Enrolment No:	UPES

Course: CHEM-1011 (Chemistry) (End Semester Examination December-2018)

Programme: B.Tech [ASE, ASE+AVE, Civil(IFE), Mechatronics, ADE, GSE, GIE, FSE, ECE, Electrical, CS-CCVT, CS-BAO, ECRA,MAD, IFM, MFT, BFSI, GG]

Semester: I (2018-19)

Time: 03 hrs. **Max. Marks:100**

Number of pages: 03

Instructions: Read all the below mentioned instructions carefully and follow them strictly:

1) Write your **Enrolment No**. at 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) Internal choice is given for question number 9 & 11 only.
5) CO1, CO2, CO3, CO4 & CO5 mentioned in the last column stand for course outcomes and are for official use only

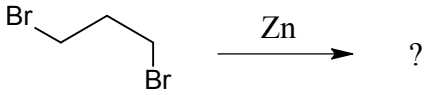
Section - A (Attempt all **FIVE** Questions**)**

1.	If an iron nail is pierced in wall, which area of nail will corrode faster and why?	**[4]**	**CO3**
2.	The molar heat of formation of NH_4NO_3(s) is -367.54 kj and those of N_2O (g) and H_2O (l) are +81.46 kJ and -285.78 kJ respectively at 25°C and at 1atm pressure. Calculate ΔH and ΔE for the reaction $NH_4NO_3(s) \rightarrow N_2O(g) + 2H_2O(l)$	**[4]**	**CO1**
3.	What is zeolite? How is it used in purification of water? Give reasons.	**[4]**	**CO4**
4.	One mole of H_2, two moles of I_2 and three moles of HI are injected in one litre flask. What will be the concentration of H_2, I_2 and HI at equilibrium at 500° C ? kc for reaction $H_2 + I_2 \leftrightarrow 2HI$ is 45.9	**[4]**	**CO2**
5.	Draw the conductometric titration curve for weak acid versus strong base, indicate end point and give suitable reasoning for the same.	**[4]**	**CO3**

SECTION - B

(Question No. 6,7 and 8 are Compulsory; Attempt any one from question numbers 9A & 9B)

6.	i) Discuss micro-emulsion route for nanomaterial preparation. ii) Vulcanization: a boon to rubber industry. Explain the process. iii) Write advantages of hardness of water	**[5+3+2]**	**CO5** **CO5** **CO4**
7.	i) The decomposition of Cl_2O_7 at 400K in the gas phase to Cl_2 and O_2 is of 1st order. After 55 sec at 400 K, the pressure of Cl_2O_7 falls from 0.062 to 0.044 atm. Calculate the rate constant. ii) What is ion exchange process in terms of water purification? What are its different types? Write disadvantage and advantages of the same.	**[5+5]**	**CO2** **CO4**
8.	i) Which type of corrosion is more prevalent in sea water? Explain in detail. ii) The molar conductivities at infinite dilution of $AgNO_3$, NaCl and $NaNO_3$ are 116.5,	**[5+5]**	**CO3**

	110.3 and 105.2 Scm^2mol^{-1} respectively. The conductivity of AgCl in water is 2.40 X 10^{-6} S cm^{-1} and of water used is 1.16 X 10^{-6} S cm^{-1}. Find the solubility of AgCl.		
9A.	i) Write the complete mechanism for cationic polymerization of ethene. ii) Write short notes on the following for improvement of octane number a) Isomerisation b) Aromatisation	**[5+5]**	**CO5 CO1**
9B.	i) Classify polymers based on following and give suitable examples of each a) Final application b) Thermal behaviour ii) Complete the following reactions a)  b) 	**[5+5]**	**CO5 CO1**
	SECTION - C **(Question No. 10 is Compulsory; Attempt any one from question numbers 11A & 11B)**		
10.	i) A 100 ml sample of water required 27 ml of 0.01 M EDTA solution for titration using Erichrome Black T as indicator. Another 200 ml of water from the same source was boiled and precipitate removed by filtration. The filtrate required 12 ml of 0.01M EDTA for titration. Calculate total hardness, permanent hardness and temporary hardness of water sample. ii) Derive an expression for [A], [B] and [C] for following reaction after time "t". $A \xrightarrow{K_1} B \xrightarrow{K_2} C$ iii) How does size of the particle affect the optical, electrical and magnetic properties of nanomaterials?	**[8+7+5]**	**CO4 CO2 CO5**
11A.	i) The specific conductance of 0.2 M aqueous solution of NaCl is 1.1830 Sm^{-1} and of water is 8.1 x $10^{-2}Sm^{-1}$. A cell shows resistance of 35 Ω when filled with 0.2M NaCl solution and 290 Ω when filled with 0.2M CH_3COOH solution. Calculate the molar conductance of acetic acid. ii) A sample of water contains following impurities: $Mg(HCO_3)_2$ = 146 mg/L, $CaCl_2$ = 111 mg/ L, $MgSO_4$ = 240 mg/ L, $Ca(NO_3)_2$ = 82 mg/ L. Calculate the quantity of lime (74% pure) and soda (90% pure) needed for softening 2000 L of water. iii) Calculate heat of formation AgCl. Given that heat of formation of $Ag_2O(s)$, HCl(g) and $H_2O(l)$ are -731, -22.06 and -68.32 Kcal respectively. Also $Ag_2O(s) + 2HCl(g) \rightarrow 2AgCl(s) + H_2O(l)$ ΔH = - 77.61 Kcal	**[7+8+5]**	**CO3 CO4 CO1**

11B.	i) The emf of the following cell is found to be 0.20 V at 298K, $Cd\|\ Cd^{+2}$ (?) $\|\|\ Ni^{+2}$ (0.2M) $\|Ni$. What is the molar concentration of Cd^{+2} in the solution? $E^0Cd^{+2}/\ Cd = -0.4V$ $E^0\ Ni^{+2}/Ni = -0.25V$ ii) a) What do you understand by sodium hexametaphosphate? Explain its action with suitable reactions. b) A 200 mL of water sample required 50 mL of 0.09 N H_2SO_4 for phenolphthalein end point and another 16mL for Methyl orange end point. Determine nature and amount of alkalinity present in water. iii) Explain the principle and working of Bomb Calorimeter, with suitable diagram.	**[7+8+ 5]**	**CO3 CO4 CO1**

Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Chemistry (CHEM1011) **Semester: I**

Programme: B.TECH. (ASE, ASE-AVE, ADE, Mechatronics, GSE, GIE, ELE, ECE, Civil, FSE, BAO,CCVT, ECRA, GG, IFM, BFSI, MAD, MFT)

Time: 03 hrs. **Max. Marks: 100**

Instructions: Attempt all parts of a question at one place only. Internal choice is given in question 9 and 11.

SECTION A

S. No.		Marks	CO
Q 1	The emf of the cell, Zn (s) | Zn^{+2} (aq. 0.1 M) ‖ Cd^{+2} (aq. 'x' M) | Cd (s) has been found to be equal to 0.33 V at 298 K. Calculate the concentration 'x' of Cd^{2+}(aq). Given that $E^0_{Zn\|Zn^{2+}}$= +0.76 V and $E^0_{Cd2+\|Cd^2}$ = - 0.40 V	4	CO3
Q 2	Discuss the conductance variations in the following cases with the help of graph if: (i) N/50 NaOH is titrated against N/50 sulfuric acid solution. (ii) Ammonium hydroxide is titrated against hydrochloric acid.	4	CO3
Q 3 (a)	How will you differentiate 1-butyne and 2-butyne?	4	CO1
(b)	How will you convert ethane into pentane?		
Q 4	Calculate the distance between the adjacent planes if the first order reflection from X-rays of wavelength 2.29 A occurs at an angle of 27°.	4	CO5
Q 5 (a)	Compare the corrosion behavior in an experiment if; (i) An iron plate of 50 cm^2 is connected to a zinc plate of 50 cm^2. (ii) Another iron plate of 50 cm^2 is connected to a zinc plate of 100 cm^2.	4	CO3
(b)	Iron bolts have shorter life time in sea water than in river water. Explain with proper reasoning.		

SECTION B

Q 6 (a)	Calculate the temporary, permanent and total hardness of a water sample, containing $Mg(HCO_3)_2$ = 7.3 mg/L, $Ca(HCO_3)_2$ = 16.2 mg/L, $CaSO_4$ = 13.6 mg/L, $MgCl_2$ = 9.5 mg/L, $CaCl_2$ = 11.1 mg/L and NaCl = 10 mg/L. (molecular weight of $Mg(HCO_3)_2$ = 146; $Ca(HCO_3)_2$ = 162; $CaSO_4$ = 136; $MgCl_2$ = 95; $CaCl_2$ = 111; NaCl = 58.5)	5+5	CO4
(b)	An exhausted zeolite softener was regenerated by passing 250 L of NaCl solution, having a strength of 150 g/L of NaCl. How many litres of hard water sample, having hardness of 600 ppm can be softened, using this softener?		
Q 7 (a)	In a reaction A+ B → C , rate is doubled when the concentration of 'A' is doubled and the rate increases by 8 times when the concentration of both the reactants 'A' and 'B' are doubled. Write the rate law and what is the order of the reaction w.r.t A and B.	3+7	CO2
(b)	A 1st order reaction is 50% complete in 30 minute at 27° C and in 10 minute at 47° C. Calculate (i) rate constant for reaction at 27° C and 47° C. (ii) energy of activation for the reaction.		
Q 8	Give reasons: (i) Bulk polymerization sometimes leads to explosion.	10	CO5

	(ii) Elemental composition of polymers formed by condensation polymerization is different from monomers. (iii) Polyvinyl chloride pipes are preferred to make electrical fittings. (iv) Vulcanization of rubber is required. (v) PMMA is used for making contact lenses.		
Q 9 (a)	Calculate the standard internal energy change for the reaction: $OF_2(g) + H_2O(l) \rightarrow O_2(g) + 2HF(g)$ at 298K Given: enthalpy of formation of $OF_2(g)$, $H_2O(l)$ and HF(g) is +20 Kj/mole, -250Kj/mole and -270 Kj/mole respectively.	**6+4**	**CO1**
(b)	Explain four main characteristics of a good fuel. **OR**		
(a)	Write short notes on: (i) Octane number (ii) Cracking		
(b)	Discuss any two types of renewable fuels.		
	SECTION-C		
Q10(a)	A 0.5 g of $CaCO_3$ was dissolved in dilute HCl and diluted to 500 mL. 100 ml of this solution required 96 mL of EDTA solution for titration. 50 mL of given hard water sample required 15 mL of EDTA solution for titration, while 50 ml of boiled water of the same sample required 5 mL of EDTA solution for titration. Calculate the temporary and permanent hardness of water sample in ppm.	**6+6+5 +3**	**CO4**
(b)	Explain: (i) Hot lime-soda process is better than cold lime-soda process. (ii) Demineralization process is preferred over zeolite process. (iii) Why is it conventional to express hardness of water in terms of $CaCO_3$ equivalent at the International level?		**CO4**
(c)	Explain, using E^o values; (i) Can a solution of 1M $ZnSO_4$ be stored in a vessel made of silver? Given, $E^o (Zn^{2+}/Zn) = -0.76$ V and $E^o (Ag^+/Ag) = +0.80$V (ii) Why does blue colour of $CuSO_4$ solution get discharged by adding iron pieces to it? Given $E^o (Cu^{2+}/Cu) = +0.34$ V and $E^o (Fe^{2+}/Fe) = -0.44$ V		**CO3**
(d)	Differentiate between dry corrosion and wet corrosion with example.		**CO3**
Q11(a)	0.5 mole of N_2 and 0.5 mol of H_2 react in 10 L flask at 448°C. At equilibrium, 20% N_2 reacts. For the reaction, $N_2(g) + 3H_2(g) \rightleftarrows 2NH_3(g)$, Calculate; (i) Value of Kc (ii) Value of K_p	**6+6+8**	**CO2**
(b)	Explain the synthesis of nanoparticles using chemical precipitation route and sol gel method.		**CO5**
(c)	The resistance of 0.1 M solution of acetic acid occupying a volume between two platinum electrodes 2.4 cm apart and 1.72 cm^2 in area was found to be 62Ω. Calculate molar conductance of the solution. If molar conductance of acetic acid at infinite dilution is 300 Scm^2mol^{-1}, calculate its dissociation constant.		**CO3**

	OR		
(a)	The degree of dissociation of PCl_5 into PCl_3 and Cl_2 at one atmosphere and 40°C is 0.310. Calculate its Kp at 40°C. Also, calculate the degree of dissociation of PCl_5, if the reaction occurs at 10 atm pressure and at same temperature.		**CO2**
(b)	Explain the synthesis of nanoparticles using physical route and reverse microemulsion method.		**CO5**
(c)	Explain specific conductance and equivalent conductance. Also, discuss the variation of these conductances if the solution is diluted to 10 times.		**CO3**