UNIVERSITY OF THE PUNJAB

B.A. / B.Sc. (Composite) Annual Exam – 2019

Roll No. .....

Subject: Chemistry
PAPER: A

MAX. TIME: 3 Hrs.
MAX. MARKS: 50

NOTE: Attempt any FIVE questions. All questions carry equal marks.

Q1. (a) Apply Van der Waals equation for real gases to understand the critical phenomenon and derive the expression for Pc, Tc and Vc in terms of Van der Waals constants. (4)

(b) Explain the laws of crystallography. (4)

(c)The density of acetic acid is 1.046 g cm^{-3} and its refractive index for Sodium vapour is 1.3715 at 22.9 °C. The molecular weight of acid is 60.05 g mol^{-1}. Calculate its molar refraction. (2)

Q2. (a) Discuss the importance of viscosity in elucidating the structure of molecules? (4)

(b) What is ment by average, root mean square and most probable velocity of a gaseous molecule? What is the ratio between different molecular velocities? (4)

(c) A crystal has interplaner distance of 2.04 Å and wavelength of X-rays used is 1.54×10^{-10} m. calculate the angle of deflection? (2)

Q3. (a) Derive Schrodinger wave equation considering that electrons have the standing waves. Also give its different forms. (5)

(b)What is the physical meaning of normalization of a wave function? (3)

(c)What is the ground state energy for an electron that is confined to a potential well with a width of 0.2 nm? (2)

Q4.(a) State second law of thermodynamics in different ways. How does it relate with first law of thermodynamics? (4)

(b) Derive an expression for the variation of Gibb's free energy with temperature and pressure? (4)

(c) The vapour pressure of a liquid at 85 °C and 95 °C are 560 torr and 650 torr respectively. Calculate ΔH_v of the liquid at this temperature range? ($R = 8.314\ JK^{-1}mol^{-1}$) (2)

Q5. (a) Differentiate clearly between order and Molecularity of a reaction? (3)

(b) Derive the reaction kinetics for second order reaction when both the reactants have different initial concentrations? (5)

(C) The rate of a particular reaction becomes four times when temperature changes from 20 °C to 40 °C. Calculate energy of activation of this reaction? (2)

Q6. (a)Apply the law of mass action to heterogeneous equilibrium with special reference to dissociation of $CaCO_3$, NH_4HS and NH_2COONH_4? (4)

(b) Derive the following expression:

$$K_p = K_n(P/N)^{\Delta n}$$ (3)

P.T.O.

(c) PCl_5 dissociates into PCl_3 and Cl_2, the value of the equilibrium constant K_c is 33.3 at 760 K. One gram of PCl_5 is introduced into a 500 cm^3 evacuated flask and equilibrium is allowed to establish. Calculate the % age dissociation of PCl_5? (3)

Q7. (a) Explain the variation of specific and equivalence conductance with dilution? (4)

(b)What is the Kohlarausch law of independent migration of ions? (4)

(c)Calculate the equilibrium constant at 298 K for the reaction:

$$Zn_{(s)} + Cu^{2+}(1\ M) \rightleftharpoons Zn^{2+} + Cu_{(s)}$$

E^o for this cell is 1.10 V. (9)

Q8. (a) Explain the Vant Hoffs factor "i". How it can be explained from the dissociation and association of substances in the solution state? (4)

(b)What is semi-permeable membrane? Give one method for the preparation of semi-permeable membrane of Copper ferrocyanide. (4)

(c) When 0.419 g of the solute of molar mass 252.4 g mol^{-1} is dissolved in 75 g of the solvent, the boiling point of the solution is found to be 80.256 °C. Find the ebullioscopic constant. The boiling point of pure solvent is 80.2 °C? (2)

Q9. (a) What is Langmuir adsorption isotherm? Give its mathematical derivation and graphical explanation? (4)

(b)What are the criteria of catalysis? (3)

(c) Differentiate clearly between physical and chemical adsorption? (3)

Q10. Write notes on any "TWO" of the following: (5+5)

i. Calomel electrode

ii. Clausius Clapeyron equation

iii. Tyndall cone effect

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MAX. MARKS: 50

Subject: Chemistry
PAPER: B

NOTE: Attempt any Five questions. All questions carry equal marks. (Periodic Table is not allowed)

Q.No.1 Comment/Justify briefly; (2x5=10)

a) Atomic absorption technique is more useful than Flame photometer.

b) NH_3 is a hard base while H^- is a soft base.

c) I_3^- has linear structure.

d) Which one is paramagnetic and why? Cu(I) or Cu(II)

e) What is meant by Chalcogens?

Q.No.2 a) What is a chemical bond? Explain Co-ordinate covalent bond with suitable examples. (2,3)

b) Define Common Ion Effect. (2)

c) Explain its use for the followings in Salt-Analysis. (3)

(iv) HCl in Group II basic radicals

(v) NH_4Cl in Group III basic radicals

(vi) NH_4OH in Group IV basic radicals

Q.No.3 a) Give different postulates of VSEPR Theory (4)

b) Predict the shapes of the following molecules on VSEPR concept; (2,2,2)

(i) BrF_3 (ii) $[ICl_4]^-$ (iii) NOCl

Q.No.4 a) Describe the principle and instrumentation of Flame photometer. (2, 4)

b) Give some applications of Flame photometer in daily life. (4)

P.T.O.

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B.A. / B.Sc. (Composite) Annual Exam – 2019

Roll No. .....

Subject: Chemistry
PAPER: C

MAX. TIME: 3 Hrs.
MAX. MARKS: 50

NOTE: Attempt any FIVE questions. All questions carry equal marks.

Q.No.1.

a) Arrange the following alkenes in order of their relative stability. How will you proceed to determine the order practically? **(5)**

(i) 1-hexene (ii) cis-3-hexene (iii) trans-3-hexene
(iv) 2-methyl-2-pentene (v) 2,3-dimethyl-2-butene

b) Explain why? **(2.5x2)**

(i) Poly substitution is a complicating factor in aromatic alkylation but not in aromatic nitration or halogenation.

(ii) A undergoes nitration predominantly at the ortho/ para positions but B mainly at meta position

A B

Q.No.2.

a) Complete the following equations: **(1 x 5)**

(i) $CH_3CH{=}CHCH_3 \xrightarrow{?} CH_3CH_2CH_2CH_3$
(ii) $C_2H_5Br + Na \longrightarrow ?$
(iii) $C_2H_5Br + (CH_3)_2CHBr \xrightarrow{Na} ?$
(iv) $CH_3COCH_3 \longrightarrow CH_3COCH_3$
(v) $CH_3COCH_3 \longrightarrow CH_3CH_2CH_3$

b) Write the structure of alkene that on ozonolysis yields: **(1 x 5)**

(i) $CH_3CH_2CH_2CHO + HCHO$ (ii) $(CH_3)_2CHCHO + CH_3CHO$
(iii) $OHC(CH_2)_3CHO$ only (iv) CH_3COCH_3 only
(v) $CH_3CHO + HCHO + OHCCH_2CHO$

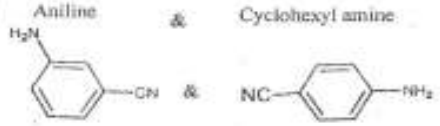
Q.No.3.

a) How will you bring about the following conversions? **(2.5x2)**

(i) $CH_3CHBrCH_2COOC_2H_5 \longrightarrow HOOCCH_2CH(CH_3)CH_2COOH$
(ii) $CH_3CH(COOC_2H_5)_2 \longrightarrow HOOCCH_2CH(CH_3)CH_2COOH$

b) Compare the basicity of: **(1x5)**

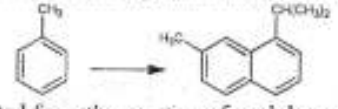
(i) $(CH_3)_3N$ & $(CCl_3)_3N$
(ii) $C_6H_5CH_2NH_2$ & $CH_3C_6H_4NH_2$
(iii) Aniline & Cyclohexyl amine

(iv) 

(v) 

Q.No.4.

a) How will you bring about this conversion? Explain with mechanism **(5)**



b) Give the main product(s) expected from the reaction of cyclohexanol with **(1 x 5)**

(i) Cold conc. H_2SO_4 (ii) hot conc. H_2SO_4 (iii) CrO_3, H_2SO_4 (iv) Na (v) conc. HBr

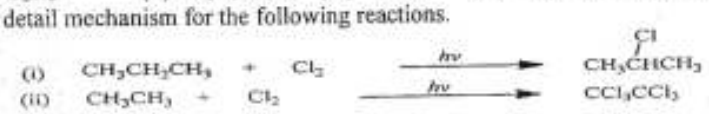
P.T.O.

Q.No.5.

a) Show which of the molecules will have dipole moment, indicating the direction of dipole moment by an arrow. **(1x5)**

(i) C_2H_6 (ii) C_6H_5-C_6H_5 (iii) CCl_4 (iv) CO_2 (v) p-dinitrobenzene

b) Describe the detail mechanism for the following reactions. **(2.5x2)**



Q.No.6.

a) How will you prepare benzylamine from each of the following substances? (Write only equation) **(1 x 5)**

(i) Benzaldehyde (ii) benzamide (iii) phenyl acetamide
(iv) benzonitrile (v) phenyl nitromethane

b) How will you compare the boiling point of the following? Account for your answer. **(2.5 x 2)**

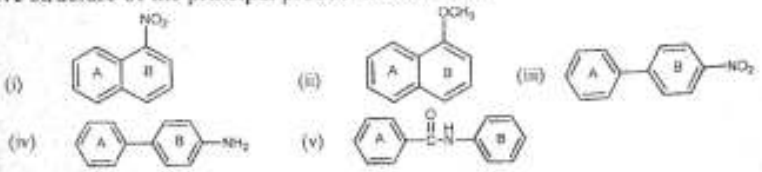
(i) *n*-butane, acetone and propionaldehyde
(ii) *n*-hexane, pental and 1-pentol

Q.No.7.

a) Compare with explanation the nucleophilicity of following pairs of nucleophiles. **(1x5)**

(i) NH_3 & NH_2^- (ii) NH_3 & PH_3 (iii) RO^- & ROH
(iv) n-$C_4H_9O^-$ & t-$C_4H_9O^-$ (v) p-$NO_2C_6H_4O^-$ & $C_6H_5O^-$

b) Which ring (A or B) of each of the following compounds would you expect to undergo nitration more readily? Give structure of the principal product in each case. **(1x5)**



Q.No.8.

a) Explain with reasons whether: **(2.5 x 2)**

(i) Addition of bromine is likely to be more favorable to the 1,4 position of naphthalene or to the 9,10 position of phenanthrene.
(ii) Anthracene is more likely to be brominated at the 1-, 2- or 9 position.

b) How will you synthesize each of the following compounds from a carbonyl compound and some other substances? Write only equation in each case. **(1 x 5)**

(i) C_6H_5CH=NOH (ii) HON=CHCH=NOH (iii) C_6H_5NHN=$CHCH_3$

(iv) $(CH_3)_2C$=N-N=$C(CH_3)_2$ (v)

Q.No.9.

a) Which of the following compounds would involve hydrogen bonding and what type of hydrogen bond would they form? **(0.5x10)**

(i) Acetic acid (ii) acetaldehyde (iii) ammonia (iv) ethane (v) ether (vi) ethanol
(v) Oxalic acid (viii) fluoroform (ix) salicylaldehyde (x) acetyl acetone

b) Write equations for the preparation of *n*-butane from each of the following: **(1x5)**

(i) 1-butene (ii) 2-betene (iii) ethyl chloride (iv) *n*-butyl bromide
(v) *sec*- butyl bromide

Q.No.10.

a) Explain the following terms and give examples of each **(1 x 5)**

(i) Isomerism (ii) chirality (iii) racemate
(iv) resolution (iv) dihedral angel

b) How will you synthesize each of the following compound starting from acetylene (Write Only Equation) **(1 x 5)**

(i) Ethane (ii) 1,1-dibromoethane (iii) acetaldehyde
(iv) Vinylchloride (v) ethylene