

SCIENCE 9

MODULE 3: EARTH AND SPACE

Lesson 1: Volcanoes and Climate

Introduction and Focus Questions

Have you personally been to Albay or Tagaytay? Have you actually seen Mayon Volcano or Taal Volcano? Have you ever seen a live volcanic eruption? How did that make you feel? If you haven't, wouldn't you want to see an erupting volcano in full view or at least see a real volcano in person? Have you heard about the damage caused by the eruption of Mount Pinatubo in Zambales? Volcanic eruption is not new in the Philippines and we've had several eruptions in the past decades. **Why do a number of a particular type of volcanoes exist in the Philippines?**

Is it possible for volcanic eruptions to affect our climate in the Philippines or other parts of the world? What exactly are the factors that affect the climate of a place? Recently and in the past years, there has been much discussion about global climate change and its effects. **How can global climate change be best controlled?** These are some of the questions that you will need to find the answers in this module.

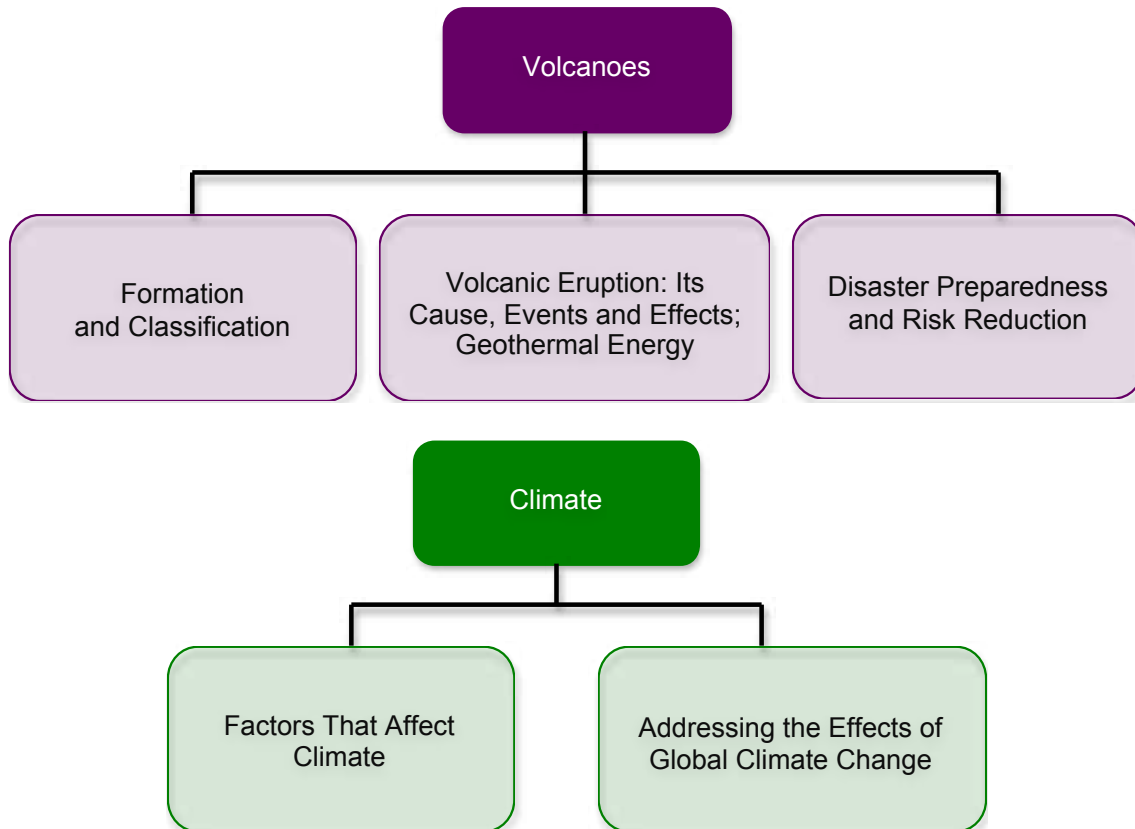
COVERAGE OF THE LESSON

The above lesson will cover the following:

Lesson No.	Title	You'll learn to...	Estimated Time
1.1	Volcanoes: Classification of Volcanoes and Volcanic Eruptions	<ul style="list-style-type: none">Describe the different types of volcanoesDifferentiate between active and inactive volcanoesExplain what happens when volcanoes eruptIllustrate how energy from volcanoes may be tapped for human use	10 Hours
1.2	Climate: Addressing the Effects of Global Climate Change	<ul style="list-style-type: none">Explain how different factors affect the climate of an areaDescribe certain climatic phenomena that occur on a global level	9 Hours

MAP OF THE LESSONS

Here is a simple map of the lessons you will cover:



EXPECTED SKILLS

To do well in this lesson, you need to remember and do the following:

1. Read the instructions carefully before starting anything.
2. Complete all the activities and worksheets. Follow instructions on how to submit them.
3. Look up the meaning of words that you do not know.
4. You will frequently come across process questions as you go through different lessons. Keep a notebook (or use the Notepad) where you can write (and revise) your answers to these questions. Use also the notebook to jot down short notes, draw diagrams, and summarize what you have just read.
5. For worksheets and reports that need to be submitted, use the provided checklist and rubric to evaluate your work before submission.
6. Allow time for relaxation and recreation when you are mentally tired. Make a timetable to schedule your study and recreation.

PRE-ASSESSMENT

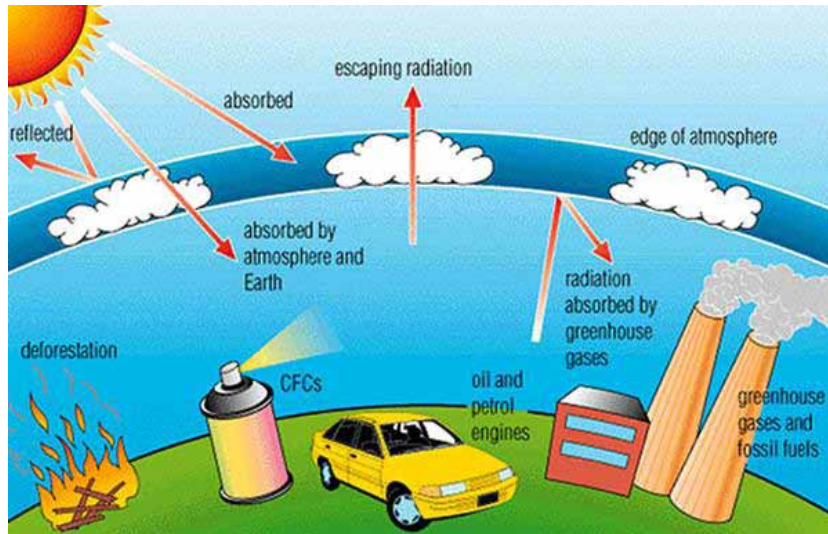


Let's find out how much you already know about this lesson. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

- (A) 1. Which type of volcanoes have broad bases and steep sides, usually have a large crater at the top and are formed by alternating layers of magma and ash?
- A. Cinder cones
 - B. Shield volcanoes
 - C. Composite volcanoes
 - D. Calderas
- (A) 2. Why are supervolcanoes the most dangerous type of volcano?
- I. The eruption significantly increases the global temperature.
 - II. During an eruption, enormous amounts of ash are thrown into the atmosphere and encircles the globe.
 - III. The ash from an eruption lowers the temperature of the entire planet.
 - IV. The lava that flows during an eruption causes damage to property.
- A. I and II only
 - B. II and III only
 - C. II and IV only
 - D. I, II and III only
- (A) 3. Which best describe a dormant volcano?
- A. a volcano that is presently not erupting and that is unlikely to do so for a very long time in the future
 - B. it is currently erupting or shows signs of unrest activities
 - C. not presently erupting but has erupted in the past and is likely to erupt again in the future
 - D. also called sleeping volcano because it is presently inactive but could erupt again
- (A) 4. Julie watched an old news video of the last explosive eruption of Mount Pinatubo. She lives in Tagaytay and thought that Taal Volcano in the past did not erupt the way Mt. Pinatubo did because it's located within a lake while the other is directly situated on land. Thus, she inferred that volcanoes erupt differently because of their composition and location. Which among the following is not a basic feature shared by all volcanoes if you were to explain this to Julie?

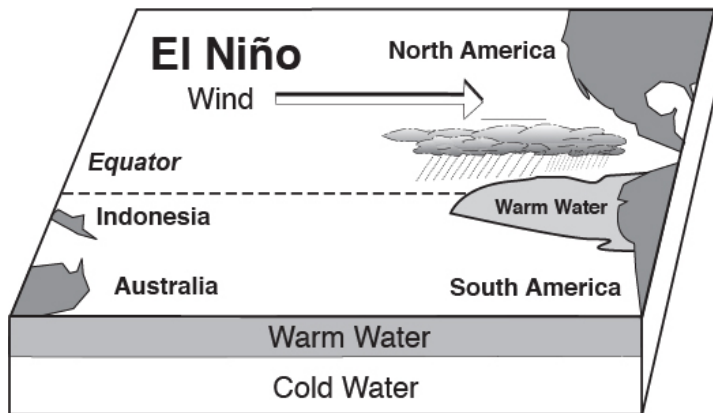
- A. The magma collects in magma chambers that can be 160 kilometers beneath the surface.
 - B. As the rock heats, it expands, which creates even more pressure causing the magma to seek a way out pushing toward the surface.
 - C. Eruption of the magma on the surface is always violent and explosive due to the extreme heat and pressure.
 - D. When magma reaches the surface, it comes out and is called an eruption.
- (A) 5. In the recent past, humans have been looking for and trying out alternative sources of renewable energy to reduce dependence on fossil fuels. How can the energy from volcanoes be tapped for human use?
- A. The lava can be used for cooking.
 - B. The energy from the magma can be used to heat water.
 - C. Geothermal energy can be tapped to produce steam used for heating showers.
 - D. Geothermal energy can be used to generate electricity.
- (A) 6. Wilma recently migrated to Washington, DC in the United States on October 31st last year. She is originally from Manila, Philippines. She knows that come November, it's already fall season in the USA which means it would be cold. What she finds fascinating is when she's taking a walk around noon time to look for a fast food chain in the city, the sun was never positioned directly overhead as she can see from her shadow. The sun seems to be just above the horizon. On the other hand, when she was in Manila on the same month of the year and the same time of the day, the sun would be directly above her and it would feel hot outside. Which statement best explains Wilma's observation about factors that determine the climate of a place?
- I. The amount of solar energy a particular location receives is the most important factor in determining that location's temperature.
 - II. The lower the latitude, the more sunlight an area will receive. At the equator, days are equally long year-round and the sun is just about directly overhead at midday.
 - III. The tropics are warmer than the temperate regions. The polar areas are in between, both in latitude and average air temperature.
 - IV. The amount of sunlight that strikes the ground is different at each latitude.
- A. II and IV only
 - B. I and III only
 - C. I and IV only
 - D. II, III and IV only

(A) 7. In the image below, which is true about the greenhouse effect?



- A. It is the retention of part of the sun's energy in the Earth's atmosphere in the form of heat as a result of the presence of greenhouse gases.
- B. It is the heating of the atmosphere resulting from the absorption of radiation from the sun.
- C. It involves both natural and man-made greenhouse gases that completely trap the infrared and UV radiation from the sun.
- D. It refers to both the absorbed and escaped solar energy in the atmosphere through the help of greenhouse gases.

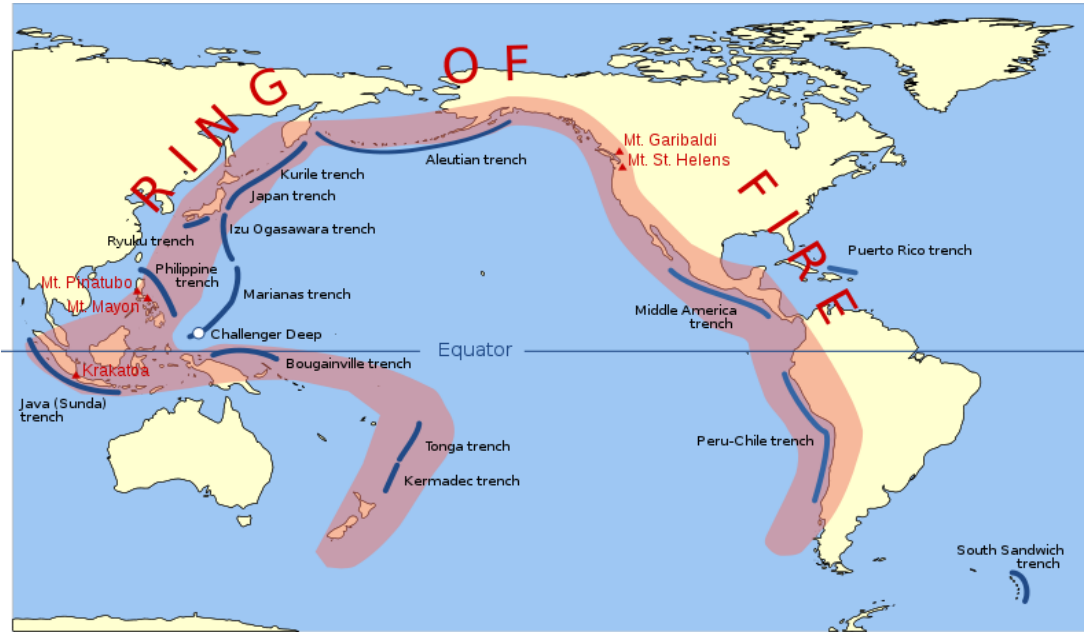
(A) 8. Looking at the image below, which among the following statements is incorrect about El Niño?



- A. The term El Niño refers to the large-scale ocean-atmosphere climate interaction linked to a periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific.
- B. El Niño means *The Little Boy*, or *Christ Child* in Spanish.

- C. El Niño episodes represent periods of below-average sea surface temperatures across the east-central Equatorial Pacific.
- D. Typical El Niño effects are likely to develop over North America during the upcoming winter season.

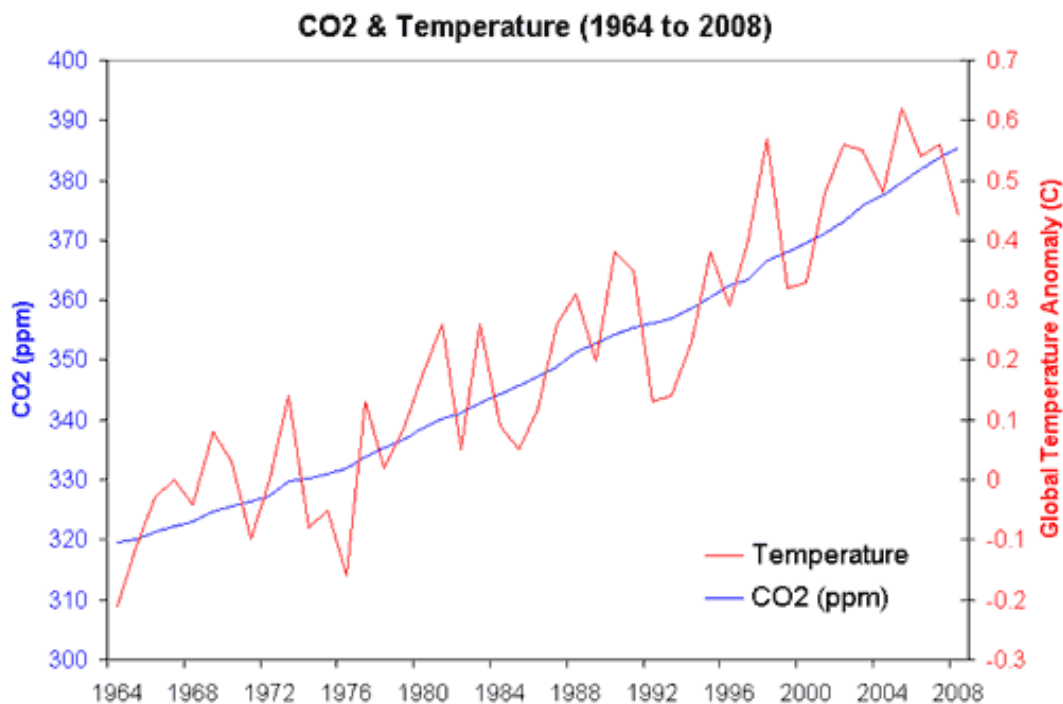
For numbers 9-11, refer to the image below showing a map of the ring of fire.



- (M) 9. Which statement accurately describes the location of the Philippines on this particular type of map?
 - A. The Philippines is located above the equator.
 - B. The Philippines is directly within the ring of fire.
 - C. The Philippines slightly missed the ring of fire.
 - D. The Philippines is enclosed by the ring of fire.
- (M) 10. The Ring of Fire is an area of frequent earthquakes and volcanic eruptions encircling the basin of the Pacific ocean. It is associated with a nearly continuous series of oceanic trenches, island arcs, and volcanic mountain ranges and/or plate movements. Based on the map and this information, is it correct to say that there are many volcanoes in the Philippines?
 - A. No, that is incorrect.
 - B. Yes, that is correct.
 - C. It is partially correct because not all the islands in the Philippines have volcanoes.
 - D. It is partially correct because not all the volcanoes in the Philippines are actively erupting.

- (M) 11. Several stratovolcanoes like Mt. Mayon of the Philippines, Mt. Fuji of Japan, Mt. Sinabung of Indonesia and Mt. Saint Helens of the USA are located in the ring of fire. Would you say stratovolcanoes are common in the Philippines? Why or why not?
- Yes, because approximately 75% of the world's volcanoes are found in the Pacific ring of fire and stratovolcanoes are common around the ring of fire.
 - Yes, because all of the world's active stratovolcanoes are found in the ring of fire.
 - Yes, because 100% of stratovolcanoes are located within the ring of fire where plate boundaries are actively subducting.
 - No, because there are other types of volcanoes in the Philippines.

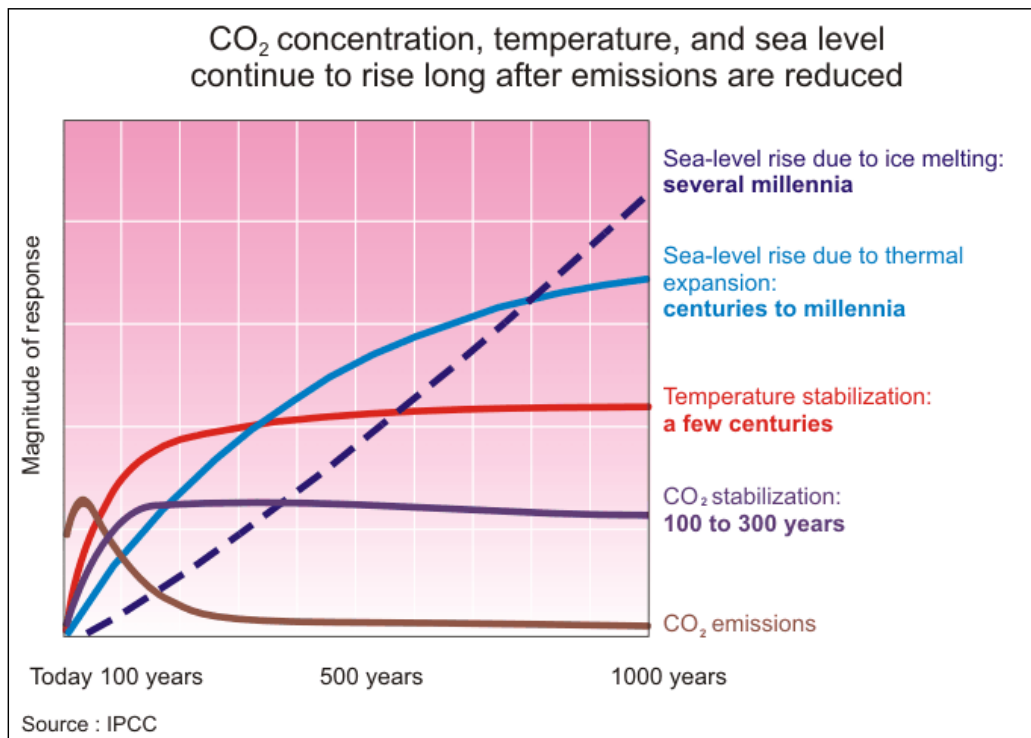
For numbers 12-13, refer to the graph below.



- (M) 12. Which statement best describes the graph showing the relationship between carbon dioxide and temperature from 1964 to 2008?
- Temperature is inversely proportional with the carbon dioxide concentration for this time period.
 - Temperature is directly proportional with the carbon dioxide concentration for this time period.
 - As the concentration of carbon dioxide increases, so does the temperature in a span of approximately 5 decades.
 - From 1964 to 2008, the CO₂ concentration is steadily increasing. While temperature is variable, the general trend is increasing as well.

- (M) 13. Based on the graph shown above, what does this tell us about how the global CO₂ concentration will affect the global temperature in the future?
- The trend will be the same because the period covered to complete this data is long enough to forecast the future.
 - The trend may continue to rise for CO₂ concentration if we continue to use fossil fuels at the same rate or with a higher emission rate, thus further causing an increase in global temperature.
 - We cannot predict the future trend because we don't have the data yet.
 - The global temperature is bound to increase in the future because humans will continue to burn fossil fuels which currently are our sole source of energy.

For number 14, use the graph below.



- (M) 14. What does this projected data tell us about how human activities contribute to global climate change?
- The international community needs to be united and committed in making huge and drastic efforts now to adapt to and mitigate climate change to reduce greenhouse gas emissions and establish more carbon sinks because it will still take about 100 years before CO₂ and temperature will stabilize.
 - Humans, on a global level, are the main contributors to climate change especially those from rich countries. Thus, the use of fossil fuels should be reduced mainly by developed countries like the US.

- C. Human activities are the main source of higher CO₂ emissions, thus, climate change adaptation strategies and policies must be strictly enforced in developing countries because they will experience the greatest impacts of climate change.
 - D. Human activities are causing the climate to change therefore any climate change strategy will not significantly decrease the global temperature in the future.
- (T) 15. You observed that your neighbor has been burning dried fallen leaves, weeds and twigs in his backyard every weekend. What appropriate action should you take?
- A. Report him to the barangay office and request the barangay captain to make him stop.
 - B. Speak kindly to your neighbor and ask if he could stop burning leaves and withered branches of trees because it's not good for our environment.
 - C. Ask your neighbor why he's doing this and educate him on the science behind and possible effects of his action then teach him the benefits of composting and how to do it.
 - D. Advise your neighbor to at least lessen the number of times he's burning because it will be hard for him to break this habit and you wouldn't want to hurt his feelings.
- (T) 16. It's summer and you have been planning to take a vacation in Naga City in Bicol where your parents live so you bought a bus ticket early. While you were still in Manila a few days before your scheduled trip, you saw the news on TV that Mt. Mayon in Albay has erupted and thousands of people were evacuated. Is it safe for you to still go on vacation in Naga?
- A. Yes, because Mayon is a 2-3 hour drive from Naga. The lava can't go that far and based on its past eruptions the people in Albay are the ones mainly affected but be prepared to encounter some traces of ash.
 - B. Yes, because Mayon is too far for the pyroclastic flow to reach Naga and the bus will never pass through Albay anyway so it's safe to take the trip.
 - C. No, because the ashes will surely be flown by the wind and will eventually reach Naga, thus, ruining your vacation.
 - D. No, because the eruption can continue for weeks.
- (T) 17. Your father just got a promotion and his already high salary was even doubled but your family had to move to Camiguin Island several kilometers away from Mount Hibok-Hibok which is an active volcano. Having known that you live near an active volcano, what information should you know and preparations should you take in case the volcano will show signs of an eruption?

- A. Check out the website of PHIVOLCS and read on the past eruption history of Mt. Hibok-Hibok from your local library.
 - B. Interview local community folks in the island about the past eruptions of this volcano and asked what they did.
 - C. Be prepared for a possible volcanic eruption by keeping and regularly maintaining a bag of clothes, footwear, non-perishable goods, bottled water, toiletries, flashlight, batteries, and cash which is always ready to carry anytime.
 - D. Search the internet or other resources for pertinent data about Mt. Hibok-Hibok, talk to long-time residents or officials in the area, and discuss with your family a possible volcanic disaster preparedness plan.
- (T) 18. Your family has internet access at home but no wifi connection yet. Your younger siblings, who are currently in grade school, love watching TV while playing with their gadgets, and surfing the internet in your family's desktop computer all at the same time. You have an environmental science subject in school. What can you do in this situation to apply what you have learned in class about climate change?
- A. Tell your siblings to use only one gadget/electronic device at a time to save on electric bills.
 - B. Educate them on how to save electricity for their own future because using too much electricity contributes to climate change.
 - C. Teach them about the carbon cycle for kids using an animation, let them take a fun online quiz, then give a prize for the highest scorer.
 - D. Show them an animation for kids of the greenhouse effect and have them watch a short animated video about climate change then ask them how their actions/activities contribute to climate change.
- (T) 19. Given that climate change is happening, which among the above activities has the most impact when it comes to reducing your carbon footprint?
- I. walking to/from school
 - II. riding a bicycle
 - III. carpooling
 - IV. using an electric motorbike
- A. I and III only
 - B. II and IV only
 - C. I and II only
 - D. III and IV only

(T) 20. Your school has a solid waste management program. Which slogan would you use as a guiding principle for this program to promote awareness of climate change?

- A. Segregate and Clean As You Go
- B. Reduce, Reuse, Recycle
- C. Stop and Pick a Trash
- D. May Pera sa Basura



Lesson 1.1: Classification of Volcanoes and Volcanic Eruptions

EXPLORE



Volcanoes are a sight to behold. But even with their magnificent natural beauty, they can cause severe damage to properties and harmful effects to our environment like the ones that happened to our country in the past. Have you ever wondered why we have a lot of volcanoes in this country or how these volcanoes were formed?

Why do a number of a particular type of volcanoes exist in the Philippines?

Let's start this module by gathering your ideas about volcanoes.

Activity 1.1: Video Analysis

Watch the two video clips by clicking on the links below. The first shows a 58-second video clip from the movie "2012". The second video is a 9.42-minute part 1 clip of Mt. Pinatubo eruption at Clark Air Base.



2012 Super Volcano Eruption Video Clip
By gantoo
www.youtube.com

<http://www.youtube.com/watch?v=6GAxVSMwVYg>



Mt. Pinatubo Explosion at Clark Air Base,
Philippines Part 1 Video Clip
By Lastog 561
www.youtube.com

<http://www.youtube.com/watch?v=SMe0VPQftsc>



Read and answer the questions that follow after watching the two videos.

1. How will you describe the eruption of the super volcano in the movie “2012”?
2. How will you compare this eruption to the explosion of Mt. Pinatubo back in 1991?
3. What do you think caused the eruption of Mt. Pinatubo?
4. Why do you think we have many volcanoes in the Philippines several of which are active?
5. How do volcanic eruptions affect us? How do we prepare for this natural calamity?
6. Having seen that huge amount of energy that exploded from Mt. Pinatubo, how can we use it in a way that would be beneficial for Filipinos?

Activity 1.2: Eliciting Prior Knowledge Through the Anticipation-Reaction Guide

What were your initial answers to the questions posted in the previous activity?

Confirm your ideas about volcanoes using the Anticipation-Reaction (A-R) Guide provided. In the Anticipation column of the A-R Guide, tick the box of the corresponding statement in which you agree with.

ANTICIPATION	STATEMENTS	REACTION
	1. All volcanic eruptions are violent.	
	2. Volcanoes are found in hot climates.	
	3. Volcanoes are randomly located across the earth’s surface.	
	4. Volcanoes are found only on land.	
	5. Volcanoes only erupt straight up through the vent.	
	6. If a volcano does not produce lava, it is not dangerous.	
	7. If a volcano doesn’t erupt for a hundred years, it’s extinct.	
	8. Magma is the word for molten volcanic material before it erupts; lava is what it is called after it erupts and reaches the earth’s surface.	
	9. Volcanic eruptions can be predicted.	
	10. A volcanic eruption occurs when there is an earthquake happening beneath the earth’s surface.	
	11. An eruption is caused by pressure of dissolved gas building up in the magma.	



End of EXPLORE



You gave your initial ideas on volcanoes by answering the Anticipation-Reaction Guide.

Let's find out how others would answer the above and compare their ideas to our own. As you compare, you will find out if your ideas are in line with the standard. You will also learn other concepts that will help you complete a required project found at the end. This project is about participating in a meaningful activity that promotes risk reduction of the effects of climate change by creating a brochure.

We will start by doing the next activity.

FIRM UP



Your goal in this section is to learn and understand the types of volcanoes and how they are formed, the difference between active and inactive volcanoes, and why many volcanoes are found in the Philippines. You will also know more about the processes and events involved when volcanoes erupt and discover how the energy from volcanoes may be tapped for human use.

Activity 1.3: Discovering the Pacific Ring of Fire

Documentary Film-Viewing. "How the Earth Was Made: The Ring of Fire"

Discover the Pacific Ring of Fire and learn how volcanoes are formed through this very interesting documentary film. While watching the film, jot down important terms or concepts and get their meanings as well. Use the Vocabulary Journal to write all the words that you will gather.

VOCABULARY JOURNAL VOLCANOES	
Term / Word / Concept	Definition / Meaning / Importance

SAVE

Now, click the link to watch the film. The film is 43.38 minutes long.

<http://www.youtube.com/watch?v=Xs4yNL1M8Gg>



PROCESS QUESTIONS:

1. What is the Ring of Fire? Is the Philippines in the Ring of Fire? Explain.
2. Why is the Ring of Fire dotted with volcanoes?
3. How are volcanoes formed in the Ring of Fire?

Activity 1.4: Net Exploration

To further enhance your knowledge about volcanoes and review the information you gained from the film, answer the following questions then click on the link provided to check the correct answers and learn more. You may also refer to your Vocabulary Journal from the previous activity.

Question & Answer	Link
1. What is subduction?	http://earthguide.ucsd.edu/eoc/teachers/tectonics/p_subduction.html
2. What is a hot spot?	http://education.nationalgeographic.com/education/encyclopedia/hot-spot/?ar_a=1 http://www.wwnorton.com/college/geo/egeo2/content/animations/2_6.htm https://www.classzone.com/books/earth_science/terc/content/investigations/es0810/es0810page03.cfm
3. What is the difference between magma and lava?	http://vulcan.wr.usgs.gov/LivingWith/VolcanicPast/Notes/magma_lava.html http://education.nationalgeographic.com/education/encyclopedia/magma/?ar_a=1

<p>4. What are the 3 principal types of volcanoes? Which type of volcano is the most common in the Philippines?</p>	<p>http://www.cotf.edu/ete/modules/volcanoes/vtypesvolcan1.html</p> <p>http://facweb.stvincent.edu/academics/pathways/science/volcanoes.htm</p> <p>http://msnucleus.org/membership/slideshows/volcano.swf</p> <p>http://dli.taftcollege.edu/streams/geography/Animations/VolcanoTypes.html</p> <p>http://www.volcanodiscovery.com/philippines.html</p>
<p>5. Why does the Philippines have many volcanoes?</p>	<p>http://www.phivolcs.dost.gov.ph/index.php?option=com_content&view=article&id=50&Itemid=86</p> <p>http://global.britannica.com/EBchecked/topic/118426/Ring-of-Fire</p>
<p>5. What is the difference between an active and inactive volcano? How is dormant different from extinct?</p>	<p>http://ellerbruch.nmu.edu/classes/cs255w03/cs255students/lfogle/p4/facts3.html</p>
<p>7. What causes a volcano to erupt and what happens when it finally erupts?</p>	<p>http://news.bbc.co.uk/2/hi/sci/tech/4972366.stm</p> <p>http://www.youtube.com/watch?v=uZp1dNybfgc</p>
<p>8. How can we tap the energy from volcanoes for human use?</p>	<p>http://education.nationalgeographic.com/education/encyclopedia/geothermal-energy/?ar_a=1</p> <p>http://www.youtube.com/watch?v=C1pcfhltpt4</p> <p>http://www.youtube.com/watch?v=VdlxkTGW5VA</p> <p>http://www1.eere.energy.gov/geothermal/gpp_animation.html</p>





PROCESS QUESTIONS:

1. Why do a number of a particular type of volcanoes exist in the Philippines?
2. Why can volcanic eruptions become deadly?
3. How can volcanoes affect the lives of people in a positive way or in a way that is beneficial to us?

Activity 1.5: Common Mistakes and Misconceptions About Volcanoes and Volcanic Eruptions

You now have heightened your knowledge about volcanoes after exploring the web resources. Other people including reporters in the media and students may still have some erroneous ideas about volcanoes. In this activity, you will know more about the common mistakes committed by the media in reporting volcanic eruptions and the common misconceptions of students about volcanoes.

Click the links below to read the articles.

<http://blogs.agu.org/magmacumlaude/2010/11/09/common-mistakes-in-reporting-on-volcanic-eruptions/> Common mistakes in reporting on volcanic eruptions

<http://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/common-misconceptions-about-weathering-erosion-volcanoes-and-earthquakes> Common Misconceptions about Weathering, Erosion, Volcanoes, and Earthquakes



PROCESS QUESTIONS:

1. Why do some journalists give erroneous reports about volcanoes?
2. What are some of the common mistakes in reporting on volcanic eruptions? What should be the correct information?
3. What are the common misconceptions of students about volcanoes? What should be the accurate facts?

Activity 1.6: Self-Assessment

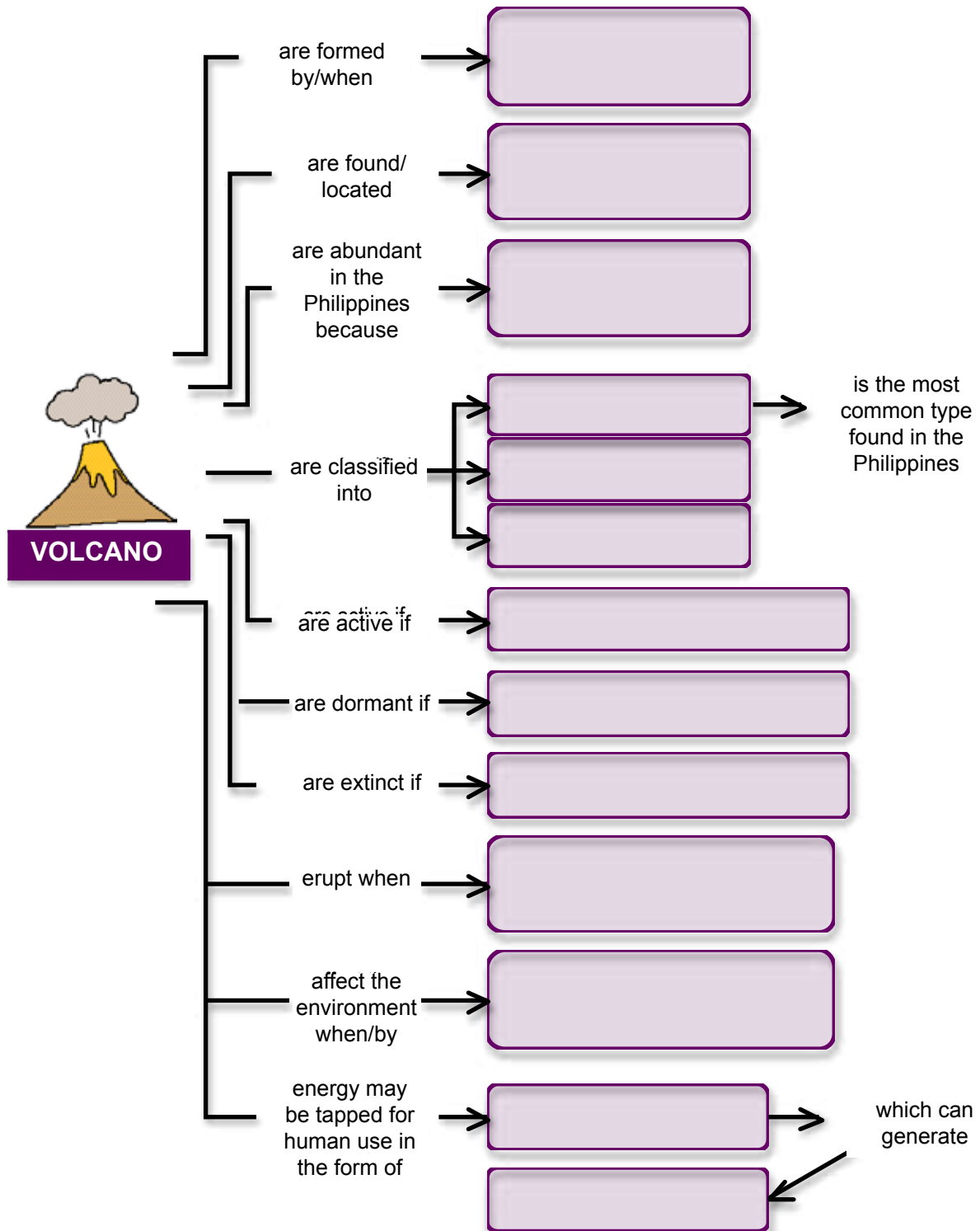
It's now time for you to do an assessment of your progress in this module.

Part 1: Half a Minute Volcano Online Quiz

Click the link to take the Volcano Online Quiz. http://www.interactivegeography.co.uk/games/volcano_half_min.html

Part 2: Concept Mapping

Accomplish the concept map then send it to your teacher through the OHSP portal.



SUBMIT

Activity 1.7: Getting To Know PHIVOLCS

The Philippine Institute of Volcanology and Seismology (PHIVOLCS) is a service institute of the Department of Science and Technology (DOST) that is principally mandated to mitigate disasters that may arise from volcanic eruptions, earthquakes, tsunami and other related geotectonic phenomena.

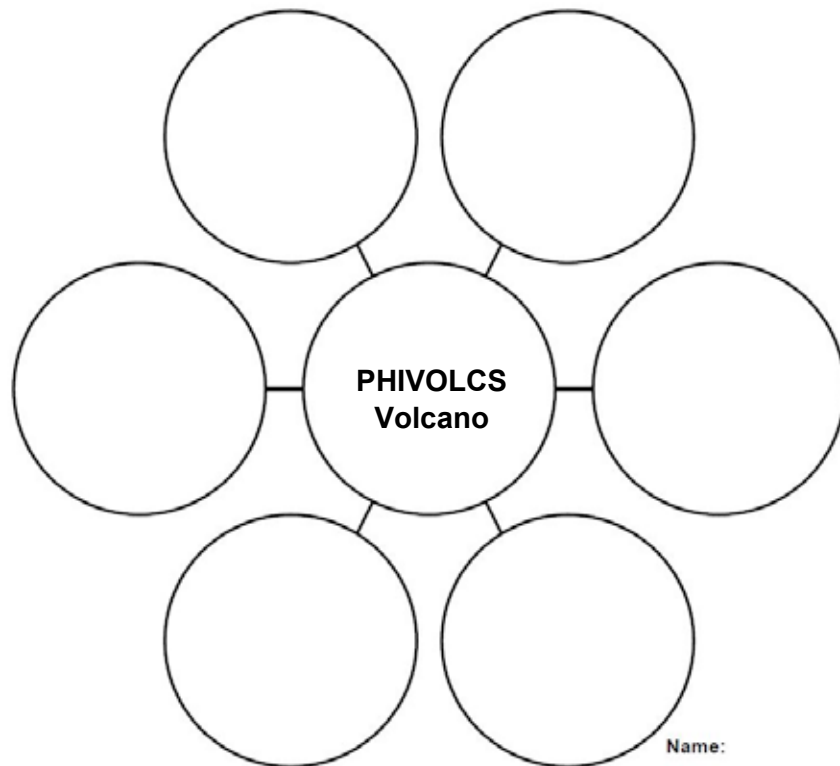
Click on the following links to know more about PHIVOLCS, its services, programs and projects.

<http://www.phivolcs.dost.gov.ph> - Official website of the Philippine Institute of Volcanology and Seismology

<http://www.phivolcs.dost.gov.ph/images/IEC/safeguarding%20life.pdf> - Pamphlet from PHIVOLCS on “Safeguard Life and Investments by Understanding Geologic Hazards”

<http://reliefweb.int/report/philippines/albay-province-philippines-coexisting-mayon-volcano-and-countermeasures-disaster> - Article entitled “Albay Province, Philippines: Coexisting with Mayon Volcano and countermeasures for disaster preparedness”

Complete the Bubble Map below by identifying some of PHIVOLCS initiatives, programs, projects and activities focusing on volcanic disasters.



SUBMIT



PROCESS QUESTION:

How should we respond to the Volcano Disaster Risk Reduction Programs and Projects of PHIVOLCS when there is a forecast for a volcanic eruption and when there isn't?

Activity 1.8: Guide to Emergency Preparedness and Disaster Risk Reduction

A volcanic eruption is just one of several natural disasters that can cause huge damage to properties and even take the lives of people. Whether a disaster is caused by nature like an earthquake, tsunami, and typhoons or man-made like a fire from an explosion, chemical spills and war, we need to be prepared. We need to know the facts, understand the risks and have a plan in case of an emergency or when disaster strikes.

In this activity, your goal is to learn how to plan for an emergency in order to reduce risks of harmful consequences and critical threat to the health, safety, security and wellbeing of a community from a disaster.

Click the link below to know more about the **seven steps** to successful emergency preparedness.

http://www.careclimatechange.org/files/toolkit/CARE_Being_Ready.pdf - Being Ready: A Guide to the Emergency Preparedness Planning Process.



PROCESS QUESTIONS:

1. Why should we plan for an emergency or a disaster?
2. What are the seven steps to successful emergency preparedness?
3. How will this planning process be of use to you and to the community you belong?


At this point, your task is to write a step-by-step emergency preparedness plan for an earthquake. Given a set-up wherein you are a student in a school here in the Philippines, write the details that the school officials should include in their emergency preparedness plan. Recall what you've learned about earthquakes in grade 8. Also, remember that the Philippines is located within the Pacific Ring of Fire where frequent earthquakes and volcanic eruptions occur. Use the worksheet below to write and check your work.

EMERGENCY PREPAREDNESS PLANNING PROCESS WORKSHEET	
Seven Steps to Successful Emergency Preparedness	Details of the School's Earthquake Emergency Preparedness Plan
<i>Step 1: Gather Information</i>	

<i>Step 2: Identify Risks</i>	
<i>Step 3: Analyze Risks and Develop Scenarios</i>	
<i>Step 4: Review Operations and Management Considerations</i>	
<i>Step 5: Analyze Capacity Gaps</i>	
<i>Step 6: Document and Distribute the Plan</i>	
<i>Step 7: Monitor, Review for Impact and Update the Plan</i>	



End of FIRM UP



In this section, the discussion was about the formation and classification of volcanoes, volcanoes found in the Philippines, volcanic eruptions, tapping the energy from volcanoes for human use, the volcano disaster risk reduction programs and projects of PHIVOLCS and the seven steps to a successful emergency preparedness.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? What new learning goal should you now try to achieve?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN



After learning the basic information about volcanoes and volcanic eruptions, your goal in this section is to take a closer look at some aspects of the topic. You will now focus on disaster preparedness and risk reduction in the Philippines and how volcanic eruptions around the world affect the global climate.

Activity 1.9: Article Analysis

Read each article by clicking on the link. Answer the questions that follow after reading each article. Remember that as you read the articles, you can always highlight significant information or jot down notes using your notepad or notebook.

Article 1:

<http://www.nydailynews.com/news/world/20-000-evacuated-erupting-philippine-mayon-volcano-spits-lava-article-1.435326>



PROCESS QUESTIONS:

1. Why was the province of Albay placed under a “state of imminent disaster”? Why were thousands of people evacuated?
2. Did people die in the past eruptions of Mayon volcano? What could be the reason for these casualties?

Article 2:

<http://www.citiesonvolcanoes7.com/vistaprevia2.php?idab=619>



PROCESS QUESTIONS:

1. What is the basic risk reduction strategy of the PDRRMC (previously called PDCC)? Why was this employed?
2. How did the APSEMO achieve zero casualties during the past four eruptions of Mayon volcano?

Article 3:

<http://www.bbc.co.uk/news/world-asia-22430378>



PROCESS QUESTIONS:

1. Why did five people die and seven injured when they climbed Mount Mayon?
2. What was PHIVOLCS’ explanation about the cause of explosion?

3. If PHIVOLCS has long set a Permanent Danger Zone around the volcano, how could the climbers have reached near the summit?

Use the Volcano Disaster Preparedness and Risk Reduction Worksheet below to write the significant details and events from each article. Be guided by the process questions for each article.

Review your analysis of the three articles.

- What can you generalize about the disaster preparedness and risk reduction programs of PHIVOLCS and the province of Albay for Mayon volcano?
- Why does the Philippines have to strictly enforce and observe risk reduction management programs for volcanic disasters?
- ***Why does a number of a particular type of volcanoes exist in the Philippines?***

Write your generalization in the worksheet below. How is your generalization connected with the number and type of volcanoes found in the Philippines? Write your answer in the same worksheet.

Volcano Disaster Preparedness and Risk Reduction Worksheet		
Article 1	Article 2	Article 3
<i>Generalization:</i>		
<i>Why do a number of a particular type of volcanoes exist in the Philippines?</i>		



Activity 1.10: Inferring from Gathered and Established Data

The Philippines is just one of several countries in the Pacific Ring of Fire dotted with many volcanoes. You are probably familiar that it is mainly hot and humid here in our country especially during the dry season. Are volcanoes really found in hot climates? Recall from the previous activities that it's the geographic location along subducting plate boundaries that mainly determines the formation and existence of volcanoes.

You are now familiar with the volcano disaster risk reduction programs and projects of PHIVOLCS. Take note that volcanologists forecast eruptions, but cannot predict them. The average number of volcanic eruptions per year is about 50 to 60 globally. Remember that volcanic eruptions may be explosive or non-explosive, that is, not all of them are violent. Have you ever wondered if this has any effect on our climate or the global climate for that matter?

How can volcanic eruptions collectively affect the global climate? Can one volcanic eruption change the global climate? If in case an eruption does affect climate, is this temporary or permanent?

To find the answers to these questions, read the information and analyze the data presented in each research/resource. Click on the available link then answer the questions that follow.

Data from Research 1:

http://science.larc.nasa.gov/research_pinatubo.php and

http://science.larc.nasa.gov/research_pinatubo_sagellobs.php



PROCESS QUESTIONS:

1. Why was the SAGE II satellite instrument used? What was its purpose?
2. What were the observations made by NASA using the SAGE II? What did these data show?

Data from Resource 2:

http://www.geology.sdsu.edu/how_volcanoes_work/climate_effects.html



PROCESS QUESTIONS:

1. What is the influence of volcanic eruptions on the ozone, greenhouse and haze effects?
2. What was the overall effect of past historic eruptions to global climate?

Data from Resource 3:

<http://www.sciencemuseum.org.uk/ClimateChanging/ClimateScienceInfoZone/Exploringwhatmighthappen/2point2/2point2point2.aspx> (Volcanic Eruptions in the 20th Century)



PROCESS QUESTIONS:

1. What happened to the global temperature when there was a decrease in volcanic activity in the first half of the 20th century?
2. What was the effect to the global temperature when volcanoes erupted frequently since the 1960s?

Accomplish the worksheet below after going through these data. Be guided by the following focus questions.

- What is your conclusion about the effect of volcanic eruptions to global climate change? What is the general trend?
- Can one volcanic eruption affect the global temperature to a certain degree? Cite an example.
- Is this change in global temperature temporary or permanent? Why?

Topic: Volcanic Eruptions and Climate Change
Problem:
Gathered/Established Data:
Conclusion:



Compress your conclusion in one sentence then present it by creating your own speaking avatar in Voki using this link, <http://www.voki.com/create.php>. Submit the worksheet through the OHSP system and email your published speaking avatar to your OHSP teacher.

Activity 1.11: Revisiting the Anticipation-Reaction Guide

Now that you have a deeper understanding of volcanoes and how volcanic eruptions affect humans on a local and global scale, it's time to go back to the Anticipation-Reaction Guide you filled up in the first part of this module.

This time, tick the box of the corresponding statement in which you agree with under the Reaction column.

ANTICIPATION	STATEMENTS	REACTION
	1. All volcanic eruptions are violent.	
	2. Volcanoes are found in hot climates.	
	3. Volcanoes are randomly located across the earth's surface.	
	4. Volcanoes are found only on land.	
	5. Volcanoes only erupt straight up through the vent.	
	6. If a volcano does not produce lava, it is not dangerous.	
	7. If a volcano doesn't erupt for a hundred years, it's extinct.	
	8. Magma is the word for molten volcanic material before it erupts; lava is what it is called after it erupts and reaches the earth's surface.	
	9. Volcanic eruptions can be predicted.	
	10. A volcanic eruption occurs when there is an earthquake happening beneath the earth's surface.	
	11. An eruption is caused by pressure of dissolved gas building up in the magma.	

SUBMIT

Did you notice any change in the boxes you ticked from the Anticipation column to the Reaction column, or did you tick the same statements?

Copy the wrong statements, then write the correct statements and briefly explain your revisions. Use the worksheet below.

WRONG STATEMENT	CORRECT STATEMENT	EXPLANATION FOR REVISION

SUBMIT

If the statements you agreed with were reduced to statements 8 and 11 only, then you're on the right track. All the rest are misconceptions.

End of DEEPEN



In this section, the discussion was about volcano disaster preparedness and risk reduction management programs in the Philippines, and the effect of volcanic eruptions to the global climate.

What new realizations do you have about the topic? What new connections have you made for yourself? What helped you make these connections?

Now that you have a deeper understanding of the topic, you are ready to proceed to the next lesson.

You are halfway through the completion of this module. Give yourself a pat on your shoulder. Relax a bit when you're feeling tired before moving on to the next lesson.

TRANSFER



Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

Activity 1.12: Preparing For A Volcanic Eruption

Read the situation below and follow the directions for the task you will do in this section.

Kanlaon Volcano (also spelled Canlaon), located on the island of Negros, is one of the most active volcanoes in the Philippines. The town of Guintubdan is situated 5 kilometers west of the volcano. Given that you are the mayor of this place, how should you prepare your town for a possible volcanic eruption? What should you and the town officials include in the municipality's plan in order to reduce risks from a volcanic disaster?

Use the planning process for successful emergency preparedness. You may vary the seven steps you learned should you find the need to. Present your town's emergency preparedness and disaster risk reduction plan using www.blabberize.com and email the link or URL of your blabber to your teacher.

You may also watch the Blabberize Tutorial video to help get you started by clicking on this link <http://www.youtube.com/watch?v=FETUu1r8Pe4>.

Have fun blabberizing.

End of TRANSFER



In this section, your task was to create a blabber explaining the emergency preparedness and risk reduction plan for the town of Guintubdan near Kanlaon Volcano.

How did you find the performance task? How did the task help you see the real world use of the topic?

You have completed this lesson. You may now proceed to the next lesson.

Lesson 1.2: Addressing the Effects of Global Climate Change

EXPLORE



You learned about the influence of volcanic eruptions to climate and how these affect the global temperature in the first lesson. Now, pause for a moment and think, what exactly is climate?

Have you ever wondered what it would be like to live in a different part of the world? What would the weather be like? Since you live in a tropical country like the Philippines, do you think you'll be able to adapt to a new environment if you go to a country like the United States of America or England, or perhaps a continent like Africa or Antarctica?

Why does climate differ in other parts of the world? What contributes to the change in climate? With all the varied weather disturbances we are experiencing, is the global climate really changing? ***How can global climate change be best controlled?***

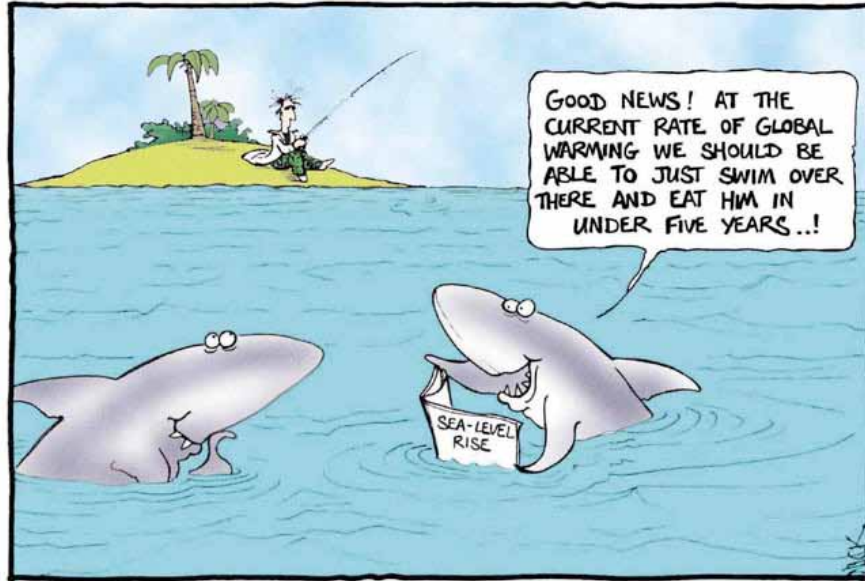
Let's begin to explore the answers to these questions by looking at the factors that affect climate.

Activity 2.1: Cartoon Analysis: Hot and Funny

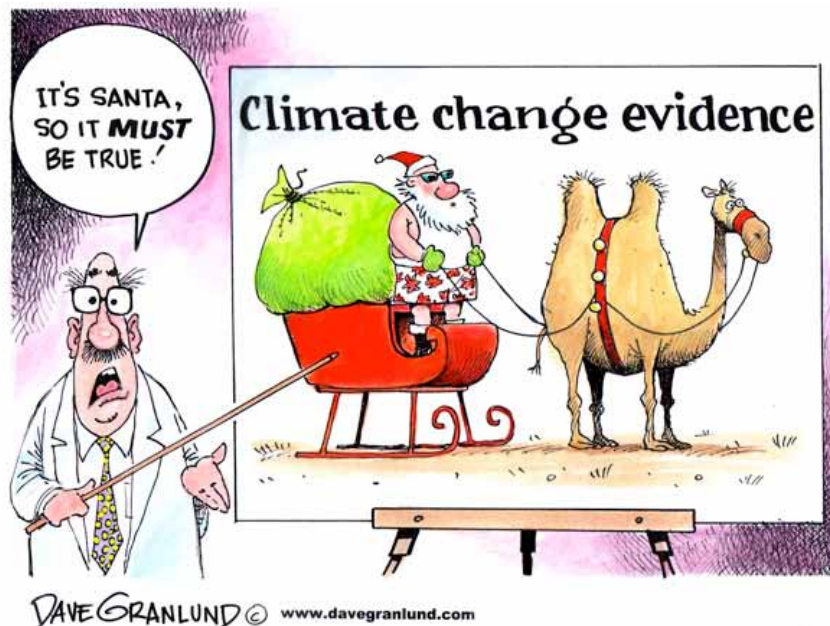
Look at the three cartoon images.



Source: <http://www.ecowren.net/2012/climate/>



Source: <http://www.climatechangedispatch.com/climate-change-hot-air.html>



Source: <http://teamfuelforward.weebly.com/1/post/2013/04/crazy-cartoons-on-climatechange.html>

What is so amusing or funny about these cartoons? How are these images related? What is the focus of these cartoons?

Activity 2.2: Drawing Out Prior Knowledge With IRF Chart


Global warming and climate change are some environmental issues we've been hearing about in the news, on TV and even in movies. Before we go into that, let us first get your ideas about climate.

Write your ideas about climate and climate change by filling in the INITIAL column of the IRF Chart below.


INITIAL	REVISED	FINAL



End of EXPLORE

 You just gave your initial ideas about climate using the IRF Chart. Let's now find out more information about this topic by doing the next part. What you will learn in the next sections will also enable you to do the final project which involves creating a brochure that aims to promote awareness of the effects of climate change and reduce its risks.

FIRM UP

 Your goal in this section is to learn and understand key concepts about how different factors affect the climate of an area.

Activity 2.3: Identifying The Factors That Affect Climate

You are now about to learn more about climate. Make sure you are in a relaxed position. This activity will require you to answer several questions. Remember to use your notebook or notepad to write down important notes.

Click the links below to know what climate is and understand how different factors affect the climate of a place.

http://www.classzone.com/books/earth_science/terc/content/investigations/es2101/es2101page01.cfm?chapter_no=investigation - What Factors Control Your Local Climate

<http://www.youtube.com/watch?v=E7DLLxrrBV8> - Five Factors That Affect Climate

<http://www.slideshare.net/RhajTheWonder/factors-affecting-climate> - LAMECOWS: Factors Affecting Climate



PROCESS QUESTIONS:

1. What is climate?
2. What are the different factors that affect the climate of a place?
3. How does each factor influence or determine the climate of an area?
4. How does latitude influence the climate at the equator and the polar regions?
5. How do mountain ranges affect the precipitation levels of an area's climate? Compare the precipitation level between the side of a mountain facing the ocean and the other side facing away from the ocean.
6. Based on the location of Quito, Ecuador, what type of climate do you think it should have? What about Guayaquil, Ecuador? What factor influenced the type of climate in Quito and Guayaquil? How did this factor affect the difference in climate of these two places?
7. Recall what you've just read from the websites about surface ocean currents. How would you expect the climate of western South America to be influenced by the Pacific Ocean? Could this same effect happen in the Northern Hemisphere? Explain.

Organize and write your answers to these questions on the worksheet below.

Definition Of Climate:	
Factors Affecting Climate	How These Factors Affect Climate

SUBMIT

Activity 2.4: Understanding Common Climatic Phenomena

You will now study some common climate phenomena. Make sure your mind is prepared to stay focused so you can easily understand the topics in this activity. Should you have questions or clarifications, do not hesitate to ask your online teacher.

Part 1: El Niño and La Niña

Have you heard the terms El Niño and La Niña before? What do these words remind you of? To find out more about these, click on the links below. Then accomplish the El Niño and La Niña worksheet.

<http://oceanservice.noaa.gov/facts/ninonina.html> - What are El Niño and La Niña?

http://esminfo.prenhall.com/science/geoanimations/animations/26_NinoNina.html - Animation of El Niño and La Niña

<http://www.pacificclimatechangescience.org/animations/climatecrab/> - The Pacific Adventures of the Climate Crab



PROCESS QUESTIONS:

1. What is El Niño?
2. What is La Niña?
3. How are they similar and different?
4. How do they affect climate?

Compare and contrast El Niño and La Niña by filling in the worksheet below.

El Niño and La Niña Worksheet	
<i>El Niño</i>	<i>La Niña</i>



Part 2: Greenhouse Effect

At this point, you will learn more about another climatic phenomenon known as the Greenhouse Effect. Click the links below. Write down the important points by accomplishing the worksheet that follows.

<http://www.sumanasinc.com/webcontent/animations/content/greenhouse.html> The Greenhouse Effect (Animation)

http://www.damocles-eu.org/education/Animation_about_the_greenhouse_effect_182.shtml Animation about the Greenhouse Effect and Factors that Influence

<http://environment.nationalgeographic.com/environment/global-warming/gw-overview-interactive/> The Greenhouse Effect, Greenhouse Gases and Global Warming



PROCESS QUESTIONS:

1. What is the greenhouse effect?
2. How is it different from the “enhanced” greenhouse effect?
3. What are greenhouse gases?
4. How do greenhouse gases contribute to global warming?

THE GREENHOUSE EFFECT WORKSHEET
Greenhouse Effect:
Greenhouse Gases:
Enhanced Greenhouse Effect/Global Warming:

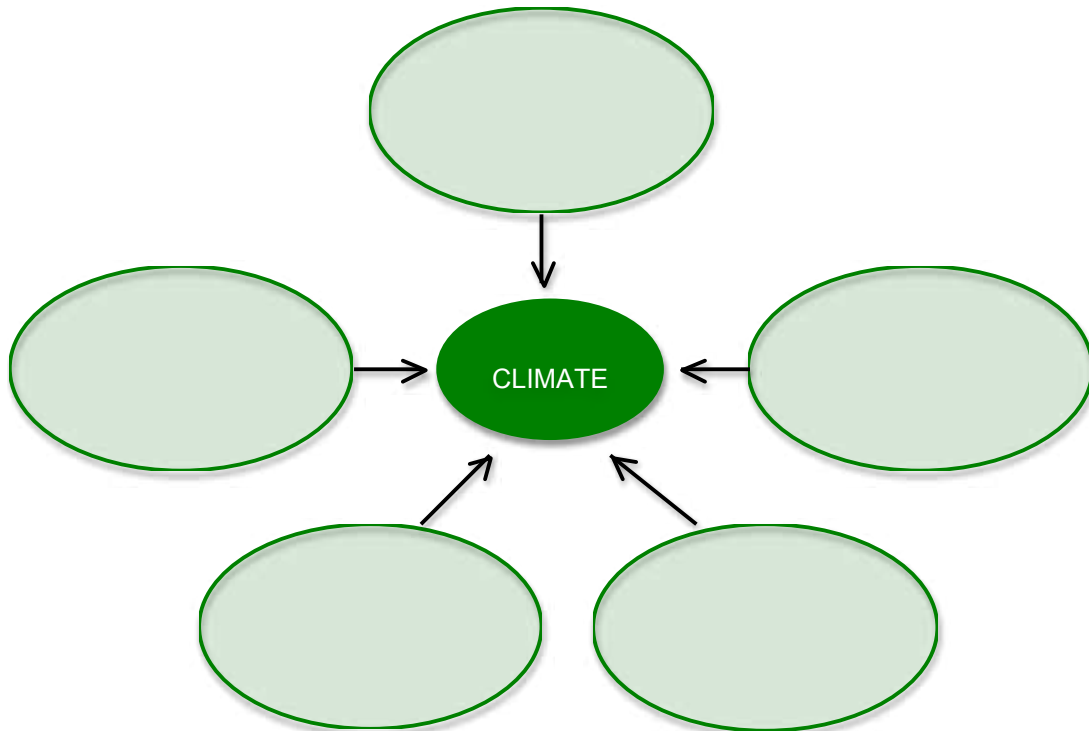


Activity 2.5: Self-Assessment

You will now check your knowledge and understanding of climate.

Part 1: Map of Main Idea

Accomplish the Map of Main Idea below by writing the five main factors that affect the climate of an area and briefly describe how each factor affects climate. Submit this to your teacher through the OHSP system.



SUBMIT

Part 2: Online Climate Quiz

Click the link below to take the short online climate quiz.

<http://www.mcwdn.org/WEATHER/ClimateQuiz.html>

Click the two links below to answer the climate map questions.

http://www4.uwsp.edu/geO/faculty/ritter/interactive_climate_map/climate_map.html

Interactive Climate Map and

<http://www.proprofs.com/quiz-school/story.php?title=interactive-climate-map-questions>

Interactive Climate Map Questions

Part 3: El Niño and La Niña Interactive Online Quiz

Click the links below to take the online quizzes about El Niño and La Niña.

http://oceanworld.tamu.edu/students/elnino/elnino_quiz.htm El Niño Interactive Online

Quiz

<http://achieve.weatherbug.com/Lessons/LessonWrapper.aspx?dir=IMS&less=IMS040&lessname=El+Nino/La+Nina&lang=English&schname=AWS+Headquarter&schcity=Germanatown&schstate=MD&maxPages=0&Units=English&stnid=AWSHQ&camid=AWSHQ&usertype=s&isSample=1&> El Niño/La Niña Online Quiz

Part 4: Greenhouse Gases Quiz

Click the link below to take the online quiz on greenhouse gases.

http://www.proprofs.com/quiz-school/story.php?title=greenhouse-gases-quiz&user_name=Guest Greenhouse Gases Quiz

How well did you do in the online quizzes? Congratulations for completing the Self-Assessment part of this lesson.

Remember to take a break when you feel exhausted. The next series of activities will require a lot of reading and concentration. You will be asked to watch some videos, thus, always remember to jot down significant notes using your notepad or notebook. When you are asked to read from the web resources, you may also highlight some technical words or phrases, copy and paste them directly on to the worksheet. Then just edit your work.

You are now ready to move on to the next activity.

Activity 2.6: Exploring The Science Of Climate Change

You are now getting closer to the peak of this lesson. You have already encountered the term, climate change, at the beginning of this lesson and when you studied the greenhouse effect. What exactly is climate change? It's time for you to explore the science of climate change.

To learn more about climate change and the science behind it, click on the links below. Accomplish the Climate Change Worksheet and submit it to your teacher through the OHSP system.

<http://www.epa.gov/climatechange/> Why is the climate changing?

<http://www.youtube.com/watch?v=W2dkFG2oJ3w> Man versus Wild

<http://www.youtube.com/watch?v=aFsC4sGzMJ8> What is Climate Change?



PROCESS QUESTIONS:

1. What does climate change mean?
2. What are the causes of climate change?
3. What are the evidences that indicate the climate is changing?
4. How will climate change affect us?

CLIMATE CHANGE WORKSHEET

Climate Change:

Causes:

Evidences/Indicators:

Effects:

SUBMIT

Activity 2.7: Comparing The World Maps Of Koppen-Geiger Climate Classification

In this activity, you will explore the possible future effects of climate change in different parts of the world by comparing two world maps.

The Koppen-Geiger climate classification system is the most frequently used climate classification map. You will now study and compare the observed and projected climate shifts from 1901 to 2100 depicted by world maps of the Koppen-Geiger climate classification.

You are to locate and identify some parts/regions of the world that may experience a climate shift in the future. To help you organize this information, use the worksheet below. Compare the 1901-1925 world map with the 2076-2100 world map, then identify the **coordinates** of the latitude and longitude or the **range of coordinates** of latitude and longitude grid where you see a shift or change in climate.

To know more about latitude and longitude, click these links, <http://olc.spsd.sk.ca/DE/k9mod/Mapskill/mod3fl5.swf> and http://www.diffen.com/difference/Latitude_vs_Longitude.

<http://koeppen-geiger.vu-wien.ac.at/shifts.htm> Observed and Projected Climate Shifts 1901-2100 Depicted by World Maps of the Koppen-Geiger Climate Classification

Latitude and Longitude (Coordinates/ Range)	Shift in Climate, Precipitation and Temperature
e.g. 70°-80° (or 70°-80° N) 70°-110° (or 70°-110° E)	From polar, polar tundra and snow, winter dry, cool summer to snow, fully humid, cool summer



PROCESS QUESTIONS:

1. What was/were the most significant projected shift/s in climate in the areas/ regions you have identified?
2. What do these world maps tell you about climate change?

Activity 2.8: Climate Change Adaptation And Mitigation

Now that you are more familiar with climate change, its causes and effects, it's time to ask yourself this question, "What can I do?".

To help you explore the answers to that question, click the links below. Use your notepad or notebook to highlight or jot down key ideas.

You may communicate or chat with your classmates and have a discussion forum to help you better understand the web resources in this activity.

<http://spark.ucar.edu/longcontent/climate-mitigation-and-adaptation> Climate Mitigation and Adaptation: Definition and discussion; Includes key mitigation technologies and practices for 7 sectors

<http://www.unep.org/climatechange/adaptation/> Climate Change Adaptation and Mitigation; Discussion of strategies and principles involved in adaptation; Discussion and examples of mitigation strategies across 8 sectors

<http://www.epa.gov/climatechange/impacts-adaptation/adapt-overview.html> Adaptation Overview: This page presents examples of adaptation and ongoing efforts.

<https://www.e-education.psu.edu/meteo469/node/175> Adaptation vs. Mitigation; Graphic illustration of the place of adaptation in response to climate change; Use of world maps to illustrate scenarios that involve no response measures at all, adaptation alone, mitigation alone, and a combination of adaptation and mitigation

<http://www.youtube.com/watch?v=QjnV8-oo12A> This animated video produced by the Wisconsin Educational Communications Board distinguishes the roles of mitigation and adaptation in responding to climate change.



PROCESS QUESTIONS:

1. What is adaptation?
2. What is mitigation?
3. How are these two concepts similar and different? Discuss.
4. What are examples of adaptation strategies/efforts?
5. What are examples of mitigation strategies/efforts?
6. Why do we have to adapt to or mitigate climate change?
7. Which is better – adaptation or mitigation? Explain.

End of FIRM UP



In this section, the discussion was about factors affecting climate, common climatic phenomena, climate change, its causes and effects, and climate change adaptation and mitigation.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? What new learning goal should you now try to achieve?

You will now accomplish the Revised column of the IRF Chart.

INITIAL	REVISED	FINAL



Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

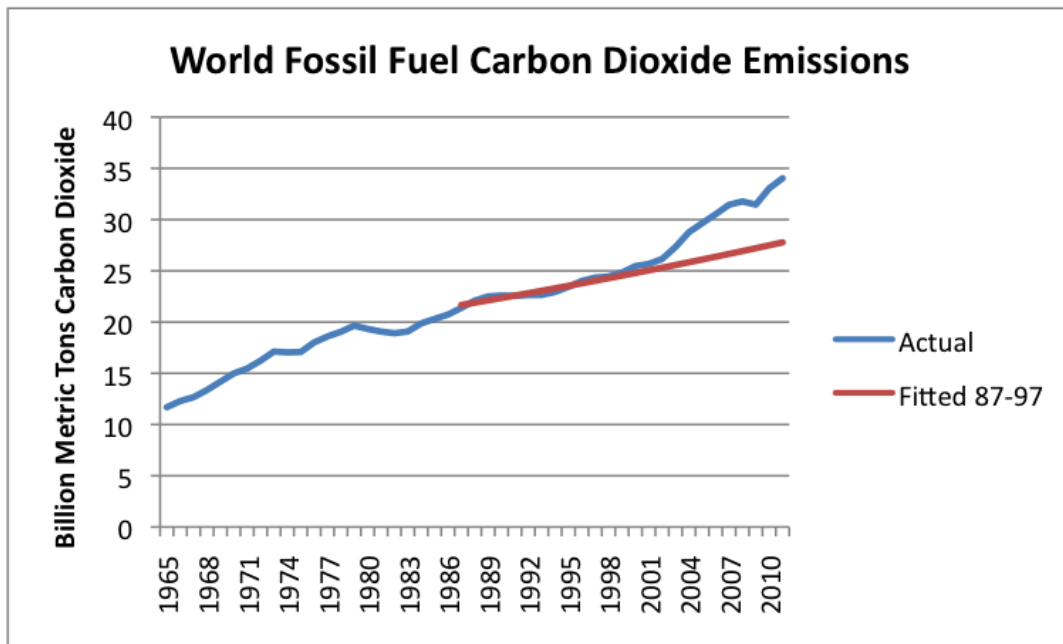


Your goal in this section is to take a closer look at some aspects of addressing the effects of global climate change.

Activity 2.9: Graphic Data Analysis

In this activity, you will study and analyze four graphs showing data related to climate change.

Data No. 1:



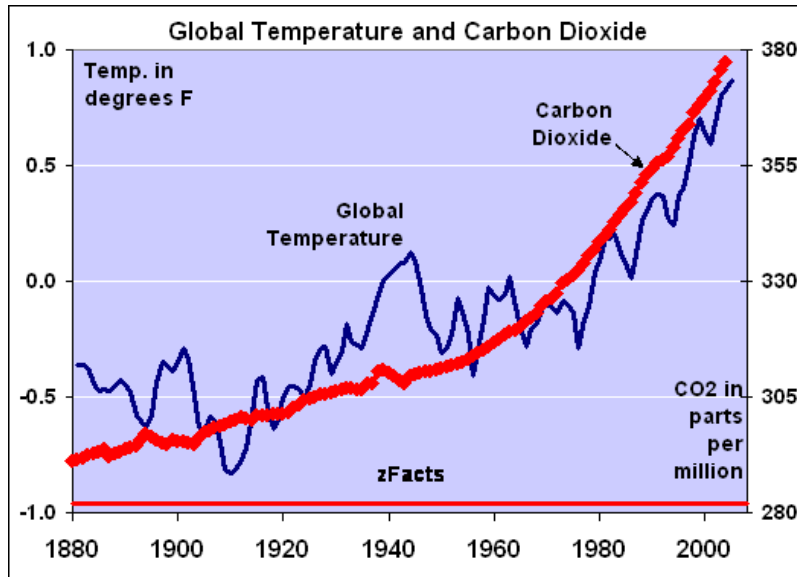
Source: <http://ourfineteworld.com/2012/09/17/the-close-tie-between-energy-consumption-employment-and-recession/>



Question:

- How will you describe the trend of carbon dioxide emissions from fossil fuels in this graph?

Data No. 2:



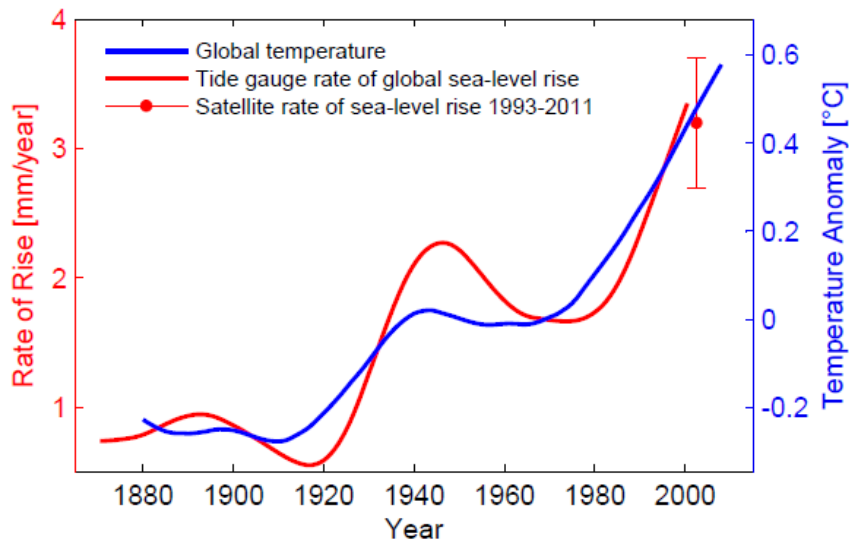
Source: <http://zfacts.com/book/export/html/88>



Question:

- What is the relationship between carbon dioxide concentration and global temperature as presented in this graph?

Data No. 3:



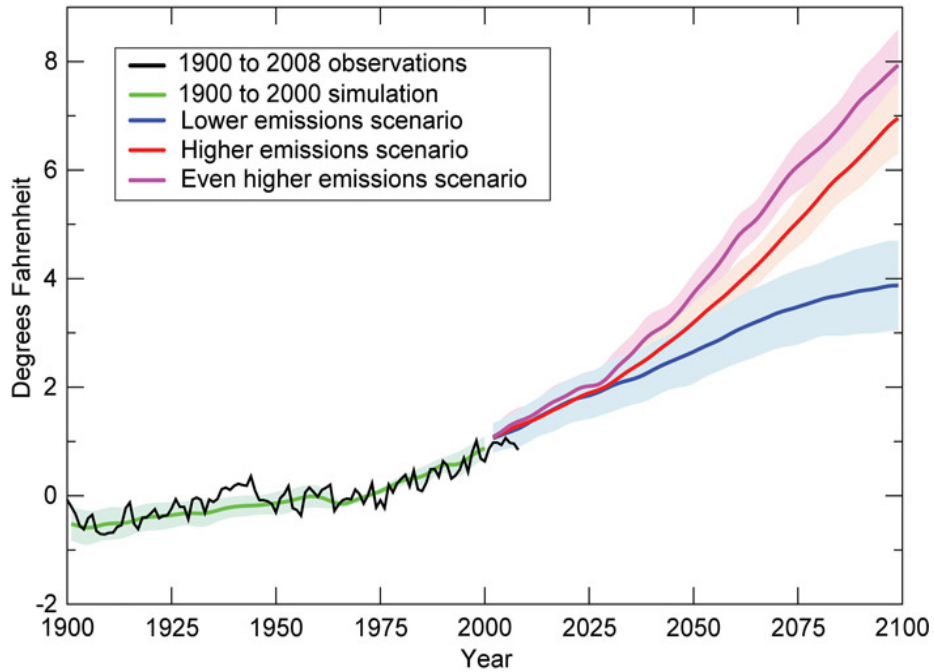
Source: <http://www.realclimate.org/index.php/archives/2013/01/sea-level-rise-where-we-stand-at-the-start-of-2013/>



Question:

- How does the change in global temperature affect the global sea level?

Data No. 4:



Question:

- How will you compare the graphic projections between a lower emissions scenario and a higher emissions scenario?

Now that you've analyzed the four graphic data, what is your conclusion on how we should address the effects of climate change? What is the main cause of climate change and how does it affect us significantly on a global level? ***How can global climate change be best controlled?***

Use the worksheet below to write your analysis and conclusion.

GRAPHIC DATA ANALYSIS WORKSHEET	
Data No. 1:	
Data No. 2:	
Data No. 3:	
Data No. 4:	

Conclusion:

How can global climate change be best controlled?

SUBMIT

Activity 2.10: Analysis Of Best Practices

You now have a deeper understanding of climate change and the ways and means to address its effects. The Philippines itself, as a member of the international community, has been actively involved in climate change adaptation and mitigation.

Read the articles below on Best Practices in the Philippines. Click the links and answer the questions that follow. Then accomplish the Best Practices Worksheet.

Best Practices No. 1: ABS-CBN FOUNDATION, INC.

http://climatechange.dentr.gov.ph/index.php?option=com_content&view=article&id=147:climate-change-adaptation-best-practices-in-the-philippines&catid=8:press-releases Click the green book *Climate Change Adaptation Best Practices in the Philippines* to download the PDF file. Please take note that the download time may take at least an hour. Once download is complete, go to pages 24-27.



Questions:

1. What were the best practices of ABS-CBN Foundation, Inc.?
2. How can these practices be classified – as examples of adaptation or mitigation? Why?

Best Practices No. 2: BANK OF THE PHILIPPINES ISLANDS

<http://ayala.weboui.com/book/export/html/80> BPI Leads in Sustainable Energy Financing

https://www.mybpimag.com/images/pdf/2_Our%20Report%20.pdf BPI's Report

<http://www.philstar.com/banking/2013/12/10/1266084/bpi-ifc-climate-change-efforts-noted> BPI-IFC climate change efforts noted



Questions:

1. What were the best practices of BPI?
2. Between adaptation and mitigation, what is BPI's primary strategy? Why do you say so?

Best Practices No. 3: PILIPINAS SHELL PETROLEUM CORPORATION

From the same PDF file of the green book *Climate Change Adaptation Best Practices in the Philippines* that you downloaded, go to pages 326-329.



Questions:

1. What were the best practices of Shell?
2. What type of strategy did Shell use to address the effects of climate change? Did Shell concentrate on just one type of strategy or a combination? Support your answer.

Finally, write your generalizations by completing the Best Practices Worksheet below. Be guided by the following process questions. Then submit the worksheet to your teacher through the OHSP system.



PROCESS QUESTIONS:

1. Which among the three companies/organizations used strategies that primarily involve adaptation, mitigation or both?
2. Which company/organization used the best strategy?
3. Between adaptation and mitigation, which is more effective or better in dealing with climate change? Are both strategies equally important and effective? Do we need to make a choice between the two? Why or why not? What will happen if we neither choose to adapt nor mitigate and just do nothing?
4. *How can global climate change be best controlled?*

BEST PRACTICES WORKSHEET
Adapt, Mitigate or Both? 1. ABS-CBN FOUNDATION, INC. 2. BANK OF THE PHILIPPINE ISLANDS 3. PILIPINAS SHELL PETROLEUM CORPORATION
Adaptation vs. Mitigation:

Conclusion/Generalization:



The following rubric will be used to evaluate your Best Practices Worksheet.

RUBRIC FOR UNDERSTANDING

Criteria	3	2	1	0
Generalization	Generalization is valid, logical, insightful and makes accurate references to the data presented.	Generalization is valid.	Generalization shows little relationship to the data presented.	Generalization is invalid.
Justification	Justification is comprehensive, clearly stated, and based on careful analysis of cases given. The way the student defends his/her answer is reflective of strategic thinking and a deep understanding of the topic.	Justification is correct and shows some analysis of cases given. The way the student defends his/her answer is reflective of an adequate understanding of the topic.	Some statements are correct, but most are inaccurate due to incomplete analysis of cases given. The way the student defends his/her answer is reflective of a superficial understanding of the topic.	Justification is incorrect and has no relationship or no reference to the cases given. The student clearly does not understand the topics. The way the student defends his/her answer is coming out from memorization.

Activity 2.11: Planning For Risk Reduction Of Climate Change Impacts

Being aware of the impacts of climate change and knowing how to adapt or mitigate is not enough, we need to have a concrete risk reduction plan to address the future effects of climate change.

Click the link below and read the news article from ABS-CBN.

<http://www.abs-cbnnews.com/nation/metro-manila/08/19/13/record-high-rainfall-swamps-southern-metro-manila> New habagat rains worse than storm ‘Ondoy”



PROCESS QUESTIONS:

1. Why was the accumulated rainfall from habagat worse than typhoon Ondoy?
2. Can this be considered an indicator of climate change? Explain and support your answer.

Your goal at this point is to complete a task given this situation.

After reading the news article about “habagat”, you now recognize the fact that you live in a heavily populated and busy lowland area close to a river. There are several factories a few hundred meters near your house. You often hear the buzz of vehicles outside.

The wet season is fast approaching. In the past, your family has experienced several flooding in your place. Given that climate change is happening, what specific climate change adaptation and mitigation strategies will you include in your risk reduction plan at home? How will you initiate, practice and sustain this?

Your task is to create a home-based disaster preparedness plan for the possible effects and impacts of climate change. Recall the skills you’ve learned from the previous lesson on how to plan and prepare for an emergency or a disaster. Which among those skills do you need to use in order to complete this task?

Organize your simple and easy to understand Climate Change Risk Reduction Plan for your family at home using www.powtoon.com. Powtoon is an online presentation software tool that allows you to create free, cool, and awesome animated presentations and animated videos as an alternative to PowerPoint and video editing softwares.

Create a short (minimum of 2 minutes, maximum of 5 minutes) animated educational video through this website. You need to create a free account with powtoon and upload/export the video in www.youtube.com. You need to have a gmail email account with www.google.com to create a channel in Youtube. Powtoon will direct you to a URL once you are ready to upload/export. For security reasons, refrain from providing confidential personal information in your email account that you will use to create a channel in Youtube which powtoon can also view.

Finally, once you receive the confirmation that your animated powtoon video is successfully exported/uploaded to youtube, email the URL or link to your online teacher to submit your work.

Click this link, <http://www.youtube.com/watch?v=Ktt5KpVnh0w>, to give you a tutorial on how to create a free powtoon animated video. You can always go to www.youtube.com to search other powtoon tutorials and watch sample powtoon videos.

Good luck and enjoy your Powtoon experience.

End of DEEPEN



In this section, the discussion was about making decisions about climate change adaptation and mitigation and planning for disaster risk reduction.

What new realizations do you have about the topic? What new connections have you made for yourself? What helped you make these connections?

Finally, it is time for you to complete the IRF Chart by filling in the Final column.

INITIAL	REVISED	FINAL



Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.



Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

Activity 2.12: Transfer Task

You have reached the peak of this lesson. You have come a long way so take a deep breath as you prepare to apply your learning to a real life situation.

You are now ready to perform this task.

Your goal is to participate in a meaningful community activity that promotes risk reduction of climate change.



TASK

In the past decades, humans have been using fossil fuels that led to an increase in the global carbon dioxide concentration in the atmosphere. This caused an increase in global temperature which has influenced climate change. You are an environmental scientist and the head of the Community Environment and Natural Resources Office (CENRO) in your city. The CENRO wants to promote awareness of the factors that affect climate change and its effects, and encourage people to be conscious of and reduce their carbon footprint.

Your team at CENRO decided to create a brochure that contains information, pictures and environment-friendly practices with the agency’s goal in mind. The brochures will be given to the heads of the Local Government Units to educate, empower and mobilize the residents of your city on risk reduction that involves strategies for climate change adaptation and mitigation.

You may save and submit the brochure as a PDF file to the OHSP portal.

Your brochure will be evaluated based on content, organization, creativity and impact. The rubric is shown below.

RUBRIC FOR BROCHURE

CRITERIA	Outstanding 4	Satisfactory 3	Developing 2	Beginning 1
Content	Shows student’s deep and thorough understanding of concepts learned; able to apply knowledge to novel and relevant situations	Shows student’s correct understanding of concepts learned; able to apply knowledge to novel situations	Shows student’s inadequate understanding of concepts; able to apply knowledge but to a less extent	Shows student’s lack of understanding of concepts; not able to apply knowledge to new situations
Organization	The brochure has a strong educational value. The information is presented in an interesting and logical fashion.	The brochure is educational and the information is presented in a logical order.	The brochure has weak educational value and some information is presented illogically.	The brochure is hard to follow and lacks educational value.
Creativity	Shows originality and creativity in activities and materials done; exceptional effort is put into performance/ completion of the output.	Shows creativity in activities and materials done; good effort is put into performance/ completion of the output.	Shows lack of creativity in activities and materials done; some effort is put into performance/ completion of the output.	Shows no originality and serious lack of creativity in activities and materials done; very little effort is put into the performance/ completion of the output.
Impact	Material is highly effective, convincing and encouraging to the audience	Material is convincing and encouraging to the audience	Material is weak in convincing and encouraging the audience	Material fails to convince or encourage the audience

Activity 2.13: Reflective Journaling

Now that you have a deeper understanding of climate change adaptation and mitigation and risk reduction, let's take one last look at it.

Check out the link, <http://climatechange.denr.gov.ph>, then download the video titled *Sapat na ang Ating Kaalaman* by clicking on **Download Animated film in Filipino (Length: 5 minutes, 2 seconds)**.

As a response to this video, write your personal thoughts in the Reflection Journal below.

Reflection Journal
Activities/actions I did/have done that contributed to climate change:
Activities/actions I ought to do to reduce risks and lessen effects of climate change:

End of TRANSFER

In this section, your task was to create a brochure that will promote risk reduction of climate change.

How did you find the performance task? How did the task help you see the real world use of the topic?

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

Before you do, place a check in the box after the sentence if you have achieved the specific competency.

Lesson 1.1 Classification of Volcanoes and Volcanic Eruptions	Describes the different types of volcanoes	
	Differentiates between active and inactive volcanoes	
	Explains what happens when volcanoes erupt	
	Illustrates how energy from volcanoes may be tapped for human use	
Lesson 1.2 Addressing the Effects of Global Climate Change	Explains how different factors affect the climate of an area	
	Describes certain climatic phenomena that occur on a global level	

POST-ASSESSMENT



It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

- (A) 1. Mt. Mayon is an example of a _____ volcano because _____.
- cinder cone, it is formed exclusively of pyroclasts.
 - composite, it is composed of alternating layers of pyroclastic fragments and solidified lava flows.
 - shield, it is constructed of solidified lava flows.
 - caldera, it was created when the summit was blown off by exploding gases.
- (A) 2. Which among the following does not belong to the group?
- Mt. Taal in the Philippines
 - Mt. Fuji in Japan
 - Mt. Kilimanjaro in Africa
 - Mt. Sinabung in Indonesia
- (A) 3. Which type of volcano is presently not erupting, has not erupted in recent history and that is unlikely to do so for a very long time in the future?
- Active volcano
 - Dormant volcano
 - Extinct volcano
 - Inactive volcano
- (A) 4. Why do people near a volcano need to evacuate before it erupts?
- Hot lava can spew out in gentle streams or can erupt violently into the air.
 - Death and serious injury to people and animals may result from burns and inhalation of hot ash and gases.

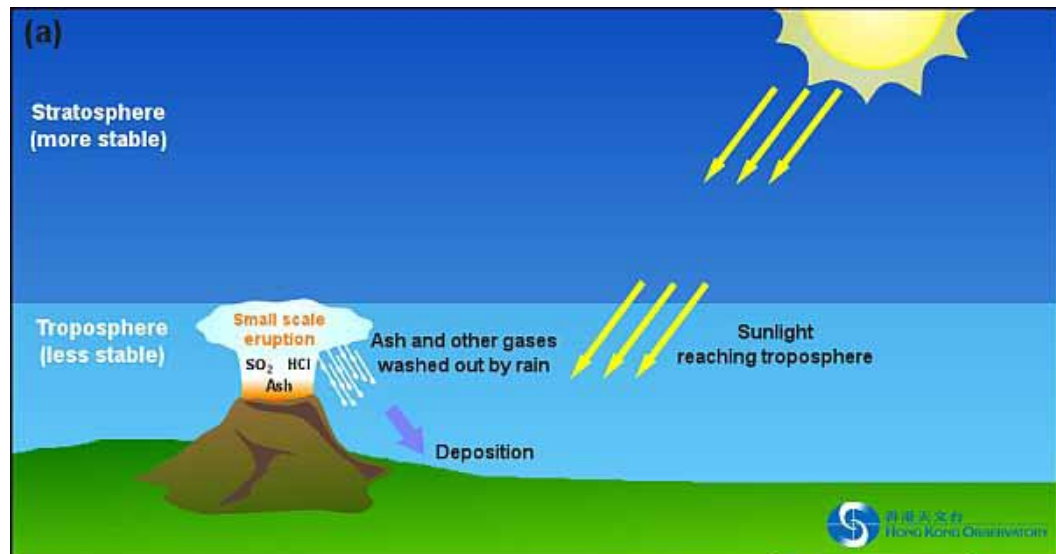
- III. After erupting from the volcano, hot lava will solidify instantly once an object gets in its way as it flows trapping anything in its path.
 - IV. The extreme temperatures of rocks and gas inside pyroclastic flows can cause combustible material to burn.
 - A. I and II only
 - B. III and IV only
 - C. I, II and IV only
 - D. II, III and IV only
- (A) 5. Geothermal energy can be explained simply by its name, which derives from the Greek words “geo,” meaning Earth, and “therme,” meaning heat. The heat is directly below the Earth’s surface, making it a universal resource. The most active geothermal spots are found near fault lines and volcanoes but also occur where there are hot springs, geysers and geothermal reservoirs. It can be harnessed cleanly and efficiently. How is geothermal energy tapped to convert heat to electricity for human use?
- A. Wells are drilled. The turbine drives the electric generator. Steam turns the turbine. Power lines deliver electricity.
 - B. Steam turns the turbine. The turbine drives the electric generator. Power lines deliver electricity. Wells are drilled.
 - C. Wells are drilled. The turbine drives the electric generator. Wells are drilled. Steam turns the turbine.
 - D. Wells are drilled. Steam turns the turbine. The turbine drives the electric generator. Power lines deliver electricity.
- (A) 6. Vicky’s mother is an OFW in Canada. Vicky lives in the Philippines but spends her vacation in Winnipeg, Canada from April to May which is summer time in the Philippines. The temperature was 34 °C when Vicky left Manila but when she arrived in Winnipeg, it was 4 °C. The weather in Manila is hot and humid while Winnipeg is cold and dry. How do you explain the difference?
- I. The Philippines is located in both the northern and eastern hemisphere while Canada is positioned in both the northern and western hemisphere.
 - II. Manila’s latitude is 14° 35’ N while Winnipeg’s is 49° 53’ N which means that Manila is much closer to the equator.
 - III. Manila is located on the eastern shore of Manila Bay while Winnipeg is found on the eastern edge of the Canadian prairies.
 - IV. Canada is found in North America while the Philippines is in Asia.
 - A. I and II only
 - B. II and III only
 - C. III and IV only
 - D. I and IV only

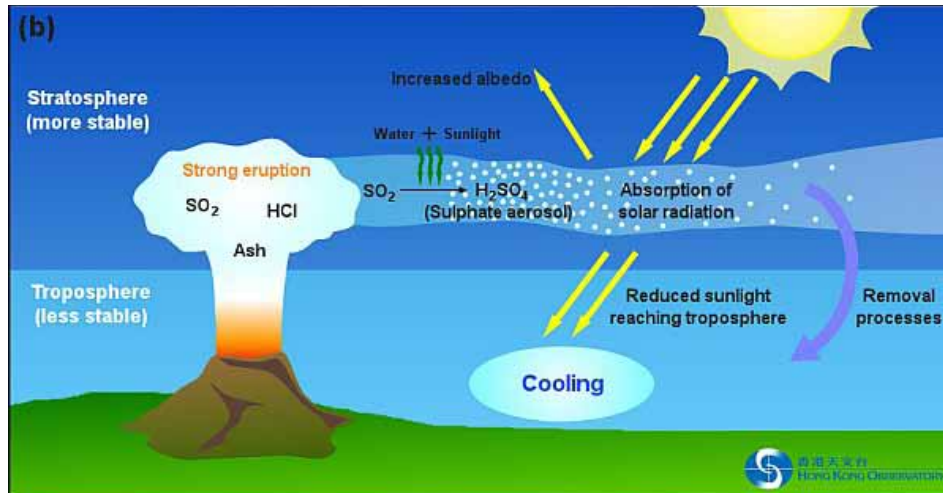
- (A) 7. Even in a neutral state, temperatures in the Pacific Ocean vary from east to west – for example, the western Pacific ‘warm pool’ in the tropical Pacific has some of the warmest large-scale ocean temperatures in the world. Which condition does not distinctly describe an El Niño event?
- It is an oscillation of the ocean-temperature system in the tropical Pacific having important consequences for weather and climate around the globe.
 - The trade winds blow towards the west across the tropical Pacific. These winds pile up warm surface water in the west Pacific, so that the sea surface is about 1/2 meter higher at Indonesia than at Ecuador.
 - The trade winds relax in the central and western Pacific leading to a depression of the thermocline in the eastern Pacific, and an elevation of the thermocline in the west.
 - The easterly trade winds weaken. Rainfall follows the warm water eastward, with associated flooding in Peru and drought in Indonesia and Australia.
- (A) 8. How do you distinguish a La Niña episode from an El Niño episode?
- La Niña is characterized by unusually cold ocean temperatures in the Equatorial Pacific, compared to El Niño which is characterized by unusually warm ocean temperatures in the Equatorial Pacific.
 - El Niño and La Niña are opposite phases of what is known as the *El Niño-Southern Oscillation* (ENSO) cycle.
 - El Niño and La Niña episodes typically last nine to 12 months, but some prolonged events may last for years.
 - El Niño events are associated with a cooling of the central and eastern tropical Pacific, while La Niña events are the reverse, with a sustained warming of these same areas.

For numbers 9-10, refer to the image below.



- (M) 9. What determines the frequency or prevalence of and type of volcanoes that can be found in a place?
- I. its geographic location on Earth
 - II. latitude and longitude
 - III. located in subducting plate boundaries
 - IV. proximity to an ocean
- A. I only
 - B. II and III only
 - C. III and IV only
 - D. I and III only
- (M) 10. Why do a number of a particular type of volcanoes exist in the Philippines?
- A. Because the Philippines is geographically located in the Pacific Ring of Fire.
 - B. Because the Philippines sits on a chain of tectonic plates that are the sites of convergence and divergence.
 - C. Because the Philippines lies within the Ring of Fire which is a seismically active belt of earthquake epicenters, volcanoes and tectonic plate boundaries that fringes the Pacific basin.
 - D. Because the Philippines is geographically positioned in a chain of major seafloor spreading which is actually horseshoe-shaped where magma wells up constantly.
- (M) 11. Guided by the image shown below, how would you generalize the effects of volcanic eruptions to the global climate?

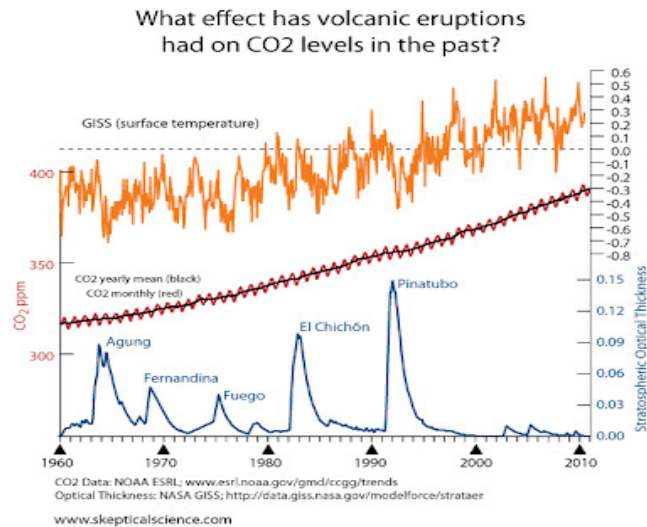




- A. A minor volcanic eruption does not affect the global climate but may affect the short-term weather. A huge and explosive volcanic eruption can significantly reduce solar radiation that penetrates the atmosphere due to the fine, volcanic dust and gas that remained suspended over the earth for years. Hence, causing a drop in the global temperature.
- B. Minor volcanic eruptions are less violent compared to a major volcanic eruption which can cause a significant change in the atmosphere.
- C. A small scale eruption is not enough to change the climate. It will take one strong eruption to release huge amounts of ash and aerosol in the stratosphere to cause a significant change in the troposphere making the latter less stable.
- D. Both small scale and large scale eruptions, when combined, will eventually decrease the global temperature. A minor eruption has less impact while a major eruption has a huge impact.
- (M) 12. Climate change is the change in global climate patterns apparent from the mid to late 20th century onwards, attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels. If humans will not act to control climate change, this could pose serious effects that will put human life and ecosystems at risk, some of which are already happening. There is a cost to control climate change but the price of inaction is much higher compared to the amount of money involved for taking actions. How can global climate change be best controlled?
- A. To control climate change, alternative energy technologies must be developed and renewable energy sources must be used.
- B. Each country must have comprehensive and strategic policies and approaches for climate change adaptation and mitigation.
- C. National approaches to and international agreements on climate change mitigation and adaptation must be strictly enforced and individual lifestyle changes should be observed and practiced to control climate change.

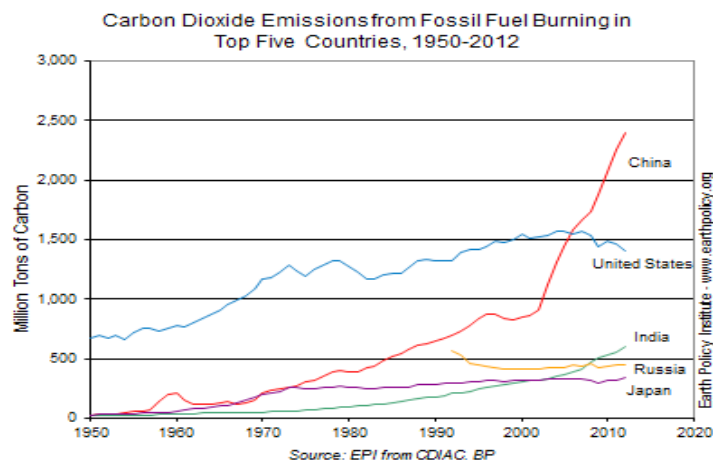
D. To control climate change, highly developed nations must reduce their CO₂ emissions and developing countries must learn to adapt and prepare for the impacts of global warming.

(M) 13. Refer to the data shown below. What effect has volcanic eruptions had on CO₂ levels in the past?



- A. CO₂ levels are affected by volcanic eruptions because they keep rising as result of several major eruptions.
- B. A strong and massive eruption significantly caused a decrease in the global temperature for a certain period of time. Nevertheless, CO₂ levels continued to rise consistently with or without a volcanic eruption.
- C. Both temperature and CO₂ levels are influenced by a series of volcanic eruptions in the past as shown in the graph.
- D. The occurrence of volcanic eruptions especially with huge and massive ones makes the global temperature variable and further leads to an increase in CO₂ levels.

(M) 14. Given the data shown in the figure below, how should countries in the international community respond to the impacts of climate change?



- A. China has the highest emission so this country has to strengthen and improve its mitigation strategies more as compared to the other countries.
 - B. The United States is second in rank, thus, it has to continue its mitigation strategies and at the same time can still use fossil fuels so that its economy and the global economy will not suffer.
 - C. All the top 5 countries need to be united in implementing their mitigation strategies to significantly reduce the global carbon dioxide emission.
 - D. Nations around the world need to be committed in doing their part for climate change mitigation to succeed.
- (T) 15. You observed that your school service, which is a jeepney, has been smoke belching for the past 2 months. You are aware of the possible effects of this smoke from vehicles to human health as well as to the environment. What should you do?
- A. Ask the driver what is wrong with his jeepney and tell him to fix it.
 - B. Report the jeepney driver to LTFRB.
 - C. Speak with the driver about the cause of his jeepney's smoke belching and tell him its possible effects if he doesn't know yet how it contributes to climate change, suggest ways to help then follow up on the action he has taken to fix the problem.
 - D. Have a chat with the driver about the cause and effects of smoke belching. Tell him that you will report him to LTFRB and request the school to ban his jeepney from entering the campus if he will not fix the problem.
- (T) 16. Your school has internet and wifi connection and subscribes to an e-learning system which your science class uses sometimes for lessons and explorations. Your science teacher would always ask your class to submit in paper some requirements such as homework/assignment and written projects/transfer tasks. Many of your classmates have internet access at home including yourself. What can you do to minimize the use of paper in class and yet still accomplish the task assigned by your teacher?
- I. Ask your teacher if she has an email address and suggest if it would be possible to just email some of the requirements in class instead of writing or printing them on paper.
 - II. Suggest to your teacher the possibility of using the school's e-learning system for assignments and transfer tasks when applicable.
 - III. Ask your teacher if you can submit handwritten paper requirements instead of printing them.
 - IV. Organize a group account in Facebook for your class so that soft copies of handouts, documents, presentations and tasks in class can just be posted online without having to print nor photocopy them.

- A. I and II only
 - B. II and III only
 - C. I, II and IV only
 - D. II, III and IV only
- (T) 17. Which among the following is a practice that will help in mitigating climate change?
- A. Have a no-aircon day or no-aircon hour daily in school.
 - B. Fix the drainage within the barangay.
 - C. Teach children how to conserve water.
 - D. Use sandbags during typhoons.
- (T) 18. Santa Rosa City is planning to launch a program that aims to promote awareness on energy conservation as a means to mitigate climate change. The program is supported by the DENR (Department of Environment and Natural Resources) and DOE (Department of Energy). This will also be funded by a private Japanese company. What eco-friendly strategies should be included in this program?
- I. Giving flyers to all the residents of Santa Rosa City about the launching of the program
 - II. Giving away 2 free energy-efficient compact fluorescent light (CFL) bulbs for every incandescent bulb surrendered by the city's residents or 1 free CFL bulb to a resident who simply comes to the city hall and registers during the week-long event
 - III. Conducting free seminars on how to save and earn money from conserving energy and using energy-efficient technology at home, in school and at work
 - IV. Announcing the launching of the program through text messaging, television, radio and the internet
- A. I, II and III only
 - B. II and III only
 - C. II, III and IV only
 - D. I, II, III and IV
- (T) 19. How does fixing and widening the drainage in your barangay help reduce risk of climate change impacts?
- A. It allows sewage to flow easily during heavy rains.
 - B. It prevents solid wastes like plastic from blocking the flow of liquid.
 - C. It prevents growth of microorganisms that may be stuck in the drainage.
 - D. It minimizes flooding during typhoons and prevents diseases like cholera, dengue, malaria, typhoid fever and leptospirosis brought about by floods.

- (T) 20. You have been invited by an old friend you haven't seen for a long time to visit her at home because she recently arrived from overseas. You've never been in this subdivision before. After getting off from the jeepney near the entrance of the subdivision, you have to decide whether to walk or ride a tricycle or pedicab to reach your friend's house which is 3 blocks away from the main entrance of the subdivision. It's now 5:00 in the afternoon and it's the month of April. Which mode of transportation will you use that is more environment-friendly to get to your friend's house?
- A. Take a walk.
 - B. Ride a bicycle.
 - C. Take a pedicab ride.
 - D. Take a tricycle ride.



GLOSSARY OF TERMS USED IN THIS LESSON:

Active volcano - a volcano that is erupting; Also, a volcano that is not presently erupting, but that has erupted within historical time and is considered likely to do so in the future

Adaptation – a response to climate change that involves developing ways to protect people and places by reducing their vulnerability to climate impacts

Caldera – the Spanish word for cauldron; a basin-shaped volcanic depression

Carbon footprint - the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person, group, etc.

Cinder volcano - a volcanic cone built entirely of loose fragmented material (pyroclastics)

Climate - the weather conditions prevailing in an area in general or over a long period

Climate change - the change in global climate patterns apparent from the mid to late 20th century onwards, attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels

Composite volcano - a steep volcanic cone built by both lava flows and pyroclastic eruptions; also known as stratovolcano

Dormant volcano - a volcano which is presently inactive but which may erupt again

El Niño - an irregularly occurring and complex series of climatic changes affecting the equatorial Pacific region and beyond every few years, characterized by the appearance of unusually warm, nutrient-poor water off northern Peru and Ecuador, typically in late December

Extinct volcano - a volcano that is not presently erupting and is not likely to do so for a very long time in the future

Global warming - a gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons, and other pollutants

Greenhouse effect - the phenomenon whereby the earth's atmosphere traps solar radiation, caused by the presence in the atmosphere of gases such as carbon dioxide, water vapor, and methane that allow incoming sunlight to pass through but absorb heat radiated back from the earth's surface

Habagat – The Habagat season is characterized by hot and humid weather, frequent heavy rainfall, and a prevailing wind from the west. Habagat is also known as *monsoon* or *southwest monsoon* in the Philippines.

Hotspot - a volcanic center, 60 to 120 miles (100 to 200 km) across and persistent for at least a few tens of million of years, that is thought to be the surface expression of a persistent rising plume of hot mantle material. Hot spots are not linked to arcs and may not be associated with ocean ridges.

Lahar - a torrential flow of water-saturated volcanic debris down the slope of a volcano in response to gravity

La Niña - a cooling of the water in the equatorial Pacific that occurs at irregular intervals and is associated with widespread changes in weather patterns complementary to those of El Niño, but less extensive and damaging in their effects

Latitude - distance measured in degrees east or west from an imaginary line (called the prime meridian) that goes from the North Pole to the South Pole and that passes through Greenwich, England

Lava – magma which has reached the surface through a volcanic eruption

Longitude - the angular distance of a place east or west of the meridian at Greenwich, England, usually expressed in degrees and minutes

Magma - molten rock beneath the surface of the earth

Mitigation - involves attempts to slow the process of global climate change, usually by lowering the level of greenhouse gases in the atmosphere

Pyroclastic flow - a dense, destructive mass of very hot ash, lava fragments, and gases ejected explosively from a volcano and typically flowing downslope at great speed

Pyroclastic material - pyroclastic rocks or pyroclastics are clastic rocks composed solely or primarily of volcanic materials

Ring of Fire - also called Circum-Pacific Belt or Pacific Ring of Fire, long horseshoe-shaped seismically active belt of earthquake epicentres, volcanoes, and tectonic plate boundaries that fringes the Pacific basin

Shield volcano - a gently sloping volcano in the shape of a flattened dome and built almost exclusively of lava flows

Stratovolcano – another name for composite volcano; a volcano composed of both lava flows and pyroclastic material

Subduction - the sideways and downward movement of the edge of a plate of the earth's crust into the mantle beneath another plate

Subduction zone - the zone of convergence of two tectonic plates, one of which usually overrides the other

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https://www.mybpimag.com/images/pdf/2_Our%20Report%20.pdf BPI's Report

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<http://brightstarswildomar.blogspot.com/2012/05/volcanoes-co2-and-temperatures.html> graph for post-assessment number 13

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Lesson 2: Stars and Constellations

INTRODUCTION AND FOCUS QUESTION(S):

Do you read and/or listen to horoscopes? Have you wondered how these forecasts and “practical advice” were arrived at? Have you listened to statements about compatibilities and incompatibilities between people based on their zodiac signs? (“He’s Aries; you’re Capricorn. You two aren’t compatible.”)

Have you tried looking for your zodiac constellation in the night sky? Thousands of years ago, the Greeks have named the groupings of stars in the sky with characters and objects in their mythologies. In effect, their stories have been “archived” in the sky for all to see. Now, are our life stories also “written in the stars”? Is it alright to base our actions on these patterns of stars in the sky?

In this module, you will familiarize yourself with stars and constellations. Using tools, you will verify which stars and constellations are visible at different times of the year and hours through the night. You will then compare and contrast: astronomy vs. astrology. You will then find out whether or not these star patterns are good basis for our actions and decisions.

As you go through the lessons in this module, you will be answering the following questions:

1. What are the more prominent stars and constellations? How do the other stars compare to our Sun would look like? (in terms of size, mass and color)
2. **Why study the night sky?** What are the available tools for locating these stars and constellations, and how are they used? **What do we get from studying the positions of stars and constellations in the sky?**
3. Between astronomy and astrology, which is scientific and which is not? What are the benefits of engaging in these fields?
4. Why do people read horoscopes? Should this practice be continued? Why or why not? **Is our future and destiny really “written in the stars”?**

Lesson Coverage:

In this lesson, you will examine these questions when you take the following parts:

Part 1: Identifying and naming stars and constellations

Part 2: Stargazing!

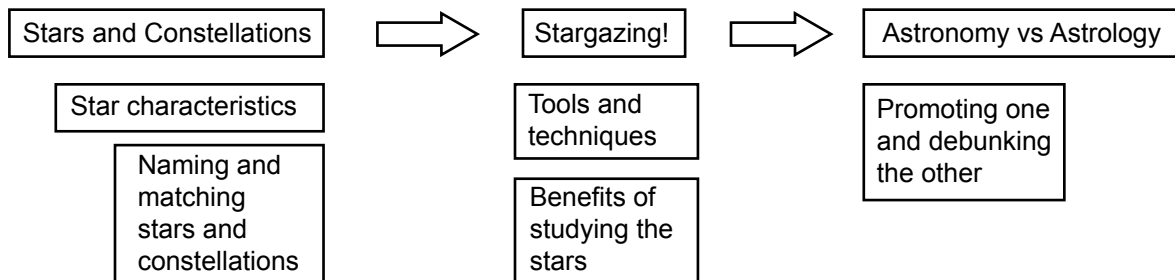
Part 3: Astronomy vs. Astrology

In these segments of the lesson, you will learn the following:

<i>Part 1</i>	<ul style="list-style-type: none">Names of the more prominent constellations and their brightest stars.The different characteristics of stars, as compared to the Sun.The tools and charts used in studying the stars.
<i>Part 2</i>	<ul style="list-style-type: none">Making inferences about the movements of stars across the sky.Determine which constellations and stars are visible at different times of the year.The practical applications and benefits of studying the constellations and the stars.
<i>Part 3</i>	<ul style="list-style-type: none">The similarities and differences between astronomy and astrology.Simple scientific methods to validate astronomy and persuade people from practicing astrology.

Map of the Lesson:

Here is a simple map of the above topics you will cover:



EXPECTED SKILLS:

To do well in this lesson, you need to remember and do the following:

1. Be more observant for details.
2. When you do your stargazing, be ready with some, if not all of the prescribed tools and charts: star maps and charts, a simple telescope / binoculars, and the downloaded software / apps and simulations of the night sky.
3. Learn how to use these tools ahead of your actual time for stargazing.
4. Schedule your time (2 weeks) on this module to be on the days when the moon small or is not in the night sky (between last quarter to 1st quarter, inclusive of the new moon).

5. As your time permits, do “informal” stargazing whenever you have a clear view of the stars: no clouds, no rain, and specially of there is no moon in the night sky.
6. Seek to do more and read more. Do not be limited to the resources presented in the module. Do your own search for useful readings, apps and references.
7. Seek help online with the other online learners and from your assigned teacher, especially during your face-to-face meeting with him/her.

PRE-ASSESSMENT:

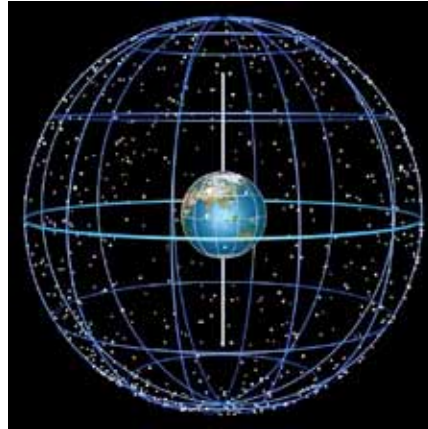


Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

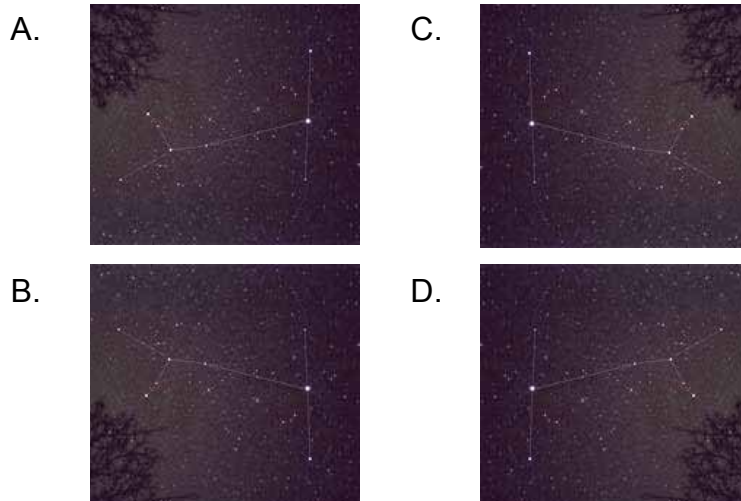
1. Which of the following stars is most similar to the Sun?
 - A. red giants
 - B. white dwarfs
 - C. main sequence stars
 - D. neutron stars
2. Betelgeuse is a red supergiant whose mass is about _____ that of the Sun, and whose radius is about _____ that of the Sun.
 - A. equal to ; 100 times
 - B. 10 to 20 times ; 1,000 times
 - C. 1,000 times ; 10 to 20 times
 - D. 1,000 times ; 1 million times
3. The brightest star in the constellation Canis Major, is _____, while the only fixed star, in the constellation Ursa Major (Big Bear or Big Dipper) is _____.
 - A. Sirius ; Polaris
 - B. Polaris ; Sirius
 - C. Rigel ; Antares
 - D. Betelgeuse ; Polaris
4. Aldebaran is the brightest star in the constellation _____, while Antares is the brightest in the constellation _____.
 - A. Orion ; Scorpio
 - B. Taurus ; Scorpio
 - C. Scorpio ; Taurus
 - D. Bootes ; Big Dipper
5. Characters of Greek mythology, written thousands of years ago, are immortalized as the names of the constellations. Until now, we see that some of them closely resemble the human or animal figures they are named after. From this, it can be inferred that _____.
 - A. stars move together from west to east
 - B. stars move a bit, but they are confined within their constellations



- C. stars are fixed in their constellations
 - D. the grouping of stars is subjective – a product of human imagination instead of natural laws
6. The celestial sphere is a fixed imaginary sphere around the Earth where stars are mapped according to how they are seen from the Earth which rotates around its axis. This mapping is inaccurate because _____, but it is useful just the same because _____.



- A. the stars are actually not at equal distances from the Earth; the stars' arrangements are fixed through thousands of years.
 - B. stars are shown much smaller than the Earth; the stars' are free to move even while the celestial sphere is fixed
 - C. not all stars can be mapped on the sphere; we only need to map the more visible stars
 - D. the colors of the stars are not indicated (not all stars are white); the stars' are actually observed to be fixed in their groupings
7. Pictured above is the constellation Canis Major, as seen above the eastern horizon an hour after sunset. How will it look like at the western horizon, an hour before sunrise the following day?



8. Pictured at the right is a view of the Big Dipper constellation above the northern horizon in the Philippines. How will the Big Dipper look like a few hours later?



- A. (rotated to the left / counterclockwise)
 - B. (rotated to the right / clockwise)
 - C. (lowered)
 - D. (flipped vertically, in-place)
9. Given two star charts, one printed in 1973 - Northern hemisphere) and another printed in 2003 - Southern hemisphere, which chart will be alright to use in your upcoming stargazing activity, and why?
- A. The 2003 chart. It is newer, so it is better.
 - B. The 1973 chart. It is what you'll need.
 - C. Either. Stars are fixed within our lifetimes.
 - D. Neither. Both are already old and dated



10. Pictured above is a familiar constellation, but it seems to have two new member stars, which are not indicated in star charts. What can be inferred from this picture?
- A. These are two newly born stars. The star map used is not yet updated to include them.
 - B. These are actually stars from the adjacent constellation which somehow moved into this constellation.

- C. These are not stars, but could be planets or comets.
 - D. These are not stars but could be airplanes or unidentified flying objects.
11. Are the locations of stars and planets and constellations in the sky at certain times of the year, really good basis for our beliefs, practices and decisions? Why?
- A. Yes. Many people became successful through hard work, luck, and some advice from the stars.
 - B. Yes. Why would newspapers and TV shows feature them if they are not reliable and useful?
 - C. No. The influence of the stars and planets on human behavior has no scientific basis.
 - D. No. Stars are much farther away than the moon and the sun, thus the latter should be the basis for our beliefs.
12. Flora goes along better with her best friend Gwen than with her sister Faye. Her guidance counselor asks her why, and she replies: "It's our parents' fault. Faye is a Scorpio, thus she's really not compatible with me. Gwen is a Libra, and so I chose to be with her more often. These Zodiac signs are based on stars, and that makes these things scientific, right?" To this, her guidance counselor says, "Well, I guess you're right." What about you? What would you have told Flora?
- A. Studying and plotting stars is scientific, but attributing compatibility among people to the stars, is not.
 - B. That compatibility assignment is for last year. Isn't it that this year, you are compatible with Scorpio?
 - C. Forget Roman mythology. Chinese astrology is more scientific.
 - D. It's alright to consider zodiac signs, but you'll still be able to find ways to be in good terms with your sister.
13. Which of the following statements best summarizes how much of all the sky can be seen by a person staying on the same place on Earth throughout the year?
- A. It depends on where the person is on Earth. For someone on the equator, he will see almost the entire sky.
 - B. It depends on where the person is on Earth. For someone on the north pole, he will see the entire sky.
 - C. Anywhere on Earth, a person just sees half of the sky.
 - D. Anywhere on Earth, a person sees the entire sky as the Earth rotates and revolves around the Sun.

14. The calendar year is divided into the 12 zodiac signs. Each day is therefore assigned to the zodiac constellation _____.
- A. that is in the Sun's background in the sky
 - B. at the zenith of the night sky at midnight
 - C. that first appears in the Eastern horizon at midnight
 - D. that is in the Moon's background
15. The zodiac signs are often mentioned in this module. What is the benefit of discussing them?
- A. To encourage more people to know how to make useful predictions
 - B. They are helpful in plotting the location of planets around the ecliptic
 - C. To determine the location of the brightest stars
 - D. To help make it easier to memorize the names of the constellations
16. As a student of science who has studied the Scientific Method, what should be your reaction when somebody tells you this: "Oh, I read in your horoscope for today that you should be wary of water and riding boats. Maybe you should postpone your trip to the islands."?
- A. "Oh, thanks for that. I'll just go next week."
 - B. "Hmm. Let's design an experiment that will test whether it is really unsafe for me to ride boats today."
 - C. "That doesn't make sense. I'll be riding with many other people who are of different zodiac signs, right?"
 - D. "Actually even without horoscopes, people should be riding airplanes instead of boats. It is much safer in planes, and faster too."
17. Which of the following procedures will best help prove that horoscopes are not to be relied upon?
- A. Ask 100 people whether they read and believe their horoscopes, and get more than 50 people who says no.
 - B. Interview people of the same zodiac sign, and see that more than half of them had experiences that are way off from the predictions.
 - C. Interview 12 people, one of each zodiac sign, and see that none of them confirms that their horoscope predictions on them weren't even close to coming true.
 - D. Get 100 people to read the horoscope predictions from yesterday for all 12 zodiac signs (signs are covered), and they guess which one was for their zodiac sign – and not all of them picking correctly.

18. Which of the following will best show people the benefit of studying stars and constellations?
- A. Demonstrate how the stars and constellations are useful for navigation.
 - B. Narrate the Greek mythology while stargazing and pointing out the characters of the stories in the sky.
 - C. Share testimonies of people meeting tragedies which they could have avoided if they read their horoscopes.
 - D. Show people a documentary film about Sun-like stars that may have Earth-like planets.
19. You hear a younger student in your school say that astrology is a branch of science, while astronomy is not. She explains this, confidently saying that the ending of –logy for astrology gave it away. What would you say to her?
- A. Right on! Good thinking!
 - B. Isn't it that both are sciences? The suffix of –omy (as in anatomy) is also for branches of science.
 - C. It's the other way around. Astrology is baseless predictions, while astronomy is based on actual observations of stars.
 - D. It's the other way around. Though practitioners of both do look up to stars, it is in the latter that data is systematically analyzed.
20. There are now available apps, and software, where the night sky at specific dates may be “viewed” on the computer screen. Will it be better to use these apps instead of doing some stargazing?
- A. Yes. They will allow studying astronomy anytime, anywhere.
 - B. Yes. These apps will be more accurate than the dated star maps used in stargazing.
 - C. No. It is always best to see the real thing.
 - D. No. Using these apps side by side with doing stargazing will be best.

EXPLORE:



Let's begin by looking up at the sky tonight, rather, at late afternoon, just as the sun sets in the west. What are the brightest stars that you get to see first? Note their locations on the first hour of the evening. Later into the night, how have these brighter stars' positions changed? Are the stars all white? Or do they come in different colors?

People from ages ago have also studied the stars, gave them names, and grouped them together, and gave names to these groupings – the constellations. Why study these far, far away stars? What benefit do we get from studying the stars? How true is it that our futures are “written in the stars”?

Let's start the module by doing the following activities:

ACTIVITY NO. 1: Horoscope reading

DESCRIPTION: Look for your horoscope for today, either from the newspaper or from the Internet (e.g. horoscope.com). If you are not familiar with horoscopes, look first for your zodiac sign which is based on your birth date. Scan through the horoscope tips / advice / warnings for the other zodiac signs. Ask around among family and friends whether or not they read and / or believe in horoscopes. Ask them why or why not.

PROCESS QUESTIONS:

- What are the different zodiac signs? How are they related with horoscopes?
- Are the horoscopes believable? Why or why not?

ACTIVITY NO. 2: Stargazing 1

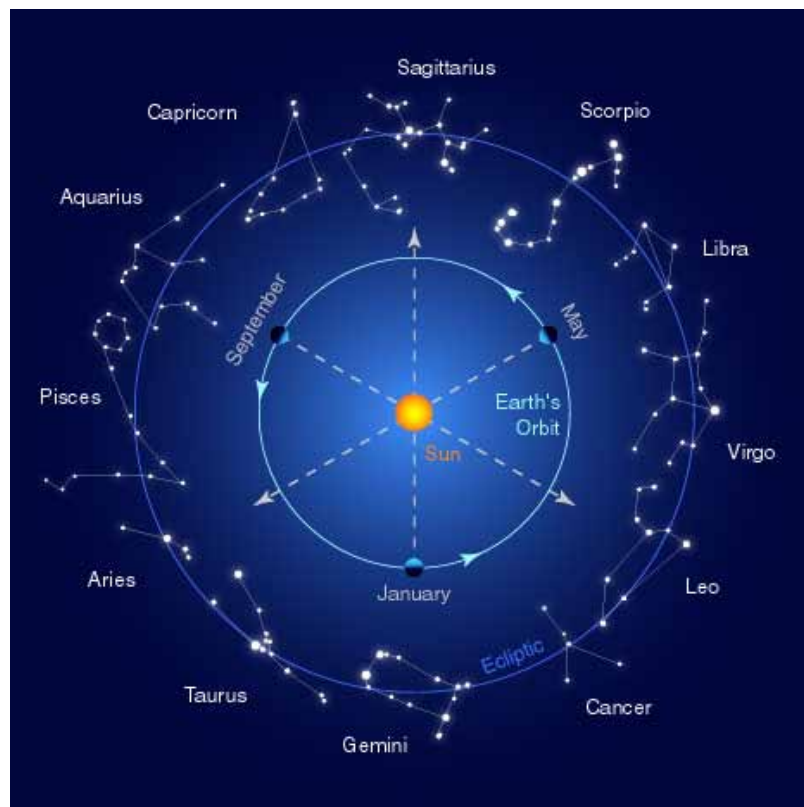
DESCRIPTION: Get ready for some stargazing!

Read up the following webpage on tips for preparing for stargazing:

<http://www.wikihow.com/Stargaze-Comfortably>

Choose a good date to stargaze. Start when the sun is about to set. See the first bright stars that appear. See how the number of stars you see gradually increase as it goes darker. Try to see how the stars gradually move through the sky.

What zodiac constellations are visible in the sky tonight?



The following zodiac constellations are more easily identifiable in the sky: Gemini (the twins), Taurus (the bull), Leo (the lion) and Scorpio (the scorpion). The others are quite less prominent and therefore take more effort to locate in the sky.

Browse through the page from where the above diagram is taken

<http://zoroastrianastrology.blogspot.com/p/houses-of-zodiac.html>

to get an idea on how these constellations look like, and which of these constellations are visible at different times of the year.

Worksheet 1: (For Stargazing 1) Turning on the night lights!

Draw how the sky looks like, indicating the first bright objects to come out, in the spaces here:

<p>Facing West Just as the Sun sets below the horizon</p>	<p>Facing East Just as the Sun sets below the horizon</p>
<p>Facing West 10 minutes after the Sun has set</p>	<p>Facing East 10 minutes after the Sun has set</p>

Facing West Past 7:30 pm	Facing East Past 7:30 pm



Right at sunset and a few minutes after, some bright stars and planets (Venus and /or Jupiter) may already be visible, but star patterns are not yet visible.

By 7:30 pm, some star groups / patterns are already be visible. If you have some background on the names of constellations, you may be able to name the groups that you saw. Why do you think were the constellations given such names?

If you are to give new names to these patterns, what names will you give them? Why these names?



PROCESS QUESTIONS:

- How do stars move through the night sky?
- Are the stars all white? Or are they of different colors?
- How are these stars named? How are their groupings, called constellations named?
- What are the zodiac constellations? Which of these constellations are visible at different times of the year?

ACTIVITY NO. 3: Eliciting prior knowledge: I-R-F chart

DESCRIPTION: Write down your initial (I) ideas pertinent to the topic by answering the questions and filling up the I column. Make a copy of this chart on a page set at landscape to have wider columns.

Questions	I Initial ideas	R Revised answers	F Final answers
1. Why study stars? What benefits do we get from studying them?			
2. Are horoscopes believable? Why or why not?			
3. In what ways are astronomy and astrology similar? How are they different?			



PROCESS QUESTIONS:

1. Why study the stars? What benefits do we get from studying them?
2. Are horoscopes believable? Why or why not?
3. In what ways are astronomy and astrology similar? How are they different?

End of EXPLORE:



You just started your “journey to the stars” by doing these preliminary activities: Stargazing 1 and Horoscope Reading. You also should have written down initial ideas about why we study stars, and whether or not horoscopes are believable. “Why study the stars? Are horoscopes believable?”

Let us reflect on our **EQ: Is our future and destiny really “written in the stars”?**
Why study the night sky? What do we get from studying the positions of stars and constellations in the sky?

Continue your learning journey by doing the next part.

What you will learn in the next sections will also enable you to do the final project which involves *doing a creative presentation to a selected audience about astronomy and astrology.*

Find out other learners’ initial ideas and compare them with your own. As you compare, you will find out if your ideas are in line with the standard. You will also learn other concepts which will help you complete a required project found at the end. This project is about *promoting astronomy and critically assessing astrology.*

We will start by doing the next activities: readings about characteristics of stars and a simple inventory of stars and their groupings into constellations.

FIRM UP:

Your goal in this section is to learn and understand these key concepts:

- characteristics of stars, as compared to the characteristics of the Sun
- the naming of the prominent stars and their grouping into constellations
- how the position of constellations change in the course of a night
- how to determine which constellations may be seen at different times of the year using models

You will continue pondering on the following questions:

- Why study the night sky?
- What do we get from studying the positions of stars and constellations in the sky?
- Do the stories of the characters / animals to whom constellations are named, have any influence on our own life stories?

*Before we further proceed with the discussion of these topics, let us first ponder on our EQ again: **Is our future and destiny really “written in the stars”?** Why study the night sky? What do we get from studying the positions of stars and constellations in the sky?*

ACTIVITY NO. 4: Article reading: Star Characteristics

DESCRIPTION: Read about the characteristics of stars: mass and size, color and brightness.



Concept Article: Characteristics of Stars (Grade 9)

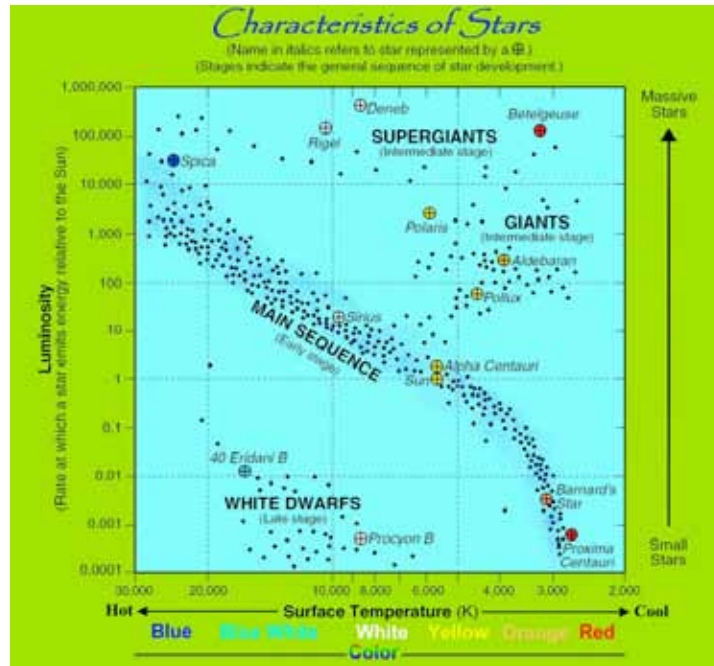
By John Vincent D. Salayo

A cloudless sky splashed with countless stars is a sight to behold. Humanity has long been interested in stars. Just like people, stars are of different colors and sizes. Our Sun is a yellow medium-sized star. Sirius, the brightest star in the sky, is also medium sized (just about twice the Sun) but is white. Betelgeuse, in constellation Orion, is a red giant. Besides color and size, what are other interesting characteristics of stars? What do we get from studying the stars? Read on and get star-struck!

Great balls of fire of different colors!

Stars are great balls of fire which burn for millions and billions of years before running out of fuel. Our sun is a middle-aged star, about 4.6 billion years old, and has about 5 more billions years of fuel to burn. In its core the temperature is as high as 15 million degrees Celsius, while it is a lot cooler (but still scorching hot) at the surface: 5,500 degrees Celsius.

The surface temperature determines the star's color. The chart at the right shows that red and orange stars are cooler than our Sun, while white, blue-white, and blue stars are hotter. This pattern is very similar to that of familiar hot objects here on Earth, arranged from coolest to hottest: red hot coals, filaments of bulbs that glow yellow, and the blue flame in gas stoves and Bunsen burners. Even hotter is the blue-white pointed flame of the acetylene torch, used in cutting and welding metals.



[http://regentsearth.com/illustrated%20ESRT/Page%2015%20\(Luminosity\)/Luminosity%20index.htm](http://regentsearth.com/illustrated%20ESRT/Page%2015%20(Luminosity)/Luminosity%20index.htm)



<http://oxyacetylenetorch.net/>

Luminosity and brightness

Along the y-axis in the chart is the stars' luminosity: the rate at which it gives off energy, or the amount of light give off per unit of time. In the chart, it is given in comparison to our Sun. Rigel and Spica are about 100,000 times more luminous than the Sun. On the lower end, the luminosity of Procyon B and Proxima Centauri are about one-thousandth that of the Sun. Luminosity is an internal property of the stars – it just depends on how fast it burns up fuel.

Brightness on the other hand, depends on the distance of the star from the observer. Brightness is stated in terms of magnitude. Tabulate below are the brightest stars.

Star name	Magnitude
Sirius	-1.46
Canopus	-0.72
Alpha Centauri	-0.27
Arcturus	-0.04
Vega	+0.03
Capella	+0.08
Rigel	+0.12
Procyon	+0.38
Achernar	+0.46
Betelgeuse	+0.50 (variable)

Note in the chart that Rigel is much more luminous than Sirius. However, Sirius is much closer to the Earth at just 8.6 light years away, while Rigel is 773 light years away! This great distance makes Rigel less bright than Sirius.

In the early times, the Greek mathematician Hipparchus devised a system where the brightest stars are called *1st magnitude* stars, while the faintest stars visible to the eye were assigned as *6th magnitude* stars. All other stars were assigned to 2nd, 3rd, 4th and 5th magnitudes. 1st magnitude stars are about 100 times brighter than 6th magnitude stars. All the stars above are 1st magnitude stars in this old system.

In the newer system, brought about by more sensitive telescopes, the faintest objects in the sky are in the 20th magnitude. Also, the 1st magnitude stars were rightly distinguished, as they are really not equally bright. The lower the number, the brighter is the star. For comparison, planets Venus and Jupiter are much brighter than Sirius, and they are assigned magnitudes of -6 and -4 respectively. The farther planets Saturn, Uranus, Neptune and Pluto are assigned magnitudes +1, 6 (barely visible to the unaided eye), 8, and 14 respectively.

Video Break

Follow this link: <https://www.youtube.com/watch?v=Bcz4vGvoxQA>

Watch this video to see how the sun looks like compared with the other stars in the vast universe

What can you say about our sun as compared with the other stars?

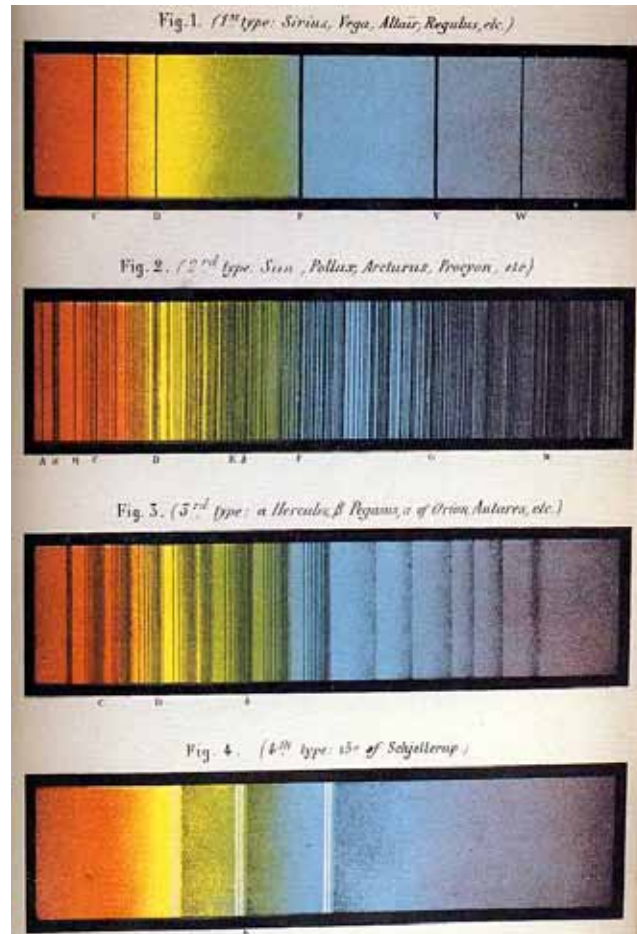
Transition Statement: After watching the video, continue reading the article below to discover how scientists learn more about the stars.

Spectroscopy: Fingerprinting the stars

Stars, like people, are unique. Though many stars look the same to our unaided eyes, their lights have unique characteristics that serve as their fingerprints.

Spectroscopy is the study and analysis of starlight. At the right is a page from the studies of Angelo Secchi, an Italian priest and astronomer who did pioneering work in this field.

Through spectroscopy, as it is with rocks mined here on Earth, the elements making up the stars are determined. It was determined then that stars are indeed mostly hydrogen, with variations of small amounts of the other elements.



<http://www.aip.org/history/cosmology/tools/pic-spectroscopy-lithograph.htm>

Quiz 1: Star Characteristics

1. What are the different groups of stars? What are the different characteristics that are the basis for grouping the stars?
2. The Sun is: (click on your answer)

- white	yellow	red	blue
- small/dwarf	medium-sized	large/giant	
- highly luminous	moderately luminous	of low luminosity	
3. What are the two factors that determine how bright stars appear to us here on Earth?

4. In the old system, all the stars in the table below are called 1st magnitude stars. Is the new system really better? Why? Or is it better to have stayed with the old system? Explain.

Star name	Magnitude
Sirius	-1.46
Canopus	-0.72
Alpha Centauri	-0.27
Arcturus	-0.04
Vega	+0.03
Capella	+0.08
Rigel	+0.12
Procyon	+0.38
Achernar	+0.46
Betelgeuse	+0.50 (variable)

Worksheet 1: Post-article-reading assessment



PROCESS QUESTIONS:

After reading the article and viewing the video clip, answer the following questions. Post your answers in a discussion forum where your teacher and other online learners can comment, give you feedback or share their own answers.

1. The Sun is special to us because it is our source of energy. In comparison to the other stars in the sky, is it really special? Or is it more ordinary than special? Why do you think so?
2. Why are stars of different colors? What do we know about stars based on their colors?
3. What is the difference between luminosity and brightness of stars? Which is a more truthful description of stars? Which is more useful for us?

EQ:

4. **What benefit do we get from learning of the characteristics of stars?**

ACTIVITY NO. 5: Webpage readings: Constellations and stars inventory

DESCRIPTION: Read through the following webpages to get to know the more prominent stars and the constellations where they belong.

<http://www2.potsdam.edu/islamma/phys335constellations.htm>

This is a very informative site showing most of the constellations with the names of the brightest stars in them.

<http://stardate.org/nightsky/constellations>

This page has clickable links to more information about the constellations and the stars in them – how to locate them in the sky, and the stories behind their names.

<http://www.seasky.org/constellations/constellations-intro.html>

Here's another site where all constellations are listed, and grouped according which are visible in each month of the year for northern hemisphere observers (that includes us).

<http://www.funbrain.com/constellation/>

This is an interactive game where you'll identify the constellations, given pictures and some clues.

Quiz 2: Constellations and Stars

Answer the following questions about the constellations and the prominent stars in them.

1. The brightest star is _____, in the constellation _____.
 - A. Polaris ; Ursa Minor
 - B. Betelgeuse ; Orion
 - C. Sirius ; Canis Major
 - D. Deneb ; Cygnus
2. The twins who got "immortalized" as stars, are _____, in constellation _____.
 - A. Castor and Pollux ; Gemini
 - B. Polaris and Pollux ; Hydra
 - C. Betelgeuse and Rigel ; Orion
 - D. Rigel and Regulus ; Leo
3. Which of the following sets of animals has *one* that doesn't have a constellation named after it?
 - A. dog, cat and lion
 - B. bull, scorpion and swan
 - C. crab, bear and snake
 - D. rabbit, fish and ram
4. The prominent pentagon pattern near Polaris is the constellation _____ and its brightest star is _____.
 - A. Cassiopeia ; Schedar
 - B. Arcturus ; Bootes
 - C. Auriga ; Capella
 - D. Ursa Major ; Dubhe

5. The brightest star in Scorpio is _____, while the brightest in Taurus is _____.
 - A. Aldebaran ; Arcturus
 - B. Antares ; Aldebaran
 - C. Vega ; Rigel
 - D. Scorpius ; Betelgeuse
6. The largest constellation is _____, while the smallest is _____.
 - A. Hydra ; Crux
 - B. Scorpio ; Canis Minor
 - C. Orion ; Cancer
 - D. Draco ; Pleiades
7. Polaris is not a very bright star, but it is quite prominent because it is _____.
 - A. a coveted jewel in many ancient myths
 - B. relatively fixed while other stars revolve around it
 - C. in the head of the largest constellation
 - D. visible to everyone, everywhere around the world
8. "The Hunter" is constellation _____, and the brightest stars in it are _____.
 - A. Hercules ; Rigel and Sirius
 - B. Orion ; Betelgeuse and Rigel
 - C. Sagittarius ; Polaris and Sirius
 - D. Canis Major; Castor and Pollux
9. Some constellations are named after objects (not humans, animals or mythical creatures). Two of these are _____.
 - A. bow and arrow
 - B. scales and crown
 - C. guitar and anchor
 - D. hourglass and shears
10. The constellation that has the closest resemblance to its name is _____.
 - A. Capricorn
 - B. Gemini
 - C. Scorpio
 - D. Leo



PROCESS QUESTIONS:

1. What are the most prominent constellations in the sky? Which of them can you see tonight?
2. Which constellations and stars have names from characters and stories that are somehow familiar to you? Most of these are names of characters from Greek mythology.
3. Make your list of Top 10 favorite constellations. What are your criteria for making your list? Compare your list with those of other learners.



You were able to have a glimpse of the different stars and constellations that can be seen in the night sky. Using the information you have, you are now ready for the next activity.

ACTIVITY NO. 6: Stargazing 2: Using charts and maps

DESCRIPTION: In this activity, you will learn and practice some skills on how to *actually* see and locate these stars, using some tools for stargazing – star charts, the celestial sphere, and telescopes / binoculars.

Study the following resources before heading out to your next stargazing.

http://www.astro.umass.edu/~arny/constel/learn_const.html

This site has links to the following: how to use star charts, how the sky looks like at different times of the year, and an interactive quiz on identifying constellations.

<http://www.youtube.com/watch?v=ih7aGeFKBPE>

Celestial Coordinates. This video shall orient you about the celestial sphere and will help you locate stars and constellations in the sky.

After studying the above resources, take time to print star maps in these sites. Print the maps for the northern hemisphere and for the equatorial region, since the Philippines is just a few degrees north from the equator (Manila is at 14° north). Some maps are also specific to months of the year. Choose the maps to print according to the time of the year that you are on this module. Read further the instructions for using these maps. <http://www.skymaps.com/downloads.html>

<http://www.star-map.fr/free-star-maps/>

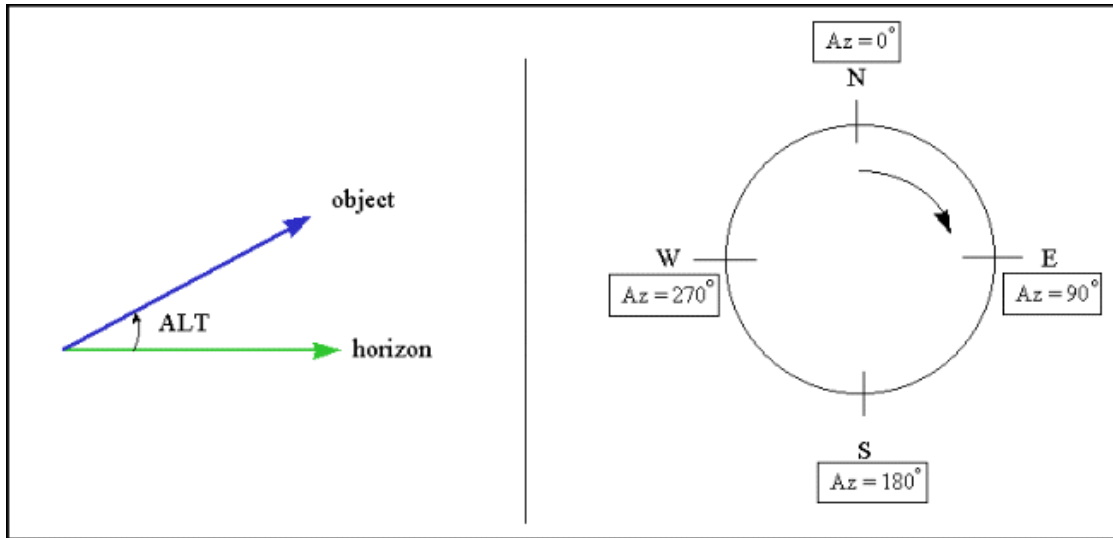
Follow this link: <http://www.wikihow.com/Stargaze-Comfortably>

to review the tips to prepare for a better stargazing experience

<http://curious.astro.cornell.edu/question.php?number=359>

http://www.astro.cornell.edu/academics/courses/astro2201/alt_az.htm

for instructions on how to describe the location of objects (stars and planets) in the sky using the elevation angle or altitude and the azimuthal angle.



Read the following questions before doing your stargazing.

1. Which star charts / maps will be helpful for your stargazing at this time of the year?
2. If you are in Australia, should you be using the same star charts? Why or why not?
3. How are stars located in the sky? How is mapping / locating stars in the night sky similar to locating places on the ground?
4. Define the following: horizon, zenith, azimuth, and altitude.
5. How do stars move along the sky through the night?

Do your stargazing with family or friends, or other learners at clear nights while you are in this module. See which constellations and stars are visible. Observe how they move through the night sky.

ACTIVITY NO. 7: Lab Report 1: Logging and tracking the positions of objects in the sky

With some other online learners, agree on locating 5 objects in the sky (maybe the brightest, excluding the moon), in addition to Polaris, at agreed upon times (e.g 9:00pm, 12:00mn and 3:00 am) on the evening that you'll be doing your stargazing. Fill in the following tables.

Time: 9:00 pm

Star / Planet	Elevation angle or altitude	Azimuthal angle
1) Polaris		
2)		
3)		
4)		
5)		

Time: 12:00 mn

Star / Planet	Elevation angle or altitude	Azimuthal angle
1) Polaris		
2)		
3)		
4)		
5)		

Time: 3:00 am

Star / Planet	Elevation angle or altitude	Azimuthal angle
1) Polaris		
2)		
3)		
4)		
5)		



Questions:

1. How did the objects' positions change through the night? What was the general direction of their movement through the sky?
2. Were your reports of the stars' / planets' positions about the same as those of your co-learners who did their observations at the same time? Should they be similar or close to each other? Why or why not?
3. Should the reports of a star's position be different for observers in different parts of the Philippines? How about for observers at different parts of the world?

PROCESS QUESTIONS:

1. How did you decide which star maps to print and use?
2. Was it easier to identify the stars using the star maps? Why or why not?
3. Did you see bright objects in the sky that look like stars but are not indicated in the star map? What could these bright objects be?
4. ***What do you now see as benefits of naming and locating stars in the sky? Do they really have practical uses, or is stargazing just a nice hobby or pastime? Explain.***

ACTIVITY NO. 8: The Stellarium and Starmap: Interactive stargazing

DESCRIPTION: Stargazing is easier and more fun with the help of technology. The Stellarium and the Starmap are downloadable software applications (or apps) that show

on screen, what stars and planets are actually visible in the sky at your location, at the time you are doing your stargazing.

The Stellarium (www.stellarium.org) is good to download onto a desktop or notebook computer. Make sure your computer has sufficient memory to be able to download this. Follow the instructions for downloading, until you get a shortcut button for it on your desktop. Once downloaded, it can be used even while offline (not connected to the internet). Set the time, date and location so that what you see on your screen will be what you'll actually see in the sky.



You may even go back in time or jump to the future to see eclipses, comets, and key events like the conjunction of planets with stars.

If you have a smartphone or a tablet, they can be your window to the sky, simply by downloading these apps:

- Google Sky Map (<http://google-sky-map.en.softonic.com/android>)
- Starmap for iPad or iPhone (<http://www.star-map.fr/>)

Download and explore!



PROCESS QUESTIONS:

1. What are the advantages of using technology (softwares and apps) for studying the stars and constellations?
2. With these apps and gadgets in hand, will it be better to just do virtual stargazing? Or is it still better to go out and see the real deal?



For sure you had a wonderful experience about looking at the stars during your activity. You already have lots of ideas about the location of these prominent stars. At this point, you will explore more on your own zodiac constellation

ACTIVITY NO. 9: The Zodiac Constellations

Part 1

Follow the link: <http://www.space.com/15722-constellations.html> to get to know more about your own constellation and how to locate it in the night sky



PROCESS QUESTIONS:

1. What is your constellation?
2. What new things did you find out about your constellation?

Part 2

In this part, the links show how the Zodiac constellations were determined and how the calendar dates today are assigned to the wrong zodiac constellations.

<http://m.gulfnews.com/opinion/predictions-or-plain-guesswork-1.1272875>

“Predictions or plain guesswork?” This article gives a specific reason why horoscopes cannot be believable – that calendar dates now are wrongly assigned to the Zodiac constellations, and that horoscopes are somehow vaguely written, generally practical advice such that anyone may be tricked to acknowledge them as true and sensible.

<http://www.youtube.com/watch?v=Wf16fm0oXVE>

“Fallacy of Horoscope and Zodiac Astrology”. This video clearly explains how precession has shifted the zodiac signs assigned to calendar dates through the two thousand or so years since zodiac astrology began.

<http://en.wikipedia.org/wiki/Zodiac>

This page has a table showing the boundary dates for each Zodiac sign, and how these dates are inconsistent with the constellations that are actually at the background of the sun.



PROCESS QUESTIONS:

1. What evidences and arguments were presented to discredit the Zodiac signs and horoscopes?
2. How has these assignments of dates to Zodiac signs, and the practice of horoscopes persisted through thousands of years?
3. Is it really right to match your personality to the characteristics of the Zodiac constellation that is your sign? Cite one trait that you know is true about you, but is listed under those in a different Zodiac sign.



After knowing more about your zodiac constellations, it's time for you now to discover more on the importance of stars and how the knowledge on the different positions of the brighter stars can be applied in very important situations

ACTIVITY NO. 10: Article Reading: Navigating by the Stars: Its History

by [Joe Rao](#), SPACE.com Skywatching Columnist | September 19, 2008 07:00am ET
<http://www.space.com/5849-navigating-stars.html>

Astronomy is the oldest of the sciences, and quite possibly the oldest use of astronomy is navigating by the stars. This craft dates from prehistoric times among humans, and is even practiced by certain animals.

For example, during the 1960s, a study undertaken by New York's Cornell Lab of Ornithology demonstrated through use of planetarium simulations that the indigo bunting, a brilliantly blue bird of old fields and roadsides, [migrates at night](#) using the stars for guidance. It learns its orientation to the night sky from its experience as a young bird observing the stars.

Some primitive tribes accomplished amazing feats of pathfinding using only the sky as their guide. The Māori came to New Zealand from eastern Polynesia, probably in several waves between the years 1280 to 1300. With no instruments or tables to consult, they very carefully observed the night sky as well local weather patterns and ocean currents.

In today's modern world, private and commercial aircraft depend on a complex network of radio, satellite, inertial and other [navigation systems](#). But should any or all of these systems fail, the starry sky can serve as the last resort.

As the late Henry Neeley, a popular lecturer at New York's Hayden Planetarium during the 1950s once noted: "The navigational use of the stars will continue to be a valuable asset for many years to come. In spite of all the scientific aids that have been developed to do the navigating by robot science, the ancient stars will still be a 'must' for navigator or pilot." Indeed, celestial navigation is still an important part of a navigator's formal training and while we might immediately think of sailors in this regard, the pilot of an aircraft can also sight on the stars in an emergency (and often with an advantage over sailors, being high above any obscuring clouds).

57 important stars

In addition, there is a standard roster of 57 stars used by aviators and navigators worldwide and chosen for their ease of identification and wide spacing. A navigator would try to measure the altitude of one of these stars above the horizon during twilight, when both the star and horizon are visible. This yields a "circle of position" on the Earth's globe; the observer must be somewhere on this circle to see the star at a certain altitude at a given time. Other stars yield other circles of position. The point where they all intersect is the observer's location.

In order to be visible against a twilight sky, the majority of the 57 navigation stars are second magnitude or brighter, although a few third magnitude stars were included on the list simply because they occupied regions where none brighter existed (the lower the figure of magnitude, the brighter the star).

PROCESS QUESTIONS:

1. How did Astronomy come about? How did this field of study evolve through time?
2. How are stars become useful from the past to present?

For you to learn more about how to navigate the stars, read this article below:

How to Navigate by the Stars (March 8, 2013)



<http://mentalfloss.com/article/52041/how-navigate-stars>

Explorers have used the stars as a compass for millennia, and if you're out having adventures at night, you should add the skill to your arsenal. (If nothing else, it's a killer party trick.) Here's how to transform the night sky into your personal roadmap.

1) LEARN THE BIG THREE

According to the Royal Naval Academy, 58 stars are handy for navigation. You need to know 38 different constellations to find all of them. If that seems daunting, there's a cheat code. Just learn to spot three constellations: Cassiopeia, Crux, and Orion. Also keep your eye on the Big and Little Dipper.

2) FIND THE NORTH STAR

It's always within one degree of true north. So use the Big Dipper and Cassiopeia as your guides. Look at the Dipper's ladle and pretend you're pouring soup from it. The flow of that space soup will point straight to the North Star. If you hit a constellation that looks like a wonky 'W,' you've gone too far. That's Cassiopeia. Recalculate your cosmic GPS and back up. The North Star is smack between Cassiopeia and the Big Dipper.

3) SHOOT FOR THE MOON

If you can find Orion's sword, following its point will show you south. Alternatively, if there's a crescent moon, draw an imaginary line from between its tips and follow it to the horizon. That'll point you toward the penguins.

4) DOWN UNDER? NO PROBLEM!

The North Star isn't visible below the equator. Instead, look for the constellation Crux—it resembles a kite. If you draw a line from the top of the kite to the bottom, it'll point you south.

5) MOVE LIKE A STAR

Like the sun, stars skate east to west. Tracking how they travel across the sky should tell you which way you're facing. For something more precise, look to Orion's belt. The star on the belt's right side—Mintaka—rises close to true east and sets at true west.

6) TAKE A SURVEY

Forgot to memorize your constellations? There's an easy fix. Simply place two sticks in the ground and set them one yard apart. Now pick a star—any star. Line it up with the tops of both sticks, as if you were looking down a rifle sight. The earth's rotation will make the star "move." If it runs left, you're facing north. If it shifts right, you're south. If it rises, you're east. If it sinks, west.

* * *

Now that you know how to use the stars, the sky is your compass.

End of FIRM UP:



In this section, you learned a lot more about stars using tools, references and digital apps. We hope you've had fun naming the stars and the constellations that you see in the sky, and see that some bright objects are actually planets, not stars.

By now also, you may already be putting some more thought into why we study stars. What do we really get out of studying these things that, though they are pretty to look at, are so far away and beyond our reach? Are stars just there to light up our nights and inspire artists and songwriters? What are the practical benefits of studying them?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section, where you'll see how people have been looking up to the stars for guidance in two intertwined fields: astronomy and astrology.

DEEPEN:



Your goal in this section is to get deeper into the realms of the stars – the realities on why we study them, and the fallacies that a lot of people have gotten into by going “overboard” in studying these stars.

You started this unit by reading some horoscopes, then learned about the characteristics of stars. You then did some stargazing and mapping of stars in the sky. Maps are for locating places and getting from one place to another. In this section, you’ll learn how to navigate using the stars, or at least see how it works and do some basic stuff on it – basic practical astronomy.

Other people have gone beyond practical navigation, to even looking at stars for “navigating” the course of their lives – astrology.

Which of these two appeals more to you? Among your family, peers and neighbors, are they more into astrology or astronomy? You will do a simple survey with some people towards the end of this section, before you go to the Performance Task.

Use the illustration below, and follow these links:

<http://www.youtube.com/watch?v=TAFvN83NZAc>

Celestial Sphere Animation. This 3D animation video clearly explains why stars in the sky change positions the way they do, and explain some terminologies for navigating the sky, without any boring monotone voice-over.

<http://www.youtube.com/watch?v=1Toya19H12w>

Basics of Astronomy: The Celestial Sphere. This video clearly explains how stars are mapped along the celestial sphere.

<http://www.youtube.com/watch?v=DKQ8XuCINUU>

Introductory Astronomy: Motion of Stars. This video lecture has helpful visuals to help you understand how the stars move across the sky.

ACTIVITY NO. 11: Article Readings

Follow this link to know more about the importance of stars in astronomy

<http://www.astronomytoday.com/blog/importance-stars/>

Also other articles related such in the link below

<http://www.sciencedaily.com/articles/a/astronomy.htm>

Transition: Now that you have already sufficient ideas about stars and their importance and other concepts in astronomy, you are now ready to discover more of both astronomy and astrology

ACTIVITY NO. 12: Astronomy vs Astrology

DESCRIPTION: Go through the following resources to learn the similarities and differences between the two. Which is scientific? Which isn't?

<http://www.youtube.com/watch?v=hVx4K9nMep4>

Stargazing: A Graphic Guide to the Heavens. View the video from 4:20 to 7:08. See the zodiac constellations – what is so special about them, and also how ordinary they are. Go on to read the comments posted to see other people's opinions on astrology and astronomy.

<http://curious.astro.cornell.edu/question.php?number=34>

This is a brief and direct-to-the point write-up spelling the difference between the two.

<http://www.galaxymaine.com/SA/SA7.htm>

This page further clarifies why astrology is unscientific, with a simple interactive test to prove wrong the character traits assigned to people according to their birth dates and Zodiac signs.

Gather as much people as you can – family and friends, to pick the traits listed that best describe them. See how many of them pick the set that matches their Zodiac sign, and how many whose picks does not match.

<http://www.biblestudysite.com/astrol.htm>

This page is an *optional* read – may be recommended for those in Catholic schools / Christian schools. This may be quite long, but the material in this page has answers to such defenses for astrology like: “I don't really believe in horoscopes. I read them just for fun,” and “Wala naman mawawala kung babasahin ko yung horoscope ko. Magsisispag at magdarasal pa rin naman ako.” (Reading horoscopes is harmless. I'll still be working hard and praying - I won't really be relying on horoscopes.)



PROCESS QUESTIONS:

1. Which came first? Which one emerged from the other? Why is it that the earlier one has persisted even in modern times, seemingly in competition now with the latter?
2. What are the arguments that support the claim that astronomy is science, while astrology isn't?
3. If you have a close friend or relative who is so into astrology, will you be wanting to convince him/her out of his/her unscientific preoccupation or “pastime”? Why or why not?

ACTIVITY NO. 13: Practical Astronomy (Videos and Blogs)

DESCRIPTION: In this activity, you will see one practical application of looking up to the stars: Navigation. You will learn some basic skills using simple tools, like an improvised sextant, to know your location in the world, in case you get lost at sea.

View the following videos. Get the materials shown (e.g. protractor, string) and get out and try the techniques and methods yourself.

<http://www.youtube.com/watch?v=unSnBkSZkK4>

How to use a sextant. This video discusses how to use a protractor as an improvised sextant / astrolabe for knowing one's location on the world.

<http://www.youtube.com/watch?v=XWLZKmPU17M>

Celestial Navigation Math. This video discusses the mathematical details for finding out one's location by looking up at the stars.

http://www.youtube.com/watch?v=ByD5by_PL64

This video shows a nice-to-do project that clearly demonstrates how to know one's latitude based on the distance of Polaris from the horizon.

Task:

Gather for yourself the materials to make an improvised sextant – basically a protractor with a sighting straw, and a hanging weight to indicate the vertical. The challenge here is how to fix the device such that it is stable while a star is sighted and its angle of elevation is being read from the protractor.

Get a map of the Philippines. Determine your location's latitude – how many degrees away you are from the equator. Now point your sighting straw towards Polaris, then record the angle between the vertical plumb line and line of sight to Polaris.

Does the angle you get come close, if not fall exactly, on your location's latitude?

Example: Manila is at 14° N of the equator. For an observer in Manila (and nearby places up north or south), a properly held sextant pointing at Polaris should yield an angle of 14° between the plumb line and the line of sight.

<http://www.arvindguptatoys.com/toys/simplesextant.html>



Below are additional sites for you to visit that will add up to your knowledge about astronomy

<http://www.youtube.com/watch?v=QZ3IJRgr9v4>

This video is quite dated already, but it is still a great watch. This video is actually more about navigating the stars in the northern hemisphere, starting from having located the prominent Big Dipper and the Polaris.

<http://www.naturalnavigator.com/find-your-way-using/stars>

This blog shares in simple language how directions can be figured out using the stars in the sky. Follow the link to a video on how the ancient Polynesians were able to navigate the vast Pacific ocean thousands of years ago, way earlier than the European and American explorers: http://youtu.be/_1bG0Fj7oE (Polynesian Wayfinders)

<http://www.naturalnavigator.com/news/2014/01/astronavigating-with-the-bbc?cat=stars&page=1>



This is an account by Tristan Gooley, the “Natural Navigator” of his taped episode for BBC, where he was blindfolded and brought out to sea, and was tasked to determine his location and to go to a specified island – just with the help of his sextants and star maps. No digital apps and computers. J

Worksheet 2: Practical Astronomy: Basic navigation techniques using the stars



How to Deal with the Stars

List down your five (5) practical navigating tips using the stars for your direction

- 1.
- 2.
- 3.
- 4.
- 5.

To close this activity, follow this link:

<http://www.rmg.co.uk/explore/astronomy-and-time/astronomy-facts/stars/the-star-of-bethlehem>

to read about the theories on the **Bethlehem star** which supposedly guided the Magis from the East to journey to Bethlehem. This page shows some good scientific analysis and reasoning, cross-referenced with historical, cultural and literary patterns during that time.



PROCESS QUESTIONS:

1. What are your key insights on the benefits of looking up to the stars?
2. What improvisation and math concepts and skills did you learn in this part of the module?
3. Is stellar navigation still relevant today? Isn't it enough to rely on maps, compasses, and GPS (global positioning system)?
4. If you are to ride on a cruise through the Pacific Islands, what materials will you bring with you so that you'll be able to practice some navigation techniques using the stars?

ACTIVITY NO. 14: Survey: Are you into Astronomy or Astrology?

DESCRIPTION: You are to survey 10 people to see whether they are more into astronomy or astrology. Print the following statements in a sheet of paper.

Instructions: Read the following statements. Put a check on the blank after the statement if it is true for you. Leave it blank if the statement is NOT true for you.

1. I know how (some of) the Zodiac constellations look like – I can identify them in the night sky. _____
2. I know all the twelve Zodiac constellations. _____
3. I can state the location of planets (e.g. Jupiter) in the sky, whether it is in this or in that constellation. _____
4. I know the Zodiac signs of almost all my family members and close friends. _____
5. I know the “starring stars” in some constellations: Castor and Pollux in Gemini; Aldebaran in Taurus... _____
6. I ask for people’s birthdays, or directly their Zodiac signs to see if I am compatible with them or not. _____
7. I may not know the names of stars, but I know whether a bright object is a star or a planet. _____
8. I read my horoscope whenever I can, in websites or in newspapers and magazines. _____

9. If I could choose between an astrology chart and a star map, I'll choose the latter. _____
10. I know my lucky day, lucky color, and lucky planet, based on my Zodiac sign. _____

If a respondent checks more of the odd-numbered statements, s/he is more into astronomy. If more of the even-numbered statements were checked, then s/he is more into astrology. In case of a tie (equal numbers of odd and even numbered statements checked), then use Statement 8 as the determinant. If it was checked, then this participant is more into astrology.

Record who among your participants are more into astrology. You will be inviting them to be your audience in your Performance Task later.



PROCESS QUESTIONS:

1. How many of your respondents are more into astrology than astronomy? What are your initial thoughts about the results of your survey?
2. Answer the survey yourself. Are you more into astrology than astronomy? If yes, share a bit of a background on how you got introduced into horoscopes and Zodiac signs.
3. If you are more into astronomy than astrology, start thinking of strategies on how you can influence someone who is more into astrology to shift to astronomy.

ACTIVITY NO. 15: I-R-F Worksheet Review

DESCRIPTION: Pull out your I-R-F Worksheet. Fill up the R (revised) column. See how some of your answers to the questions changed after you've done most of the activities in this module.

Questions	I Initial ideas	R Revised answers	F Final answers
1. Why study stars? What benefits do we get from studying them?			
2. Are horoscopes believable? Why or why not?			
3. In what ways are astronomy and astrology similar? How are they different?			



PROCESS QUESTIONS:

1. How have your answers changed from the I column when you started this module?
2. Which specific material/s or activities were helpful in bringing you to change your ideas / understanding?
3. Which ideas are you still struggling with – those where the materials seem to be telling you things that you still cannot accept?
4. ***Why do we need to study the night sky? What do we get from studying the positions of stars and constellations in the sky? (EQ)***

End of DEEPEN:



In this section, you got exposed to resources that spelled out why astronomy is a science while astrology is not. You learned about the Zodiac constellations, that they are very real up there in the sky, but that the other interpretations on their on our day-to-day lives, are not very true and reliable.

You also got exposed to some techniques on stellar navigation, and how other people have successfully been navigating the Earth by looking up to the stars.

Are you being clarified about the real and imagined benefits of studying the stars and the constellations? Or are you still struggling with some of the ideas you are encountering? Are you now more scientific and more into astronomy?

Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section, Transfer.

TRANSFER:



Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding of astronomy. If you are really now more into astronomy, then you will be in a position to help increase the “scientific quotient” of our society. You will do this by persuading others out of their unscientific beliefs, practices, or pastimes, specifically their reading of horoscopes and other astrological activities.

ACTIVITY NO. 16: Persuasive Presentation



Horoscope reading is a popular activity for some people, and for some, it has become a basis for their decisions and actions. Some people even refer to Zodiac signs to look up degrees of compatibility or incompatibility, to decide whom to befriend, or for adults, whom to consider marrying. Is it right, or alright for people to be doing this?

Horoscopes have persisted in mass media: in daily newspapers, popular magazines and news programs on TV. Is this responsible journalism or not?

Your task is to deliver a persuasive presentation to an audience of four (4) people who admitted to being more into astrology (reading horoscopes) than astronomy. (You may invite these people from the survey you conducted, or your teacher may assign you your audience from other learners' surveys.) As an amateur astronomer, your goal is to convince your audience to “shift” into astronomy and veer away from horoscope reading and other astrological activities.

Your presentation should not be longer than 5 minutes, should be interactive, scientific and persuasive.

Rubric for Scoring:

Pts	Persuasive (35%)	Scientific (35%)	Interactive (30%)
4	The presentation persuaded all 4 people	The information is accurate, updated, systematically and rigorously presented	The presentation is engaging and audience actively participates in the discussion
3	The presentation persuaded 3 out of 4 people	The information is accurate and systematically presented	The presentation is clear and audience is attentive to the discussion
2	The presentation persuaded 1 or 2 persons	The information is inconsistent in certain parts and not coherently presented	The presentation is erroneous in some parts and so the audience appears confused by the discussion.
1	No one was convinced by the presentation	The presentation is not scientific but rather anecdotal in nature	The presentation is vague and the audience does not pay any attention at all to the discussion. Audience is distracted.



PROCESS QUESTIONS:

1. How did you find the result of your presentation?
2. Which part of your presentation did your audience find most convincing? Why do you think so?
3. If you only convinced one, or not convinced any at all, why do you think this happened? What could you improve to make it more persuasive? How can you improve it to make it more persuasive?
4. Check with other learners about their strategies to make their presentations convincing.
5. Christian teachings consider horoscope reading to be a subtle, sublime evil and occult. Do you think this will help your presentation more convincing? Or do you think the scientific method argument is enough? Explain your thoughts on this.

ACTIVITY NO. 17: Reflection Paper / Piece

DESCRIPTION: Now that you are ending this module, write a 2-page reflection that will summarize your learning and realizations in this module. Give your reflection paper a catchy title. You may use the following questions as a guide, but use some flexibility in not just answering these questions one by one.

- Was it worthwhile knowing about constellations and stars that are light years away from us? Why or why not?
- What are the benefits of humanity from those who have devoted years of their lives to study these stars?
- Has the immensity of the universe and the great number of the stars caused you to see our insignificance? Or do you now feel our importance - as these greater things were created still for us?

Post your essay (in your online blog) to be read by other learners. Feel free to comment on others' essays. After reading other essays, go on to the last activity: the I-R-F Worksheet.

Instead of an essay, you may compose a poem, which you may later record as a rap or a song, and post online (soundcloud.com or youtube.com). See how many views, likes, and comments your creative work receives. See how the feedback from others affect (hopefully improve or clarify) your understanding.

ACTIVITY NO. 18: I-R-F Worksheet

DESCRIPTION: Pull out your I-R-F Worksheet. Fill up the F (final) column. See how some of your answers to the questions changed after you've done the Performance Task in this module.

Questions	I Initial ideas	R Revised answers	F Final answers
1. Why study stars? What benefits do we get from studying them?			
2. Are horoscopes believable? Why or why not?			
3. In what ways are astronomy and astrology similar? How are they different?			



PROCESS QUESTIONS:

1. How have your answers changed from the **I** column when you started this module, to the **R** column, and now at the **F** column?
2. Which specific material/s or activities were helpful in bringing you to change your ideas / understanding?
3. Which ideas are you still struggling with, even now that you are approaching the end of this module?

EQ: *Is our future and destiny really “written in the stars”? Why study the night sky? What do we get from studying the positions of stars and constellations in the sky?*

End of TRANSFER:



In this section, your task was to persuade others to get more into astronomy and to turn away from the unscientific practices in astrology, particularly horoscope reading.

How did you find the performance task? Were you able to help increase the scientific literacy of society? Or were you the one swayed more into astrology?

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

POST-ASSESSMENT



It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

1. The term Zodiac refers to _____.
 - A. the light from Saturn's rings
 - B. a method for making astrological predictions
 - C. a group of constellations lying near the ecliptic
 - D. the head of the Celestial Empire.
2. What is the characteristic common to the stars in a constellation?
 - A. equally bright
 - B. they are in the same cluster
 - C. they are so-called Copernican
 - D. none of these
3. Which of the following is NOT a constellation?
 - A. Cassiopeia
 - B. Cepheus
 - C. Great bear
 - D. Magellanic cloud
4. Which is a measure of the amount of a star's light received on earth?
 - A. red shift
 - B. parallax
 - C. absolute magnitude
 - D. all of these
5. A first magnitude star is how many times brighter than a second magnitude star?
 - A. 2.5
 - B. 7.3
 - C. 10
 - D. 15

6. Stars including the sun form when _____
- A. enough rock from space is pulled together by gravitational attraction
 - B. enough rock from space is pulled together by magnetism
 - C. enough dust and gas from space is pulled together by gravitational attraction
 - D. enough dust and gas from space is pulled together by magnetism
7. Which of the following characterizes a pulsar?
- A. black hole
 - B. white dwarf
 - C. neutron star
 - D. red giant
8. Why are stars very massive?
- A. The force of magnetism that tends to draw together the matter from which they are made is very weak.
 - B. The force of gravity that tends to draw together the matter from which they are made is very weak.
 - C. The force of magnetism which tends to draw together the matter from which they are made is very strong
 - D. The force of gravity which tends to draw together the matter from which they are made is very strong
9. The constellations are totally imaginary things that poets, farmers and astronomers have made up over the past 6,000 years. On a really dark night, you can see about 1000 to 1500 stars. Which below gives the BEST purpose of constellations?
- A. Viewers can recognize different star patterns
 - B. Aside from forming patterns, they can be a source of direction
 - C. Stars move a bit, but they are confined within their constellations
 - D. They are a product of human imagination, they can also be a form of entertainment
10. These stars are the most massive and hottest. They have a surface temperature of around 60 000 K (59726.85 °C)
- A. red stars
 - B. blue stars
 - C. white stars
 - D. yellow stars

11. Which observation provides the BEST evidence that Earth revolves around the sun?
 - A. Stars are seen from earth appear to circle Polaris
 - B. Earth's planetary winds are deflected by Coriolis's effect
 - C. The change from high ocean tide to low ocean tide is a repeating pattern
 - D. Different star constellations are seen from earth at different times of the year
12. The brightest star in this constellation is Aldebaran. In which constellation can this star be found?
 - A. Gemini
 - B. Taurus
 - C. Polaris
 - D. Orion
13. Which type of star has a relatively low effective temperature and has a large radius that is about 100 times that of the sun?
 - A. Red giant
 - B. White dwarf
 - C. Main sequence
 - D. Pulsar
14. Which statement describes the general relationship between the temperature and the luminosity of main sequence stars?
 - A. As the temperature decreases, luminosity increases
 - B. As the temperature decreases, luminosity remains the same
 - C. As the temperature increases, luminosity increases
 - D. As the temperature increases, luminosity remains the same
15. Which of the given statements below is NOT TRUE?
 - A. Both Astronomy and Astrology are based on the scientific method of observation, deduction and experiments
 - B. Astronomy and Astrology are two sciences that both involve constellations and stars.
 - C. Astronomy scientifically studies the objects in space while Astrology simply is based on a number of assumptions.
 - D. Astronomy studies the processes which occur in the outer space while Astrology studies the position of celestial bodies and relates these phenomena to people's lives on Earth.

16. This constellation is located on celestial equator and visible throughout the world. Its family include 5 constellations- the Orion, Canis Major and Canis Minor, Monoceres and Lepus
- A. Ursa Major
 - B. Orion
 - C. Draco
 - D. Hercules
17. Which of the statements below BEST supports the idea that the patterns of the celestial objects have certain effects on people's beliefs and practices?
- A. Many people became successful through hard work, luck, and some advice from the stars.
 - B. Why would newspapers and TV shows feature them if they are not reliable and useful?
 - C. The influence of the stars and planets on human behavior has no scientific basis.
 - D. Stars are much farther away than the moon and the sun, thus the latter should be the basis for our beliefs.
18. Which of the following is CORRECT about zodiac constellations?
- A. Unlike other constellations, they are not a product of human imaginations
 - B. They are more scientific since they are bases of compatibility signs
 - C. A total of 14 zodiac constellations were developed through time
 - D. They still are part of the 88 constellations which are all products of human imaginations
19. Which list shows stars in order of increasing temperature?
- A. Polaris, Sirius, Rigel, Aldebaran
 - B. Aldebaran, Vega, Betelgeuse, Antares
 - C. Betelgeuse, Deneb, Sirius, Vega
 - D. Deneb, Vega, Antares, Sirius
20. How do star patterns appear to move during the course of the night across the sky?
- A. East to West
 - B. North to South
 - C. West to East
 - D. Any direction in the sky

GLOSSARY OF TERMS USED IN THIS LESSON:

1. **Astrology** - the persisting practices and beliefs that have started from ancient times, which holds that the movement of heavenly bodies – stars, the planets, the Sun and the moon, have influences on human behavior and events in human societies.
2. **Astronomy** - the scientific study of the stars and other bodies in space, their characteristics and their motion through the sky, that lead to some useful applications like navigation, and some existential theories – how and when the Earth (and the universe) was formed, and how and when they could possibly end.
3. **Constellations** - the groupings of stars according to some patterns that resemble human figures, mythological creatures and objects, after which these groups are named. The sky is divided into 88 constellations, such that planets, comets, and the Sun can be located in the sky according to the constellation in their background as viewed from Earth.
4. **Celestial sphere** - the imaginary sphere, made up of domes, on which all stars are mapped, according to how they are seen from Earth. This is a useful tool for determining which stars and constellations are visible at different locations on Earth, at different times of the year.
5. **Ecliptic** - the band in the sky where the planets seem to move through, as the orbits of the planets around the sun are approximately coplanar (lying on the same plane).
6. **Horizon** - the line at the distance where the Earth's surface and the sky appear to meet. The Sun, the stars and the planets appear to rise above the eastern horizon, and set at the western horizon.
7. **Horoscope** - a forecast of a person's future and assessments on one's character traits, based on their Zodiac sign (the relative positions of the Sun and the Zodiac constellations) at the time of the person's birth. Horoscopes are widely popular, printed in newspapers and magazines, and in a host of websites.
8. **Precession** - the wobbling of the Earth, such that its axis of rotation's tilt in space is not really constant, but also rotates on another axis. One implication of the Earth's precession is that Polaris is not the permanent North Star, but it is for a few thousands of years only.
9. **Polaris** - the current North Star; such that it is the only star that seems to be fixed in its place in the sky as the Earth rotates. Other stars, therefore, seem to be revolving around Polaris though the hours of the night.
10. **Star maps / charts** - maps of the stars in the sky, specific to one's location on Earth (northern or southern hemisphere), and the time of the year (seasons). Since the stars are relatively fixed through hundreds of years, even the dated star charts are still useful today. Some specialized maps and charts even include planets that are visible in the sky at specified dates.
11. **Zodiac constellations** - the "special" constellations that are located along the ecliptic; these 12 constellations therefore serve as the background of the Sun and the planets as they move through the sky through the year.

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

- 1) <http://www.wikihow.com/Stargaze-Comfortably>
Tips on how to prepare for a good stargazing activity.
- 2) <http://zoroastrianastronomy.blogspot.com/p/houses-of-zodiac.html>
Get an idea on how the zodiac constellations look like, and which of these constellations are visible at different times of the year.
- 3) [http://regentsearth.com/Illustrated%20ESRT/Page%2015%20\(Luminosity\)/Luminosity%20index.htm](http://regentsearth.com/Illustrated%20ESRT/Page%2015%20(Luminosity)/Luminosity%20index.htm)
Diagram of the characteristics of stars.
- 4) <http://www.aip.org/history/cosmology/tools/pic-spectroscopy-lithograph.htm>
Diagram on spectroscopy, the key to understanding the composition of stars. Learners may browse the page, but they need not delve too much into the technical details.
- 5) <http://www2.potsdam.edu/islamma/phys335constellations.htm>
This is a very informative site showing most of the constellations with the names of the brightest stars in them.
- 6) <http://stardate.org/nightsky/constellations>
This page has clickable links to more information about the constellations and the stars in them – how to locate them in the sky, and the stories behind their names.
- 7) <http://www.seasky.org/constellations/constellations-intro.html>
Here's another site where all constellations are listed, and grouped according which are visible in each month of the year for northern hemisphere observers (that includes us).
- 8) <http://www.funbrain.com/constellation/>
This is an interactive game where you'll identify the constellations, given pictures and some clues.
- 9) http://www.astro.umass.edu/~arny/constel/learn_const.html
This site has links to the following: how to use star charts, how the sky looks like at different times of the year, and an interactive quiz on identifying constellations.
- 10) <http://www.youtube.com/watch?v=ih7aGeFKBPE>
Celestial Coordinates. This video shall orient you about the celestial sphere and will help you locate stars and constellations in the sky.
- 11) <http://www.youtube.com/watch?v=TAFvN83NZAc>
Celestial Sphere Animation. This 3D animation video clearly explains why stars in the sky change positions the way they do, and explain some terminologies for navigating the sky, without any boring monotone voice-over.

- 12) <http://www.youtube.com/watch?v=1Toya19H12w>
Basics of Astronomy: The Celestial Sphere. This video clearly explains how stars are mapped along the celestial sphere.
- 13) <http://www.youtube.com/watch?v=DKQ8XuCINUU>
Introductory Astronomy: Motion of Stars. This video lecture has helpful visuals to help you understand how the stars move across the sky.
- 14) <http://www.skymaps.com/downloads.html>
<http://www.star-map.fr/free-star-maps/>
These sites contain printable star maps.
- 15) <http://curious.astro.cornell.edu/question.php?number=359>
http://www.astro.cornell.edu/academics/courses/astro2201/alt_az.htm
Instructions on how to describe the location of objects (stars and planets) in the sky using the elevation angle or altitude and the azimuthal angle.