

Week 4: May 4 - May 8

Earth Science 11 - ~~Week 3: April 27 - May 1~~

Anticipated time required: 3 hours

New learning objective: **Weather vs Climate, Climate Change**

Goals to be completed:

1. Understand and describe the differences between weather and climate.
2. Develop and understanding of how climates can naturally change, as well as how they can be artificially changed
3. Complete your climate change pamphlet

Please read through the lesson package and watch all of the videos included within it. The formal portions to submit are indicated throughout the package. These can be sent to Charlie.feht@yesnet.yk.ca either as a scanned and uploaded PDF attachment to email, or as a jpeg image file.

Upcoming next week:

An introduction to space and the universe

The electromagnetic spectrum

The Big Bang Theory

Section 1: Weather vs Climate

Watch the following video to fill in the blanks about what the differences between weather and climate are.

<https://www.youtube.com/watch?v=6Aigcv7UnTU>

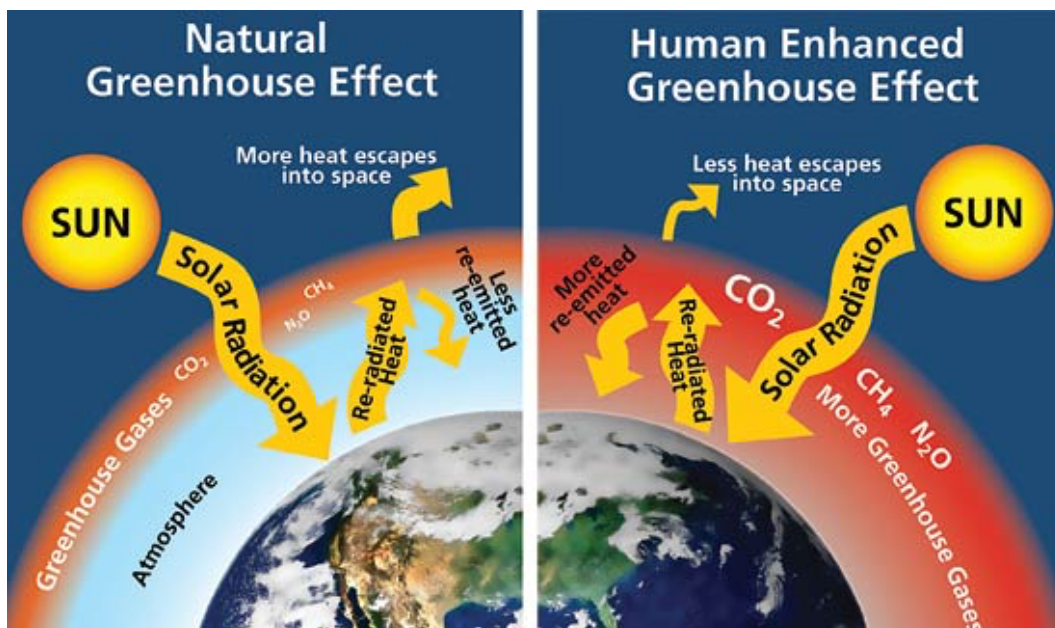
- Weather is the _____ condition of the atmosphere in a given _____.
- The weather can be _____ on any given day.
- Weather can _____ greatly.
- Climate is the _____ condition of the atmosphere for a location.
- Weather is affected by _____, _____, _____, _____, _____.
- Climate is affected by _____, _____, _____, _____.
- Climate change is a change in the climate _____ attributed largely to the _____ level of _____ produced by the use of fossil fuels.
- Climate change refers to _____ changes that are generally seen when looking at _____ trends, not at _____ weather conditions.

Activity: Label the following statements below as an example of weather or climate:

1. A cold arctic air mass is moving south towards Whitehorse bringing extended periods of -40°C temperatures.
2. A maritime polar air mass is forming in the Gulf of Alaska and will bring with it periods of heavy rain and snow through the white pass.
3. A stationary front has formed over British Columbia's lower mainland resulting in heavy fog.
4. The Okanagan Valley of British Columbia's interior is dry and arid thanks to the protection of the Rocky Mountains.
5. Avoid travelling to southeast Asia between November and March because it's monsoon season.
6. Despite a relatively high latitude, the UK rarely feels extreme cold or hot swings thanks to the motion of the north Atlantic current ocean.

Section 2: Climate Change

Climate change is a very real and active threat in our daily lives. It is not something that will occur eventually and effect future generations, it is occurring now and impacting the globe with dramatic effect. There is much supporting evidence available to prove this claim, and many people will agree that climate change is a real thing. But what is the actual science behind climate change? What causes global temperatures to rise? The answer, is the **greenhouse effect**. Take a look at the diagram below to summarize this concept.



The above diagram shows two important concepts:

1. The greenhouse effect does occur naturally. Carbon dioxide and other greenhouse gasses are present at low levels in the atmosphere, and trap some heat in the lower atmosphere. The sun's radiation hits the earth, much of it is reflected back into space thanks to our albedo, but some gets trapped and stays in the atmosphere.
2. Human activity has resulted in exponentially more carbon dioxide present in the atmosphere. This carbon dioxide acts as a shield preventing the sun's radiation from escaping into space naturally. This results in more radiation unable to escape into space and instead is stuck in the atmosphere, raising global temperatures.

So, what's the proof of this? Watch the following video to learn about how we know climate change exists. <https://www.youtube.com/watch?v=ffjlyms1BX4>

Summary Supporting Evidence

- Based on arctic and Antarctic ice core samples, we can see that there is more carbon dioxide in the atmosphere than ever before in history
- The carbon dioxide present in the atmosphere contains the signature Carbon-12 that humans produce when we burn fossil fuels. Not the naturally occurring heavier Carbon-13 or Carbon-14
- Global temperatures are rising despite the fact that measured solar radiation values are decreasing from the sun
- Only the lower layers of the atmosphere are being heated. If the sun were the only influence, all layers of the atmosphere would rise in temperature evenly.

Major Resulting Effects

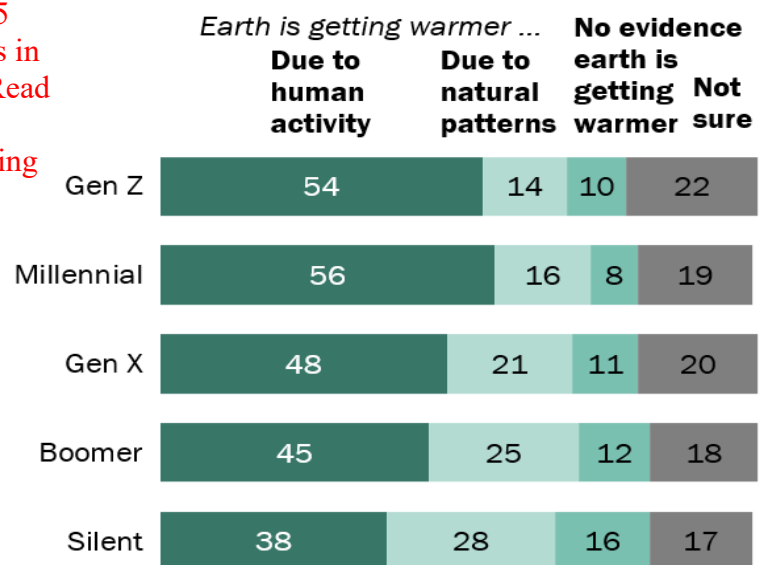
- Ocean Acidification – The ocean is responsible for taking in 50% of all atmospheric carbon dioxide. When carbon dioxide dissolves in water, it creates carbonic acid. This acid reacts vigorously with any calcium-based material like calcium carbonate, the prime ingredient in formation of shellfish and coral reefs.
- Rising sea levels – As water temperatures warm, water begins to expand. This expansion along with the melting of polar ice caps results in drastically rising ocean levels. As ocean levels rise, shorelines recede and areas flood.
- Warming ocean – Certain species of fish require cool ocean temperatures. As oceans heat up, they will change the migration patterns and overall health of a variety of ocean species. Oceans also require a balance of temperature to allow currents to move across the globe. Without a balance of cool and warm water, global climates will further change if water cannot circulate and transfer air masses around the globe.
- Extreme weather – Less precipitation during summer months results in high risk of forest fires and droughts, while greater amounts of precipitation during winter months can result in global flooding, hurricanes, and monsoons.

Until recently, world governments have been underestimating the seriousness of climate change

Gen Z, Millennials most likely to see link between human activity, climate change

% saying ...

Generation Z (individuals born between 1995 and 2015) has proven to be the global leaders in creating initiative to tackle climate change. Read the article below and answer the questions associated to see how action on global warming is being taken.



Note: Share of respondents who didn't offer an answer not shown. Source: Surveys of U.S. adults ages 18 and older conducted Sept. 24-Oct. 7, 2018, and U.S. teens ages 13 to 17 conducted Sept. 17-Nov. 25, 2018.

"Generation Z Looks a Lot Like Millennials on Key Social and Political Issues"

PEW RESEARCH CENTER



INTERNATIONAL

THE VOICE OF CHANGE

– STUDENTS DEMAND ACTION ON GLOBAL WARMING



On March 15, students around the globe took part in a climate strike. Youth from 120 countries, including Canada, left their classrooms and hit the streets to send world leaders a message: Tackle the issue of climate change once and for all.

WHAT'S THE PROBLEM?

Scientists have been warning for decades that the levels of **greenhouse gases** in the atmosphere are rising too much.

Greenhouse gases exist naturally in the air around the Earth. There, they trap and hold the sun's heat. This warms our planet and makes life possible. But over the past 200 years, more gases have been gathering in the atmosphere than naturally exist there. That's throwing the Earth's natural warming system, known as the Greenhouse Effect, out of balance. The result? Average global temperature are increasing.

Human activity is responsible for this imbalance. By burning **fossil fuels** to run cars, heat homes, and make products, people are continually adding to the amount of greenhouse gases in the atmosphere. Rotting garbage also gives off methane gas, one of the most **potent** greenhouse gases. And cutting down trees, which absorb these **emissions**, makes the problem worse.

DID YOU KNOW?

Since 1880 the average global temperature has risen about 1 degree Celsius. Currently the world is on track for an increase of 4 degrees Celsius above **pre-industrial** levels.

If current trends continue, melting ice will cause ocean levels to rise higher. Low-lying areas around the world will flood. Many animal and plant species will become extinct. Fresh water

supplies will **dwindle**, and the world will experience more extreme weather more often. **Droughts** – which are already more frequent – will grow longer and more severe.

Worse still, scientists warn of a "tipping point" when methane released from permafrost, even in the absence of human-caused carbon dioxide, will be enough to keep the planet warming, thus releasing even more methane. Such a feedback loop would be unstoppable.

WHAT'S THE SOLUTION?

To avoid the worst effects of climate change, scientists say the world must work together to keep the average global temperature below 1.5 degrees Celsius above **pre-industrial** levels. This could be accomplished if global emissions can be reduced by 40 to 70 percent by 2050 compared to 2010 levels. By 2100, emissions must drop to zero.

DEFINITIONS

DROUGHT: long period of little or no rain

DWINDLE: to become gradually less or smaller over a period of time until almost nothing remains

EMISSION: something given off

FOSSIL FUEL: a fuel (such as coal, oil, or natural gas) that is formed in the Earth from dead plants or animals

GREENHOUSE GAS: a gas, such as carbon dioxide or methane, that contributes to the Greenhouse Effect by absorbing infrared radiation

POTENT: powerful or effective

PRE-INDUSTRIAL: the period of time before the Industrial Revolution, which took place between 1750 and 1850



INTERNATIONAL THE VOICE OF CHANGE

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In December 2015, at the United Nations Framework Convention on Climate Change in France, the Paris Agreement was drawn up to meet these targets. As of February 2019, 194 countries plus the European Union had signed the agreement, which takes effect in 2020. However, critics are concerned that not enough is being done quickly enough to put the agreement into practice. Data from NASA has shown the past five years to be the warmest on record, and a report released in October 2018 by the United Nations Intergovernmental Panel on Climate Change warned that the planet was only 12 years away from catastrophe unless “far-reaching and unprecedented changes” are taken.

A YOUNG LEADER

Greta Thunberg, a shy, quiet 16-year-old student from Sweden, learned about climate change in elementary school. What she learned, scared her.

“I began thinking about it all the time and I became very sad,” she said. “Those pictures were stuck in my head.”

By age 11, she was very depressed, partly because of her fears about the planet’s future. So last August, she decided to take action. Her plan? To skip classes most Fridays and demonstrate in front of the Swedish parliament.

At first, Greta protested alone, holding a handmade sign that read “School Strike for Climate.” But word spread through social media, and other students began to band together and take part in Greta’s #FridaysforFuture movement. Soon, protests were taking place throughout Europe and Australia.

A DAY OF ACTION

In December 2018, Greta was invited to speak at the United Nations climate conference.

“I don’t want you to be hopeful,” she told conference participants. “I want you to panic. And then I want you to act.”

Later, in January, she presented at the World Economic Forum. Then, on March 15, the first global student climate strike took place. An estimated 1.6 million high school and university students participated in this day of action, marching and holding signs calling for change.

DID YOU KNOW?

Three Norwegian lawmakers have nominated Greta Thunberg for the 2019 Nobel Peace Prize for her activism.

In Canada, protests were held in 55 locations across the country, from Victoria, B.C. to St. John’s, Newfoundland. In Montreal, an estimated 150,000 students took part, forming human chains around some schools to prevent classes from taking place. Protesters were passionate, and determined.

“As Greta Thunberg said, we have not come here to beg politicians for change,” yelled Sophia Mathur, 11, from a podium in front of the Ontario legislature. “We have come here to show them that change... is... coming!”

“During World War II, everybody knew there was a war on. It was the lens through which every individual and government decision was made

and I want the climate crisis to be seen with the same level of urgency and addressed with the same level of scale,” said Rebecca Hamilton, 16, in Vancouver.

TAKING SIDES

Some students were penalized for cutting classes, while others were encouraged by their schools, teachers, and parents to attend.

The education minister of Australia, Dan Tehan, did not agree with the protests, saying “students leaving school during school hours to protest is not something that we should encourage.” Others worried that the protests increased teachers’ workload and said that they were a waste of time. Greta’s response?

“That may well be the case. But then again, political leaders have wasted 30 years of inaction. And that is slightly worse.”

Some world leaders weighed in on the students’ side, with German Chancellor Angela Merkel and French President Emmanuel Macron lending their support publicly. Many scientists backed the student protests, too.

WHAT’S NEXT?

The protesters say they’re just getting started. Canadian students are planning a national climate strike for May 3, and another global student strike is coming May 24. Meanwhile, Greta Thunberg is vowing to continue her protest until the Swedish government adopts policies in line with the Paris Agreement.

“I know I have something to say,” she explains. “I have a message I want to get out and I want people to listen.” ★

DEFINITIONS

NASA: National Aeronautics and Space Administration – an independent agency of the United States government responsible for aviation and spaceflight



ON THE LINES

Answer the following in complete sentences:

1. Explain what the **Greenhouse Effect** is.

2. How has the Earth's natural warming system been thrown out of balance over the last 200 years?

3. What effects do scientists say global warming will have on the planet?

4. What do scientists say must happen if global warming is to be kept below 1.5 degrees C?

5. Explain what the **Paris Agreement** is. When did this meeting occur and how many countries signed on?

6. Why do some people believe we must speed up efforts to reduce greenhouse gas emissions?

7. How did information about global warming affect Greta Thunberg?

8. What did she do last August to show others how she felt? Explain how other people joined her protest.

9. Describe what happened in many cities on March 15.

ASSIGNMENT: CREATING A CLIMATE CHANGE INFORMATION PAMPHLET

Objective

You are required to create a one-page information flyer/pamphlet about the climate for a region across the globe of your choosing. In your flyer, you must detail what the natural climate is and how the climate is changing/has been negatively impacted by climate change. You may choose a broad area such as the Australian outback, or a smaller specific region such as the Slim's River delta in Kluane National Park.

Assignment Requirements

In your pamphlet you must include the following:

- The name of your region
- The location of your region
- The typical climate characteristics
- Common weather patterns this climate experiences
- How your climate region has changed
- What impacts these changes have had/will have on the local biodiversity and ecosystem (animal species, population dynamics, vegetation etc.)
- Interesting facts

Additional Requirements

Your pamphlet must be coloured and include pictures of your region. Electronic pamphlets are acceptable.

You may select any region of the globe that interests you, but here is a list of options to help you choose if you can't decide with potential research starter points

- The Australian Outback – Increased prevalence of wildfire
- The Great Barrier Reef – Destruction of coral species
- The Sahara Desert – Expansion towards other regions
- The Serengeti Plains of Africa – Lack of rain impacting wildebeest and zebra migration
- Antarctica – Melting ice sheets
- The Arctic – Reduction of hunting zones for polar bears
- The South West coast of South Africa – Impacting penguin colonies
- The Caribbean – Stronger Hurricanes
- The Amazon Rainforest – Potential to turn into a savanna