Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

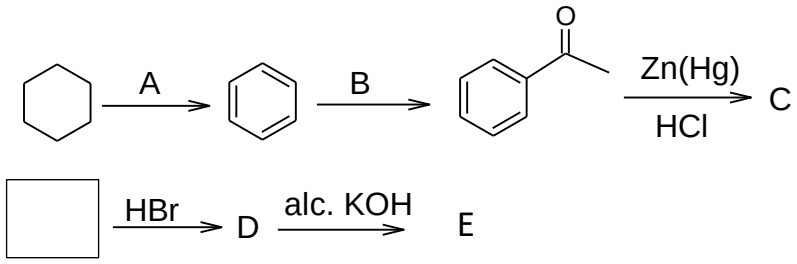
Mid Semester Assignment for all SoCS branches following

Programme Name:B. Tech(BT, IOT, OSOS, Bigdata, DevOps, AIM, OGI, SCF) **Semester : II**

Course Name : Chemistry **deadline : two days**

Course Code : CHEM-1011 **Max. Marks : 20**

SECTION -A **(6x5=30 marks)**

S. No.	(Attempt ALL questions)	Marks	CO
Q 1	Calculate ΔH° for the given reaction by using the given average bond dissociation energies: $C_2H_5Cl\ (g) + Cl_2(g) \rightarrow C_2H_4Cl_2(g) + HCl(g)$ [Given: average bond energies of C-H, C-C, C-Cl, Cl-Cl, H-Cl are 414, 347, 377, 243, 431 kJ/mol respectively]	5	CO1
Q 2	Compare bulk and solution polymerization.	5	CO5
Q 3	Complete the following reactions and identify A, B, C, D and E. 	5	CO1
Q4	A first order reaction has rate constant of 4500 s^{-1} at 1°C and an activation energy of 58000 J/mol. At what temperature would rate constant be 10000 s^{-1}?	5	CO2
Q5	At 250°C, the reaction $PCl_{5\,(g)} \rightleftharpoons PCl_{3\,(g)} + Cl_{2\,(g)}$ has an equilibrium constant Kc = 1.80. If 0.100 mol of PCl_5 is added to a 5.0 L flask, what are the concentrations of PCl_5, PCl_3 and Cl_2 at equilibrium at this temperature?	5	CO2
Q6	Calculate the number average molecular weight (M_n), weight average molecular weight (M_w) and PDI of the polymer with molecular mass 1000 of monomer units of 100, 2000 molecular mass of 200 monomer units and 5000 molecular mass of 300 monomer units.	5	CO5

SECTION B

(Attempt All questions, internal choice given for Q 8)

Q 7	Following mechanism has been suggested for the decomposition of N_2O_5: Overall reaction: $2N_2O_5 \longrightarrow 4NO_2 + O_2$ **Mechanism:** $N_2O_5 \xrightarrow{K_1} NO_3 + NO_2$ $NO_3 + NO_2 \xrightarrow{K_2} N_2O_5$ $NO_3 + NO_2 \xrightarrow{K_3} NO + NO_2 + O_2$ $NO_3 + NO \xrightarrow{K_4} 2NO_2$ Apply SSA for intermediates and derive rate for the formation of NO_2	**10**	**CO2**
Q 8	**i)** A fuel has the following composition by volume: H_2 = 30%; CH_4 = 5%; CO = 20%; CO_2 = 6%; O_2 = 5%; and N_2 = 34%. If 50% excess air is used find the weight of air actually supplied per m^3 of this fuel. (Given molecular weight of air =29 g/mol) **ii)** A sample of coal was analyzed as follows: Exactly 1.6 g was weighed in a silica crucible. After heating for one hour at 110°C, the residue weighed 1.42 g. The crucible next was covered with a vented lid and strongly heated for exactly 7 minutes at 925±20°C. The residue weighed 0.98 g. The crucible was then heated without cover at 725±20°C, until a constant weight was obtained. The last residue was found to weigh 0.41 g. Calculate the percentage of moisture, volatile matter, ash and fixed carbon from above analysis. ***OR*** **i)** The following data in a bomb calorimeter experiment Weight of the cubicle = 2.34 g Weight of the crucible + fuel = 3.58 g Water equivalent of the calorimeter = 650 g Water taken in the calorimeter = 2200 g Observed rise in temperature = 4.24°C Cooling correction = 0.048°C Acids correction = 60 cal Calculate gross calorific value of fuel sample. If the fuel contains 4% hydrogen, determine the net calorific value. (Latent heat of steam = 587 cal/g) **ii)** Explain the process of ultimate analysis to determine percentage of carbon and hydrogen of a fuel sample using suitable diagram.	**5+5**	**CO1**