Model Answer -Basic Chemistry

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
		Important Instructions to examiners: 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme. 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate. 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills). 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn. 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer. 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding. 7) For programming language papers, credit may be given to any other program based on equivalent concept.		

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>1</td><td></td><td>Attempt any nine of the following:</td><td></td><td>18</td></tr>
<tr><td></td><td>a)</td><td>Distinguish between energy level and subenergy level. (any two points)
<table><tr><th>Sr. No.</th><th>Energy Level</th><th>Sub - Energy Level</th></tr><tr><td>1)</td><td>Bohr’s stationary orbits with definite amount of energy called energy levels.</td><td>Close grouping of energy levels in the main energy levels called sub – energy levels.</td></tr><tr><td>2)</td><td>Denoted by letters K, L, M, N, O, P etc.</td><td>Denoted by letters s, p, d, f</td></tr><tr><td>3)</td><td>Maximum number of electrons is given by $2n^2$ in energy level.</td><td>Maximum number of electrons in sub energy levels are s = 2, p = 6, d = 10, f = 14.</td></tr><tr><td>4)</td><td>These are circular or elliptical in shape.</td><td>They have different geometrical shapes i. e. s = spherical, p = dumb-bell shaped etc.</td></tr></table></td><td>1 mark each</td><td>2</td></tr>
<tr><td></td><td>b)</td><td>Give <u>two applications</u> of carbon and cobalt isotopes.
Applications of Carbon isotopes : (any two)
1) C^{12} being most abundant in nature as backbone of life on earth. C^{12} participates in all metabolic processes including respiration and photosynthesis.
2) Fossil fuels are created from dead carbon based organic matter.
3) All our energy needs are satisfied by carbon base crude oil and natural gas deposits.
4) C^{13} has application in NMR, as it has nuclear spin, which respond to radio frequency signal,
5) In Earth science (C^{13}) it is used to determine identity of water sources.
6) C^{14} is the radioactive isotope of carbon, used in radiocarbon dating technique.It is used to determine the age of carbon containing materials which are up to 60,000 years old.</td><td>½ mark each</td><td>2</td></tr>
</table>

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1.	**b)**	**Application of isotopes of Cobalt: (any two)** **Cobalt – 57 (Co^{57}):** It is a radioactive isotope used in 1) Medical tests 2) Used as a radiolabel for vitamin B_{12} uptake. 3) Useful for Schilling test i. e. a medical investigation done for patients with vitamin B_{12} deficiency **Cobalt –60 (Co^{60}):** It is a gamma ray source used in - 1) Sterilization of medical supplies and medical waste. 2) Radiation treatment of foods for sterilization (cold pasteurization) 3) Industrial radiography (weld integrity radiographs) 4) In density measurement (concrete density measurement) 5) In tank fill height switches. 6) Used to treat various types of cancers. 7) Can be used to detect flaws in metal components.	½ mark each	
	c)	**Define electrovalency and covalency.** **Electrovalency:** The number of electrons that an atom of an element gains or loses to complete its last orbit is called electrovalency. **Covalency:** The valency obtained by the mutual sharing of electrons between the similar or dissimilar atoms, so as to complete their last orbits is called 'Co-volency'. **Or** The number of electron pairs which an atom of an element shares with another similar or dissimilar atom is called as covalency.	1 1	2
	d)	**Define conductor and give two examples.** **Conductor:** A substance which allows electric current to pass through it is known as conductor. **Examples: (any two)** All metals, graphite, fused salts, aqueous solutions of acids, bases and salts.	1 ½ mark each	2

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<tr><td>1</td><td>e)</td><td>Distinguish between strong electrolyte and weak electrolyte.

<table>
<tr><th>Sr.No.</th><th>Strong electrolyte</th><th>Weak Electrolyte</th></tr>
<tr><td>1.</td><td>Electrolyte which is highly ionized in solution is known as strong electrolyte.</td><td>Electrolyte which is weakly ionized in solution is known as weak electrolyte.</td></tr>
<tr><td>2.</td><td>They have high degree of ionization.</td><td>They have low degree of ionization.</td></tr>
<tr><td>3.</td><td>e.g.strong acids – HCl, HNO_3
Strong bases – KOH, NaOH</td><td>e.g. Weak acids CH_3COOH, H_2CO_3,
weak base like NH_4OH</td></tr>
<tr><td>4.</td><td>Produces more number of ions.</td><td>Produces less number of ions.</td></tr>
</table>
(Note : consider any two points)</td><td>1 mark each</td><td>2</td></tr>
<tr><td></td><td>f)</td><td>Define ECE. State the relation between ECE and CE.

ECE (Electrochemical Equivalent): Electrochemical equivalent of an electrolyte is defined as the amount of substance deposited or liberated at electrode by the passage of 1 ampere current for 1 second. Or It is the weight of substance deposited at the electrode when 1 coulomb of electricity is passed through electrolyte solution

Relation between ECE and CE: The quantity of electricity, 96500 coulombs required to liberate or deposit 1 gm equivalent of a substance. 1 coulomb liberates or deposits to its e.c.e. Thus, equivalent weight of a substance is 96,500 times the electrochemical equivalent. C.E. (Eq. Wt.) = 96500 x E.C.E.</td><td>1

1</td><td>2</td></tr>
<tr><td></td><td>g)</td><td>Why blue colour of copper sulphate solution turns to colourless after its electrolysis using platinum electrodes?

The platinum electrodes are inert. Hence does not dissolve into the solution. The Cu^{++} ions (blue) present in the solution are discharged on the surface of cathode & OH^- are discharged on the surface of anode while H^+ and SO_4^{2-} ions remains in the solution. As a result of this electrolysis, blue coloured $CuSO_4$ solution is slowly converted into colorless H_2SO_4 solution.</td><td>1

2</td><td>2</td></tr>
</table>

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1.	**h)**	**Why all ores are minerals but all minerals are not ores? Explain with example.** **Mineral: -** A naturally occurring substance present in earth's crust which contains metal in the free or combined state is known as mineral. **Ore: -** A minerals from which the metal can be extracted economically is known as ore. Clay and bauxite are two minerals of aluminium but aluminium can be profitably extracted only from bauxite not from clay, hence bauxite is an ore while clay is mineral of aluminium.	½ ½ 1	2
	i)	**Give <u>two purposes</u> of making an alloy.** **The purposes of making an alloy:** 1. Improve hardness of metal 2. Lower the melting point 3. Increase the tensile strength 4. Increase corrosion resistance 5. To get good casting 6. Modify colour 7. Reduce malleability & ductility 8. Modify chemical activity	1 mark each	2
	j)	**Give composition of Woods metal.** **Composition:** Bi=50% Pb = 25% Sn = 12.5% Cd = 12.5%	½ mark each	2
	k)	**Define Pigment and give two examples.** **Pigment:** The colouring matter used in plastics which imparts resistant to the action of sunlight & beautiful shades of colour is called as pigment. **Examples:** (any two) Organic dyestuffs & inorganic pigments like red lead, cobalt blue, and chrome green.	1 ½ mark each	2

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1	l)	**Write <u>two drawbacks</u> of natural rubber.** **Drawbacks of Natural (Raw) Rubber:-** 1) During summer, the raw rubber becomes soft & sticky while in cold weather it becomes hard & brittle. 2) Low tensile strength. 3) It is too weak to be used in heavy duty operation. 4) Large water absorbing capacity. 5) On stretching it undergoes permanent deformation. 6) Affected by solvent like gasoline, benzene, carbon tetrachloride, vegetable oils etc. 7) Tarnished in air due to oxidation as result, its durability is considerably decreases.	1 Mark each	2
2.		**Attempt any four of the following:**		16
	a)	**Write orbital electrtonic configuration of $_{9}F^{19}$, $_{15}P^{31}$, $_{24}Cr^{52}$, $_{20}Ca^{40}$.**		4
		$_{9}F^{19}$: $1s^2, 2s^2, 2p^5$	1	
		$_{15}P^{31}$: $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$	1	
		$_{24}Cr^{52}$: $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1, 3d^5$	1	
		$_{20}Ca^{40}$: $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$	1	
	b)	**Describe the formation MgO molecule with diagram and name the type of bonding.**		4
		Explanation:- In the formation of magnesium oxide two electrons are transferred from magnesium atom to oxygen atom. By the loss of 2 electrons it acquires +2 charges (Mg^{++}) & attains stable configuration like Ne (2, 8). Oxygen atom acquires -2 charges by the gain / takes of $2e^-$s from magnesium atom & attain stable configuration like Neon (2, 8). These two equal & oppositely charged ions (Mg^{++} & O^{--}) combine together by electronstatic force of attraction & form neutral MgO molecule.	1	

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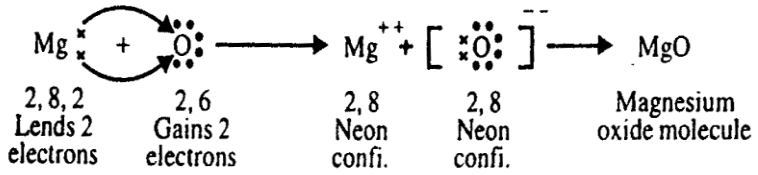
2.	**b)**		2	
		Type of bonding is **Electrovalent Bond**	1	
	c)	**If atomic number and atomic mass number of an element is 11 and 23 resp. Write number of protons, neutrons and electrons each.**		4
		Given: Atomic number (Z) : 11 Atomic mass number (A) : 23	1	
		1) Number of protons (p): Z = p = 11	1	
		2) Number of neutrons (n): A – Z = 23-11 =12	1	
		3) Number of electrons (e): Z = p = e =11	1	
	d)	**Explain Faraday's first law of electrolysis and derived its mathematical expression.**		4
		Faraday's first law of electrolysis: 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.	1	
		Explanation: Let W be the amount of substance deposited or liberated at the electrode. Let Q coulombs of electricity passed through the electrolyte solution.	1	
		Then, according to Faraday's First law we have, W ά Q But Q = c x t Where, c– current in ampere t – time in second Q – number of coulombs	2	

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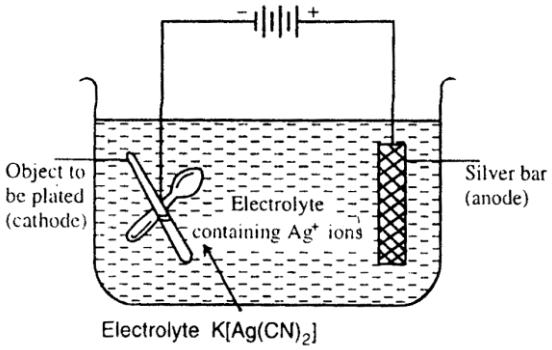
2.	**d)**	Therefore, $W \propto c \times t$ $W = z\ c\ t$ Where Z is constant known as electrochemical equivalent (ECE).		
	e)	**Give any four assumptions of Arrhenius theory of ionisation.** 1. The molecules of an electrolyte when dissolved in water split up into two kinds of charged particles, positively charged particle known as cation, negatively charged particle known as anion. 2. 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. 3. 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. 4. The cations & anions present in the solution reunite together forming the original electrovalent compound. Therefore it is reversible type of process. e.g NaCl $\rightleftharpoons$ $Na^+ + Cl^-$ 5. The number of positive or negative charges on the cations or anions corresponds to the valency of the element or radical from which yhe ion is derived.	1 mark each	4
	f)	**Explain with neat diagram the process of electroplating of silver.** **Diagram:**  	1	4

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2.	**f)**	**Process:** 1. Electroplating of silver on iron – spoon is carried out in a rectangular tank of steel. 2. Iron spoon, which is to be electroplated, is cleaned thoroughly by boiling with caustic soda in order to remove the grease & dirt. 3. Further it is washed with water until free from caustic soda & carefully polished. 4. The iron spoon is then made as cathode. 5. The anode consists of pure silver metal plate. The anode & cathode both are suspended in the electrolyte in the cell of potassium argento-cyanide $K[Ag(CN)_2]$. 6. on passing the direct electric current at the applied voltage, the iron spoon gets plated with a smooth & brighter deposit of silver. Silver anode gets slowly dissolved in solution by giving Ag^+ ions. Ionisation $K[Ag(CN)_2$ $\downarrow$ $K^+ + [Ag(CN)_2]$ To $\downarrow$ From $Ag^+ + e^- \rightarrow Ag\downarrow \leftarrow Ag^+ + 2CN^- \leftarrow Ag \rightarrow Ag^+ + e^-$ Cathode $H^+ + OH^-$ anode $\downarrow\uparrow$ H_2O	1 2	
3.		**Attempt any four of the following:**		16
	a)	**Define Tensile strength, Machinability, Soldering and castability.**		4
		1. Tensile Strength: - Is the ability to carry a load without breaking. **Or** A tensile strength of a metal is its ability to resist pull without breaking	1	
		2. Machinability: - 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.	1	
		3. Soldering: - A method of joining the metals surfaces by introducing a molten non-ferrous alloy with melting point below 400^0C between them, is known as soldering.	1	

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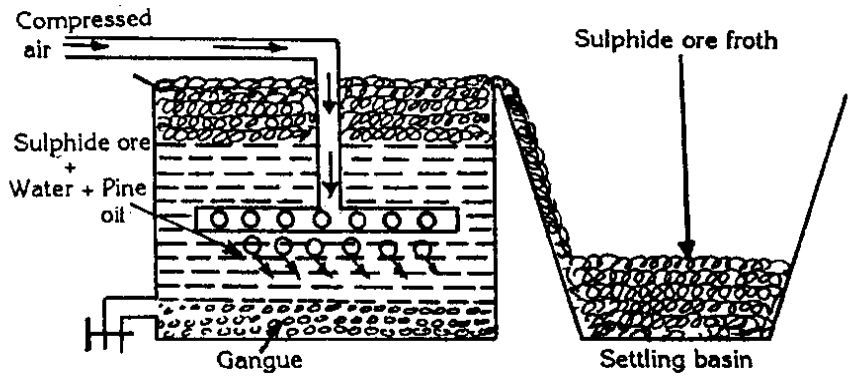
3.	**a)**	**4. Castability:-** The process of pouring molten metal into a mould & allowing it to solidify is known as casting and the ability of metal to get casted is called as castability.	1	4
	b)	**Name and explain the process used for concentration of ZnS ore.**		4
		The process used for concentration of ZnS ore is **Froth Floatation Process.**	1	
			1	
		Process : In this process, the powdered sulphide ore is mixed with water & pine oil. The whole mixture is then stirred vigorously by passing compressed air. The oil forms a froth with air bubbles. The sulphide ore particles get attached with the Froth & Floats on the surface, while the gangue or earthy impurities are wetted by water & sink to the bottom of the tank. The floating froth is then skimmed off into settling basins from where by filter press a concentrated ore is recovered.	2	
	c)	**Define alloy. Explain fusion method of preparation of allloy.**	1	4
		Alloy: It is defined as homogeneous mixture of two or more elements one of which must be metal.		
		Process: 1) The component metal having higher M.P. is melted first in a crucible & the other having lower melting points are added to in it. 2) The molten metals are at high temp & hence may react with atmospheric oxygen to form oxide. So in order to prevent oxidation the molten mass is covered with charcoal powder.	2	

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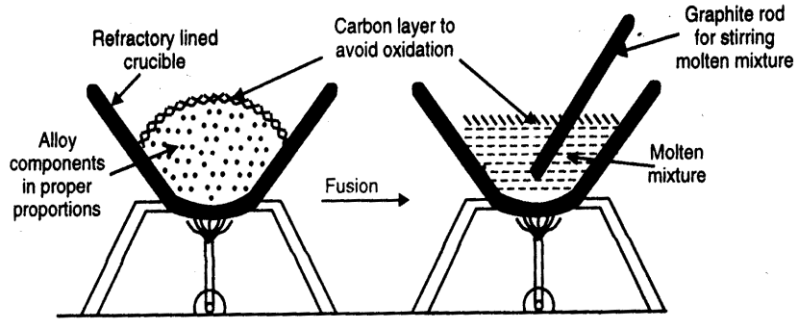
3.	**c)**	3) The molten mixture is stirred using graphite rods to get uniform alloy. 4) The molten mass is then allowed to cool which gives required alloy.  	1	4
	d)	**Distinguish between thermosoftening and thermosetting plastics.** **Thermosoftening plastics** / **Thermosetting Plastics** i) They are formed by addition plymerisation. / i) They are formed by condensation polymerization. ii) Linear long chain polymers with limited cross links. / ii) Three dimensional structure. iii) Smaller molecular weight. / iii) Higher molecular weight. iv) Softened on heating & reshaped & reused. / iv) Do not soften on heating & reshaped & reused. v) Reclaimed form wastes. / v) Can not be reclaimed from wastes. vi) Intermolecular bonds are weaker. / vi) Strong covalent bonds are joined. vii) Softer, weaker, less brittle. / vii) Harder, stronger & more brittle. viii) Soluble in organic solvents. / viii) Insoluble in organic solvents. xi) Polyethylene, Polystyrene PVC. / xi) Bakelite, Polyesters, silicone Plastics. **(Note: cosider any four points)**	1 mark each	

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3.	**e)**	**What is vulcanisation of rubber? Explain why it is necessary?** **Vulcanization of rubber:-** "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." Vulcanisation of rubber is necessary for 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 ^{o}C to100 ^{o} C v) To improve electrical insulation property. **(Note: Consider any two points)**	2 1 mark each	4
	f)	**Define Thermocole. Explain its preparation, properties and application.** **Thermocole:** It is foamed plastic. **Preparation:** "Thermocole is a foamed plastic obtained by blowing compressed air into molten polystyrene or polyurethane is known as thermocole". **Properties :- (any one)** 1) It is soft, spongy, porous, low density. 2) Its thermal & electrical conductivity is low. 3) It is quite shock - proof. 4) It is quite strong through extremely light. 5) It is chemically inert & resists ageing. 6) It can be used upto 55^0C. **Uses :- (any one)** 1) As a thermal insulators in refrigerator, cold-storage, ice-boxes & cold rooms etc. 2) As good packing material for delicate electric & electronic equipment. 3) As decorative material for decoration. 4) As protecting screen in radars at the airports.	1 1 1 1	4