TITLE: Climate Change Solutions
PRIMARY SUBJECT: Science
GRADE LEVEL: 6th - 12th
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CONCEPTS / TOPICS TO TEACH:

The burning of fossil fuels such as oil and coal, deforestation, industrialized agriculture, and other human activities has increased the atmospheric concentration of carbon dioxide by more than a third in the last century. The increased emission of greenhouse gases into the atmosphere traps more heat and affects Earth's climate. It's important for students to understand the greenhouse effect and how human activities are causing increased emissions. It's also necessary for students to grasp that there are many ways to approach solutions, varying from a larger scale approach to small habit changes in individuals.

STANDARDS ADDRESSED:

COMMON CORE	NGS STANDARDS
Grades 6-8: CCSS.ELA-LITERACY.WHST.6-8.1.B Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.	**Grades 6-8:** MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
Grades 9-10: CCSS.ELA-LITERACY.WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
Grades 11-12: CCSS.ELA-LITERACY.WHST.11-12.2.E Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).	**Grades 9-12:** HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

General Goal(s):
Introduce students to the human factors that drive climate change. Acquaint students with the causes of rising emissions and how it's connected to human activity. Establish an understanding of effective strategies and conservation techniques that reduce our contribution to climate change.

Specific Objectives:
Students will review the scientific method and create a hypothesis around effective solutions for climate change, then use art to explain their hypothesis. This activity allows students to utilize skills in critical thinking, research, solution-oriented learning, literacy and vocabulary development, and art.

Required Materials:
- Access to computer or tablet
- Climate Change Reflection Handout
- Activity Instruction Handout

Websites for Student Research:
- https://climate.nasa.gov/causes/
- https://climate.nasa.gov/solutions/

Anticipatory Set (Lead-in):
- Q: Ask students how scientists test an idea?
- A: The scientific method
- Q: Ask students to review the steps in the scientific method
- A: Make an observation, form a hypothesis, experiment, record data, make a conclusion
- Q: Ask students to make an observation about climate change
- A: Human activities are impacting the climate, more carbon dioxide is being released into the atmosphere, the greenhouse effect traps more heat, etc (answers will vary)
- RESOLVE: Scientists can and do use the scientific method to test possible solutions for climate change.

ACTIVITY
After reviewing the causes of our changing climate and discussing effective strategies and solutions for combating climate change, students will develop a hypothesis (remind students that a hypothesis is a testable idea) then creatively represent it using an art medium of their choice, (drawing, model, song, magazine article, video, etc.).

Using the websites listed above, students can research current approaches that have been already taken to inspire their own hypotheses. If there are similar hypotheses presented in class (at teacher's discretion) students can combine and work together in teams to create their solution.

GLOSSARY OF LESSON TERMS

- Greenhouse effect- When radiated heat from the sun is absorbed by greenhouse gases (water vapor, carbon dioxide, methane, chlorofluorocarbons, and nitrous oxide) which traps outgoing heat.
- Carbon dioxide (CO_2)- A minor but very important component of the atmosphere, carbon dioxide is released through natural processes such as respiration and volcano eruptions and through human activities such as deforestation and burning fossil fuels. Humans have increased atmospheric CO_2 concentration by more than a third since the Industrial Revolution began.
- Methane- A gas produced both through natural and human activities, including the decomposition of wastes in landfills, agriculture, and digestion and manure management associated with domestic livestock. Methane is a far more active greenhouse gas than carbon dioxide, but also one which is much less abundant in the atmosphere.
- Nitrous oxide- A powerful greenhouse gas produced by soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
- Water vapor-The most abundant greenhouse gas, but importantly, it acts as a feedback to the climate. Water vapor increases as the Earth's atmosphere warms, but so does the possibility of clouds and precipitation, making these some of the most important feedback mechanisms to the greenhouse effect.
- Chlorofluorocarbons (CFCs)- Synthetic compounds entirely of industrial origin used in a number of applications, but now largely regulated in production and release to the atmosphere by international agreement for their ability to contribute to the destruction of the ozone layer. They are also greenhouse gases.
- Unsustainable resource: a resource that is not able to be maintained at the current rate or level
- Sustainable resource- a resource this is able to be maintained at a certain rate or level

Plan for Independent Practice:

- Encourage students to record their behaviors that contribute to climate change over a weeks time and discuss how to make habit changes as individuals and as a class to positively affect the environment
- Ask students to research the "6th major extinction" and discuss how animals are affected by climate change
- Challenge students to write a short persuasive paper on why they believe their hypothesis would be effective in combating climate change

Potential Connections to Other Subjects:

Art: drawing, design, graphics
Language: vocabulary development, scientific writing, literacy
Ecology: basic biology, ecosystem connection

Name:

CLIMATE CHANGE REFLECTION

1. What is an unsustainable resource? Give 2 examples.

2. What is a sustainable resource?

3. List two strategies the United States is using to combat climate change:

4. Do you personally contribute to climate change? How?

5. List 5 small things you can do to help fight climate change:

6. Now list 3 big ideas(project, law, model, etc) that could help fight climate change:

ACTIVITY INSTRUCTIONS

Choose one idea and form a hypothesis (a testable idea) on how the idea is an effective strategy in combating climate change:

Hypothesis:

_____

_____

_____

_____

After forming a hypothesis that is based in science and logic, think about how you will creatively represent your idea. Make a video, write a song/rap, paint or draw and model, write a magazine article or use any other form of art to bring your hypothesis to life.

Must include (either directly in presentation or written separately)

- An in-depth description of the hypothesis (Introduction)
- Why you thought of it, what influenced or inspired you?
- How it addresses climate change, be specific!
- Using the scientific method how could be tested or experimented? What would it require and who would be involved?
- Conclusion