

Name:	 UPES UNIVERSITY WITH A PURPOSE
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, June 2021

Course: Chemistry Program: B. Tech. (EE, ECE, APE-UP, ASE, ASE-Avionics) Course Code: CHEM 1011	Semester: II Time 03 hrs. Max. Marks: 100
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SECTION A

1. Each question will carry 5 marks
2. Instruction: Complete the statement/ Select the correct answer

S. No.	Question	Marks	CO
Q 1	(i) The octane number of a fuel containing 80% of n-heptane and 20% of 2, 2, 4-trimethylpentane will be ... (ii) Unburned material remaining after 750 °C during the proximate analysis of coal is known as... (iii) Among cyclopropane, cyclobutane, cyclopentane, cyclohexane and cycloheptane which two are more stable? (iv) Write any two characteristic points of an aromatic compounds. (v) Out of NO_2^- , NO_2^+ , HNO_3 and NO_3 , which one is the reactive species for the nitration of benzene?	5	CO1
Q 2	(i) Before the establishment of Lindemann theory, it was difficult to justify the mechanism of ... order of reaction. (First/Second/Third/All) (ii) The concentration of a reactant of a reaction was measured by UV-Vis technique, at two time intervals with proceeding of the reaction. At the first time interval, the concentration of the reactant is 0.45 mol L^{-1} ; 240 seconds later, the concentration is 0.25 mol L^{-1} . What is the rate the reaction in $\text{mol L}^{-1} \text{ min}^{-1}$? (iii) The half-life period for a first order reaction is 15 minutes; calculate the time taken in minute, for completion of 75, 80 and 90 % completion of the reaction.	(1+1+3)	CO2
Q 3	(i) Write the name of any two methods by which the order of reaction can be determined. (ii) The following concentrations (in moles/liter) were obtained for the formation of NH_3 from N_2 and H_2 at equilibrium at 500 K. $[\text{N}_2] = 0.015$, $[\text{H}_2] = 0.03$ and $[\text{NH}_3] = 0.012$. The equilibrium constant of the reaction will be... (iii) What will be the value of K_c if the K_p is 0.61 for a reaction, $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$ at 25 °C?	(1+2+2)	CO2

Q 4	<p>(i) On increasing dilution, the equivalent conductance of the solution will ...</p> <p>(ii) We can store a one molar CuSO₄ solution in Zn container. (True/False)</p> <p>(iii) We can store a two normal ZnSO₄ solution in Cu container. (True/False)</p> <p>(iv) Kohlrausch law is not applicable for calculation of conductivity of weak electrolyte.(True/False)</p> <p>(v) The equivalent conductance of Ca²⁺ and Cl⁻ are 77 and 76 Ohm⁻¹ cm⁻¹ eq⁻¹ at infinite dilution, respectively. The equivalent conductance of CaCl₂ at infinite dilution will be..... Ohm⁻¹ cm⁻¹ eq⁻¹.</p>	5	CO3
Q 5	<p>(i) Two important advantages of hard water are and</p> <p>(ii) Permanent hardness of water is due to ... and</p> <p>(iii) Temporary hardness of water may be due the presence of and salts.</p> <p>(iv) Zeolite process uses thesalt for its regeneration.</p> <p>(v) Fluoride ion is removed by R.O; usingion exchange resin. (Cation/Anion)</p>	5	CO4
Q 6	<p>(i) Urea-formaldehyde resin is a thermosetting plastic. (True/False)</p> <p>(ii) Nylon is a type of polyamide. (True/False)</p> <p>(iii) Paints are synthesized using bulk polymerization. (True/False)</p> <p>(iv) Weight average molecular weight is always lower than number average molecular weight, of polymers. (True/False)</p> <p>(v) Write the name of any two methods for preparation of nano particles.</p>	5	CO5

SECTION B

1. Each question will carry 10 marks
2. Instruction: Write short / brief notes

Q 1	<p>(i) Derive the rate constant equation for a second order reaction (2 A → Product).</p> <p>(ii) Derive the rate expression for given below type of isomerisation reaction in the chemical refinery.</p> $\text{Cyclopropane} \xrightleftharpoons[k_2]{k_1} \text{Propene}$ <p>Where K₁ & K₂ are the rate constant for forward and backward reaction respectively.</p>	(4+6)	CO2
Q 2	<p>The emf of cell-</p> $\text{Ni(s)} / \text{Ni}^{2+} (\text{a}) // \text{Cu}^{2+} (0.75\text{M}) / \text{Cu(s)}; \text{ is } 0.601 \text{ V at } 25^\circ\text{C}.$ <p>E⁰ (Ni/Ni²⁺) = +0.25 V, E⁰ (Cu²⁺/Cu) = +0.34 V.</p> <p>(i) Write down the half-cell reaction & complete cell reaction.</p> <p>(ii) Find out the concentration of Ni²⁺ i.e. the value of “a”.</p> <p>(iii) Does temperature have any effect on the value of E_{cell}? Describe the same in two lines, what happen on the value of E_{cell} of above reaction if it will increase or decrease.</p>	(4+4+2)	CO3

Q 3	<p>(i) Discuss the effect of dilution on the conductance of strong and weak electrolyte using appropriate illustrations.</p> <p>(ii) Describe alongwith a neat sketch that how corrosion be controlled by sacrificial anodic protection method?</p>	10	CO3
Q 4	<p>(i) 25 ml of a sample of water required 15 ml of N/50 H₂SO₄ using methyl orange indicator but did not give any coloration with phenolphthalein. Determine the type and extent of alkalinity is present.</p> <p>(ii) A sample of water on analysis was found to contain following impurities: Ca(HCO₃)₂ : 4 mg/lt Mg(HCO₃)₂ : 6 mg/lt CaSO₄ : 8 mg/lt MgSO₄ : 10 mg/lt Calculate temporary, permanent and total hardness in ppm. Given that atomic weights of Mg = 24; Ca = 40; S = 32; O = 16 and C = 12.</p>	10	CO4
Q 5	<p>(i) 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 °.</p> <p>(ii) Differentiate between thermoplastics and thermosetting polymers.</p>	10	CO5

SECTION-C

1. Each question carries 20 marks
2. Instruction: Write long answers

Q 1	<p>(i) A sample of coal contains C = 92.2 %, H = 6.3 % and ash = 1.5 %. The following data were obtained when the above coal was tested in a bomb calorimeter:</p> <p style="margin-left: 40px;">Weight of coal burnt = 0.93 g Weight of water taken = 560 g Water equivalent of bomb and calorimeter = 2,210 g Rise in temperature = 2.32°C Fuse wire correction = 11.0 cal Acid correction = 53.0 cal</p> <p>Calculate the gross and net calorific value of coal, assuming that the latent heat of condensation of steam is 583 cal/g.</p> <p style="text-align: center;">OR</p> <p>Estimate the value of enthalpy of combustion for ethane and butane. Using the bond energies data as given below in kJ/mole for different bonds.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>C-H</td> <td>O=O</td> <td>C=O</td> <td>H-O</td> <td>C-C</td> </tr> <tr> <td>413</td> <td>498</td> <td>803</td> <td>463</td> <td>480</td> </tr> </table>	C-H	O=O	C=O	H-O	C-C	413	498	803	463	480	10 + 10	CO1
C-H	O=O	C=O	H-O	C-C									
413	498	803	463	480									

(ii) Describe the need of ultimate analysis in chemistry in short. During estimation of nitrogen present in organic compound by Kjeldahl's method, 3.12 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. After absorption, the excess acid requires 12.5 ml of 0.1 N NaOH for neutralization. Determine the percentage of nitrogen in the substance.

OR

Write down the limitation of the proximate analysis in a paragraph. An organic compound (0.2346 g) 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 percentage of carbon, hydrogen and oxygen in it.