UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination-Online Bb mode, July 2020 (date of exam: 8th July 20)

Course: Chemistry   **(common course)**   **Semester:** II
Program: B Tech (All SoE)   **Time 03 hrs.**
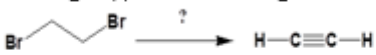**Course Code:**   CHEM1011   **Max. Marks:** 100

PART- A(Answer ALL questions)   30 x 2 = 60 Marks
PART A contains 30 questions for a total of 60 marks.
Part-A contains multiple (MCQs) choice and multiple answer questions(MAQs)(Negative marks for MAQs incorrect answers)

Q 1	The standard enthalpy of formation of $NH_3(g)$ at 298 K is –46 kJ mol^{-1}. Which of the following values is correct for the standard enthalpy change for the following reaction? The answer is given per mole of reaction. $$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$$ A. -92 kJ. Mol^{-1} B. +92 kJ. Mol^{-1} C. +46 kJ. Mol^{-1} D. -46 kJ. Mol^{-1}
Q 2	The enthalpy of combustion of butane as is -2878 kJ.mol^{-1}. Which of the following statement(s) is/are correct? A. Combustion of butane is an exothermic process B. Butane releases heat as it burns C. Standard heat of formation of butane is 2878 kJ mol^{-1} D. The enthalpy change that accompanies the combustion of 2.5 moles of butane is -7195 kJ
Q 3	1.56g of coal sample was treated by Kjeldahl's method and the ammonia gas evolved from it was absorbed in 50ml of N/10 sulfuric acid. After absorption, excess of acid required 16.5ml of N/10 sodium hydroxide for exact neutralization. Sample contains following percentage of nitrogen in it? A. 2 B. 3 C. 4 D. 5 ***or*** 6.45g sample of coal was heated in hot air oven at 110°C for 1 hr. After heating and cooling, sample weighed 5.94g. Then, the crucible was heated with a lid in muffle furnace at 950°C for 7 min. The sample after this step weighed 4.95g. Finally, the crucible was heated in muffle furnace without lid at 750°C till constant weight was not obtained. Final weight of sample was 2.8g. Fixed carbon in the sample is: A. 33.35% B. 43.45% C. 54.45% D. 24.45%
Q 4	The polymer in which substituent are arranged in an alternate manner on carbon chain A. syndio-tactic polymer B. isotactic polymer C. atactic polymer D. none of the mentioned
Q 5	How many litres of 58.5 mg/L NaCl solution will be required to regenerate an exhausted zeolite bed after softening of 10 litres of hard water of 100 ppm hardness? A. 20L B. 25L C. 30L D. 35L
Q6	The equivalent conductance at infinite dilution of NaCl, HCl and CH_3COONa at 25°C are 126.0, 426.0 and 91.0 ohm^{-1} cm^2 respectively. The equivalent conductance of acetic acid at infinite dilution at 25°C will be A. 391.0 B. 217.0 C. 517.0 D. 643.0
Q7	The positive value of the standard electrode potential of Cu^{2+}/Cu indicates that _____ A. this redox couple is a stronger reducing agent than the H^+ /H_2 couple. B. this redox couple is a stronger oxidising agent than H^+ /H_2. C. Cu can displace H_2 from acid.

	D. Cu cannot displace H_2 from acid.
Q8	A sample of water contains following impurities: $Ca(HCO_3)_2$ = 40.5 mg/l, $Mg(HCO_3)_2$ = 46.5 mg/l, $CaCl_2$ = 22.45 mg/l, $MgSO_4$ = 27.6 mg/l, $CaSO_4$ = 32.1 mg/l. Calculate the total hardness of water. (Given m.w. for $Ca(HCO_3)_2$ = 162, $Mg(HCO_3)_2$ = 146, $CaCl_2$ = 111, $MgSO_4$ = 120, $CaSO_4$ = 136. A. 123.68 ppm B. 132.77 ppm C. 156.65 ppm D. 148.45 ppm
Q9	A water sample is not alkaline to phenolphthalein. However, 100 ml of the water sample reached the end point of titration using methyl orange as indicator with 36.5 ml of 0.02 N HCl. What are the types and amounts of alkalinity present in water? A. CO_3^{--}, 365 ppm B. HCO_3^-, 365 ppm C. CO_3^{--}, 182.5 ppm D. HCO_3^-, 182.5 ppm
Q10	A 100 ml sample of water required 13.5 ml of 0.02 M EDTA solution for titration using Eriochrome Black T as indicator. Another 100 ml of water from the same source was boiled and precipitate removed by filteration. The filterate required 6 ml of 0.02M EDTA for titration. Calculate the temporary hardness of water sample: A. 270 ppm B. 120 ppm C. 150 ppm D. 75 ppm
Q11	A sample of atactic polystyrene is separated into 5 fractions; <table><tr><td>Fraction</td><td>Number of Moles</td><td>Molecular Weight</td></tr><tr><td>1</td><td>20</td><td>10,000</td></tr><tr><td>2</td><td>20</td><td>20,000</td></tr><tr><td>3</td><td>20</td><td>30,000</td></tr><tr><td>4</td><td>20</td><td>40,000</td></tr><tr><td>5</td><td>20</td><td>50,000</td></tr></table> What is the number average molecular weight? A. 3.0×10^4 B. 2.33×10^4 C. 3.66×10^4 D. 4.33×10^4
Q12	The number average molecular weight and Weight average molecular weight of a polymer are respectively 38,000 and 48,000. The Poly Dispersity Index(PDI) of the polymer is A. >1 B. <1 C. 1 D. -1
Q13	1-bromo-3-chlorocyclobutane when treated with two equivalents of Na, in the presence of ether which of the following will be formed? a) b) Br c) Cl d)
Q14	The reagent(s) for the following conversion, is/are? Br — CH₂ — CH=CH — Br ? → H—C≡C—H a) Alcoholic KOH b) Alcoholic KOH followed by $NaNH_2$ c) Aqueous KOH followed by $NaNH_2$ d) Zn/CH_3OH

| Q15 | Identify the compound X in the following reaction:

H_3C —C(H)= CH_2 + HBr $\longrightarrow$ X
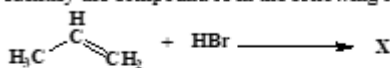
a) 1- bromo propan
b) 2-promo propane
c) 1,2-dibromo propane
d) propane |
|---|---|
| Q16 | Given the following data for this reaction:
$$NH_4^+(aq) + NO_2^-(aq) \longrightarrow N_2(g) + 2H_2O(l)$$
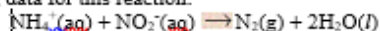
EXPT	$[NH_4^+]$	$[NO_2^-]$	RATE
1	0.010 M	0.020 M	0.020 M/s
2	0.015 M	0.020 M	0.030 M/s
3	0.010 M	0.010 M	0.005 M/s

The rate law for the reaction is:
(a) Rate = $k[NH_4^+][NO_2^-]$
(b) Rate = $k[NH_4^+]^2[NO_2^-]^2$
(c) Rate = $k[NH_4^+]^2[NO_2^-]$
(d) Rate = $k[NH_4^+][NO_2^-]^2$ |
| Q17 | Given: A + 3B $\longrightarrow$ 2C + D
This reaction is first order with respect to reactant A and second order with respect to reactant B. If the concentration of A is doubled and the concentration of B is halved, the rate of the reaction would _____ by a factor of _____ .
(a) increase, 2
(b) decrease, 2
(c) increase, 4
(d) decrease, 4 |
| Q18 | Lime requirement for temporary Mg hardness is

(a) double that required for Ca hardness
(b) same as required for Ca hardness
(c) triple that required for Ca hardness
(d) None |
| Q19 | For the reaction $CaCO_3 (s) \rightleftharpoons CaO(s) + CO_2(g)$, the expressions for K and Kp are written as

a. $K = \frac{[CaO] \times [CO_2]}{CaCO_3}$ and $K_p = \frac{P_{CaO} \times P_{CO_2}}{P_{CaCO_3}}$
b. $K = [CO_2]$ and $K_p = P_{CO2}$
c. Both a and b can be written
d. None of the above |
| Q20 | If the equilibrium constant for the reaction $A_2 + B_2 \rightleftharpoons 2AB$ is 'K', then what will be the equilibrium constant for the backward reaction $AB \rightleftharpoons \frac{1}{2} A_2 + \frac{1}{2} B_2$.

a. 1/K
b. 2K
c. K/2
d. K |

| Q21 | Sol-gel synthesis of nanomaterials is

(a) Top-Down, Chemical route, Solution phase synthesis

(b) Bottom-Up, Physical route, Solution phase synthesis

(c) Bottom-Up, Physical route, Solid phase synthesis

(d) Bottom-Up, Chemical route, Solution phase synthesis |
|---|---|
| Q22 | X-rays of wavelength 4×10^{-10} m is diffracted at an angle of $5°$. The interplanar spacing assuming first order diffraction is

(a) 2.29 nm

(b) 8.13 nm

(c) 11.0 nm

(d) 25 nm |
| Q23 | Which of the following nanomaterials is two-dimensional

(a) Nanoparticles

(b) Nanowire

(c) Nanodot

(d) Nanosheet |
| Q24 | In the reversible reaction $2NO2 \leftrightarrow N_2O_4$, the rate of disappearance of NO_2 is equal to

a) $K_1 [NO_2]^2 - 2k_2[N_2O_4]$

b) $2K_1 [NO_2]^2 - k_2[N_2O_4]$

c) $2K_1 [NO_2]^2 - 2k_2[N_2O_4]$

d) None of these |
| Q25 | In a reversible reaction between C and D, K_1 is the rate constant for the formation of D from C, and K_2 is the rate constant for the formation of C from D. What is the rate equation if both reactions are first order with respect to the reactant?

a) rate of disappearance of $C = K_1 [C] - K_2[D]$

b) rate of appearance of $D = K_1[C] - K_2[D]$

c) Rate of appearance of $C = K_1[C] - K_2[D]$

d) rate of disappearance of $D = K_1[C] - K_2[D]$ |
| Q26 | Domestic cooking gas is the mixture of

a. Mixture of propane and butane

b. Mixture of different hydrocarbons

c. Mixture of methane and ethane

d. Mixture of methane and benzene |
| Q27 | In zeolite process, the exchange of _____ takes place.

A. Anions   B. Cations   C. Both cations and anions   D. No ions exchange |

Q28	With respect to the constituents causing alkalinity in water, which of the following situation never arises? A. CO_3^{2-} and HCO_3^- together B. HCO_3^- and OH^- together C. OH^- only D. OH^- and CO_3^{2-} together
Q29	1 g of CaCO3 was dissolved in dilute HCl and the solution was diluted to 1 litre. Then 100 ml of this solution required 90 ml of EDTA solution. Also, 100 ml of water sample contains 36 ml of same EDTA solution. Calculate total hardness: A. 100 ppm B. 200 ppm C. 300 ppm D. 400 ppm
Q30	A water sample contains 204 mg of $CaSO_4$ per litre. Calculate the hardness in terms of $CaCO_3$ equivalent. A. 100 ppm B. 150 ppm C. 200 ppm D. 250 ppm
Q31	For an electrochemical cell Pt, H_2 (1 atm) I HCl (0.1 M)CH_3COOH (0.1 M) I H_2 (1 atm), Pt. The EMF of the cell will not be zero because; (a) EMF depends on the molarities of acids used (b) pH of 0.1 M HCl and 0.1 M CH_3COOH is not same (c) the temperature is constant (d) acids used in two compartments are different
Q32	Standard electrode potential for Sn^{4+}/Sn^{2+} couple is +0.15 V and that for the Cr^{3+}/Cr couple is -0.74. These two couples in their standard state are connected to make a cell. The Cell potential will be (a) +0.89V (b) +0.18 V (c) +1.83 V (d) +1.199 V

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Part- B (Answer ALL questions)   5 x 8 = 40 Marks

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1. There are total of five questions attempt all carry equal marks
2. **PART B** consist of long answer based questions and has the total weightage of 40%. (Whereas **PART A** it is 60%)
3. **The PART B** responses(Answers) should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, SAP ID at the top (as in the format) and signature at the bottom (right hand side bottom corner)

Q 1	Explain all types of corrosion and explain prevention control methods.
Q 2	**a)** A Zn rod is placed in 0.1M solution of ZnSO4 at 25°C. Assuming that the salt is dissociated to 95% at this dilution, calculate the potential of the electrode at this temperature. Given: $E°(Zn^{+2}/Zn)$ = -0.76V. **b)** From the given molar conductivities at infinite dilution, calculate λ_m^∞ for NH_4OH. λ_m^∞ for $Ba(OH)_2$ = 457.6 ohm^{-1} cm^{2}mol^{-1}. λ_m^∞ for $Ba(Cl)_2$ = 240.6 ohm^{-1} cm^{2}mol^{-1}. λ_m^∞ for NH_4Cl = 129.8 ohm^{-1} cm^{2}mol^{-1}. **(4+4)**
Q 3	**a)** Calculate the temporary and total hardness of a water sample containing $Mg(HCO_3)_2$= 73mg/L, $Ca(HCO_3)_2$= 162mg/L, $MgCl_2$= 95mg/L, $CaSO_4$=136mg/L. **b)** Write a short note on Ion-exchange process. And solve below numerical Explain with chemical equations and calculate the amount of lime and soda required for softening of 1,00,000l of water containing the following: HCl = 7.3 mg/L, $Al_2(SO_4)_3$ = 34.2mg/L, $MgCl_2$ = 9.5mg/L, NaCl = 29.25mg/L.

	Purity of lime is 90% and that of soda is 98%. 10% of chemicals are to be used in excess in order to complete the reaction quickly. **(4+4)**
Q 4	**a)** 1000 litres of hard H_2O is softened by zeolite process. The zeolite was regenerated by passing 10 litres of sodium chloride solution containing 1000 ppm of NaCl. Calculate hardness of H_2O. **b)** How many litres of 58.5 mg/L NaCl solution will be required to regenerate an exhausted zeolite bed after softening of 10 litres of hard water of 100 ppm hardness? **(4+4)**
Q 5	Describe sol-gel and micro emulsion technique for the synthesis of nanomaterials.