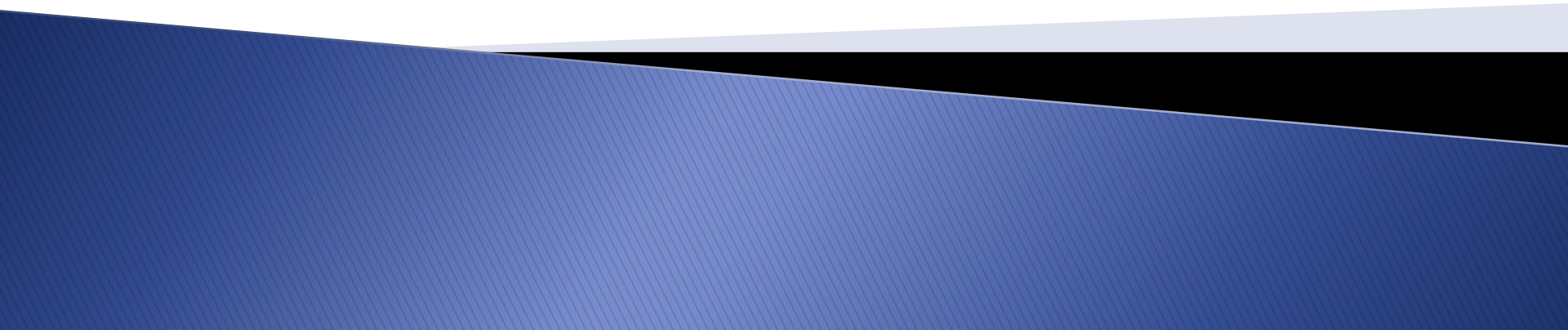
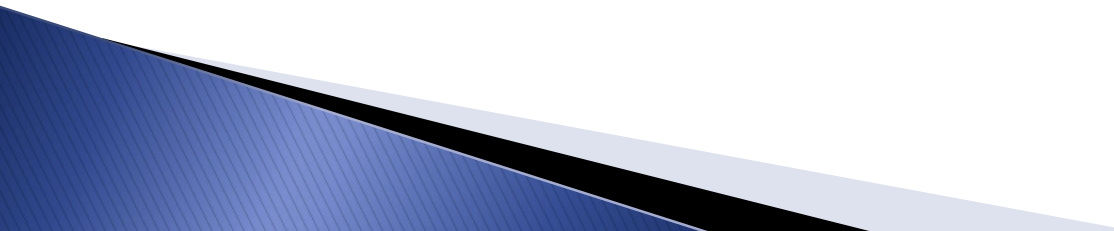


Chapter 4: Reactions and the Environment

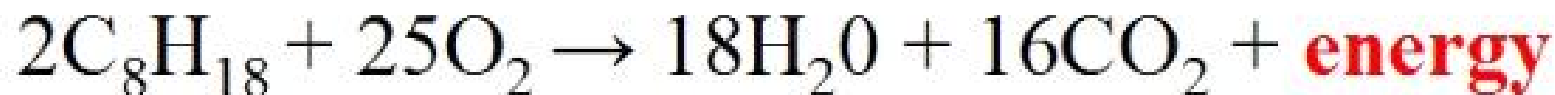


Fossil Fuel Combustion

- ▶ Plays a large part in electricity, transportation, heating, along with many other applications
 - ▶ Come from ancient decaying plant and animal matter
 - ▶ Energy stored in fossil fuels must be transformed before it can be used
 - ▶ Most common method is **Combustion**
- 

Combustion

- ▶ A fuel (fossil) reacts in the presence of oxygen to produce carbon dioxide, water, and energy



(**octane + oxygen** → **water + carbon dioxide + energy**)

- ▶ Exothermic! Energy often in form of **mechanical energy** or **heat**

Incomplete Combustion

- ▶ When the fuel doesn't combust completely. Occurs when not enough oxygen is available
- ▶ Ex. Blocked chimney, inefficient furnace, etc.
- ▶ **Complete combustion:** H_2O , CO_2 , Energy
- ▶ **Incomplete Combustion:** Carbon monoxide (CO), carbon (C), CO_2 , H_2O , Energy



Air Hole Open



Air Hole Closed

Carbon Monoxide

- ▶ Extremely poisonous – enters the bloodstream and starve the body for oxygen
- ▶ Odorless gas, colourless gas – very difficult to detect



Greenhouse Gases

- ▶ Humanity burns millions of litres of gasoline daily – heating, vehicles, generate energy
- ▶ All these combustion reactions release millions of tonnes of CO₂ into the atmosphere
- ▶ Causes a process known as **Global Warming**

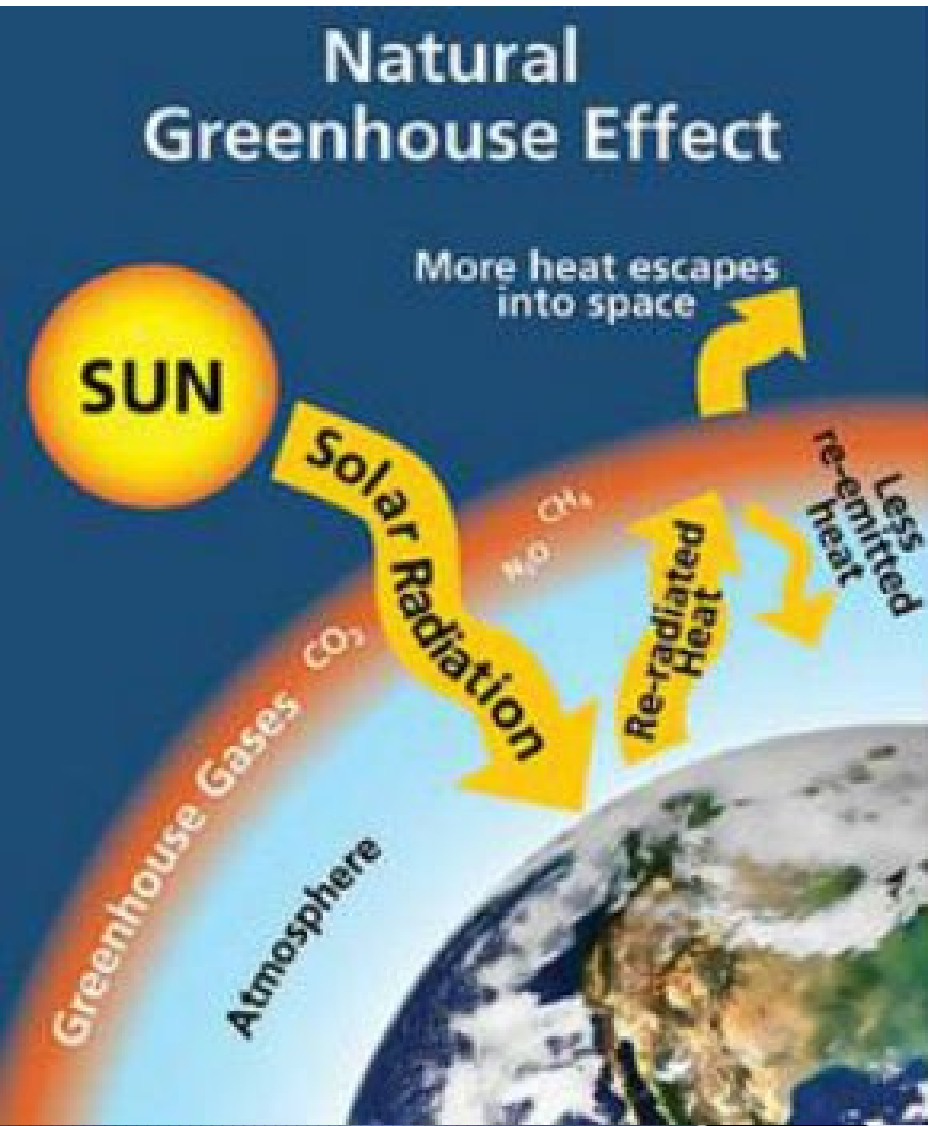


Greenhouse Gases

- ▶ Most scientists agree that CO₂ is important to life on earth
- ▶ All living things produce CO₂, water vapour, and methane – which are greenhouse gases
- ▶ These gases trap heat in the Earth's atmosphere. Create an average temperature of +15C, instead of what it would be naturally (-18C)



The Greenhouse Effect



Global Climate Change

- ▶ Earth has had intervals of hot and cold periods
- ▶ Big concern is global warming and how we are accelerating it
- ▶ Many species are not able to adapt fast enough → extinction
- ▶ Some believe global warming is a myth

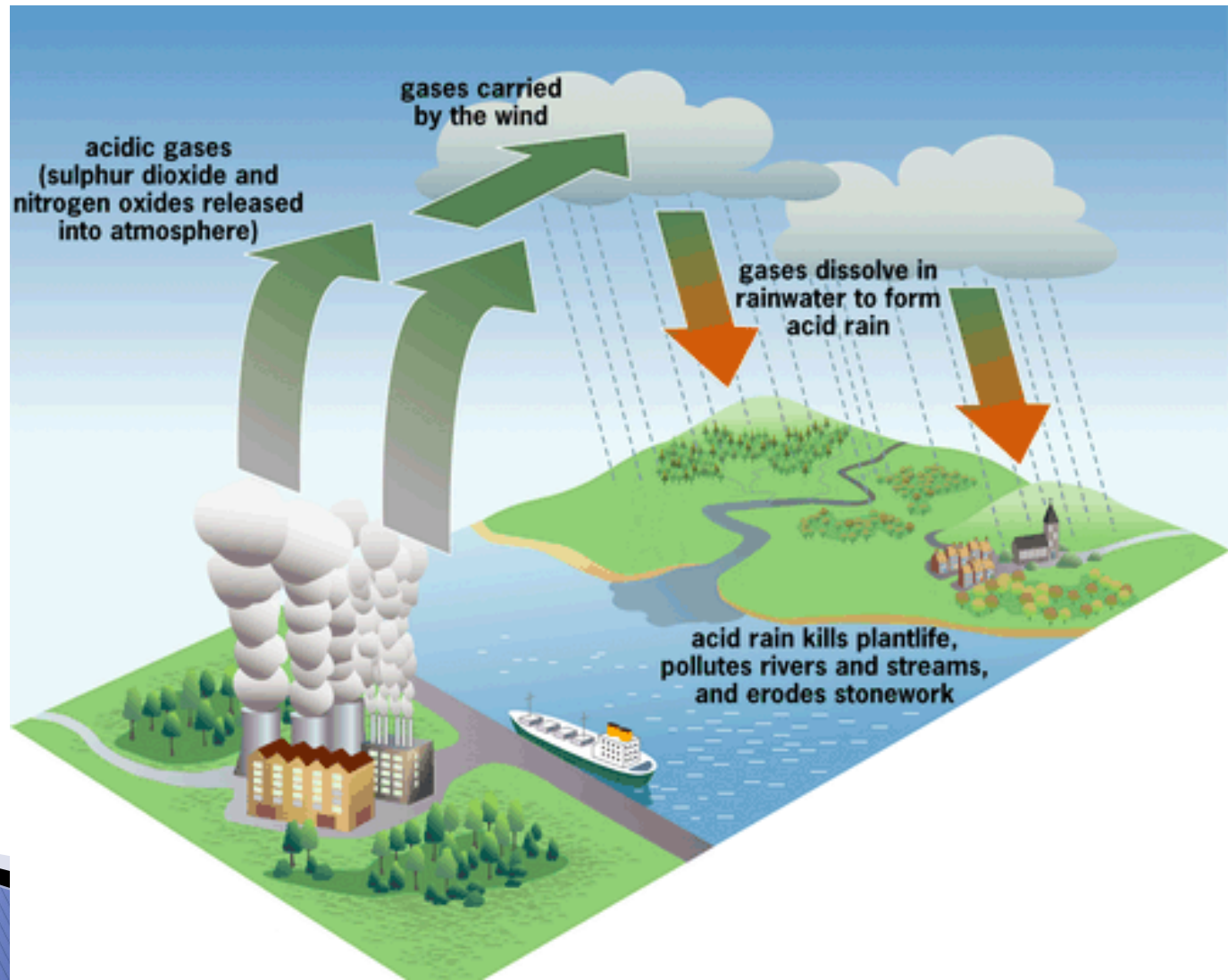


Air Pollution



- ▶ Considered as any chemical in that air that can cause harm to living things or the environment
- ▶ Can combine with each other to produce acid rain
- ▶ Also known as **acid deposition** since the acid isn't always in the form of rain, can be fog or mist, as well as rain

Formation



Acid Deposition



Sulphurous acid



Acid Base Reactions

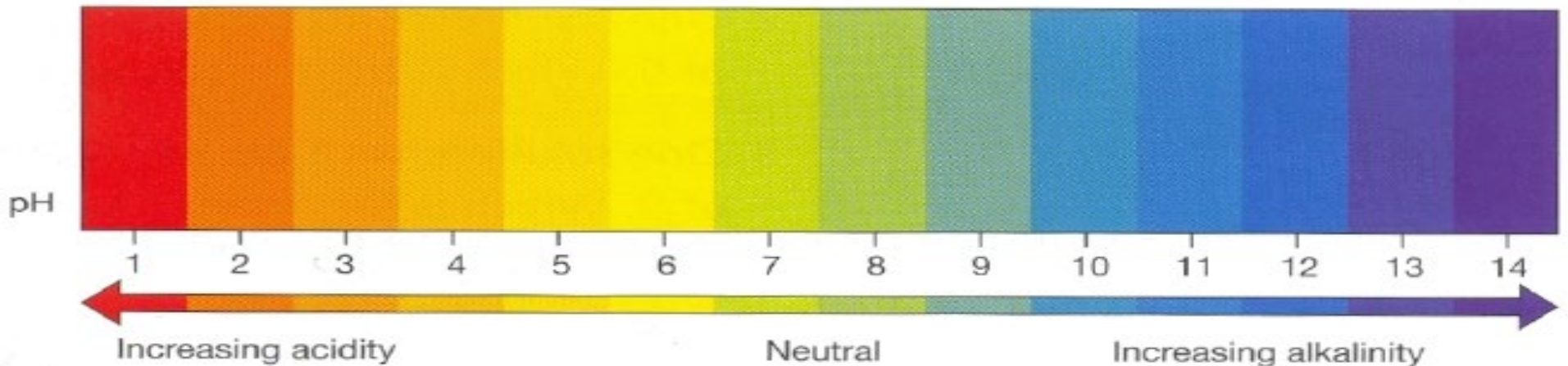
- ▶ Neutralization Reactions – Acid + Base
- ▶ Also happen in our body – stomach, pancreas, small intestine
- ▶ By neutralizing these reactions we stop our bodies from harming themselves



In the Environment



- ▶ Natural limestone (CaCO_3) is a natural base
- ▶ Used to neutralize lakes if the water is too acidic in a process called liming
- ▶ pH around 12



Reducing Emissions



- ▶ Best way to reduce acid deposition is to stop the processes that form it
- ▶ High levels of acid deposition are a result of high levels of sulfur and nitrogen oxides
- ▶ Sulfur dioxide is a product of industrial work
- ▶ In Waterton, Alberta they are able to remove the sulfur before the fuel is burned and prevent it from being released into the atmosphere

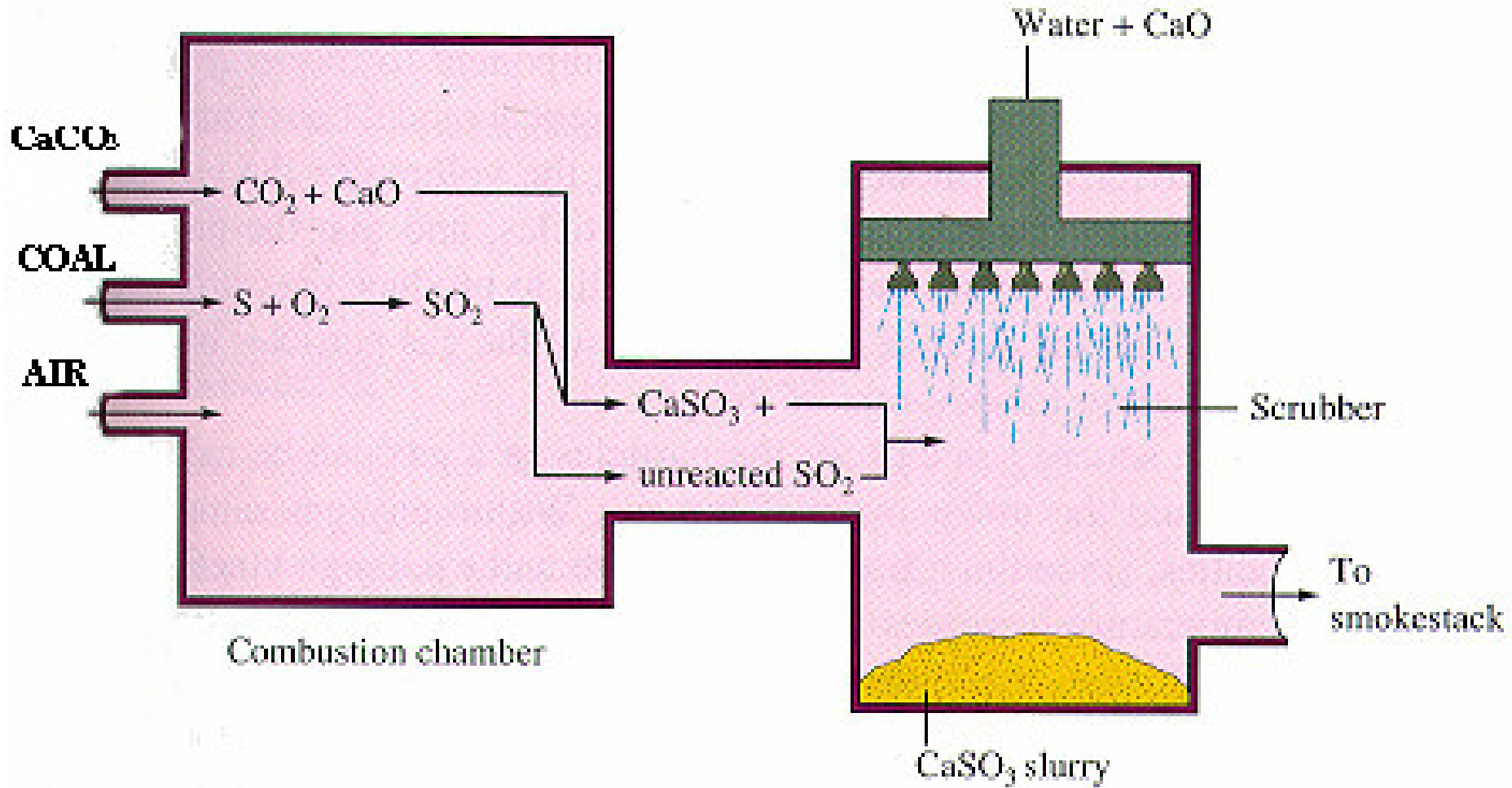
Waterton, AB



Sulfur Scrubbing



- ▶ Present in coal products
- ▶ When burned the sulfur enters the atmosphere and can create acid deposition
- ▶ To prevent this we can use a device called a scrubber
- ▶ Scrubbers are installed on the smoke stacks of many power plants
- ▶ Chemical and physical process that removes sulfur compounds during combustion of coal



Corrosion of Iron

- ▶ **Corrosion** is any process that chemically breaks down or degrades metal
- ▶ The most common process is **rusting**
- ▶ Most metals, will rust but when steel and iron do it is a problem because they are so widely used



The Process

- ▶ Metal is exposed to oxygen and moisture for an extended period of time
- ▶ Rust will form in flakes
- ▶ When flakes are removed it exposes new metal
- ▶ Structure weakens over time

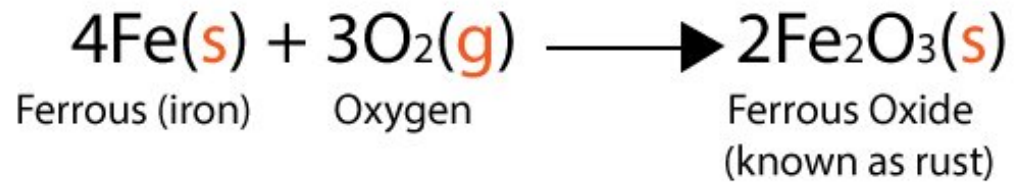


Reaction

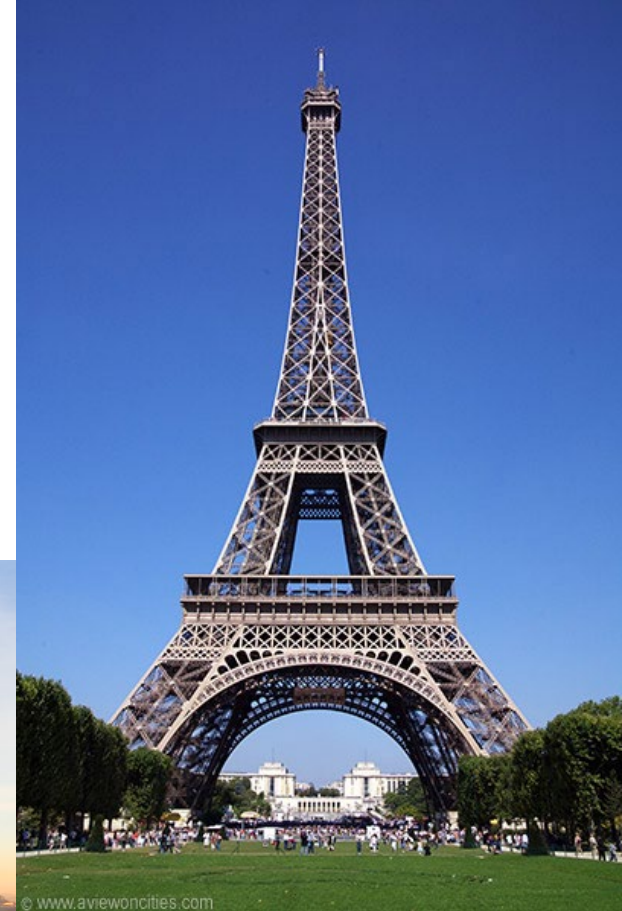
Composition Reactions



$\Delta H = -1625 \text{ kJ}$
exothermic heat
(gives up heat)



Things that will rust



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Solving the Problem

- ▶ Have you ever noticed that there are certain parts of a car that seem more susceptible to rust?
- ▶ We will look at 3 methods on how to reduce this problem

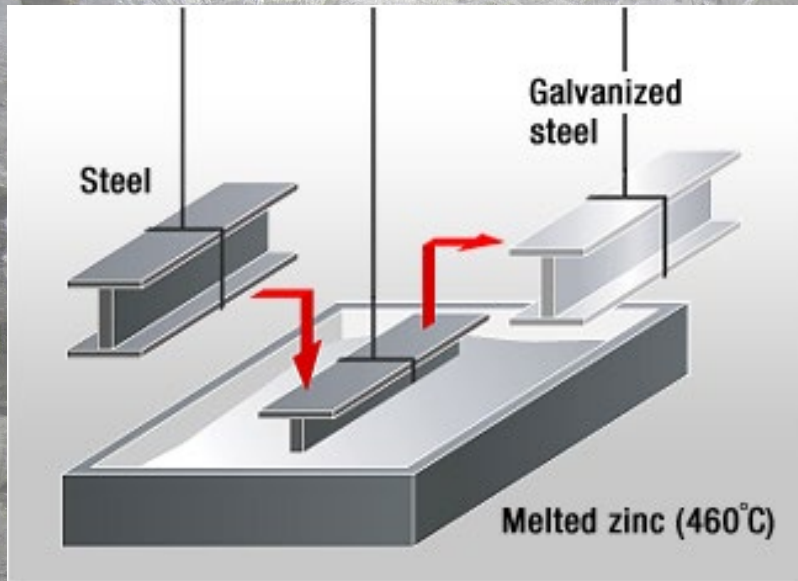


Painting

- ▶ Provides a protective coating over the metal
- ▶ Prevents the oxygen and water from reacting with metal
- ▶ Without proper maintenance the coating will eventually flake off and leave the metal exposed



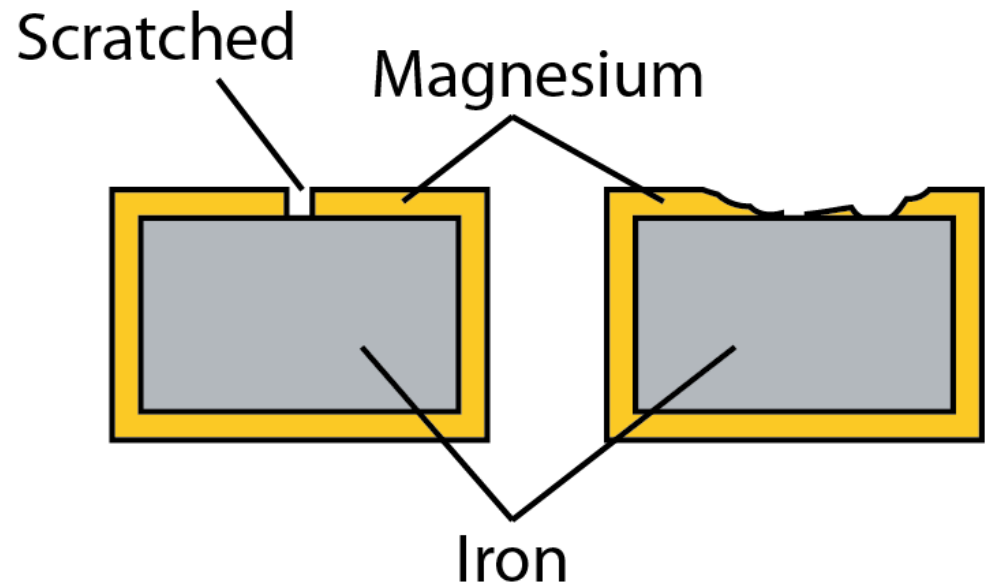
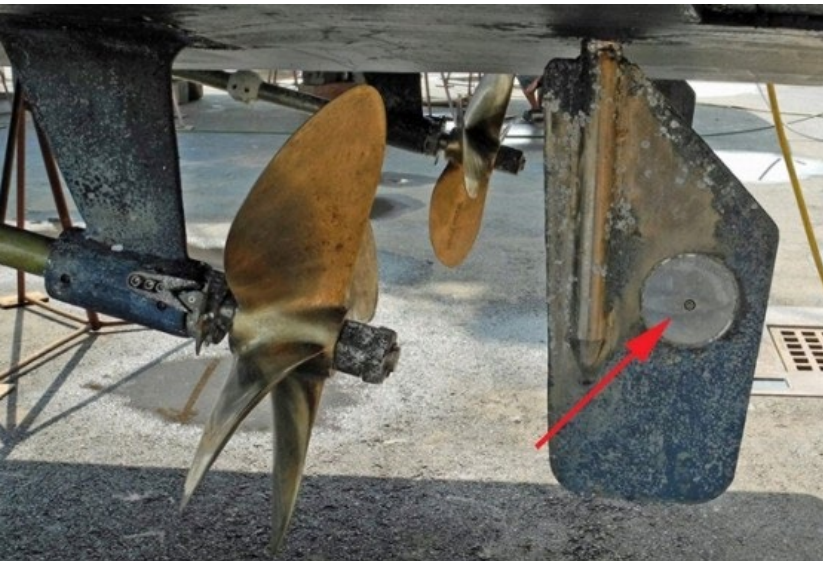
Galvanizing



- ▶ Process of applying a zinc coating to iron/steel
- ▶ Metal is bathed in molten zinc
- ▶ Provides a protective coating
- ▶ Does not flake off, actually becomes part of the metal

Sacrificial Metal

- ▶ A metal that is added that will corrode but prevents the main structure from being effected
- ▶ Used in boats and pipelines
- ▶ Easier to replace this metal than get new product



Candle + Jar

1. Light Candle in tray of water
2. Put jar over candle
3. What will happen?

