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Program Sequence and Description

Introduction

This two-hour program is designed to follow the *Climate Change Clues, Fossil Fuel Blues* Program. The bridge activity between the two programs is "How much energy is in my Popcorn?" *Fabulous Fixes and Magical Mixes* is designed to flow from Lessons One to Five. Depending on your student's previous knowledge, you may want to pick and choose from these activities. Please note that subsequent lessons may assume knowledge covered in an earlier lesson. Each lesson has a main idea, activity, materials required and a description of ways the activity may be carried out. As an introduction to this program, we would ask the students what they remembered from the previous program, particularly the last activity relating to the impacts of global warming and sea level rise.

Why is the Climate Changing?

Methane: An odourless, colourless, flammable gas, CH_4, the major constituent of natural gas, that is used as a fuel, and is an important source of hydrogen and a wide variety of organic compounds.

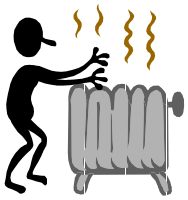
To find the solution to a problem we need to know why it happened. Climate change is natural but the rapid increase in carbon dioxide levels in the last 100 years is not. Simply, our influence on climate change is due to the burning of fossil fuels and the addition of heat trapping greenhouse gases into our atmosphere. Since the industrial revolution, developed countries have produced increasing amounts of greenhouse gases (e.g. **Methane**), due to burning fossil fuels such as coal, oil and natural gas to drive our vehicles, power our industries and heat our homes. Other human activities that add to the increasing concentrations of greenhouse gases include clearing land for agriculture and urban development, land filling and other waste disposal methods.

Source: Natural Resources Canada
http://adaptation.nrcan.gc.ca/posters/articles/bc_01_en.asp?Region=bc&Language=en

What can you do to help?

We burn fossil fuels to get energy to make stuff, keep us warm and to move us around. The most effective way to reduce your impact on the changing climate is to reduce your consumption of energy. This means not only turning out lights etc., but also reducing your use of things that were made by burning fossil fuels. It can feel that the little steps we take to reduce our energy use are very small but if everyone does these small steps then they result in very large effects. For example, a leaky water tap can be an expensive "energy leak". Energy is used to pump, clean and even heat that water. One drip of water per second through a defect tap results in 0.7 litres per hour. Over 10 days this results in 170 litres, that's the average per capita daily consumption level in the industrial countries. Fixing that leak seems like a very small step when you are the one buying the replacement washer, but if everyone were to fix their "energy leak" the results would be significant.

Source: Viterra Energy Services
http://www.viterra-es.com/20008.html



The thing in our homes that uses the most energy is the furnace. Heating our house uses more energy then any other activity in our homes. It follows that any improvements to household heating efficiency will reduce greenhouse gas emissions by simply requiring less energy to heat our homes. Encouraging students to take an active role in finding air leaks in their house to be filled is an example of small steps leading to large leaps in energy savings and slowing our impact on climate change.

What are Alternative Energies?

Only those who understand and who are motivated to conserve energy will.
To reduce the impact of those who are unwilling or unable to change their energy use, the only solution is to change their form of energy use. The best way to do this is to eliminate our dependence on fossil fuels through alternative energies. Solar, winds, wave, geothermal, hydro and tidal are all sources of **alternative energy** that do not involve the production of as much carbon dioxide as burning fossil fuels.
A **Savonius windmill**, which originated in Finland in the 1920's, is an S-shaped blade, which rotates and turns a vertical shaft. This windmill does not need to turn to face the wind like other types of windmills.

Source: Wind Power and Windmills
http://earthsci.org/energy/wind/wind.html#Aeration%20Windmill
Oswego State University of New York
http://www.oswego.edu/nova/facts/wind/wind.html

Fabulous Fixes and Magical Mixes

Grade level: Grades 3 - 7
Subject: Climate Change
Keywords: Energy, alternative energy, fossil fuels, climate change
Overview: Discover how to slow climate change through your energy choices. Find out the technological alternatives to fossil fuels. Students discover how they can help slow climate change and create a simple alternative energy source model.
Time Required: 2 hours

This program is outlined below in major subject categories. Click on the link to go to the activity procedure.

Energy, Energy Everywhere
Students examine all the different ways we use energy to produce our "stuff".
Students discover how our lifestyle choices can contribute to climate change.

How Can We help?
Many times it feels as though we have little impact or control of the earth, but that is not usually the case. Your power lies in your ability to make choices and these choices often have far-reaching consequences.

Every Little Bit is Important
Where in your house uses the most energy? Students learn how even the smallest actions can make a difference by building a draft detector.

Alternative Energy
All we need to do to slow climate change is to burn fewer fossil fuels. Students discover the different technological solutions to the fossil fuel puzzle.

Climate Change Crunch
A wrap-up quiz to the three-part program series. Students participate in a climate change jeopardy challenge as a review of concepts learned throughout the program series.

Lesson One

Energy, Energy Everywhere

New Vocabulary
Energy, electricity, fossil fuels

Time
Approximately 20 - 25 minutes

Materials
"How much energy is in my popcorn"

- Large sheets of chart paper (1 per group of 4 students),
- Markers

Activity Descriptions

Energy: The capacity to do work or vigorous activity. In this exercise "energy" refers to all of the types of energy used to produce a product.

1. We use **energy** everywhere and everyday. Ask students to give some examples of ways we use energy in the classroom. Note: students may list things such as lights, heat, overhead projector, stereo, radio, television, telephone.

2. Explain to students that a lot of energy goes into making and manufacturing the things we use everyday such as our clothes, our desks, our shoes and many other things. Our lifestyles in Canada greatly depend on our use of energy.

3. Using the example of a pineapple grown in Hawaii and then shipped to our hometown, brainstorm with the students all the energy-using steps involved in this process. Some energy-using steps include: growing the pineapple on a farm; maintaining the farm; picking the pineapple; shipping the pineapple to be packaged; producing the packaging or cardboard boxes; shipping the packaged pineapple to a warehouse; shipping to the grocery store; maintaining the grocery store; driving to the grocery store. It is clear in this example that energy is used in an endless number of ways.

4. **How much energy is in my popcorn:** Divide the class into groups of four and give each group 1 piece of large white chart paper. Explain to the class that they will be creating web maps of all the energy-using steps required to produce popcorn (from the corn seed to the grocery store). Students should start with a circle in the middle of the page entitled "popcorn." Branching from this main circle

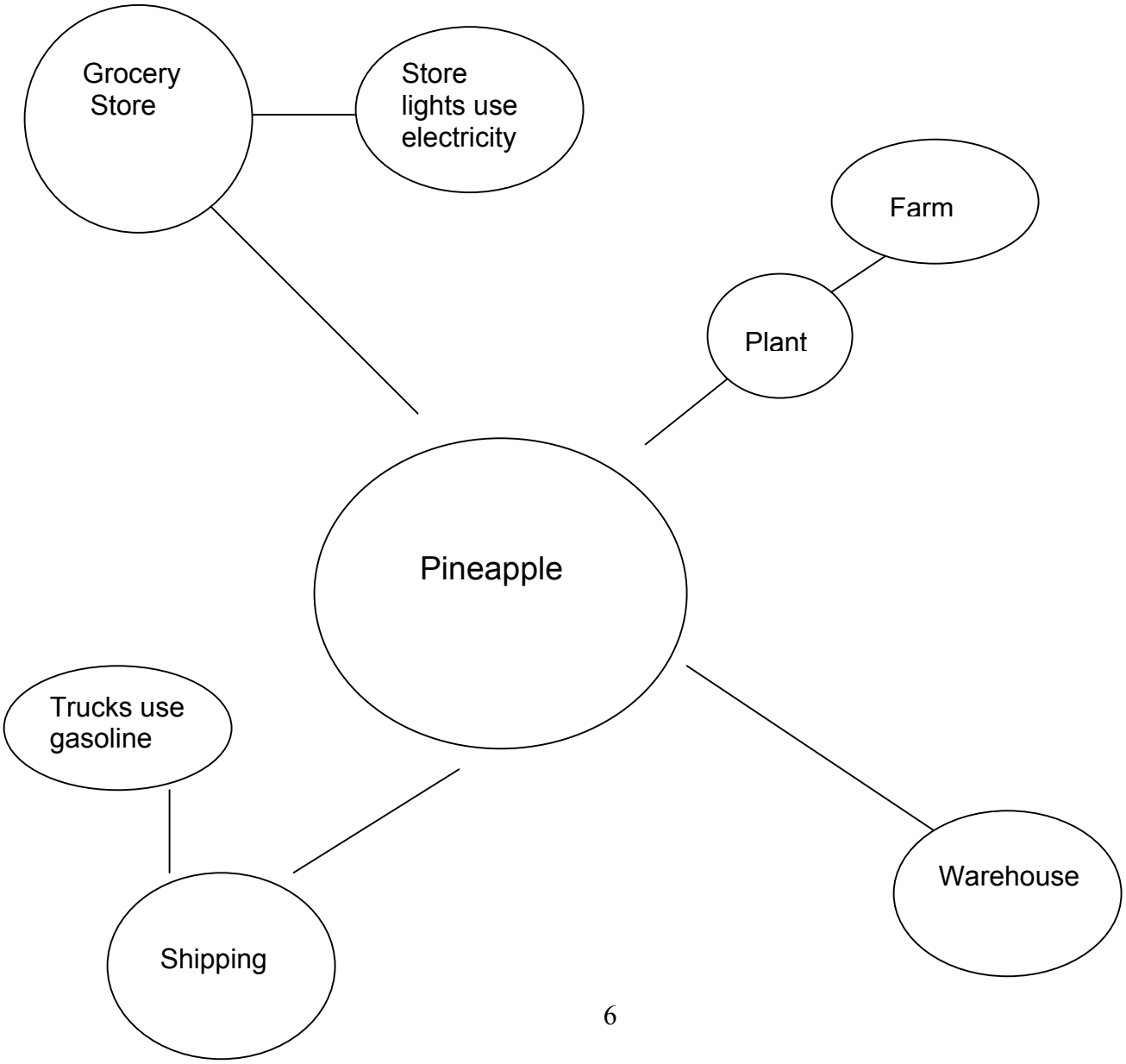
will be all the energy-using steps needed to get a corn seed from a farm to a bag of popcorn in the grocery store. Get the students to indicate what kind of energy each step uses, gasoline, electricity etc.

5. Students should be able to fill their chart paper with many energy-using steps. After groups have finished their web maps, ask the students to share some of their different energy-using steps they included in their web map.

Suggestion

Draw the example of the pineapple plant grown in Hawaii on a piece of chart paper. Students can see the format they will use for their own web maps.

Example: Pineapple from Hawaii



Lesson Two

How Can We Help?

New Vocabulary
Priority

Time
Approximately 20 - 25 minutes

Materials
"What Humans Need":

- 4 sets: 4 Laminated title cards: Highest Priority, High Priority, Low Priority, Lowest Priority;
- 25 laminated choices cards

Activity Description

1. A large part of the solution to global warming and climate change is sustainable living and reducing our energy consumption. Students should gain some awareness of how their personal and collective actions contribute to global warming and climate change. Having students adopt the perspective of someone in a simpler society of the early 1600s while ranking items helps them appreciate the value of basic needs such as water, fuel, and tools. It also helps to put a teen's desire for more CDs into perspective.

2. **What Humans Need:** Ask students to imagine that they are living in Canada in the 1600s. Describe the setting at that time: no electricity, no running water, hand-built shelters, horse transportation, little medicine, food grown at home. Tell students they will determine what would have been their most important needs at that time by categorizing items into "Highest Priority," High Priority," Low Priority," and "Lowest Priority."

3. Divide the class into 4 large groups. Each group will receive a set of 4 title cards and 25 items cards. The title cards should be set at the top of a working area and each student should receive 3-5 items cards each. Allow each student to place their card in the appropriate category, according to the needs of those living in the 1600s. Continue until all cards have been placed in the appropriate category. Discussion should be encouraged such that students may debate certain card placements.

SCIENCE
It has been estimated that the richest 20 percent of humanity consumes 86 percent of all goods and services, while the poorest fifth consumes just 1.3 percent. Americans and Canadians consume much more that their share of the world's gasoline, paper, energy, water and meat. The "reduce" part of "reduce, reuse, recycle" has been largely neglected because of the commonly held attitude that a growing economy requires an increasing consumption of natural resources.

4. After all the items cards have been placed, introduce a new rule. There can be only 6 items in the highest priority category. Allow a short time for students to move their cards. This will allow students to further prioritize the most basic needs and wants.

5. As a wrap-up to this activity, have students notice that the items in the lowest priority category require a great amount of energy, which through the burning of fossil fuels contributes to global warming. Also reflect that people living in the 1600s survived without all the products requiring electricity. Therefore, by focusing one's priorities on basic needs, they will help to reduce their impact on the environment and help to slow the rate of climate change.

Suggestion

1. Before the activity begins, write the words onto index cards, one word per card and laminate. Prepare 4 sets of cards for each group of students in a class. Item cards may include:

Books	Hot water	TV
Happiness	Pets	Electricity
Clothes	Shelter	Fuel
Shampoo	Health	Stereo
Phone	Heat	Bike
Oxygen	Bed	Tools
Computer	Air conditioning	Meat
Medicine	Car	Toilet
Fridge	Education	Food
V.C.R.	Friends	Water

Source: Green Teacher, Summer 2002, Issue 68, pg.29-31

Lesson Three

Every Little Bit is Important

Draft:
A current of air in an enclosed area.

New Vocabulary
Heat, energy, draft detector, draft

Time
Approximately 15 minutes

Materials


"Draft Detector"
- Scissors,
- Strip of tissue paper (10cm x 15cm),
- Tape,
- Skewers

SCIENCE
Air leaks through the cracks in your house. In the winter, this lets cold air in from the outside and allows the hot air to escape. Therefore, the inside temperature cools down and energy is wasted. In the summer, the same leaks let the cool, house air out and allow summer's heat to pour in.

Activity Description

1. Sometimes, small actions are very effective when many people partake in them. Students become draft detectives as they investigate leaking air in tiny holes and cracks in a building. Air leaks in a home or school let hot air escape in the winter, therefore wasting energy. Although individuals can't control many large sources of wasted energy, we can make small important changes.

2. Ask students where we use the most energy in our own homes. Students may list things such as: living room, kitchen, stove, TV, air conditioning, bedroom, computer, heating, lighting. Tell students that the most energy used in the home is through heating the whole house. Leaks in the house allow heat to escape, therefore wasting energy and money.

3. **Draft Detector:** Tell students they will construct a device that will let them find tiny holes of leaking air. This device is known as a *Draft Detector!*

4. Each student can construct their own draft detector using a piece of tissue paper, tape, a skewer and a marker. Tape one side of the tissue paper along the length of the skewer like a flag on a flagpole. Blow gently on the tissue to make sure it is well taped. Hold the draft detector near the edges of the windows and doors in the classroom and at home. Once you have found all the air leaks, it's a simple job for your family handyperson to plug them up.

Suggestions

1. An easy way to tape the tissue paper to the skewer: place a piece of tape along the edge of the skewer and stick the skewer to the tissue paper.

2. Students can use markers to decorate their draft detectors. Encourage students to take their draft detectors home and share this information with their parents.

Source: "Scienceworks: An Ontario Science Centre Book of Experiments." Kids Can Press: Toronto. 1984.

Lesson Four

Alternative Energy

New Vocabulary
Energy, fossil fuels, alternative energy, energy resource, solar energy, wind energy, wave energy, geothermal energy, Savonius windmill

Time
Approximately 20-25 minutes

Materials
"Savonius Windmill"

- Toilet paper tubes (one per student),
- Skewers (1 per student),
- 2 – 2 cm pieces of drinking straws,
- Tape,
- Markers

SCIENCE
An energy resource is a supply of energy that we can use. Solar, wind, water, geothermal, and biomass resources can regenerate themselves over time and are said to be "renewable resources." Nonrenewable energy resources such as oil, coal, natural gas, and uranium are those of which there is a limited supply buried in earth. Most of the energy we use is contained in these nonrenewable energy resources and we are rapidly depleting our current supplies.

Activity Description

1. Discuss with students the way that energy often needs to be collected before we can use it to do work. What are some sources of energy in the environment, and how can that energy be collected so we can use it? Some examples of this would be windmills collecting wind power, water turbines collecting wave energy, and solar panels collecting the sun's energy.

2. Explain to students that most of the energy we use involves the burning of fossil fuels. The burning of fossil fuels adds increasing amounts of carbon dioxide into the atmosphere, enhancing the natural greenhouse effect.

3. Alternative energy resources include energy sources that are alternative to fossil fuel use. These include solar energy, wind energy, water energy, and geothermal energy. For those unwilling to conserve energy, offering them an alternative form of energy may be the best solution. Tell students they will build their own device to capture wind energy.

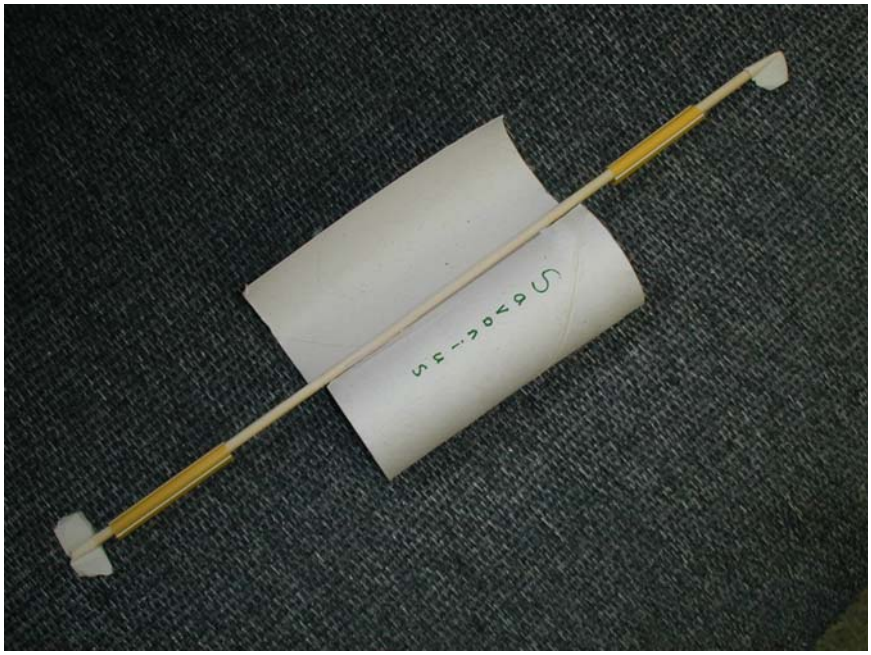
4. **Savonius Windmill:** This activity introduces students to wind energy as they build their own Savonius windmill. A Savonius windmill, which originated in Finland in the 1920's, is an S-shaped blade, which rotates and turns a vertical shaft. This windmill does not need to turn to face the wind like other types of windmills. To build a Savonius windmill, cut a toilet paper tube in half lengthwise. Provide students with 1 skewer per student. Tape the two half-cylinders to the skewer in an S-shape. Pieces of straw (2cm each) can be slid onto each end of the skewer to act as handles. Masking tape flags can be placed on either end of the skewer to hold the straw in place. Students can colour the paper tubes with markers. Take the windmills to different areas of the school and find where they catch the most wind.

Suggestions

1. Students may need multiple pieces of masking tape or cellophane tape to secure the windmill in place.

Source: "Energy and the Environment." Prism: Teaching Children about Science and Technology.
APASE: Vancouver. October 1991. Volume 1, Number 3.

Savonius Windmill: Most windmills have a horizontal axis and look like airplane propellers or the windmills famous in Holland. The Savonius rotor is a type of "vertical axis" windmill, which is less common but also works effectively.



Lesson Five

Climate Change Crunch

New Vocabulary

All past vocabulary is reviewed in this lesson

Time

Approximately 15 - 20 minutes

Materials

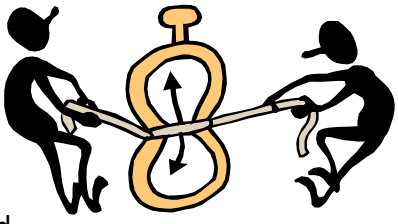
"Climate Change Crunch"

- Review questions for each of the 3 programs

Activity Description

1. This activity allows for a review of everything covered in the Crux of Climate Change Program Series.

2. **Climate Change Crunch**: In this Jeopardy style game, three sections of questions are numbered on the chalkboard, titled *Wild Wind Forces, Climate Change Clues or Fabulous Fixes* (representing each of the three programs). The questions corresponding to each section will be related to topics covered in that program. Each section is numbered 1 –12, corresponding to questions 1 –12. Students may each choose one question from a section of their choice. Each student will have an opportunity to answer a question. As well, prizes may be awarded for a correct answer (every student will receive a prize by the end).



Suggestions

1. One student is selected to go first, at the discretion of the teacher.

2. A student may ask for help from his or her classmates for a particular question. After a student has correctly answered his or her question, he or she will pick another student of the opposite sex to go next.

3. Prizes related to climate change were given to students such as Government of Canada Climate Change Information folders, climate change word search, climate change 'fun' quiz, posters, magnets etc.

DeliveryStrategies/Helpful Hints

- For the "How Much Energy is in my Popcorn?" web maps you should get the students to elaborate on what kind of energy is used by each step. For example the truck to get the corn from the field to the packinghouse uses gasoline that is a fossil fuel. To encourage the students to get more detail out of their web maps keep asking the questions *where did this come from*? *What do you need to get this*?

- When handing out the cards for the "What Humans Need" activity give the priority cards to one student in the group and the items cards to another student to be in charge of. The student with the item cards will need to be instructed to hand out at least three cards to everyone in their group. The priority cards need to be spaced out so that there is enough room for all the item cards to be seen near the priority card. A good discussion generator is to ask each group which was the item card that created the most arguments and why.

- As there are two activities that use wooden skewers in this program please point out to the students that they are pointy and to please not poke anyone or them selves with the skewer.

- As an additional prop to demonstrate a way to conserve energy, you can use a fluorescent spiral light bulb and an ordinary incandescent light bulb. The spiral bulb uses about 12 watts of energy to the incandescent 60 watts. We used the two bulbs in a lamp to demonstrate that the fluorescent bulb uses much less energy to give off the same amount of light (lumens). Using a solar toy, we demonstrated that both types of bulbs would make the solar toy spin therefore both bulbs gave off the same amount of light. Interestingly, some students thought that the fluorescent would make the toy spin faster!

Curriculum Links

Grade 2 and 3
Science
Life Science

- Demonstrate knowledge of what animals need to survive
- Suggest reasons for the endangerment or extinction of plant/animal species

Physical Sciences

- Identify the sources of energy in a variety of sources and experiences
- Draw simple interpretations from personal experiences, oral sources, and v representations
- Identify an issue and provide several reasons to support a position
- Organize information into sequenced presentations that include a beginning, middle and end

Grade 4
Socials

- Identify and clarify a problem, issue, or inquiry
- Assess at least two perspectives on a problem or an issue

Environment

- Analyze how people interact with their environment, in the past and in the present

Grade 5
Science
Application of Science

- Describe technologies that allow humans to extend their natural abilities

Socials
Environment

- Demonstrate understanding of sustainability, stewardship, and renewable versus non renewable natural resources
- Assess effects of lifestyles and industries on local and global environments

Grade 6
Science
Application of Science

- Compare ways of solving problems and finding explanations

Socials

- Identify and clarify a problem, issue, or inquiry

Grade 7
Socials

- Identify and clarify a problem, issue or inquiry

Glossary

Air

A colorless, odorless, tasteless, gaseous mixture, mainly nitrogen (approximately 78 percent) and oxygen (approximately 21 percent) with lesser amounts of argon, carbon dioxide, hydrogen, neon, helium, and other gases.

Air pressure

The pressure exerted by the atmosphere

Alternative energy

Energy derived from sources that do not use up natural resources or harm the environment

Atmosphere

The gaseous mass or envelope surrounding a celestial body, especially the one surrounding the earth, and retained by the celestial body's gravitational field

Barometer

An instrument for measuring atmospheric pressure, especially in weather forecasting.

Carbon

A naturally abundant nonmetallic element that occurs in many inorganic and in all organic compounds exists freely as graphite and diamond and as a constituent of coal, limestone, and petroleum.

Carbon dioxide

A colorless, odorless, incombustible gas, CO_2, formed during respiration, combustion, and organic decomposition. It is used in food refrigeration, carbonated beverages, fire extinguishers, and aerosols.

Carbon cycle

The combined processes, including photosynthesis, decomposition, and respiration, by which carbon as a component of various compounds cycles between its major reservoirs—the atmosphere, oceans, and living organisms.

Carbon sink

Anything that takes in more carbon then it releases, one example is the oceans.

Carbon source

Anything that releases more carbon then it takes in, examples include forest fires and volcanic eruptions.

Climate

The meteorological conditions, including temperature, precipitation, and wind, which characteristically prevail in a particular region. Climate is what you expect a region to be like.

Core sample

A cylindrical sample of rock, ice, or other material obtained from the center of a mass by drilling or cutting.

Draft

A current of air in an enclosed area

Energy

The capacity for work or vigorous activity.

Electricity

The physical phenomena arising from the behavior of electrons and protons that is caused by the attraction of particles with opposite charges and the repulsion of particles with the same charge.

Element

A substance composed of atoms having an identical number of protons in each nucleus. Elements cannot be reduced to simpler substances by normal chemical means.

Fossil fuels

A hydrocarbon deposit, such as petroleum, coal, or natural gas, derived from living matter of a previous geologic time and used for fuel.

Gas

The state of matter distinguished from the solid and liquid states by relatively low density and viscosity, relatively great expansion and contraction with changes in pressure and temperature, the ability to diffuse readily, and the spontaneous tendency to become distributed uniformly throughout any container.

Geothermal energy

Of or relating to the internal heat of the earth.

Global circulation

The movement around the Earth of gases and water in the atmosphere.

Global warming

An increase in the average temperature of the earth's atmosphere, especially a sustained increase sufficient to cause climatic change.

Greenhouse

A structure, primarily of glass, in which temperature and humidity can be controlled for the cultivation or protection of plants.

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.

Greenhouse gases

Any of the atmospheric gases that contribute to the greenhouse effect.

Instrument data

A device for recording, measuring, or controlling, especially such a device functioning as part of a control system.

Methane

An odorless, colorless, flammable gas, CH_4, the major constituent of natural gas, that is used as a fuel and is an important source of hydrogen and a wide variety of organic compounds.

Nitrogen

A nonmetallic element that constitutes nearly four-fifths of the air by volume, occurring as a colorless, odorless, almost inert diatomic gas, N_2, in various minerals and in all proteins and used in a wide variety of important manufactures, including ammonia, nitric acid, TNT, and fertilizers.

Nitrous oxide

A colorless, sweet-tasting gas, N_2O, used as a mild anesthetic in dentistry and surgery.

Oxygen

A nonmetallic element constituting 21 percent of the atmosphere by volume that occurs as a diatomic gas, O_2, and in many compounds such as water and iron ore. It combines with most elements, is essential for plant and animal respiration, and is required for nearly all combustion.

Paleoclimatology

The study of historical climatic conditions through the examination of proxy data sources including ice cores, ocean sediments, tree rings, coral reefs, among others.

Priority

Precedence, especially established by order of importance or urgency.

Proxy data

Proxy data is data that paleoclimatologists gather from natural recorders of climate variability, e.g., tree rings, ice cores, fossil pollen, ocean sediments, coral and historical data.

Savonius windmill

Most windmills have a horizontal axis and look like airplane propellers or the windmills famous in Holland. The Savonius rotor is a type of "vertical axis" windmill, which is less common but also works effectively.

Sediment

Solid fragments of inorganic or organic material that come from the weathering of rock and are carried and deposited by wind, water, or ice.

Solar energy

Radiation from the sun that is converted into heat or electrical energy.

Temperature

A measure of the average kinetic energy of the particles in a sample of matter, expressed in terms of units or degrees designated on a standard scale.

Tornado

A rotating column of air ranging in width from a few yards to more than a mile and whirling at destructively high speeds, usually accompanied by a funnel-shaped downward extension of a cumulonimbus cloud.

Vortex

A spiral motion of fluid within a limited area, especially a whirling mass of water or air that sucks everything near it toward its center.

Weather

The state of the atmosphere at a given time and place based on temperature, moisture, wind speed, and air pressure.

Source: Dictionary.com http://dictionary.reference.com/