

CLASS 3 OUTLINE

COAL-FIRED POWER PLANTS AND DEMONSTRATION OF AN ELECTROSTATIC PRECIPITATOR

- I. Review Last Week's Class re Air Pollution
 - A. Briefly discuss what the kids learned last week about air pollution
 1. Ask them what they learned: Different kinds of air pollution, causing different problems
 - a. Particulate matter: smoke, soot, dirt.
 - b. Bad ozone (smog), troposphere, aggravates asthma
 - c. Good Ozone: stratosphere, blocks harmful ultraviolet rays from the sun so that we don't get sunburned and get skin cancer.
 2. Global warming/climate change
 - a. Pollutants that humans emit from power plants, cars, trucks and other sources get into the atmosphere and trap heat, like a greenhouse. Melting ice caps at poles.
 - b. Expected to cause problems like increased flooding, drought in some areas, more severe storms, and harm to agriculture and changing disease patterns.
 3. Acid rain: caused by sulfur dioxide emitted mainly from coal-burning power plants. It can harm forests and plants and accelerate the deterioration of statues and buildings (remember the chalk experiment).
- II. Focus on power plants
 - A. Electricity needs
 - B. How do power plants work?
 1. What are different ways to generate electricity?
 - a. Hydroelectric
 - b. Nuclear
 - c. Coal burning. (Potomac River Power Plant, Alexandria)

2. What is coal, and why does it produce energy?
 - a. Talk about how coal is formed (handout)
 - b. It traps energy
3. How do we make electricity by burning coal?
 - a. Handout showing power plant schematic.
 - b. Coal heats water for steam
 - c. Steam turns turbine, which turns generator, creating electricity
 - d. Electricity gets transmitted over power lines to homes, business
4. What happens to the coal when we burn it?
 - a. Produces heat
 - b. Produces sulfur dioxide (which contributes to acid rain)
 - c. Produces nitrous oxides (which contributes to smog)
 - d. Produces particulate matter (fly ash) (which contributes to breathing difficulties)

III. How can we reduce pollution from coal-fired power plants?

- A. What's the role of the law here?
 1. We know that pollution causes problems, but we know that we need electricity
 2. Write laws requiring power companies to control pollution
 3. One system for controlling sulfur dioxide emissions is cap and trade program that they will learn more about next week
 - a. Put limit on how much SO₂ can go into air
 - b. Give each plant an allowance
 - c. Make them hit their allowance by reducing their pollution, or by buying credits from a plant that pollutes less than their allowance
- B. How to reduce pollution?

1. Burn less of it (conserve energy)
2. Burn cleaner coal (low-sulfur coal from western U.S., or treated coal)
3. Capture the pollution through technology

IV. Introduce idea of electrostatic precipitator

A. What is static electricity?

1. Atoms: protons, neutrons, electrons
2. Electrons have negative charge
3. Negative charges seek out positive charges

B. Balloon and pepper experiment

1. Set up each group
2. Discuss principle of rubbing balloon against clothes or hair to pick up electrons
3. What happens when you hold the balloon over the pepper?

C. Electrostatic precipitator works on same principle

1. Show what happens when no static electricity in tube (Bernoulli effect, high pressure to low pressure)
2. Show what happens when static is introduced.
3. What happens to the fly ash after it's caught?
 - a. Collected (by tapping, etc.) and disposed in safe manner.

IV. Recap and conclusion