

Name:			
Enrolment No:			
UPES End Semester Examination, May 2023			
Course: Chemistry Program: B.Tech. Civil and Sustainability Engineering Course Code: CHEM 1001		Semester : II Time : 03 hrs. Max. Marks: 100	
Instructions: Read all the below mentioned instructions carefully and follow them strictly.			
1) Mention Roll No. at the top of the question paper.			
2) Internal choice is given in Q. no. 10.			
3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	How can you determine the % of C and % of H in our fuel sample.	4	CO1
Q 2	Discuss the necessary conditions for a reaction to take place according to collision theory.	4	CO2
Q 3	Derive the rate expression for a chemical reaction with rate law equation, Rate = $k[A]^2$	4	CO2
Q 4	List out the factors affecting rate of a chemical reaction.	4	CO2
Q 5	A polymer sample consists of 20% by weight of macromolecules of molecular weight 10,000 and 80% by weight of macromolecules with molecular weight 100,000. Calculate number average and weight average molecular weight of the polymer.	4	CO5
SECTION B (4Qx10M= 40 Marks)			
Q 6	Explain the various methods of cathodic protection with suitable diagram.	10	CO3
Q 7	What do you understand by the term alkalinity of water. Which ions are responsible for it. Discuss the relation of P and M when both carbonate and bicarbonate ions will be present in the given water sample.	10	CO4
Q 8	(i) Discuss the chemical precipitation method for the synthesis of nanoparticles.	5	CO5
	(ii) Inter planar distance between two layers is 4\AA in a crystal. Calculate the angle of reflection for first order reflection. X-rays of wavelength 1.54\AA are diffracted by the crystal.	5	
Q 9	A sample of coal contains C = 90%, H = 9% and ash = 1%. The following data were obtained when the above coal was tested in a bomb calorimeter:	10	CO1

	<p>(i) Weight of coal burnt = 0.83 g (ii) Weight of water taken = 540 g (iii) Water equivalent of bomb and calorimeter= 2,300 g (iv) Rise in temperature = 2.62°C (v) Fuse wire correction = 10.0 cal (vi) Acid correction = 50.0 cal.</p> <p>Calculate the gross and net calorific value of coal, assuming that the latent heat of condensation of steam is 580 cal/g</p>		
SECTION-C (2Qx20M=40 Marks)			
Q 10	<p>(i) In a particular cell, 0.01M solution of KCl gave a resistance of 15Ω while 0.01M solution of HCl gave a resistance of 51.4Ω at the same temperature. If the specific conductance of 0.01M KCl is 0.1409Sm^{-1}, calculate specific conductance and equivalent conductance of HCl solution.</p> <p style="text-align: center;">OR</p> <p>Calculate EMF of the cell in which the net cell reaction is, $\text{Mg(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Mg}^{+2}(\text{aq}) + 2\text{Ag(s)}$ Given; $[\text{Mg}^{+2}] = 0.130\text{M}$ and $[\text{Ag}^+] = 1.0 \times 10^{-4}\text{M}$ & $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.80\text{V}$ and $E^\circ_{\text{Mg}^{+2}/\text{Mg}} = -2.37\text{V}$.</p> <p>(ii) Discuss the working of Galvanic cell with suitable diagram taking example of appropriate electrode systems.</p> <p style="text-align: center;">OR</p> <p>Explain the nature of film produced during corrosion process. How pilling and Bedworth rule explain it.</p>	10	CO3
Q 11	<p>(i) A sample of water contains following impurities: $\text{Mg}(\text{HCO}_3)_2 = 73 \text{ mg/lit.}$, $\text{CaCl}_2 = 222 \text{ mg/lit.}$, $\text{MgSO}_4 = 120 \text{ mg/lit.}$, $\text{CaSO}_4 = 164 \text{ mg/lit.}$ Calculate the quantity of lime and soda needed for the softening of water.</p> <p>(ii) What is the hardness of water? List out the salts responsible for temporary and permanent hardness of water. Discuss zeolite method for softening of hard water.</p>	10 10	CO4