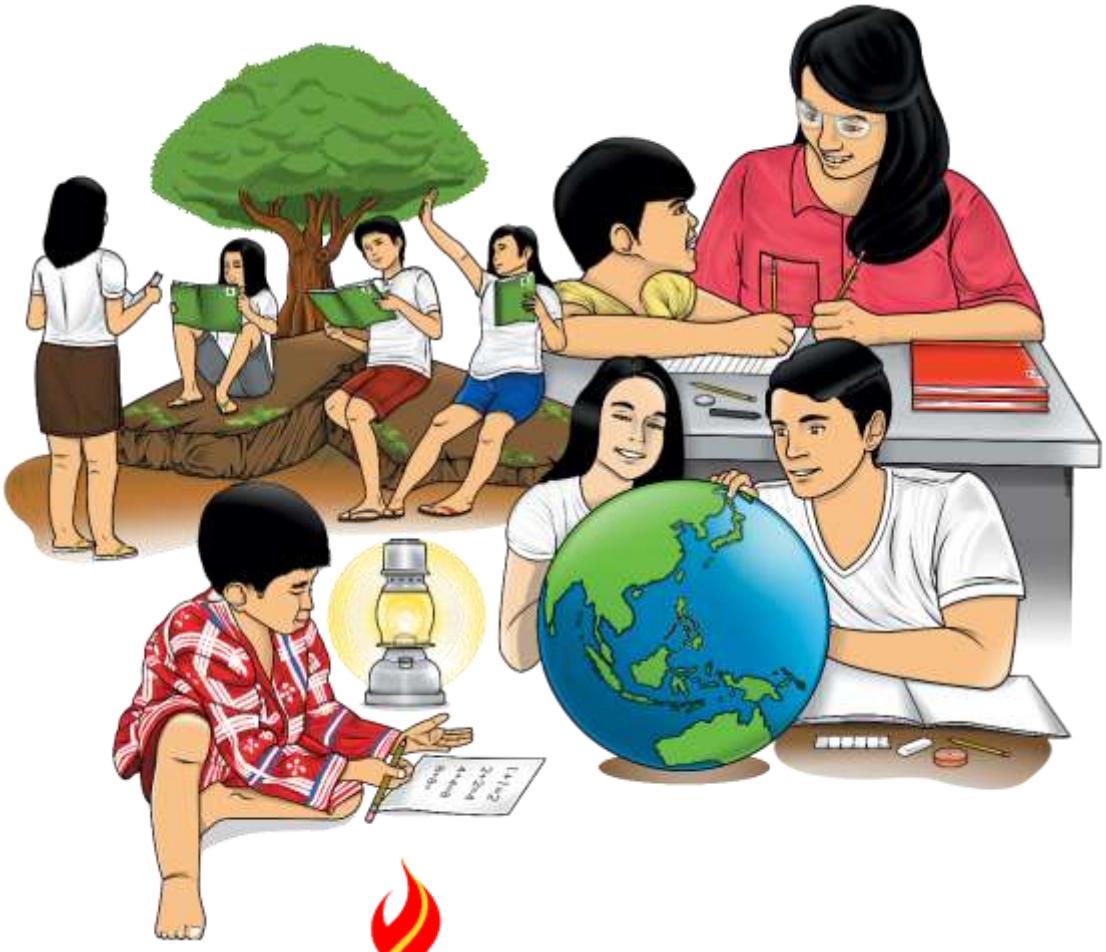
DEPARTMENT OF EDUCATION

Science

Quarter 3 – EARTH & SPACE
Module 5: Climatic Phenomena Occuring on a Global Level



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Science

Quarter 3 – Module 5:
Climatic Phenomena Occcuring on a Global Level

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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 Climatic Phenomena Occurring on a Global Level. 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 focuses on achieving this learning competency:

Describe certain climatic phenomena that occurs on a global level. (S9ES-IIIf31)

After going through this module, you are expected to:

1. describe climatic phenomena that occur on a global level such as global warming, climate change, El Niño and La Niña;
2. determine the factors that influence global climatic phenomenon;
3. explain the impact of global climatic phenomenon on the daily lives of the people; and,
4. create an advocacy material or activity that will raise awareness of the impact
   of global climatic phenomenon to the people.

What I Know

Directions: Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following can cause global warming?
   A. volcanic eruptions
   B. the amount of rainfall
   C. the rising of warm air into the atmosphere
   D. the absorption of heat from the earth's interior.
2. When does greenhouse effect happen?
   A. When the earth surface absorb heat from the atmosphere.
   B. When the earth surface absorb heat from the earth's interior.
   C. When the upper atmosphere absorb heat from the outer space.
   D. When the lower atmosphere absorb heat from the earth's surface.
3. Which activity does NOT contribute to global warming?
   A. reforestation
   B. illegal fishing
   C. mining activities
   D. incineration of garbage
4. What will happen if there is too much carbon dioxide in the atmosphere?
   A. Temperature increases
   B. Temperature decreases
   C. Water vapor condenses
   D. Greenhouse effect occurs
5. What causes La Niña?
   A. Warming of water in the Atlantic Ocean.
   B. Cooling of water in the Atlantic coast of the US.
   C. Warming of water in the Pacific Ocean off the coast of South America.
   D. Cooling of water in the tropical Pacific Ocean between the Tropic of Cancer and the Tropic of Capricorn.
6. During an El Niño year, what happens to ocean temperature in the central and eastern tropical Pacific Ocean?
   A. It is cooler than the average.
   B. It is warmer than the average.
   C. It is varied throughout the ocean.
   D. It remains in the same temperature.
7. Which of the following gases are responsible for the 75% of the global warming effect?
   A. carbon dioxide, oxygen, fluorine
   B. carbon dioxide, nitrogen, oxygen
   C. carbon dioxide, methane, oxygen
   D. carbon dioxide, methane, nitrous oxide
8. Which of the following factors is the contributor to current enhanced (human-induced) global warming?
   A. solar radiation
   B. littering everywhere
   C. hole in the ozone layer
   D. carbon dioxide emissions

9. Which of the following human activities **DOES NOT** contribute to enhanced climate change?
    A. Always using cars when going even to short distance places.
    B. Joining in tree planting activities whenever possible.
    C. Rallying against the use of renewable energy.
    D. Chopping down rainforests.
10. Which of the following greenhouse gases is the most abundant in the atmosphere?
    A. methane
    B. water vapor
    C. nitrous oxide
    D. carbon dioxide
11. Which statement supports the importance of forests for mitigating climate change?
    A. It provides building materials.
    B. It is an important source of food.
    C. It serves as a sink in the carbon cycle.
    D. It reflects sunlight away from the Earth.
12. Which statement supports reduction of carbon footprint?
    A. Drive a hybrid car.
    B. Hang blankets to dry.
    C. Eat a plant-based diet.
    D. Turn off your lights if not needed.

13 – 15. Write:
    A. If the first statement is correct and the second statement is incorrect.
    B. If the first statement is incorrect and the second statement is correct.
    C. If both statements are correct.
    D. If both statements are incorrect.

13.
    I. The El Niño and La Niña are two natural occurrences in the global climate system as results of variations in ocean temperatures in the Equatorial Pacific.
    II. The El Niño and La Niña affect weather conditions in some regions and can cause droughts, floods, and storms.

14.
    I. El Niño is a term for the warming phase of the El Niño Southern Oscillation.
    II. La Niña is a term for the cooling phase of El Niño Southern Oscillation.

15.
    I. Climate change is a phenomenon in which the Earth's climate warms or cools over long periods of time.
    II. The effects of climate change include rising sea levels, drought, water shortages, crop failure, floods, and extreme weather conditions.

Lesson 1 Earth and Space: Climatic Phenomena Occurring on a Global Level

This module provides you with scientific knowledge about the relationship of Greenhouse effect, global warming, climate change, and how those issues affects the environment and human beings.

Here are some key questions for you to ponder after finishing this module:

1. What is the difference between greenhouse effect and global warming?
2. What is climate change?
3. What are the negative effects of climate change?
4. How can one contribute to lessen the negative effects of global warming?
5. What are the differences between El Niño and La Niña? and
6. How do El Niño and La Niña occur?

What's In

Let us try to recall your understanding of the concepts of the factors affecting the climate of an area. Use a separate sheet of paper to answer the questions.

1. In which specific location will have the highest air pressure?
   A. at the beach
   B. on mountain top
   C. below the clouds
   D. above earth's atmosphere
2. Why is the part of the ocean near the equator receiving more heat than the other parts?
   A. The equator is closer to the sun.
   B. The equator has higher sea levels.
   C. The equator receives more direct sunlight.
   D. The equator rotates more quickly on earth's axis.
3. Which of the following factors contribute to the tropical climate that is experienced in the Philippines?
   A. Altitude
   B. Latitude
   C. Landmass
   D. Topography
4. How do oceans affect the climate of an area?
   A. The solar radiation is absorbed by ocean.
   B. Ocean currents act much like a conveyor belt.
   C. The ocean helps to distribute heat around the globe.
   D. All of the above.
5. Which person is talking about the weather?
   A. Let us go to the beach.
   B. It is hot and sunny today.
   C. There is a hole in the ozone layer.
   D. It rains a lot in spring in my village.

What's New

"There's one issue that will define the contours of this century more dramatically than any other, and this is the urgent threat of a changing climate"

1. What message does the passage convey?

2. Why are most of the countries around the world do threatened by climate change?

3. What do you think are the adverse effect of climate change to human/society?

In this module you will learn the different global climatic phenomena such as greenhouse effect, global warming, climate change, La Niña and El Niño. You will also determine the different factors that influence these global climatic phenomena, the negative effects of climate change, and some activities that contribute to lessen the negative effects of global warming.

What is It

Greenhouse Effect

The greenhouse effect is the natural warming process of the Earth that results when gases in the atmosphere trap heat from the earth that would otherwise escape into space. Sunlight makes the earth habitable. While 30 percent of the solar energy that reaches our world is reflected back to space, approximately 70 percent passes through the atmosphere to the earth's surface, where it is absorbed by the land, oceans, and atmosphere, and heats the planet. This heat is then radiated back up in the form of invisible infrared radiation. While some of this infrared radiation continues on into space, the vast majority—indeed, some 90 percent—gets absorbed by atmospheric gases, known as greenhouse gases, and redirected back toward the earth, causing further warming.

The different greenhouse gases are carbon dioxide, methane, nitrous oxide, hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), sulfur hexafluoride, and water vapor. These gases can be naturally occurring, or man-made. The effect of each greenhouse gas on earth's climate depends on its chemical nature and its relative

concentration in the atmosphere. Some gases have a high capacity for absorbing infrared radiation and occur in significant quantities, whereas others have considerably lower capacities for absorption and occur only in traces. Among the different greenhouse gases, carbon dioxide absorbs the least amount of energy.

For most of the past 800,000 years, much longer than human civilization has existed, the concentration of greenhouse gases in our atmosphere was between about 200 and 280 parts per million. But in the past century, that concentration has jumped to more than 400 parts per million, driven up by human activities such as burning of fossil fuels and deforestation. The higher concentrations of greenhouse gases and carbon dioxide is causing extra heat to be trapped and global temperatures to rise.

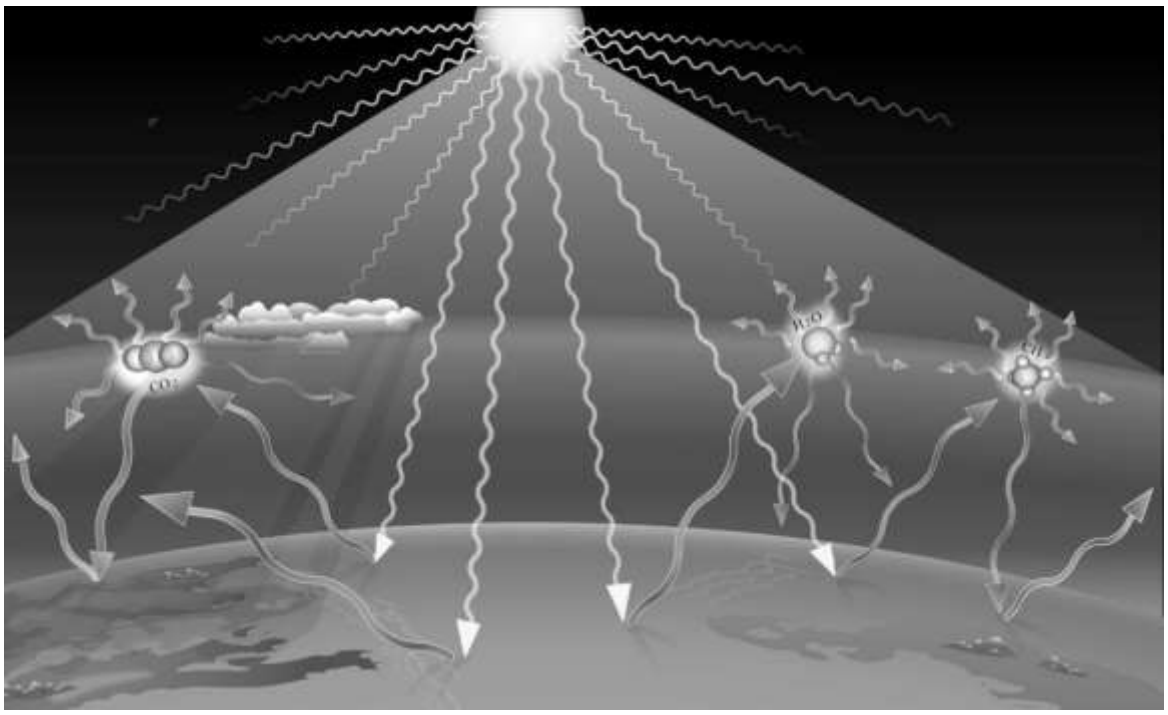


Figure 1. The Greenhouse Effect

Source: A loose necktie, *Greenhouse-Effect-t2.svg*, https://commons.wikimedia.org/wiki/File:Greenhouse-effect-t2.svg. Creative Commons Attribution-Share Alike 4.0 International.

Global Warming

Global warming is caused by several factors such as man-made, anthropogenic, or natural. One example of natural causes is the released of methane gas from arctic tundra and wetlands. Burning fossil fuels is one of the man-made causes of global warming resulting to pollution. When fossil fuel is burned it gives off carbon dioxide. Global warming can bring sea level to rise due to the melting of ice caps and glaciers. Consequently, people may experience severe weather disturbances like strong typhoons, heavier rainfalls, and climate change. Normally, sunlight enters the earth's atmosphere, absorbed and then reradiated by back into space. However, because of the greenhouse effect where the earth's atmosphere is accumulating additional greenhouse gases and trapping the earth's infrared radiation from leaving into space raises the earth's temperature and causes climate change.

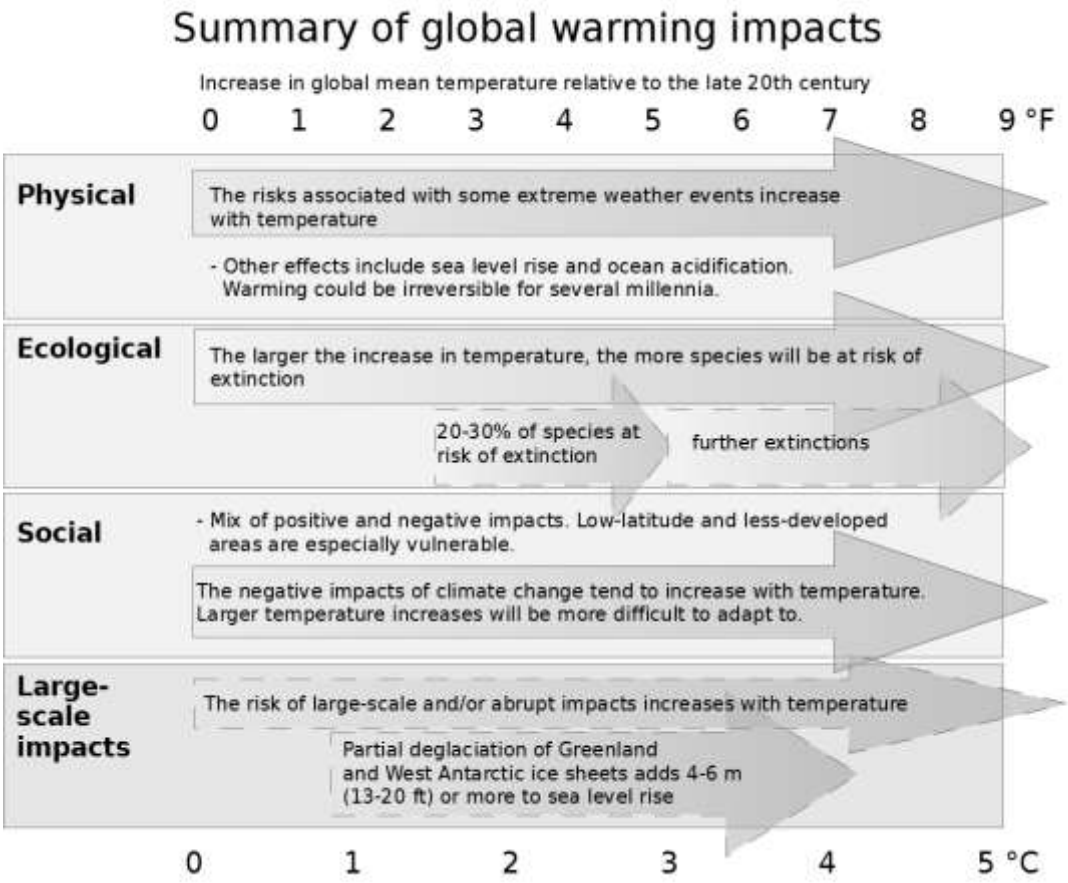


Figure 2. Impact of Global Warming

Source: Enescot, *Effects of Global Warming, Plotted Against Changes in Global Mean Temperature.png,* https://commons.wikimedia.org/wiki/File:Effects_of_global_warming,_plotted_against_changes_in_global_mean_temperature.png. Creative Commons CC0 1.0 Universal Public Domain Dedication.

Climate Change

Climate Change is a long-term change in the average weather patterns. It is incorporated with the two phenomena, the global warming and large – scale change in weather patterns. Changes in Earth's climate since the start of the twentieth century are mainly caused by human activities, such as burning of fossil fuels for energy and transportation, agricultural and industrial activities, deforestation and others. Deforestation is the primary cause of carbon dioxide release because forest and trees store carbon dioxide and commonly known as "carbon sinks". The average temperature of the Earth is determined by greenhouse effect. Greenhouse gases in the lower atmosphere trap the heat, that should be reflected back to the outer space, and contributed much to the increase of the Earth's average surface temperature. Natural processes also contribute to global climate change such as volcanic activity, changes within the Sun's energy output, and variations in Earth's orbit. Climate records give proof of global climate change key indicators, like land and ocean temperature increase, rising ocean levels, melting of ice at Earth's poles and in mountain glaciers, severe and frequent change in extreme weather phenomena like hurricanes, heat waves, wildfires, droughts, floods and precipitation, and cloud and vegetation cover changes.

El Niño

Some parts of the world may experience two cyclical events the El Niño or the La Niña and may lead to the extinction of some fauna and flora. El Niño is a lengthy warming in the eastern part of the Pacific Ocean. This natural phenomenon occurs at irregular intervals of two to seven years and lasts for nine months or two years at most.

Figure 3. Drought

Source: CSIRO, *CSIRO ScienceImage 429 Drought Effected Landscape.jpg*, https://commons.wikimedia.org/wiki/File:CSIRO_ScienceImage_429_Drought_Effected_Landscape.jpg. Creative Commons Attribution 3.0 Unported.

Normally, as trade wind moves from east to west, it collects warm air. But when trade winds is weakened, it causes the piling up of warm surface water and making the part of the Pacific Ocean warmer leading to El Niño phenomenon. This happens when the upwelling of colder water is blocked by the large quantities of warm surface water. El Niño will most likely bring severe drought. It is believed that it causes stronger thunderstorm disturbance and massive storms. It also causes the decrease of the population of some species.

La Niña

La Niña is the opposite climatic disturbance to El Niño. This natural phenomenon may but does not always follow El Niño events. It may last for nine to twelve months but in some cases, it lasts for two years. This event is triggered by the cooling of the eastern part of the Pacific Ocean. Trade winds that move from east to west are strengthened.

Figure 4. Floods

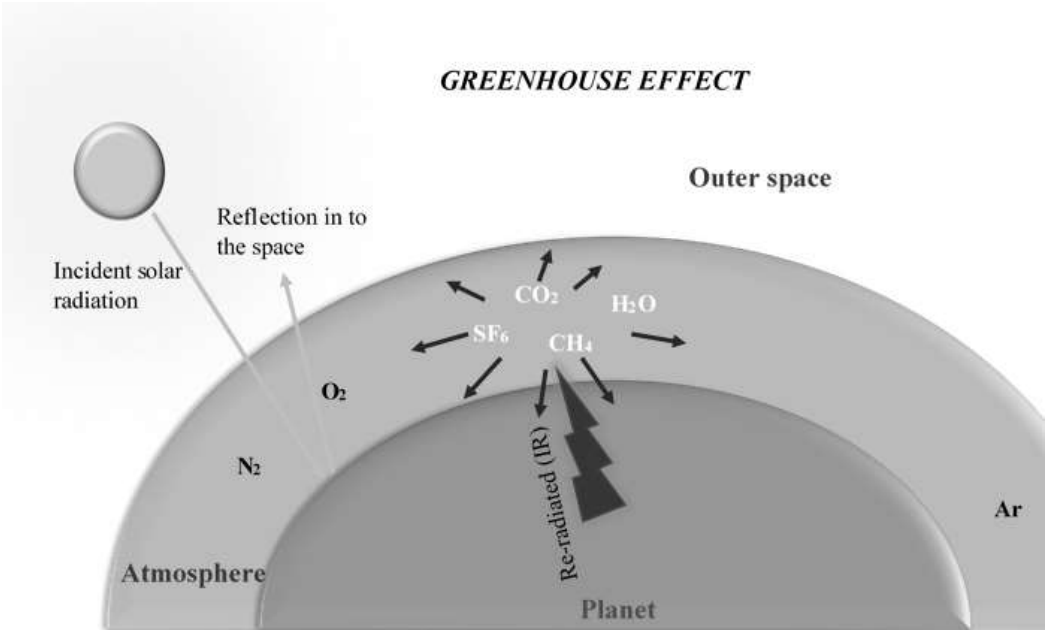
Source: Thapaliyashreeram, *Flooding village.jpg*, https://commons.wikimedia.org/wiki/File:Flooding_village.jpg. Creative Commons Attribution-Share Alike 4.0 International.

Moving air brings along too much water vapor. Areas that experienced severe drought which was caused by El Niño may encounter above normal rainfall. But in some cases, areas that experience dry season will be drier than normal conditions. La Niña's effects are the opposite of El Niño.

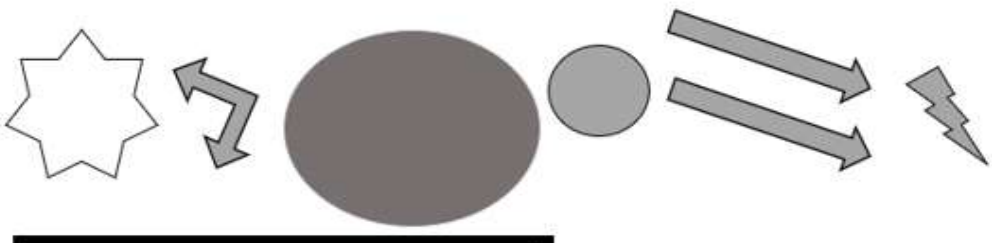
What's More

ACTIVITY 1: HOW DOES GREEHOUSE EFFECT HAPPEN?

Analyze the given diagram below. Illustrate the greenhouse effect and describe it in relation to global warming and climate change. You may also refer to the concept bank for the proper labels of your illustration. Write your answer on a separate sheet of paper.



Source: Wikilakz, *Greenhouse effect.png*, https://commons.wikimedia.org/wiki/File:Greenhouse_effect.png. Creative Commons Attribution-Share Alike 4.0 International



a. Sun
b. Earth
c. Atmosphere
d. Greenhouse gases
e. Sunlight enters the earth's atmosphere
f. Infrared Radiation
g. The earth heats up.

ACTIVITY 2: WHAT DO YOU THINK?

A. Read the given statements about greenhouse effect and global warming. Make your decision whether you **AGREE** or **DISAGREE** to each statement. Write your answer on a separate sheet of paper.

_____1. Some greenhouse gases are naturally present in the Earth's atmosphere.

_____2. All of the radiation from the Sun is absorbed by the Earth.

_____3. Plants and animals are already changing their behavior because of climate change.

_____4. Without the greenhouse effect the Earth would be cold.

_____5. The trade winds are weaker during an El Niño event.

B. Read each statement and classify whether it describes La Niña or El Niño. Write **LN** for La Niña and **EN** for El Niño. Write your answer on a separate sheet of paper.

1. The episodes of ocean warming that affect the eastern tropical Pacific. _____
2. A powerful climate change that occurs about every two to seven years. _____
3. It can cause wild weather on the west coast and strong winds over the Pacific Ocean, violent typhoons, rainstorms, and floods. _____
4. It occurs when the ocean waters are cooler than normal. _____
5. The episode when winds push from east to west resulting to a wetter weather to the Pacific region. _____

ACTIVITY 3: LET ME SPEAK!

Write a reflection on any the following images (you may also select only one image for reflection). Write your answer on a separate sheet of paper.

Source: Dorothe, *Garbage Paradise Sun Aircraft Trash Mountain*, https://pixabay.com/photos/garbage-paradise-sun-aircraft-4277613/. Pixabay License

Source: Gerd Altmann, *Forest Fire Forest Climate Change Fire Heat Flame,* https://pixabay.com/illustrations/forest-fire-forest-climate-change-3836834/. Pixabay License

Source: Yuri, *Drought Desert Elephant Dry Global Warming,* https://pixabay.com/illustrations/drought-desert-elephant-dry-1733889/. Pixabay License.

Rubrics for Essay

Indicators	4 (Very Good)	3 (Good)	2 (Fair)	1 (Poor)
Content	*All major points of the topic are stated clearly and supported with specific examples.*	*Some major points of the topic are stated and supported with specific examples.*	*Few major points of the topic are stated but lacks specific examples.*	*Major points stated are not clear and lacks specific examples.*
Organization and Structure	*The ideas show high degree of attention to logic and reasoning and leads to strong conclusion.*	*The ideas show high degree of attention to logic and reasoning but leads to weak conclusions.*	*The ideas are misplaced and shows poor logical organization that leads to vague conclusion.*	*The ideas lack logical organization and conclusion.*
Mechanics	*Without errors in spelling, punctuation, capitalization, sentence structure and grammar.*	*Few errors in spelling, punctuation, capitalization, sentence structure and grammar, and thought is not obscured.*	*Frequent errors of spelling, punctuation, capitalization, sentence structure and grammar; and thought is obscured.*	*More errors in spelling, punctuation, capitalization, sentence structure and grammar; and lacks thought.*

What I Have Learned

Write the word that correctly completes the statement. Write your answer on a separate sheet of paper.

1. The _____ is the warming of earth's atmosphere due to the build-up of heat-trapping gases, such as carbon dioxide and methane.
2. The _____ is the gradual increase in the overall temperature of earth's atmosphere due to the greenhouse effects. This effect is caused by increased levels of greenhouse gases such as _____, chlorofluorocarbons, methane, and other gases in the air, many of them released by human activity.
3. _____ is any substantial change in earth's climate that last for an extended period. It brings drastic effects to people, plants, and animals.
4. The _____ phenomena happens when the temperature in the eastern Pacific Ocean rises above normal.
5. The _____ phenomena occurs when the temperature in eastern Pacific Ocean decreases below normal.

What I Can Do

Create an advocacy campaign material/activity to raise the awareness of people on the adverse effect of global climatic phenomenon to humanity and society.

Rubrics for Advocacy Campaign Material

Indicators	**4** **(Very Good)**	**3** **(Good)**	**2** **(Fair)**	**1** **(Poor)**
Issue	*The issue selected as the focus for the awareness campaign is an important one and one of the campaigner feels a particular concern for. Sufficient justification for explanation of this is provided in the activity*	*50% of the focus issue are clear*	*40% of the focus issue are clear*	*30%. of the focus issue are clear*
Articulation of the issue	*What the issue is, how it affects individuals society, or another entity (for example, the environment) and the goal for the awareness campaign are accurately and clearly articulated.*	*50% accurate and articulated*	*40% accurate and articulated*	*30% accurate and articulated.*

Assessment

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

1. Which of the following is the best practice to reduce the effect of climate change?
   A. organic farming
   B. livestock raising
   C. burning fossil fuel
   D. car manufacturing
2. Which is **TRUE** about greenhouse effect?
   A. Greenhouse gases on the surface absorb heat from the atmosphere.
   B. Greenhouse gases on the surface absorb heat from the earth's interior.
   C. Greenhouse gases in the upper atmosphere absorb heat from the outer space.
   D. Greenhouse gases in the lower atmosphere absorb heat from the earth's surface.
3. Which of the following is **NOT** likely result of global warming?
   A. Rising sea level
   B. Worsening health effects
   C. Increased storm frequency and intensity
   D. Increased agricultural productivity worldwide
4. Which condition happens during La Niña phenomenon?
   A. Trade wind becomes stronger.
   B. Upwelling of cold water is blocked.
   C. Air pressure in the western Pacific increases.
   D. Air pressure in the eastern Pacific decreases.
5. Which of the following gases is **NOT** a greenhouse gas?
   A. Methane
   B. Nitrogen
   C. Water vapor
   D. Carbon dioxide
6. Which of the following phenomena are included in climate change?
   A. Decomposition and germination
   B. Weather changes and precipitation
   C. Volcanic eruptions and earthquake
   D. Global warming and extreme change in weather patterns
7. Which of the following is **NOT** expected to increase with enhanced climate change?
   A. Flood
   B. Drought
   C. Less typhoons
   D. Sea level rising
8. Which activity contributes the **MOST** to carbon emissions?
   A. Forestry
   B. Transport
   C. Agriculture
   D. Energy supply

9. Which can cause global warming?
   A. Deforestation
   B. Industrial and agricultural activities
   C. Air pollutants due to extraction of natural gas
   D. All of the above
10. Which of the following is classified as natural factor that caused global warming?
   A. Burning of fuels
   B. Melting of ice caps
   C. Typhoon and heavy rains
   D. Methane release from arctic wetlands

11. El Niño: _____ La Niña: _____
   A. unnatural warming, natural cooling
   B. natural warming, unusual cooling
   C. unusual warming, unusual cooling
   D. unusual warming, unnatural cooling

12 - 15. Write:

   A. If the first statement is correct and the second statement is incorrect.
   B. If the first statement is incorrect and the second statement is correct.
   C. If both statements are correct.
   D. If both statements are incorrect.

12.
   I. Methane has a lesser warming effect than CO_2.
   II. Carbon dioxide is responsible for over 60% of the enhanced greenhouse effect.

13.
   I. Burning of fossil fuels is releasing carbon dioxide into the atmosphere at a faster rate than it can be absorbed.
   II. The current atmospheric levels of carbon dioxide are rising by over 10% every 20 years.

14.
   I. El Niño phenomenon is the unusual cold ocean temperatures in the Equatorial Pacific.
   II. La Niña phenomenon is the unusual warm ocean temperatures in the Equatorial Pacific.

15.
   I. Carbon dioxide is a greenhouse gas that traps heat in the atmosphere and the main cause of global warming.
   II. Greenhouse gases, such as carbon dioxide, methane, nitrous oxide and water vapour, trap heat and prevent it from going into space.

Additional Activities

Answer the questions below to test your understanding about global climatic phenomena.

1. What does global warming have to do with a greenhouse?

2. Explain why the greenhouse effect has increased over the years.

3. Enumerate at least 5 best practices to reduce the effect of climate change.

Answer Key

What I Know

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

What's In

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

What's More

ACTIVITY 1: HOW DOES GREENHOUSE-EFFECT HAPPEN?

ACTIVITY 2: WHAT DO YOU THINK?

A. Agree or Disagree

1. Agree
2. Agree
3. Agree
4. Agree
5. Disagree
6. Agree
7. Agree
8. Agree

B. LN or EN

1. LN
2. LN
3. LN
4. EN
5. EN

ACTIVITY 3: LET ME SPEAK!

Rubrics for Essay

Indicators	4 (Very Good)	3 (Good)	2 (Fair)	1 (Poor)
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What I Have Learned

1. Greenhouse effect
2. Global warming, carbon dioxide
3. Climate change
4. El Niño
5. La Niña

What I Can Do

Rubrics for Advocacy Campaign Material

Indicators	4 (Very Good)	3 (Good)	2 (Fair)	1 (Poor)
Issue	*The issue selected as the focus for the awareness campaign is an important one and one of the campaigner feels a particular concern for. Sufficient justification for explanation of this is provided in the activity*	*50% of the focus issue are clear*	*40% of the focus issue are clear*	*30% of the focus issue are clear*
Articulation of the issue	*What the issue is, how it affects individual society, or another entity (for example, the environment) and the goal for the awareness campaign are accurately and clearly articulated.*	*50% accurate and articulated*	*40% accurate and articulated*	*30% accurate and articulated.*

Assessment

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

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Image

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