# 14. Substances in Common Use

- **Important salts in day to day life -NaCl, $NaHCO_3$, $Na_2CO_3$**
- **Radioactive substances** - **Some chemical substances in day to day life**

**Can you recall?**

1. What are the important substances that we use in day to day life? For what purposes do we use them?
2. How are the various substances in day to day use classified from the scientific point of view?

We use various substances in day to day life. We have previously learnt in some detail about a few of them, their uses and constituents and the method of their preparation.

**Classify**

The names of some substances in everyday use are given below. Classify them into groups like acids, bases, metals, non--metals and salts.

**Substances :**Table salt, soap, toothpaste, baking soda, water, curds, milk, alum, iron, sulphur, washing powder.

## Important salts in daily life

**Can you tell?** What are salts?

The ionic compounds which do not contain $H^+$ and $OH^-$ ions and contain only one kind of cation and anion are called simple salts. For example, $Na_2SO_4$, $K_3PO_4$, $CaCl_2$.

Inorganic substances occur naturally in the form of salts rather than acids or bases. About 80 million tons of salts are added every year to seawater. Therefore, the sea is said to be a rich source of salts. In fact, the sea is a rich source of several salts of various elements such as chlorine, sodium, magnesium, potassium, calcium, bromine., However, we also use other salts apart from these in day to day life. Let us learn more about them.

**Do you know?**

The important salts found in sea water

1. Sodium chloride
2. Magnesium chloride
3. Magnesium sulphate
4. Potassium chloride
5. Calcium carbonate
6. Magnesium bromide

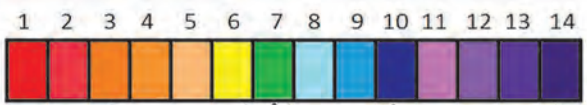
**Try this**

Prepare saturated solutions of some salts and put 2-3 drops of the universal indicator in them and note your observations in the table alongside.

| Salt | Original color (of the solution) | Color on addition of universal indicator | pH value | Nature |
|---|---|---|---|---|
| Table salt | Colorless | Green | 7 | Neutral |
| Soap | | | | |
| Washing soda | | | | |
| Baking soda | | | | |
| Baking powder | | | | |
| POP | | | | |

**Can you tell?**

1. What is the strip shown below? What is it used for?
2. How is it determined whether a substance is acidic, basic or neutral?
3. Make a list of substances in day to day use in accordance with their pH value (1 to 14).




We have seen in the previous lesson that a salt is neutral when its pH value is 7. Such a salt is made from a strong acid and a strong base. The pH value of a salt made from a strong acid and a weak base is less than 7 and it is acidic. On the other hand, the pH value of a salt made from a weak acid and strong base is more than 7 and it is basic. Let us now learn about some salts of everyday use.

## Sodium chloride (Table salt- NaCl)

Table salt, or common salt, which gives a salty taste to food, is the most used of all salts. Its chemical name is sodium chloride. Sodium chloride is formed by a neutralization reaction between sodium hydroxide and hydrochloric acid.

We have already seen that this is a neutral salt and that the pH value of its aqueous solution is 7.

### Properties and uses

1. Common salt is a colourless and crystalline ionic compound. There is no water of crystallization in its crystalline structure.
2. It is a neutral salt, salty in taste.
3. This compound is used for the production of salts like $Na_2CO_3$, $NaHCO_3$.
4. When an electric current is passed through a saturated solution of sodium chloride (brine) it is electrolysed and hydrogen gas is released at the cathode while chlorine gas is released at the anode. This method is used for production of chlorine gas. In this method an important basic compound NaOH is formed in the cell.

$$2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2\uparrow + H_2\uparrow$$

5. When salt is heated to a high temperature (about 800 $^0$C), it melts. This is called the fused state of the salt.
6. When fused salt is electrolysed, chlorine gas is released at the anode and liquid sodium metal, at the cathode.

**Do you know?**

Salt is also obtained from a certain type of rock. This salt is called rock salt. The mineral halite and Himalayan rock salt are some examples of rock salt. This salt is used to treat many diseases.

The 25% aqueous solution of salt is called saturated brine. When $\frac{1}{5}$ of this solution is evaporated the dissolved salt gets crystallized and salt gets separated from the solution.

## Sodium bicarbonate (Baking soda – $NaHCO_3$)

Your mother brings cake on your birthday or makes it at home. She also makes crisp *bhaji*. Have you ever asked your mother what makes the cake porous or the *bhaji* crisp?

Mother adds baking soda in the batter. Baking soda is a white non-crystalline powder. Its chemical name is sodium hydrogen carbonate or sodium bicarbonate and its molecular formula is $NaHCO_3$.

### Properties and uses

1. $NaHCO_3$ reacts with moist litmus paper and red litmus turns blue which means that it is basic in nature.
2. It is used to make bread, cake, *dhokla*.
3. Being basic in nature it is used to reduce acidity in the stomach.
4. $NaHCO_3$ is used to make the active substance $CO_2$ in the fire extinguisher.
5. Baking soda is used to clean an oven.

**Research**

What are the constituents of baking powder? Where is the baking powder used?

## Bleaching powder (Calcium oxychloride $CaOCl_2$)

**Try this**

Take a piece of coloured cloth. Put some saturated solution of bleaching powder on a small part and observe.

What change takes place in the colour of the cloth?

Tap water has a typical strong odour in the rainy season. Have you experienced it? Water in a swimming pool also has the same odour. It is the odour of the chlorine gas used to destroy the microbes in the water. Chlorine gas is a strong oxidizing agent and therefore, it has a strong disinfecting as well as bleaching action.

Chlorine is inconvenient to handle because of its gaseous state. Instead, the solid bleaching powder which has the same effect is more convenient to use. Bleaching powder undergoes slow decomposition due to the carbon dioxide in air and chlorine gas is released. Bleaching powder gets its property because of this release of chlorine gas.

$$CaOCl_2 + CO_2 \rightarrow CaCO_3 + Cl_2 \uparrow$$

Bleaching powder is obtained by the reaction of chlorine gas with slaked lime.

$$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$$


**Find out**

1. About various types of bleaching powder available in the market.
2. What distinguishes these different types?

**Properties and uses**

1. Bleaching powder is a yellowish white coloured solid substance.
2. Its chemical name is calcium oxychloride.
3. It has a strong odour of chlorine gas.
4. It is used for disinfection of drinking water at the water works and the water in the swimming pool.
5. It is used for bleaching of cloth.
6. It is used for disinfection by the road side and garbage sites.
7. Dilute sulphuric acid and dilute hydrochloric acid react rapidly with bleaching powder to release chlorine gas completely.
   $CaOCl_2 + H_2SO_4 \longrightarrow CaSO_4 + Cl_2 \uparrow + H_2O$
8. Calcium oxychloride reacts slowly with carbon dioxide to form calcium carbonate and chlorine.

## Washing soda $Na_2CO_3.H_2O$

**Try this**

**Procedure :** Take a sample of water from a well or a bore-well, in a beaker, add some soap to it and stir. Then take another sample, add one spoonful of washing soda and stir; then add some soap and stir again. Observe the changes that take place. Which changes did occur? Why do they occur?

The hard water from a well or a bore-well becomes soft on adding washing soda and we come to know this from the lather formed on it. The hardness of water is due to the presence of chlorides and sulphates of calcium and magnesium in it. $Na_2CO_3$ is added to it to soften such water and make it suitable for use. The reaction with $Na_2CO_3$ causes the formation of insoluble carbonate salts of magnesium and calcium.

$$MgCl_2\,(aq) + Na_2CO_3\,(s) \rightarrow MgCO_3(s) + 2\,NaCl\,(s)$$

Sodium carbonate is a water soluble salt of sodium. Crystalline sodium carbonate,on keeping, loses its water of crystallization readily and a white powder is obtained. This powder is called washing soda.

$$Na_2CO_3.10\,H_2O \xrightarrow{-\,H_2O} Na_2CO_3.H_2O$$

white powder (washing soda)

**Properties and uses**

1. Washing soda is a whitish and odourless powder at room temperature.
2. Litmus has a blue color in its aqueous solution.
3. It is hygroscopic, that is, it absorbs moisture if left exposed to air.
4. It is used mainly for washing clothes.
5. Sodium carbonate is used in the glass and paper industry and also in refining of petrol.

Write down the reaction of $Na_2CO_3$ with $H_2SO_4$

## Some crystalline salts

You have learnt about water of crystallization in the previous chapter. We use various salts which contain water of crystallization.

## Some substances in our daily use which contain water of crystallization

1. Alum (Potash alum – $K_2SO_4.Al_2(SO_4)_3.24H_2O$ )
2. Borax ($Na_2B_4O_7.10H_2O$)
3. Epsom salt (Magnesium sulphate $MgSO_4.7H_2O$)
4. Barium chloride ($BaCl_2.2H_2O$)
5. Sodium sulphate (Glauber's salt $Na_2SO_4.10\ H_2O$)

Collect more information on the properties and uses of the substances listed above.

You have learnt that alum is used in the process of water purification. Because of property of coagulation, the solid impurities in water come together, become heavy and settle to the bottom. As a result, the water above becomes clear.

Blue vitriol is used in the blood test for diagnosing anaemia. In the Bordeaux mixture which is used as a fungicide on fruits like grapes, musk melon, slaked lime it is used with blue vitriol.

## Soap

**Can you recall?**

1. What are detergents?
2. Which chemicals and apparatus will you use in the laboratory for making soap?

When oil or animal fat is boiled with an aqueous solution of sodium or potassium hydroxide, sodium or potassium salts of carboxylic acids (fatty acids) are formed. These salts are called soap. When soap is mixed with hard water calcium and magnesium salts of fatty acids are formed. These being water insoluble they form a precipitate and that is why lather is not formed.

**Complete the table by writing the differences between bathing soap and washing soap.**

| Bathing soap | Washing soap |
|---|---|
| 1. High grade fats and oils are used as the raw material. | 1. Low grade fats and oils are used. |
| 2. | 2. |

## Radioactive substances

Elements with a high atomic number such as uranium, thorium, radium have a property of spontaneously emitting invisible, highly penetrating and high energy radiation. This property is called radioactivity. A substance having this property is called a radioactive substance. The nucleus of radioactive elements is unstable. Radiation occurs from an unstable nucleus. Radioactive substances are relevant to our day to day life. However, before going further, let us learn something more about these substances.

Three types of radiation are given out by radioactive substances. These are alpha, beta and gamma rays.

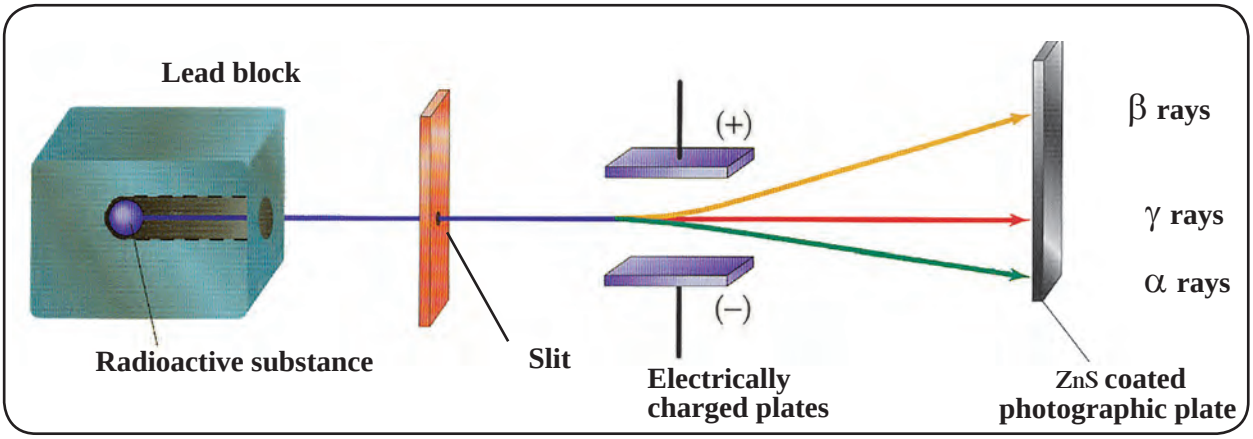
## An introduction to scientists

The French scientist Henry Becquerel was studying pitch-blende, a compound of uranium. He had kept some unused photographic plates in a cardboard box in a drawer. A key was lying on the box. He happened to leave the uranium compounds on it. After a few days, he washed the plates only to find that the plates were cloudy and showed the shape of the key. As this incidence occurred in the dark, Becquerel inferred that the uranium compounds might be emitting from their interiors, rays like x-rays which penetrate substances. These rays were called Becquerel rays. After a few days, Madame Curie discovered similar properties in compounds of thorium.

## Nature of radioactive radiation

In 1889 Rutherford discovered that the radiations emitted by radium were of two types. They are called alpha and beta radiation. Willard discovered the third type namely gamma radiation.

When these rays are allowed to pass through two oppositely charged plates they get separated. This method was introduced by Rutherford in 1902. Rutherford and Willard studied the radiation emitted by radioactive substances. For this purpose, the rays were allowed to pass through an electrical field and a photographic plate was held in their path. It was found that the radiation was divided into three types. One type of radiation deviated slightly towards the negatively charged plate, while the second type of radiation deviated substantially towards the positively charged plate. However, the third type of radiation did not deviate at all in the electrical field. The rays which deviated slightly toward negatively charged plate are called alpha rays, those which deviate substantially towards the positively charged plate are called beta rays and those which do not deviate at all are called gamma rays.




**14.1 Alpha, beta and gamma rays**

**An introduction to scientists :** Ernest Rutherford (1871-1937), a scientist from New Zealand did research on radioactivity under the guidance of J.J. Thomson at the Cavendish Laboratory at Cambridge and McGill University, Canada. He showed that the nitrogen atom could be split by bombarding it with alpha particles. This experiment ushered in a new era in the field of Physics.

## Characteristics of alpha, beta and gamma rays

| Sr. No. | Property | Alpha rays ($\alpha$) | Beta rays ($\beta$) | Gamma rays ($\gamma$) |
|---|---|---|---|---|
| 1. | Nature | Current of alpha ($He^{++}$) particles | Current of beta ($e^{-}$) particles | Electromagnetic radiation |
| 2. | Mass | 4.0028 u | 0.000548 u | No mass |
| 3. | Charge | +2 | −1 | Electrically neutral |
| 4. | Velocity | 1/5 to 1/20 times the velocity of light | 1/5 to 9/10 times the velocity of light | Same as the velocity of light |
| 5. | Deviation in the electric field | Attracted toward negatively charged plate | Attracted toward positively charged plate | Not deviated |
| 6. | Penetrating power | Can penetrate an aluminum sheet of thickness < 0.02 mm | Can penetrate an aluminium sheet of thickness 2mm, which is 100 times the penetration of alpha particles. | Can penetrate 15 cm thick lead screen which is 10,000 times the penetration of alpha particles |
| 7. | Ionization power | Very high | Low | Very low |
| 8. | Power to produce fluorescence | Very high | Very low | Low |

**Uses of radioactive isotopes :** It is a misconception that radioactive elements are used only for making an atom bomb. Radioactive isotopes are used in various fields such as scientific research, agriculture, industry, medicine, etc. Radioactive substances are used in two ways.

**a. By using the radiation alone.**

**b. By using the radioactive element itself.**

**Natural radioactivity :** Generally, the elements with atomic numbers from 82 to 92 are found to radiate spontaneously in nature. These are called natural radioactive elements.

**Artificial radioactive elements –** The couple Fredric Joliot Curie and Irene Joliot Curie first invented induced radioactivity. The radioactive elements produced in the nuclear fission processes brought about in the laboratory by bombardment of particles are called artificial radioactive elements. They were awarded the Nobel prize in 1935 for this invention.

## Radioactive isotopes are used in various fields as follows

### 1. Industrial field

**Radiography –** Internal cracks and voids in cast iron articles and iron solder can be detected with the help of gramma rays. For this purpose, isotopes like cobalt-60, iridium-192 are used in the radiography camera. This technique is used for detecting flaws in metal work.

**Measurement of thickness, density and level-** It is necessary to maintain the required thickness in the manufacture of aluminium, plastic, iron sheets of differing thickness. In the manufacturing process, a radioactive substance is placed on one side and an instrument to measure radiation on the other. The radiation read by the measuring instrument varies with the thickness of the sheet. Material inside a packing can also be examined by the same technique.

**Luminescent paint and radioluminescence –** The radioactive substances radium, promethium, tritium with some phosphor are used to make certain objects visible in the dark, for example, the hands of a clock, and certain other objects. Krypton-85 is used in HID (High Intensity Discharge) lamps while promethium-147 is used in portable X-ray units as the source of beta rays.

**Use in Ceramic articles –** Luminous colours are used to decorate ceramic tiles, utensils, plates, etc. Earlier uranium oxide was used in these paints.

### 2. Field of agriculture

1. The genes and chromosomes that give seeds properties like fast growth, higher productivity, etc. can be modified by means of radiation.
2. The radioactive isotope cobalt-60 is used for food preservation.
3. Onions, potatoes are irradiated with gamma rays from cobalt-60 to prevent their sprouting.
4. Strontium-90 is used as a tracer in the research on various crops.

### Medical science

1. **Polycythemia :** The red blood cell count increases in the disease polycythemia. Phosphorus-32 is used in its treatment.
2. **Bone cancer :** Strontium-89, strontium-90, samarium-153 and radium-223 are used in the treatment of bone cancer.
3. **Hyperthyroidism :** Enlargement of thyroid gland, weight loss in spite of appetite, insomnia are the symptoms of hyperthyroidism. It occurs due to overproduction of hormones by the thyroid gland. Iodine-123 is used in the treatment of hyperthyroidism .
4. **Tumour detection :** Boron-10, iodine-131, cobalt-60 are used in treatment of brain tumour, while arsenic-74 is used in detection of small tumours in the body.

## Hazards of radioactive substances and radiation

1. The central nervous system is affected by radioactive radiations.
2. Hereditary defects are generated by bombardment of radiation on D.N.A in the body.
3. Radioactive radiation can penetrate the skin, and causes diseases like skin cancer, leukemia.
4. The radiative pollutants created due to explosions enter the body through air and it is difficult to control them.
5. The radioactive pollutants released in the sea enter the bodies of fishes and through them enter the human body.
6. The radioactive paint on the watch can cause cancer.
7. The radioactive isotopes strontium-90 can enter the body through plants, fruits, flowers, cereals, milk, etc. and cause diseases like bone cancer, leukemia.

**A peep into the past**

**Chernobyl disaster :** On 26th April 1986 the graphite reactor in the Chernobyl atomic power plant exploded, and suddenly the radioactive isotopes and radiation came out. Due to this episode radioactive isotopes entered the human body through water and land and caused genetic disorders. These got carried further into the next generation. Thyroid disorders increased in children as well as adults. As a result, the incidence of throat diseases is greater there than in other places.

## Some chemical substances in day to day life.

The food that we eat, objects like clothes, utensils, watches, medicines and other objects are made from various kinds of matter. These affect our health directly or indirectly. Let us learn about some such substances.

**Can you tell?**

1. A sweets shop looks attractive because of the colorful sweets displayed there. Which colours are used in these substances?
2. A doctor gives you medicines when you fall ill. What are the medicines made from?

### Food colours and essences

Food colours are mixed in most soft drinks and foodstuffs available in the market. These food colours are in the form of powders, gels and pastes. Food colours are used in domestic as well as commercial products. Certain colours and essences are added to ice cream, ice candies, sauce, fruit juices, cold drinks, pickles, jams and jelly. Food colors are often found to be added to packaged meat (chicken, mutton), chilli powder, turmeric, sweets and other similar substances so as to give them a good colour.

**14.2 Colourful eatables**

**Harmful effects of artificial food colours**

1. Food colours added to pickles, jam and sauce contain small quantities of lead and mercury. These can be harmful for those who consume these products on a regular basis.
2. Diseases like ADHD (Attention Deficit Hyperactivity Disorder) can affect children due to excessive consumption of foods with added food colours.

**Always remember**

Food colours are natural as well as artificial. The food colours prepared from seeds, beetroot, flowers and fruit concentrate are natural. Tetrazene, sunset yellow are artificial food colours used extensively. However, over-consumption of artificial food colours can be detrimental to health. Therefore, usage of natural food colours is always good.

## Dye

The coloured substance which on applying to an article, imparts that colour to the article, is called a dye. Generally, a dye is soluble in water and insoluble in oil. Often a mordant has to be used to fix the colour after dying a cloth.

Plants are the main source of colour for preparing a natural dye. Roots, leaves, flowers, bark, fruits, seeds, fungus and pistil are used for making dyes. In Kashmir a very good dye is made from saffron, which is used to dye fibres from which saris, shawls and dresses are made. These are very costly. Many people are engaged in this occupation as their means of earning a livelihood.The use of henna leaves to colour hair is safe for health.

William Henry Perkin invented an artificial dye in 1856. Artificial dyes are classified into many types on the basis of chemical properties and solubility. Petroleum products and minerals are used in these dyes.

### Uses

1. They are used for colouring cloth and hair.
2. Fluorescent colours are used to make street boards that are visible at night.
3. Dyes are used to polish leather shoes, purses and chappals.

### Adverse effects

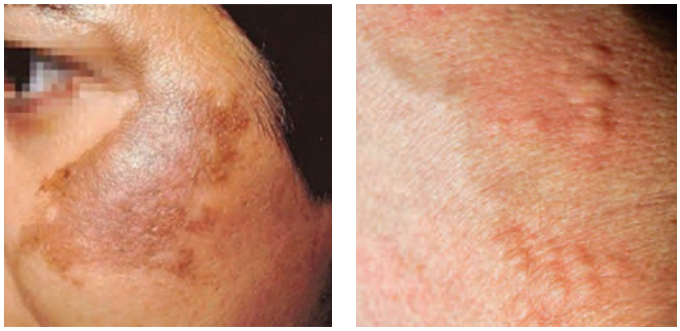
1. Dyeing hair can have adverse effects like hair fall, damage to hair texture, burning of skin, adverse effect on eyes, etc.
2. Lipstick contains a dye named carmine. It does not affect lips but causes stomach disorders.
3. Excessive use of plants for making natural dyes results in deterioration of the environment.

## Artificial colours

**Can you tell?**

1. What problems do you get after playing colours on Rang Panchami? Why?
2. Which colors will you use to prevent the occurence of these problems?
3. What problem do you have on painting the house and furniture?

We regularly use artificial colours on Rang Panchami, decorating the housd by painting. The red color use on Rang Panchami is very dangerous. It contains a high proportion of mercury in it. This poses risks like blindness, skin cancer, asthma, itching of the skin, permanent blocking of sweat pores etc. Therefore, it is necessary that artificial colours are used cautiously.



**14.3 Harmful effects of artificial colours**

**Find out**

Find out the hazardous chemicals present in the artificial colours and their harmful effects.

**Try this**

Prepare colours for Rang Panchami from natural resources such as beet root, flowers of flame of forest, spinach, flame tree (gulmohar) and protect your health by using these.

## Deodorant

Body odour is caused by the bacterial decomposition of the sweat. A deodorant is used to prevent this odour. Everybody likes a fragrant deodorant to remain fresh the whole day. School children use deo on a large scale. This large scale use of deo in adolescent is a result of the advertisements shown on television. Deodorants contain parabens (methyl, ethyl, propyl, benzyl and butyl) and also alcohol in large proportions. Aluminium compounds and silica are also used.

**1. Ordinary deo –** It contains a smaller proportion of aluminium. It decreases the odour of the sweat.

**2. Antiperspirant deo –** This decreases the extent of sweating. It contains about 15% of aluminium chlorohydrate. It clogs the sweat pores on the skin.

**3. Clinical deo –** Some people sweat heavily and it has harmful effects on the skin. Clinical deo is meant for such people. It contain 20 to 25% aluminium. It is used during the night.

**Harmful effects**

1. Aluminium – Zirconium compounds are the most harmful chemicals in the deodorant. Disorders like headache, asthma, respiratory disorders, heart disease are likely to occur without our knowledge.
2. There is a possibility of various skin disorders and also skin cancer due to the aluminium chlorohydrates.

## Teflon

Teflon is used for coating cooking utensils and industrial equipment to avoid sticking. It is the polymer of tetrafluoroethylene. Roy J. Plunkett discovered it in 1938. Its chemical name is polytetrafluoroethene $(C_2F_4)_n$.

**14.4 Teflon coating**

**Can you tell?** What is the property of Teflon because of which it is used in nonstick ware ?

### Properties

1. The atmosphere and chemical substances have no effect on Teflon.
2. Neither water nor oil will stick to Teflon coated articles.
3. High temperatures do not affect Teflon as its melting point is 327 $^0$C.
4. Teflon coated articles are easy to clean.

### Uses

1. Teflon is a poor conductor of electricity. Therefore, Teflon cladded wires and parts are used in high technology electronics instruments.
2. It is used for making non-stick kitchenware.
3. The colored metal sheets of two-wheelers and four-wheelers are given a Teflon coating to protect them from damage due to high temperature and rain.

**Powder coating :** Powder coating is a method of applying a layer harder than paint on the surface of an iron object to prevent rusting. In this method, a polymer resin, a pigment and some other ingredients are melt mixed, cooled and ground into a uniform powder. This powder is sprayed on the polished metal surface by electrostatic spray deposition (ESD). In this method, the particles of the powder are given an electrostatic charge due to which a uniform layer of the powder sticks to the metal surface. Then the object is heated in the oven along with the coating. A chemical reaction occurs in the layer, resulting in the formation of long cross-linked polymeric chains. This powder coating is highly durable, hard and attractive. Powder coating can be done on plastic and medium density fibre (MDF) board in day to day use as well.

**Anodizing :** A protective layer is formed naturally on the surface of aluminium metal by reaction with oxygen in air. In the anodizing process, this layer can be made of the desired thickness. Anodizing is done by electrolysis. Dilute acid is taken in the electrolytic cell and the aluminium article is dipped in it as the anode. When an electric current is passed hydrogen gas is released at the cathode and oxygen gas at the anode. A reaction with oxygen occurs and a layer of hydrated aluminium oxide is formed on the anode, i.e. the iron article..This layer can be made attractive by adding colour in the cell during electrolysis. We use anodized cooking utensils like griddles and cookers. Why?

**Ceramic :** Ceramic is a heat resistant substance formed by kneading an inorganic substance in water and then shaping it and hardening it by heating. Pots made by a potter, Mangalore roofing tiles, construction bricks, pottery, terracotta articles are some examples of common ceramic articles that we see around.

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**This is how a ceramic article is made**

When clay is kneaded in water, shaped and then fired in a kiln at a temperature of 1000 to 1150$^0$C , a porous ceramic is formed. To overcome the porosity the fired object is covered with finely ground glass powder suspended in water (glaze) and is then fired again. As a result, the surface of the ceramic becomes shiny and its porosity disappears

**14.5 Ceramics**

**Porcelain :** This is a hard, translucent and white coloured ceramic. It is made by using the white clay called kaolin, found in China. Glass, granite and the mineral feldspar is mixed with kaolin and kneaded with water. The resulting mixture is shaped and fired in a kiln at a temperature of 1200 to 1450 $^0$C. On firing again after glazing, beautiful articles of porcelain are obtained. Which porcelain vessels are used in the laboratory?

**Bone china –** Bone china is made by adding some ash of animal bones in the mixture of china clay, feldspar and fine silica while making porcelain. This ceramic is harder than porcelain.

**Advanced ceramics :** Oxides like Alumina ($Al_2O_3$), Zirconia ($ZrO_2$) Silica ($SiO_2$) and some other compounds like silicon carbide (SiC), boron carbide ($B_4C$) are used instead of clay for making advanced ceramic. This ceramic requires a temperature of 1600 to 1800 $^0$C and an oxygen free atmosphere for firing. This process is called sintering.

Ceramics can withstand high temperatures without decomposing. Ceramic is brittle, water resistant and an electrical insulator. Therefore, it is used in electrical instruments, for coating the interior of a kiln, the outer surfaces of ships and blades of jet engines. A certain type of ceramic tiles are fixed on the outer layer of a space shuttle. Some types of ceramics are used as superconductors.

## Exercises

**1. Fill in the blanks.**

a. The number of molecules of water of crystallization in washing soda is …..
b. The chemical name of baking soda is ….
c. ….. is used in treatment of hyperthyroidism.
d. The chemical name of Teflon is ….

**2. Match the pairs**

| Group A | Group B |
|---|---|
| 1. Saturated brine | a. sodium metal freed |
| 2. Fused salt | b. basic salt |
| 3. $CaOCl_2$ | c. crystallization of salt |
| 4. $NaHCO_3$ | d. oxidation of colour |

**3. Write answers to the following**

a. What is meant by radioactivity?
b. When is the nucleus said to be unstable?
c. Which diseases are caused by artificial food colours ?
d. Where in the industrial field is radioactivity used?
e. Write down properties of teflon.
f. What type of colours will you use to celebrate ecofriendly Rang Panchami? Why?
g. Why has the use of methods like Teflon coating become more common?

**4. Give scientific explanation**

a. Bleaching powder has the odour of chlorine.
b. The hard water of a well becomes soft on adding washing soda to it.
c. Soap forms a precipitate in hard water.
d. The particles of powder are given an electric charge while spraying them to form the powder coating.
e. The aluminium article is used as an anode in the anodising process.
f. When the radiation coming out from certain radioactive substance is passed through an electric field, marks are found at three places on the photographic plate placed in its path.
g A certain type of ceramic tiles are fixed on the outer layer of a space shuttle.

**5. Write answers to the following**

a. Write about artificial food colours, the substances used in them and their harmful effects.
b. What is meant by water of crystallization? Give examples of salts with water of crystallization, and their uses.
c. Write briefly about the three methods of electrolysis of sodium chloride.

**6. Write the uses.**

a. Anodizing b. Powder coating
c. Radioactive substances d. Ceramic

**7. Write the harmful effects**

a. Artificial dye b. Artificial food colour
c. Radioactive substances d. Deodorant

**8. Write the chemical formula**

Bleaching powder, common salt, baking soda, washing soda

**9. Explain what you see in the following picture**

**Project :** Visit the places where powder coating, Teflon coating is done. Get information about the process and present it in the class.