- Science & Technology

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- CHEMISTRY

  - Part 3

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Oxygen cycle

- Oxygen Cycle:
  Oxygen present in air is removed or used up in the processes:-
  - Decomposition of waste materials
  - Combustion of Fuels
  - Breathing / Respiration
  - Corrosion of metallic objects

- Oxygen is added in atmosphere mainly by Photosynthesis.

- Oxygen is also added slightly (Very Little) by breakdown of Ozone.

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Carbon Cycle

- The various processes by which the percentage proportion of Carbon Dioxide is kept constant constitute the carbon cycle.
- In the atmosphere, the proportion of carbon dioxide is maintained at 0.03% to 0.04% by volume. The cycle of removal and addition of carbon dioxide in nature is continuing un-interrupted.

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Carbon Cycle

Addition of Carbon Dioxide:

1. Animals and human beings burn food taken from plant by consuming Oxygen and release Carbon Dioxide.
2. At night plants take in oxygen and give out carbon dioxide.
3. The decay of plants and animals and other organic material also added carbon dioxide to atmosphere.
4. The burning of fuels, such as wood, coke, coal, petrol, diesel, gas etc. produces Carbon Dioxide.
5. Volcanic activity also adds Carbon Dioxide to atmosphere.
6. Industry and human settlements also releases lot of Carbon Dioxide to atmosphere.

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Carbon Cycle

- Removal of Carbon Dioxide:
- Carbon Dioxide is used in photosynthesis and is also absorbed by water.
- There is carbon dioxide dissolved in sea water. When atmospheric carbon dioxide levels increase, the excess gas dissolves in sea water. Conversely, when carbon dioxide level decreases in the atmosphere the sea gives up some of the dissolved carbon dioxide to restore the required level.
- Thus, the balance of Carbon Dioxide and Oxygen are maintained in the atmosphere with dynamic cycles of absorption and release of them incessantly.

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Water

- Water is the most important natural resource. More than 70% of earth's area in under water.
- HARDLY 2.5% MAKES UP THE TOTAL WORLDs SUPPLY OF FRESH WATER INCLUDING THE FROZEN WATER IN THE POLAR ICE CAPS AND GLACIERS.

Source of water	Percentage of Total
Oceans	97.33
Saline Lakes	0.008
Polar Ice and Glaciers	2.04
Ground Water	0.61
Lakes	0.009
Soil Moisture	0.005
Atmospheric water Vapours	0.001
Rivers	0.0001

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Water

- Water exists in all three states: Ice, Water, Vapour
- Water is major constituent of all living viz. Plants, Animals and Human being
  and of the atmospheric environment in which we live and thrive. Nearly 70% of our body weight is water
- Water is a chemical compound. It has a definite composition by mass
  The ratio of H to O is 1:8 by mass.
  The H and O in water cannot be separated by physical means. They can be separated by chemical means only.
- Method: Electrolysis

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Physical properties of water

- Pure water is a clear transparent liquid
- It is colourless, odourless and tasteless
- Sometime we say water is tasty: the taste in water is due to the dissolved gases and dissolved solids which really speaking are impurities present in it.
- Under normal pressure, pure water boils at 100^{o} C.
  With increase in pressure , the higher the boiling water temperature (Pressure cooker works on this principle). In the hills, water boils at temperature lower than 100^{o} C. On Mount Everest the boiling temperature of water drops to 70^{o} C
- The boiling point of water also increases due to the presence of dissolved impurities in it.

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Physical properties of water

- Freezing point of water or melting point of ice is 0^{o} C. under normal pressure. The freezing point of water decreases with increase in pressure.
  - Kulfiwalas put salt in ice to lower its freezing point to keep kulfi in frozen state. The temperature gets lower to up to -15^{o} C

- Density of water: At 4^{o} C water has its maximum density that is $1 g/cm^3$ and it has minimum volume. Water expands on freezing. 92 volumes of water becomes 100 volume of ice. Therefore ice is lighter than water and thus it floats.

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Physical properties of water

- - ANOMALOUS EXPANSION OF WATER:
  Water has an unusual physical property.
  When cooled it first contracts in volume as do other liquids, but at 4^{o}C it starts EXPANDING and continues to do so till the temperature reaches 0^{o}C. At this point it freezes in to ice.
  Advantage: The property of anomalous expansion of water enables marine life to exist in the colder regions of the world, because even when the water freezes on top, it is still liquid below the ice layer.

- Pure water is non-conductor of electricity. But water containing dissolved impurities like salt and gases conducts electricity.

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Latent heat

- It is the heat energy required or used for change of a state of matter from one state to another during which there is no change in the temperature.
  LATENT HEAT OF FUSION OF ICE:-
- The latent heat of fusion is the amount of heat required to change a substance from the solid state to its liquid state at its melting point without any change in temperature.
- It is 80 calories/g
- The same amount of heat is released when 1 g of water solidifies to form 1 g of ice at 0^{o} C.
- IT IS ON ACCOUNT OF HIGH SPECIFIC LATENT HEAT OF SOLIDIFICATION THAT LAKES AND RIVERS DO NOT FREEZE SUDDENLY.

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Latent heat

- LATENT HEAT OF VAPORIZATION OF WATER:-
  The energy required to change water into its vapour at its boiling point without any change in temperature is called Latent Heat of Vaporization of Water and its specific value is 540 calories/g
  The same amount of heat is released when 1 g of steam condenses to form 1 g of water at 100^{o}C.

- Steam burns more severely than water at the same temperature because steam is having more energy.

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Latent heat

- SPECIFIC HEAT CAPACITY:
  1 g of water when heated through 1^{o}C requires 1 calorie of heat energy. It is called its specific heat capacity.

- It is on account of high specific heat capacity that water is used as coolant in motor car radiators.
  Due to its high specific heat capacity, the presence of a large amount of water is able to modify the climate of the nearby land areas, making them warmer in winter and cooler in summer.

- Land and sea breeze are also set up because of this great moderating property of water.

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Air dissolved in water

- Air is present in dissolved state in all the natural sources of water.
  Of the two main components of air nitrogen and oxygen, oxygen is more soluble in water than nitrogen.
  The composition of air dissolved in water is 33% oxygen, 66% nitrogen and 1% carbon dioxide.

- IMPORTANCE of AIR DISSOLVE IN WATER:
  - Marine life like fish have fins. Fins are used for respiration. Water is moved across the fins. Fins absorb oxygen from water.

- 1 dm^3 of water contains nearly 40 cm^3 of dissolved oxygen.

  Carbon Dioxide: Aquatic plants make use of dissolved carbon dioxide for photosynthesis to prepare their food.

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Atomic structure

- Matter is made up of atoms. The name ATOM was suggested by Greek philosopher Democritus. Greek word ‘atoms’ means indivisible.
- First scientific theory of atomic structure was given by John Dalton in 1808. He said atoms are indivisible particles and are the fundamental building blocks of matter.
- He also said Atoms of one element combine with atoms of another element in simple ratio to form molecules of compound.
- He also concluded that atoms are the smallest units of matter that can take part in a chemical reaction.

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Atomic structure

- Atoms are made up of small charged particles was the conclusion of Faraday in 1833 while he conducted experiments on conduction of electricity. He showed that flow of electricity is due to the flow of charged particles.
- Stoney in 1874 suggested the name electron for these electrical particles.
- Thomson showed the existence of electrons as an essential constituent of all matter. He also could established that electrons are negatively charged particles.
- Electron means atom of negative electricity.

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Properties of electrons

- PROPERTIES OF ELECTRONS
  - Electrons from all sources are alike having same mass

  - They are a constituent part of all atoms

  -The mass of an electron is $9.108 \times 10^{(-)31}$ kg

  - An electron carries negative charge of (-) $1.602 \times 10^{(-)19}$ coulombs

  -The electron is extremely small its radius is less than $1x\ 10^{(-)\ 15}$ m

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Atoms

- Atoms are found to be electrically neutral, so they must contain particles that are positively charged.
- And total negative charged must be equal to positive charged to make atom neutral.
- This realization led to the discovery of positively charged particles which were named as Protons.

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Rutherford Experiment

- Rutherford experiments further lead to discovery of nucleus. He suggested atomic model stating how atom is made up.
  - The atom is heavy at the centre called Nucleous
  - The atom contains large empty space surrounding Nucleous
  - The Nucleous has +vely charged particles called Protons
- - The electrons which are -vely charged particles are present in empty space surrounding Nucleous
- - The electrons revolve around the Nucleous in orbits
- - The atom is electrically neutral
- The atomic model is similar to the structure of the solar system.

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Bohr's Atomic Model

- In 1913 Neils Bohr expanded the model which was proposed by Rutherford.
- He called orbits as energy levels.
- Electrons move in different orbits of different energy levels. When electrons are excited energised move to higher level energy.

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Neutrons

- The mass of nucleous was found to be much more than what could be explained by the presence of Protons alone. Chadwick discovered particles other than Protons having no charge on them but the mass equal to that of protons.
- IT WAS FOUND THAT ALL ATOMS HAVE SIMILAR FOLLOWING THE SAME BASIC STRUCTURE.

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Atomic number

- ATOMS of all elements (Matter) have similar structure. However all atoms have characteristic number of Protons. No two elements have same number of protons. All atoms have same number of electrons as of protons as atom has to be electronically neutral.
- The number of PROTONS is known as Atomic Number of that element.
- RULE OF OCTET: 8 electrons in the outermost shell is known as OCTET

  All Noble gases have eight electrons in the outermost shell (except Helium which has 2).

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Atomic number

Element	Number of Protons
Hydrogen	Nil
Helium	2
Carbon	6
Neon	10
Calcium	20

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Reason for chemical activity of an atom

- The chemical activity of an element depends upon the number of electrons in the outermost shell of its atom.
- These electrons are called valence electrons.
- Atoms of different elements come together and try to make OCTET. Who ever elements can make OCTET will react to form the stable compound.
  Bond is formed by these atoms of different elements.
- Ex: Sodium Atom 2,8,1
  Chlorine Atom 2,8,7
- When they combine it becomes 2,8,8 for both
  Sodium Chloride is stable compound.

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Periodic table

- We know more than 100 elements today. The elements can be studied and understood better if we classify them into various groups according to their nature and behaviour with other elements. We are able to correlate the properties of the elements in an organized them.

  In 1869, Mendeleev, a Russian chemist, arranged all the 63 elements known at that time in the increasing order of their atomic masses.

  Atomic mass = Number of Protons + Number of Neutrons.

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Periodic table

- He observed that elements with similar properties occurred at regular intervals. This is called periodicity of the properties of the elements.
- Later on it was noticed Atomic Number is more important in deciding and predicting the behaviour of elements.
  Atomic Number = Number of Protons = Number of Electrons
  The Periodic table prepared with the basis of Atomic Number is called Modern Periodic Table.
- The objections or limitation of Mendeleev Periodic Table gets removed in Modern Periodic Table.

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Periodic table

- The Modern Periodic Table is divided in to eighteen Vertical Columns and nine Horizontal Rows.
  The cause of periodicity is the recurrence of similar electronic configuration.
  Example:

Element	Sodium	Magnesium	Aluminium	Silica	Phosphorus	Sulphur	Chlorine	Argon
Atomic Number	11	12	13	14	15	16	17	18

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- Thank You