PHARMACEUTICAL INORGANIC CHEMISTRY / BPH-101

UNIT-II

MADE BY: SAGAR BANSAL

ASST. PROF. / SIP, ALLD.

Topical agents

Topical agents are used locally, where the medicine is applied on the area being treated. For example creams, ointment and lotions are applied topically on the skin. Eye drops are instilled directly into the eyes.

CALAMINE

According to B.P. calamine is basic Zinc carbonate suitably coloured with ferric oxide. According to the I.P. Calamine is Zinc oxide coloured with Ferric oxide.

Properties: It is an amorphous , reddish brown powder and the colour depends on the variety and amount of ferric oxide present and the method by which it is incorporated. It is practically insoluble in water and completely soluble in mineral acids. Since there is a possibility of adulteration with dyes, there are tests for water soluble dyes and alcohol soluble dyes.

Storage: Store in well closed containers.

Medicinal and Pharmaceutical Uses: Topical protective. Widely used in lotions, ointments and dusting powders as a soothing agent. It is used in sunburns, eczema and urticaria and some other skin conditions. Calamine lotion is very popular.

TITANIUM DIOXIDE

Titanium dioxide, also known as **titanium(IV) oxide** or **titania**, is the naturally occurring oxide of titanium,chemicalformula TiO2. When used as a pigment, it is called **titanium white**, **Pigment White 6 (PW6)**, Generally it is sourced from ilmenite,rutile and anatase. It has a wide range of applications, from paint to sunscreen to food colouring.

Production

The most common method for the production of titanium dioxide utilizes the mineral ilmenite. Ilmenite is mixed with sulfuric acid. This reacts to remove the iron oxide group in the ilmenite. The by-product iron(II) sulfate is crystallized and filtered-off to yield only the titanium salt in the

digestion solution. This product is called synthetic rutile. This is further processed in a similar way to rutile to give the titanium dioxide product.

Properties	
Chemical formula	TiO 2
Molar mass	79.866 g/mol
Appearance	White solid
Odor	odorless
Density	4.23 g/cm^3 (Rutile) 3.78 g/cm^3 (Anatase)
Melting point	1,843 °C (3,349 °F; 2,116 K)
Boiling point	2,972 °C (5,382 °F; 3,245 K)
Solubility in water	insoluble

USES:

In cosmetic and skin care products, titanium dioxide is used as a pigment, sunscreen and a thickener. It is also used as a tattoo pigment. Titanium dioxide is produced in varying particle sizes, oil and water dispersible, and in certain grades for the cosmetic industry.

Titanium dioxide is found in the majority of physical sunscreens because of its high refractive index, its strong UV light absorbing capabilities and its resistance to discolouration under ultraviolet light. This advantage enhances its stability and ability to protect the skin from ultraviolet light.

KAOLIN

It is an aluminum silicate represented as Al_2O_3-2Si_O2-2H_2O. Kaolin was first found in China.

Preparation:

Kaolin is derived from the mineral Kaolinite which comes from the Earth's crust.

USE:

- In toothpaste
- in cosmetics

- in paint to extend the titanium dioxide (TiO_2)
- for modiying the properties of rubber upon vulcanization
- in adhesives to modify rheology[47]
- in organic farming as a spray applied to crops to deter insect damage,
- as an indicator in radiological dating since kaolinite can contain very small traces of uranium and thorium

TALC

Talc is a clay mineral composed of hydrated magnesium silicate with the chemical formula $H_2Mg_3(SiO_3)_4$ or $Mg_3Si_4O_{10}(OH)_2$. In loose form, it, along with corn starch, is one of the most widely used substances known as baby powder (in the case of talc, often called simply talcum powder). It is the softest known mineral. As such, it can be easily scratched by a fingernail. It has a specific gravity of 2.5–2.8, a clear or dusty luster, and is translucent to opaque. Talc is not soluble in water, but is slightly soluble in dilute mineral acids. Its color ranges from white to grey or green and it has a distinctly greasy feel. Its streak is white.

Formation:

Talc is a metamorphic mineral that results from the metamorphism of magnesian minerals such as serpentine, pyroxene, amphibole, olivine, in the presence of carbon dioxide and water. This is known as *talc carbonation* and produces a suite of rocks known as talc carbonates.

Talc is primarily formed via hydration and carbonation via the following reaction;

serpentine 2 $Mg_3Si_2O_5(OH)_4$ + carbon dioxide3CO_2 → talc$Mg_3Si_4O_{10}(OH)_2$ + magnesite3 $MgCO_3$ + water3 H_2O

PROPERTIES: **Color** :Light to dark green, brown, white, grey
Odour: odourless
Insoluble in water

Uses

Talc is used in many industries—including paper making, plastic, paint and coatings, rubber, food, electric cable, pharmaceuticals, cosmetics, and ceramics.

Talc finds use as a cosmetic (talcum powder), as a lubricant, and as a filler in paper manufacture. Talc, with heavy refinement, has been used in baby powder, an astringent powder used to prevent rashes on the area covered by a diaper.

Topical astringents

Topical astringents are agents that cause skin cells or mucus membranes to contract or shrink, by precipitating proteins from their surface. When applied topically they dry, harden and protect the skin. They reduce bleeding from minor abrasions and are used to relieve skin irritations resulting from minor cuts, allergies, eczema, stretch marks, insect bites and so on. Topical astringents can be used in throat lozenges, mouthwash, creams, lotions, etc.

ZINC SULFATE

Zinc sulfate is the inorganic compound with the formula $ZnSO_4$ as well as any of three hydrates. It was historically known as "white vitriol". All of the various forms are colorless solids.

Production

Zinc sulfate is produced by treating virtually any zinc containing material (metal, minerals, oxides) with sulfuric acid.[3]

Specific reactions the reaction of the metal with aqueous sulfuric acid:

$$Zn + H_2SO_4 + 7\ H_2O \rightarrow ZnSO_4(H_2O)_7 + H_2$$

Pharmaceutical grade zinc sulfate is produced by treating high purity zinc oxide with sulfuric acid:

$$ZnO + H_2SO_4 + 6\ H_2O \rightarrow ZnSO_4(H_2O)_7$$

Properties			
Chemical formula	$ZnSO_4$		
Molar mass	161.47	g/mol	(anhydrous)

	179.47 g/mol (monohydrate) 287.53 g/mol (heptahydrate)
Appearance	white powder
Odor	odorless
Density	3.54 g/cm^3 (anhydrous) 2.072 g/cm^3 (hexahydrate)
Melting point	680 °C (1,256 °F; 953 K) decomposes (anhydrous) 100 °C (heptahydrate) 70 °C, decomposes (hexahydrate)
Boiling point	740 °C (1,360 °F; 1,010 K) (anhydrous) 280 °C, decomposes (heptahydrate)
Solubility in water	57.7 g/100 mL, anhydrous (20 °C) (In aqueous solutions with a pH < 5)[1]
Solubility	alcohols

Uses:

The hydrates, especially the heptahydrate, are the primary forms used commercially. The main application is as a coagulant in the production of rayon. Zinc sulfate is used to supply zinc in animal feeds, fertilizers, and agricultural sprays. Zinc sulfate, like many zinc compounds, can be used to control moss growth on roofs.[5] It is used as in electrolytes for zinc plating, as a mordant in dyeing, as a preservative for skins and leather and in medicine as an astringent and emetic.

POTASSIUM ALUM:

Potassium alum, **potash alum**, or **potassium aluminum sulfate** is a chemical compound: the potassium double sulfate of aluminium. Its chemical formula is $KAl(SO_4)_2$ and it is commonly found in its dodecahydrate form as $KAl(SO_4)_2 \cdot 12H_2O$. Alum is the common name for this chemical compound, given the nomenclature of potassium aluminum sulfate dodecahydrate. It is commonly used in water purification, leather tanning, dyeing,[4] fireproof textiles, and baking powder. It also has cosmetic uses as a deodorant, as an after shave treatment and as a styptic for minor bleeding from shaving.

PREPARATION:

Potash alum is prepared by mixing equi-molecular masses of potassium sulphate and aluminum sulphate in water followed by evaporation.

$$K_2SO_4 + Al_2(SO_4)_3 + 24H_2O \xrightarrow{\text{-------}} K_2SO_4.Al_2(SO_4)_3.24H_2O$$

Properties	
Chemical formula	$KAl(SO_4)_2 \cdot 12H_2O$
Molar mass	474.3884 g/mol
Appearance	white small crystals
Odor	watery metallic
Density	1.725 g/cm^3
Melting point	92 to 95 °C (198 to 203 °F; 365 to 368 K)
Boiling point	200 °C (392 °F; 473 K)
Solubility in water	14.00 g/100 mL (20 °C) 36.80 g/100 mL (50 °C)
Solubility	insoluble in acetone

Medicinal use:

- as an astringent/styptic and antiseptic.
- as a natural deodorant by inhibiting the growth of the bacteria responsible for body odor.[5]
- after shaving to prepare the skin
- to reduce bleeding in minor cuts and abrasions, nosebleeds, and hemorrhoids.

Topical anti-infectives

A drug may be classified by the chemical type of the active ingredient or by the way it is used to treat a particular condition. Each drug can be classified into one or more drug classes.

Topical anti-infective agents act by either killing or inhibiting the spread of the infectious agent. They include antibiotics, antibacterial, antifungal and antiviral agents.

Topical anti-infective agents are applied to the skin, on the nail, onto mucus membranes or vaginally, to treat the infection. These topical agents are available as creams, ointments, shampoos, powders and other forms, which can be applied locally on the area that needs to be treated.

BORIC ACID

Boric acid, also called **hydrogen borate**, **orthoboric acid** is a weak, monobasic Lewis acid of boron often used as an antiseptic, insecticide, flame retardant,

It has the chemical formula H_3BO_3 (sometimes written $B(OH)_3$), and exists in the form of colorless crystals or a white powder that dissolves in water. When occurring as a mineral, it is called sassolite.

Preparation

Boric acid may be prepared by reacting borax (sodium tetraborate decahydrate) with a mineral acid, such as hydrochloric acid:

$$Na_2B_4O_7 \cdot 10H_2O + 2\ HCl \rightarrow 4\ B(OH)_3\ [\text{or } H_3BO_3] + 2\ NaCl + 5\ H_2O$$

Properties	
Chemical formula	BH_3O_3
Molar mass	61.83 $g \cdot mol^{-1}$
Appearance	White crystalline solid
Density	1.435 g/cm^3
Melting point	170.9 °C (339.6 °F; 444.0 K)
Boiling point	300 °C (572 °F; 573 K)
Solubility in water	2.52 g/100 mL (0 °C) 4.72 g/100 mL (20 °C)
Solubility in other	Soluble in lower alcohols

solvents	moderately soluble in pyridine very slightly soluble in acetone

Uses

Boric acid can be used as an antiseptic for minor burns or cuts.

Boric acid is applied in a very dilute solution as an eye wash.

As an antibacterial compound, boric acid can also be used as an acne treatment.

The preservative in urine sample bottles in the UK is boric acid.

Boric acid solutions used as an eye wash or on abraded skin are known to be toxic, particularly to infants, especially after repeated use; this is because of its slow elimination rate.

HYDROGEN PEROXIDE:

Hydrogen peroxide is a chemical compound with the formula H_2O_2.

In its pure form, it is a colourless liquid, slightly more viscousthan water; however, for safety reasons it is normally used as a solution. Hydrogen peroxide is the simplest peroxide (a compound with an oxygen–oxygen single bond) and finds use as a weak oxidizer, bleaching agent and disinfectant.

Previously, hydrogen peroxide was prepared industrially by hydrolysis of the ammonium peroxydisulfate, which was itself obtained by the electrolysis of a solution of ammonium bisulfate (NH4HSO4) in sulfuric acid:

$$(NH4)2S2O8 + 2\ H2O \rightarrow H_2O_2 + 2\ (NH4)HSO4$$

Properties	
Chemical formula	H_2O_2
Molar mass	34.0147 g/mol
Appearance	Very light blue color; colorless in solution
Odor	slightly sharp

Density	1.11 g/cm^3 (20 °C, 30% (w/w) solution)[1] 1.450 g/cm^3 (20 °C, pure)
Melting point	−0.43 °C (31.23 °F; 272.72 K)
Boiling point	150.2 °C (302.4 °F; 423.3 K) (decomposes)
Solubility in water	Miscible
Solubility	soluble in ether, alcohol insoluble in petroleum ether

Medical Use:

Disinfectant

Hydrogen peroxide can be used for the sterilization of various surfaces, including surgical tools. H_2O_2 demonstrates broad-spectrum efficacy against viruses, bacteria, yeasts, and bacterial spores.

In general, greater activity is seen against gram-positive than gram-negative bacteria.

Higher concentrations of H_2O_2 (10 to 30%) and longer contact times are required for sporicidal activity.

Hydrogen peroxide is seen as an environmentally safe alternative to chlorine-based bleaches, as it degrades to form oxygen and water and it is generally recognized as safe as an antimicrobial agent by the U.S. Food and Drug Administration (FDA).

Historically hydrogen peroxide was used for disinfecting wounds, partly because of its low cost and prompt availability compared to other antiseptics. It is now thought to slow healing and lead to scarring because it destroys newly formed skin cells.[45] Only a very low concentration of H_2O_2 can induce healing, and only if not repeatedly applied.

It is absorbed by skin upon contact and creates a local capillary embolism that appears as a temporary whitening of the skin.

Cosmetic applications

Diluted H2O2 (between 1.9% and 12%) mixed with ammonium hydroxide is used to bleach human hair. The chemical's bleaching property lends its name to the phrase "peroxide blonde".Hydrogen peroxide is also used for tooth whitening and can be mixed with baking soda and salt to make a home-made toothpaste.

Hydrogen peroxide may be used to treat acne, although benzoyl peroxide is a more common treatment.

POVIDONE-IODINE

Povidone-iodine (**PVP-I**), brand name **Wokadine**, **Pyodine**, and **Betadine** is a stable chemical complex of polyvinylpyrrolidone (povidone, PVP) and elemental iodine. It contains from 9.0% to 12.0% available iodine.

This unique complex was discovered in 1955 at the Industrial Toxicology Laboratories in Philadelphia by H. A. Shelanski and M. V. Shelanski.[2] They carried out tests *in vitro* to demonstrate anti-bacterial activity, and found that the complex was less toxic in mice than tincture of iodine.

Human clinical trials showed the product to be superior to other iodine formulations.[3]

Betadine was immediately marketed, and has since become the universally preferred iodine antiseptic.

It is on the WHO Model List of Essential Medicines, the most important products needed in a basic health system.

Properties:

PVP-I is completely soluble in cold and mild-warm water, ethyl alcohol, isopropyl alcohol, polyethylene glycol, and glycerol.

Free iodine, slowly liberated from the povidone-iodine (PVP-I) complex in solution, kills eukaryotic or prokaryotic cells through iodination of lipids and oxidation of cytoplasmic and membrane compounds.

This agent exhibits a broad range of microbicidal activity against bacteria, fungi, protozoa, and viruses.

Slow release of iodine from the PVP-I complex in solution minimizes iodine toxicity towards mammalian cells.

USES:

Povidone-iodine is a broad spectrum antiseptic for topical application in the treatment and prevention of infection in wounds. It may be used in first aid for minor cuts, grazes, burns, abrasions and blisters. Providone also exhibits longer lasting antiseptic effects than tincture of iodine, due to its slow absorption via soft tissue.

POTASSIUM PERMANGANATE

Potassium permanganate is an inorganic chemical compound with the chemical formula $KMnO_4$. It Is a salt consisting of K^+ andMnO^-_4 ions. Formerly known as **permanganate of potash** or **Condy's crystals**, it is a strong oxidizing agent. It dissolves in water to give intensely pink or purple solutions, the evaporation of which leaves prismatic purplish-black glistening crystals.

Preparation:

Potassium permanganate is produced industrially from manganese dioxide, which also occurs as the mineral pyrolusite. The MnO_2 is fused with potassium hydroxide and heated in air or with another source of oxygen, like potassium nitrate or potassium chlorate.[3] This process gives potassium manganate:

$$2\ MnO_2 + 4\ KOH + O_2 \rightarrow 2\ K_2MnO_4 + 2\ H_2O$$

The potassium manganate is then converted into permanganate by electrolytic oxidation in alkaline media:

$$K_2MnO_4 + H_2O \rightarrow KMnO_4 + KOH + {}^1\!/_2\ H_2$$

Properties	
Chemical formula	$KMnO_4$
Molar mass	158.034 g/mol
Appearance	purplish-bronze-gray needles magenta–rose in solution
Odor	odorless
Density	2.703 g/cm^3
Melting point	240 °C (464 °F; 513 K) (decomposes)
Solubility in water	6.4 g/100mL (20 °C) 250 g/L (65 °C)
Solubility	decomposes in alcohol and organic solvents

USES:

As an oxidant, potassium permanganate can act as an antiseptic. For example, dermatitis, and fungal infections of the hands or feet.

Potassium permanganate is used extensively in the water treatment industry. It is used to remove iron and hydrogen sulfide (rotten egg smell) from well water.

In analytical chemistry, a standardized aqueous solution of $KMnO_4$ is sometimes used as an oxidizing titrant for redox titrations.

SILVER NITRATE

Silver nitrate is an inorganic compound with chemical formula AgNO3. This compound is a versatile precursor to many other silver compounds, such as those used in photography.

Synthesis:

Silver nitrate can be prepared by reacting silver, such as a silver bullion or silver foil, with nitric acid, resulting in silver nitrate, water, and oxides of nitrogen. Reaction byproducts depend upon the concentration of nitric acid used.

$$3\ Ag + 4\ HNO_3\ (\text{cold and diluted}) \rightarrow 3\ AgNO_3 + 2\ H_2O + NO$$
$$Ag + 2\ HNO_3\ (\text{hot and concentrated}) \rightarrow AgNO_3 + H_2O + NO_2$$

This is performed under a fume hood because of toxic nitrogen oxide(s) evolved during the reaction.

Properties	
Chemical formula	$AgNO_3$
Molar mass	169.87 $g \cdot mol^{-1}$
Appearance	White solid
Odor	Odorless
Density	4.35 g/cm^3 (24 °C) 3.97 g/cm^3 (210 °C)[1]
Melting point	209.7 °C (409.5 °F; 482.8 K)[1][3]
Boiling point	440 °C (824 °F; 713 K) decomposes[1]
Solubility in water	256 g/100 mL (25 °C)

Solubility	Soluble in acetone,[1]ammonia, ether, glycerol

USES:

Silver salts have antiseptic properties.

Fused silver nitrate, was traditionally called "lunar caustic".

Dentists sometimes use silver nitrate infused swabs to heal oral ulcers.

INHALANTS

Profile

Inhalants are chemical vapors that, when inhaled, cut off the brain's supply of oxygen, producing psychoactive (mind-altering) effects. These effects can vary greatly; some have depressant effects while others can be stimulants. Inhalants fall into the following four categories:

Volatile Solvents are liquids that vaporize when exposed to air at room temperature. They are found in numerous household cleaning products and industrial items.

Aerosols are sprays that contain solvents and propellants. They include spraypaint and various other types of sprays.

Gases
include those used in household and commercial products as well as medical anesthetics. Medical anesthetic gases include ether, chloroform,and nitrous oxide ("laughing gas" or "whippets"),the most abused of these gases.

Nitrites
Do not act directly on the central nervous system like most other inhalants; they primarily act to dilate blood vessels and relax the muscles. The two most commonly abused nitrites are amyl and butyl nitrite.

The effects of inhalants range from an alcohol-like intoxication and intense euphoria to vivid hallucinations, depending on the substance and the dose. Nitrous oxide is a gas when inhaled it can make people feel euphoric and relaxed. This happy feeling has led to it being nicknamed 'laughing gas'. Some people also experience hallucinations.

NITROUS OXIDE: 44.01

N2O. It is an oxide of nitrogen. At room temperature, it is a colourless, non-flammable gas colourless gas with a slightly sweet odour and taste. It is used insurgery and dentistry for its anaesthetic and analgesic effects..

Solubility:	1 L of the gas dissolves in 1.5 L water at 20°C; freely soluble in sulfuric acid; soluble in alcohol, ether, oils

PREPARATION:

nitrous oxide usually is produced using Humphry Davy's method of gently heating ammonium nitrate to decompose it into nitrous oxide and water vapor:

NH_4NO_3 (s) → 2 H_2O (g) + N_2O (g)

The key here is *gently* heating the ammonium nitrate to between 170°C and 240°C, because higher temperatures may cause the ammonium nitrate to detonate.

1. It is prepared by heating a mixture of sodium nitrate and ammonium sulphate.

   $2NaNO3 + (NH_4)_2SO_4 \rightarrow Na_2SO_4 + 2N2O + 4H2O.$

2. The reaction of urea, nitric acid and sulfuric acid according to the present invention produces nitrous oxide

   $2 (NH_2)_2CO + 2 HNO3 + H2SO4 \text{-----} > 2 N2O + 2 CO2 + (NH_4)_2SO_4 + 2H2O$

3. It is also formed by reducing nitric acid with stannous chloride and HCl.

   $2 HNO3 + 8 HCl + 4 SnCl2 \rightarrow 5 H2O + 4 SnCl4 + N2O$

PROPERTIES

Nitrous oxide is a colourless, non-toxic gas with a faint, sweet odour.

Nitrous oxide supports combustion by releasing the dipolar bonded oxygen radical,[Name?] thus it can relight a glowing splint.

N2O is inert at room temperature

USES:

There are three main legitimate uses of nitrous oxide:

- To numb pain during medical procedures such as dental work.
- In engines to increase their power output.

- In catering, in whipped cream aerosol cans to prevent the cream going 'bad'and in food packaging to prevent the food from rotting.
- Nitrous oxide is bacteriostatic (stops bacteria growth), fat soluble and does not leave residues, taste or odor, which makes it useful as an aerosol propellant in the dairy industry.
- it's primary medical use is sedative and analgesic
- nitrous oxide IS used as an anaesthetic in dental treatment,.

DENTAL PRODUCTS

Dental caries (Latin, "rot"), also known as **tooth decay** or a **cavity**, is an infection, bacterial in origin, that causes demineralization and destruction of the hard tissues of the teeth (enamel, dentin and cementum). It is a result of the production of acid by bacterial fermentation of food debris accumulated on the tooth surface.

Dental plaque is a biofilm, usually a pale yellow, that develops naturally on the teeth. Like any biofilm, dental plaque is formed by colonizing bacteria trying to attach themselves to the tooth's smooth surface.

The mechanisms of plaque formation include:

- Adsorption of proteins and bacteria to form a film on the tooth surface.
- The effect of van der Waals and electrostatic forces between microbial surfaces and the film to createreversible adhesion to the teeth.
- Irreversible adhesion due to intermolecular interactions between cell surfaces and the pellicle.
- Secondary colonisers attach to primary colonisers by intermolecular interaction.
- The cells divide and generate a biofilm.

Dentifrices are agents used along with a toothbrush to clean and polish natural teeth. They are supplied in paste, powder, gel or liquid form.
Abrasive substances in most commercially available toothpastes are now largely of inorganic origin, but in place of this, natural abrasives are widely used.

SODIUM FLUORIDE

Sodium fluoride is an inorganic chemical compound with the formula **NaF.** A colorless solid, it is a source of the fluoride ion in diverse applications. Sodium fluoride is less expensive and less hygroscopic than the related salt potassium fluoride.

PREPARATION:

NaF is prepared by neutralizing hydrofluoric acid or hexafluorosilicic acid (H_2SiF_6), byproducts of the reaction of fluorapatite ($Ca_5(PO_4)_3F$) (from phosphate rock) from the production of superphosphate fertilizer. Neutralizing agents include sodium hydroxideand sodium carbonate. Alcohols are sometimes used to precipitate the NaF:

$$HF + NaOH \rightarrow NaF + H_2O$$

From solutions containing HF, sodium fluoride precipitates as the bifluoride salt $NaHF_2$. Heating the latter releases HF and gives NaF.

$$HF + NaF \rightleftharpoons NaHF_2$$

Properties	
Molecular formula	NaF
Molar mass	41.988173 g/mol
Appearance	White to greenish solid
Odor	odorless
Density	2.558 g/cm^3
Melting point	993 °C (1,819 °F; 1,266 K)
Boiling point	1,704 °C (3,099 °F; 1,977 K)
Solubility in water	36.4 (0 °C); 40.4 (20 °C); 50.5 (100 °C) g/L[1]
Solubility	slightly soluble in HF,ammonia negligible in alcohol,acetone, SO_2,dimethylformamide

USES:

Fluoride salts is often added to drinking water and some food products for dental health.

The fluoride enhance the strength of teeth by the formation of fluorapatite, a naturally occurring component of tooth enamel

Toothpaste often contains sodium fluoride to prevent cavities.

Sodium fluoride is used as a cleaning agent (e.g., as a "laundry sour")

A variety of specialty chemical applications exist in synthesis and extractive metallurgy.

The fluoride is the reagent for the synthesis of fluorocarbons.

Sodium fluoride is used as a stomach poison for plant-feeding insects.

SAGAR BANSAL