SCHEME OF VALUATION

(Scoring Indicators)

Revision:15		Course Code: 2004
Course Title: ENGINEERING CHEMISTRY II		

Qn No.	Scoring Indicator	Split up Score	Sub Total	Total
	Part A			
I 1	They have a stable configuration of 8 electrons in the valence shell.	2	2	2
2	Do not conduct either in fused or in dissolved state. Eg: sugar , alcohol	1 ½ + ½	1 1	2
3	Any four properties-refractoriness, porosity, thermal spalling, chemical inertness	½ x 4	2	2
4	Calorific value-quantity of heat liberated by the complete combustion of unit mass or volume of fuel in air with subsequent cooling of the product to the initial temperature of the fuel	2	2	2
5	Harmful chemicals formed from two or more primary components and one or two air components.	1	1	2
	Eg: SO_3, O_3	½ + ½	1	
II	**Part B**			
1 a	$\lambda = h / mv$ terms explanation Since λ is inversely proportional to mass, wavelength associated with a macroscopic particle is negligible.	1 ¼ x 4 2	1 1 2	4
b	Weak force of attraction between covalently bonded hydrogen of one molecule and an electronegative atom of another molecule. Eg: $H^{\delta+} - F^{\delta-}$	1 ½ ½	2	2
2 a	$n = 3$ $l = 1$ $m = -1 , 0 ,1$ $s = \pm ½$	1 1 1 1	4	4

b	any two limitations- cannot explain spectrum of multi electron atom cannot explain fine spectrum of hydrogen atom	1 x 2	2	2
3 a	$NaCl \longrightarrow Na^+ + Cl^-$ $H_2O \longrightarrow H^+ + OH^-$	½ ½	1	
	At anode : Only Cl- ions undergo oxidation	½	½	4
	$Cl^- - 1e \longrightarrow Cl$ $Cl + Cl \longrightarrow Cl_2$	1	1	
	At cathode: Only H+ ions undergo reduction $H^+ + 1e \longrightarrow H$	½	½	
	$H + H \longrightarrow H_2$	1	1	
b	For metallic conductors, conduction decreases For electrolytic conductors, conduction increases	1 1	2	2
4 a	First law- During electrolysis, the amount of substance deposited or liberated at an electrode is directly proportional to the quantity of electricity passed through the electrolyte.	2	2	4
	$W \; \alpha \; Q$ $W = ZQ$ $W = Zit$	½ ½ 1	2	
b	Zinc is highly reactive than iron and tin is less reactive than iron. Hence coating of zinc can protect iron from corrosion by sacrificial protection.	1 1	2	2
5 a	Baeyer' s test Decolourise alkaline $KMnO_4$ -- unsaturated Do not decolourise alkaline$KMnO_4$ -- saturated	1 ½ ½	1 1	
	Bromine water test Decolourise yellow bromine water -- unsaturated Do not decolourise bromine water -- saturated	1 ½ ½	1 1	4
b	Any two advantages-transmission of signals over longer distances Immune to electromagnetic interfernce	1 x 2	2	2
6 a	Homo polymers - formed from same kind of monomers Eg : Polythene	1 ½ ½	2	
	Co polymers – formed from different kinds of monomers Eg: Nylon - 66	1 ½ ½	2	4
b	Natural fibre – cotton , silk Synthetic rubber - Buna S, Buna – N	½ x 2 ½ x 2	1 1	2

7 a	Mixture of CO and H_2 Prepared by passing steam over red hot carbon $\quad C + H_2O \longrightarrow CO + H_2$	2 1 1	2 2	4	
b	London smog: mixture of smoke and fog containing SO2, carbon particles etc. This occurs in cool, humid conditions.	2		2	

Part C

UNIT I

III a	Ionic bond – complete transfer of one or more valence electron from one atom to another or electrostatic force of attraction between ions Co-valent bond - mutual sharing of electrons between the atoms $\quad Ca \quad + \quad 2 F \quad \longrightarrow [Ca]^{2+} [F_2]^- \quad$ or CaF_2 $\quad 2,8,8,2 \quad\quad 2, 7 \quad\quad\quad 2,8,8 \quad 2,8$ $\quad\quad H \quad + \quad Cl \quad \longrightarrow \quad H - Cl$ $\quad\quad 1 \quad\quad 2,8,7 \quad\quad\quad\quad 2 \quad 2,8,8$	2 2 1 1	4 2	6	

b	subshell are sigly occupied with electrons of same spin.	2	2 ½		

$_7N$ $1s^2$ $2s^2$ $2p^3$

$$\boxed{\uparrow\downarrow}\quad \boxed{\uparrow\downarrow}\quad \boxed{\uparrow}\,\boxed{\uparrow}\,\boxed{\uparrow}$$

                 ½   5
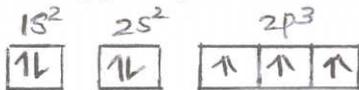
Pauli's exclusion principle –No two electrons in an atom can have the same set of all the four quantum numbers

                                               2   2 ½

$_2He - 1s^2$

	n	l	m	s
$1^{st}\ \bar e$	1	0	0	$+\frac{1}{2}$
$2^{nd}\ \bar e$	1	0	0	$-\frac{1}{2}$

                                                 ½

c	Represents main energy level, determines energy of the electron and average distance from the nucleus, gives an idea about size of an atom Represented by the letter 'n' and have values 1,2,3 etc	1 x 4		4

UNIT II

V	a	Identifying the anode and cathode Cell diagram anode reaction $H_2 + 2OH^- \xrightarrow{\quad\quad} H_2O + 2e$		1	
			½ ½		
		Cathode reaction $\frac{1}{2}O_2 + 2e + H_2O \xrightarrow{\quad\quad} 2OH^-$	1	1	
		Overall cell reaction: $H_2 + \frac{1}{2}O_2 \xrightarrow{\quad\quad} H_2O$	1	1	6
		Advantages: Less pollution, converts energy of the fuel directly into electrical energy (or any other two advantages)	1	1	
		Rust is $Fe_2O_3 . xH_2O$	1 x 2	2	
	b	Iron in contact with water is anode and portion in contact with air is the cathode	½	1	
		Anode reaction $Fe - 2e \xrightarrow{\quad\quad} Fe^{2+}$	½		
		Cathode reaction $\frac{1}{2}O_2 + 2e + H_2O \xrightarrow{\quad\quad} 2OH^-$	1		
		$Fe^{2+} + 2OH^- \xrightarrow{\quad\quad} Fe(OH)_2$	1	4	5
		$Fe(OH)_2 + H_2O + O_2 \xrightarrow{\quad\quad\quad} Fe(OH)_3$ or $Fe_2O_3 . 3H_2O$	1		
		Electrochemical series – arrangement of elements in the increasing order of standard reduction potential.	1		

c	Blue colour of copper sulphate solution discharges and thickness of iron rod decreases	2			4
VI a	Cell diagram Anode – Zinc in zinc sulphate Cathode – Cu in copper sulphate Anode reactiobn : $Zn - 2e \longrightarrow Zn^{2+}$ Cathode reaction : $Cu^{2+} + 2e \longrightarrow Cu$ Net cell reaction: $Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$	2 1 1 1 1 1		6
b	Barrier protection – chemically inert physical barrier is placed over the object barrier may be metallic- less reactive or more reactive non-metallic- anodized coating or chromate coating and organic- polymers, paints etc Cathodic protection – highly reactive metal is placed near to the metal and are connected by wire Reactive metal acts as anode and metal to be protected is the cathode, Anode metal sacrifices to protect the metal	1 1 ½ x 3 1	2 ½ 2 ½	5
c	Any four difference etc	1 ½		

c	Blue colour of copper sulphate solution discharges and thickness of iron rod decreases	2			4
VI a	Cell diagram Anode – Zinc in zinc sulphate Cathode – Cu in copper sulphate Anode reactiobn : $Zn - 2e \longrightarrow Zn^{2+}$ Cathode reaction : $Cu^{2+} + 2e \longrightarrow Cu$ Net cell reaction: $Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$	2 1 1 1 1 1		6
b	Barrier protection – chemically inert physical barrier is placed over the object barrier may be metallic- less reactive or more reactive non-metallic- anodized coating or chromate coating and organic- polymers, paints etc Cathodic protection – highly reactive metal is placed near to the metal and are connected by wire Reactive metal acts as anode and metal to be protected is the cathode, Anode metal sacrifices to protect the metal	1 1 ½ x 3 1	2 ½ 2 ½	5

c	Any four difference etc			1		
	electoplating	anodising		½		
	Metallic coating	Oxide film is applied				
	Metal to be protected is cathode	Lead or graphite rod is cathode				
	Superior metal is anode	Metal to be protected is anode			4	4
	Salt of superior metal is the electrolyte	Electrolyte is oxidizing electrolyte like dil H_2SO_4	4 x 1			

UNIT III

Addition and condensation polymers

| VII
a | Addition polymers: polymers formed by the repeated addition of monomers, no elimination of molecules, monomers usually contain multiple bonds.

Eg: formation of polythene
$n\ CH_2- CH_2 \longrightarrow -(CH_2 - CH_2)_n-$

Condensation polymers: polymer chain formed by the condensation reaction between monomers, with the elimination of molecules, monomers usually contain functional groups

Eg: formation of nylon-66
$n\ COOH- (CH_2)_4-COOH + n\ NH_2-(CH_2)_6-NH_2 \longrightarrow$ | 1

1

1 ½

1

1 ½ | 1

2 ½

2 ½ | 6 |

		$-(CO-(CH_2)_4-CONH-(CH_2)_6-NH-)_n$	1		
b		Soda glass- mixture of sodium and calcium silicates. It softens at comparatively lower temperature. Uses – window glass, bottles, jars	1 x 2	2	5
		Borosilicate glass- mixture of sodium aluminium silicates. Withstand sudden change in temperature Uses- laboratory purpose, television tubes	¼ x 2	½ 2	
c		Catenation- self linking capacity- carbon combines with other carbon atoms to form variety of structures.	1 x 2	½ 2	4
		Tetra covalency – capacity to form four covalent bonds	¼ x 2 2	2	
VIII a		Vulcanization Rubber is heated with sulphur and its compounds to 110-140°C. Sulphur cross linkage between polymer chains.	2 1	2 1	6
		Advatages- Low elasticity and high extensibility Better electrical insulator High resistance to corrosion Or any three	2 3 x 1	2 3	
b		Thermoplastics 1.Addition polymers 2.Linear structure 3.soft, weak and less brittle 4.can be reoulded and reused. 5. on heating they become soft Thermosetting plastics 1.Condensation poymers 2.cross linked structure 3.hard, strong and brittle 4.cannot be remoulded or reused 5.on heating they become hard Or any five differences	5 x1	5	5
c		An atom or group of atom that provide characteristic properties to that compound. Amine: –NH₂ Aldehyde: -CHO	2	2	4
		Unit IV	1 1	2	
IX a		Cracking- process of breaking up of less volatile bigger hydrocarbons into more volatile lower hydrocarbons by applying heat and pressure. **2 types- Thermal and catalytic cracking- name only**	2	2	
		Thermal cracking- cracking carried out at high temperature and pressure	(½ x2)	2	

			Marks		
	b	Catalytic cracking: Cracking carried out under pressure in presence of a suitable catalyst like silica alumina mixture.	2		6
		Use of catalyst increases the rate of cracking and process to be carried out at lower temperature than required for thermal cracking.	1	2	
	b	Green house effect- heating up of earth's atmosphere due to trapped thermal radiations. Gases responsible for green house effect are CO_2, methane etc	1	2	
		Consequences			
		1. Polar ice will melt and sea level would rise.	2		
		2. Summer will be longer and winter will be shorter			5
		3. Pattern of rain fall will change.		3	
		Or any three consequences	3 x 1		
	c	1. High calorific value			
		2. Moderate ignition temperature			
		3. Moderate velocity of combustion			
		4. Loe moisture content			
		5. Less pollution			
		6. Efficient burning without smoke		4	
		7. Controllable combustion			4
		8. Low noncombustible matter content	8 x ½		

Based on physical state- solid, liquid and gaseous fuels.

		Solid fuels	Liquid fuels	Gaseous fuels			
X	a	1.least calorific value	calorific value is higher	Highest calorific value	2	2	
		2.easily available and cheap	costlier than solid fuels	All gaseous fuels are costly except natural gas			6
		3.Ash and smoke is produced	No ash is produced, but may produce smoke	No ash and smoke	1 x 4	4	
		4 risk of fire hazard is least	Greater risk of fire hazard	Risk of fire hazard is very high			

	b	Green chemistry encourages the design , development and implementation of chemical process that minimize the use and generation of toxic substances. It aims to avoid problems before they happen.		2	
		1. For bleaching, toxic chlorine can be replaced by H_2O_2.	2		5
		2. Replacing organic solvent with harmless water.			
		3. For dry cleaning, liquefied CO_2 can be used instead of			

		tetrachloro ethane.	3 x 1	**3**	

c		Air pollution- excessive discharge of undesirable substance into the atmospheric air, thereby affecting the quality of air and causing damage to human, plants and animals.
		
		Major sources
		   1. Natural sources like volcanic eruptions, forest fire etc
		   2. Emission of vehicles
		   3. Rapid industrialization
		   4. Burning of fossil fuels
		Or any four sources
			2
			
			4 x ½
				2
				
				2
					4