Bhanu's PPT

Science & Technology

- CHEMISTRY
  - Part 4

New Elements Discovered

- Four new elements have been added in periodic table.

NIHONIUM (Nh) 113

MOSCOVIUM (Mc) 115

TENNESSINE (Ts) 117

OGANESSON (Og) 118

Alloy

- An alloy is a combination of metals or of a metal and of another element. Alloys are defined by a metallic bonding character.
  Examples:
  STEEL- a combination of iron and carbon
  BRONZE-a combination of copper and tin

Hydrogen

- Hydrogen is the first element in the periodic table. Its atomic number is 1. It has only one electron in the outermost shell that is first shell.
  Cavendish in 1766 discovered hydrogen gas.
  In the free state, hydrogen is found in traces in the earth's crust and atmosphere. The atmospheres of the Sun and the stars are found to contain 1.1% hydrogen.

- Hydrogen in combined state:
  - Plants and animals tissues are made up of compounds of hydrogen with carbon, oxygen and nitrogen

- Hydrogen is constituent of acids, alkalies, hydrocarbons and proteins. In addition to these, sugar, petroleum products, fats, carbohydrates also contain hydrogen

Hydrogen

- USES OF HYDROGEN:
  - As a fuel: Hydrogen has a high heat of combustion. It is used as a fuel in the form of a) Coal gas b) Water gas (CO + Hydrogen) c) Liquid hydrogen (Non polluting and easy to store)

- Oxy-hydrogen torch: A mixture of hydrogen and oxygen is burnt in a specially designed oxy-hydrogen torch.

- It can produce temperature up to 2500^{o}C. The flame is used for cutting and welding metals, for melting platinum and quartz, and for fusing alumina to produce synthetic rubies and sapphires that are used as jewels in watches.

Hydrogen

- Atomic hydrogen torch: Creates a high temperature 2800^{o}C which is used for welding alloys containing metals like tungsten, manganese, chromium, etc.
- Hydrogen is used in self-lighting gas jets and automatic lighters
- It is used for manufacture of ammonia
- For hydrogenation of vegetable oil- Hydrogen is used in the preparation of solid Vanaspati ghee from vegetable fats like groundnut oil, coconut oil

Acids and Bases

- The word acid was originally applied to substances with a 'sour' taste. Vinegar, Lemon juice and spoilt milk are all sour tasting because of the presence of acids.
  A number of acids are also corrosive. They can eat their way through clothing, are dangerous on the skin, and some are able to attack stonework and metals.

- LITMUS: Litmus is extracted from Lichens. Litmus is purple in neutral solution. When added to an acidic solution, it turned red.
  pH scale is a measure of strength of an acid solution. The scale runs from 1 to 14.

Acids and Bases

- Acids have a pH less than 7
  - The more acidic a solution, the lower the pH.
  - Natural substances such as pure water, have a pH of 7.
  - Alkalies have a pH greater than 7.

  All acids contain Hydrogen.
  All acids dissolve in water produce hydrogen ions H^+ ions
  All alkalis dissolve in water produce hydroxide ions OH^- ions.

- ALKAI (BASES): are substance that dissolve in water to produce hydroxide ions OH^-
  Alkali turns litmus blue.

- Alkalis have a pH higher than 7.

Acid reaction in everyday life

- The dilute hydrochloric acid in our stomach is there to help digest our food. However, excess acid causes indigestion, and eventually give rise to ulcers.

  To ease this we can take Antacids.

  They are used to neutralise the effects of acid indigestion. Ex. Milk of Magnesia- it contains magnesium hydroxide.

- Fizzy Antacids contain sodium hydrogen carbonate. The tablet also contain some citric acid. On adding water the acid and sodium hydrogen carbonate react, producing carbon dioxide gas- the fizz in the glass. The sodium hydrogen carbonate neutralizes the excess hydrochloric acid in the stomach, thus easing the indigestion.

Acid reaction in everyday life

- DESCALING KETTLES:
- Limescale collects inside kettles and water heaters in hard water areas.
  Hard water contains more dissolved calcium than normal water. Calcium carbonate is formed when water is boiled. This limescale can be removed by treatment with an acid which will react with calcium carbonate. Vinegar can be used to descale kettles.

Salt

- A base will neutralise an acid, and in the process a salt is formed. This type of reaction is known as neutralization reaction.

  ACID + BASE --→ SALT + WATER

Sodium Chloride

- Sodium chloride is essential for life. Biologically it has a number of functions.
- It is involved in muscle contraction. It enables the conduction of nerve impulses in the nervous system.
- It regulates osmosis- the passage of solvent molecules through membranes.
- It is converted into the hydrochloric acid that aids digestion in the stomach.
- When we sweat, we lose both water and sodium chloride. Loss of too much salt during sport and exercise can give us muscle cramp.

Alkali as Degreasing agent

- Alkalis feel soapy to the skin. They convert oil in our hand into soluble soap, which can be washed away easily. Sodium Hydroxide is alkali which is used as degreasing agent in cleaning purposes.

pH

- A measure of acidity or alkalinity of water
- pH stands for potential of Hydrogen
- A substance that is neither acidic nor basic is neutral.
- The pH scale measures how acidic or basic a substance is.
- The pH scale ranges from Zero to 14.
  1- very strong acid
  7- Neutral
  14- Very strong base/alkaline
- Examples: Blood, Water = 7, Milk = 6, Lemon = 2, Baking Soda = 8, Hand Soap = 9

Soil pH and Plant growth

- Plant growth is affected by the acidity or alkalinity of the soil. Different crops require different pH for their best growth.
- If the soil is too acidic, it is usually treated by 'Liming'. That is adding of calcium oxide or calcium hydroxide or limestone (calcium carbonate). These compounds have the effect of neutralising the acidity of the soil
  If the soil is too alkaline adding manure or decaying organic matter helps.
- WASTE FROM FACTORIES is often acidic. If such waste gets into river, the acid will kill fish and planktons. Slaked lime is added to the waste to neutralize it.

Soil pH and Plant Growth

- Slaked lime is also used to treat streams, rivers and lakes affected by acid rain.

VEGETABLES	Preferred pH
Potatoes	4.5-6.0
Carrot	5.5-6.5
Tomato	5.5-7.5
Onion, Cabbage	6.0-7.5

Rate of Chemical Reaction

- The rate of a reaction is different for different reactions. Some reactions are very slow and some are very fast to happen. If we know the reasons affecting the rate of reaction we can control the rate according to its usefulness to us.

- Factors affecting the rate of reaction:

  - The surface area of any solid reactants: the rate (speed) of a reaction increases when the surface area of a solid reactant is increased.
  - The concentration of the reactants: The rate (speed) of a reaction increases when the concentration of a reactant in solution is increased.

Rate of Chemical Reaction

- The concentration of the reactants: The rate (speed) of a reaction increases when the concentration of a reactant in solution is increased.
  - The temperature at which the reaction is carried out: The rate of a reaction increases when the temperature of the reaction mixture is increased.
  - the use of catalyst: Catalyst is a substance that increases the rate of a chemical reaction. The catalyst remains chemically unchanged at the end of the reaction.
  -The influence of light on some reactions: photosynthesis, photography

Rate of Chemical Reaction

- Food is stored in a refrigerator because the food 'keeps better' . the rate of decay and oxidation is slower at lower temperatures.
- Industrial chemists use catalysts to make everything from polythene and painkillers to fertilizers and fabrics.

Specific Heat

- Heat capacity or thermal capacity is a measurable physical quantity of heat required to raise its temperature by 1 degree centigrade.

- Every element is having different specific heat.
  Water has the highest specific heat capacity of any liquid.
  Example: specific heat

Wood 1.76 joules/g degree C.		Concrete 0.88
Glass 0.84.		Granite 0.79
Water 4.184	Air 1.0.	Iron 0.0005

  Land heats and cools more quickly than water. This difference affects the climate of different areas on Earth.

Catalytic converters

- Catalytic converters are used in vehicles to reduce the polluting effects of car exhaust fumes.
  Car exhaust fumes contain gases such as carbon monoxide, nitrogen monoxide and unburnt hydrocarbons from the fuel which cause pollution in the air.
  The catalytic converter converts these to less harmful products such as carbon dioxide, nitrogen and water.
  Reactions:
  Carbon monoxide + Oxygen ---→ Carbon dioxide
  Nitrogen monoxide + carbon monoxide ----------→ nitrogen + carbon dioxide
  Nitrogen monoxide ------→ nitrogen + oxygen
  hydrocarbons + Oxygen ----→ carbon dioxide + Water

Catalytic Converters

- The catalytic converter therefore ‘removes’ polluting oxides and completes the oxidation of unburnt hydrocarbon fuel.
- It speeds up these reactions considerably by providing a ‘honeycombed’ surface on which the gases can react.
- The converter contains a thin coating of RHODIUM AND PLATINUM CATALYST on a solid honeycomb surface.
  These catalysts have many tiny pores which provide a large surface area for the reactions.
- Catalytic converters can only be used with unleaded petrol. The presence of lead poison the catalyst and stop it working.

Potassium Bromate and Potassium Iodate

- Potassium Bromate and Potassium Iodate are carcinogenic chemicals.
- They are used in bread making.
- The All India Bread Manufacturers Association decided to stop the use of these chemicals immediately.

Isotopes

- Isotopes are variants of a particular chemical element which differ in neutron number. All isotopes of a given element have the same number of protons in each atom.
  Isotopes of Hydrogen:

- Normal 1 electron and 1 proton
  Deuterium 1 electron , 1 proton and 1 neutron
  Tritium 1 electron, 1 proton, and 2 neutrons

  Isotopes of Cobalt:
  Normal 27 electrons, 27 protons and 32 neutrons
  Cobalt 60 - 27 electrons, 27 protons and 33 neutrons

  Cobalt 60 is used in treatment of cancer. Cobalt 60 gives gamma rays. When gamma rays are given to cancerous cells they die. The process is called radiation therapy.

Hard Water

- Temporary hardness can be removed by boiling of water.
- Temporary hardness is caused by presence of dissolved bicarbonate minerals (calcium bicarbonate and magnesium bicarbonate

Hard Water and Soft Water

- Hard water has high mineral content.
- It largely has calcium and magnesium carbonates.
- Hard water is formed when water percolates through deposits of limestone and chalk.
- Soft water has less minerals generally (less than 61mg/liter)
- Very hard water has more than 180 mg of minerals per liter
- Soap doesn't leather in hard water
- Hard water causes scaling in pipes and taps

Hard Water

- Hard water is not a health hazard. In fact drinking hard water can help body getting calcium and magnesium minerals.
- Hard water bathing leave our skin dry and itchy
- Hard water can be made soft by removing calcium ions and magnesium ions from it.
- Reverse osmosis system removes the minerals that cause hard water
- Rain water and distilled water are soft

Effects of Hard Water

- With hard water, soap solutions form a white precipitate instead of producing lather
- Synthetic detergents don't form the precipitate with hard water
- Calcium and magnesium carbonates tend to be deposited as off-white material in the water pipes, thus chocking them
- Washing soda (sodium carbonate) is used as water softener in laundry.
- Water softening is used to reduce hard water's adverse effects.

- Thank You