

Name:

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

**End Semester Examination (Online Mode), January 2021**

**Course: Chemistry I (common paper)**

**Semester: I**

**Program: B. Tech. (ADE, APE-gas, Chemical, Civil, FSE, Mechanical, Mechatronics)**

**Course Code: CHEM-1011**

**Time: 3 hr**

**Max. Marks: 100**

**SECTION - A**

**6 x 5 = 30 Marks**

**1. Each Question will carry 5 Marks**

**2. Instruction: Complete the statement / Select the correct answer(s)**

Q 1	<p><b>A: In the reaction <math>2A + B \rightarrow A_2B</math>, if the concentration of A is doubled and that of B is halved, then the rate of the reaction will ----- ?</b></p> <p>(a) increase 2 times (b) increase 4 times (c) decrease 2 times (d) remain the same</p> <p><b>B: A substance 'A' decomposes by a first-order reaction starting initially with <math>[A] = 2.00M</math> and after 200min, <math>[A]</math> becomes 0.15M. For this reaction <math>t_{1/2}</math> is ----- ?</b></p> <p>(a) 46.45 min (b) 50.49 min (c) 48.45 min (d) 53.72 min</p>	CO2
Q 2	<p><b>A: Consider the Arrhenius equation given below and mark the correct option.</b></p> $k = A e^{-E_a/RT}$ <p>(a) Rate constant increases exponentially with increasing activation energy and decreasing temperature. (b) Rate constant decreases exponentially with increasing activation energy and decreasing temperature. (c) Rate constant increases exponentially with decreasing activation energy and decreasing temperature.</p>	CO2

	<p>(d) Rate constant increases exponentially with decreasing activation energy and increasing temperature</p> <p><b>B: Which of the following observations is incorrect about the order of a reaction?</b></p> <p>(a) Order of a reaction is always a whole number  (b) The stoichiometric coefficient of the reactants doesn't affect the order  (c) Order of reaction is the sum of power to express the rate of reaction to the concentration terms of the reactants.  (d) Order can only be assessed experimentally</p>	
Q 3	<p><b>A: Acetic acid is weak acid than sulphuric acid because which of the following reasons?</b></p> <p>a) It decomposes on increasing temperature  b) It has less degree of ionization  c) It has -COOH group  d) It has more inductive effect</p> <p><b>B: Which among the following is not a property of aromatic hydrocarbon?</b></p> <p>a) These compounds have very good aromaticity  b) These compounds have excellent stability  c) These compounds do not undergo nucleophilic substitutions but they undergo electrophilic substitutions  d) There exists a strong ratio between carbon and hydrogen</p>	CO1
Q 4	<p><b>Give reasons:</b></p> <p>(i) Bulk polymerization sometimes leads to explosion.  (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.</p>	CO5
Q 5	<p><b>A: A conductivity cell when filled with 0.01M KCl solution has a resistance of 747.5 ohm at 25°C. When the same cell was filled with an aqueous solution of 0.05M CaCl<sub>2</sub> solution the resistance was 876 ohm. Calculate (i) Conductivity of the solution</b></p>	CO3

	<p><b>(ii) Molar conductivity of the solution</b>  <b>(given conductivity of 0.01M KCl = 0.14114 Sm<sup>-1</sup>)</b></p> <p>(a) Conductivity = 0.1204 Sm<sup>-1</sup> ; Molar Conductivity = 0.00241 Sm<sup>2</sup>mol<sup>-1</sup>  (b) Conductivity = 0.2104 Sm<sup>-1</sup> ; Molar Conductivity = 0.0241 Sm<sup>2</sup>mol<sup>-1</sup>  (c) Conductivity = 0.1204 Sm<sup>-1</sup> ; Molar Conductivity = 0.01240 Sm<sup>2</sup>mol<sup>-1</sup>  (d) Conductivity = 0.4201 Sm<sup>-1</sup> ; Molar Conductivity = 0.00421 Sm<sup>2</sup>mol<sup>-1</sup></p> <p><b>B: Calculate the emf of the cell in which the following reaction takes Place</b></p> $\text{Ni}_{(s)} + 2 \text{Ag}^+ (0.002\text{M}) \rightarrow \text{Ni}^{2+} (0.160\text{M}) + 2\text{Ag}_{(s)}$ <p>(a) 0.914 V  (b) 0.419 V  (c) 0.149 V  (d) 0.194 V</p>	
Q 6	<p><b>Explain:</b></p> <p>(i) Hot lime-soda process is better than cold lime-soda process. <b>(1 mark)</b>  (ii) Demineralization process is preferred over zeolite process. <b>(1 mark)</b>  (iii) Why is it conventional to express hardness of water in terms of CaCO<sub>3</sub> equivalent at the International level? <b>(3 marks)</b></p>	CO4
<p><b>SECTION – B</b> <span style="float: right;"><b>10 x 5 = 50 Marks</b></span></p> <p><b>1. Each question will carry 10 marks</b>  <b>2. Instruction: Write short / brief notes</b></p>		
Q 1	<p>The effect of adding N<sub>2</sub>O<sub>5</sub> to the reaction</p> $\text{NOCl} + \text{O}_3 \longrightarrow \text{NO}_2\text{Cl} + \text{O}_2$ <p>Was studied and the mechanism proposed is</p> $\text{N}_2\text{O}_5 \xrightarrow{k_1} \text{NO}_2 + \text{NO}_3$ $\text{NO}_3 + \text{NO}_2 \xrightarrow{k_2} \text{N}_2\text{O}_5$ $\text{NO}_2 + \text{O}_3 \xrightarrow{k_3} \text{NO}_3 + \text{O}_2$ $\text{NOCl} + \text{NO}_3 \xrightarrow{k_4} \text{NO}_2\text{Cl} + \text{NO}_2$ <p>Show that it leads to</p> $-\frac{d[\text{NOCl}]}{dt} = \left(\frac{k_1 k_3 k_4}{k_2}\right)^{1/2} [\text{NOCl}]^{1/2} [\text{O}_3]^{1/2} [\text{N}_2\text{O}_5]^{1/2}$	CO2
Q 2	<p><b>A.</b> Discuss the construction and cell reactions of Daniel cell. Explain with proper illustrations.</p> <p><b>B.</b> Calculate the concentration of Ni<sup>2+</sup> in the given cell</p> $\text{Ni} \mid \text{Ni}^{2+} (x) \parallel \text{Cu}^{2+} (0.8 \text{ M}) \mid \text{Cu}$ <p>Given that E<sub>cell</sub> = 0.6 V; E°Ni<sup>2+</sup>/Ni = -0.251 V ; E°Cu<sup>2+</sup>/Cu = 0.3 V</p>	CO3

Q 3	<p><b>A:</b> A sample of water contains following impurities: <math>\text{Mg}(\text{HCO}_3)_2 = 146 \text{ mg/L}</math>, <math>\text{CaCl}_2 = 111 \text{ mg/L}</math>, <math>\text{MgSO}_4 = 240 \text{ mg/L}</math>, <math>\text{Ca}(\text{NO}_3)_2 = 82 \text{ mg/L}</math>. Calculate the quantity of lime (74% pure) and soda (90% pure) needed for softening 2000 L of water.</p> <p><b>B:</b> 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.</p>	CO4
Q 4	<p><b>A:</b> Derive rate for Lindemann reactions mechanism for unimolecular reactions.</p> <p><b>B:</b> The degree of dissociation of <math>\text{PCl}_5</math> into <math>\text{PCl}_3</math> and <math>\text{Cl}_2</math> at one atmosphere and <math>40^\circ\text{C}</math> is 0.310. Calculate its <math>K_p</math> at <math>40^\circ\text{C}</math>. Also, calculate the degree of dissociation of <math>\text{PCl}_5</math>, if the reaction occurs at 10 atm pressure and at same temperature.</p>	CO2
Q 5	<p><b>A:</b> Mention any three classification of polymers with details.</p> <p><b>B:</b> Explain the synthesis of nanoparticles using reverse microemulsion method.</p>	CO5
<p><b>Section – C</b> <span style="float: right;"><b>1 x 20 = 20 Marks</b></span></p> <p><b>1. Answer any One Question. Each Question carries 20 Marks.</b></p> <p><b>2. Instruction: Write long answer.</b></p>		
Q 1	<p><b>A:</b> Differentiate cold and hot lime soda method for softening of water. Use proper illustrations and chemical reactions.</p> <p><b>B:</b> A water sample has no phenolphthalein alkalinity. The 100 ml of water sample requires 16.9 ml of 0.02 N HCl with methyl orange. Calculate the type and alkalinity present in water in ppm?</p> <p><b>C:</b> Describe bulk and solution polymerization techniques.</p> <p style="text-align: center;"><b>Or</b></p> <p><b>A:</b> Explain zeolite method and ion exchange methods of softening of hard water.</p> <p><b>B:</b> 10000 liters of hard water made soft with zeolite required a total amount of 8 liters of NaCl solution containing 150 g/lit of sodium chloride for regeneration. Calculate the hardness of water.</p> <p><b>C:</b> Describe emulsion and suspension polymerization techniques.</p>	CO4,5 (7+7+6)