Total number of printed pages: **Programme(UG)/2nd Sem/UCH201**

2022

Engineering Chemistry

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

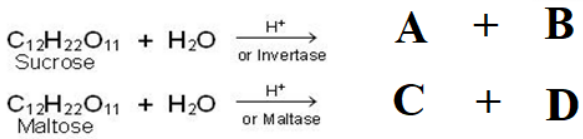
Question no 1 is mandatory, answer any four from the rest

1,	Answer all the questions			(15 x 1) +5 =20
	(a)	For an ideal gas the change in internal energy(ΔU)in a reversible isothermal process is		
		a	Positive	
		b.	Negative	
		c.	Zero	
		d.	Depends on other condition	
	(b)	The quantity of electricity needed to liberate one g-equivalent of an element is		
		a.	1 Ampere	
		b.	96500 Ampere	
		c.	96500 Culombs	
		d.	96500 Faradays	
	(c)	Relation between C_P and C_V is:		
		a.	C_P-C_V = 1/R	
		b.	C_P-C_V = R	
		c.	C_P-C_V = R^n	
		d.	C_P-C_V = R^γ	
	(d)	Stronger the oxidizing agent, greater the		
		a.	Reduction potential	
		b.	Oxidation potential	
		c.	Ionic behaviour	
		d.	None	
	(e)	When a system undergoes change at constant temperature, it is known as:		
		a.	Isothermal process	
		b.	Isobaric process	
		c.	Isochoric process	

		d.	Adiabatic process	
	(f)	Mass spectroscopy is associated with		
		a.	Proton transition	
		b.	Electronic transition	
		c.	Molecular vibrations	
		d.	Electron bombardment	
	(g)	Amino group is example of		
		a.	Chromophorev	
		b.	Auxochrome	
		c.	Relative abundance	
		d.	None of the above	
	(h)	Which of the following is not an important property of an ideal fuel		
		a.	High viscosity	
		b.	High calorific value	
		c.	Low cost	
		d.	Moderate ignition temperature	
	(i)	Choose the chemical species that can be used a nuclear fuel		
		a.	^{236}Pu	
		b.	^{237}Pu	
		c.	^{238}Pu	
		d.	^{239}Pu	
	(j)	Highest rank of coal is		
		a.	Peat	
		b.	Lignite	
		c.	Anthracite	
		d.	Graphite	
	(k)	Inductive effect is due to the		
		a.	Polarization of sigma bonds	
		b.	Polarization of pi bonds	
		c.	Presence of anions	
		d.	None of above	
	(l)	Find out the electron deficient compound		
		a.	NH_3	
		b.	$AlCl_3$	

		c.	H_2	
		d.	HCl	
	(m)	To follow the Markovnikoff rule, the alkene compound must be		
		a.	Asymmetric	
		b.	Symmetric	
		c.	Cyclic	
		d.	Aromatic	
	(n)	Electrophiles are		
		a.	Positively charged	
		b.	Electron rich	
		c.	Bronsted acid	
		d.	All the above	
	(o)	For synthesis of paracetamol, the starting compound is		
		a.	p-nitrophenol	
		b.	m-nitrophenol	
		c.	o-nitrophenol	
		d.	Cyclohexanone	
	(p)	Fill in the blanks		
		a)	The unit of rate constant of 2nd order reaction is _____	
		b)	The molecularity of the reaction $H_2 + I_2 = 2HI$ is _____	
		c)	In co-polymers monomers are _____ .	
		d)	The chemical name of vitamin A is _____ .	
		e)	The name of monomer of Teflon is _____ .	
2.	(a)	Define the term “Electrolytes”. How will you classify electrolytes? Give examples		4
	(b)	Write down the Nernst equation for the following cell: Zn / Zn^{2+} || Cu^{2+} / Cu. What are the applications of Nernst equation?		3+2
	(c)	Calculate the emf of the following cell: Zn / Zn^{2+} (0.1M) || Ag^{+} (10M)/ Ag [Given: Standard reduction potential of Ag/Ag^{+} electrode is 0.8V and standard reduction potential of Zn/Zn^{2+} electrode is -0.76 V.]		5
	(d)	What are the differences between emf and potential difference?		4
	(e)	Consider the following electrochemical cell: Zn / Zn^{2+} || Cu^{2+} / Cu; The standard reduction potential of zinc electrode is -0.76 volt and standard reduction potential of Cu electrode is +0.34 volt. Calculate the standard emf of the cell.		2

3.	(a)	Give short notes on : (a) Mesomeric effect. and (b)Nucleophilic reagents	2+2
	(b)	Write down the electrophilic addition reaction with mechanism of an alkene to haloalkane	2
	(c)	Draw the energy profile diagram for S_N^1 and E2.	2
	(d)	Give a flow chart of electron displacement effects.	4
	(e)	Give synthetic method for drug molecule such as paracetamol	4
	(f)	Write down the addition reaction between (i) Ketone and HCN (ii) Alkene and HBr	2+2
4.	(a)	Write down the formation of homolytic and heterolytic fission.	2+2
	(b)	Write the decomposition products of ketene and diazomethane?	2+2
	(c)	Give hybridization and shape of singlet and triplet carbenes.	2+2
	(d)	Give mechanism of (any two): (i) Beckmann reaction (ii) Aldol reaction (iii) Favorskii reaction (iv) Benzyne reaction	4+4
5.	(a)	Define the following with examples: (a) Isolated system (b) Closed system (c) Adiabatic process	6
	(b)	Deduce mathematical expression for 1st law of thermodynamics.	3
	(c)	Prove that for isothermal reversible process work done (W) = $nRT\ln V_2/V_1$	3
	(d)	100 grams of expands from 10atm to 0.1 atm at 100°C. Calculate the heat absorbed, assuming ideal behaviour of the gas (Atomic weight of Ar = 40)	4
	(e)	Write short note on Carbon nanotube	4
6.	(a)	What are parent ion peak and base peak found in mass spectroscopy?	2
	(b)	Write the absorption laws associated with UV-visible spectroscopy.	4
	(c)	Describe the instrumentation of IR spectrophotometer giving a suitable diagram.	3
	(d)	Explain the ^1H NMR spectra of methanol and ethanol.	4
	(e)	What is crystal field splitting energy? Compare the magnetic properties of $[CoF_6]^{3-}$ and $[Co(NH_3)_6]^{3+}$ on the basis crystal field splitting energy.	1+6
7.	(a)	Explain the stoichiometric combustion of butane with proper chemical equation.	4
	(b)	Answer any three of the following questions (i) Carbonization process of coal. (ii) Define the proximate and ultimate analysis of coal. (iii) Octane and cetane number	3x2 =6

		(iv) Producer gas	
	(c)	For the reaction A+ 2B = C+ D, the differential rate equation is given as: $-d[A]/dt = K[A]^{1/2}[B]^{1/2}$. What is the order with respect to reactant A. Find out the over all order of the reaction.	2
	(d)	Find out the half-life period for the reaction : A → Product .Where $t_{1/2}$ is the half- life period.	4
	(e)	Give the reaction products of following hydrolysis reactions of carbohydrates  	4
8	(a)	Distinguish between co-polymer and homo-polymer.	3
	(b)	What is a pseudo-unimolecular reaction? Give example.	3
	(c)	Give two examples of 2nd order reactions.	3
	(d)	Distinguish between DNA and RNA.	3
	(e)	What are amino acids? What are various types of amino acids? Give example of each.	3
	(f)	(i) Give the Arrhenius equation for 1st order reaction. (ii) The half-life period of 1st order reaction is 15 minutes. Calculate the rate constant and time taken to complete 80 % of the reaction.	5