

Chemistry in Everyday Life

Review

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Introduction

1. Universe was established as a result of a huge chemical explosion called the Big Bang. It took place about 13,7000 million years ago.



Fig. 1 Universe the moment after the Big Bang

Energy, space, time, electron, proton, neutron, fermions, Sun, Moon, stars, countless galaxies and various forms of matter originated in the universe due to the chemical process.

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2. Beginning of life forms appeared first on earth about 12000 million years back because of chemical changes.
3. Air on Earth surface is a mixture of many gases like Nitrogen (78%), Oxygen (21%) and other gases like water vapor, carbon dioxide, Neon, Helium, Argon etc.

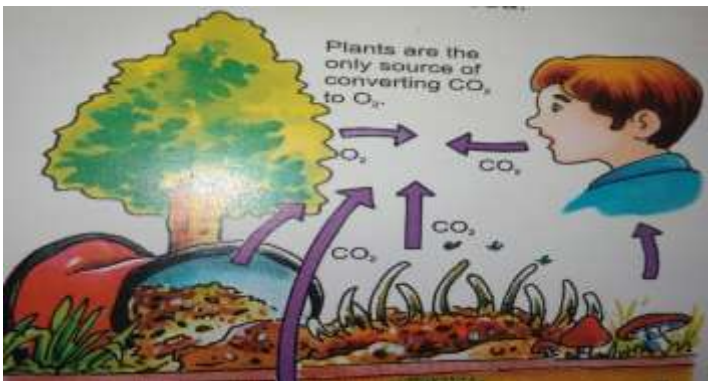
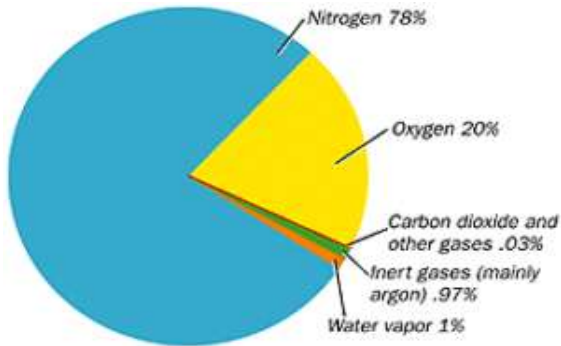


Fig. 2 Components of Air (left); breathing (Right)

4. Minerals are the natural chemicals from which the Earth's crust is made. All the substances in the Universe are made up from about 100 elements. Each element has its own unique chemical and physical properties.

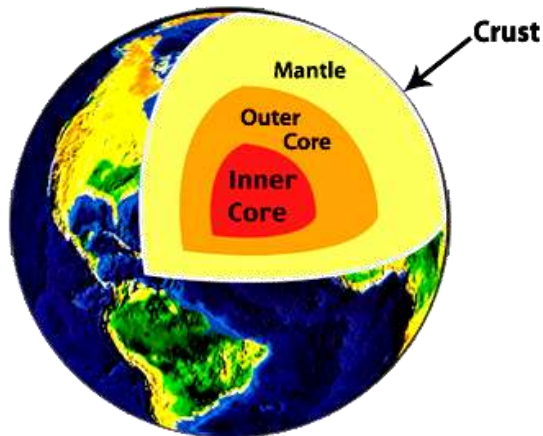


Fig. 3 Elements of Earth Crust

5. Water, which is one of the most essential natural resources, is used for drinking, preparing food, bathing, cleaning, manufacturing various industrial products, in production of Hydroelectric power, irrigation etc.



Fig. 4 Waterfall

6. Contribution of chemistry is seen directly or indirectly in each and every field of our daily life. For example: water, food, medicines, cosmetics, cloths, oils, fats, soaps and detergents, dyes, shelter, fertilizers, pesticides, polymers, match box, candle, paper, glass, cement, fuels, explosives preservatives, metal alloys and other miscellaneous use of chemistry in home appliances, mirror, bulb, thermometer, ripening agents, ink, paper, coolants, fire extinguishers, balloon, photography, solar panels, tea/coffee etc.
7. Finally, we can see life and civilization would have not been, what it is today without the quick innovative development of chemistry in each and every field of life.

Water

1. Water is a simple pure liquid substance composed of only two elements-hydrogen and oxygen. Two thirds of the body is water. It has no caloric value. Water is necessary for the functioning of every organ of the body.



Fig. 5 Drinking Water

Food

1. Food is the best insurance of long life. Food is the first weapons of preventive medicine. Food can furnish heat and energy, build and repair body tissues. The body is like a machine in many respects. So balanced or adequate diet is needs of the body.

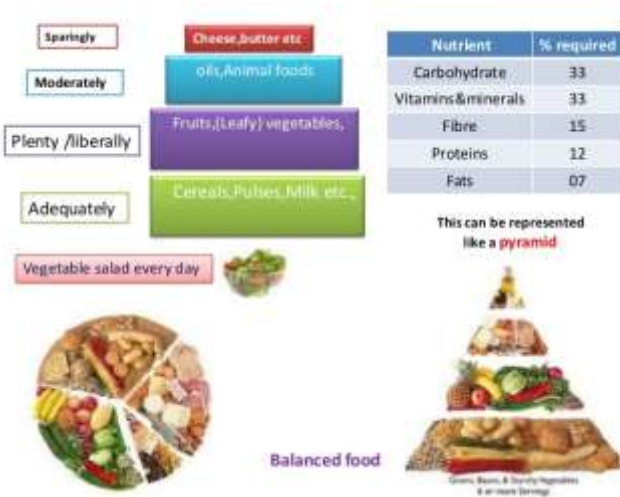


Fig. 6 Food Elements

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2. Nature makes most foods a combination of different chemical substances with different bodily functions to perform.
3. There are six chemical substances sometimes known as “the food sextet” can be classified as Carbohydrates, Fats, Proteins, Minerals, Vitamins and Water.

Food Preservatives

Specific chemicals are added to food for their preservation, enhancing their appeal and improving nutritive value.

Sr.	Compounds	Examples	Importance
(1)	Artificial sweetening agents	Aspartame, saccharin, sucralose, alitame	Their sweetness is higher than table sugar but they give less calories to body
(2)	Food preservatives	Table salt, table sugar, vegetable oil, sodium benzoate, sodium meta-bisulphite, salt of propionic acid, salt of sorbic acid	To prevent food from spoilage by microorganisms
(3)	Antioxidants	Citric acid, ascorbic acid, butylated hydroxy toluene (BHT), butylated hydroxy anisole (BHA)	They cause slow activity of oxygen and resulting food is preserved for long time.
(4)	Food colours	β -Carotene, caramel, tetrazine, arneto	They make food colourful.

Table: 1 Some important compounds are added to food Medicines / Drugs

1. Ayurvedic and Unani systems were used for health care in the ancient time but their effect were so slow. Nowadays, because of fast life style Allopathic medicines are used against various diseases and pains.

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Sl. No.	Drug	Uses	Example	Note
(1)	Antacids	Prevents acidity	Sodium hydrogen carbonate, mixture of aluminium hydroxide and magnesium hydroxide	Give relief only for the symptoms but do not control the cause.
(2)	Antihistamine Drugs	In treatment of acidity	As antacids : cimetidine, ranitidine. As antiallergic drugs : bromopheniramine, terfenadine	Act as antihistamine drugs, the antacids cannot be used as antiallergic drugs or the antiallergic drugs cannot be used as antacids.
(3)	Neurologically Active Drugs			They affect mainly the message transfer mechanism between nerve and receptor.
	(A) Tranquillizers	Relief from anxiety, stress, irritability.	Hyponitrid, phenelzine, chlorhydrate, meprobamate, derivatives of barbituric acid such as veronal, amytal, barbital, luminal, secobarbital	These drugs are sedative (sleep producing)

Table: 2 Therapeutic actions of different classes of drugs

(B) Analgesic drugs				
(i) Non-Narcotic	In treatment of body pain, fever, coagulation of blood	Paracetamol, aspirin		Patient does not suffer from sleepiness or excitement.
(ii) Narcotic	In treatment of body pain	Morphine		Patient suffers from sleepiness and excitement
(C) Antimicrobial Drugs				To prevent and to inhibit the pathogenic action of microorganisms
(A) Antibiotics	To prevent and inhibit the growth of microorganism	Penicillin, tetracycline, chloramphenicol, amino glycosides, ofloxacin, erythromycin		

(B) Antiseptic Drugs	In making tissues free from microorganisms	Potassium permanganate, tincture iodine, furacine, soframycin, boric acid, 0.2% aqueous solution of phenol		
(C) Disinfectants	In making inanimate objects free from microorganism	Chlorine water having 0.2 to 0.4 ppm concentration, dilute solution of sulphur dioxide, 1% of aqueous solution of phenol		
(5) Antifertility Drugs	Prevention of impregnation	Mixture of mestranol (estrogenic) and norethindrone (progestogenic)		These drugs are for females, these pills are taken orally.

Table: 2 Therapeutic actions of different classes of drugs

Cosmetics

Substances used for decorating, beautifying, or improving complexion of skin are called cosmetics. Various cosmetics used in daily life are as follows:

1. Cream
2. Perfume
3. Talcum powder
4. Deodorants
5. Sindoor
6. Kajal
7. Lipstick
8. Nail polish



Fig. 7 Cosmetics

1. Cream: Creams are classified as: cleansing creams, cold creams, vanishing creams, sunburn creams, bleach creams, and foundation creams. Creams are made of

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myrisyl palmitate, cetyl palmitate, almond oil, cod-liver oil, borax, vitamin A and E with some perfumery agents.

2. Perfume: Perfumes are prepared by mixing fragrant substances in suitable liquid or solid vehicles. The solvent for perfumes is a mixture of ethanol and water. Sandalwood oil, benzoin, glyceryl diacetate and cinnamic alcohol ester are mixed with natural or synthetic essences (fragrant substances) like anisaldehyde, linalool etc.
3. Talcum powder: Talcum powder is used to reduce irritation of the skin. Talcum powders contain talc (magnesium hydrosilicate $Mg_3(OH)_2 Si_4O_{10}$), Chalk, zinc oxide, zinc stearate, a suitable perfume, suitable antiseptic and cooling agents. Baby talcum powders contain zinc stearate and boric acid for antiseptic purpose.
4. Deodorants: Deodorants are applied primarily to mask the body odour (due to perspiration). Parachlorometaxyleneol and dichlorometaxyleneol having antiseptic are used as deodorants. In addition, aluminum salts like aluminum chloride, zinc oxide, and zinc stearate are also used.
5. Sindoor: It is a mixture of turmeric, alum, lead tetraoxide, cinnabar, vermilion (HgO) etc.
6. Kajal: It is made up from amorphous Carbon, antimony (Sb_2S_3) based or lead (PbS) based.
7. Lipstick: It is prepared from carnabawax ($>85^{\circ}C$), isopropyl myristate, lake of calcium, mica, silica, pearl particles, oils, antioxidants and emollients pigments.
8. Nail Polish: It is generally made from nitrocellulose, butyl acetate, and other ingredients like plasticisers, dyes and pigments.

Cloths

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Materials used to make cloths are called Fabrics. These fabrics are prepared in textile industry either from Natural fibres or Man made fibres. They are polymers or copolymers of simple organic compound monomers. For example: Cotton, Linen, Silk, Wool, Rayons, Nylons etc.



Fig. 8 Types of Cloths

Cleaning Agents

1. The chemical compounds used to remove dirt or oily materials from surfaces are called cleaning agents.
2. Soaps and synthetic detergents are important cleaning agents.

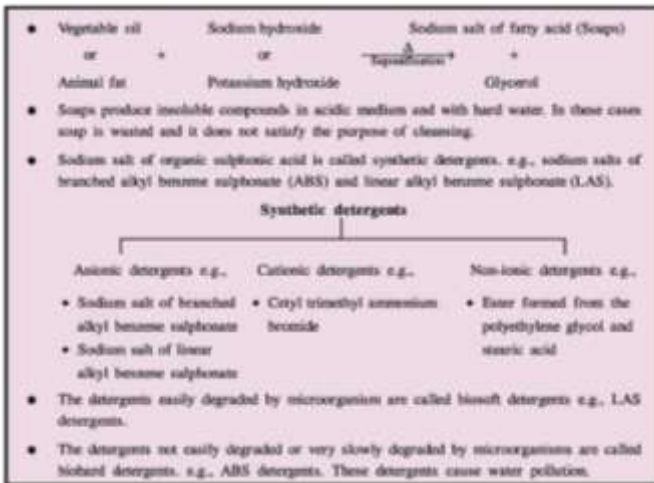


Fig. 9 Cleaning Agents



Fig. 10 Cleaning Agents

Dyes

A dye is a coloured substance that can be applied in solution or dispersion to a substrate, giving it a coloured appearance. The process of applying colour is called dyeing and it gives a fast colour to the fabric. There is no effect of soap, detergent or bleaching on such fast colours. Dyes used for dyeing paper, plastic and foods usually disperse throughout the matter dyed. In these types of dyes, there is no need of reactive groups which can make strong bonds with fabric. Dyes used as a food colour should be harmless for humans. Food-colours are therefore strictly restricted for use by Law.

Classification of Dyes

(1) Natural dyes (2) Synthetic dyes

In nature, in indigo plant there is a dark blue coloured substance called indigo within the hollow space of branches of the plant. The red dye called alizarin is also obtained from plants. Natural dyes can be found only in limited quantities from plants while many synthetic dyes can be prepared from aromatic compounds found in coal-tar or petroleum. For instance, Congo Red, Malachite Green etc. are synthetic dyes.



Fig. 11 Different types of Dyes

Fertilizers

1. A fertilizer is a substance used to supply essential elements like nitrogen, phosphorus, potassium, to the soil. The soil must have the sufficient amount of these elements to produce high yield of crop.

The essential qualities of good fertilizer are as follows:

2. Nitrogenous Fertilizers: Ammonium sulphate $[(NH_4)_2SO_4]$, Calcium cyanamide $[CaNCN]$
3. PhosphorousFertilizers: Super phosphate, Nitro phosphate
4. Potash Fertilizers: Potassium sulphate, Potassium nitrated
5. NP Fertilizers: Dihydrogen ammoniated phosphate, Calcium super phosphate.
6. NPK: Nitrogen, Phosphorous, Potassium



Fig. 12 Fertilizers

Ceramics

Ceramics are obtained by heating at high temperature clay or Kaolin ($\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$). Earlier ceramics were used in the traditional production of porcelain tiles, bricks etc. Nowadays ceramic having various types of characteristics are manufactured.

Classification and uses

1. Clay ceramics: uses to produce porcelain, pottery, table wares, sanitary fittings, building bricks, tiles and sewer pipes.
2. Glass ceramics: For preparing kitchen wares
Abrasiveceramics: Cutting and grinding tools which contain silicon carbide and tungsten carbide.
3. Refractory ceramics: Industrially used for refractory bricks used as furnace linings.

Super Conductor Ceramics

If during the production of ceramics, oxides of calcium, barium or copper are added, a super conductor property is attained, these types of ceramics are called super conductor ceramics. Such ceramics are used in the production of electrical power transmission, high-speed switching and signal

transmission for computer and in high-speed magnetically elevated trains (trains which move on air without rails)



Fig.13 Products of Ceramics

Micro Alloys

1. When a metal mixes with other metal only at surface level and not is complete metal mixture, this type of mixed metal is called micro alloy.
2. By adding niobium, titanium and vanadium in the micro alloy of steel, some important properties like strength, toughness, formability and weld ability are attained. It can be given new shape by pouring into moulds. It has excellent resistance against abrasion and corrosion. It does not deform by heavy weights placed over it. For such reasons steel micro alloys are used for various purposes.
3. Micro alloy prepared from aluminium and lithium has less weight by 7% and is used for production of aeroplanes. Even in space, it does not corrode.
4. 24 karat gold is traditionally not used to manufacture jewellery as it cannot withstand everyday wear. Recently a number of micro alloys high karat gold qualities have been marketed with a gold content of 99.55 percent or even higher. These micro alloys are found to possess improved hardness and strength and can be used in jewellery for everyday use. In some of the cases the micro alloyed gold

is found to show physical properties very similar to platinum.

Fuels

1. Fossil Fuels: For our day-to-day energy needs we are heavily dependent on fossil fuels which include: coal, petroleum and natural gas these are carbon compounds formed as a result of decomposition and decaying of dead organic matter that got buried under the earth millions of years ago, this is considered as non-renewable energy source.



Fig. 13 Types of Fuels

Solid Fuels

The solid fuel is polyurethane or poly butadiene, while oxidising agent is solid ammonium perchlorate. This blend is used in rockets. This solid fuel can be made more reactive by adding aluminium or magnesium (finely graded) powder in it. Also a paste of nitro glycerine and nitrocellulose is also used as a propellant. Once a combustion process of solid fuel starts, it is continuous with a fixed speed cannot be controlled abruptly.

Liquid Fuels

Fuels such as kerosene, alcohol, hydrogen or liquid hydrogen and oxidants such as liquid oxygen, liquid dinitrogen tetra oxide or nitric acid are used as propellants. Once the combustion of liquid fuel starts it continues with a fixed rate.

This rate can be controlled easily through several control-switches. As compared to solid fuel, liquid gives rocket a more powerful stokes. With liquid fuels like methyl nitrate, nitro methane and hydrogen peroxide, there is no need of an oxidant.

Pesticides

Pesticides are very useful chemicals in raising agricultural yield by protecting the crop from insects, fungi, bacteria, viruses, rats etc. These are sometimes also useful in the field of public health by preventing many diseases caused by harmful organism.

Some common pesticides

1. DDT
2. Gammexane
3. Malathion, Parathion, Chloropyrifos
4. Pyrethroids, pyrethrum, Azadirachin
5. Atrazine, picloram, propazine
6. Strychnine, sodium fluoro acetate
7. Alpha naphthyl urea etc.



Fig. 14 Spraying Pesticides

Miscellaneous uses of Chemistry

1. Mirror: Glass surface coated on its back with a variety of metals such as silver, gold, chrome, mercury, or copper film and two or more layers of waterproof paint for protection of acid and moisture.
2. Balloon: A gas balloon is a balloon that flies in the air because it is filled with a gas less dense than air or lighter than air (such as helium or hydrogen). It is tied to a thread to prevent it from flying up in the air.
3. Plastics: These are the wonder substance that has invaded human lives in a big way. Plastics can be moulded and remoulded to make various articles (e.g., Comb to Computer, tubs, and buckets to eating plates, micro-wave ovens to cooking) plastics are non-biodegradable.

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4. Refrigerants: Refrigerants are the substances used in refrigerators. They consist of mainly the chlorofluorocarbons and hydrochlorofluorocarbons.
5. Paints: In the olden days people used eco-friendly substances like quick lime and vegetable colours as paints. Synthetic paints and emulsion have now replaced the natural substances.
6. Papers, Ink, Fire extinguishers, Photography, Coolants, ripeningagents, Oil and Fats, Thermometer, Glass and Cement are the gifts of chemistry.
7. Synthesis of creative and destructive explosives used in security of nation has become possible through chemistry. In this way chemistry is closely associated with our daily life.
8. Noble prize given for discoveries every year is due to the capitals earned from nitro glycerine used in Dynamite by Alfred Noble.

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