

# WHAT HAPPENS WHEN SUBSTANCES BURN?

**Burning** is a chemical process (chemical change) where a substance is combusted (burned) to form a new substance. Burning is commonly referred to as combustion.

## REQUIREMENTS FOR BURNING TO TAKE PLACE.

There are three conditions that need to be met in order for burning to take place.

1. A fuel must be present
2. The fuel must be heated to its kindling temperature – which is the lowest temperature at which a substance catches fire.
3. Burning requires oxygen. The greater the amount of oxygen present, the faster and more completely a fuel will burn.

## PRODUCTS OF COMBUSTION

Burning a fuel such as candle wax can cause different substances to be formed. The substances formed depend on how much oxygen is available.

- **Sufficient supply of oxygen – Complete Combustion**

Fuel + Oxygen → Carbon Dioxide + Water

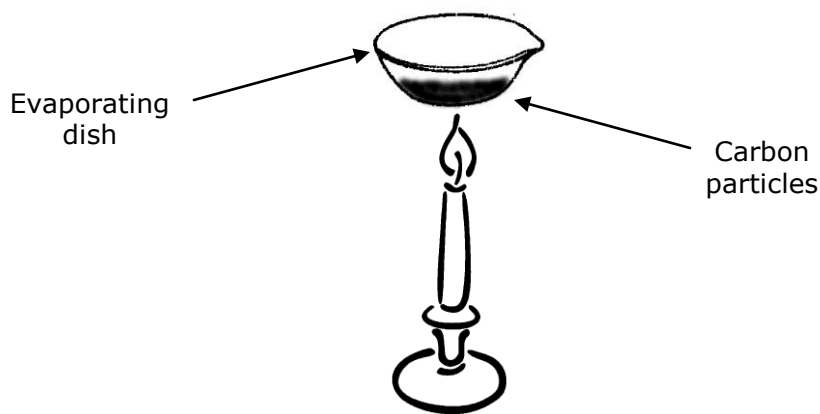
- **Insufficient supply of oxygen – Incomplete Combustion**

Fuel + Oxygen → Carbon (soot) + Water

In some cases, incomplete combustion can form an odorless, colorless poisonous gas called carbon monoxide.

It is likely in a combustion reaction that you will find most or all of these products produced.

Fuel + Oxygen → Carbon (soot) + Carbon Monoxide + Carbon Dioxide + Water



*The black material that appears on the bottom of an evaporating dish is the result of incomplete combustion. The hot, yellow flame caused by the candle wax burning contains heated carbon particles. The black carbon particles are deposited on the bottom of the evaporating dish when they cool.*

## SPONTANEOUS COMBUSTION

Fires can sometimes start spontaneously (without help from say... a match). Raising a substance to its kindling temperature can cause a substance to begin to burn unexpectedly.

Sometimes, substances can react with oxygen to form new substances and **heat**. If the heat is confined and allowed to build, then the kindling temperature can be reached and the substance can burst into flames. A good example of this is what happens when grain is stored and allowed to mold and decay.

When wet feed grain is stored in a silo, it can begin to mold and decay if left long enough. When it molds and decays, heat is formed through a chemical reaction. If enough heat is allowed to accumulate, then the grain could spontaneously burst into flames when the temperature reaches the kindling point of the grain.



## HOW TO PUT OUT FIRES

Remember that there are 3 things in order for burning to take place.

1. A fuel must be present
2. the fuel must be heated to its kindling temperature – which is the lowest temperature at which a substance catches fire.
3. Burning requires oxygen. The greater the amount of oxygen present, the faster and more completely a fuel will burn.

To put out or extinguish a fire, you must remove one or more of the 3 conditions listed above.

### REMOVE FUEL

### LOWER THE TEMPERATURE BELOW KINDLING POINT

### CUT OFF THE SUPPLY OF OXYGEN

## FIRE EXTINGUISHERS

SODA-ACID FIRE EXTINGUISHER – this type of extinguisher contains an acid and a baking soda. When you mix these two things together you form Carbon Dioxide gas and water. The gas produced builds up pressure inside the container and provides the pressure necessary to spray the water and carbon dioxide gas onto the fire. The water cools the fuel below its kindling temperature and the carbon dioxide gas cuts off the supply of oxygen gas.

This type of fire extinguisher works well on most small fires, but it has its limitations. It cannot be used on **electrical fires** or **oil fires**. Since water is a good conductor of electricity, it can make an electrical fire spread more easily. Since oil is less dense than water, it will float on the water sprayed from the extinguisher and therefore spread the fire.

## OTHER TYPES OF FIRE EXTINGUISHERS

FOAM – foam can be sprayed on a fire in large amounts to cut off the oxygen supply.

CARBON DIOXIDE – carbon dioxide extinguishers contain liquid carbon dioxide. When sprayed, the liquid turns to a gas and cuts off the supply of oxygen to the fire.

DRY CHEMICAL EXTINGUISHERS – contain powders that when heated release substances (such as carbon dioxide) that cut off the supply of oxygen to the fire.