

Subject Code: 17211

<u>SUMMER-2015 Examination</u> Model Answer : Applied Science (Chemistry)

Page No: 1/14

Que.	Sub.	Model Answer	Marks	Total Marlia
Que. No.	Sub. Que.	Interpretation of the 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.	Marks	Total Marks



Subject Code: 17211

Page No: 2/14

Que.	Sub.		Model Answ	ver	Marks	Total
No.						Marks
1.		Attempt any I	NINE of the following:			18
	a)	Write the two	o ores of Copper with th	eir chemical formula.		2
		Type of ore	Name	Chemical formula	1	-
		Oxide	Cuprite or ruby copper	Cu ₂ O	Mark	
		Sulphide	Copper glance	Cu ₂ S	each	
			Copper pyrite	CuFeS ₂		
		Carbonate	Malachite	$CuCO_3, Cu(OH)_2$		
			Azurite	$2CuCO_3,Cu(OH)_2$		
		(Any two ores	s of Copper with formu	la: 1 mark each)		
	b)	Constituents :	constituents of copper n Mixture of molten Cu ₂ S		2	2
	c)	FeS(Ferrous su Write two use	s of aluminium.			
				ruments, heating appliances,		
		parts of aer	oplanes, containers for cl	nemical industry etc.		2
		2) For making	g electric wires and cable	s for transmission lines.	1	
		3) Aluminium	n foils are used for wrar	oping cigarettes, sweets and	Mark	
		confectiona	-	Fund and and and	each	
		4) Al – powde	er is used for making silv	ery paints.		
		5) As a reduct	ing agent in the production	on of Cr, Mn etc.		
		6) In thermite	welding process.			
		7) As a deoxie	dizer in the manufacture of	of steel.		
		8) For windin	g the moving coils of dyr	namos and motors.		
		9) Highly put	re Al is used as an abs	orber in the preparation of		
		antibiotics	(chloromycines).			
		10) Al – powde	$er + NH_4NO_3$ mixture is u	used in bombs.		
		11) For makin	g many useful alloys.			
		12) For chemic	al plants and transporting	g and storing nitric acid.		
		13) As refracto	ory for lining of furnace	and for making refractory		
		bricks.				



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION (Autonomous) (ISO/IEC - 27001 - 2005 Certified)

SUMMER-2015 Examination

Page No. 3 /14

Subj	ect Co	de: 17211 Page N	No: 3 /14	
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
<u>1.</u>	d)	Define immersed corrosion . Definition: The corrosion which is brought about through ionic	2	2
		reactions in the presence of moisture or solution as a conducting		
		medium when two dissimilar metals are in contact with each other		
		is called electro chemical corrosion.		
	e)	State the two functions of pigment. 1) Provide opacity and colour to paint film.	1	2
		2) Give strength to the film.	Mark each	
		3) Give protection to the paint film by reflecting harmful ultraviolet	each	
		light.		
		4) Provide resistance to paint film against abrasion, moisture and weather.		
		5) Give an aesthetical appeal (i.e pleasing to look at) to the paint		
		film.		
		(Note: Any two functions)		
	£	Draw next and labelled diagram for application of metal on an		
	f)	Draw neat and labelled diagram for application of metal on an article by galvanizing process.		2
		Iron Sheet Pair of hot rollers Pair of Salvanised Sheet Anneating Chamber Bath Bath Anneating Meiten Zinc. at 425-460°C Rest Pair of Salvanised Sheet Chamber Pair of Salvanised Sheet Sheet Sheet Salvanised Sheet	2	2
	g)	What are applications of sherardizing process?(Two points) Applications:-		2
		i)Sherardizing is used especially for protecting small odd shaped	1	
		steel articles like bolts, screws, nuts, threaded parts washers, valves,	Mark each	
		gauge, tools etc.against atmospheric corrosion.	Cucii	
		ii) The main advantage of sherardizing is that coating is quite		
		uniform even if the surface has crevices or depression and there is		
		practically no change in the dimensions of articles.		
	•	•		



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION (Autonomous) (ISO/IEC - 27001 - 2005 Certified)

SUMMER-2015 Examination

Subie	ct Code	<u>SUMMER-201</u> : 17211		e No: 4/14	
Que.	Sub.				Total
No.	Que.	Mode	l Answer	Marks	Marks
1.	h)	Define the terms:i)Specific co	nductance ii) Equivalent		2
		conductance	·····		
		i)Specific conductance (k) : Specific conductance of a 1 cm ³ of the s	ubstance or solution		
		Conductance of a 1 cm of the s		1	
		_	olution of unit length & area of		
		unit cross section is known as s	-		
		ii) Equivalent conductance (λ	v) : It is the conductance of the		
		solution containing 1 gm equiva	alent of solute / electrolyte when	1	
		placed between two sufficiently	large electrodes 1 cm apart.		
	i)	Write two points to differenti secondary cell	ate between primary cell and		
		Primary cell	Secondary cell		2
		1. Non- rechargeable cells	1. Rechargeable cells are		2
		are known as primary cells.	known as secondary cells.	1	
		2. Chemical reaction is	2. Chemical reaction is	Mark	
		irreversible.	reversible.	each	
		3. They are light in weight.	3. They are heavy.		
		4. They have short life.5. They can not be recharged	4. They have long life5. They can be recharged &		
		& reused.	reused.		
		6. e.g. Dry cell, Daniel cell,	6. e.g.Lead acid storage cell,		
		Leclanche cell.	Nickel- cadmium storage cell		
		(Any two points)			
		State two uses of electrically c	conducting polymor		
	j)	State two uses of electrically c	conducting polymer.		2
		1 They are used in rechargeable	batteries		
		2 They are used as analytical ser	sors to detect pH, O_2 ,NO ₂ ,		
		SO_2 , NH ₃ , glucose etc	tarials in offices theatres at	1	
		 They are used as antistatic ma They are used as electro chror 		Mark	
		5. They are used in optical filters		each	
		computer, T.V. screens.			
			s, light emitting wall papers, light		
		emitting diodes &data storage.			2
		7. They are used in construction	of photo voltaic cell		
	k)	(Any two uses) State two applications of silion	e fluids.		
		state the appreciations of smon			
1					



Subject Code: 17211

Page No: 5 /14

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
-		Applications:- 1) As a lubricant: excellent lubrication for plastic and elastomeric surfaces. 2)In polishes and chemical specialities: It is used in automobile and furniture polishes due to its high gloss and water repellency. 3) As a mechanical fluid: It is used as hydraulic or transformer oils, damping mediums. 4) As coolant: They are used as coolant in radio, pulse and aircraft transformers. 5) As a foam preventive: effectively control foam in many machines like photocopiers and laser printers. 6) Also used in cosmetic and pharmaceutical industries. 7) In electrical and chemical specialities: Used as an insulator in medium and high voltage applications i.e. in transformers. 8) As a release material : an odourless ,non-toxic , non-carbonizing moulds release for rubber, plastics and metal die castings. Write two applications of phenol formaldehyde resin as an adhesive. 1) Used as adhesive for grinding wheels & brake linning. 2) Used for decorative laminates wall covering & industrial laminates for electrical parts. 3) Used for making water-proof plywoods. 4) Used in bonding articles in air craft and ship building.	Marks 1 Mark each 1 Mark each	



Subject Code: 17211

Page No: 6/14

	r		[
Que.	Sub.	Model Answers	Marks	Total
No.	Que.			Marks
2.		Attempt any FOUR of the following:		16
	e)	How copper is obtained from its ore by smelting process? Write		4
	a)	it with labeled diagram.		-
		Charging pipe		
		Waste gases exit		
		Fire bricks -		
		Water jacket		
		Air blast main		
			1	
		Fusible		
		slag out		
		Molten matte out		4
		Process:		
		i) Roasted copper ore is then mixed with coke & sand particles &		
		then strongly heated at high temperature in a water jacketed blast		
		furnace. ii)At high temperature ferrous sulphide (FeS) is oxidised &		
		converted into ferrous oxide (FeO) which further reacts with sand		
		particles to form a fusible slag (FeSiO ₃)	2	
		$2FeS + 3O_2 \longrightarrow 2FeO + 2SO_2 \uparrow$	-	
		$FeO + SiO_2 \longrightarrow FeSiO_3$		
		iii) Further cuprous oxide (Cu ₂ O) formed during roasting combines		
		with ferrous sulphide (FeS) to form ferrous oxide (FeO) & cuprous		
		sulphide (Cu_2S). The ferrous oxide (FeO) formed further react with silica particula to form slag		
		silica particals to form slag. $Cu_2O + FeS \longrightarrow FeO + Cu_2S$		
		iv) Thus during smelting process most of the ferrous sulphide	1	
		impurity is converted into the fusible slag (FeSiO ₃)which is then		
		removed from the upper slag outlet.		
		v)The molten mass containing mostly cuprous sulphide (Cu ₂ S) &		
		little quantity of ferrous sulphide (FeS) is called as matte which is		
		then removed from the lower outlet.		
	b)	Write the purification of aluminium with labelled diagram by		
	b)	electroytic refining.		
				4



Subject Code:17211

Page No: 7 /14

Que. No.	Sub. Que.		Mod	lel Answers		Marks	Total Marks	
2.		Impu	Impure Aluminium Carbon cathodes					
		 with carbon, was cathode. 2) The cell is a i)The top macts as cathod ii) The top macts as cathod iii) The midd molten fluorid iii) The bot 3) On passing layer discharg layers. Same a into the middl time to time. 	1) The electrolytic cell consists of an iron tank lined at the bottom with carbon, which serve as anode. A number of graphite rods serve					
	c)	solder or rose Solder	e metal Composition	Properties	ons of Tinmann's Applications		4	
		Tinmann's solder: Rose metal	Sn = 66 % Pb = 34 % Bi = 50% Pb = 28% Sn = 22%	 It melts at 180°C. I.It is easily fusible alloy. Its melting point is 89°C 	It is used for joining articles of tin. 1. It is used for making fire alarms. 2 It is used in electrical fuse wires, 3. It is used for casting for dental works 4. It is used in automatic sprinkler system.	4		



Subject Code: 17211

Page No: 8/14

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
2.	Zuc.	(Note: 2 mark for composition,1mark for properties , 1mark for applications for any one alloy)		
	d)	Write four properties and applications of urea-formaldehyde resin.		4
		 Properties : 1) The bond film produced by urea – formaldehyde resin is quite rigid & transparent. 2) It is good resistant to moisture, insects & fungi. 	2	
		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.	2	
		 Applications: (Any two) 1) Used for bonding wooden surfaces. 2) Used for bonding water proof plywood , laminates. 3) Bonding articles in aircraft & ship building industries etc. 		
	e)	Give construction, working and application of Dry cell.		
		Wet paste of $Metallic cap$ Wet paste of $MH_4CI + ZnCI_2$ Wet paste of ground carbon, MnO ₂ and water in muslin cloth	1	4
		Construction: It consists of zinc container (vessel) which acts as an anode.Cathode is a Graphite rod. It acts as inert electrode. The Graphite rod is surrounded by a paste of MnO_2 (Manganese dioxide) & powdered Carbon (Black). The cell is filled with a paste of $NH_4Cl \& ZnCl_2$ prepared in water. The cell is sealed at the top by wax or resin. Working At zinc anode: -	1	
		Dissolution of zinc electrode to form zinc ions. Zn → Zn ⁺⁺ + 2e ⁻ (oxidation) Zn ²⁺ combines with ammonia to form its complex. Zn ²⁺ + 4 NH ₃ → Zn (NH ₃) ₄ ⁺⁺ At the graphite cathode: - Manganese dioxide (MnO ₂) reaction with NH ₄ ⁺ (ammonium) ions to liberate ammonia. 2NH ₄ ⁺ + 2 MnO ₂ + 2 e ⁻ → Mn ₂ O ₃ + H ₂ O + 2NH ₃ ↑	1	



Subject Code: 17211

Page No: 9/14

Que. No.	Sub.	Model Answer	Marks	Total Marka
2.	Que.	Ammonia thus produced is liberated as a gas but it combines with Zn ^{$2+$} to form a Zn (NH ₃) ₄ ⁺⁺ ions complex at the zinc anode. Application:		Marks
		1) The dry cell useful for small amount of current required for short	1	
		period of time.		
		2) Dry cells are used in torches, transistors, tape recorders, door bells,		
		gas – engine ignition, wall clock, T. V. remote.c.		
		3) The cell develops a potential 1.5 volts.		
		(Any one application 1 mark)		
	f)	Write reactions taking place during charging and discharging of lead acid storage cell. • Discharging: - At Anode: - Pb \rightarrow Pb ²⁺ + 2e ⁻ $Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4 \downarrow$ (Oxidation) At Cathode:-	1	4
		PbO ₂ + 4 H ⁺ + 2e ⁻ → Pb ²⁺ + 2H ₂ O (Reduction) Pb ²⁺ + SO ₄ ²⁻ → PbSO ₄ ↓ Net reaction during Discharging: - Pb + PbO ₂ + 4H ⁺ + 2SO ₄ ²⁻ → 2PbSO ₄ ↓ + 2H ₂ O • Charging: - At Cathode: PbSO ₄ + 2e ⁻ → Pb + SO ₄ ²⁻ At Cathode: PbSO ₄ + 2 H ₂ O → Pb + SO ₄ ²⁻ Net reaction during Charging: 2PbSO ₄ + 2H ₂ O → Pb + PbO ₂ + 4 H ⁺ + SO ₄ ²⁻ + 2e ⁻ Net reaction during Charging: 2PbSO ₄ + 2H ₂ O → Pb + PbO ₂ + 4 H ⁺ + 2SO ₄ ⁻² [Note: 1mark each to be given to reaction at anode & cathode]	1	
3.	a)	Attempt any FOUR of the following: Define atmospheric corrosion. Write mechanism when oxygen attacks on a metal.	1	16
		Atmospheric corrosion: This type of corrosion occurs when metal surface comes in immediate contact directly with atmospheric gases like O ₂ , Cl ₂ , Br ₂ , I ₂ , H ₂ S, CO ₂ , SO ₂ , NO ₂ etc.		4
		Mechanism: Metallic surfaces when exposed to air undergo oxidation		
		and the process of corrosion is represented by the eq ⁿ .		
		$2M + O_2 \longrightarrow 2MO \text{ (Metal Oxide)}$		
		(Metal) (Oxygen)		



`_____

SUMMER-2015 Examination

Subject Code: 17211

Page No: 10/14

Que.	Sub.	Model Answer	Marks	Total
<u>No.</u> 3.	Que.	A thin oxide layer is formed on the metal surface and the nature of this film decides further action depending upon the film so produced. $M \longrightarrow M^{2+} + 2e^{-}$ (loss of electrons) (Metal ion)	1	Marks
		$O + 2e^{-} \longrightarrow O^{2^{-}} (gain of electrons)$ $M + O \longrightarrow M^{2+} + O^{2-} \longrightarrow MO (Metal oxide)$	1	
		Metal Oxide (MO) Layer Oz of Air	1	
	b)	Describe the hydrogen evolution mechanism of immersed corrosion. H ₂ H_2 Fe	1	4
		Steel tank: - Anode , Cu – strip:- Cathode These types of corrosion occur usually in acidic environments like industrial waste, solutions of non – oxidizing acids. Process: A steel tank containing acidic industrial waste and small piece of copper scrap in contact with steel. The portion of the steel tank in contact with copper is corroded most with the evolution of hydrogen gas.	1	
		At anode Fe \longrightarrow Fe ⁺⁺ + 2 e ⁻ (Oxidation) These electrons flow through the metal from anode to the cathode At cathode H ⁺ ions are eliminated as H ₂ gas	1	
		$2H^{+} + 2e^{-} \longrightarrow H_{2} \uparrow (\text{Reduction})$ Thus, over all reaction is Fe + 2H^{+} \longrightarrow Fe^{++} + H_{2} \uparrow [Note: 1mark each to be given to reaction at anode & cathode.]	1	



Subject Code: 17211

Page No: 11/14

	C 1		1	TT (1
Que. No.	Sub. Que.	Model answers	Marks	Total Marks
3.	c)	 Describe metal spraying process for protection of metal from corrosion .Write its two applications. Process:-i) In this method, coating metal sprayed on the surface of base metal with the help of spraying gun or pistol. ii) The spraying gun consist of a duct for compressed air and is fitted with the oxy- hydrogen flame. iii) The coating metal in the form of wire is fed into the gun which is then melted inside the gun with the help of oxy hydrogen flame. iv) The molten metal then sprayed on the surface of base metal with the help of compressed air. Applications: (Any Two) 1) Can be applied to non metallic bases made of wood plastic and glass. 2) Coating can be applied to fabricated structure. 3) Worn-out out machine parts can be reclaimed. 4) Coating of metals like Al, Zn, Ni, Sn, Pb etc. is made by the method of spraying. (Note: mark should be given if diagram is drawn) 	2	4
	d)	diagram. $\int \frac{1}{\sqrt{1 + 1}} \int \frac{1}{1 $	1	4
		Construction: i) 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. ii)They also contain an activated additive 2% Ba(OH) ₂ which increases the life of plates. Negative plates consist of spongy Cadmium.	1	



Subject Code:17211

Page No: 12/14

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
3.	Que	iii) The electrolyte is 20- 15% solution of KOH to which small quantity of lithium hydroxide (LiOH) is added to increase the capacity of cell. Working: A) Discharging:- Positive Plate: NiO ₂ (s) + 2H ₂ O (l) + 2e ⁻ \rightarrow Ni (OH) ₂ (s) + 2OH ⁻ Negative Plate: Cd (s) + 2OH ⁻ (aq) \rightarrow Cd (OH) ₂ (s) + 2e ⁻ Net reaction: NiO ₂ (s) + Cd(s) + 2H ₂ O \rightarrow Ni(OH) ₂ + Cd(OH) ₂ B) Charging:- Positive Plate: Ni(OH) ₂ (s) + 2OH ⁻ (a) \rightarrow NiO ₂ (s) + 2H ₂ O + 2e ⁻ Negative Plate: Ni(OH) ₂ (s) + 2OH ⁻ (a) \rightarrow NiO ₂ (s) + 2H ₂ O + 2e ⁻ Negative Plate: Cd(OH) ₂ (s) + 2e ⁻ \rightarrow Cd(s) + 2OH(s) Net reaction: Ni(OH) ₂ + Cd(OH) ₂ \rightarrow NiO ₂ (s) + Cd(s) + 2H ₂ O Thus, discharging & charging reactions can be shown simultaneously as: - NiO ₂ (s) + Cd (s) + 2H ₂ O \rightarrow 2Ni(OH) ₂ + Cd(OH) ₂	1	
		OR A) Discharging:- Positive Plate: NiO(OH) + $2H_2O + 2e^- \rightarrow 2Ni (OH)_2 + 2OH^-$ Negative Plate: Cd + $2OH^- \rightarrow Cd (OH)_2 + 2e^-$ Net reaction: NiO(OH) + Cd + $2H_2O \rightarrow 2Ni(OH)_2 + Cd(OH)_2$ B) Charging:- Positive Plate: Ni(OH)_2 + $2OH^- \rightarrow NiO(OH) + 2H_2O + 2e^-$ Negative Plate: Cd(OH)_2 + $2e^- \rightarrow Cd + 2OH^-$ Net reaction: Ni(OH)_2 + Cd(OH)_2 $\rightarrow NiO(OH) + Cd + 2H_2O$ Thus, discharging & charging reactions can be shown simultaneously as: - NiO(OH) + Cd (s) + $2H_2O \rightarrow 2Ni(OH)_2 + Cd(OH)_2$	1	



Subject Code:17211

Page No: 13/14

Que.	Sub.			Total
No.	Que.	Model answers	Marks	Marks
3.	e)	Give Construction and working of hydrogen-oxygen fuel cell	1	
		Construction :- i)One of the simplest & most successful fuel cell is hydrogen – oxygen fuel cell. ii) It consists essentially of an electrolytic solution such as 25% KOH or NaOH solution, & two inert porous electrodes (like	1	4
		porous carbon) containing suitable catalyst. iii) Hydrogen & oxygen gases are bubbled through the anode & cathode compartment respectively. Working: - At anode: - $2H_2 + 4 \text{ OH}^- \rightarrow 4H_2\text{O} + 4e^-$ At cathode: - $O_2 + 2 H_2\text{O} + 4e^- \rightarrow 4\text{OH}^-$ Net Reaction: $2H_2 + O_2 \rightarrow 2H_2\text{O}$ [Note: 1mark each to be given to reaction at anode & cathode.] Write discharging and charging process of lead acid storage	2	4
	f)	Write discharging and charging process of lead acid storage cells. i) Discharging: - While discharging chemical energy gets converted into electrical energy. At Anode: - $Pb \rightarrow Pb^{2+} + 2e^{-}$ (Oxidation) $Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4 \downarrow$ At Cathode:- $PbO_2 + 4 H^+ + 2e^{-} \rightarrow Pb^{2+} + 2H_2O$ (Reduction) $Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4 \downarrow$ Net reaction during discharging: - $Pb + PbO_2 + 4H^+ + 2SO_4^{2-} \rightarrow 2PbSO_4 \downarrow + 2H_2O$	2	4



Subject Code:17211

Page No: 14/14

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
3.	Que.	Lead sulphate is precipited at both the electrodes. The voltage of		IVIALKS
		each cell is 2.0 volts at 25° C because the concentration of		
		sulphuric acid varies from 5% to 40%.		
		ii) Charging: - To recharge a lead storage cell, the reactions		
		taking place during discharging are reversed by passing an		
		external e.m.f. greater than 2 volts from a generator.	2	
		At Cathode: $PbSO_4 + 2e^- \rightarrow Pb + SO_4^{-2-}$ At Anode: $PbSO_4 + 2 H_2O \rightarrow PbO_2 + 4 H^+ + SO_4^{-2-} + 2e^-$ Net reaction during Charging: $2PbSO_4 + 2H_2O \rightarrow Pb + PbO_2 + 4 H^+ + 2SO_4^{-2}$ During the process of charging, the electrodes of the cell are restored to their original conditions (to Pb and PbO ₂ respetively).	2	