

Blank Lesson Template

Yellow highlight = required component

Subject Area(s) AP Biology

Associated Unit Body Systems

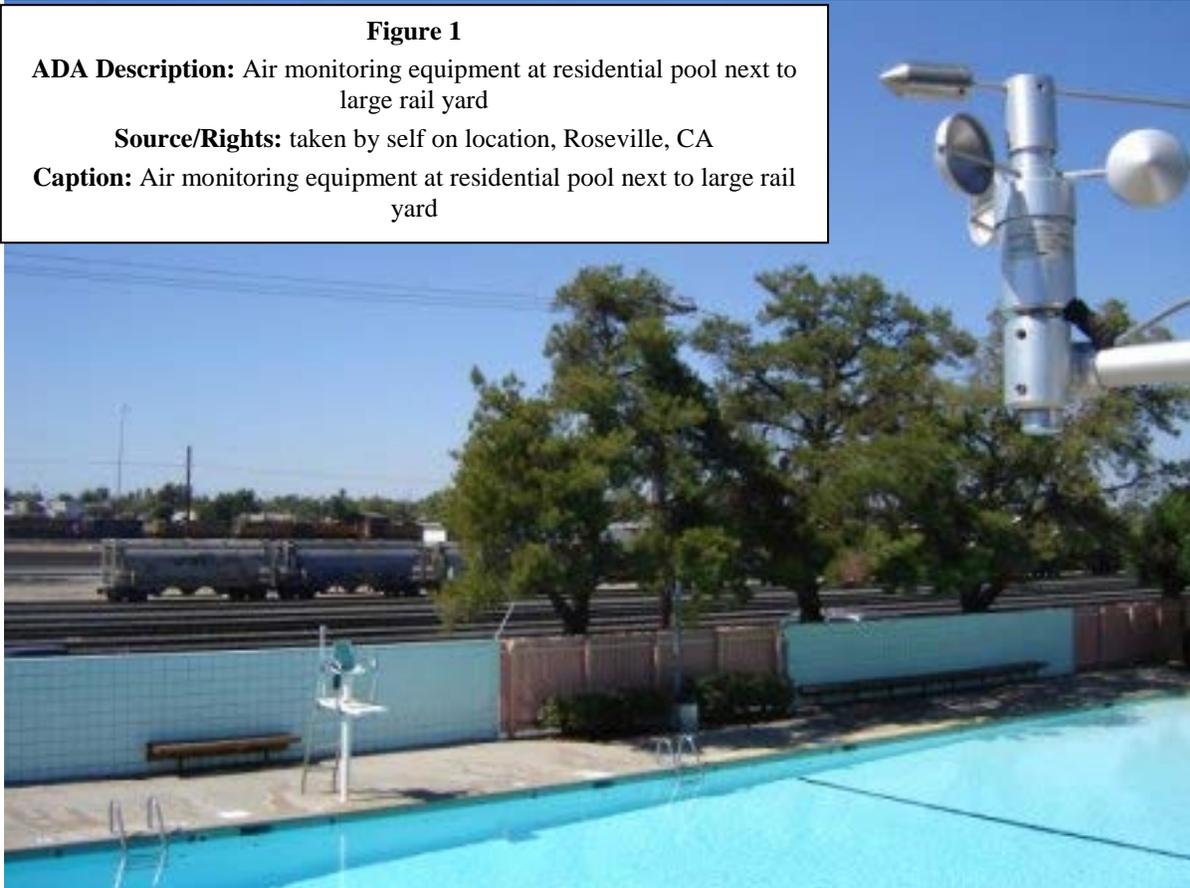
Lesson Title What am I breathing?

Figure 1

ADA Description: Air monitoring equipment at residential pool next to large rail yard

Source/Rights: taken by self on location, Roseville, CA

Caption: Air monitoring equipment at residential pool next to large rail yard



Grade Level __ (_10_-_12_)

Lesson # __ of __

Lesson Dependency

Time Required 40 minutes

Summary

By making a connection between something as constant and necessary as breathing to the respiratory system, the students will be motivated to learn the material as well as be exposed to current research in the field of air quality.

Engineering Connection

Engineers from many different disciplines are involved in improving air quality, from better automotive engine designs to controls on smokestacks. Engineers at UC Davis and University of Houston are continually improving monitoring technologies to aid local, state and federal agencies in their mission to protect human health.

Engineering Category = #_

Choose the category that best describes this lesson's amount/depth of engineering content:

1. Relating science concept to engineering

Keywords

Respiratory system, air quality, nanoparticles, pollution

Educational Standards

Science: Texas, science, 2009, The Texas Essential Knowledge and Skills, Chapter 112

3B communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials

3D evaluate the impact of scientific research on society and the environment

10A describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals

Pre-Requisite Knowledge

Learning Objectives

After this lesson, students should be able to:

- **Describe the respiratory system**
- **Be familiar with various air pollutants and their general effects on the human body**

Introduction / Motivation

Take a breath, how much air did you just inhale? We all know air is made of gas, but what gases? Did you know that you also took in about a million particles? Where did these particles come from and are they dangerous?

Even though an adult male can have a lung capacity of 6 liters, the “tidal volume”, or amount breathed in and out at, is closer to 500 mL. In that small amount of air is 78% nitrogen gas, 21% oxygen and small fractions of percents of argon, carbon monoxide, carbon dioxide, methane etc. There are also solid and liquid particles called Particulate Matter (PM). PM is generally referred to by its size which can be as large as the finest grains of sand (called coarse PM) or measured in nanometers (about the size of a virus, called ultrafine particles). In the middle are the fine particles, which can be created by combustion or chemical reactions in the atmosphere. Coarse particles are often associated with natural sources such as sea salt and wind-blown dust, while fine and ultrafine particles come from man-made pollution (cars, power plants, etc).

The animal respiratory system is very effective at protecting individuals from natural pollution; however, they are fairly unequipped at dealing with man-made ultrafine particles that often contain a significant amount of toxic metals. Scientists and engineers are working hard to reduce the amount of PM pollution and simple lifestyle changes can be very effective at reducing pollution in your area. In what ways can you help reduce air pollution?

Lesson Background & Concepts for Teachers

Review the textbook material on gas exchange and respiratory organs. Also, excellent descriptions of current understandings of air pollutants and their effects can be found on the EPA's webpage:

www.epa.gov/airnow/airaware/

Also, there is a wealth of engineering control technologies at the Air Pollution Control Technology Center:

www.epa.gov/etv/vt-apc.html

If interested, teachers can find more information on ultrafine particles here:

www.epa.gov/ncer/nanotech/research/particle_index.html

Vocabulary / Definitions

Word	Definition

Associated Activities

Activity: Debate on pros and cons of renewable energies

Lesson Closure

After the students have been shown the respiratory system and an overview of air quality science, the students generally ask “what can be done?” To end the lesson, simple suggestions can be posed. For example, riding a bike to a friend's house instead of driving will reduce automotive pollution. Turning off lights when they are not needed will reduce power plant pollution. For many high school students, these connections have never been made before. Bringing them to light makes them feel empowered that they can personally reduce pollution in their area with very simple changes to habits. Ask the students what other things they might be able to do and see where the conversation leads. The students may wish to discuss alternative energy or other such environmental topics in response to the lecture.

Assessment

For homework, each student needs to research an air pollutant in their city that is being monitored by a government agency. The 2 page report should include a brief explanation of why the pollutant is being monitored and should include the value of the agency's standard. The report should also include a brief description of sources of the pollutant. The report should have at least 3 references.

Lesson Extension Activities

Additional Multimedia Support

References

Attachments

Other

Redirect URL

Contributors

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Supporting Program

National Science Foundation GK-12 program, University of Houston, Department of Civil and Environmental Engineering