Protect Your Climate

Bay Area Air Quality Management District

Welcome to the Protect Your Climate Curriculum Program!

- Curriculum contains 16 science-based lessons for 4th and 5th grade.
- Lessons investigate the science and causes of climate change and how to take action to protect our climate.
- Hands-on activities explore air quality, energy, waste, and transportation issues related to climate change.
- Science and other State Content Standards addressed.

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PROTECT YOUR CLIMATE CURRICULUM
TEACHER'S GUIDE

Welcome and thank you for choosing to use *Protect Your Climate!* The objective of this curriculum is to teach students about the science, causes, and impacts of climate change. Most importantly, this curriculum seeks to inspire students to protect their climate by empowering them with knowledge, tools, and skills to reduce greenhouse gas emissions in their daily lives.

The Importance of Teaching Climate Protection

Climate change is one of the biggest challenges facing the world. Climate change is caused by the large amounts of greenhouse gases that human activities are releasing into the atmosphere. The largest source of greenhouse gas emissions is the burning of fossil fuels for energy, electricity, and transportation uses. Greenhouse gases trap heat which is leading to global warming and as a result, changes in global climate conditions. Changes in climate worldwide have already and will continue to cause droughts, flooding, wildfires, and food and water shortages. Climate change is a global challenge, however, all of us can act together to avoid severe climate change impacts in the future. This curriculum teaches students how they can take action and reduce greenhouse gas emissions at home, at school, and in the community.

About the Curriculum

This interdisciplinary curriculum uses hands-on demonstrations, interactive activities, discussions, experiments, and home assignments to engage students in understanding and applying important climate change concepts. Students are encouraged to use logic, foresight, and critical thinking in making informed decisions and taking action for climate protection.

We welcome all comments, suggestions, and critiques you may have regarding the *Protect Your Climate* curriculum. Feedback on content, activities, and relevance to California State Content Standards and the Environmental Principles and Concepts is essential in making this educational tool the best it can be.

The *Protect Your Climate* curriculum is a program from the Bay Area Air Quality Management District (District). With the help of Strategic Energy Innovations, the contracted consultant for the program, the District developed *Protect Your Climate* and launched it in schools across the Bay Area.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Bay Area Air Quality Management District is responsible for maintaining air quality in the San Francisco Bay Area. The *Protect Your Climate* program launches the Air District's effort to provide climate protection education materials to Bay Area schools.

Strategic Energy Innovations
Helping Communities Enhance Sustainability

Strategic Energy Innovations is a non profit organization that provides energy efficiency and renewable energy consulting & related services to underserved markets including: schools and universities, local governments, small businesses and affordable housing communities.

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How to Use the Curriculum

Target Grade Levels

Protect Your Climate targets 4th and 5th grades but is easily adaptable to other grades. The lessons, background, and support materials are tailored to meet a wide range of student learning styles, skill levels, and prior knowledge.

Topic Sections

The curriculum contains 16 lessons that are presented in four topic sections with three to six lessons in each section and a final lesson that can be used as an assessment for the whole unit. Each section begins with background for teachers on the section topic. The backgrounds summarize definitions, science, and current issues for each topic area.

Climate Change Basics
Students will become aware of the key scientific principles around air pollution and climate change.

Reducing Impacts from Energy Use
Students will discover how energy, and specifically electricity use, is connected to climate change. Students will also examine renewable energy sources and ways to conserve electricity.

Reducing Impacts from Waste
Students will examine their own waste habits at school and learn and discuss the benefits of reducing waste, recycling, and composting.

Reducing Impacts from Transportation
Students will be introduced to how transportation contributes to climate change and will explore ways to avoid emissions from transportation uses.

Tool Kit & Image Library

Protect Your Climate includes a tool kit with necessary materials for the lessons, such as thermometers, hanging scales, and candles. Basic classroom materials, such as paper, pencils, and scissors, are not included in the tool kit. Any additional classroom materials necessary for the lesson are listed in the lesson page sidebar.

The toolkit also includes a CD with images to engage students. Images can be projected with a computer projection system or printed from the CD onto an overhead transparency.

 Look for this camera icon within lessons for image recommendations.

Using the Lessons

The *Protect Your Climate* lessons build knowledge and skills in a sequential manner for students to gain a fundamental understanding of climate change and its causes. Teachers are encouraged to follow the lesson sequence.

Sample Lesson Page

Topic area icon.

Focus and lesson number.

Time needed for lesson.

Lesson title and brief summary of lesson purpose and outcomes.

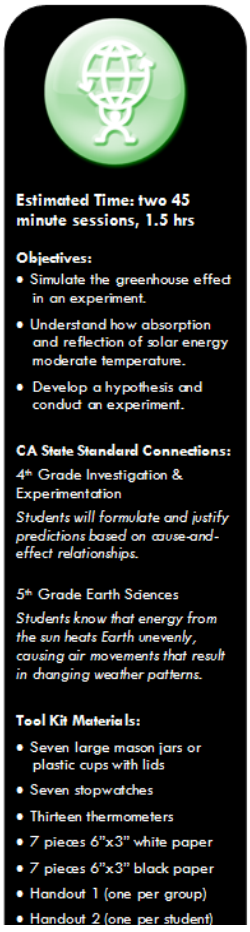
Skills and knowledge to be gained by students.

Important terms introduced in the lesson.

Connections to specific California State Content Standards.

Tips for preparing to teach each lesson.

Materials provided in tool kit and any additional materials.



Climate Change Basics
Lesson 1

Greenhouse Effect

The atmosphere contains both natural and man-made greenhouses gases. These gases allow solar radiation from the sun to pass through the atmosphere and limit the escape of infrared energy that is radiated back by the Earth. This natural function of our atmosphere results in warm temperatures in the lower atmosphere and on the planet's surface. Through discussion and a hands-on experiment, students learn about the scientific principles behind the greenhouse effect and why it is important to life on Earth.

Estimated Time: two 45 minute sessions, 1.5 hrs

Objectives:
- Simulate the greenhouse effect in an experiment.
- Understand how absorption and reflection of solar energy moderate temperature.
- Develop a hypothesis and conduct an experiment.

CA State Standard Connections:

4th Grade Investigation & Experimentation

Students will formulate and justify predictions based on cause-and-effect relationships.

5th Grade Earth Sciences

Students know that energy from the sun heats Earth unevenly, causing air movements that result in changing weather patterns.

Tool Kit Materials:
- Seven large mason jars or plastic cups with lids
- Seven stopwatches
- Thirteen thermometers
- 7 pieces 6"x3" white paper
- 7 pieces 6"x3" black paper
- Handout 1 (one per group)
- Handout 2 (one per student)

Key Words

Atmosphere: layer of gas and microscopic dust that surrounds the Earth.

Greenhouse Effect: the process of the Earth's atmosphere trapping heat.

Solar Radiation: energy emitted from the sun in a variety of forms including visible light, infrared radiation, and ultraviolet radiation.

Preparation

Read the Background on Climate Change Basics for an overview and illustration of the greenhouse effect. Test the experiment before teaching this lesson. It is best to do this experiment on a sunny day; late spring through early fall days would be best. Identify a safe place to leave your jars outside.

Activity 1 Materials: Assemble six sets of materials for groups of 4 students. Each set includes: 1 pint jar or large cup with lids, 1 stopwatch, 1 thermometer, and Handout 1. Thermometers should be at room temperature. You will also need an additional thermometer set in a ball of clay to serve as the control thermometer for the class.

Activity 2 Materials: Add one piece of 6x3 inch black paper, and one 6 x3 inch white paper to each set of Activity 1 materials.

Lesson pages are followed by the lesson procedure which contains guidelines for engaging students, conducting experiments and activities, initiating discussions, and assessing student knowledge.

GLOSSARY

Energy Input Pathways: concept used to track how energy is consumed through the lifecycle of a product, from its production, consumption, and disposal or reuse.

Fossil Fuels: coal, petroleum, and natural gas are formed over millions of years from the decayed remains of ancient plants and animals.

Fuel: something such as wood or oil which is burned to produce energy.

Fuel Efficient Vehicle: vehicle that requires less fuel to travel compared to other vehicles.

Generator: machine that converts mechanical energy into electrical energy.

Greenhouse Effect: the process of the Earth's atmosphere trapping heat.

Greenhouse Gas: a gas that traps heat in the atmosphere. An over-abundance of greenhouse gases is contributing to climate change.

Idling: an engine running while not doing useful work, such as a car sitting still with its engine running.

Landfill: large outdoor area, usually specially constructed, where waste is dumped and buried.

Manufacturing: process of turning raw materials into products that can be used or consumed.

Methane: a greenhouse gas created by anaerobic decomposition.

Miles per Gallon: number of miles a vehicle can travel on one gallon of fuel.

Mixed Use Community: community with schools, offices, homes, stores, green space, and public spaces easily accessible to one another.

Non-Renewable Energy: energy from a source that cannot be replaced or can only be replaced very slowly by natural processes, usually over millions of years.

Ozone (O_3): ground-level ozone is an air pollutant with harmful effects on the respiratory systems of animals and humans. Ozone in the upper atmosphere filters potentially damaging ultraviolet light from reaching the Earth's surface.

Paraffin: type of wax made from petroleum, a fossil fuel.

Particulate Matter: tiny particles and liquid droplets in the air, including acids, organic chemicals, metals, and dust particles.

Passenger Miles per Gallon: number of miles a single vehicle can travel on one gallon of fuel multiplied by the number of passengers.

Phantom Load: energy used by electrical devices when they are plugged in but not being used.

Photon: tiny particle of radiant energy.

Precipitation: water falling from clouds in any form, such as snow, ice, rain, or drizzle.

Product Lifecycle: the total process of a particular product's manufacture, transportation, use, and disposal.

GLOSSARY

Raw Material: natural material used as input to production.

Reduce: using fewer products and materials in our daily lives.

Recycle: collecting and processing products into new or different products.

Recycled Content: amount of recycled material in a new product.

Renewable Energy: energy from a source that is replaced rapidly by natural processes.

Reuse: to use again.

Solar Cell: device that changes energy from the sun into electricity. A solar panel is comprised of many solar cells.

Solar Radiation: energy emitted from the sun in a variety of forms including visible light, infrared radiation, and ultraviolet radiation.

Soot: fine black particulate matter produced by combustion of coal, oil, wood, or other fuels.

Smog: air pollution made primarily of ozone (O_3) that forms when pollutants from vehicles and industry react in the air with sunlight.

Sustainable: actions done in a manner that do not deplete natural resources faster than they can be naturally replenished.

Traffic: movement of cars and other vehicles on the road.

Transportation: ways of moving people or goods from one place to another.

Turbine: machine that extracts energy from fluid flows like wind, moving water, or steam to do work.

Urban Planner: person who helps plan communities.

Waste: items thrown away and not used again.

Water Cycle: change of water from one state to another as it moves between Earth's surface and atmosphere included the processes of evaporation, condensation, and precipitation.

Weather: short-term condition of the atmosphere at a place for a given time.