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Overview

I have developed 3 new classroom lessons, in addition to the Carbon Dioxide Lab, to be used in different units throughout the school year. I teach two different courses, Biology and Integrated Science, and want to utilize the new information by integrating it into units where it will connect with the theme of global change. Global change is affecting many areas of our living and non-living world. I want my lessons to be able to demonstrate how these changes are altering our planet. My goal in doing this is to have students who feel a personal connection to the survival and health of our planet and all the living creatures on it.

References

Erik A. Lilleskov; 'Invasive species: agents of ecosystem change in our backyards', GCI 2006

Air Now internet site: <http://airnow.gov>

Bill Holmes; 'Introduction to elevated CO2 and Ozone', GCI 2006

Kate Bradley; 'Introduction to global change issues', GCI 2006

Wisconsin Department of Natural Resources <http://www.dnr.state.wi.us>

US Fish and Wildlife Service <http://midwest.fws.gov>

LESSON 1: ALTERNATIVE ENERGY

TIME: 3 – 90 minute blocks

OBJECTIVE: Students will be able to identify the benefits and drawbacks of different types of alternative energies.

Wisconsin State Standards

Science

D.12.11 Using the science themes*, explain* common occurrences in the physical world

D.12.12 Using the science themes* and knowledge of chemical, physical, atomic, and nuclear interactions*, explain* changes in materials, living things, earth's features, and stars

A.12.1 Apply the underlying themes of science to develop defensible visions of the future

G.12.3 Analyze the costs, benefits, or problems resulting from a scientific or technological innovation, including implications for the individual and the community

G.12.4 Show how a major scientific or technological change has had an impact on work, leisure, or the home

G.12.5 Choose a specific problem in our society, identify alternative scientific or technological solutions to that problem and argue its merits

TECHNOLOGY STANDARDS

A. MEDIA AND TECHNOLOGY - Students in Wisconsin will select and use media and technology to access, organize, create, and communicate information for solving problems and constructing new knowledge, products, and systems.

B. INFORMATION AND INQUIRY - Students in Wisconsin will access, evaluate, and apply information efficiently and effectively from a variety of sources in print, non-print, and electronic formats to meet personal and academic needs.

C. INDEPENDENT LEARNING - Students in Wisconsin will apply technological and information skills to issues of personal and academic interest by actively and independently seeking information, demonstrating critical and discriminating reading, listening, and viewing habits, and striving for personal excellence in learning and career pursuits.

BACKGROUND:

Students will get a brief overview of different types of alternative energies used in Wisconsin. They will watch the Video: Renewable Energy: Clean Power for Wisconsin.

As they view it, they will complete a short study guide.

THE ASSIGNMENT:

Students will create a poster to illustrate one of the alternative energy sources. They will be given class time to research their topic, find pictures, type their information and complete the poster. They will also be furnished with poster paper and any other necessary materials.

As they do their research, they will fill in a note sheet with information and site their sources.

When posters are completed, they will present them to the class, describing what they learned and why, or why not, it would be an option here in Wisconsin.

ASSESSMENT:

Students will be given the following rubric as a guide in preparing their poster.

ALTERNATIVE ENERGY POSTER

TITLE	____/10
PICTURES	____/10
HOW IT WORKS	____/20
COST	____/10
LIST: ADVANTAGES	____/10
LIST: DISADVANTAGES	____/10
LOCATIONS WHERE USED	____/5
REFERENCES (3)	____/10
OVERALL APPEARANCE	____/15
 TOTAL	 ____/100

ALTERNATIVE ENERGY POSTER

You will make a poster that will illustrate a form of alternative energy. You will research the topic on computer during class. You may also work on it outside of class

Your poster needs to include ALL of the following elements:

1. BOLD TITLE: TYPED OR ARTISTICALLY DRAWN
2. PICTURES OF EQUIPMENT USED FOR THIS ENERGY
3. DESCRIPTION OF HOW IT WORKS
4. HOW MUCH IT COSTS TO INSTALL OR BUILD
5. LIST OF DISADVANTAGES: AT LEAST 5
6. LIST OF ADVANTAGES: AT LEAST 5
7. LOCATIONS WHERE IT IS CURRENTLY BEING USED

You will be provided the poster board and time in class to put your poster together.

Your written information should be TYPED or VERY NEATLY PRINTED.

BE SURE TO CITE AT LEAST 3 REFERENCES

Do NOT PLAGIARIZE INFORMATION!

We will share our posters with each other when completed. Everyone must do HIS OR HER own poster.

Name

Poster Note Sheet

Type of Energy _____

How does it work?

Reference:

Any special equipment needed?

Reference:

Cost for one home? Car? Or industry? (as it pertains to your topic)

Reference:

Where is it being used? Can it be used in Wisconsin?

Reference:

List of Advantages

List of Disadvantages

Reference:

Video Guide: Renewable Energy in Wisconsin

As you watch the video, give an example of how each of the following is being used in our state

Solar:

Wind:

Water:

Geothermal:

Nuclear:

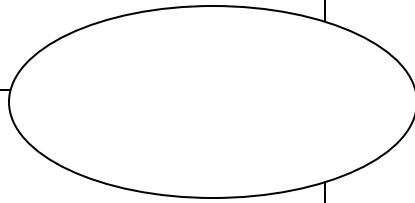
Wasted energy:

DEFINTION

WHAT IT IS

WHAT IT IS NOT

OTHER TERMS OR
DESCRIPTIONS



Activity: Carbon Dioxide in the Atmosphere

WI State Standards

A.12.1 Apply the underlying themes of science to develop defensible visions of the future

B.12.2 Identify the cultural conditions that are usually present during great periods of discovery, scientific development, and invention

C.12.3 Evaluate* the data collected during an investigation*, critique the data-collection procedures and results, and suggest ways to make any needed improvements

D.12.5 Identify* patterns in chemical and physical properties and use them to predict* likely chemical and physical changes and interactions

F.12.8 Using the science themes, infer changes in ecosystems prompted by the introduction of new species, environmental conditions, chemicals, and air, water, or earth pollution

H.12.6 Evaluate data and sources of information when using scientific information to make decisions

Lesson Objectives

1. Assess prior knowledge by completing a graphic organizer together. See Sample
2. Use laboratory tools to measure and record temperature.
3. Use computer probes and program to record and graph results in 'real-time'
4. Relate experimental results to long-term historical data.
5. Manually graph a set of historical data and develop a logical conclusion.
6. Compile class data sets to form a larger body of information and analyze results.
7. Interpret data and graphs relating to climate change.

Getting Started

1. Give each student a copy of the graphic organizer
2. Have students fill in the center oval with the term GREENHOUSE EFFECT
3. Read each of the Quadrant headings and tell students that at the end of the exercise, we will fill in a definition together.
4. Any of the other quadrants can be a starting place. If you do this on an overhead or large piece of Post-It paper, you will have a permanent class copy.
5. Students will offer terms or phrases to be put in appropriate quadrants. Some of their responses may be accepted in multiple places. That's OK.
6. If responses are completely incorrect, it is up to the instructor how to respond. Corrections and/or additions can be made to the concept map at the completion of the activity.

Name _____

Date _____

Lab Investigation: Effects of Carbon Dioxide on Air Temperatures in Sealed Plastic Bags

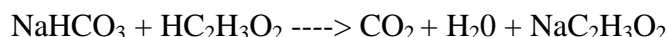
Objectives:

- 1) To observe and measure how carbon dioxide affects air temperature in plastics bags, when exposed to light.
- 2) To understand the connection between global warming and carbon dioxide emissions.
- 3) To understand how individuals can help lower carbon dioxide production.

Background Information

Carbon dioxide is a trace gas that has existed in our atmosphere for billions of years. Scientists were not around then to measure the small amounts of CO₂ levels, but past CO₂ levels can be accurately measured by using ice core samples from glaciers. The gas was trapped in the glaciers as the glaciers formed. The CO₂ levels are measured in parts per million.

Many of you may also have seen the classic chemical reaction to demonstrate gas CO₂ production. When vinegar and baking soda are mixed, the following reaction takes place:



Lastly, carbon dioxide is released to the atmosphere when fossil fuels and other hydrocarbons are burned. Also, carbon dioxide is released through plant and animal respiration.

Lab Summary

Students will measure the internal air temperature of two 1-gallon plastic bags when exposed to light. One bag will contain a beaker with baking soda and vinegar and the other bag will contain just a beaker with vinegar. Students will use Vernier probes to measure temperatures in each bag for 10 minutes. Data will be recorded and graphed using LabPro/Logger Pro software. Students will analyze data when completed.

HYPOTHESIS: Write a hypothesis that this experiment will test

Materials:

2- Vernier Temp Probes	2- 150 ml beakers
2- one gallon zip bags	15 g of baking soda
80 ml of vinegar	100 watt light source
Balance	

Procedure:

- 1) Hook up Logger Pro with the 2 temperature probes
- 2) Make sure computer is on and software recognizes the 2 probes
- 3) Set up Data parameters- 10 minute duration, 6 readings per minute.
- 4) Place light on lab table . Keep distance between the bag and light the same, about 24 inches.

- 5) In Bag One, place beaker with 40 ml of vinegar inside and insert temperature probe into the middle of the bag. Do not touch probe to the beaker. Seal bag with probe cord extending out of the bag as demonstrated by instructor.
- 6) Repeat for Bag Two using 15 grams of baking soda added to the 40 ml of vinegar. Place beaker in bag, insert probe and seal.
- 7) Turn on the light and click on Data collect icon to begin collecting data.
- 8) After 10 minutes the data collection will be complete. You may clean up your materials at this time.

Data Collection and Results

Print out the Data table and Graph using the software. Make sure your graph has a title that accurately describes the data collected.

1. What were the initial temperatures in Bag One and Bag Two?
2. What were the final temperatures in Bag One and Bag Two?
3. How much did the temperatures in Bag One and Bag Two change over the 10 minutes?

Conclusions/Analysis:

What major conclusion or conclusions can be made from your data?

Were there any experimental design flaws? How could the design of the experiment be improved?

Application

If CO₂ levels continue to increase as a result of burning fossil fuels, what are at least four ways that our planet will be affected?

How can you make a difference in limiting CO₂ production in the atmosphere?

Lesson: Endangered or Invasive Species Poster (Biology Class)

Time: 150 minutes (2 or 3 60 minute work sessions)

Objective: Students will research a plant or animal species that is either endangered, threatened or invasive in North America.

Wisconsin State Standards:

A.12.1 Apply the underlying themes of science to develop defensible visions of the future

A.12.2 Show how conflicting assumptions about science themes lead to different opinions and decisions about evolution, health, population, longevity, education, and use of resources, and show how these opinions and decisions have diverse effects on an individual, a community, and a country, both now and in the future

C.12.1 When studying science content, ask questions suggested by current social issues, scientific literature, and observations* of phenomena, build hypotheses that might answer some of these questions, design possible investigations*, and describe results that might emerge from such investigations

C.12.2 Identify* issues from an area of science study, write questions that could be investigated*, review previous research on these questions, and design and conduct responsible and safe investigations to help answer the questions

C.12.6 Present the results of investigations* to groups concerned with the issues, explaining* the meaning and implications of the results, and answering questions in terms the audience can understand

E.12.4 Analyze* the benefits, costs, and limitations of past, present, and projected use of resources and technology and explain* the consequences to the environment

F.12.6. Using concepts of evolution and heredity, account for changes in species and the diversity of species, include the influence of these changes on science, e.g. breeding of plants or animals

F.12.7 Investigate how organisms both cooperate and compete in ecosystems

F.12.8 Using the science themes, infer changes in ecosystems prompted by the introduction of new species, environmental conditions, chemicals, and air, water, or earth pollution

Getting Started

The class will have a 'Brain Storming' session on the theme of interrelationships in ecosystems. The purpose will be two-fold.

First will be to see what they already know about how ecosystems work. We will review the flow of energy and matter, producers and consumers, biotic and abiotic elements in a given ecosystem.

Second will be to instruct students with new information on the structure of an ecosystem, from the biosphere down to the individual species.

The Assignment

Students will create a poster that includes information about the species they researched. Students will be given time in class to research information and find pictures. They will be given class time to type up their information, including a management or conservation plan. They will be given class time to make their posters.

At the conclusion of the project, each person will conduct an interview of another classmate and fill out the interview sheet. They will ask questions about that species and what is contributing to the problems.

Posters will be displayed either in the classroom or one of the many display cases in our school hallways.

Assessment

On the Unit exam, students will be asked to write an essay about the species that they researched. They will include information about why it is having a problem or what kinds of problems it can cause, what is being done to address the problems and what the future might be for this species.

Endangered Species Interview

Species Researched: _____

Researcher: _____

Ask the following questions:

1. What did you learned about the habitat your species lives in?
2. What does your species eat or feed on for energy?
3. What is the Trophic level of this organism?
4. Describe some of the biotic factors that are causing it to become threatened or endangered?
5. Describe some of the abiotic factors that are causing it to become threatened or endangered?
6. What is the Management or Conservation Plan for the protection of this species?
7. Describe how is the life of this organism compares to your role (niche) as part of an ecosystem?
8. What are some consequences to other organisms (including you) if this organism should become extinct or continues its invasive ways?

PROJECT EXPECTATIONS

Name of organism: _____

MANAGEMENT PLAN: ALL PROJECTS MUST INCLUDE THIS !

Research the problems associated with your species. Include natural factors and human factors. Search for a Conservation, Management, Recovery, or Irradication Plan for your species. Summarize the information you find **IN YOUR OWN WORDS**. Copied information will not receive credit!!! Include suggestions for what each person could do to help with the problems. Choose **ONE** of the following to formats to illustrate your research and pictures on a poster. The poster must also include the management plan.

BIOTIC & ABIOTIC FACTORS

Investigate the habitat and ecosystem in which your species lives. Produce a **typed** list for each category. List the Biotic factors that affect your species. Make a separate list of the Abioitic factors that affect your species. **Display** your lists and use **images** of some of the factors you listed, as well as images of your species. **Color** must be used.

BIOTIC & ABIOTIC FACTORS

Ten Biotic Factors	/20
Ten Abiotic Factors	/20
Image of Species	/10
Overall Appearance	/20
Management plan	/30
Total =	_____

FOOD WEB

Research the habitat and ecosystem of your species. Illustrate its place in the ecosystem by showing how it fits into that food web. Include specific plants and animals that it eats or that eat it. **Images and Color must be used**. You may use a collage format if you choose.

FOOD WEB

Images of Species	/20
Organization	/20
Creativity	/10
Management plan	/30
Overall Appearance	/20
Total =	_____

LESSON: EXPLORING OUR ATMOSPHERE

TIME: 45-60 minutes

OBJECTIVE: Students will learn about air pollution, where it comes from and how it affects humans by navigating a website called Air Now.

Wisconsin State Standards

A.12.5 Show how the ideas and themes of science can be used to make real-life decisions about careers, work places, lifestyles, and use of resources

B.12.4 Show how basic research and applied research contribute to new discoveries, inventions, and applications

C.12.2 Identify* issues from an area of science study, write questions that could be investigated*, review previous research on these questions, and design and conduct responsible and safe investigations to help answer the questions

D.12.5 Identify* patterns in chemical and physical properties and use them to predict* likely chemical and physical changes and interactions

H.12.4 Advocate a solution or combination of solutions to a problem in science or technology

H.12.5 Investigate how current plans or proposals concerning resource management, scientific knowledge, or technological development will have an impact on the environment, ecology, and quality of life in a community or region

Background

Students will have completed discussion and activities on the layers of the atmosphere and how it supports life on Earth.

This Internet activity will help them discover some of the pollutants in our atmosphere and how they are causing harm to living things. It is intended to raise their awareness of how human activities impact them.

The Assignment

A self-directed Internet exploration to be done on the Air Now website.

Assessment

Students complete the guide and successfully carryover ideas to the poster project and exam questions.

EXPLORING OUR ATMOSPHERE

INTRODUCTION

This Internet activity will give you a chance to learn about two different types of air pollution: ozone and particle matter. By following the prompts, you will see how the air we breathe is being altered by human activities.

ADDRESS: <http://airnow.gov/>

The **HOME PAGE** has a map of the US. Scroll across the top menu bar above the map and notice how it changes. If you click on the map it gets bigger. You can play with these options when you are done.

To the right of the map are 2 special boxes that say Today's Action Days and Today's Highest AQI Forecasts. These are live links.

Click on one of these and tell the following:

City and State _____

What color is the box for PM 2.5 _____

What Letter or letters are used for that rating? _____

What is the Health Message?

Click on the Back Arrow at the top

In the **LEFT MENU**, select **ABOUT AIR NOW**

What does AQI stand for? _____

The AQI measures the 5 major air pollutants. What are they?

Read the Section **ABOUT THE DATA**

How often are the 'real-time' data updated and displayed on the map?

_____ In the **LEFT** menu under Air Quality Basics, **SELECT Air Quality Index**

READ the entire page then answer the following:

What is the range of values for the AQI? ____ To ____

What number value is considered to be satisfactory to the public? _____

How many categories is the AQI divided into? _____

Each of the categories is represented by a color. Tell what level of health concern each color represents:

Green	
Yellow	
Orange	
Red	
Purple	
Maroon	

In the **Left** menu under Air Quality Basics, **Select OZONE**

How many oxygen molecules make up one ozone molecule? _____

Where is good ozone found and why is it good?

Where is bad ozone found and why is it bad?

What are NO_xs? _____

What are VOCs? _____

Use the **illustration** to write the chemical equation for the formation of ground level ozone:

At the bottom of the page **Select: Ozone: Good up High, Bad Nearby**
Then Select: **Bad Nearby**

What are the 5 major sources of emissions of NO_x and VOC?

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

Why can rural areas have high levels of ozone during the summer?

What kinds of breathing problems can occur with exposure to high levels of ozone?

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

Describe the permanent damage that ozone exposure can cause to humans?

Describe the kinds of damage ground level ozone can cause to vegetation and ecosystems.

READ: Actions you can take

Read the 6 suggestions for Action. What are 3 things that you can do right now to begin reducing ozone formation?

- 1.
- 2.
- 3.

In the **Left menu** under Air Quality Basics, **Select Particle Pollution**

What does PM stand for? _____

PM is a mixture of solids and liquids in the air. What size particle is small enough to get into our lungs?
_____Micrometers.

What are the sources given for Fine Particles less than 2.5u?

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

Coarse Dust Particles come from what sources?

- 1.
- 2.

Click on **HOW SMOKE FROM FIRES CAN AFFECT YOUR HEALTH**

Select: **Where there's fire ... There's smoke**

Which kinds of particles in fire smoke pose the most health risks?

Coarse or Fine (circle one)

What are 3 health problems associated with fire smoke?

- 1.
- 2.
- 3.

In the **Left** menu under Air Quality Basics, **Select UV**

You will see a map of the US in many different colors. What do the colors represent?

What is range of the UV scale on the map? _____

What is the UV range for Portage today? _____

Why is the map helpful to you and me?