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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	<p>(i) The octane number of a fuel containing 80% of n-heptane and 20% of 2, 2, 4-trimethylpentane will be ...</p> <p>(ii) Unburned material remaining after 750 °C during the proximate analysis of coal is known as...</p> <p>(iii) Among cyclopropane, cyclobutane, cyclopentane, cyclohexane and cycloheptane which two are more stable?</p> <p>(iv) Write any two characteristic points of an aromatic compounds.</p> <p>(v) Out of NO_2^-, NO_2^+, HNO_3 and NO_3, which one is the reactive species for the nitration of benzene?</p>	5	CO1
Q 2	<p>(i) Before the establishment of Lindemann theory, it was difficult to justify the mechanism of ... order of reaction. (First/Second/Third/All)</p> <p>(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 $\text{mol L}^{-1} \text{ min}^{-1}$?</p> <p>(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.</p>	(1+1+3)	CO2
Q 3	<p>(i) Write the name of any two methods by which the order of reaction can be determined.</p> <p>(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...</p> <p>(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?</p>	(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> $\text{Ni(s) / Ni}^{2+} \text{(a) // Cu}^{2+} \text{(0.75M) / Cu(s); is 0.601 V at 25 }^{\circ}\text{C.}$ <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	(i) Discuss the effect of dilution on the conductance of strong and weak electrolyte using appropriate illustrations. (ii) Describe alongwith a neat sketch that how corrosion be controlled by sacrificial anodic protection method?	10	CO3
Q 4	(i) 25 ml of a sample of water required 15 ml of N/50 H ₂ SO ₄ using methyl orange indicator but did not give any coloration with phenolphthalein. Determine the type and extent of alkalinity is present. (ii) A sample of water on analysis was found to contain following impurities: Ca(HCO ₃) ₂ : 4 mg/lt Mg(HCO ₃) ₂ : 6 mg/lt CaSO ₄ : 8 mg/lt MgSO ₄ : 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.	10	CO4
Q 5	(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 °. (ii) Differentiate between thermoplastics and thermosetting polymers.	10	CO5

SECTION-C

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

Q 1	(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: 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 Calculate the gross and net calorific value of coal, assuming that the latent heat of condensation of steam is 583 cal/g. OR 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. <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.