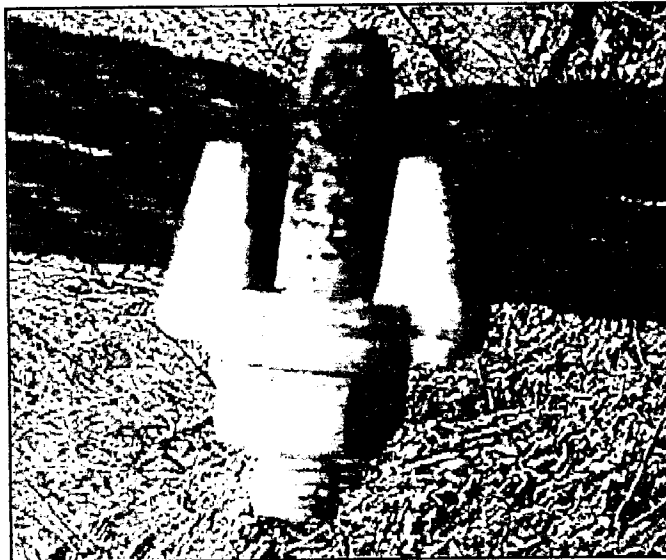




Oxygen and Oxidation Reading



Rust formed on steel cable, USGS

Oxygen is one of the most important gases for life on Earth. Most people know that oxygen is necessary for life, but not everyone can say exactly why. Oxygen is so important because of its reactivity. It reacts with many other elements and molecules, a process called oxidation. When these reactions occur, energy in the form of heat, is given off. When the reaction goes slowly, as in the case of rusting, a small amount of heat is given off. When the reaction goes quickly and can keep itself going, the reaction is called combustion. Combustion is more commonly known as burning.

Combustion or burning is a chemical reaction that requires oxygen, some sort of fuel, and an initial source of heat. Once the reaction is going, it will produce enough heat to keep itself going until it runs out of fuel or oxygen.

Combustion can only occur when there is a fuel that can react with the oxygen. Most fuels are made up of carbon and hydrogen atoms. As the fuel heats up, the atoms move more quickly. Some begin to break free from their molecules. As they do so, oxygen atoms grab the carbon and hydrogen atoms making carbon dioxide, CO₂, and water, H₂O. In this process, more heat energy is released which causes more atoms to move more quickly thus keeping the cycle going. Soot, ash, and smoke are all the remnants of incompletely burned carbon and hydrogen.

The flames themselves are carbon atoms that are so hot that they are glowing, but they have not yet combined with the oxygen atoms to form carbon dioxide or water.

During the candle observation, you put a plate over the burning flame. This left a black residue and possibly some water on the plate. When the hot carbon gas encounters the cooler plate, some of the carbon atoms cool enough so that they do not combine chemically with the oxygen atoms. This is why the black soot is left on the plate. The cooler plate also provides a place for the produced water to condense.

It is important to remember that Conservation of Matter applies to combustion. When matter is burned, it's not destroyed, it's transformed. The same amount of matter is there, just as different molecules.

Oxygen is so important for life because its tendency to react allows humans and other animals to obtain energy from sugars. This process is similar to combustion, but releases energy much more slowly and stores energy in a chemical form that does not have to be used all at once. If we did not have oxygen, our cells could not get this energy which allows us to move and drives all of the functions in our body.



Backburning of grass field to prevent wildfires; Fermi National Accelerator Laboratory, USDOE