Q.1 Attempt any NINE of the following : [18]

Q.1(a) Distinguish between orbit and orbital (Any two points). [2]

(A) [Any Two points – 1 mark each]

	Orbit	Orbital
(i)	It is fixed path along which the electrons revolve around the nucleus.	It is the region in the space where the probability of finding an electron is maximum.
(ii)	Orbits are designated by letters K, L, M, N, O, P.	Orbitals are designated by letters s, p, d, f.
(iii)	Orbit is circular paths or elliptical in shape.	The orbitals have different geometrical shapes. Eg. - Spherical, p-dumb bell shaped.
(iv)	The maximum number of electrons in an orbit is given by $2n^2$ rule.	Orbital can contain maximum two electrons with opposite spins ($\uparrow\downarrow$)
(v)	The number of orbits from the nucleus are n = 1, 2, 3, 4, 5, 6 etc.	The number of orbitals relative to energy level are n^2 = 1, 4, 9, 16 etc.

Q.1(b) State Hund's Rule of Maximum Multiplicity. [2]

(A) Hund's Rule of Maximum Multiplicity [2 marks]

It states that "when several orbitals of the same type (energy) are available then the electrons first fill all the orbitals with parallel spin before pairing in any one orbital".

Q.1(c) Define valency. Name the types of valencies. [2]

(A) Valency [1 mark]

"The number of electrons an atom can lose or gain or share so as to complete its octet (outermost shell) & become stable is called as valency".

Types of Valency: [½ mark each]

(i) Electro valency
(ii) Co-valency

Q.1(d) State Faraday's second law of electrolysis. [2]

(A) Faraday's second law of electrolysis [2 marks]

This law states that, when the same quantity of electricity is passed through the different electrolyte solutions which are connected in series, the amount of the substance deposited or liberated at the electrodes are directly proportional to their chemical equivalents.

Q.1(e) Calculate the pH of solution whose hydrogen ion concentration is 5.5×10^{-5} gm ion per litre. [2]

(A) Given : $[H^+] = 5.5 \times 10^{-5}$ gm ion per litre [½ mark]

pH = ?

$pH = -\log_{10}[H^+]$ [½ mark]

$= -\log_{10}[5.5 \times 10^{-5}]$

$= -[(\log_{10} 5.5) + (\log_{10} 10^{-5})]$ [½ mark]

$= -[(0.7404) + (-5)]$

$= [5 - 0.7404]$

$pH = 4.25$ [½ mark]

Q.1(f) Name the four factors which affect degree of ionization. **[2]**

(A) Factors affecting degree of ionization: [½ mark each]

(i) Nature of Solute
(ii) Nature of Solvent
(iii) Concentration of the solution
(iv) Temperature

Q.1(g) Define : **[2]**

(i) Ore **(ii) Gangue**

(A) (i) Ore [1 mark]

The mineral from which the metal is conveniently and economically extracted is known as ore.

(ii) Gangue [1 mark]

Ores obtained from earth's crust are always associated with impurities like sand, clay, rocks etc. & these unwanted impurities associated with the ores are known as 'gangue' or 'matrix'.

Q.1(h) Define Alloy. Give the classification of Alloy with one example of each. **[2]**

(A) Alloy [1 mark]

It is defined as a homogeneous mixture of two or more elements in which one must be a metal.

Classification of Alloys :

Ferrous Alloys [½ mark]

Examples: steel alloy, plain carbon steel, magnetic steel, stainless steel etc.

Non - Ferrous Alloys [½ mark]

Examples: Brass, Bronze, Duralumin etc.

Q.1(i) Give composition and uses of Wood's metal. **[2]**

(A) Composition: [1 mark]

Bi = 50%
Pb = 25%
Sn = 12.5%
Cd = 12.5%

Uses: [Any two – ½ mark each]

It is used in
(i) Safety plugs of pressure cookers.
(ii) Safety plugs of Boilers.
(iii) Fire alarms.
(iv) Automatic water sprinklers.
(v) Soft solder.
(vi) For casting of dental work.

Q.1(j) Define polymerization. Give the types of polymerization. **[2]**

(A) Polymerization [1 mark]

"The process in which a large number of small molecules (monomers) link together to form a large molecule (polymer) under specific conditions of temperature, pressure & catalyst is known as polymerization.

Types of polymerization: [½ mark each]

(i) Addition polymerization.
(ii) Condensation polymerization.

Q.1(k) Write the two purposes of making alloys with one example of each. [2]

(A) The purposes of making an alloy with example: [Any Two – 1 mark each]

(i) Improve hardness of metal
Example – Pure gold & silver are soft. Hence they are hardened by the addition of a small amount of copper in them.

(ii) Lower the melting point
Example – Wood's metal is an alloy of Bi, Pb, Sn, Cd. It has the M.P. 710C which is much lower than those of its constituents.

(iii) Increase the tensile strength
Example – The addition of 1% carbon increase the tensile strength of pure iron by about 10 times.

(iv) Increase corrosion resistance
Example – Pure iron is corroded fastly but its alloy stainless steel resist corrosion.

(v) To get good casting
Example – Bronze (an alloy of Cu & Zn) and Duralumin possess good casting property.

(vi) Modify colour
Example – Brass is an alloy of copper (red) and zinc (silvery white) and is yellow in colour.

(vii) Reduce malleability & ductility
Example – a small amount of copper is added to gold and silver to reduce their malleability and ductility.

(viii) Modify chemical activity
Example – Sodium is highly reactive element, but when it is alloyed with mercury to form an alloy called sodium- amalgam, it becomes less reactive.

Q.1(l) Give two properties and related applications of plastics. [2]

(A) [1 mark each]

	Properties	Applications
(i)	Low specific gravity & high tensile strength.	In aircrafts, motorcars & structural industries.
(ii)	Combination with metals.	Wheels of automobiles plastics cover dash boards.
(iii)	Resistance to wear & tear & abrasion resistance.	For making machinery parts such as gears pulleys.
(iv)	Poor electrical conductivity.	In electronic industry.
(v)	High chemical resistance and corrosion resistance.	In chemical industries PVC plastic used in place of stainless steel.
(vi)	Bad conductor of heat.	Handles of electric irons, kettles, pressure cookers, frying pan etc.
(vii)	Hard and shock absorbing capacity.	In machinery to reduce noise and vibrations.
(viii)	Clear, transparent, translucent, opaque nature.	Decorative knobs for radio, automobile & house hold appliances, wind screens for automobiles, aircrafts ,optical lenses etc.
(ix)	Water proof	Water bottles, raincoats, buckets, water tanks etc.

Q.2 Attempt any FOUR of the following. [16]

Q.2(a) Write orbital electronic configuration of $_{13}Al^{27}$, $_{20}Ca^{40}$, $_{24}Cr^{52}$, $_{10}Ne^{20}$. [4]

(A) (i) $_{13}Al^{27} = {}_1s^2, {}_2s^2, {}_2p^6, {}_3s^2, {}_3p^1$ [1 mark]

(ii) $_{20}Ca^{40} = {}_1s^2, {}_2s^2, {}_2p^6, {}_3s^2, {}_3p^6, {}_4s^2$ [1 mark]

(iii) $_{24}Cr^{52} = {}_1s^2, {}_2s^2, {}_2p^6, {}_3s^2, {}_3p^6, {}_4s^1, {}_3d^5$ [1 mark]

(iv) $_{10}Ne^{20} = {}_1s^2, {}_2s^2, {}_2p^6$ [1 mark]

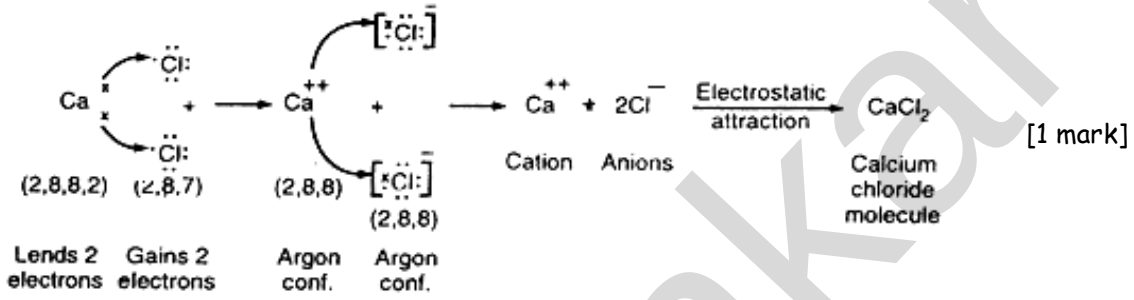
Q.2(b) Describe formation of $CaCl_2$ molecule with diagram and name the type of bonding. [4]

(A) Ca (Z = 20) = (2, 8, 8, 2)
Cl (Z = 17) = (2, 8, 7)

Explanation [2 marks]

In the formation of calcium chloride molecule 2 electrons are transferred from calcium atom to two chlorine atoms. By the loss of two electrons, the Calcium atom acquires two positive (Ca^{++}) charges& attain stable configuration like Ar (2, 8, 8). Similarly two chlorine atoms gain one electron each & acquire -1 charge & form $2Cl^-$ ions.

The oppositely charged ions (Ca^{++} & $2Cl^-$) combine together by electrostatic force of attraction to form neutral molecule of $CaCl_2$.



[1 mark]

Type of Bond is Electrovalent bond. [1 mark]

Q.2(c) Give the assumption of Bohr's theory of atomic structure. [4]

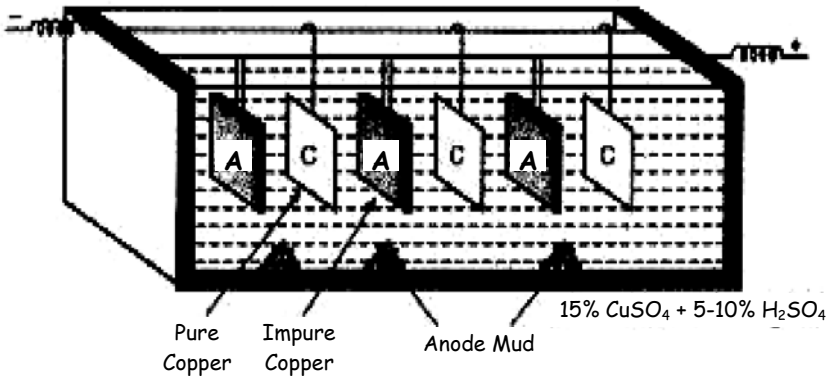
(A) Assumption of Bohr's theory of atomic structure [1 mark each]

(i) An atom consists of a dense positively charged central part called as Nucleus.
(ii) The electrons revolve around the nucleus in fixed circular paths are called orbit or shell. The electrostatic force of attraction between nucleus & electron balanced by the centrifugal force. Hence the electrons do not fall into the nucleus and therefore atom remains stable.
(iii) Electron can rotate only in certain permitted orbits known as stationary state.
(iv) Each stationary state is having definite amount of energy hence called as energy level.
(v) Electrons in the energy level nearest to the nucleus have lower energy while those are at greater distance from the nucleus have higher energy.
(vi) As long as the electron stays in the same energy level, the energy remains constant. The energy of an electron can change only when it moves from one level to another.
(vii) When the excited electron jumps from lower to higher energy level, it absorbs or gain energy. When the excited electron jumps from higher to lower energy level, it emits or loses energy.
(viii) The angular momentum of an electron (mvr) must be an itegral multiple of $h/2\pi$. Hence $mvr = nh/2\pi$

Q.2(d) Why Copper is electrorefined? Describe the process of electrorefining of copper with suitable diagram. [4]

(A) [1 mark]

Blister copper contains 3 to 4 % of impurities like Ag, Au, Pt, Cr, Ni, Fe, S etc. Presence of all these impurities in copper reduces its electrical conductivity. So when copper metal is to be used for preparation of electrical wires & cables it is electro refined because this process gives 99.99% pure copper metal.



[1 mark]

1) It is carried out in the large lead lined tank. [1 mark]
2) Impure Copper is placed into large plates which are suspended into tank at intervals and acts as anode.
3) Cathodes are thin plates of pure copper and each is suspended between two plates of anode.
4) The electrolyte is 15% $CuSO_4$ containing 5-10% free H_2SO_4 solution.
5) By the passage of electric current, Cu from the anode with traces of more active metals like Zn, Fe, Ni present as impurities go into the solution as metallic ions, whereas less active metals like Ag, Au and Pt are not ionized but crumbles down from the anodes and settle below the anode as anode mud.
6) At the applied voltage, Cu^{++} ions alone are discharged at the cathode and thus pure copper is deposited on the cathodes.
7) Electro – refined copper is deposited on the cathodes.

Ionisation

$CuSO_4$

[1 mark]

$Cu^{++} + 2e^- \rightarrow Cu\downarrow$ ← To Cathode — $Cu^+ + SO_4^{--}$ / $H^+ + OH$ — From anode → $Cu \rightarrow Cu^{++} + 2e^-$

H_2O

Q.2(e) State Faraday's first law of electrolysis. When 0.3956 g of copper was deposited by a current of 0.4 ampere in 50 mins. What is ECE of copper? **[4]**

(A) Faraday's first law of electrolysis [1 mark]

This law states that the weight of a substance liberated or deposited at the electrode is directly proportional to the quantity of electricity passed through the electrolyte solution.

Given: [1 mark]

(i) w = weight of copper deposited = 0.3956 g
(ii) c = 0.4 ampere
(iii) t = 50 minutes = 50x60= 3000 seconds

According to Faraday's First law, we have,

$W = zct$ [1 mark]

$0.3956 = z \times 0.4 \times 3000$

$z = \frac{0.3956}{0.4} \times 3000$

$z = 0.0003296$ or (3.296×10^{-4}) g/coulomb [1 mark]

Q.2(f) Give any four assumption of Arrhenius theory of electrolytic dissociation. [4]

(A) Arrhenius theory of electrolytic dissociation : [Any Four – 1 mark each]

(i) The molecules of an electrolyte when dissolved in water split up into two kinds of charged particles, positively charged particle known as cation, negatively charged particle known as anion.

(ii) Cations are metallic radicals obtained by lose of electrons from metallic atoms. Anions are non-metallic radicals obtained by gain of electrons from non-metallic atoms or groups of non-metals.

(iii) In solution, total numbers of cations (positive charges) is equal to the total number of anions (negative charges) & hence the solution as a whole is electrically neutral.

(iv) The cations & anions present in the solution reunite together forming the original electrovalent compound. Therefore it is reversible type of process.

(v) The number of positive or negative charges on cation or anion corresponds to the valency of the parent element or radical from which the ion is derived.

Q.3 Attempt any FOUR of the following. [16]

Q.3(a) Define : [4]

(i) Tensile strength (ii) Soldering

(iii) Castability (iv) Machinability

(A) (i) Tensile Strength [1 mark]

Is the ability to carry a load without breaking.

OR

A tensile strength of a metal is its ability to resist pull without breaking.

(ii) Soldering [1 mark]

A method of joining the metals surfaces by introducing a molten non-ferrous alloy with melting point below 4000C between them, is known as soldering.

(iii) Castability [1 mark]

The process of pouring molten metal into a mould & allowing it to solidify is known as casting and the ability of metal to get casted is called as castability.

(iv) Machinability [1 mark]

Is the property due to which a material can be easily cut by cutting tools to produce a desired shape & surface finish on its surface.

Q.3(b) Describe the fusion method for preparation of Alloy with suitable diagram. [4]

(A) Fusion method for preparation of Alloy [Explanation & Diagram – 2 marks each]

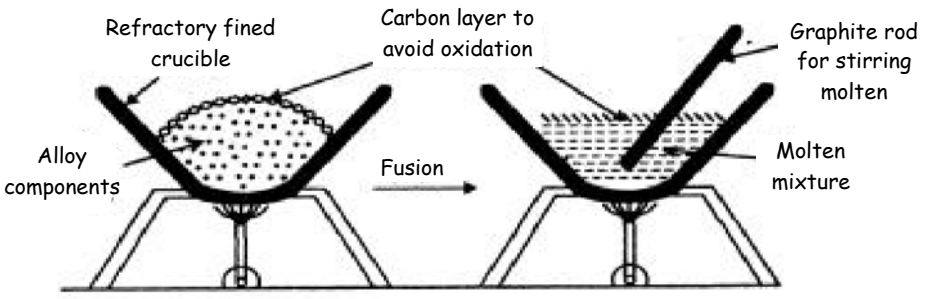
(i) It is used for preparation of binary alloys. The component metal having higher M.P. is melted first in a crucible & the other component having lower melting points are added to in the required quantity.

(ii) The molten mixture is stirred using graphite rods to get uniform alloy.

(iii) The molten metals are at high temp & hence react with atmospheric oxygen to form oxide, hence to prevent oxidation the surface of molten mass is covered with charcoal powder.

(iv) The molten mass is then allowed to cool which gives required alloy.

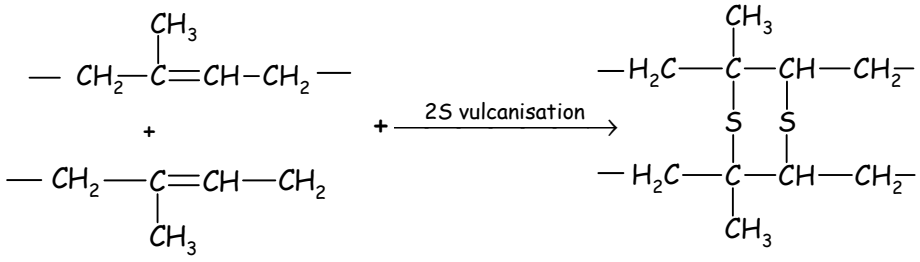
Example – Brass



Q.3 (c) Describe vulcanization of rubber. Why is rubber vulcanized? [4]

(A) Vulcanization of rubber [1 mark]

"The process which involves addition of sulphur or H_2S to crude (raw) natural rubber at high temp & pressure to improve properties of crude natural rubber is called vulcanization."



Crude rubber spring Vulcanised rubber

Vulcanisation of rubber [1 mark]

Vulcanisation of rubber is necessary for [Any Two - 2 marks]

(i) Stiffening of rubber.
(ii) Preventing intermolecular movement or sliding of rubber springs.
(iii) To improve the hardness, abrasion resistance, chemically resistant.
(iv) Makes the rubber tough, strong, usable from – 40°C to100°C.
(v) To improve electrical insulation property.

Q.3 (d) Distinguish between thermosoftening and thermosetting plastics. [4]

(A) [Any four points – 1 mark each]

	Thermosoftening plastics	Thermosetting Plastics
(i)	They are formed by addition polymerisation.	They are formed by condensation polymerization.
(ii)	Linear long chain polymers with limited cross links.	Three dimensional structure with cross linkages.
(iii)	Smaller molecular weight.	Higher molecular weight.
(iv)	Softened on heating & reshaped & reused.	Do not soften on heating & reshaped & reused.
(v)	Reclaimed form wastes.	Can not be reclaimed from wastes.
(vi)	Intermolecular bonds are weaker.	Intermolecular bonds are stronger.
(vii)	Softer, weaker, less brittle.	Harder, stronger & more.
(viii)	Soluble in organic solvents.	Insoluble in organic solvents.
(ix)	Example – Polyethylene, Polystyrene PVC.	Example – Bakelite, Polyesters, silicone Plastics.

Q.3 (e) How glass wool is prepared? Give its properties and uses. [4]

(A) Preparation [1 mark]

(i) Molten mass of alkali free glass is passed through sieve holes of 0.0005 cm diameter (5×10^{-4} cm).
(ii) The glass filaments obtained are the thrown over a rapidly rotating drum to get wool like form.

Properties : [Any Three - $1\frac{1}{2}$ mark]

(i) Its thermal conductivity is low.
(ii) It is fire proof & non-combustible.
(iii) It has low thermal & electrical conductivity.
(iv) It is resistant to chemicals.
(v) It is soft, flexible, has low density.
(vi) It is waterproof.
(vii) Its tensile strength is very high.
(viii) It is light in weight.

Applications : [Any Three - 1½ mark]

(i) It is used in air filters as a dust filtering material.
(ii) It is used as sound absorber (sound - proofing).
(iii) Being resistant to chemicals it is used for filtering hot, corrosive liquids like acids, alkali etc.
(iv) It is widely used as thermal insulating material in domestics & industrial appliances such as motors, ovens, refrigerators.
(v) It is used in the manufacturing fiber glass by reinforcing with plastic resins.

Q.3 (f) Write any four uses of rubber based on its different properties. [4]

(A) [Any four points – 1 mark each]

	Properties of Rubber	**Related uses**
(i)	Elasticity	For preparation of rubber bands, balloons, tubes for all vehicles.
(ii)	High abrasion resistance	For preparation of tyres of all vehicles, shoe sols & shoe heels, conveyer belts, floor tiles ,rubber mats.
(iii)	Shock absorbing	For preparation of sports goods, toys, helmets, goggles, for mounting heavy machines, to reduce noise & vibrations.
(iv)	Excellent Electrical insulator	For insulation of electrical wires and cables , For hand gloves of electrician.
(v)	High Chemical resistance	Rubber lined tanks are used for storing corrosive chemicals rubber hoses are used for transmission of corrosive chemicals ,rubber gaskets & seals are used for sealing.
(vi)	Hardness	Rubber gaskets are used for sealing pressure cookers, refrigerators ,ovens, cabinet doors, autoclaves etc.
(vii)	Excellent thermal & sound insulator	Sponge insulator in auditoriums, theaters, in different filters.
(viii)	Airproof	For preparation of balloons, tubes, air pillows, cushions, mattresses.
(ix)	Waterproof	For preparation of rain coats.

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