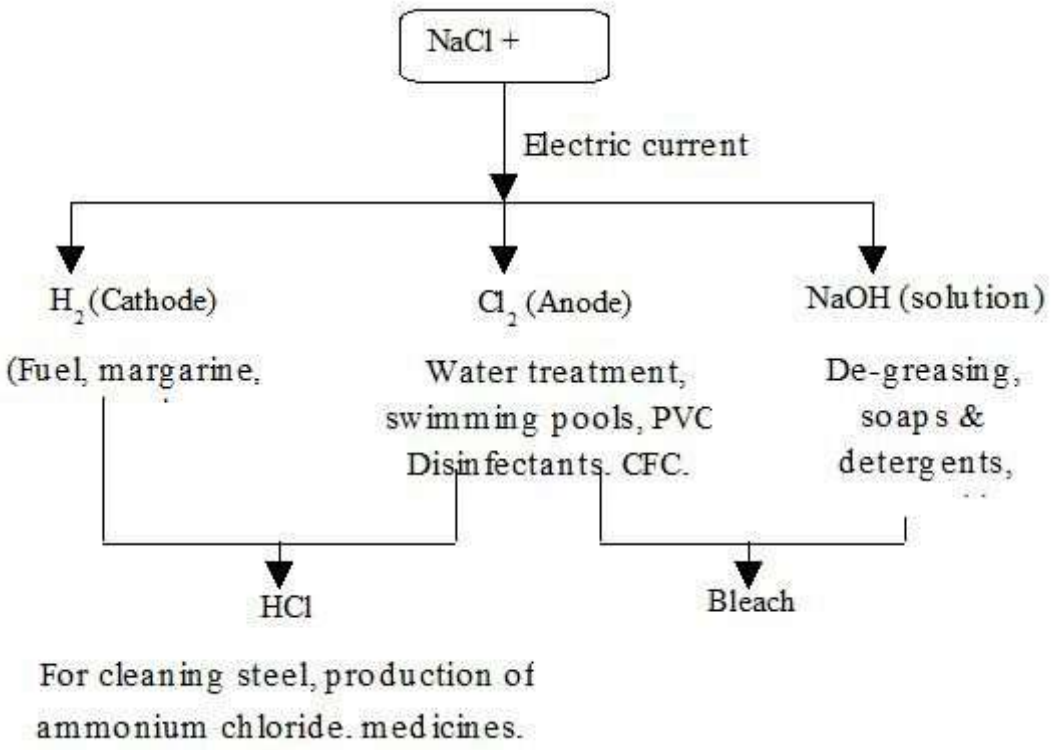
14. Substances in Common Use

- **Common salt** → NaCl



- **Bleaching powder** → $CaOCl_2$
- **Preparation–**

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

- **Use –**

Bleaching of → cotton in textile industry
→ wood pulp
→ Clothes in laundry

Oxidising agent

Disinfecting material

Baking soda – ($NaHCO_3$) Sodium hydrogen carbonate

- **Preparation –**

$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$ (Mild non-corrosive base)

- **Use –**

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Making baking powder (Baking soda + Mild acid, like tartaric acid)

Ingredient for antacids

Soda–acid fire extinguisher

Washing soda – $Na_2CO_3.\ 10H_2O$

- **Preparation**–

$$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3.10H_2O$$

- **Use** –

  In glass, soap, paper industries

  Making sodium compounds such as borax

  As domestic cleaning agent

- **Removing permanent hardness of water**

Preparation of soaps and detergents:

- **Soaps:** Prepared by reacting oil/fats with sodium hydroxide, then boiling the solution and adding sodium chloride to obtain soap.
- **Detergents:** Prepared by treating hydrocarbons obtained after refining of petroleum with concentrated sulphuric acid followed by sodium hydroxide solution.

Cleansing action of soaps and detergents

- The two ends of molecules of soaps and detergents are different. Their one end is hydrophilic (the cationic part) and the other is hydrophobic (the hydrocarbon chain part).
- When soap molecules are present in water, the molecules arrange themselves in the form of a cluster called a micelle.
- Soap does not work properly when water is hard. This is primarily because hard water contains salts of calcium and magnesium. When soap is added to hard water, it reacts with these salts to form an insoluble substance called **scum.**

Advantages of detergents over soaps

- Detergents clean efficiently in hard water whereas soaps are rendered inactive in hard water.
- Detergents are more soluble in water than soaps.
- Detergents have strong cleansing action than that of soaps.
- Detergents can work well in acidic medium, whereas soaps do not work in acidic medium.

- The elements that emit highly penetrating and high energy radiation beam are known as radioactive elements. Example, uranium, radium and thorium.
- **Becquerel rays:** Radiations given out by radioactive elements
- **Properties:**
  - Affect photographic plate
  - Ionise the gas
  - Penetrate through matter
  - Affected by electrostatic and magnetic fields
- During radioactivity, nucleons are ejected from the nucleus.
- **Alpha decay:** If nucleus ejects alpha particles

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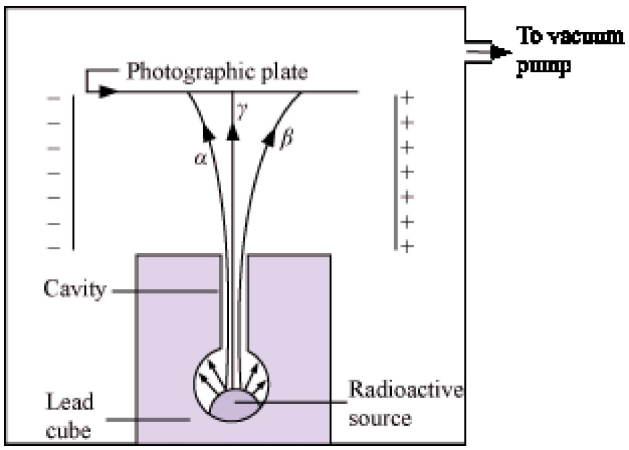
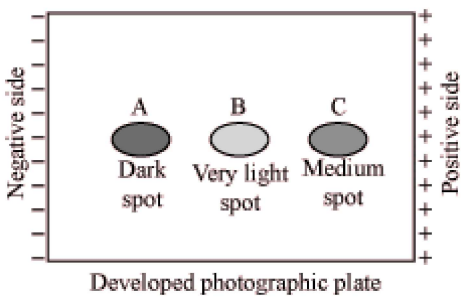
- **Beta decay:** If nucleus ejects beta particles
- **Experiment to demonstrate the properties of Bacquerel Rays**
    - The sample of radiactive element is placed in a small cavity.
    - A photographic plate is placed over the cavity.



- It was found that the photographic plate developed the following pattern.



- **Alpha particles**: The particles deflected towards the negative plate and having a dark spot.

- **Properties:**

- It is similar to doubly ionised helium atom and has the speed of the order of 10^7 ms^{-1}.
- Alpha particles have large kinetic energy and momentum.
- It strongly ionises the gas through which it passes.
- It rapidly dissipates its energy as it moves through a medium and therefore its penetrating power is quite small.
- As alpha particles are positively charged, so they are deflected by electric and magnetic fields.
- Alpha particles cause fluorescence on striking a fluorescent material.
-
- **Beta particles**: The particles deflected towards the positive plate and having a lighter spot.

- **Properties:**

- These particles have speed of the order of 10^8 ms^{-1}. Different beta particles emitted from same radioactive substance have different speed.
- The rest mass of the beta particle is equal to the mass of an electron and charge on it is equal to the charge on an electron.
- These particles ionise the gas through which they pass. Also, their ionising power is equal to 1/100 times that of the alpha particles.

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- Their penetrating power is more than the alpha particles.
- As these particles are negatively charged, so they are deflected by electric and magnetic fields.
- Beta particles cause fluorescence on striking a fluorescent material.
-
- **Gama particles**: The particles which were not deflected towards the any plate and having a very light spot.

- **Properties:**

- The speed of these particles is of the order of speed of light 3 $\times 10^8$ ms^{-1}.
- Their ionising power is very low and it is 1/1000 times that of the alpha particle.
- Penetration power is very high for these particles.
- As these particles have no charge on them, so they do not get deflected by electric and magnetic fields.
- Gamma particles cause fluorescence on striking a fluorescent material.
- Gamma radiations are very useful in the treatment of cancer.

Radioactivity as Emission of Alpha, Beta and Gamma

When radiations are given out by radioactive substances and are subjected to a magnetic field or an electric field in the direction perpendicular to their path, they separate out into three distinct constituents i.e. alpha, beta and gamma.

Fields	Alpha (α)	Beta (β)	Gamma (γ)
Magnetic Field (Inward direction)	Turn to left	Turn to right	Go straight
Electric Field (from right (+) to left (-)	Turn toward the negative plate	Turns towards the positive plate	Go straight

Uses of Radioactivity or Radio isotopes

- Medical use: In treating leukaemia, cancer or detecting the suspected brain tumour and blood clot before they become dangerous.
- Scientific use: In agriculture science to study the growth of plants by using particular chemical manure or to study the rate of decay of carbon in the remains of dead plants to study its age.
- Industrial use: As a fuel in nuclear reactors to generate power or for controlling the thickness of paper, plastic and metal sheets during their manufacturing.

Sources of Harmful Radiation

- Radioactive leak out from nuclear plants
- Nuclear waste
- Cosmic radiation and X-rays

Harmful effects of radiation: The radiations interact with the living tissue within 10^{-14} s and cause biological damage. The biological damage can be of three types:

- Short term recoverable effects, like diarrhoea, sore throat, loss of hair, nausea etc.
- Long term irrecoverable effects like leukaemia and cancer
- Genetic effects

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