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Helping Kids Learn – Post #9 4/22/20 Earth Day

Note the use of flame below!

STEM: Engineering – Environmental Engineers

As far as we know at present, Earth is the only planet we can live on easily. So, it makes sense for us to keep it in good shape for as long as possible. Today there's a special reason to investigate Environmental Engineering: it is the 50th anniversary of Earth Day. You can adapt this lesson to suit a wide range of learners. See **Lift the Level** below.

Be an Environmental Scientist – Managing CO_2

Environmental Engineers have been around as long as people have been on Earth – even if they weren't called that. That's because environmental engineers identify and solve problems to make people's lives better, to improve life on Earth, and to protect our *ecosystem*: the plants, animals, water, soil, and air on and around Earth.

To become an environmental engineer, you must learn lots of science: chemistry, geology, biology, microbiology, and ecology to name a few; and lots of math. An environmental engineer might solve problems in a town (civil engineering), for a chemical plant or oil company (chemical engineering), or in a manufacturing plant (mechanical engineering). They're smart and versatile!

Your problem for today is to think of a way to lower the amount of carbon dioxide in our air.

We can't see air but we can *sense* it:

- we can **feel** a breeze hitting our skin from a fan or the wind,
- we can **see** the air moving leaves and blades of grass,
- we can even **smell** or **taste** the air – like when something delicious is cooking on the stove

Science teaches us that air is made of several *elements.* One of them, oxygen, can combine with an element not in air, carbon, to form carbon dioxide (**CO_2**).

Carbon dioxide comes from lots of places: we breathe out CO_2, it comes from *chemical reactions,* like burning coal, wood or gasoline in cars and trucks, or mixing baking soda and vinegar. Scientists know that plants need CO_2 – they use it when they "breathe" like we use oxygen from air.

Investigate: You'll need a balloon or sandwich bag, a little candle (like a birthday candle, matches, and a jar. And someone to help.

1. Blow up the balloon or sandwich bag– get a grown-up or teenager to help you. Pinch shut the opening. The air trapped inside is mostly CO_2.
2. While you hold it shut, ask your helper to put the candle in the jar and light it. (You can melt a drop of wax and stick it in if it won't stand by itself.)
3. This part's tricky: Put the balloon/bag over the jar so it covers the opening. Don't burn your fingers! What happens to the flame?

Flames need oxygen to burn. They can't use CO_2. We can't breathe CO_2, either. Too much of it in our air harms us and other animals.

Read Closely Environmental Engineers need to read *closely* to get all the information (clues) they can. That means reading more than once. Go back to the paragraph before the Investigation. It contains lots of clues about ways to lower CO_2 in our air. List as many as you can – at least 2:

_____ _____

_____ _____

Now back to your problem for today: **What is one way to lower the amount of CO_2 in our air?** We don't want to get rid of all of it; plants need CO_2. Engineers don't always build machines to solve problems. You can write and/or draw your idea here:

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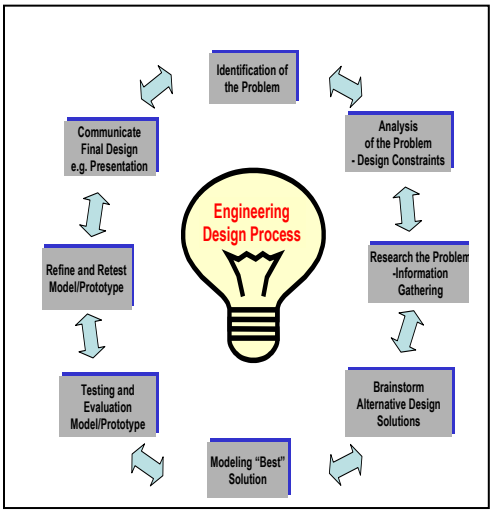

Remember the EDP

We did an investigation using the Engineering Design Process (EDP) in Post #6 on 4/14/20. The picture is a reminder. You've already done most of the steps.

If your idea uses a model, you can build and test it. Otherwise, you can share your idea with someone else, the "Communicate" step.

Lift the Level You can make this lesson deeper and/or suitable for older students by any of the following:

1. The Investigation can be conducted using baking soda and vinegar if you have them. Light the candle. Put 2 tablespoons of baking soda in a tall glass. Add ¼ cup vinegar. The bubbles are carbonic acid which quickly devolves to CO_2. Because CO_2 is heavier than air (and oxygen), it displaces air and is essentially the only gas present in the glass. Slowly "pour" only the gas over the candle flame. Write and balance a chemical equation for the reaction in the glass.
2. Dive deeper into the chemistry by writing and balancing chemical equations involved.
3. Explore the geology involved with CO_2 – which could include hydrology (the study of water resources).
4. Diagram the CO_2 cycle, which we only touched upon with animals breathing oxygen and plants absorbing CO_2.
5. Diagram the transpiration cycle of plants. Trees are typically used for this. Don't forget roots.
6. Diagram the ecology of CO_2, including as many sources of CO_2 as possible.
7. Since it's the 50th Anniversary of Earth Day, make a list of 50 things to celebrate about Earth. Then go outside and enjoy your tiny spot of our beautiful planet.

STEM Online

Carbon footprint calculator https://www.carbonfootprint.com/calculator.aspx Please note that this is a commercial site based in the UK. We are not advocating the purchase of any materials/services from the site. You may want to use their suggestions as ideas for your own actions.

NJ Student Learning Standards

1-ESS1-1 Earth's Place in the Universe

Science and Engineering Practices - Planning and Carrying Out Investigations

Crosscutting Concepts - Patterns in the natural world

English Language Arts –W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

Mathematics - MP.2 Reason abstractly and quantitatively.

3.PS2.A (1-ESS1-1);

5.PS2.B (1-ESS1-1),(1-ESS1-2); 5-ESS1.B (1-ESS1-1),(1-ESS1-2)

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Disciplinary Core Ideas - ESS3.C: Human Impacts on Earth Systems

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.