BIYANI GIRL'S COLLEGE

Concept Based Notes

Structure-bonding,

Mathematical concepts and States of matter

B.SC Semester-I

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Syllabus

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1	**I**	Ionic solids
2		Metallic bond
3		Weak intractions
4	**II**	Covalent bond
5		MOT
6	**III**	Mathematical concept
7		Liquid state
8		Solid state
9	**IV**	Gasseous state
10		Colloidal state

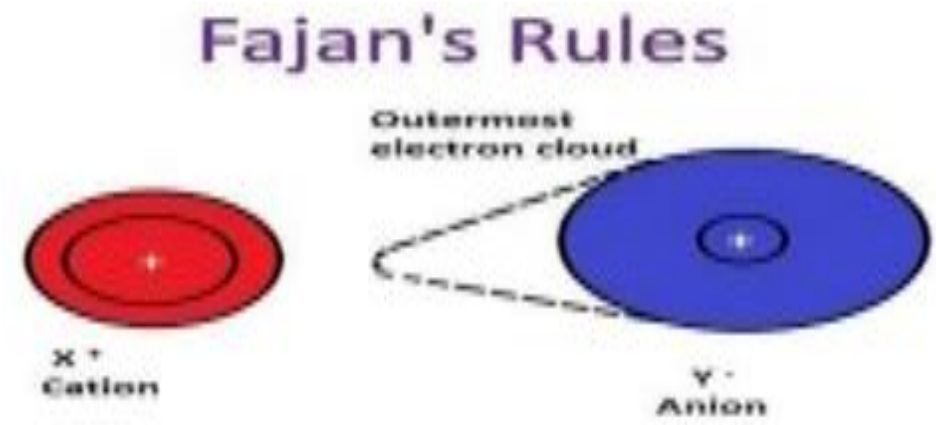
Q.1 Define Lattice Energy?

Ans. Lattice Energyis a type of potential energy that may be defined in two ways.
In one definition, the latticeenergy is the energy required to break apart an ionic solid and convert its component atoms into gaseousions.This definitioncauses thevalueforthelatticeenergytoalwaysbepositive,sincethiswillalways bean endothermic reaction.
The other definition says that lattice energy is the reverse process, meaning it isthe energy released when gaseous ions bind to form an ionic solid. As implied in the definition, thisprocess will always be exothermic, and thus the value for lattice energy will be negative. Its values are usually expressed with the units kJ/mol.

Q.2 Explain Fajan's Rule?

Ans To understand the Fajans'rule, Let us first understand a few terms:
Polarisability is the extent to which anion can be polarised. It canalsobecalledastheeasewith whichanioncan be polarised.
Polarisation is the distortion of a spherically symmetric electron cloud to an unsymmetric cloud.
Postulatesof Fajan's Rule-

1. **Size of the ion:**
   Smallerthesizeofcation,thelargerthesizeoftheanion,greateristhecovalentcharacterof theionic bond.
2. **The charge of Cation:**
   Greaterthechargeofcation,greateristhecovalent characteroftheionicbond.
3. **Electronic configuration:**
   For cationswith same charge and size, the one, with $(n-1)d^{n}ns^{o}$ whichisfoundintransitionelementshavegreatercovalentcharacterthanthecationwith $ns^{2}np^{6}$ electronicconfiguration,whichiscommonlyfoundinalkalioralkalineearthmetals



Q.3 When a solid is heated, what kind of defect can occur? What physical property is influenced by it, and how?

Ans. When a solid is heated, electrons become mobile, and when one is removed, and electron-deficient hole occurs, changing the solid's conductivity. It also has an effect on the magnetic characteristics of solids. When metallic solids are heated, their conductivity decreases.

Q.4 Why do ionic substances conduct electricity when they are molten but not when they are solid?

Ans. The electrical conductivity of any ionic solid owes to the mobility of the ions. These are non-conducting in this state because ionic mobility is negligible in the solid-state. The ions present get some mobility as they melt. Thus, this is how ionic solids become conductors.

Q.5What do you understand by a semiconductor?Brief about the two main types of semiconductors.

Ans. A semiconductoris defined as a solid material whose electrical conductivity lies between those of the typical metallic conductors and insulators. The semiconductors possess conductivity in the range of 102 to 10-9 ohm-1 cm-1.These are two types of semiconductors majorly:

1. .n-type semiconductors**:** Doping of higher group element impurity results in the formation of n-type semiconductors.

2. .p-type semiconductors**:** The impurity of lower groups results in electron-deficient bonds in the structure and the electron deficiency develops in the p-hole.

Q.6 Explain how an ionic solid gets vacancies when a cation with a higher valence is added as an impurity.

Ans.A stoichiometric point defect is a vacancy defect. Such a flaw can be found in ionic solids. Some vacancies are generated in ionic solids when the ionic impurity has a different valence than the primary component. When molten NaCl containing a little quantity of $SrCl_2$crystallises, Sr^{2+} ions occupy some of the Na^+ ions' sites. Each Sr^{2+} ion takes the place of two Na+ ions. The number of cationic vacancies created is the same as the quantity of Sr^{2+} ions.

Q.7 Compare melting points of the NaCl, $MgCl_2$, and $AlCl_3$ by using Fajan's rule.

Ans. The magnitude of the positive charge on cation increases from +1 (Na^+) to +3 (Al^{3+}). Thus, the polarizing power of cations increases from Na^+ to Al^{3+}. $Na^+<Mg^{++}<Al^{+++}$Due to this, the covalent character increases from NaCl to $AlCl_3$. Therefore, the melting point decreases from NaCl to $AlCl_3$.

Q.8 What is radius ratio rule ?how it is related with geometries?

Ans Thefirstsuchruleswereproposed by Linus Pauling, who considered how one might pack together oppositely charged spheres ofdifferent radii. Pauling proposed from geometric considerations that the quality of the "fit" depended onthe**radiusratio**of theanionandthecation.
1.If the cation can touch all of its nearest neighboranions, as shown at the right for a small cation in contact with larger anions, then the fit is good.
2. If thecation is too small for a given site, that coordination number will be unstable and it will prefer a lowercoordination structure.
The table below gives the ranges of cation/anion radius ratios that give the best fitforagivencoordinationgeometry.

Coordinationnumber	Geometry	ρ=rcation/ranion
2	Linear	0-0.155

3	Triangular	0.155-0.225
4	Tetrahedral	0.225-0.414
4	SquarePlannar	0.414-0.732
6	Octahedral	0.414-0.732
8	Cubic	0.732-1.000
12	Cubooctahedral	1.0

Q.9 Draw Born Haber Cycle for NaCl?

Ans Heatofformation=Heat ofatomization+Dissociationenergy+(sumofIonizationenergies)+(sumofElectronaffinities)+Lattice energy

IonizationEnergyistheenergyrequiredtoremoveanelectronfromaneutralatomoranion.This processalwaysrequiresaninput ofenergy, andthuswillalwayshaveapositivevalue.

Electron Affinity is the energy released when an electron is added to a neutral atom or an ion.Usually, energy released would have a negative value, but due to the definition of electronaffinity, it is written as a positive value in most tables.

Dissociation energy is the energy required to break apart a compound. The dissociation of acompoundisalwaysanendothermicprocess,Therefore, the change in energy is always positive.

Sublimation energyis the energy required to cause a change of phase from solid to gas,bypassingtheliquidphase.Thisisaninput ofenergy,andthushasapositivevalue.It mayalsobereferredtoasthe energyof atomization.

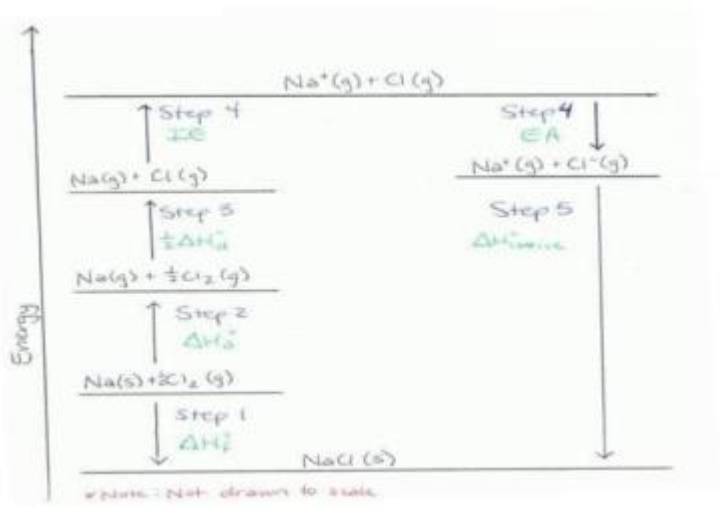
Theheatofformationis thechangein energywhenformingacompoundfromits elements.Thismaybepositiveornegative,depending ontheatomsinvolvedandhowtheyinteract.

Hess'sLaw statesthattheoverallchangeinenergy ofaprocesscanbedeterminedbreakingthe process down into steps, then adding the changes in energy of each step. The Born-HaberCycleisessentiallyHess'sLawappliedtoanionic solid.

UsingtheBorn-HaberCycle

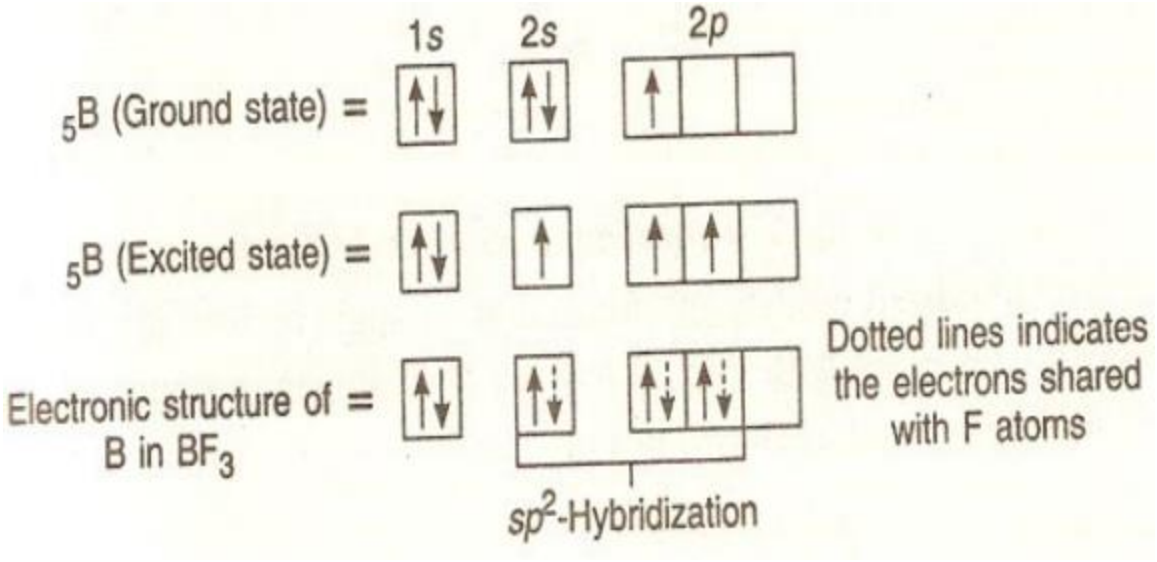
The values used in the Born-Haber Cycle are all predetermined changes in enthalpy

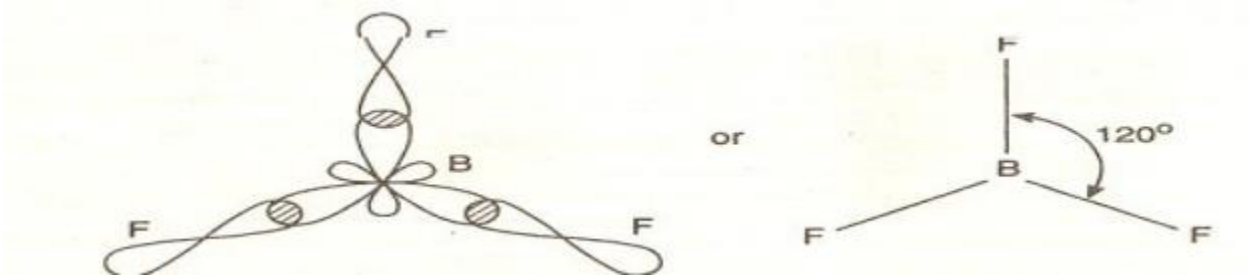
for the processesdescribed in the section above. Hess' Law allows us to add or subtract these values, which allows us todeterminethe lattice energy.



Q.10 Explain hybridization of BF_3?

Ans. BF_3 hassp^2 hybridization.Thecombinationofonesandtwop-orbitalstoformthreehybridorbitalsofequalenergyisknownassp^2-hybridization. These sp2 hybridized orbitals are oriented at an angle of 120°.When three sp2 hybridized orbitals of B overlaps with three p-orbitalsoffluorine,threeσ-bondsareformedwithbondangle120°.TheshapeofBF3moleculeisthustrigonalplanar.





Q.11 Explain the PostulatesofVSEPRTheory?

Ans. Themainpostulatesofthistheoryare :

1.Theshapeofthemoleculeisdeterminedbyrepulsionbetweenalloftheelectronpairspresentinthe valenceshell.

2.That repulsion between two lone pairs is greater thanthe repulsion between a lone pair and a bond pair, which inturnisgreat erthan the repulsion between two bond pairs. The repulsive interactions decrease in the order

:LP-LP> LP-BP>BP-BP

3.Themagnitudeofrepulsionbetweenbondingpairsofelectrons. depends on the electronegativity differencebetweenthecentralatomandtheotheratoms.

4.Double bonds cause more repulsion than single bonds, andtriple bonds cause more repulsion than a double

bond.Repulsiveforcesdecreasesharplywithincreasingbondanglebetweentheelectronpairs.

Q. 12 Explain limitations of valence bond theory?

Ans. Thistheorydoesnotexplain:

1. Thedirectionalnatureofcovalentbond.

2.Theformationofco-ordinatebondinwhichsharedpairofelectrons is contributed by only one of the combiningatoms.

3.Theparamagneticnature of O_2 molecule.

4.Thestructuresofoddelectronmoleculesorionswherenopairingofelectronstakesplace.

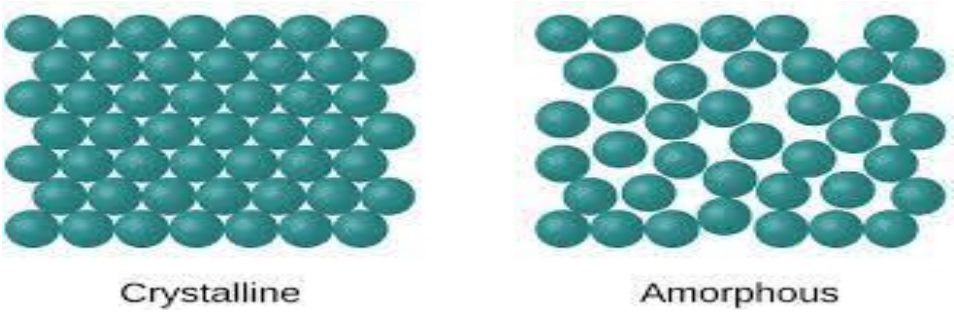
Q.13Write short notes on types of crystals. What is the difference between crystalline and amorphous solids.

Ans. When substance is at low temperature then intermolecular forces are not enough to hold the molecules together in more or less fixed position.

The material acquires a shape and is than said to be in the solid state the so called solid material may be divided into two distinct classes:-

(i) Crystalline solids

(ii) Amorphous solids



(i) Crystalline solids: In a crystalline solid, atoms, molecules or ions are arranged in a regular repeating three dimensional pattern and has a characteristic geometrical shape. Sugar and Salt are crystalline solids.

(ii) Amorphous solid: In amorphous solids, the atoms, molecules or ions are arranged in a random manner and lacks an ordered crystalline lattice. Rubber, plastic and glass are the example of amorphous solids.

In their disordered structure, amorphous solids resemble liquids thus glasses are regarded as Super-cooled or Highly viscous liquid. In very old window panes, glass become slightly thicker at the bottom due to gradual downward flow.

Difference between Crystalline and Amorphous Solids :

(i) In crystalline solids, the constituent particles are arranged in a regular fashion containing short range as well as long range orders while in amorphous solids, the constituent particles are not arranged in any regular fashion, there may be at the most some short range orders only.

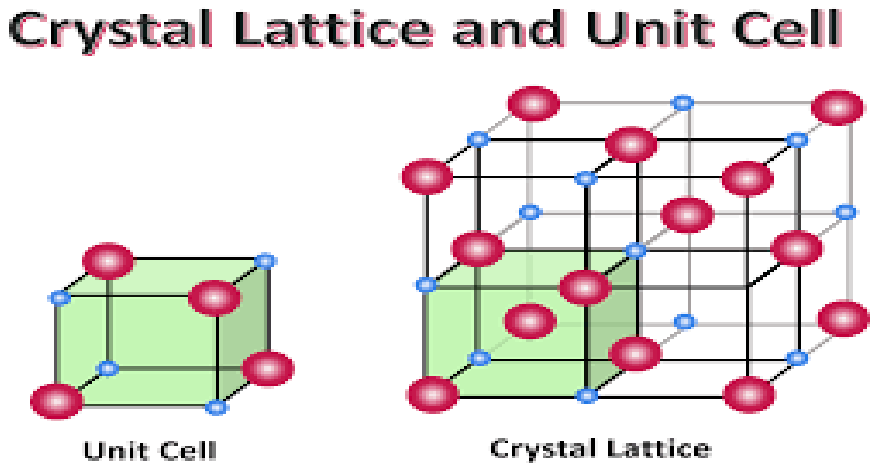
(ii) Crystalline solids have sharp M.P. while amorphous solids melts overcome range of temperature.

(iii) The properties of crystalline solids like electrical conductivity, thermal expansions, refractive index has different values in different directions. While properties of amorphous solids has same value in different directions.

(iv) Crystalline solids undergo a regular cut while amorphous solids undergo air-regular cut.

Q.14 What do you mean by space lattice and unit cell?

Ans. The Particles (atoms, molecules or ions) in crystal are arranged in regular patterns that extent in all directions the overall arrangement of particles in a crystal is called crystal lattice,



space lattice or simple lattice. The simple basic unit or the building block of the crystal lattice is called the unit cell.

Q.15 Explain the symmetry elements with suitable examples.

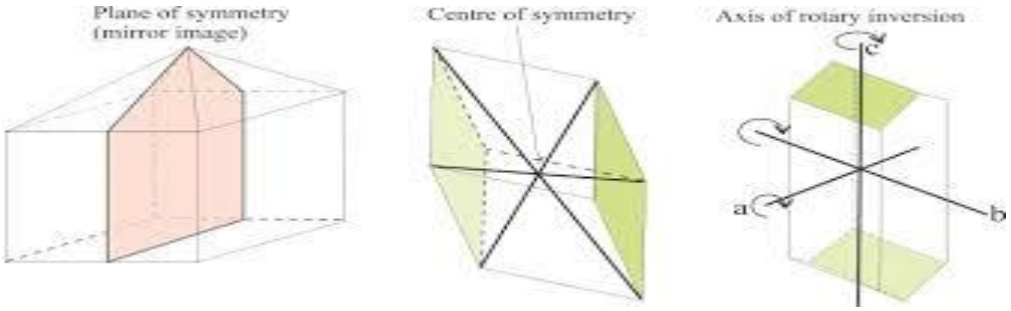
Ans. A symmetry element is a geometrical entity such as a line (or axis), a plane or a point with respect to which one or more symmetry operations may be carried out.

Symmetry elements are of following types:

(a) Plane of symmetry

(b) Axis of symmetry

(c) Centre of symmetry



(a) Plane of Symmetry: When an imaginary plane passes through the centre of crystal and divide it into two equal parts which are mirror image of each other then a crystal is said to possess a plane of symmetry

(b) Axis of Symmetry: It is a line about which the crystal may be rotated so that it represents the same appearance more than once during a complete revolution. If the equivalent configurations occurs twice, thrice, four and six times, i.e. after rotation of 1800, 1200, 900 and 600, the axis of rotation are known as two fold (dead), three fold (tread), four fold (tetrad) and sin fold (hened), axis of symmetry respectively the axis of symmetry represented by C.

(c) Centre of Symmetry: It is a point that any line drawn through will meet the surface of the

crystal at equal distances on either side. A crystal may have a number of planes or axis of symmetry but it can only have one centre of symmetry. A cube has 13 axis of symmetry (three three fold four four fold and six two fold). 9 planes of symmetry and one centre of symmetry i.e. 23 elements of symmetry altogether.

Q.16 What do you mean by crystallography. Explain the three law of crystallography.

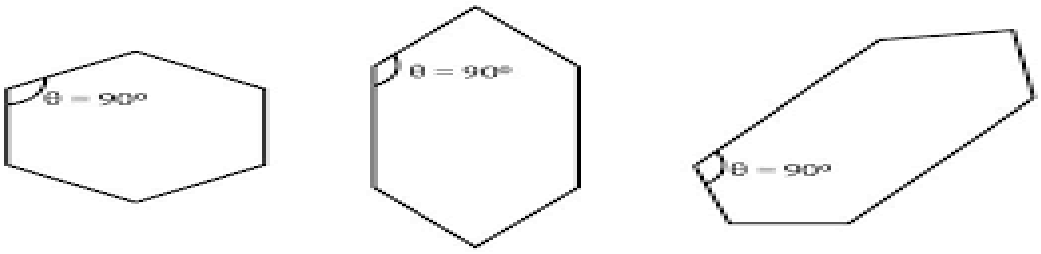
Ans. Crystallography is the science of crystals which is denoted to the study of their development and growth, their external form, internal structure and physical properties.

(a) Steno's law

(b) Law of Constancy of symmetry

(c) Law of rationality of intercepts.

(a) Steno's Law According to this law "the crystal of same substance can have different shapes depending upon the numbers and size of faces but the angles between the corresponding faces remains constant. α



(b) Law of Constancy of symmetry: According to this law "All crystals of the same substance have the same elements of symmetry.

(c) Law of rationality of intercepts: The law of rationality of intercepts or indices proposed in 1874 by Havy states that It is possible to choose along the three co-ordinate axes unit distance (a, b, c) not necessarily of the same length, such that the ratio of the three intercepts of any place in the crystal is given by Ma :nb: Pc where m, n and P are either integral whole numbers including infinity or fractions of whole numbers.

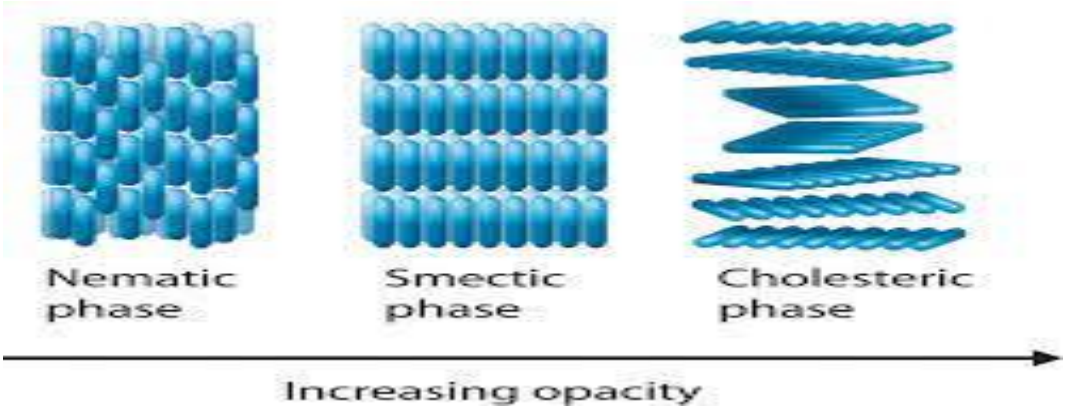
Q.17 What are the types of liquid crystals? Discuss each in brief.

Ans. Liquid crystals have been classified into following types-

(i) Nematiccrytals

(ii) Cholesteric crystals

(iii) Smectic crystals



(i) Nematic crystals: Thread like liquid crystals are called as Nematic liquid crystals this word is derived from Greece word "Nematos" meaning thread. In nematic liquid crystals, the molecules are aggregated together in groups with their axis parallel to one another. These molecules move sideways or up and down along their length. Each molecule can rotate around its axis. In an electric or magnetic field, the groups of Nematic liquid crystals get oriented in the same direction.

(ii) Cholesteric Crystals: Those liquid crystals which have some nematic characters and some smetic characters are called as Cholesteric liquid crystals. These phases/crystals show strong colour effects in polarized light which shows its layer structure. But it has much thicker layers than smetic liquid crystals.

(iii) Smectic Liquid Crystals: Soap like liquid crystals are called as Smectic liquid crystals. This word is derived from Greece word for soap. In smectic liquid crystals, molecular are arranged in layer form and show periodicity to a certain ex

Q.18 What are Colloids?

Ans. Those substances which can diffuse very slowly in solution and cannot pass through animal or vegetable membranes are called as "Colloids". For e.g. starch, gelatin, silicic acid, proteins et.This class of substances generally exist in amorphous or gelatinous condition hence the name colloids meaning "glue form".

Q.19 What are Sols? Describe the optical properties of it.

Ans. When a colloidal solution appear as fluid, it is termed as Sols. Sols are named after dispersion medium. For example, when dispersion medium is water, they are called as "hydrosols" when the dispersic medium is alcohol they are called as alcohols and so on.

Dispersed phase + Dispersion medium = Dispersion system (Colloidal Solutions) Solid + Liquid = Sol Colloidal

Sols show the following optical properties-

(1) Optical rotation by solution of high polymers.

(2) Optical anisotropy in colloids.

(3) Tyndall effect.

(1) Optical rotation by solution of high Polymers: Molecules of some organic colloids are optically active. Hence they rotate the plane of polarised light either towards left or right.

(2) Viscosity of Sols: Viscosity is a tendency of fluid to resist flow it is directly related to the shape of particles therefore viscosity dependence on concentration, temperature etc as concentration and temperature increases viscosity also increases viz sols flow more easily.

(3) Tyndall effect: If a homogeneous solution is observed in the direction of light, it appears clear. If a homogeneous solution is observed from a direction at right angles to the direction of light, it appears perfectly dark. But when a powerful beam of light is passed through a colloidal solution (in place of Homogeneous solution) placed in a darkened room, the sol appears to be luminescent when we view from direction at right angles to the direction of light because it get scattered and the maximum scattered intensity being in the plane at right angles to the path of light the path beam becomes visible. The effect was first observed by Faraday and later studied in detail by Tyndall and hence is called as "Tyndall Effect".

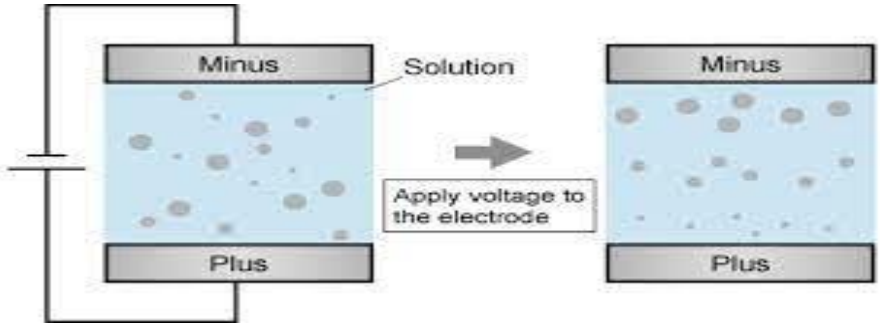
Q.20 Describe the electrical properties of Sols?

Ans. Sol colloids particles carry an electric charge. When sols are placed in the electric field they show 4 type of effect. Such effects are termed as "Electro-Kinetic effects. These electro-kinetic effects are as follows:-

(i) Electrophoresis or cataphoresis.

(ii) Electro osmosis or Electro endosmosis

(1) Electrophoresis or Cataphoresis: All Colloidal particles carry an electric charge on them this can be easily demonstrated by placing the colloidal particles in an electric field. For this purpose colloidal solution is taken in a U-tube and the two platinum electrodes are dipped in sol. The current is then switched on closing the circuit it is found that colloid particles move to the oppositively charged electrode and on reaching that electrode they get discharged. As soon as the charge of the particles is neutralised particles settle down at the bottom. This movement of the colloid particles under the influence of electric field is k/a. Cataphoresis or Electrophoresis



Cataphoresis has many important applications e.g.

(1) Determining the charge on the colloidal particles Direction of movement of the colloidal particles in the electric field shows the charge on them.

(2) It can also be used to determine the rate at which colloidal particles migrate under the influence of an electric field.

(3) It is also used in the identification & determination of homogeneity.

Q.21 Write a Short Note on "Hardy-Schulze Law".

Ans. The colloidal sols are stable by the presence electric charges on the colloidal particles.

- Because of the electric repulsion the particles do not come close to one another.

- As charge removes by any means, particles get aggregate and hence precipitation occurs.
- The process by means of which the particles of the dispersed phase in a sol are precipitated is known as "Coagulation or flocculation".
- A common method of producing precipitation is by the addition of electrolytes.

This phenomenon was studied in detail by schulze, Linder, Picton and Hardy and their observations have been summarized in the form of Hardy-Schulze laws given as below:

(a) The ion which brings co-agulation (aggregation) of a colloidal selection has opposite sign to that on the colloidal particle. Hence for coagulation of (+) vely charged Fe(OH)3 solution anion is required which is associated with it.

(b) A certain amount of electrolyte is necessary for co-agulation this amount varies, with the valency of the effective ion. Thus much more quantity of univalent cation is required than bi-valent ion similarly bivalent ion are much more required than the trivalent ion.

Thus the precipitation value or co-agulation value is defined as the minimum concentration of the electrolyte required to precipitate a given solution.

There are two possibility of co-agulation:

(i) If two oppositely charged colloids are mixed then they will comes close together and get aggregate that's why precipitation occurs. This type of co-agulation is known as Mutual co-agulation.

(ii) If two oppositely charged colloids (Particles) are mixed together and they don't have equal charges the only partial co-agulation will take place

Q.22What do you understand by GOLD NUMBER.

Ans. The power of the hydrophilic colloid to prevent the precipitation of a lyophobic colloid by addition of an electrolyte depends upon the nature of the substance this protective nature of various hydrophilic substances can be expressed by gold Number.

According to Zsigmondy, the gold number may be defined as –

The Number of milligrams of Protective colloid which just prevents the coagulation of 10 ml of a given gold sol by the addition of 1 ml of 10% Sodium chloride to it.

Smaller the gold Number, higher the protective power of a colloid.

Q.23 Write a Short Note on "Emulsifiers".

Ans. In order to prepare stable emulsions it is important to add a third component known as emulsifier or emulsifying agent in suitable amounts. Several types of emulsifier are known:

(1) Long chain compounds with polar groups such as soap, sulphonic acid sulphates etc.

(2) Most of the lyophilic colloids also act as emulsifier such as glue, gelation etc.

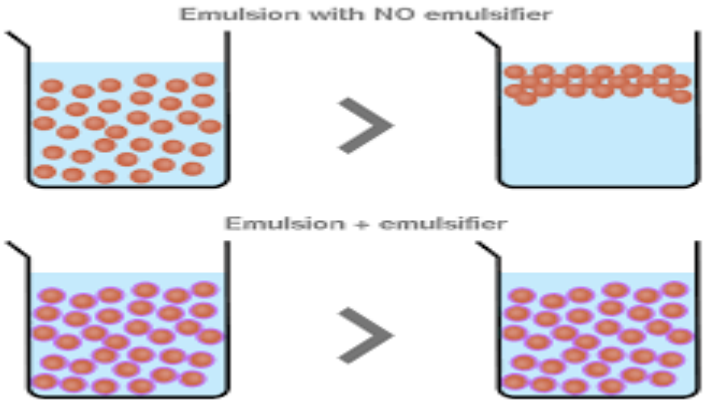
(3) Certain insoluble powders as day, lamp back etc.

(4) Soluble substances like iodine also act as emulsifier. Role of an Emulsifier.

An emulsifier can act in two ways:-

(1) It may be more soluble in one liquid than in the other.

(2) The emulsifier may be insoluble in both the liquids but not unequally wetted by two .



Q.24 Write the Postulates of Kinetic theory of gases.

Ans. Kinetic theory of gases is also called as Microscopic Model of gases.

- It is developed by following scientists

(i) Kronig (ii) Clausius (iii) Maxwell (iv) Boltzmann

- This theory was developed to explain the various gas laws or behaviour of gases such as why gases exert Pressure? Why volume is inversely proportional to the Pressure etc.
- the important assumptions of this theory are as follows:-

(i) A gas is made up of small particles called as Molecules.

(ii) These small particles behave like solid, spherical and perfectly elastic particles.

(iii) These particles are present far away from each other that's why they neither have attraction force nor repulsion force.

(iv) These molecules move in straight line in all directions rapidly collide with each other and wall as well.

(v) The molecules collisions are perfectly elastic (they come back to their position), i.e. there is no net loss or gain of energy after collision that's why all the molecules are still moving, they don't get stop.

(vi) In a gas, different-different molecules have different-different speed (velocities) and therefore different-different kinetic energy to move.

(vii) This kinetic energy may be transferred from one molecule to another but it cannot be convert in any other form of energy such as heat.

(viii) Has exerts pressure because of hits or bombardements of the molecules on the walls of the containing vessel. This force which is exerted on the per unit area of the wall is called as Pressure of gas.

(ix) the average kinetic energy of allthe molecules is directly proportional to the absolute temp. As temperature increases, velocity (speed) of Molecules increases. As a result, kinetic energy of the molecules also increases.

Q.25 Explain Maxwell-BoltzMann's law of distribution of Molecular velocities. Discuss the effect of temperature on the velocity distribution of molecules. Establish a relation between most probable velocity, root mean square velocity and average velocity of Molecules.

Ans. As we have discussed, gas is a collection of small particles separated from the one another by large empty space and move rapidly and randomly in all the directions.

- In the course of their motion, they collide with one another and also with the walls of the container.
- Due to frequent collisions, the speeds and direction of motion of molecules keep on changing. Thus, all the molecules in a sample of a gas do not have same speeds.
- The manner in which the molecular velocities changes from almost zero to very high velocities, was for the first time worked out by J.C. Maxwell in 1860, using the theory of probability.
- The results obtained by him are expressed in the form of law of distributio9n of molecular velocity.

Mathematically, it can be expressed as follows

1/ndn/ dc = 4π(M/2πRT)^3/2. e^(mc^2)/2RT

Here C = Velocity of Molecules

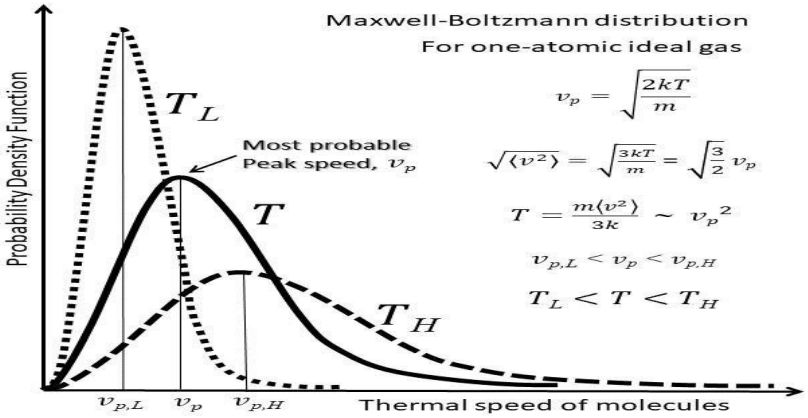
dn = fraction of molecules having velocities between C and C + dc (dc n represents a small variation of velocity) Or It represents the probability of finding the molecules possessing velocity in this very small change.

M = Molecular weight

R = Gas constant T = absolute temp.

e = base of natural logarithm

Graphical Representation of Maxwell Law



Thus Maxwell plotted the fraction of molecules having different speeds against the speeds at particular temperature. The curve so obtained is

called Maxwell's distribution curve. The important features of Maxwell's distribution curve can be summed up as follows-

(i) The fraction of molecules with very low or very high velocities (speeds) is very small.

(ii) The fraction of molecules possessing higher and higher speeds goes on increasing till it reaches the peak and thereafter it starts decreasing.

(iii) The maximum fraction of molecules possess a velocity (or speed) corresponding to the peak in the curve. This speed corresponding to the peak in the curve is referred to as 'Most Probable Speed" viz speed possessed by the maximum fraction of molecules at a particular temperature.

Effect of temperature on distribution of Speeds

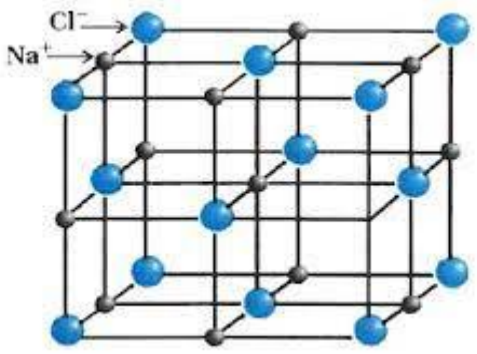
- The fraction of molecules having most probable speed remains the same so long as

temperature remains same.

- On increasing the temperature of the gas, the molecular motion becomes rapid.
- Consequently, the value of most probable speed also increases.
- The entire distribution curve, shifts towards right with rise in temperature as shown below
- However, the area under the two curves remains the same because area under the curves represents number of molecules.
- The rise in temperature increases the fraction of Molecules, havinghigher speeds.

Q.26 Explain Crystal structure of NaCl and CsCl?

Ans. Each sodium ion is surrounding by six chloride ions and each chloride ions is surrounded by six sodium ions. The maximum intensity of reflection occurs at the glancing angle of 5.90 , 8.40 and 5.20 for 100, 110 and 111 planes, respectively for first order reflection.



Structure of NaCl crystals

We know that,

$n\lambda = 2d\sin\theta$ or $= 2$

Therefore for a particular order of reflection $d \alpha 1/\sin\theta$

If only first order reflection are considered than,

$=d100:d110:d111$

$= 1/\sin 5.90 : 1/\sin 8.40 : 1/\sin 5.20$

$= 1/0.103 : 1/0.146 : 1/0.091$

$= 1:0.704:1.155$

For face-centred cubic system the planes can be passed through the atom having Miller indices

100, 110 and 111 at the relative spacing a/2:a/2√2: a/√3

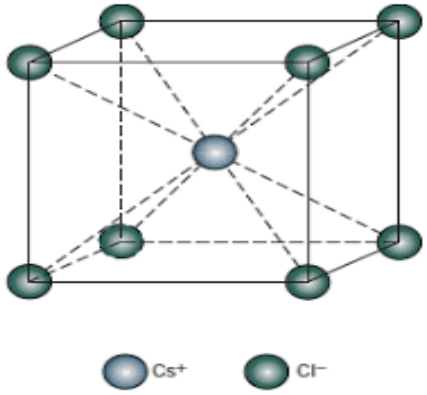
So

d100:d110:d111 = a/2:a/2√2:a/√3 = 1:0.707:1.154

This ratio is almost identical with the ratio we have calculated from experimental observations. Hence NaCl crystal is face-centred cubic system.

Structure of CsClcrystal

Cesium chloride, CsCl, has a body centred cubic structure. In its crystal lattice, each



Cesium chloride crystal lattice

Cs+ ion is surrounded by 8 Cl- ions and its coordination number is 8. The value of distance between Cs+ ion and Cl- ion as determined by Bragg's spectrometer is 3.5100A

Q.27 Derive the expression of Bragg's equation?

Ans. Let the planes ABC and DEF drawn perpendicular to the incident and reflected beams, respectively. The waves reflected from different planes will be in phase will one another only if the difference in the path length of the wave reflected from the successive planes is equal to an integral number of wavelengths. Drawing perpendicular OL and OM to the incident and reflected beams, it will be seen that the path difference in the wavelength, say δ of the wave reflected from the first two planes is given by

δ=LN+NM

This should be equal to a whole number multiple of wavelength λ, i.e.

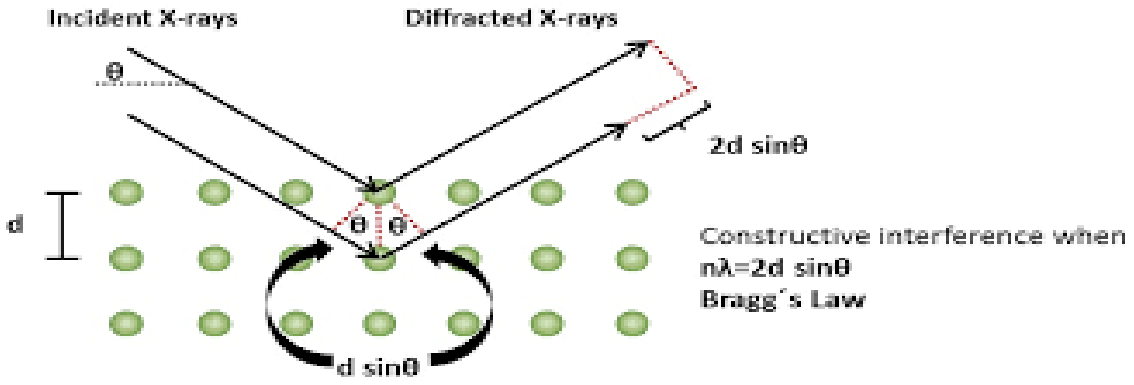
nλ= LN+NM .....(2)

Since the two triangle ONL and ONM are congruent

LN=NM nλ= 2LN= 2dsinθ .....(3)

Equation (3) is known as Bragg's equation.

For a given set of lattice planes, d has a fixed value. Therefore possibility of getting maximum diffraction (i.e., the possibility of getting reflected waves in phase with one another) depends upon θ. If θ is increased gradually, a number of positions will be found at which the reflection will be maximum. At these positions, n will have values 1,2,3,4...etc. generally, in experiments on x-ray diffractions, any set as equal to 1. If λ in known, it is possible to determine d, the distance between atomic planes in the crystal by determining θ experimentally. Thus if d is known λ can be calculated.



Q .28 Difference between solids, liquids and gases

Ans. The differences between solids, liquids and gases can be described as:

Characteristic	**Solid**	**Liquid**
Mass	Definite	Definite
Shape	Definite	Shape of the container
Volume	Definite	Definite
Interparticle space	Tightly packed	Moderately packed
Kinetic energy	Least	Higher than solids but lesser than gases

Force of attraction between particles	Strongest	Weaker than solids but stronger than gases
Compressibility	Negligible	Moderately compressed
Fluidity	Not applicable	Present
Rigidity	Most rigid	Less rigid
Diffusion	Very slow	Faster than solids but lesser than liquids
Density	Highest	Lesser than solid but more than liquids
Arrangement of molecules	Regular and close	Random and sparse
Direction of Flow	-	Higher level to lower level
Pressure	One direction – towards the bottom of the material	2 direction – liquids exert pressure downwards and towards the sides of the container
Number of free surfaces	Any number	One
Volume measurement	Cubic units (cubic centimetre, cubic meter etc.)	Litre 1cm3 = 1 mL 1dm3 = 1L

Q.29 What is Boyle's Law ?

Ans. According to Boyle's Law, at a constant temperature and mass, the volume of the given amount of gas is inversely proportional to its pressure.

- If the temperature and the mass of a given gas are kept constant, the volume of the gas will decrease with the increase in pressure.
- Boyle's Law is one of the most significant gas laws that explain an inverse relationship between pressure and volume.
- This gas law is given by one of the founders of modern experimental chemistry, an English Chemist, Robert Boyle in 1662.

- While experimenting on gases, and studying the deviating behaviour in the variable physical environment, Robert Boyle put forward Boyle's Law.
- Boyle's law works in a way that when the temperature is constant, the volume increases, and the pressure falls. In the same manner, the pressure increases, when volume falls.
- For a gas, the relation between volume and pressure (which is kept at a constant mass and temperature) can be mathematically shown as. **$P \propto (1/V)$.** (Here, P = pressure exerted by the gas and V = volume occupied).
- This proportionality can further be shown in the form of an equation by adding a constant, k. Thus, **$P = k*(1/V) \Rightarrow PV = k$**

Pressure v/s Volume Curve

We can see that a straight line is acquired when the pressure applied by gas which is represented as P is taken on the Y-axis and the volume is inversely occupied by the gas (1/V) on the X-axis.

Q.30 Charles Law Formula

Ans. Charles Law states that when the pressure on a dry gas is held constant, then the Kelvin temperature and therefore the volume will be directly proportional to each other.

As per the Charles Law equation,

$V \propto T$,

The mathematical expression for the same is given as:

$V = kT$

$\Rightarrow V/T = K$

Where,

V= Volume of gas

T= Temperature of gas (in Kelvin)

k= Constant (Non-Zero)

Charles Law illustrates that a rise in the temperature of a gas causes an increase in the volume, whereas a fall in temperature causes the volume to decrease. This law can be mathematically expressed under two different sets of conditions as follows:

In the equations above,

V_1= Initial volume of the system

V_2= Final volume of the system

T_1= Initial temperature of the system (in Kelvin)

T_2= Final temperature of the system (in Kelvin)

Sample Paper Questions

UNIT=I

Multiple Choice Questions

1) Which of the following bonds involve bonding of a hydrogen atom with two strongly electronegative atoms?

a) Hydrogen bond

b) Covalent bond

c) Co-ordinate bond

d) Metallic bond

2) When two orbitals of the two combining atoms (belonging to the same or different elements) overlap along the nuclear axis, is formed.

a) Sigma (o) bond

b) pi (n) bond

c) Covalent bond

d) Co-ordinate bond

3) When p-orbitals of two atoms overlap side-ways along a direction perpendicular to the nuclear axis, is formed.

a) Hydrogen bond

b) Covalent bond

c) pi (n) bond

d) Sigma (o) bond

4) When two partly charged atoms of the same molecule form a hydrogen bonding, it is known as

a) Intra-molecular hydrogen bonding

b) Intermolecular hydrogen bonding

c) Hydrogen bonding

d) Free electron model

5) The ability of a cation to distort an anion is known as its:

a) Polarisation capacity

b) Polarisability

c) Polarisation

d) Polarising power

5) Which of the following formulas can be used for calculation of dipole moment?

a) $\mu=qxd$

b) $\mu=q+$

c) $\mu=q-d$

d) $\mu=q/d$

7) According to Fajan's rule:

a) Every ionic compound possesses total value of covalent character.

b) Every ionic compound possesses some percentage of covalent character.

c) Every cation compound possesses covalent character.

d) Every cation has some percentage of covalent character.

8) Fluorine is an element of group 9 and its electronic configuration is:

a) 2s^{2}4p^{5}3s^{2}

b) 1s^{2}2s^{2}2p^{5}

c) 4s^{2}2p^{5}1s^{2}

d) 1p^{5}1s^{2}2s^{2}

9) The MO configuration of ion is H (1s^{1})+H (1s^{1})+e^{-}\rightarrow H_{2} I(\sigma ls)^{2} (σ)

a) H_{2}^{-}

b)

c) Cr

d) N_{2}^{-}

10) The molecular orbital which contains higher energy is called:

a) Anti-bonding molecular orbital

b) Bonding molecular orbital

c) Bonding orbital

d) Molecular orbital

11) The atomic orbitals that contain a single nucleus are known as:

a) Monocentric

b) Polycentric

c) Bonding orbital

d) Molecular orbital

12) What is the electronic configuration of silicon?

a) ns^{2}np^{2}

b) np^{2}ns^{2}

c) 2ns^{4}pn^{2}

d) s^{2}n~p^{2}n

13) An attraction among two atoms that have previously formed chemical bonds with each other is known as

a) Hydrogen bond

b) Covalent bond

c) Co-ordinate bond

d) Sigma (6) bond

14) When hydrogen bonds are formed between two atoms of different molecules, it is known as:

a) Intermolecular hydrogen bonding

b) Intra-molecular hydrogen bonding

c) Free electron model

d) Hydrogen bonding

15) Weak intermolecular forces that are dependent on the distance between atoms or molecules are known as

a) Van der Waals forces

b) Attractive forces

c) Repulsive forces

d) Debye forces

16) is formed by the electrostatic attraction of positive and negative ions.

a) Ionic compound

b) Covalent bond

c) Hydrogen bond

d) Metallic compound

17) According to Fajan's rule:

a) Every ionic compound possesses total value of covalent character.

b) Every ionic compound possesses some percentage of covalent character.

c) Every cation compound possesses covalent character.

d) Every cation has some percentage of covalent character.

18) Fluorine is an element of group 9 and its electronic configuration is:

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b) 1s^{2}2s^{2}2p^{5}

c) 4s^{2}2p^{5}1s^{2}

d) 1p^{5}1s^{2}2s^{2}

19) The MO configuration of ion is H (1s^{1})+H (1s^{1})+e^{-}\rightarrow H_{2} I(\sigma ls)^{2} (σ)

a) Cr

b) N_{2}^{-}

c) H_{2}^{-}

20) The molecular orbital which contains higher energy is called:

a) Anti-bonding molecular orbital

b) Bonding molecular orbital

c) Bonding orbital

d) Molecular orbital

21) The atomic orbitals that contain a single nucleus are known as:

a) Monocentric

b) Polycentric

c) Bonding orbital

d) Molecular orbital

22) What is the electronic configuration of silicon?

a) ns^{2}np^{2}

b) 2ns^{4}pn^{2}

c) np^{2}ns^{2}

d) s^{2}n~p^{2}n

23) An attraction among two atoms that have previously formed chemical bonds with each other is known as

a) Hydrogen bond

c) Co-ordinate bond

b) Covalent bond

d) Sigma (6) bond

24) When hydrogen bonds are formed between two atoms of different molecules, it is known as:

a) Intermolecular hydrogen bonding

b) Intra-molecular hydrogen bonding

c) Free electron model

d) Hydrogen bonding

15) Weak intermolecular forces that are dependent on the distance between atoms or molecules are known as

a) Van der Waals forces

b) Attractive forces

c) Repulsive forces

d) Debye forces

16) is formed by the electrostatic attraction of positive and negative ions.

a) Ionic compound

b) Covalent bond

c) Hydrogen bond

d) Metallic compound

14) When hydrogen bonds are formed between two atoms of different molecules, it is known as:

a) Intermolecular hydrogen bonding

b) Intra-molecular hydrogen bonding

c) Free electron model

d) Hydrogen bonding

UNIT=II

Multiple Choice Questions

1) Which of the following bonds involve bonding of a hydrogen atom with two strongly electronegative atoms?

a) Hydrogen bond

b) Covalent bond

c) Co-ordinate bond

d) Metallic bond

2) When two orbitals of the two combining atoms (belonging to the same or different elements) overlap along the nuclear axis, is formed.

a) Sigma (a) bond

b) pi (n) bond

c) Covalent bond

d) Co-ordinate bond

3) When p-orbitals of two atoms overlap side-ways along a direction perpendicular to the nuclear axis, is formed.

a) Hydrogen bond

c) pi (x) bond

b) Covalent bond

d) Sigma (a) bond

4) Which of the following formulas can be used for calculation of dipole moment?

a) u=qxd

b) u=a+d

c) u=q-d

d) µq/d

5) According to Fajan's rule:

a) Every ionic compound possesses total value of covalent character.

b) Every ionic compound possesses some percentage of covalent character.

c) Every cation compound possesses covalent character.

d) Every cation has some percentage of covalent character.

6) Fluorine is an element of group 9 and its electronic configuration is:

a) $2s^2$ 4p $3s^2$

b) Is^2 $2s^2 2p$

c) 4s^{2}2p^{5}1s^{2}

d) 1p^{5}1s^{2}2s^{2}

7) The MO configuration of H ion is H (1s^{1})+ ([(\sigma ls) 1s^{1})+e^{-}\rightarrow H_{2}

a) H_2

b) C

c) CT

d) N_{2}

8) The molecular orbital which contains higher energy is called:

a) Anti-bonding molecular orbital

b) Bonding molecular orbital

c) Bonding orbital

d) Molecular orbital

9) The atomic orbitals that contain a single nucleus are known as:

a) Monocentric

b) Polycentric

c) Bonding orbital

d) Molecular orbital

10) What is the electronic configuration of silicon?

a) ns^{2}np^{2}

b) np^{2}ns^{2}

c) 2ns^{4}Dn^{2}

d) s^{2}n~D^{2}

11) An attraction among two atoms that have previously formed chemical bonds with each other is known as

a) Hydrogen bond

b) Covalent bond

c) Co-ordinate bond

d) Sigma (o) bond

12) suggested in 1916 that by sharing the unpaired electrons in their outermost shells some atoms can combine with each other or with other atoms.

a) Andreas Vesalius

b) G.N. Lewis

c) John Bardeen

d) Max Born

13) The concept of mixing two atomic orbitals with the same energy levels to give a degenerated new type of orbitals is called as

a) Sterilisation

b) Resonance

c) Hybridisation

d) Halogenation

14) The oxygen molecule is paramagnetic. It can be explained by

a) Resonance

b) Hybridisation

c) Valence bond theory

d) Molecular orbital theory

15) introduced the concept of hybridisation.

a) Arthur Eddington

b) Linus Pauling

c) Richard Feynman

d) Alfred Wegener

16) When one s, three p and one d atomic orbitals get mixed then orbitals are produced.

a) 5~sp^{3}d hybrid

b) 4~sp^{3}c hybrid

c) 5~sp^{3}d^{2}1 hybrid

d) 5~sp^{3}d^{4}f hybrid

17) The melting point of LiBr is.

a) 446^{\circ}C

b) 613 °C

c) 597^{\circ}C

d) .870^{\circ}C

18) Many chemical species have multiple Lewis structures, and this phenomenon is termed

a) Hybridisation

b) Halogenation

c) Sterilization

d) Resonance

19) The shape of sp^{3}d^{2} hybridisation is

a) Linear

b) Trigonal

c) Tetrahedron

d) Octahedral

20) The molecular orbital configuration of beryllium (Be) is

a) 1s^{1},2p^{3}

b) 1s^{2},2p^{2}

c) 1s^{2},2s^{2}

d) 1s^{1},2p^{2}

21) The bond angle of sp^{3} hybridisation is

a) 104° 2'

b) 102^{\circ}8^{\prime}

c) 119^{\prime\prime}20^{\prime}

d) 109^{\prime\prime}28^{\prime}

22) The bond dissociation energy of H_{2} molecule is

a) 135.8 kJmol

b) 435.8 mol

c) 235.8 kJmol

d) 535.8 klmol

23) The bond length of oxygen atoms is

a) 101 pm

b) 211 pm

c) 121 pm

d) 121 mm

24) both have first proposed the Molecular orbital theory.

a) F. London

b) F. Hund

c) R.S. Mulliken

d) Both (b) and (c)

25) The unit of binding energy is

a) kJmol

b) kgmol

c) Mgmol

d) kJmol

26) The average bond energies of N-C1 is

a) 50 kJ/mol

b) 100 kJ/mol

c) 400 kJ/mol

d) 200 kJ/mol

27) Fluorine is an element of group 9 and its electro ic configuration is

a) 1s^{1}.2s^{2}.2p^{6}

b) 1s^{2}.2s^{3},2p^{4}

c) 1s^{1},2s^{1},2p^{7}

d) 1s^{2},2s^{2},2p^{5}

28) When atoms of two different elements are combined then a diatomic molecule is formed and it is known as

a) Heteronuclear diatomic molecule

b) Binary molecule

c) Heteronuclear molecule

d) Binary compound

29) In 1927, bond theory. has given the first Valence

a) W. Heitler

b) F. London

c) R.S. Mulliken

d) Both (a) and (b)

30) The average bond energies of si-0 is

a) 452 kJ/mol

b) 360 kJ/mol

c) 239 kJ/mol

d) 155 kJ/mol

31) The molecular orbital configuration of Li is

a)1s^{1}2s^{2}

b) 1s^{-2}2s

c) 1s^{2}2s^{1}

d) 1s^{2}2p^{1}

32) The bond angle of sp3 hybridisation is

a) 100.5°

b) 109.5°

c) 209.5°

d) 409.5°

UNIT-III

Multiple Choice Questions

1) Which of the following have high density?

a) Gas

b) Solid

c) Liquid

d) Vapour

2) cannot be compressed.

a) Gas

b) Solid

c) Liquids

d) Vapour

3) Molecules in liquids are held to other molecules by intermolecular interactions, which are weaker than the

a) Forces of repulsion

b) Intramolecular interactions

c) Forces of attraction

d) Intermolecular interactions

4) Thermotropic behaviour means the compounds are liquid crystalline within a defined range.

a) Volume

b) Density

c) Pressure

d) Temperature

5) Liquid crystals are of:

a) Two types

b) Three types

c) Four types

d) Five types

6) Which of the following is the special type of smectic LC?

a) Smectic A

b) Smectic B

c) Nematic phase

d) Cholesteric phase

7) Thermotropic liquid require crystalline compounds do not

a) Solute

b) Solvent

c) Polymer

d) Solution

8) Due to lack of organised have excessive disorder. structure, the solids

a) Cubic

b) Crystalline

c) Amorphous

d) Face-centered

9) In solids, different bonds have different strengths, and their external structure is irregular.

a) Irregular

b) Amorphous

c) Crystalline

d) Cubic-centered

10) In one particle is present at the centre of the cube along with the particles at the corners.

a) Body-centred unit cell

b) Simple cubic unit cell

d) Monoclinic cubic unit cell

11) In all six faces of the cube have a particle at the centre along with the particles at the corners.

a) Triclinic cubic unit cell

b) Body-centred cubic unit cell

c) Face-centred cubic unit cell

d) Cubic-centered unit cell

12) The relative development of various types of faces can be explained by which term?

a) Crystal lattice

b) Crystal form

c) Crystal symmetry

d) Crystal habit

13) The atoms of electrostatic forces. are held together by

a) Molecular crystals

b) Metallic crystals

c) lonic crystals

d) Covalent crystals

14) Diamond is an example of which type of crystal?

a) Metallic behaviour

b) Covalent crystal

c) Molecular crystal

d) lonic crystal

15) What is the lattice angle of orthorhombic unit cell?

a) a=B=90°

b) a=By=90°

c) aBy 90

d) a=B=y=90°

16) The unit cell has a lattice angle of a=B=y=90°

a) Hexagonal

b) Tetragonal

c) Rhombohedral

d) Monoclinic

17) Calcite is the example of unit cell.

a) Trigonal

b) Rhombohedral

d) Cubic

18) According the the same symmetry, all crystals of a substance have same elements of:

a) Lattice

b) Intercept

c) Symmetry

d)Interfacial angle

19)states that angle between adjacent corresponding faces of the crystal is always constant.

a) Law of crystallography

b) Law of constancy of interfacial angles

c) Law of symmetry

d) Law of rationality of indices

20) If the crystal appears same twice on rotating it by 360°, it is called a

a) Diad axis

b) Triad axis

c) Two-fold symmetry

d) Both (b) and (c)

21) Law of constancy of interfacial angles can also be called by which other name?

a) Law of rationality of indices

b) Law of symmetry

c) Steno's law

d) Law of crystallography

22) States that the ratio of intercepts of different faces of a crystal with the three axes are constant.

a) Law of symmetry

b) Law of rationality of indices

c) Law of crystallography

d) Steno's law

23) Could be present in a crystal if divided by an imaginary plane into two equal halves, forming an exact mirror image of each other.

a) Plane of symmetry

b) Law of symmetry

c) Axis of symmetry

d) Centre of symmetry

24) The whole numbers of unit intercepts n, n' and n" are called

a) Positive indices

b) Miller indices

c) Weiss indices

d) Negative indices

25) Represents an imaginary line passing through a crystal in such a manner that on rotating the crystal by 360, it appears same more than once.

a) Centre of symmetry

b) Law of symmetry

c) Plane of symmetry

d) Axis of symmetry

26) Denotes the point through which when a line is drawn, it should touch the surface of the crystal at same distances on either side.

a) Axis of symmetry

b) Two-fold symmetry

c) Centre of symmetry

d) Plane of symmetry

27) Hauy gave which law?

a) Law of symmetry

b) Law of crystallography

c) Law of constancy of interfacial angles

d) Law of rationality of indices

28) _____is the change in the direction of an electromagnetic wave when it encounters a physical barrier.

a) Diffraction

b) Refraction

c) Scattering

d) Reflection

29) Who suggested that crystal can act as grating to X- rays?

a) Hauy

b) Bravais

c) Laue

d) Frederick

30) When a beam of X-ray is allowed to fall on a crystal, a large number of images of different are formed.

a) Intensities

b) Densities

c) Shapes

d) Wavelengths

31) If the diffracted waves are in the same phase, a series of _spots are produced on a photographic plate.

a) Coloured

b) Dark

c) Bright

d) Irregular

32) If the diffracted waves are out of phase, spots are caused on the photographic plate.

a) Dark

b) Bright

c) Coloured

d) Non-uniform

33) The electrometer reading in rotating crystal method is proportional to the intensity of which rays?

a) Alpha

b) Beta

c) Gamma

d) X

34) The rotating crystal method can be used only if a single crystal is available.

a) Uniform

b) Distorted

c) Undistorted

d) Three-dimensional

35) The powder method was devised by Debye and

a) Laue

b) Scherrer

c) W. Crookes

d) W.H. Bragg

36) Electro-kinetic potential is the difference in potential between the surface of the electro-neutral region of the solution and

a) Tightly bound layer

b) Electrical double layer

c) Diffuse second layer

d) Interface

37) Which of the following are crystalline solids?

a) Glass

b) Plastics

c) Rubber

d) Diamond

38) Which of the following are amorphous solids?

a) NaCl

b) Diamond

c) Rubber

d) None of the above

39)_____ is the temperature at which the crystal lattices get disrupted by gaining minimum energy which overcomes the attractive forces.

a) Bravais melting point

b) Interfacial melting point

c) Lattice melting point

d) Crystal's melting point

40) Which one of the following is non-crystalline or amorphous?

a) Diamond

b) Graphite

c) Glass

d) Common Salt

41) Bravais lattices include end centred, and body centred including face centred,

a) 4 unit cells

b) 10 unit cells

c) 11 unit cells

d) 14 unit cells

42) Which solid structure has a definite and sharp melting point?

a) All types of solids

b) No type of solid

c) Amorphous solids

d) Crystalline solids

43) Which of the following is not a characteristic property of solids?

a) Intermolecular distances are short

b) Intermolecular forces are weak

c) Constituent particles have fixed positions

d) Solids oscillate about their mean positions

44) What are the crystallisation's initial materials?

a) Liquid, aqueous solution, emulsion

b) Gas, aqueous solution, foam

c) Aqueous solution, melt, glass or gel

d) Solid, gas, melt, solid aerosol

45) Graphite has hybridised carbon atoms.

a) sp2

b) sp3

c) sp

d) sp^2d

46) The law of constancy of interfacial angles is also known as the

a) Hauy law

b) Steno's law

c) Miller law

d) Laue law

47) Law of rationality of indices is given by

a) Archimedes

b) Leonardo da Vinci

c) Robert Boyle

d) Hauy

48) Who recommended that crystal may act as a grating for X-rays?

a) Leonardo da Vinci

b) Robert Boyle

c) Laue

d) Hauy

49) Bragg equation was introduced by

a) W.L. Bragg

b) W.H. Bragg

c) Robert Boyle

d) Both (a) and (b)

50) Is the number of positive or negative ions surrounding each ion.

a) Simple cubic numbers

b) Coordination numbers

c) Face-centred numbers

d) Body-centred numbers

51) Which of the following will have metal deficiency defect?

a) NaCl

b) FeO

c) KCl

d) ZnO

UNIT-IV

Multiple Choice Questions

1) Which of the following is the condition of ideal gas?

a) PV=RT

b) PV<RT

c) PV>RT

d) PV=nRT

2) Boyle's Law states that the volume is inversely proportional to at constan temperature.

a) Pressure

b) Density

c) Partial pressure

d) Molecular mass

3) Compressibility factor is denoted by which of the following:

a) Z

b) K

c) X

d) C

4) The value of Z for an ideal gas is:

a) Z=0

b) z=1

c) Z=2

d) z=-1

5) According to Charles's law volume is directly proportional to

a) Volume

b) Density

c) Pressure

d) Temperature

6) The ideal gas law may be stated as the volume of a given amount of gas is directly proportional to the number of moles of gas, directly proportional to and inversely proportional to the the pressure.

a) Volume

b) Density

c) Pressure

d) Temperature

7) The volume of a gas denotes which space in the vessel for the molecules to move freely?

a) Free

b) Occupied

c) Partially free

d) Fully occupied

8) Which of the following states the Avogadro's Law

a) VT

b) VP

c) Vn

d) Voc

9) The critical pressure is the minimum pressure required to liquefy the gas at its critical

a) Pressure

b) Density

c) Volume

d) Temperature

10) The critical temperature of a gas is the temperature above which it cannot be great the pressure applied. no matter how

a) Melted

b) Vaporised

c) Solidified

d) Liquefied

11) The slow moving aggregate due to converted into liquid. molecules of gas molecules between them and are

a) Charge

b) Repulsions

c) Attractions

d) Non-polar bond

12) The value of V constant of gas:

a) V=3b

b) V=6b

c) V=9b

d) V=12b

13) The reduced volume (0) and reduced temperature (0) of a gas are 10.2 and 0.7. What will be its pressure if it's critical pressure (P_{c})is~4.25a ?

a) P=0.6816 atm

b) P=0.6186 atm

c) P=0.6861 atm

d) P=0.8616 atm

14) The critical volume is the volume occupied by a mole of the gas at the critical temperature and

a) Critical Area

b) Critical volume

c) Critical pressure

d) Density

15) Three speed expressions are derived from the Kinetic molecular theory

a) Van der Waals equation

b) Maxwell-Boltzmann distribution

d) Both (b) and (c)

16) The is the maximum value on the Maxwell- Boltzmann distribution plot.

a) Velocity

b) Average speed

c) Most probable speed

d) Root-mean-square speed

17) The root-mean-square speed is square root of the squared.

a) Average speed

b) Average volume

c) Average velocity

d) Average temperature

18) is the average number of collisions between reacting molecules per unit of time per moles of reactant.

a) Mean free path

b) Collision radius

c) Collision diameter

d) Collision numbers

19) Mathematically, is related to the mean distance travelled by the moleculen one second and its per secon.

a) Collisions rate

b) Collisions velocity

c) Collisions number

d) Collisions speed

20) When the molecules approach each other during collision the outer boundaries have a limit beyond which they cannot come close to each other. This distance is known as

a) Limited space

b) Closest approach

c) Both (a) and (b)

d) Fastest approach

21) The molecules of a liquid have greater cohesion molecule.

a) Gas

b) Solid

c) Vapour

d) Liquid

22) Liquid has high intermolecular forces than

a) Gas state

b) Solid state

c) Vapour state

d) Crystal state

23)____of molecule affects the intermolecular attractions of London dispersion forces.

a) Shape

b) Volume

c) Density

d) Molecular weight

24) Which of the following have high density?

a) Gas

b) Solid

c) Liquid

d) Vapour

25) Which of the following have low density?

a) Gas

b) Solid

c) Liquid

d) Both (b) and (c)

26) The is the maximum value on the Maxwell. Boltzmann distribution plot.

a) Velocity

b) Average speed

c) Most probable speed

d) Root-mean-square

27) The root-mean-square speed is square root of the squared.

a) Average speed

b) Average volume

c) Average velocity

d) Average temperature

28)_____ is the average number of collisions between reacting molecules per unit of time per moles of reactant.

a) Mean free path

b) Collision radius

c) Collision diameter

29) The molecules of a liquid have greater cohesion than molecule.

a) Gas

b) Solid

c) Vapour

d) Liquid

30) Liquid has high intermolecular forces than

a) Gas state

b) Solid state

c) Vapour state

d) Crystal state

31) of molecule affects the intermolecular attractions of London dispersion forces.

a) Shape

b) Volume

c) Density

d) Molecular weight

32) Which of the following have high density?

a) Gas

b) Solid

c) Liquid

d) Vapour

33) Compressibility is very high in

a) Gas

b) Solid

c) Liquid

d) Vapour

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