

Name:	 UPES UNIVERSITY WITH A PURPOSE
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Chemistry
Program: B.Tech CS Cyber Law
Course Code: CHEM 1002

Semester: II
Time 03 hrs.
Max. Marks: 100

Instructions: 1. Write your Enrolment No. at provided space on the top of the question paper.
 2. Do not write anything else on the question paper except your roll number.
 3. Attempt all the parts of a question at one place only.
 4. Choice is given in Q 9 and Q 11.

SECTION A

S. No.	Question	Marks	CO
Q 1	Write various methods for increasing the octane number of gasoline and discuss anyone of them.	4	CO1
Q 2	Derive the rate constant equation for a 1 st order reaction.	4	CO2
Q 3	Outline the applications of electrochemical series.	4	CO3
Q 4	Arrange the following in increasing order of stability: a. C ₆ H ₅ CH ₂ ⁺ , (CH ₃) ₂ CH ⁺ , (C ₆ H ₅) ₃ C ⁺ , (CH ₃) ₃ C ⁺ b. C ₆ H ₅ CH ₂ ⁻ , ⁻ CH ₂ Cl, ⁻ CHCl ₂ , (CH ₃) ₂ CH ⁻	4	CO4
Q 5	Copper has FCC structure with atomic radius 1.278 Å. Calculate the density of crystal. (Atomic weight of Cu = 63.5 g/mol and N _A = 6.023 x 10 ²³ atoms/molecule)	4	CO5

SECTION B

Q 6	a. The rate law for decomposition of N ₂ O ₅ (l) is Rate=k[N ₂ O ₅], where k = 6.22x10 ⁻⁴ sec ⁻¹ . Calculate the number of seconds it will take for an initial concentration of N ₂ O ₅ of 0.100 M to drop to 0.0100 M. b. Outline the factors affecting rate of corrosion of metals.	5 5	CO2 CO3
Q 7	a. Discuss the stereochemical implication of SN ₁ reactions with example. b. Write the mechanism of Pinacol-Pinacolone rearrangement with the help of a suitable example.	6 4	CO4
Q 8	a. At what glancing angle would the first order diffraction from (110) plane of KCl can be observed using X-rays of wavelength 150 pm? The unit cell dimension is 305 pm. b. Discuss the applications of nanomaterials in various fields.	6 4	CO5
Q 9	The emf of cell Ni(s) / Ni ²⁺ (a) // Cu ²⁺ (0.75M) / Cu(s) is 0.601 V at 25 °C. E ⁰ _{(Ni/Ni²⁺) = +0.25 V, E⁰_{(Cu²⁺/Cu) = +0.34 V. Write down half-cell reaction and complete cell reaction. Also find out the concentration of Ni²⁺.}}	10	CO3

	OR																				
	A solution containing 3.654g of AgNO ₃ per 100g of solution was electrolyzed using silver electrode. After electrolysis, 122.93g of anodic solution contained 5.136g AgNO ₃ and 1.978g of Ag was deposited in a coulometer. Calculate the transport number of silver and nitrate ions.																				
SECTION-C																					
Q 10	<p>a. Complete the following reaction with mechanism:</p> <div style="text-align: center;"> </div> <p>b. Pentan-2-one on reaction with ethyl magnesium bromide followed by hydrolysis yields an alcohol (A), which on dehydration under acidic condition gives three positional isomeric alkenes. The alkene as major product (B) reacts with Br₂ to give dibromo compound (C). (C) on reaction with aq. KOH gives a diol (D) which on treatment with dil. H₂SO₄ gives 4-methylhex-3-one. Identify compounds A, B, C and D.</p>	10 10	CO4																		
Q 11	<p>a. A sample of coal contains 88% carbon, 8% hydrogen and 4% ash. The following data was obtained when above coal was tested in a bomb calorimeter:</p> <table style="margin-left: 20px;"> <tr><td>Weight of coal burnt</td><td>=</td><td>0.8 g</td></tr> <tr><td>Weight of water taken</td><td>=</td><td>500 g</td></tr> <tr><td>Weight equivalent</td><td>=</td><td>2000g</td></tr> <tr><td>Rise in temperature</td><td>=</td><td>2.5 °C</td></tr> <tr><td>Fuse wire correction</td><td>=</td><td>15.0 cal</td></tr> <tr><td>Acid correction</td><td>=</td><td>25.0 cal</td></tr> </table> <p>Calculate gross and net calorific value assuming latent heat of condensation of steam as 580 cal/g.</p> <p style="text-align: center;">OR</p> <p>During estimation of nitrogen present in organic compound by Kjeldahl's method, 0.257 g of an organic substance was heated with conc. sulphuric acid and then distilled with excess of strong alkali. The ammonia gas evolved was absorbed in 50 ml of N/10 HCl, which required 23.2 ml of N/10 NaOH for neutralization. Determine the % of nitrogen in the substance.</p> <p>b. How can corrosion be controlled by design of material? OR Discuss electrochemical theory of corrosion of metal taking iron as an example.</p> <p>c. Discuss various applications of polymers in daily life. OR Explain the synthesis and applications of Nylon 6,6.</p>	Weight of coal burnt	=	0.8 g	Weight of water taken	=	500 g	Weight equivalent	=	2000g	Rise in temperature	=	2.5 °C	Fuse wire correction	=	15.0 cal	Acid correction	=	25.0 cal	8 6 6	CO1 CO3 CO5
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Instructions:

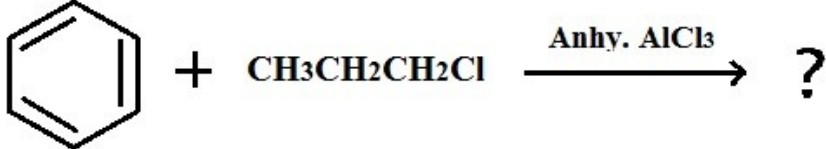
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SECTION A

S. No.	Question	Marks	CO
Q 1	Discuss the role of antiknocking agents in internal combustion engine.	4	CO1
Q 2	Derive the rate constant equation (K) for 2 nd order reaction with Rate= k[A] ² .	4	CO2
Q 3	Discuss the graph of conductometric titration for strong acid vs strong base.	4	CO3
Q 4	Arrange the following in increasing order of stability: a. CH ₃ CH ₂ CH ₂ CH ₂ ⁺ , (CH ₃) ₃ C ⁺ , CH ₃ ⁺ , CH ₃ CH ₂ CH ⁺ CH ₃ b. C ₆ H ₅ CH ₂ ⁻ , (CH ₃) ₃ C ⁻ , ⁻ CCl ₃ , CH ₃ ⁻	4	CO4
Q 5	Calculate the number of atoms per unit cell of a metal having edge length 2.9 Å ⁰ , density 7.87 gm/cc, atomic weight 55.85 and Avogadro's number 6.023 x 10 ²³ .	4	CO5

SECTION B

Q 6	a. A first order reaction is 25% completed in 30 minutes. Calculate its rate constant and half-life. b. Discuss galvanic corrosion of metal giving suitable examples.	5 5	CO2 CO3
Q 7	a. Discuss the stereochemical implications of SN ₂ reactions with example. b. Discuss inductive effect with suitable example.	6 4	CO4
Q 8	a. X rays of wavelength 0.1537 nm from a Cu target are diffracted from the (111) planes of an FCC metal. Calculate the distance between adjacent Miller planes for a first order reflection. Bragg's angle is 19.2 °. b. Discuss any two factors that can influence the properties of nanomaterials.	6 4	CO5
Q 9	A solution of CuSO ₄ was electrolyzed between copper electrodes. Before electrolysis, 10.9 g of solution contained 0.01792 g of CuSO ₄ . After experiment, 21 g of solution contained 0.06338 g of CuSO ₄ . At the same time, 0.09479 g of Ag was deposited in the Ag coulometer. Calculate the transport number of Cu ²⁺ and SO ₄ ²⁻ ions. <p style="text-align: center;">OR</p> In a moving boundary experiment, 0.01 N HCl solution was floated on a lithium	10	CO3

	chloride solution. The tube used had a diameter of 1 cm. When a current of 11 ampere was passed for 20 minutes, the H ⁺ ions-Li ⁺ ions boundary moved through 13.9 cm. Calculate the transport number of H ⁺ and Cl ⁻ ions in HCl solution.														
SECTION-C															
Q 10	<p>a. Complete the reaction and discuss the mechanism. (8)</p> <div style="text-align: center;">  </div> <p>Discuss the limitations of this reaction.</p> <p>b. A compound 'A' with molecular formula C₈H₉Br reacts with aqueous NaOH to form 'B', which in turn reacts with conc. H₂SO₄ to give 'C'. 'C' on reaction with HBr forms 'D', an isomer of 'A'. Infer the structures of 'A', 'B', 'C' and 'D' to complete the reaction sequence along with the mention of type of preferable mechanism in every step.</p>	10 10	CO4												
Q 11	<p>a. A sample of coal contains: C = 93%, H = 6% and ash = 1%. The following data were obtained when the above coal was tested in a bomb calorimeter:</p> <table style="margin-left: 40px;"> <tr><td>Weight of coal burnt</td><td>= 0.92 g</td></tr> <tr><td>Weight of water taken</td><td>= 550 g</td></tr> <tr><td>Water equivalent of bomb and calorimeter</td><td>= 2,200 g</td></tr> <tr><td>Rise in temperature</td><td>= 2.42°C</td></tr> <tr><td>Fuse wire correction</td><td>= 10.0 cal</td></tr> <tr><td>Acid correction</td><td>= 50.0 cal</td></tr> </table> <p>Calculate the gross and net calorific value of coal, assuming that the latent heat of condensation of steam is 580 cal/g.</p> <p style="text-align: center;">OR</p> <p>0.2346 g of an organic compound containing carbon, hydrogen and oxygen only was analyzed by the combustion method. The increase in weight of the U-tube and the potash bulbs at the end of the operation was found to be 0.2754 g and 0.4488 g respectively. Calculate the % of carbon, hydrogen and oxygen in it.</p> <p>b. How can corrosion be controlled by modification of environment? OR Discuss chemical corrosion of metal with suitable examples.</p> <p>c. Discuss the advantages of polymers over other conventional materials like metals, wood and ceramics. OR Explain the synthesis and applications of bakelite.</p>	Weight of coal burnt	= 0.92 g	Weight of water taken	= 550 g	Water equivalent of bomb and calorimeter	= 2,200 g	Rise in temperature	= 2.42°C	Fuse wire correction	= 10.0 cal	Acid correction	= 50.0 cal	8 6 6	CO1 CO3 CO5
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