



SUMMER – 13 EXAMINATION

Subject Code: 12021

(Section-II)

Page No: 1/15

Applied Chemistry

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
		<p><u>Important Instructions to examiners:</u></p> <p>1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.</p> <p>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.</p> <p>3) The language errors such as grammatical, spelling errors should not be given more Importance <u>(Not applicable for subject English and Communication Skills)</u>.</p> <p>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.</p> <p>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.</p> <p>6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.</p> <p>7) For programming language papers, credit may be given to any other program based on equivalent concept.</p>		



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Que. No.	Sub. Que.	Model Answer	Marks	Total Marks									
4		Attempt any nine of the following		18									
	a)	Define pH. Write sorsen pH Scale. pH is the negative logarithm to the base 10 of hydrogen ion concentration. Sorsen pH scale is 0 to 14	1 1	2									
	b)	Write the ores of copper. With formulae. The ores of copper (Any two) <table><tr><th>Sulphide ores</th><th>Oxide ores</th><th>Carbonate ores</th></tr><tr><td>Copper pyrite CuFeS₂</td><td>Cuprite Cu₂O</td><td>Malachite CuCO₃. Cu(OH)₂</td></tr><tr><td>Copper glance Cu₂S</td><td>----</td><td>Azurite 2CuCO₃. Cu(OH)₂</td></tr></table>	Sulphide ores	Oxide ores	Carbonate ores	Copper pyrite CuFeS ₂	Cuprite Cu ₂ O	Malachite CuCO ₃ . Cu(OH) ₂	Copper glance Cu ₂ S	----	Azurite 2CuCO ₃ . Cu(OH) ₂	1 Mark each	2
Sulphide ores	Oxide ores	Carbonate ores											
Copper pyrite CuFeS ₂	Cuprite Cu ₂ O	Malachite CuCO ₃ . Cu(OH) ₂											
Copper glance Cu ₂ S	----	Azurite 2CuCO ₃ . Cu(OH) ₂											
	c)	Define Dielectrics & Insulators. Definition of Dielectrics:- The materials which are used to prevent the loss of electricity through certain parts of an electrical system are known as dielectrics. Definition of Insulator:- Insulators are the substances which retard the flow of heat or electricity or sound through them.	1 1	2									
	d)	Define Specific conductivity. Specific conductivity: Specific conductivity is the conductance of a 1 cm ³ of the substance or solution. OR The conductivity offered by a solution of length 1 cm & area of unit cross section is known as specific conductivity.	2	2									
	e)	Define ceramics and write two examples. Definition: - Ceramics are inorganic, non – metallic materials that are processed & used at high temperature. Examples (Any two): Porcelain. Common bricks, Fire-bricks etc (Give marks to any relevant example)	1 ½ mark each	2									

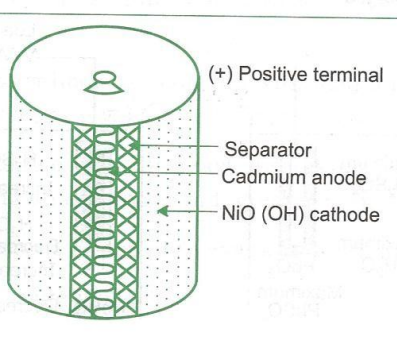


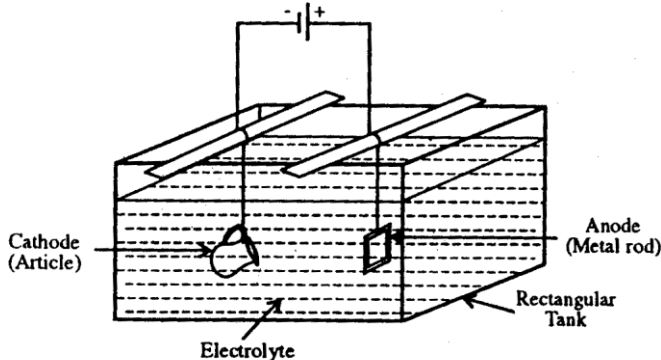
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
4.	f)	Define atmospheric corrosion. The corrosion which is brought about by the atmospheric conditions is called atmospheric corrosion.	2	2
	g)	Write two applications and properties of glass. Applications (Any two) 1. As an insulator 2. Used for lamps, line insulations, glass to metal seals. 3. Fiber glass, tapes, wire coverings. 4. Fluorescent tubes, filament supports, dielectrics in capacitors. 5. Mercury switches, bushings. Properties: (Any two) 1. Hard, rigid 2. Transparent, amorphous solids 3. Low coefficient of expansion 4. No definite melting point 5. thermal & electrical insulation 6. Chemically stable 7. Resist moisture & gases. 8. High dielectric strength	1/2 mark each	2
	h)	Why galvanized containers are not used for storing of food-storage. Galvanized utensils (zinc coated) cannot be used for preparing and storing food stuff, which are acidic in nature because zinc gets dissolved in dilute acids in food forming poisonous zinc compounds which will poison the content.	2	2
	i)	Define Primary cell and Secondary cell Primary cells: The non rechargeable cell is called primary cell.	1	2
		Secondary cells : The rechargeable cell is called secondary cell It can be used, recharged & used again. OR The cell in which the cell reactin can be reversed by passing direct electric current in the opposite direction is called as Secondary cells	1	
	j)	Define alloy with examples. Alloy: It is a homogeneous mixture of two or more elements one of which must be a metal. Examples (Any two): Steel, Brass, Bronze, Alnico etc. (Consider any relevant example)	1 1/2 mark	2



Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
4.	k)	Write applications of solar cells. Applications : (Any two) 1. Used in remote and isolated locations. 2. Artificial satellites and space probes mainly depends on electricity generated by solar panels. 3. In India, solar cells are used for lighting ,operating water pumps, radio & TV receivers. 4. Solar cells are used to provide electric power to light houses and off shore oil drilling rig platforms.	1 mark each	2
5.	a)	Attempt any four of the following. What are the advantages and limitations of fuel Cell? Advantages of fuel Cell(Any four) 1. High efficiency of energy conversion (75 to 82.8%) from chemical energy to electrical energy. 2. No emission of gases & pollutants within permissible limits. 3. Fuel cells offer excellent method for efficient use of fossil fuels. 4. H ₂ – O ₂ systems produce drinking water of potable quality. 5. Low noise pollution & low thermal pollution. 6. Modular & hence parts are exchangeable. 7. Low maintenance costs. 8. Fast start up time of low temperature systems. 9. The regenerative H ₂ – O ₂ system is an energy storage system for space applications. 10. Low cost fuels can be used with high temperature systems. 11. The regeneration of heat will increase the efficiency of high temperature systems. 12. Fuel cells are suitable for future nuclear solar hydrogen economy. 13. Hydrogen & air electrodes are useful in other battery systems. e.g. Ni – Hydrogen, zinc – air, aluminium – air etc. 14. Saves fossil fuels. 15. Fuel cell automotive batteries can render electric vehicles efficient & refillable Limitations(Any four) 1. High initial cost. 2. Large weight & volume of gas fuel storage systems. 3. High cost of pure hydrogen. 4. Lack of infrastructure for distributing hydrogen. 5. Liquification of hydrogen requires 30% of the stored energy. 6. Life time of the cells is not accurately known.	1/2 mark each	16 4

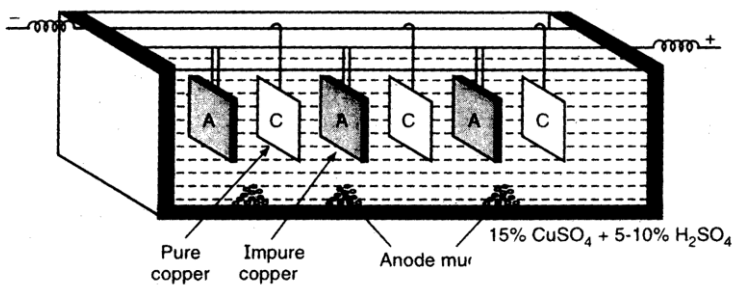
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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5.	c)	<div style="text-align: center;">  <p>(+) Positive terminal Separator Cadmium anode NiO (OH) cathode</p> </div> <p>Positive plates are made up of nickel plated tubes, containing a mixture of nickel oxide (NiO_2) & hydroxide + 17% flakes of graphite or metallic nickel for increasing conductivity. They also contain an activated additive 2% Ba(OH)_2 which increases the life of plates.</p> <p>Negative plates consist of spongy Cadmium.</p> <p>The electrolyte is 20- 15% solution of KOH to which small quantity of lithium hydroxide (LiOH) is added to increase the capacity of cell.</p> <p style="text-align: center;">• Working</p> <p>A) Discharging:- Positive Plate: $\text{NiO}_{2(s)} + 2\text{H}_2\text{O (l)} + 2\text{e}^- \rightarrow \text{Ni (OH)}_{2(s)} + 2\text{OH}^-$ Negative Plate: $\text{Cd}_{(s)} + 2\text{OH}^-_{(\text{aq})} \rightarrow \text{Cd (OH)}_{2(s)} + 2\text{e}^-$ Net reaction: $\text{NiO}_{2(s)} + \text{Cd}_{(s)} + 2\text{H}_2\text{O} \rightarrow \text{Ni(OH)}_2 + \text{Cd(OH)}_2$ </p> <p>B) Charging:- Positive Plate: $\text{Ni(OH)}_{2(s)} + 2\text{OH}^-_{(\text{a})} \rightarrow \text{NiO}_{2(s)} + 2\text{H}_2\text{O} + 2\text{e}^-$ Negative Plate: $\text{Cd(OH)}_{2(s)} + 2\text{e}^- \rightarrow \text{Cd}_{(s)} + 2\text{OH}_{(s)}$ Net reaction: $\text{Ni(OH)}_2 + \text{Cd(OH)}_2 \rightarrow \text{NiO}_{2(s)} + \text{Cd}_{(s)} + 2\text{H}_2\text{O}$ </p> <p>Thus, discharging & charging reactions can be shown simultaneously as: -</p> <p style="text-align: center;">$\text{NiO}_{2(s)} + \text{Cd}_{(s)} + 2\text{H}_2\text{O} \rightarrow 2\text{Ni(OH)}_2 + \text{Cd(OH)}_2$</p> <p>Cell has an e.m.f. of 1.4 v when fully charged.</p> <p>Applications:(Any two)</p> <ol style="list-style-type: none"> Used for industrial services such as trucks, mine locomotives. Used in railway car lighting & air – conditioning because of its long life & low maintenance cost. Used in calculators. It is widely used in sealed version for high current application (e.g. power tools) & for high cycle life applications (e.g. computer power supply units.) 	2	
			$\frac{1}{2}$ mark each	

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5.	d.	<p>Write short note on electroplating:</p> <p>Definition: The process of coating of more resistant metal on the surface of base metal with the help of electric current is known as Electroplating.</p> <p>Process :-</p> <p>i) The surface of the article to be electroplated is first cleaned thoroughly by hot solution of alkali or soap to remove the grease.</p> <p>ii) Then it is treated with dil. acid to remove the oxide layer or other impurities stick up to the article.</p> <p>iv) The cleaned article (base metal) is then suspended into the electrolytic cell & made as cathode. The anode is a pure strip or plate of metal whose coating is desired on the article, is also suspended in the cell.</p> <p>v) The electrolyte consists of solution of the salt of the coating metal.</p> <p>vi) On passing the electric current, the metallic ions from the electrolyte get deposited on the article which is made as cathode. A smooth & brighter deposits are obtained.</p> <p>vii) The equal number of metallic ions from anode dissolves in the electrolyte and from electrolyte get deposited on the article which is made as cathode.</p> <div style="text-align: center;">  </div> <p>Advantages of Electroplating.(Any one)</p> <p>i)Decoration: - Electroplating of superior metal over an inferior metal is done in order to have attractive & beautiful appearance e.g. ornaments : picture frames are electroplated with Ag, Au, Ni & Cr etc. It increases the commercial & decorative value of an article in the market.</p> <p>ii)Protection: - A coating of more resistant metal like Ag, Sn, Ni, Cr etc. is applied on the base metal like iron by electroplating in order to save the latter from rusting, corrosion & atmospheric action.</p> <p>iii)Repairs: - Sometimes, broken pieces or worn out parts of a machinery are repaired by electroplating.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	4

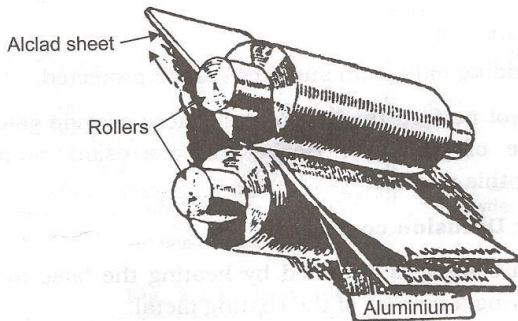


Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
5.	e	<p>Write the properties & applications of Phenol – Formaldehyde and Epoxy Resin.</p> <p>Properties of Phenol – Formaldehyde (Any two)</p> <ol style="list-style-type: none">1. Hard, rigid, strong.2. Scratch-resistant, brittle material.3. Excellent heat & moisture resistance.4. Chemical resistance & fire resistance5. Abrasion resistance6. Good electrical insulation property.7. Excellent bonding strength & adhesive properties. <p>Applications of Phenol – Formaldehyde: (Any two).</p> <ol style="list-style-type: none">1. Electrical insulator parts as switches, plugs, switch-boards, heater hands, sockets for light bulb, wire insulation.2. Moulded articles like telephone parts, cabinets for radio & television.3. Its resin is used as adhesive.4. For impregnating fabrics, wood, paper for producing laminates, wall coverings and industrial laminates5. Varnishes & paints.6. Hydrogen ion exchanger in water softening.7. For making bearings, used in propeller shafts for paper industry and rolling mills. <p>Properties of Epoxy Resin:- (Any two)</p> <ol style="list-style-type: none">1. Good adhesive property2. Epoxy resins possess excellent electrical & mechanical properties.3. Good chemical resistance.4. Low shrinkage during curing <p>Applications of Epoxy Resin :- (Any two)</p> <ol style="list-style-type: none">1. Excellent adhesive, properties due to which they are ideally suited for bonding of insulating materials such as porcelain, wood ,metal ceramic articles.2. Laminates as well as insulating varnishes have been prepared from epoxy resins.3. A trade name for common epoxy resin adhesive is araldite which is used in air-craft industry, automobiles , bicycles, golf club, snow boards etc..	<p>1/2 mark each</p> <p>1/2 mark each</p> <p>1/2 mark each</p> <p>1/2 mark each</p>	4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
5.	f)	<p>What are adhesives? Write properties and applications of Urea formaldehyde as adhesives.</p> <p>Adhesives – Any substance capable of holding materials together by surface attachments known as Adhesives.</p> <p>Properties (Any two)</p> <ol style="list-style-type: none"> 1) The bond film produced by Urea – Formaldehyde resin is quite rigid & transparent. 2) It is good resistant to moisture, insects & fungi. 3) However action of acids & alkalies deteriorate the resin film after some time. 4) It can be used in cold but a little heating helps in accelerating the setting process. <p>Uses :- (Any two)</p> <ol style="list-style-type: none"> 1) Used for bonding wooden surfaces. 2) Used for bonding water proof plywood laminates 3) Bonding articles in aircraft & ship building industries etc. 	<p>2</p> <p>1/2 mark each</p> <p>1/2 mark each</p>	4
6.	a.	<p>Attempt any four of the following.</p> <p>Describe the process of refining of Blister copper by electrolysis.</p> <p>Electro – refining of Copper:-</p> <p>Anode electrode: - Impure copper</p> <p>Cathode electrode: Pure copper</p> <p>Electrolyte: - 15% CuSO₄ + 5-10% H₂SO₄</p> 	<p>1</p>	<p>16</p> <p>4</p>



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6	a.	<p>1) It is carried out in the large lead lined tank .Impure copper is placed into large plates which are suspended into tank at intervals & acts as anodes. Cathodes are thin plates of pure copper & each is suspended between two plates of anode. The electrolyte is 15% CuSO₄ Solution.</p> <p>2) .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 & Pt are not ionized & settle below the anode as anode mud</p> <p>3) At the applied voltage, Cu⁺⁺ ions alone are discharged at the cathode & thus pure copper is deposited on the cathodes</p> <p>Reactions: At Anode: $\text{Cu} \longrightarrow \text{Cu}^{++} + 2\text{e}^{-}$ At Cathode: $\text{Cu}^{++} + 2\text{e}^{-} \longrightarrow \text{Cu}$</p>	2	4
	b.	<p>Define metallurgy What are the important ores of aluminum? Metallurgy: - Metallurgy is the process of extraction of metals in pure state from their ores economically & profitably. Important ores of Aluminium (Any three) i) Bauxite - Al₂O₃ .2H₂O. ii) Corundum- Al₂O₃, iii) Feldspar - KAlSi₃O₈, iv) Mica [KAlSi₂O₁₀(OH)₂] v) Cryolite - Na₃AlF₆ vi) Alunite (Alumstone) K₂SO₄ .Al₂(SO₄)₃ .4Al(OH)₃</p>	1	
			1	
			mark each	
	c.	<p>Write the composition, properties and applications of Soft solder & Rose metal Soft Solders :- Composition Pb = 37 – 67% Sn = 31. 60% Sb = 0.12%</p> <p>Properties: They melt at low temperatures. Applications:(Any one) They are used for soldering electrical connections. Sealing tin cans & joining Lead pipes.</p>	1	4
			1/2	
			1/2	

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6.	c.	<p>Rose metal :-</p> <p>Composition</p> <p style="padding-left: 40px;">Bi = 50%</p> <p style="padding-left: 40px;">Pb = 28%</p> <p style="padding-left: 40px;">Sn = 22%</p> <p>Properties:</p> <p>It is readily fusible alloys ($M_p = 89^{\circ}\text{C}$)</p> <p>Applications:(Any one)</p> <p>It is used for making fire – alarms, fuses wires, casting for dental works & in automatic sprinkler system sprinkler's system.</p>	1	4
	d.	<p>Explain the process of metal cladding. Write its applications</p> <p>Process:</p> <p>i) The base metal is sandwiched or cladded between the two sheets of coating metal.</p> <p>ii) This sandwich is then passed through two heavy rollers maintained at high temp & pressure.</p> <p>iii) Cladded metal is cathodic with respect to the base metal so that electrolytic protection is provided.</p>	1	
			1	
		<p>Applications : (Any two)</p> <p>1)Al clad sheets used in aircraft industry in which a plate of duralumin is sandwiched between two layers of 99.5% pure Al. It is the light and strong alloy.</p> <p>2) Cu – clad steel wire is obtained by forcing steel rod into closely fitted cu-tube is used for electrical conductors possessing combining strength of steel with the high conductivity of Cu.</p> <p>3) To develop surface properties like corrosion resistant in steel sheets.</p> <p>4) The cladding metal provides electrolytic protection to the base metal.</p>	1 mark each	

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6.	e.	<p>Explain the process of galvanizing with diagram.</p> <p>Process:</p> <ol style="list-style-type: none"> The iron or steel article to be galvanized is first cleaned with dil. H_2SO_4 for 15-20 minutes to remove any oxide layer. It is then dipped in a washing bath of $\text{Zn-NH}_4\text{Cl}$ and dried in drying chamber. It is then dipped in another bath containing molten zinc at the temperature of 115°C to 460°C. The surface of the bath is kept covered with a flux of NH_4Cl to prevent oxide formation. It is then passed through a pairs of hot rollers to make the coating uniform and to remove the excess metal. Finally it is annealed in an annealing chamber at a temperature of 650°C and then slowly cooled. 	2	4
	f.	<p>Explain the mechanism of immersed corrosion with absorption of oxygen</p> <p>Process:</p> <ol style="list-style-type: none"> The surface of iron is usually coated with a thin film of iron oxide however if this iron oxide film develops some cracks anodic area are created on the surface while the coated metal part acts as cathode. <p>In this example, anodic areas are small surface parts while nearly rest of the surface of the metal forms large cathodes.</p>	1	4



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6.	f.	<p>At anode:- $\text{Fe} \longrightarrow \text{Fe}^{++} + 2\text{e}^{-}$ The liberated electrons flow from anode to cathode areas. The electrons are reacting with water and dissolved O_2.</p> <p>At cathode:- $2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^{-} \longrightarrow 4(\text{OH}^{-})$ These in presence of water drop forms OH^{-} ions. The Fe^{++} ions at anode and OH^{-} ions at cathode diffuse and when they meet $\text{Fe}(\text{OH})_2$ is precipitated. $\text{Fe}^{++} + 2(\text{OH})^{-} \longrightarrow \text{Fe}(\text{OH})_2 \downarrow$ i) If enough O_2 is present ferrous hydroxide is easily oxidizes to ferric hydroxide. $4\text{Fe}(\text{OH})_2 + \text{O}_2 + 2\text{H}_2\text{O} \longrightarrow 4\text{Fe}(\text{OH})_3$ This product called yellow rust actually corresponds to $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>	