


Name:			
Enrolment No:			
<b>UPES</b> <b>End Semester Examination, May 2023</b>			
<b>Course: Chemistry</b> <b>Program: B.Tech ASE+ADE+Mechanical+Mechatronics</b> <b>Course Code: CHEM 1013</b>		<b>Semester : II</b> <b>Time : 03 hrs.</b> <b>Max. Marks: 100</b>	
<b>Instructions: Read all the below mentioned instructions carefully and follow them strictly.</b>			
<b>1) Mention Roll No. at the top of the question paper.</b> <b>2) Internal choice is given in Q. no. 10.</b> <b>3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.</b>			
<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
S. No.		Marks	CO
Q 1	How can you determine the % of C and % of H in 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
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
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 $4\text{\AA}$ in a crystal. Calculate the angle of reflection for first order reflection. X-rays of wavelength $1.54\text{\AA}$ 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>		
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			
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<sup>-1</sup>, calculate specific conductance and equivalent conductance of HCl solution.</p> <p style="text-align: center;"><b>OR</b></p> <p>Calculate EMF of the cell in which the net cell reaction is,  <math display="block">\text{Mg(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{Ag(s)}</math> Given; [Mg<sup>2+</sup>] = 0.130M and [Ag<sup>+</sup>] = 1.0x10<sup>-4</sup>M  &amp; E°<sub>Ag+/Ag</sub> = 0.80V and E°<sub>Mg+2/Mg</sub> = -2.37V.</p> <p>(ii) Discuss the working of Galvanic cell with suitable diagram taking example of appropriate electrode systems.</p> <p style="text-align: center;"><b>OR</b></p> <p>Explain the nature of films 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:  Mg(HCO<sub>3</sub>)<sub>2</sub> = 73 mg/lit., CaCl<sub>2</sub> = 222 mg/lit., MgSO<sub>4</sub> = 120 mg/lit,  CaSO<sub>4</sub> = 164 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