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April-24
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Scheme of Valuation
[Scoring Indicators]

Revision: 2015

Course Code: 2004

Course Title: ENGINEERING CHEMISTRY – II

Question No.			Scoring Indicator	Split-up score	Sub Total	Total
PART – A (10 marks)						
I.	1.		▪ No of e^- that can be accommodated in n^{th} shell = $2n^2$ ▪ No of electrons in the 3rd shell = $2\times(3)^2 = 18$	1 1	2	10
	2.		▪ Iron is placed above copper in the electrochemical series. Hence it can displace Cu from $CuSO_4$ **OR** $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$	2	2	
	3.		▪ An electric cell that is rechargeable and can therefore be used to store electrical energy in the form of chemical energy. ▪ Any 1 eg (Lithium-ion battery, nickel-cadmium cell etc)	1 1	2	
	4.		▪ A copolymer is a polymer that is made up of two or more monomer species ▪ Any 1 example (Buna-S, Buna-N, Nylon 6,6 etc)	1 1	2	
	5.		▪ Any 2 problems	1+1	2	
PART – B (30 marks)						
II.	1.	(a)	▪ Statement ▪ Illustration with an example	2 2	4	6
		(b)	▪ 4s ▪ Aufbau principle	1 1	2	
	2.	(a)	▪ A coordinate bond is a covalent bond in which both electrons come from the same atom. ▪ It is also called a dative covalent bond. ▪ Any one example (e.g. NH_4^+ formation)	1 1 2	4	6
		(b)	▪ In H_2O there is hydrogen bonding because oxygen has a high electronegativity. ▪ Oxygen forms hydrogen bonds with H atoms of other water molecules resulting in intermolecular hydrogen bonding. This type of hydrogen bonding is not seen in H_2S	1 1	2	
	3.	(a)	▪ Anode (Oxidation) $2H_2 \rightarrow 4H^+ + 2e^-$ ▪ Cathode (Reduction) $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$ ▪ Overall Reaction $2H_2 + O_2 \rightarrow 2H_2O$	1½ 1½ 1	4	6
		(b)	▪ An electrolytic process for producing thick oxide coatings, usually on aluminium and its alloys. ▪ The oxide layer is typically 5 to 30µm in thickness ▪ Anodising is used to give improved surface resistance to wear and corrosion, or as a decorative layer.	Any 2 points 1×2=2	2	
	4.	(a)	Any 4 factors (Temperature, Humidity/ moisture, pH of the medium, Presence of impurities, Saline environment/ Dissolved salts etc)	1×4=4	4	6
		(b)	Statement of Faradays 1st law	2	2	

5.	(a)	▪ Homopolymers – Polymers which are made up of identical monomer units. ▪ Copolymers – Polymers which are made up of more than one type of monomer units. ▪ One example for each	1 1 1 + 1	4	6
	(b)	A property of an element to form different types of bonds by joining other atoms of the same element.	2	2	
6.	(a)	▪ An atom or a group of atoms present in an organic compound and which is responsible for its unique chemical reactions ▪ Aldehyde: CHO Ketone: >C=O	2 1 + 1	4	6
	(b)	▪ Tetrafluoroethene ▪ Any one use (eg. Nonstick cookware)	1 1	2	
7.	(a)	▪ Greenhouse effect is the process by which radiations from the sun are absorbed by the greenhouse gases & not reflected back to space. ▪ Any two causes with explanation (i) Burning of Fossil Fuels (ii) Deforestation (iii) Industrial Waste and Landfills [½ mark each if no explanation is given]	1 1½+1½	4	6
	(b)	Any 2 eg. (carbondioxide, chlorofluorocarbons etc)	1 + 1	2	

PART – C (60 marks)

UNIT – I

III.	(a)	Al – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ or [Ne] $3s^2\ 3p^1$ Ar – $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ or [Ne] $3s^2\ 3p^6$	2 2	4	15
	(b)	Any 3 differences Orbit / Orbital (i) 2 Dimensional / 3 Dimensional (ii) $2n^2$ electrons / 2 electrons in any orbital (iii) Not in accordance to Heizenbergs Uncertainity Principle / In accordance to HUP Heizenbergs Uncert. Principle	2 each	6	
	(c)	▪ Statement of Heizenbergs Uncertainty Principle ▪ Mathematical Representation ▪ $m = h/4\pi.\Delta x.\ \Delta v$ $m = 6.6\times 10^{-34} / 4\times3.14\times0.1 \times 10^{-9} \times 5.2 \times 10^{-24}$ $= 0.101$ kg.	2 1 ½ 1 ½	5	
		OR			
IV.	(a)	▪ Statement of Octet rule ▪ Illustration using molecules that obey octet rule (any 1.eg. CCl_4) ▪ Any 2 examples of molecules that violate octet rule	2 1 1	4	15
	(b)	▪ Definition of ionic bond ▪ Ca → Ca^{2+} 2,8,8,2 2,8,8 ▪ O → O^{2-} 2,6 2, 8 ▪ $Ca^{2+} + O^{2-} \rightarrow CaO$	2 ½ ½ + ½ ½ ½ + ½ 1	6	
	(c)	(i) True (ii) True (iii) False (iv) False (v) True	1×5 = 5	5	

		UNIT – II			
V.	(a)	▪ A Daniell cell is a galvanic cell which converts chemical energy into electrical energy. The Daniell cell consists of two electrodes of dissimilar metals, Zn and Cu kept in contact with $ZnSO_4$ and $CuSO_4$ solutions respectively. ▪ Diagrammatic representation ▪ Half-cell reaction at anode: $Zn(s) \longrightarrow Zn^{2+}_{(aq)} + 2e^-$ ▪ Half-cell reaction at cathode: $Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu\ (s)$	1 2 1 1	5	**15**
	(b)	Any 5 characteristics ▪ Ions are responsible for conduction ▪ Involves chemical change ▪ Accompanied by the decomposition of the substance ▪ Involves transfer of matter ▪ Conductance increases with increase of temperature	 1 × 5	5	
	(c)	▪ Electrochemical series is a list that describes the arrangement of elements in the order of their increasing electrode potential values. ▪ The series is set by measuring the potential of various electrodes versus standard hydrogen electrodes(SHE) ▪ The more reactive metals occupy the top position of the series <u>Any 3 uses</u> ▪ Helps in comparing Oxidizing & Reducing Strengths ▪ Use to calculate Std. emf (E°) of Electrochemical Cell ▪ Helps in Predicting the Feasibility of Redox Reaction	Any 2 points 1×2=2 1×3=3	5	
		OR			
VI.	(a)	▪ Explaining Cathodic protection with example (½ mark) ▪ Explaining Sacrificial protection with eg (½ mark)	2 + ½ 2 + ½	5	**15**
	(b)	▪ Inert electrode: Electrode that does not actively participate in the electrochemical cell's chemical reaction. They serve only as a source or sink for electrons without playing a chemical role in the electrode reaction. ▪ Active electrode: Electrode that actively participates in the electrochemical cell's chemical reaction. The active electrode's metal ions will dissolve in the electrolytic solution. ▪ Inert electrodes are primarily used in electrolysis while Active electrodes are primarily used in electroplating	2 2 1	5	
	(c)	▪ Defining Strong electrolyte ▪ Defining Weak electrolyte ▪ Example for Strong and Weak electrolyte	2 2 1	5	
		UNIT – III			
VII.	(a)	Any 4 properties ▪ Very High Melting Point ▪ High Strength ▪ Superior Abrasion and Wear Resistance ▪ High degree of corrosion resistance ▪ Resistance to Thermal Shocks	1 × 4	4	**15**

	(b)	▪ Explaining about any 2 synthetic rubbers (polymeric form and the monomers involved) ▪ Any one use for each	2 + 2 1 + 1	6	
	(c)	▪ Nylon 6 : Caprolactum ▪ Nylon 6,6 : Adipic acid & Hexamethylene diamine. ▪ Polymeric structure of Nylon 6 ▪ Polymeric structure of Nylon 6,6	1 1 + 1 1 1	5	
		OR			
VIII.	(a)	▪ 2 eg for isomerism exhibited by organic compounds	2 + 2	4	**15**
	(b)	▪ Explaining thermosetting plastics ▪ 2 examples of thermosetting plastics ▪ Thermosetting plastics cannot be recycled as they posses strong crosslinking between monomer units	2 2 2	6	
	(c)	▪ Borosilicate glass is a type of glass with silica and boron trioxide as the main glass-forming constituents ▪ <u>Any 2 properties</u> • Low coefficients of thermal expansion and are hence resistant to thermal shock. • Resistant to chemicals ▪ <u>Any 2 Uses</u> • Used to make glassware's for chemistry labs • Used to make kitchen ware.	2 1 + 1 ½ + ½	5	
		UNIT – IV			
IX.	(a)	Any 2 qualities (readily available, less expensive, transported easily, high calorific value, shouldn't leave behind any undesirable residues. etc)	1 × 5	5	**15**
	(b)	▪ Definition of air pollution ▪ Sources & effects of any 3 pollutant gases (CO, SO_2, SO_3, NO_2 etc)	2 1×3=3	5	
	(c)	▪ Explaining acid rain and causes ▪ Consequences of acid rain (any 2)	2 + 1 2	5	
		OR			
X.	(a)	▪ Primarily caused by the reactions of nitrogen oxides and volatile organic compounds in presence of sunlight ▪ Also called Los Angeles smog ▪ Commonly associated with urban areas with high levels of vehicle emissions ▪ It is often characterised by an brownish haze. ▪ Primary pollutants are oxides of nitrogen and Volatile organic compounds ▪ Occurs in cold humid climate	1 × 5	5	**15**
	(b)	Any 5 principles of Green Chemistry	1 × 5	5	
	(c)	▪ Explanation on Cracking ▪ Discussion on two types of Cracking	1 2 + 2	5	