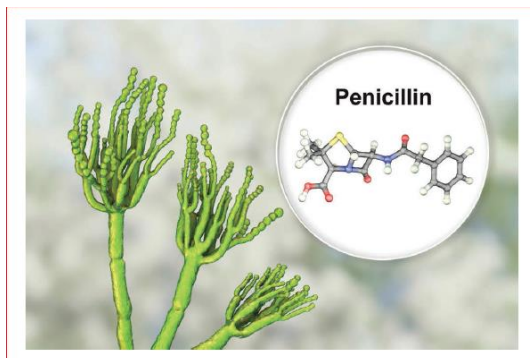


7th Science Lesson 15 Notes in English

15] Chemistry In Daily Life



Introduction:

During the Bangladesh liberation war, Therapy with Oral Rehydration Solution (ORS) in 1971 reduced cholera death rates from 50% to 3% among thousands of refugees. An Indian doctor, Dilip Mahalanabis, had to manage the shortage of saline bottles and coup up with the dehydration faced by the refuges. Dr. Dilip Mahalanabis showed the efficacy of ORS in cholera cases among Bangladeshi refugees (1971-72). Further field trial during the cholera epidemic in Manipur attested to its efficacy, ORS has since saved the lives of millions of children around the world.

Look at the above information. What do you infer from this? Now you get the curiosity to know about ORS and its function. Don't you? In addition to this, let us know about some of the common medicines and how do they work.

In the normal healthy intestine, there is a continuous exchange of water through the intestinal wall. Up to 20 liters of water is secreted and very nearly as much is reabsorbed every 24 hours. This mechanism allows the absorption of soluble metabolites into the bloodstream from digested food. However when a person becomes sick, due to diarrhea, water is expelled and the body is not able to retain the liquid balance. This is called as 'dehydration'. It is not the diarrhea that kills, but the dehydration' resulting from the infection that kills. If more than 10% of the body's fluid is lost death occurs.

Oral Rehydration Solution (ORS):

ORS (Oral Rehydration Solution) is a special combination of dry salts that is mixed with safe water. It can help to replace the fluids lost due to diarrhea. In a state of diarrheal disease there is imbalance and much more water is secreted than reabsorbed causing a net loss to the body which can be as high as several liters a day. In addition to water loss, sodium and potassium are also lost.

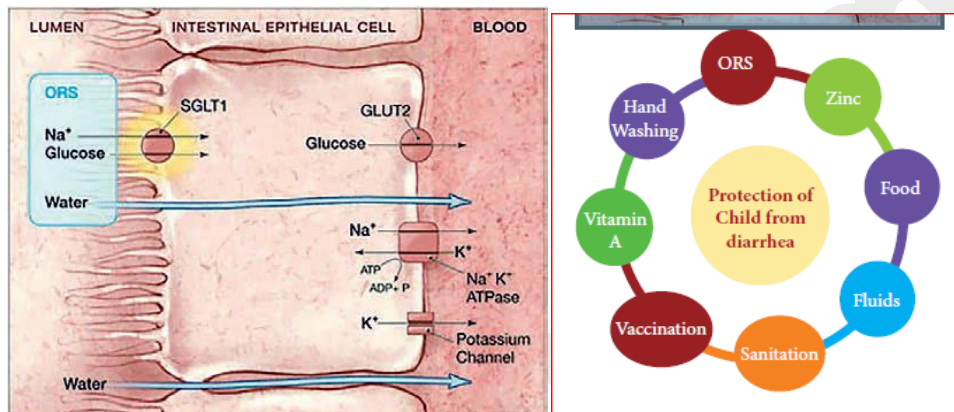
Certain concentration of sodium (Na) is needed for proper functioning of the body. For example, only with adequate sodium concentration in the intestinal wall, water can be absorbed by it through a process known

as osmosis. If there is inadequate salt in the intestinal wall the body will not be able to absorb water.

The saline bottle directly transfers water and sodium into the blood stream. However, for the saline water is administered through mouth, intestinal wall, is a not able to absorb neither water nor sodium. Dr. Dilip Mahalanabis found that if glucose (sugar) is added to the salt solution, then all the three- water, sodium and glucose are absorbed by the body.

During diarrhea the intestine is still able to absorb glucose molecules. Thus, the ORS solution uses the glucose molecules to enable the sodium to be carried through by a cotransport coupling mechanism. ORS is an effective treatment for 90 – 95% of patients suffering from diarrhea, regardless of the cause. As the water is replaced balance is attained saving the patient in most cases.

Let us see how to make ORS, be very careful to mix 6 level teaspoons of sugar and 1/2 level teaspoon of salt dissolved in 1 litre of clean water. Too much sugar can make diarrhea worse. Too much salt can be extremely harmful to the child. Making the mixture a little too diluted (with more than 1 litre of clean water) is not harmful.



Through the process of osmosis, the salts and sugars pull water into your bloodstream and speed up rehydration.

Antacid:

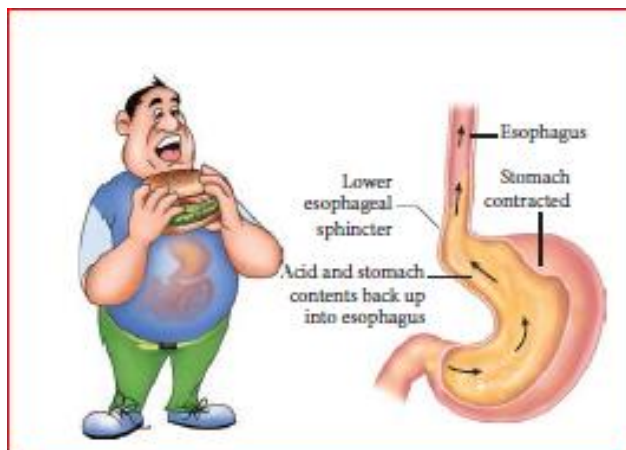
Acidity is a set of symptoms caused by excess production of acid by the gastric glands of the stomach. Your stomach naturally produces gastric or hydrochloric acid (HCl) to help digest and break down food. Acidity issues arise when there is excess production of this acid due to triggers such as acidic foods, spicy food, alcohol, dehydration and stress. When acidity occurs, the excess acid may move up from your stomach to your esophagus.

The lining of your stomach with a pH of 1 to 3 is designed as such to withstand a high acidic environment.

When we have acidity or heartburn, we are administered a class of medicines known as antacids. They are actually weak bases. As learned in chemistry, when a base is mixed with an acid a neutralization reaction occurs. When antacids are consumed, it creates a chemical reaction in the stomach lowering the acidity and makes the digestive acids less corrosive and damaging.

Most of the common antacids are Sodium Bicarbonate (NaHCO_3), Calcium Carbonate (CaCO_3), Magnesium Hydroxide ($\text{Mg}(\text{OH})_2$), Magnesium Carbonate (MgCO_3) and Aluminium Hydroxide $\text{Al}(\text{OH})_3$.

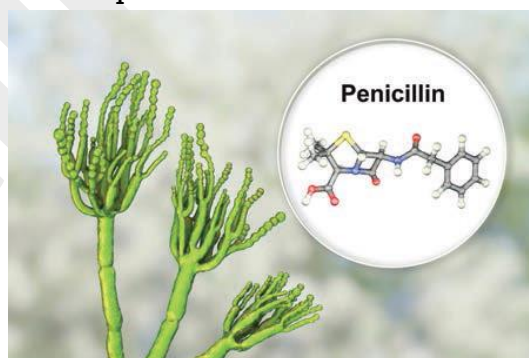
The chemical reaction created when Magnesium Hydroxide neutralizes HCl in the stomach and intestine.

**Antibiotics:**

Ages ago, there was a time where even a small infected wound can cause death in human beings. The discovery of antibiotics changed all. Now armed with antibiotics, many deadly infectious diseases can be tackled, which once meant to cause serious illness and death.

The discovery of antibiotics was an accident, which happened in 1928 while a British bacteriologist, Dr. Alexander Fleming was involved in research on staphylococcus bacteria. This bacterium was meant to cause deadly diseases such as pneumonia, sour throat, etc. The discovery happened while he was culturing the bacteria on a nutrient agar media in a Petri dish. He went on a holiday carelessly leaving the dish in his laboratory table without cleaning and sterilization.

After several days, when he returned back, he observed the growth of mould (kind of common fungus, which grows on stale bread/cheese) on a part of the Petri dish. He also observed that there was no bacterial growth surrounding the mould, which indicated that something in the mould had prevented the growth of bacteria in the culture medium. On further research, Fleming identified that the "mold juice" was capable of killing a wide variety of harmful bacteria, such as streptococcus, meningococcus and diphtheria bacillus.



And that was how the world's first antibiotic – penicillin – was discovered. Fleming named the mould penicillium notatum, from which the antibiotic penicillin was isolated. However, Fleming was not the first using moulds and other living micro organisms to treat infections. Thousands of years ago, the ancient Egyptians, had used mouldy bread to treat infected wounds. Similar practices were observed among ancient Greeks, Serbians and even among Indians. While these were perhaps partially effective, their efficacy is nowhere near the modern antibiotics.

Naturally, many micro organisms and plants synthesize chemicals which are toxic in nature to protect them from invading organisms. The biosynthesized chemicals isolated from the plants/micro organisms and used as medicines against infectious diseases. These substances

were called as antibiotics. Ex: Chloramphenicols, tetracyclines, Penicillin derivatives, cephalosporin's and their derivatives. Today, many infectious diseases in the world are rare due to the advancement in antibiotic research.

However, the overuse of antibiotics makes it inactive or less effective. Antibiotic resistance is defined as the ability of the microorganisms to resist the effects of an antibiotic to which they were once sensitive. Thus the antibiotics become less effective and we are forced to either consume a larger dose or shifting towards the use of other virulent variants of antibiotics. Thus the research on antibiotics is of great importance to combat the virulent and mutated microorganisms.

Analgesics:

Injury, burn, pressure from sharp objects and other conditions cause pain in our body. The unpleasant feeling may be a burning sensation in the tissue around the injury, throbbing headache or ache of arthritis. Back

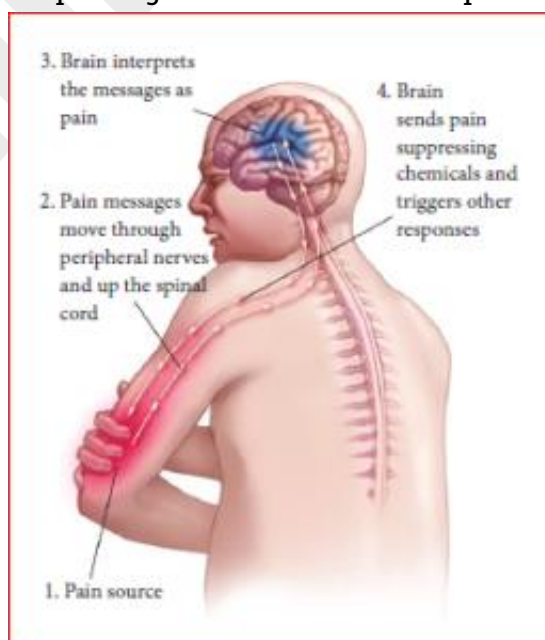
pain, neck pain, joint pain, headaches, pain from nerve damage, pain from an injury and pain related to diseases are some of the most common pains.

The unpleasant emotion of 'pain' is created in the brain and not at the spot of the injury. If the pain is severe, say from burn, the impulse sent to brain trigger immediate response. Reacting to the signal from the brain, muscle pulls our hand from the fire.

Reacting to the message received from the pain spot, the brain sends back messages that initiate healing process. It can trigger to release pain suppressing chemical and additional flow of additional white blood cells and platelets to help repair tissue at an injury site.

Analgesics or pain killers are the pain suppressing chemicals released by the body. They suppress the feeling of 'pain'. This analgesics drug selectively relieves pain by acting either in CNS (Central Nerves System) or on peripheral pain mechanism, without significantly altering consciousness.

When we are affected by fever, oft en we are administered Paracetamol. Paracetamol interact with the receptors and reduce the intensity of pain signals to the brain, also suppresses the release of substances, called prostaglandins that increase pain and body temperature.



Traditional anti inflammatory agents:



Peppermint Catnip

These are classified as follows,

- i) Non – narcotic (Non – additive) analgesics Eg. Aspirin.
- ii) Narcotic drugs. E.g. codeine

Antipyretic:

In normal course our body temperature is ranges from 98.4 to 98.6 degrees Fahrenheit. When the temperature goes above this level it is called fever. Most common cause of fever is infection. Bacteria and virus cannot thrive above a certain temperature. To defend the invading virus and bacteria the immunity system increases the body temperature.

Once infection is sensed, the immune system releases a chemical called pyrogen. These pyrogens released into bloodstream reaches the hypothalamus, present at the basal part of the brain. The function of Hypothalamus is to control the body temperature. Sensing the pyrogens, hypothalamus increases the body temperature by releasing a chemical called prostaglandin.



Normally little fever is good as it helps to arrest the growth of infection. However if the internal body temperature exceeds 105°F, this may cause damage to our body protein and the brain may experience seizures and delirium. The prolonged high fever may also cause death.

Antipyretics (anti - against and pyretic-Feverish) are chemical substances that reduce fever. They suppress the release of prostaglandin and reduce fever. The most common and well known anti pyretic is paracetamol. Other antipyretics and anti inflammatory agents include Aspirin, Ibuprofen, Diclofenac.

Antiseptic:

Antiseptics are substances applied to the exterior of a body that kill or inhibit microbes and infective agents. Antiseptics can be effective against one or a combination of bacteria, fungi, viruses or other microorganisms.

Natural antiseptics:

- 1. Garlic.
- 2. Turmeric.
- 3. Aloe vera.

Difference between Antiseptic and Disinfectants	
Antiseptic	Disinfectants

1. All antiseptic are disinfectants.	All disinfectants are not antiseptic
2. It can be applied on the live tissues	It can be apply on in animate object
For example. Skin / Mucous	For example. Surface, lab working tables, floor.

Antihistamine:

Anti histamines are defined as drugs that combat the histamine in the body that are used for treating allergic reactions and cold symptoms. Histamine is a chemical messenger involved in number of complex biological reactions. When a foreign body such as pollens enters the body, the immune system believes those substances to be harmful and generates the release of histamine. When histamine is released, it will interact with the histamine receptors on the cell surface or within a target cell and cause changes in the bodily functions. This stimulates many smooth muscles to contract, such as gastrointestinal tract and bronchi. In certain smooth muscles, they cause relaxation of blood capillaries which increase the flow of lymph and its protein content and lead to the formation of edema (redness and rashes).



Antihistamines or histamine receptor antagonists oppose selectively all the pharmacological effects of histamines. For, Ex. Diphenhydramine, chlorpheniramine, cimetidine. The adverse effects of antihistaminics are mouth dryness and sleepiness.

Medicine:

Medicines are used to treat the disease and to improve our health.

நோய்நாடி நோய்முதல் நாடி அது தணிக்கும்

வாய்நாடி வாய்ப்பச்செயல்

There is a Kural,

“Diagnose the disease and understand its seeds; Identify the cause and make sure it succeeds”.



The science or practice of the diagnosis, treatment, and prevention of disease. There are many ways to intake the medicine.

1. Oral use.
2. External use.
3. Injections (Intra muscular/Intra venous)

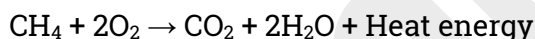
The medicines we take treat our disease and lead us to a good health.



Combustion:

Can you guess what is common in rusting or iron, burning coal and the flame of candle? They all undergo a chemical reaction known as combustion. Combustion is a chemical reaction that occurs in the presence of a fuel and an oxidizing agent that produces energy, usually in the form of heat and light.

What we call as 'burning' is really a combustion reaction. In fact combustion is one of the first chemical reactions intentionally harnessed by humans. Any reaction that involves reaction with oxygen is called oxidation reaction. In the combustion of hydrocarbon with oxygen, typically carbon dioxide and water are produced.



(Hydrocarbon) (Oxygen) (Carbon dioxide) (Water)

All combustion reactions are exothermic; that is they release heat.

Ignition Temperature:

The minimum temperature at which a substance catches fire and burns is called its ignition temperature.

A substance will not catch fire and burn if its temperature is lower than its ignition temperature. Different substances have different ignition temperatures.

Substances which have very low ignition temperature and can easily catch fire with a flame are called inflammable substances. E.g. Petrol. Alcohol, LPG (Liquefied Petroleum Gas), CNG (Compressed Natural Gas), etc.

Flame:



Flame is actually a chemical reaction. To be specific, the flame is a mixture of gases (vaporized fuel, oxygen, carbon dioxide, carbon monoxide, water vapor, and many volatile materials) and so is matter. The light and heat produced by the flame is energy, not matter. But fire is a matter.

Flame and its structure:



Which is the festival of light? What is the specialty of that festival? Yes. We will light more lamps to decorate the houses. Won't we? Now how do the lights glow? Yes, with flame.



Here is an experiment with colorful flame

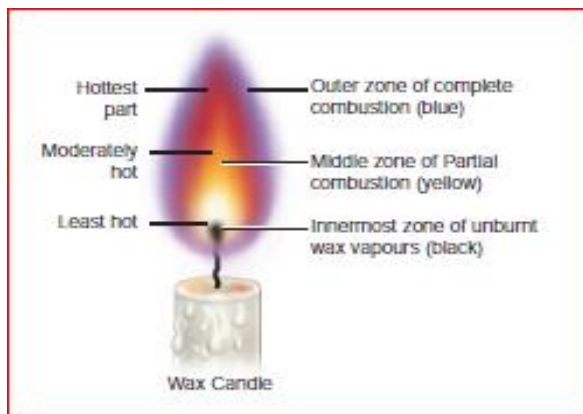
- White flame – Epsom salt (MgSO_4).
- Violet flame – Lithium Chloride.
- Indigo flame – Potassium Chloride.
- Blue flame – Bleaching powder.
- Green flame – Borax powder.
- Yellow flame – Calcium chloride.
- Orange flame – Table salt.
- Red – Strontium chloride

Teacher shows the experiment with these salts soaked in alcohol and makes fire.

Flame:

Flame is a zone of combustions of a combustible substance. Substances which vaporize during burning produce flames. E.g. Wax, Kerosene etc.

Substances which do not vaporize during burning do not produce flames e.g. coal.

**Structure of a Candle flame:**

A candle flame has three main zones, they are

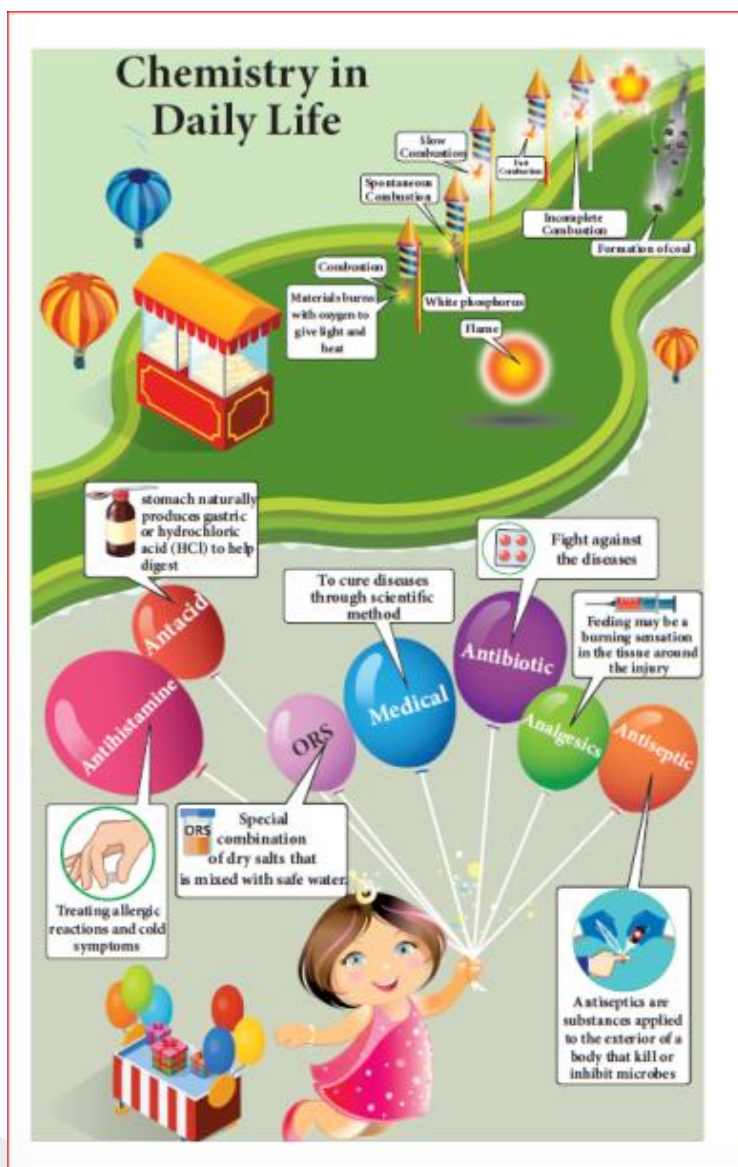
- i. The outer zone – complete combustion of the fuel takes place and the colour of the flame is blue and is the hottest part of the flame. It is the non-luminous part of the flame.
- ii. The middle zone -partial combustions of the fuel takes place and the colour of the flame is yellow and is moderately hot part of the flame. It is the luminous part of the flame.
- iii. The inner zone: There are un burnt vapours of the fuel and the colour is black and is least hot part.

Finger inside the flame



Why is the candle flame straight?





Calorific value of different fuels

Fuel	Calorific Value (kJ/kg)
Cow dung cake	6000 – 8000
Wood	17000 – 22000
Coal	25000 – 33000
Petrol	45000
Kerosene	45000
Diesel	450000
Methane	500000
CCNG	50000
LPG	55000
Biogas	35000 – 40000

Hydrogen	150000
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The amount of heat energy produced on complete combustion of 1kg of fuel is called its calorific value. The calorific value of a fuel is expressed in a unit called kilo joule per kg (kJ/kg).

Calorific value = Heat produced / Amount of fuel used for burning in kJ/kg

If 4.5kg of fuel is completely burnt and the amount of heat produced stands measured at 1, 80,000 kJ what is its calorific value.

Calorific value = $1,80,000 / 4.5 = 40,000 \text{ KJ/Kg}$

Types of combustion:

There are three main types of combustion. They are,

Rapid combustion:

It is a combustion process in which a substance burns rapidly and produces heat and light with the help of external heat. E.g. Burning of LPG.

Spontaneous combustion:

Is combustion process in which a light without the help of external heat.eg. Phosphorus burns spontaneously at room temperature.

Explosion:

It is a type of combustion in which a substance burns suddenly and produces heat, light and sound with the help of heat or pressure. E.g. Explosion of crackers.

CO- Leads to respiratory problem

CO₂- Global warming

SO₂/NO₂ – Acid Rain

More Environmental Impacts:



Remedies:



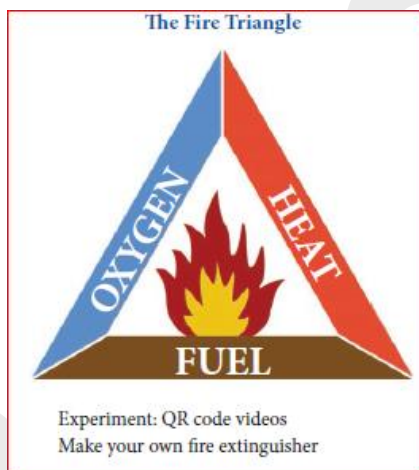
Characteristics of good fuel:

- ❖ Readily available.
- ❖ Cheap.
- ❖ Easy transport and store.

- ❖ Burns at moderate rate.
- ❖ Produce large amount of heat.
- ❖ Do not leave behind any undesirable substances.
- ❖ Does not cause pollution.

**Slow combustion:**

Slow combustion is a form of combustion which takes place at low temperatures. Respiration is an example of slow combustion.

Fire Control:

The conditions necessary for producing fire are,

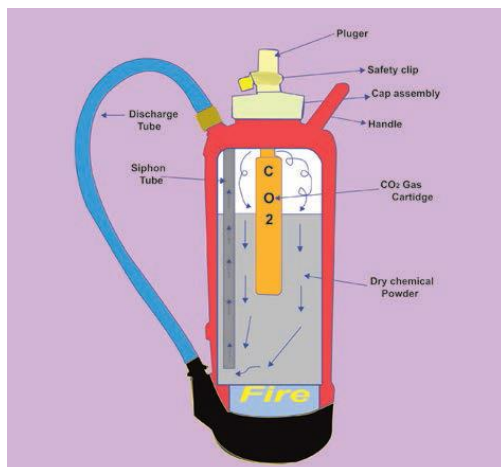
- ❖ Fuel.
- ❖ Air (to supply oxygen).
- ❖ Heat (to raise the temperature of the fuel beyond its ignition temperature)

Fire can be controlled by removing any one or more of these conditions.

Fire extinguisher:

A fire extinguisher cut off the supply of air or bring down the temperature of the fuel or both and controls the fire.

How do fire extinguishers work?



Portable fire extinguishers apply an extinguishing agent that will cool burning fuel, displace or remove oxygen, or stop the chemical reaction so fire cannot continue to burn. When the handle of an extinguisher is compressed, it opens and inner canister of high pressure gases forces the extinguishing agent from the main cylinder through a siphon tube and out the nozzle. A fire extinguisher works much like a can of hair spray.

Types of fire extinguisher:

The most common types of fire extinguishers are,

- ❖ Air pressurized water extinguishers.
- ❖ Carbon-di-oxide extinguishers.
- ❖ Dry chemical powder extinguishers.

Fire extinguishers can be broadly classified into five types:

1. Water
2. Foam
3. Dry Powder
4. CO₂
5. Wet Chemical

The classes of fire

There are five classes of fire: Class A, Class B, Class C, Class D, and Class E.

Class A fires – **Combustible materials:** caused by flammable solids, such as wood, paper, and fabric

Class B fires – **Flammable liquids:** such as petrol, turpentine or paint

Class C fires – **Flammable gases:** like hydrogen, butane or methane

Class D fires – **Combustible metals:** chemicals such as magnesium, aluminum or potassium

Class E fires – Typically a chip-pan fire

Electrical fires – **Electrical equipment:** once the electrical item is removed, the fire changes class

Points to remember:

- ❖ Oral Rehydration Solution (ORS) is a mixture of electrolytes, sugar, and water taken by mouth to absorb water and electrolytes in the body and properly restore the electrolyte and fluid balance lost by excessive sweating, vomiting or diarrhea.

- ❖ ORS is an effective treatment for 90 – 95% of patients suffering from diarrhea, regardless of the cause.
- ❖ Antacid is one that neutralize stomach acid.
- ❖ Medications, drugs, substances used to treat and cure diseases, and to promote health.
- ❖ Some micro organisms and plants produce their own toxic substances. These substances those help to destroy other living things are called as antibiotics.
- ❖ The chemical process in which a substance reacts with oxygen to produce heat is called combustion.
- ❖ Flame is a zone of combustion of a combustible substance. Substances which vapourise during burning produce flames. E.g. Wax, Kerosene.
- ❖ The minimum temperature at which a substance catches fire and burns is called its ignition temperature.
- ❖ The amount of heat energy produced on complete combustions of 1kg of fuel is called its calorific value.
- ❖ A fire extinguisher cut off the supply of air or bring down the temperature of the fuel or
- ❖ both and controls the fire.

Do you know?

UNICEF/WHO norms the O.R.S should be prepared as follows

S. NO	New ORS	Grams/Litre	%	New ORS	Mmol/Litre
1.	Sodium Chloride	2.6	12.683	Sodium	75
2.	Glucose, Anhydrous	13.5	65.854	Chloride	65
3.	Potassium Chloride	1.5	7.317	Glucose, Anhydrous	75
4.	Trisodium Citrate, Dehydrate	2.9	14.146	Potassium	20
				Citrate	10
5.	Total	20.5	100	Total Osmolarity	245

Antibiotics don't work for viruses like cold and the flu.

Anesthetics:

The first local anesthetic was cocaine was isolated from coca leaves by Albert Niemannin Germany, 1860.

1. Dettol

Mixture of chloroxylenol and Terpinol



2. Tincture

Iodine + 2 to 3% alcohol – Water mixture Soap, Iodoform, phenolic solutions, ethanol, Boric acid, are examples.



Fact:

Fire chemical Reaction

Oxygen + Heat + Fuel = Fire

A candle flame is caused by vapour burning above the candle. This burning vapour is hotter than the surrounding air and is therefore less dense. So, by the principle of convection, it “rises” so the flame is always Upwards.