

The purpose of this lesson is to allow students to demonstrate knowledge at the culmination of a unit of study about IAQ.

TOPIC(S)		COMPOSITION OF AIR	DEFINING THE INDOOR ENVIRONMENT
EFFECTS OF INDOOR AIR POLLUTION ON OCCUPANTS		SOURCES OF INDOOR AIR POLLUTION	MOVEMENT OF AIR Natural and mechanical airflow (HVAC)
IDENTIFYING INDOOR ENVIRONMENT POLLUTANTS	√	SOLVING INDOOR ENVIRONMENT PROBLEMS (Preventing and Fixing)	VOCABULARY

OBJECTIVE(S)

The students will be able to design inventions that will prevent or fix indoor environment problems. The students will demonstrate an understanding for the process that inventors go through to identify a problem, investigate solutions, and develop inventions to meet the needs of the problem or situation.

SCIENCE/HEALTH STANDARD CORRELATIONS

National Science Education Standards, Science Content Standards

6.1 Science as Inquiry

- Levels K-12: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry

6.6 Science in Personal and Social Perspectives

- Levels K-4: Personal Health; Changes in environments
- Levels 5-8: Personal Health; Populations, resources, and environments, Natural hazards
- Levels 9-12: Personal and community health; Environmental quality; Natural and human-induced hazards

Mid-continent Research for Education and Learning (McREL), Science Standards

Earth and Space Sciences 1.1, 1.4, 1.5 and Physical Sciences 8.1, 8.3, 8.5

**See "Curriculum Connections" section for standards that apply to other content areas.*

SUGGESTED GRADE BAND

4-5, 6-8 science, 9-12 science

ESTIMATED TIME LENGTH

5 class periods

LESSON PROCEDURES

In this lesson students will:

- read about inventors
- propose inventions to solve IAQ problems they have identified
- build models or draw diagrams of their proposed inventions

- share their inventions when the class hosts an “Invention Convention”

PHASE 1 – PROJECT INTRODUCTION

Have a class discussion about the process of inventing. Discuss famous inventors and their inventions.

PHASE 2 – RESEARCH CURRENT IAQ INVENTIONS

Have a class discussion about poor indoor air quality (IAQ). Build your own background knowledge about IAQ using the [EPA's IAQ Tools for Schools Action Kit](#) (see Resources section). Post a list of problems caused by indoor air pollution. Discuss the root causes of these problems. In this discussion include a determination of whether an invention is the most efficient means to solve the problem, or if the problem could be more appropriately addressed with simple maintenance or awareness building. Could an invention address a simple maintenance or awareness issue? Discuss current inventions “on the market” that solve IAQ problems. Teacher will divide students into groups. Each group will conduct research on a current product “on the market” that claims to improve the IAQ in an indoor environment (such as a home or office building). Provide each group with magazines, catalogs (such as Sharper Image) and Internet access. Students will pick a product to research and then present to the class. They will explain what the equipment is, its function, cost and effectiveness. The group will create a visual aid using chart paper and make a five minute presentation to the class about the product.

PHASE 3 – INVENT

Have students select an IAQ problem and invent a product that can improve IAQ in schools. Provide students with a box of supplies (odds and ends). Students can make a prototype model (this model will not need to actually work) of the invention or a blueprint. A written proposal should also be submitted with the invention. In this proposal, students will need to explain why they chose the problem, how their invention works, and how it solves the problem (fixes or prevents). The proposal should also identify potential buyers, estimate product cost and include marketing ideas for the invention.

PHASE 4 – INVENTION CONVENTION

Designate a date and time to display the inventions in a central location in the school. Have a session during school for other students to attend. Have a session after school for parents (a great opportunity to promote public awareness about IAQ). Have the students design invitations and posters about the event. At the event students will display their model or blueprint and written proposal. They will stay with their inventions so that they can answer questions. As a class develop awards for the

inventions and have the convention attendees vote anonymously for the winners. Announce the winners at the end of the convention. Provide refreshments.

MATERIALS

a box of odds and ends, books about inventors, paper, pencils, chart paper, markers

GROUPING

whole class, small group, independent

ASSESSMENT

Teacher can observe for active participation during the first and second phase of the project. Teacher can evaluate the student's inventions for addressing the problem and for design creativity. Teacher can evaluate written proposal.

MODIFICATIONS/EXTENSIONS

This lesson could be used as either an introduction or culminating activity for a unit on IAQ. Have students research and report on the patent process for new inventions. Invite a local inventor to class to talk about his or her invention.

Short on time? Since time is so precious, if you are not able to implement this entire lesson, try these activities:

- Tell the students about HVAC systems (using [EPA's IAQ Tools for Schools Action Kit](#) diagrams from the [IAQ Background](#)—page 5 and the [Reference Guide](#)—section 2, page 4)
- Place materials in a central location and have students recreate the diagrams by making physical models using the materials provided

CURRICULUM CONNECTIONS

Reading and Language Arts, [International Reading Association and National Council of Teachers of English Standards, Standards for the English Language Arts](#)

- 4: Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- 5: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes
- 6: Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and nonprint texts
- 7: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience

- 8: Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- 12: Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information)

Social Studies, Center for Civic Education, National Standards for Civics and Government

- Content Standard K-12, V: What are the Roles of the Citizen in American Democracy? /What are important responsibilities of Americans?

Health, American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD), National Health Education Standards

- Health Education Standard 1, Grades PK-12: Students will comprehend concepts related to health promotion and disease prevention

Technology, International Society for Technology in Education (ISTE), National Educational Technology Standards Project (NETS)

- Performance Indicators K-2
 - 8: Create developmentally appropriate multimedia products with support from teachers, family members, or student partners. (3)
 - 9: Use technology resources (e.g., puzzles, logical thinking programs, writing tools, digital cameras, drawing tools) for problem solving, communication, and illustration of thoughts, ideas, and stories. (3, 4, 5, 6)
- Performance Indicators 3-5
 - 5: Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum. (3)
 - 6: Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom. (3, 4)
 - 7: Use telecommunications and online resources (e.g., e-mail, online discussions, Web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom. (4, 5)
 - 8: Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem solving, self-directed learning, and extended learning activities. (5, 6)
 - 9: Determine when technology is useful and select the appropriate tool(s) and technology resources to address a variety of tasks and problems. (5, 6)
- Performance Indicators 6-8
 - 4: Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, Web tools) to support learning and research. (3, 5)
 - 5: Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum. (3, 6)
 - 6: Design, develop, publish, and present products (e.g., Web pages, videotapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom. (4, 5, 6)
 - 7: Collaborate with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside the classroom. (4, 5)

- 8: Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems. (5, 6)
- 10: Research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems. (2, 5, 6)
- Performance Indicators (9-12)
 - 5: Use technology tools and resources for managing and communicating personal/professional information (e.g., finances, schedules, addresses, purchases, correspondence). (3, 4)
 - 6: Evaluate technology-based options, including distance and distributed education, for lifelong learning. (5)
 - 7: Routinely and efficiently use online information resources to meet needs for collaboration, research, publication, communication, and productivity. (4, 5, 6)
 - 8: Select and apply technology tools for research, information analysis, problem solving, and decision making in content learning. (4, 5)
 - 9: Investigate and apply expert systems, intelligent agents, and simulations in real-world situations. (3, 5, 6)
 - 10: Collaborate with peers, experts, and others to contribute to a content-related knowledge base by using technology to compile, synthesize, produce, and disseminate information, models, and other creative works. (4, 5, 6)

Math, National Council of Teachers of Mathematics, Math Standards

- Data Analysis and Probability
 - Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer

RESOURCES

- [EPA's IAQ Tools for Schools Action Kit](#) (3rd Edition)