BRILLIANT PUBLIC SCHOOL, SITAMARHI

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IX Chemistry Chapter Notes

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Class: IX
Chapter 1 : Matter in our surroundings
Chapter notes

Top concepts

1. Anything that occupies space and has mass is known as matter.
2. Matter is not continuous but rather consists of large number of particles.
3. Characteristics of Particle

- Large number of particles constitutes matter.
- Particles of matter are very small in size.
- Particles of matter have spaces between them
- Particles of matter are continuously moving

4. Solids have definite shape, distinct boundaries and fixed volume
5. Liquids have fixed volume but no fixed shape.
6. Gases neither have fixed shape nor volume.
7. Solids possess least compressibility.
8. Liquids possess higher compressibility than solids.
9. Gases possess highest compressibility as compared to solids and liquids.

11. The process in which a solid changes to liquid state by absorbing heat at constant temperature is called fusion.

12. The temperature at which a solid melts to become a liquid at the atmospheric pressure is called as melting point.

13. SI unit of temperature is Kelvin. T (K)= T (^{o}C) +273

14. The hidden heat which breaks the force of attraction between the molecules during change of state is called latent heat.

15. Latent heat of fusion is the amount of heat energy required to change 1kg of solid into liquid at its melting point.

16. The melting point of a solid is an indication of the strength of the force of attraction between its particles.

17. The temperature at which a liquid changes to solid by giving out heat at atmospheric pressure is called freezing point.

18. The temperature at which a liquid starts boiling at the atmospheric pressure is known as boiling point.

19. Latent heat of vaporisation is the heat energy required to change 1kg of liquid to gas at atmospheric pressure at its boiling point.

20. Boiling is a bulk phenomenon.

21. The phenomenon of change of a liquid into its gaseous state at any temperature below its boiling point is known as evaporation.

22. In evaporation, the conversion of liquid to gaseous state occurs at a much slower rate, compared to boiling.

23. Evaporation takes place only at the surface of the liquid while boiling can take place in all parts of the liquid.

24. Evaporation is surface phenomenon

25. Boiling is a bulk phenomena

26. The amount of water vapour present in the air is called humidity.

27. Evaporation is a continuous or ongoing process.

28. Evaporation causes cooling.

29. The process of evaporation of water from the aerial parts of plants especially leaves is known as **transpiration**.

30. The rate of evaporation is affected by the surface area exposed to atmosphere, temperature, humidity and wind speed.

31. Since evaporation is a surface phenomenon, therefore, it increases with an increase in surface area

32. Evaporation increases with an increase in temperature.

33. Evaporation decreases with an increase in humidity

34. Evaporation increases with the increase in wind speed

35. The process in which a gas changes into liquid state by giving out heat at constant temperature is called condensation.

Subject: Chemistry

Class: IX

Chapter Name: Is Matter Around Us Pure

Chapter Notes

Top Concepts

1. Anything which has mass and occupies space is called matter
2. Matter can be classified as pure substances or mixtures
3. A pure substance may either contain constituent particles of only one kind or of different kinds. A pure substance has a fixed composition
4. An element is a basic form of matter which cannot be broken down into simpler substances by any physical or chemical means
5. Elements can be broadly classified as metals, non-metals and metalloids.
6. Metals are one category of elements that have lustre. They conduct heat and electricity. They are sonorous .They are malleable and ductile
7. Non metals do not have lustre, are not sonorous and are bad conductors of heat and electricity.
8. Metalloids are elements having properties intermediate between those of metals and non metals
9. A compound is a pure substance composed of two or more elements chemically combined in a fixed proportion. It can be broken down into simpler substances by chemical or electrochemical methods
10. A mixture contains two or more elements or compounds which are mixed together in any proportion. In a mixture no new compound is formed. A mixture shows the properties of the constituent substances
11. Mixtures are classified are homogeneous or heterogeneous mixture
12. Mixtures whose components mix completely with each other to make a uniform composition are called homogeneous mixtures

13. Mixtures whose components mix completely with each other to make a uniform composition are called homogeneous mixtures
14. A heterogeneous mixture has a non – uniform composition
15. The ability of a substance to dissolve in another substance is called solubility.
16. Homogeneous mixture of two or more substances is called a solution.
17. Component of a solution present in small quantity is called a solute.
18. Component of a solution present in large excess is called a solvent.
19. Solution with high solute concentration is called concentrated solution and those with low concentration is called dilute solution
20. A solution that has dissolved maximum amount of solute at any particular temperature is said to be a saturated solution.
21. If the amount of solute contained in a solution is less than the saturation level, it is called an unsaturated solution.
22. The concentration of a solution is the amount of solute present in a given amount (mass or volume) of solvent or solution.

23. Percentage by mass is one of the methods of expressing concentration of solution
24. There are two kinds of heterogeneous mixtures, colloids and suspensions
25. Colloids are mixtures with particle sizes from 1 nm to 1000 nm.
26. The component of colloid present in small amount is called dispersed phase.
27. The medium in which colloidal particles dispersed or suspend themselves is called dispersion medium.
28. In a colloidal system particles are always suspended and do not settle down. This constant colliding of the particles in continuous motion is called Brownian movement.
29. Scattering of a beam of light when light is passed through a colloidal solution is called the Tyndall effect

30. Colloids are classified according to the state (solid, liquid or gas) of the dispersed medium or dispersing medium and the dispersed phase.
31. Colloid in which dispersed medium is a liquid and dispersed phase is solid ,it is called as sol
32. Colloid in which both dispersed phase and dispersed medium are in liquid state is called as an emulsion
33. Colloid in which dispersed phase is either liquid or a solid and dispersed medium is a gas is called as aerosol.
34. A suspension is heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout bulk of medium .Particles of suspension are visible to naked eye. Suspensions are heterogeneous mixtures with particles that have a size greater than 1000 nanometers
35. Magnetic impurities can be separated from non-magnetic impurities by magnetic separation
36. Volatile compounds can be separated from non-volatile compound by sublimation
37. Mixtures of two or more liquid components can be separated by simple or fractional distillation or by using a separating funnel.
38. Simple distillation is used for separating liquids having a difference in boiling points of more than or equal to 25 K.
39. Fractional Distillation is used for separating liquids having a difference in boiling points of less than 25 K.
40. Liquids that are immiscible in each other differ in their densities and so can be separated by making use of a separating funnel.
41. The process, by which a soluble solid can be obtained from a solution by allowing the solvent to vaporize, is called evaporation.
42. Chromatography is used for separation of those solutes which dissolve in same solvent
43. Chromatography is a method of separating and identifying various components in a mixture, which are present in small trace quantities.

44. Mixture containing two solid substances out of which one is soluble in a particular solvent and other is insoluble can be separated by dissolving the soluble constituent in a suitable solvent and then separating the insoluble substance through filtration.
45. This process of separating the suspended particles of an insoluble substance, from a liquid, by rotating it at high speed is called centrifugation.
46. The change in which the shape, size, appearance or state of a substance may alter but its chemical composition remains the same is called a physical change. In a physical change no new substance is formed.
47. Any change that involves the formation of a new substance and leads to a transformation of chemical identity is called chemical change.
48. Chemical changes are usually accompanied with heat exchanges. Chemical changes are permanent changes which are usually irreversible.

Top Formulae

$$\text{Mass by mass percentage of solution} = \frac{\text{Mass of a given substance}}{\text{Total mass of solution}} \times 100$$

$$\text{Mass by volume percentage of solution} = \frac{\text{Mass of a given substance}}{\text{Volume of solution}} \times 100$$

Chapter notes

Class: IX
Chapter Name: Atoms and molecules

Top concepts

1. Laws of chemical combination
    - Law of conservation of mass: Mass can neither be created nor destroyed in a chemical reaction
    - Law of constant proportion or Law of definite proportion: In a chemical substance the elements are always present in definite proportions by mass

2. Postulates of Dalton's atomic theory
    - All matter is made of very tiny particles called atoms
    - Atoms are indivisible particles, which cannot be created or destroyed in a chemical reaction
    - Atoms of a given element are identical in mass and chemical properties
    - Atoms of different elements have different masses and chemical properties
    - Atoms combine in the ratio of small whole numbers to form compounds
    - The relative number and kinds of atoms are constant in a given compound

3. Some Limitations of Dalton's atomic theory

- According to Dalton's atomic theory atoms of a given element are identical in mass and chemical properties. Atoms of different elements have different masses and chemical properties. This is wrong because atoms of some elements vary in their mass and density. Such atoms of the same element having different masses are called isotopes. For example, chlorine has two isotopes having mass numbers 35 a.m.u and 37 a.m.u.

- According to Dalton's atomic theory atoms of different elements have different masses and chemical properties. This has been proved wrong in certain cases like argon and calcium atoms, which have the same atomic mass of 40. Such atoms of different elements that have the same atomic mass are called isobar.

- According to Dalton's atomic theory atoms combine in the ratio of small whole numbers to form compounds. This is not seen in complex

organic compounds like sugar $C_{12}H_{22}O_{11}$. Ratio of C, H and O is 12:22:11 which is not simple.

4. Atoms are building block of all matter

5. Atomic radius is measured in nanometres (1 m = 10^9 nm)

6. Individual atoms can be observed using Scanning Tunnelling Microscopes

7. Each element has a name and a unique symbol

8. Rules for assigning symbols for atoms of various elements

   a. The abbreviation used to represent an element is generally the first letter in capital of the English name of element

English name of element	Symbol
Hydrogen	H
Boron	B
Oxygen	O
Nitrogen	N
Fluorine	F

   b. When the names of two or more elements begin with the same initial letter, the initial letter followed by the letter appearing later in the name is used to symbolize the element

Name of element	Symbol
Barium	Ba
Bismuth	Bi
Bromine	Br
Silicon	Si
Cadmium	Cd

   c. Symbols of some elements are derived from their Latin names

Name of element	Latin name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Copper	Cuprum	Cu
Iron	Ferrum	Fe

Gold	Aurum	Au
Silver	Argentum	Ag

9. One atomic mass unit is a mass unit equal to exactly one twelfth(1/12th) the mass of one atom of carbon-12

10. Relative atomic mass of the atom of an element is defined as the average mass of the atom, as compared to 1/12th the mass of one carbon-12 atom

11. Atoms of most elements are not able to exist independently. Atoms form molecules and ions

12. A molecule can be defined as the smallest particle of an element or a compound that is capable of an independent existence and shows all the properties of that substance

13. Molecules of element are formed by the atoms of the same type

14. Atoms of different elements join together in definite proportions to form molecules of compounds

Based upon atomicity we can classify molecules as follows.

- Monoatomic molecules: Noble gases like helium, neon, argon, etc., exist in atomic forms, i.e., they are monoatomic. For example, helium, neon and argon exist as He Ne and Ar respectively.

- Diatomic molecules: These molecules consist of two atoms. For example, hydrogen (H_2) oxygen (O_2), nitrogen (N_2), chlorine (Cl_2), carbon monoxide (CO), hydrogen chloride (HCl) and sodium chloride (NaCl).

- Triatomic molecules: These molecules consist of three atoms. For example. ozone (O_3) is a triatomic molecule. Similarly, carbon dioxide (CO_2), nitrogen dioxide (NO_2) and hydrogen sulphide (H_2S) are examples of triatomic molecules.

- Tetraatomic molecules: These molecules consist of four atoms. For example, P_4 is a tetraatomic molecule of phosphorus.

- Polyatomic molecules: Any molecule containing more than four atoms is called a polyatomic molecule. For example, sulphur (S_8), methane (CH_4), nitric acid (HNO_3), ethanol (C_2H_5OH).

15. An ion is a charged particle and can be negatively or positively charged

16. A negatively charged ion is called an 'anion'

17. A positively charged ion is called 'cation'

18. Ions may consist of a single charged atom or a group of atoms that have a net charge on them

19. Ionic compounds contain charged species called ions as their smallest unit

20. A group of atoms carrying a fixed charge on them are called polyatomic ions or radicals

21. The chemical formula of a compound is a symbolic representation of its composition

22. Valency is the combining capacity of an element

23. Valency can be used to find out how the atoms of an element will combine with the atom(s) of another element to form a chemical compound

24. Names and symbols of some ions

Vale-ncy	Name of ion	Symbol	Non-metallic element	Symbol	Polyatomic ions	Symbol
1.	Sodium	Na^+	Hydrogen	H^+	Ammonium	NH_4^+
	Potassium	K^+	Hydride	H^-	Hydroxide	OH^-
	Silver	Ag^+	Chloride	Cl^-	Nitrate	NO_3^-
	Copper (I)*	Cu^+	Bromide	Br^-	Hydrogen	
			Iodide	I^-	carbonate	HCO_3^-
2.	Magnesium	Mg^{2+}	Oxide	O^{2-}	Carbonate	CO_3^{2-}
	Calcium	Ca^{2+}	Sulphide	S^{2-}	Sulphite	SO_3^{2-}
	Zinc	Zn^{2+}			Sulphate	SO_4^{2-}
	Iron (II)*	Fe^{2+}				
	Copper (II)*	Cu^{2+}				
3.	Aluminium	Al^{3+}	Nitride	N^{3-}	Phosphate	PO_4^{3-}
	Iron (III)*	Fe^{3+}				

25. Rules for writing formula of compound:
    - Formula of compound is given by writing side by side the symbols of constituent elements
    - Symbol of the more metallic element is written first in formula
    - Number of atoms of each of the constituent element present in the molecule is indicated by subscript
    - When either of the ions or both the ions are polyatomic and their valency is more than 1, we enclose the polyatomic ions in brackets. No brackets are necessary if the valency(ies) of polyatomic ion(s) is(are) 1
    - While writing formula of compound if the valency numbers have a highest common factor (H.C.F), divide the valency numbers by H.C.F to get the simple ratio between the combining elements

26. The simplest compounds, which are made up of two different elements are called binary compounds

27. Formula of a binary compound is written by criss crossing the valencies of elements present in a molecule of the compound

28. A chemical compound is always electrically neutral, so the positive and negative valencies or charges of the ions in the compound must add up to zero

29. The molecular mass of a substance is the sum of the atomic masses of all the atoms in a molecule of the substance. It is therefore the relative mass of molecule expressed in *atomic mass units (u)*

30. The formula unit mass of a substance is a sum of the atomic masses of all atoms in a formula unit of a compound

31. 1mole of any substance = 6.022×10^{23}units

32. The mole is the amount of substance that contains the same number of particles (atoms/ ions/ molecules/ formula units etc.) as there are atoms in exactly 12 g of carbon-12

33. Mass of 1 mole of a substance is called its molar mass

34. Atoms of different elements are of different sizes and masses. A mole of one type of atoms will have a different mass from a mole of another type of atoms

35. Molar mass = Mass of one mole of any substance = Gram atomic mass or gram molecular mass or gram formula mass of the substance

36. Number of moles = Given number of particles/Avogadro's number

37. Molar mass is expressed in g/mol

38. Atomic mass of an element expressed in grams is called gram atomic mass

39. Molecular mass of a substance expressed in grams is called gram molecular mass

40. Mass of one mole of atoms of any element is equal to gram atomic mass of that element

Chapter notes

Class: IX
Chapter Name: Structure of atom

Top concepts

1. Ionisation of gases in the discharge tube proved that atoms have subatomic particles

2. Summary of characteristics of electrons, protons and neutrons

Particle	Electron	Proton	Neutron
Symbol	e	p	n
Relative charge	-1	+1	0
Nature	Negatively charged	Positively charged	Neutral
Discovered by	JJ Thomson	E. Goldstein	Chadwick

3. Thomson model of atom :

An atom is a uniform sphere of positive charges (due to presence of protons) as well as negative charges (due to presence of electrons). Atom as a whole is electrically neutral because the negative and positive charges are equal in magnitude

4. Limitations of Thomson model of atom:
Model failed to explain how protons and electrons were arranged in atom so close to each other

5. α-particles are charged particles having two units of positive charge and 4 units of mass, i.e. they are doubly charged helium ions(He^{2+})

6. Observations predicted from α-particle scattering experiment by Rutherford based on Thomson model of atom:

Rutherford expected that if the model proposed earlier by J.J Thomson, according to which there is uniform distribution of positive and negative charge, was correct then α-particle particles striking the gold atoms would be uniformly deflected which was not the case. Since the α-particles were much heavier than the protons, he did not expect to see large deflections

7. Selection of gold metal for Rutherford's α-particle scattering experiment:

Since α-particles are easily absorbed by objects; he wanted to ensure that alpha particles pass through foil without getting absorbed. If α-particles were absorbed in matter then they would not be able to give any useful information about insight of atom. Only if α-particles were deflected then only it can give useful information about insight of atom. Gold is easily malleable and can be beaten into very thin sheets.

8. Observations made by Rutherford from α-particle scattering experiment:

1. Most of the α-particles passed straight through gold foil without suffering any deflection from their original path
2. Some of the α-particles were deflected by the foil by small angles
3. One out of every 12000 particles appeared to rebound

9. Conclusions from Rutherford's model of an atom

1. Most of the space between inside atoms is empty; hence it allows the α particles to pass straight through it without any deflection
2. Very few particles were deflected from their path which suggests that the positive charge of the atom occupies very little space
3. The total volume occupied by a nucleus is very small compared to the total volume of the atom, as very few α particles are reflected by 180^{o} and all the positive charge and mass of the gold atom were concentrated in a very small volume within atom.

10. Rutherford's model of an atom

1. There is positively charged centre in an atom called the nucleus and the entire mass of atom resides in the nucleus
2. Electrons revolve around the nucleus in well defined orbits
3. Size of nucleus is very small as compared to size of atom

11. Defects in Rutherford model of atom:

1. Rutherford had proposed that electrons move around a positively charged nucleus at very high speed in circular orbits. To remain in a circular orbit electron would have to be accelerated centripetally (tending to move toward a center). But according to electromagnetic theory if charged body (electron) is accelerated around another charged body (nucleus) then there would be continuous radiation of the moving body (i.e. electron). This loss of energy would slow down speed of electron and eventually electron would fall into nucleus. But Rutherford's model could not explain such a collapse

2. Rutherford had proposed that electrons revolve around the nucleus in fixed orbits. He did not specify the number of electrons in each orbit

12. Postulates put forward by Bohr regarding model of atom:

1. Electrons revolve around the nucleus in a limited number of orbits called discrete orbits of electrons or also called as permissible orbits
2. While revolving in discrete orbits the electrons does not radiate energy i.e. energy of an electron remains constant so long as it stays in a given orbit. Electrons present in different orbits have different energies
3. When an electron jumps from lower energy level to higher energy level some energy is absorbed, while energy is released when electron jumps from higher energy to lower one

Orbits or shells are represented by the letters K, L, M, N… or the numbers, n=1, 2, 3, 4…

13. Bohr-Bury scheme for distribution of electrons in different orbits

1. Maximum number of electrons that can be accommodated in a shell is given by $2n^2$,where n is the shell number i.e. first shell can accommodate 2 electrons, second shell can accommodate 8 electrons, third shell can accommodate 18 electrons and so on
2. Outermost orbit of an atom can accommodate a maximum number of 8 electrons
3. Electrons are not accommodated in a given shell, unless the inner shells are filled i.e. the shells are filled in a step-wise manner

14. Combining capacity of an atom is called its valency

15. Outermost shell of an atom is called valence shell

16. Electrons present in valence shell is called valence electrons

17. If the outermost shell of an atom is completely, its valency is 0

18. Valency of elements having 1-4 electrons in outermost shell are generally determined by the rule: Valency = Number of electrons in outermost shell

19. Valency of elements having number of electrons in outermost shell close to 8 is determined by the formula: Valency=8- Number of electrons in outermost shell

20.Significance of valence electrons:
1. Valence electrons are responsible for chemical changes
2. Elements having same number of valence electrons in their atoms possess similar chemical properties because chemical properties of an element are determined by the number of valence electrons in an atom
3. Elements having different number of valence electrons in their atoms possess different chemical properties

21. Atomic number(Z) is defined as the total number of protons present in nucleus of an atom

22.Protons and neutrons together are called nucleons

23.Mass number (A) is defined as the sum of the total number of protons and neutrons present in the nucleus of an atom.

24. Isotopes:

- Isotopes are the atoms of same element having same atomic number but different mass number
- Isotopes have similar chemical properties because they have same number of valence electrons
- Isotopes have different physical properties like boiling point, melting point etc because they have different mass number
- Fractional atomic mass of elements are due fact that all elements have isotope
- Applications of isotopes:

1. Uranium isotope(${}^{235}_{92}U$) is used in nuclear reaction
2. Cobalt isotope (${}^{60}_{27}U$) is used to remove brain tumours and in their treatment
3. Isotope of sodium (${}^{24}_{11}Na$)has been used to diagnose restricted circulation of blood

25. Isobars are the atoms of different element with different atomic number but same mass number