



# PUNJAB TECHNICAL UNIVERSITY JALANDHAR

Max. Marks: 90

Time: 90 Mins.

## Entrance Test for Enrollment in Ph.D. Programme

### Important Instructions

- Fill all the information in various columns, in capital letters, with blue/black ball point pen.
- Use of calculators is not allowed. Use Blue/Black ball point pen for attempting the questions.
- All questions are compulsory. No negative marking for wrong answers.
- To attempt a question, make a tick mark (✓) at the right option/answer.
- Each question has only one right answer.
- Questions attempted with two or more options/answers will not be evaluated.

Subject (Engg./Arch./Pharm./Mgmt./Sciences) APPLIED SCIENCE

Discipline / Branch CHEMISTRY

Name .....

Father's Name .....

Roll No. .... Date : 10-07-2010

Signature of Candidate .....

Signature of Invigilator .....

Q. 1 Which of the following amino acid does not contain benzene ring?

- (a) Tryptophan
- (b) Tyrosine
- (c) Phenylalanine
- (d) Serine

Q. 2 What is not correct about enzymes in the following?

- (a) Enzymes are chiral
- (b) Enzymes display stereo-specificity
- (c) Enzymes cannot be used as catalysts
- (d) Enzymes display stereo-selectivity

Q. 3 What are the units of pressure?

- (a) Pascal
- (b) atmosphere
- (c) torr
- (d) All of these

Q. 4 ppm by weight can be defined as

- (a) ng solute/g solution
- (b) µg solute/g solution
- (c) meq solute/litre solution
- (d) mg solute/100 mL solution

Q. 5 How many grams of  $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$  (MW=392.14) must be dissolved and diluted to 250 mL to prepare an aqueous solution, of density 1.00 g/mL, that is 1.00 ppm  $\text{Fe}^{2+}$  by weight?

- (a)  $1.76 \times 10^{-3}$  g
- (b)  $1.76 \times 10^3$  g
- (c)  $1.00 \times 10^{-3}$  g
- (d)  $0.76 \times 10^3$  g

Q. 6 Evaluate  $100 + 6 + 0.35 - 48$ .

- (a) 48
- (b) 58
- (c) 68
- (d) 54

Q. 7 Which of the following indicators can be used in acidic pH?

- (a) methyl orange
- (b) Phenolphthalein
- (c) thymolphthalein
- (d) alizarin yellow

Q. 8 Which of these can be used to make primary standard solution?

- (a) NaOH
- (b) KOH
- (c) oxalic acid
- (d) Dil. HCl

- Q. 9 The percentage uncertainty in the result of  $(23.4 \pm 0.1) (17.7 \pm 0.05) = 414.18$  is
- (a)  $\pm 0.28$
  - (b)  $\pm 0.43$
  - (c)  $\pm 0.71$
  - (d)  $\pm 0.91$
- Q. 10 Neutralization equivalent of benzoic acid is
- (a) 61
  - (b) 63
  - (c) 83
  - (d) 122
- Q. 11 Dye test is given by
- (a) aromatic aldehydes
  - (b) aromatic amines
  - (c) aliphatic aldehydes
  - (d) aliphatic amines
- Q. 12 Anthranilic acid can be prepared from phthalamide by
- (a) Mannich reaction
  - (b) Cannizzaro reaction
  - (c) Hoffmann rearrangement
  - (d) Cope reaction
- Q. 13 Separation of pigments can be done by
- (a) colorimetry
  - (b) chromatography
  - (c) filter photometry
  - (d) photochemistry
- Q. 14 The apparatus used to determine the surface tension of liquids is
- (a) viscometer
  - (b) specific gravity bottle
  - (c) stalagmometer
  - (d) none of these
- Q. 15 Which of the following is an ore of iron?
- (a) Haematite
  - (b) Dolomite
  - (c) Bauxite
  - (d) Ferric chloride
- Q. 16 The permanent hardness of water is due to
- (a) calcium bicarbonate
  - (b) magnesium bicarbonate
  - (c) calcium sulphate
  - (d) sodium bicarbonate
- Q. 17 Ferroin indicator is an aqueous solution of
- (a) ferrous sulphate
  - (b) *o*-phenanthroline monohydrate
  - (c) both (a) and (b)
  - (d) mixture of ferrous and ferric sulphate
- Q. 18 The units of coefficient of viscosity are
- (a) poise
  - (b)  $\text{J/m}^2$
  - (c)  $\text{kg/cm}$
  - (d) curie
- Q. 19 Calorific value of LPG is
- (a) 50 KJ/gm
  - (b) 500 KJ/gm
  - (c) 5000 KJ/gm
  - (d) 50000 KJ/gm
- Q. 20 Green vitriol is
- (a) Copper sulphate
  - (b) Nickel sulphate
  - (c) Ferrous sulphate
  - (d) Zinc sulphate
- Q. 21 An electron has kinetic energy  $2.8 \times 10^{-23}$  J, de-Broglie's wavelength will be nearly ( $m_e = 9.1 \times 10^{-31}$  kg)
- (a)  $9.24 \times 10^{-4}$  m
  - (b)  $9.24 \times 10^{-7}$  m
  - (c)  $9.24 \times 10^{-8}$  m
  - (d)  $9.24 \times 10^{-10}$  m
- Q. 22 Two elements, X (at. Mass = 75) and Y (at. Mass = 16) combine to give a compound having 75.8% of X. The formula of the compound is
- (a) XY
  - (b)  $X_2Y$
  - (c)  $X_2Y_2$
  - (d)  $X_2Y_3$

Q. 23 Calcium pyrophosphate is given by the formula  $\text{Ca}_2\text{P}_2\text{O}_7$ . The molecular formula of ferric pyrophosphate is

- (a)  $\text{Fe}_2\text{P}_2\text{O}_7$
- (b)  $\text{FeP}_2\text{O}_7$
- (c)  $\text{Fe}(\text{P}_2\text{O}_7)_3$
- (d)  $\text{Fe}_4(\text{P}_2\text{O}_7)_3$

Q. 24 A proton accelerated from rest through a potential difference of 'V' volts has a wavelength  $\lambda$  associated with it. An alpha particle in order to have the same wavelength must be accelerated from rest through a potential difference of

- (a) V volts
- (b) 2V volts
- (c) 4V volts
- (d) V/8 volts

Q. 25 The percentage of Fe in  $\text{Fe}^{3+}$  in  $\text{Fe}_{0.93}\text{O}_{1.00}$  is

- (a) 15.00%
- (b) 84.20%
- (c) 16.98%
- (d) 18.49%

Q. 26 Find the volume in mL of 0.1 N HCl solution required to react completely with 1.0 g of a mixture of  $\text{Na}_2\text{CO}_3$  and  $\text{NaHCO}_3$  containing equimolar amounts of two compounds

- (a) 147.9 mL
- (b) 157.9 mL
- (c) 151.9 mL
- (d) 152.6 mL

Q. 27 A 10 cm column of air is trapped by a column of Hg 8 cm long in a capillary tube horizontally fixed at 1 atm pressure as shown in *Figure 1*. Length of the air column when tube is fixed vertically with open end up is

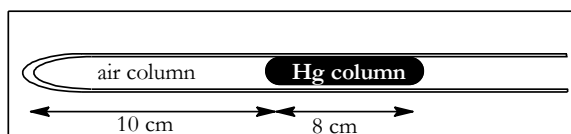


Figure 1

- (a) 11.17 cm
- (b) 10.00 cm
- (c) 9.04 cm
- (d) 9.30 cm

Q. 28 Pressure of a gas is due to

- (a) collisions of gas molecules
- (b) the random movement of gas molecules
- (c) the intermolecular forces of attraction between the gas molecules
- (d) the collision of gas molecules against the walls of the container

Q. 29 Which of the following solutions of KCl has the lowest value of equivalent conductance

- (a) 1.0 M
- (b) 0.1 M
- (c) 0.01 M
- (d) 0.001 M

Q. 30 The half life period of a radioactive nuclide is 3 hrs. In 8 hrs its activity will be reduced by a factor of

- (a) 1/6
- (b) 1/8
- (c) 1/9
- (d) 1/27

Q. 31 Which solution will have the highest b.pt.?

- (a) 1 M  $\text{C}_6\text{H}_{12}\text{O}_6$  solution
- (b) 1 M NaCl solution
- (c) 1 M  $\text{BaCl}_2$  solution
- (d) 1 M  $(\text{NH}_2)_2\text{CO}$  solution

Q. 32 6 g of  $\text{H}_2$  and 28 g of  $\text{N}_2$  was mixed. At equilibrium 17 g of  $\text{NH}_3$  was produced. The weights of  $\text{N}_2$  and  $\text{H}_2$  at equilibrium are respectively

- (a) 11 g, 0 g
- (b) 1 g, 3 g
- (c) 14 g, 3 g
- (d) 11 g, 3 g

Q. 33 If a chemical reaction is at equilibrium, which of the following is not correct

- (a)  $\Delta G^\circ = 0$
- (b)  $K_p = 1$
- (c)  $K_c = 1$
- (d)  $\Delta G^\circ = 1$

- Q. 34 The pH of a  $10^{-8}$  HCl solution is
- 6.98
  - 7.00
  - 7.02
  - 8.00
- Q. 35 The solubility of  $\text{Al}(\text{OH})_3$  is  $S$  mole/litre, the solubility product is
- $S^2$
  - $S^3$
  - $4S^3$
  - $27S^4$
- Q. 36 The specific rate constant of a first order reaction depends on the
- Concentration of the reactant
  - Concentration of the product
  - time
  - temperature
- Q. 37 A catalyst increases the rate of a chemical reaction by
- increasing the activation energy
  - decreasing the activation energy
  - increasing the number of active molecules
  - both (b) and (c)
- Q. 38  $E^\circ$  for  $\text{F}_2 + 2\text{e}^- \rightarrow 2\text{F}^-$  is 2.8 V,  
 $E^\circ$  for  $\frac{1}{2}\text{F}_2 + \text{e}^- \rightarrow \text{F}^-$  is
- 2.8 V
  - 1.4 V
  - 2.8 V
  - 1.4 V
- Q. 39 Heat of neutralization of HCl by NaOH is -55.9 kJ/mole. If heat of neutralization of HCN by NaOH is -12.1 kJ/mole, the energy of dissociation of HCN is
- 43.8 kJ
  - 43.8 kJ
  - 68.0 kJ
  - 68.0 kJ
- Q. 40 Molar heat capacity of water in equilibrium with ice at constant pressure is
- zero
  - $\infty$
  - $40.45 \text{ kJ K}^{-1} \text{ mol}^{-1}$
  - $75.48 \text{ J K}^{-1} \text{ mol}^{-1}$
- Q. 41 A metal crystallizes in a simple cubic unit cell. The length of the edge of the unit cell,  $a$ , is  $6.22\text{\AA}$ . The radius of each atom of the metal is
- $6.22\text{\AA}$
  - $12.44\text{\AA}$
  - $3.11\text{\AA}$
  - none of these
- Q. 42 Bragg's law is given by
- $n\lambda = 2 \sin \theta$
  - $n\lambda = 2d \sin \theta$
  - $2d = n\lambda \sin \theta$
  - $n\lambda = d \sin \theta$
- Q. 43 One litre of water containing 12 g aniline is shaken with 50 mL of benzene. The partition coefficient of aniline between benzene and water is 10. The mass of aniline extracted by benzene will be
- 1.2 g
  - 2.5 g
  - 4.0 g
  - 10.0 g
- Q. 44 The number of degrees of freedom in an aqueous solution of sugar is
- 0
  - 1
  - 2
  - 3
- Q. 45 Which of the following metal oxide decomposes on heating
- ZnO
  - HgO
  - $\text{Al}_2\text{O}_3$
  - CuO

Q. 46 The oxidation state of iodine in  $\text{H}_4\text{IO}_6^-$  is

- (a) +7
- (b) -7
- (c) +5
- (d) -5

Q. 47 In the electrolysis of an aqueous solution of NaOH, 2.8 litre of  $\text{O}_2$  gas at NTP was liberated at anode. The amount of  $\text{H}_2$  gas liberated at cathode will be

- (a) 22.4 litre
- (b) 11.2 litre
- (c) 5.6 litre
- (d) 2.8 litre

Q. 48 Trisilylamine  $(\text{SiH}_3)_3\text{N}$  has

- (a) tetrahedral structure
- (b) plane triangular structure
- (c) pyramidal structure
- (d) octahedral structure

Q. 49 Sodium thiosulphate,  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  is used in photography to

- (a) reduce undecomposed AgBr to metallic Ag
- (b) convert metallic Ag to Ag salt
- (c) remove undecomposed AgBr as a soluble silver thiosulphate complex
- (d) remove reduced silver

Q. 50 Which of the following is highest melting halide?

- (a) NaF
- (b) NaBr
- (c) NaCl
- (d) NaI

Q. 51 In the standardization of  $\text{Na}_2\text{S}_2\text{O}_3$  using  $\text{K}_2\text{Cr}_2\text{O}_7$  by iodometry, the equivalent weight (Eq. wt.) of  $\text{K}_2\text{Cr}_2\text{O}_7$  is

- (a) Mol. wt./2
- (b) Mol. wt./3
- (c) Mol. wt./6
- (d) same as Mol. Wt.

Q. 52 A substance A, on heating gives a colourless gas. The residue is dissolved in water to form B. When excess  $\text{CO}_2$  is bubbled through a solution of B, C is formed which on gentle heating reforms A. The substance A is

- (a) calcium carbonate
- (b) calcium nitrate
- (c) sodium carbonate
- (d) sodium bicarbonate

Q. 53 The chief ore of Aluminium is

- (a) bauxite
- (b) feldspar
- (c) cryolite
- (d) kaoline

Q. 54 Tin plague refers to

- (a) tin plating
- (b) conversion of stannous salts to stannic salts
- (c) conversion of white tin to grey tin
- (d) emission of sound on bending of a tin plate

Q. 55 Inert pair effect is exhibited by

- (a) Pb
- (b) B
- (c) Si
- (d) Al

Q. 56 Which of the following is expected to be paramagnetic complex?

- (a)  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
- (b)  $[\text{Ni}(\text{CO})_4]$
- (c)  $[\text{Zn}(\text{NH}_3)_4]^{2+}$
- (d)  $[\text{Co}(\text{NH}_3)_6]$

Q. 57 What kind of isomerism is exhibited by octahedral  $\text{Co}(\text{NH}_3)_4\text{Br}_2\text{Cl}$  ?

- (a) geometrical and ionization
- (b) geometrical and optical
- (c) optical and ionization
- (d) geometrical only

Q. 58 The catalytic oxidation of  $\text{NH}_3$  gives

- (a) NO
- (b)  $\text{N}_2\text{O}$
- (c)  $\text{N}_2\text{O}_3$
- (d)  $\text{N}_2\text{O}_5$

Q. 59 If phosphoric acid is allowed to react with sufficient quantity of NaOH, the product formed is

- (a)  $\text{NaH}_2\text{PO}_4$
- (b)  $\text{Na}_3\text{PO}_4$
- (c)  $\text{NaHPO}_3$
- (d)  $\text{Na}_2\text{HPO}_4$

Q. 60 Which of the following hydrides of the oxygen family shows the lowest b.pt?

- (a)  $\text{H}_2\text{O}$
- (b)  $\text{H}_2\text{S}$
- (c)  $\text{H}_2\text{Se}$
- (d)  $\text{H}_2\text{Te}$

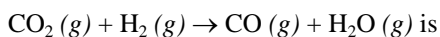
Q. 61 The type of fluorescence excited by an electron beam is called as

- (a) phosphorescence
- (b) cathodo-luminescence
- (c) triboluminescence
- (d) photoluminescence

Q. 62 Quantum yield of the photochemical formation of HCl from  $\text{H}_2$  and  $\text{Cl}_2$  is

- (a) 1
- (b) 2
- (c)  $10^4$ - $10^6$
- (d) 0.01

Q. 63 The  $\Delta H_f^\circ$  for  $\text{CO}_2 (g)$ ,  $\text{CO} (g)$  and  $\text{H}_2\text{O} (g)$  are  $-393.5$ ,  $-110.5$  and  $-241.8 \text{ kJ mol}^{-1}$  respectively. The standard enthalpy change (in kJ) for the reaction



- (a) 524.1
- (b) 41.2
- (c)  $-262.5$
- (d)  $-41.2$

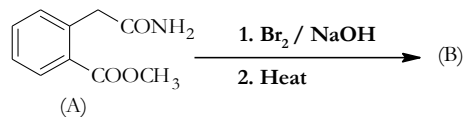
Q. 64 Which of the following electrolytes will be most effective in the coagulation of gold gel?

- (a)  $\text{NaNO}_3$
- (b)  $\text{K}_4[\text{Fe}(\text{CN})_6]$
- (c)  $\text{Na}_3\text{PO}_4$
- (d)  $\text{MgCl}_2$

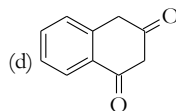
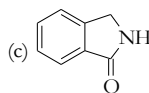
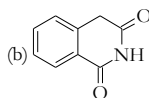
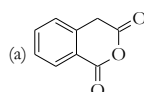
Q. 65 If the molar conductance values of  $\text{Ca}^{2+}$  and  $\text{Cl}^-$  at infinite dilution are  $118.88 \times 10^{-4} \text{ m}^2 \text{ mho mol}^{-1}$  and  $77.33 \times 10^{-4} \text{ m}^2 \text{ mho mol}^{-1}$  respectively, the molar conductance values of  $\text{CaCl}_2$  (in  $\text{m}^2 \text{ mho mol}^{-1}$ ) is

- (a)  $118.88 \times 10^{-4}$
- (b)  $154.66 \times 10^{-4}$
- (c)  $273.54 \times 10^{-4}$
- (d)  $196.21 \times 10^{-4}$

Q. 66 The following sequence of reactions on A gives B:



B is,



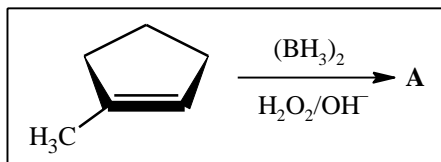
Q. 67 *sec*- Butyl chloride on reaction with alcoholic KOH gives..... as product(s)

- (a) *sec*- Butyl alcohol and n-butyl alcohol
- (b) But-2-ene and But-1-ene
- (c) *sec*- Butyl alcohol
- (d) But-1-ene

Q. 68 Which of the following will be major product of ozonolysis of natural rubber

- (a)  $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CHO}$
- (b)  $\text{CH}_3\text{COCH}_2\text{CH}_2\text{COCH}_3$
- (c)  $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3$
- (d)  $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_2\text{CHO}$

Q. 69 In the following reaction, the product A is



- (a) *cis*-2-Methyl-1-cyclopentan-1-ol
- (b) *trans*-2-Methylcyclopentan-1-ol
- (c) *cis*-1-Methylcyclopentan-2-ol
- (d) *trans*-1-Methylcyclopentan-2-ol

Q. 70 Mustard gas (2,2'-dichlorodiethyl sulfide) on hydrolysis gives

- (a)  $\text{ClCH}_2\text{CH}_2\text{-SH} + \text{HOCH}_2\text{CH}_2\text{OH}$
- (b)  $\text{HOCH}_2\text{CH}_2\text{-SH} + \text{HOCH}_2\text{CH}_2\text{OH}$
- (c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{-S-CH}_2\text{CH}_2\text{OH}$
- (d)  $\text{HOCH}_2\text{CH}_2\text{-S-CH}_2\text{CH}_2\text{OH}$

Q. 71 Which of the following is aromatic

- (a) cyclopentadienyl cation
- (b) cyclopentadienyl radical
- (c) cyclopentadienyl anion
- (d) cycloheptatrienyl radical

Q. 72 Bromination of ethylbenzene in presence of light gives

- (a) 1-Bromo-1-phenylethane
- (b) 2-Bromo-1-phenylethane
- (c) Both (a) and (b)
- (d) none of the above

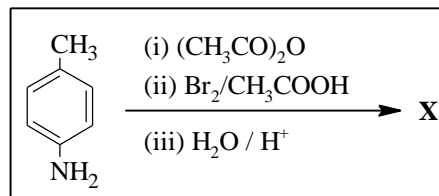
Q. 73 How many signals are expected to be observed in the  $^{13}\text{C}$  spectrum of 3-methylheptane

- (a) 4
- (b) 5
- (c) 7
- (d) 8

Q. 74 *m*-Bromobenzamide on reaction with  $\text{KOH}$  gives ..... as the product

- (a) *m*-Dibromobenzene
- (b) *m*-Bromoaniline
- (c) *m*-Bromophenol
- (d) *o*-Bromobenzamide

Q. 75 In the following reaction, X is



- (a) 2-Bromo-4-aminotoluene
- (b) 3-Bromo-4-aminotoluene
- (c) N-Bromo-4-aminotoluene
- (d) 2-Bromo-3-aminotoluene

Q. 76 Which of the following is *Oil of cloves*?

- (a) Isoeugenol
- (b) Thymol
- (c) Vanillin
- (d) Eugenol

Q. 77 Which of the following is an essential amino acid?

- (a) Glycine
- (b) (-) Proline
- (c) (-) Tyrosine
- (d) (-) Histidine

Q. 78 Which of the following will show maximum  $\lambda_{\text{max}}$  value in UV spectrum?

- (a) Pentacene
- (b) Naphthalene
- (c) Anthracene
- (d) Phenanthrene

Q. 79 Which of the following are IR active molecules?

- (a)  $\text{H}_2$
- (b)  $\text{HCl}$
- (c)  $\text{N}_2$
- (d)  $\text{O}_2$

Q. 80 Which of the following will show spin-spin coupling?

- (a) 1,2-Dichloroethane
- (b) *cis*-1,2-Dichloroethene
- (c) 1,2-Dibromoethane
- (d) 1,2-Diiodoethane

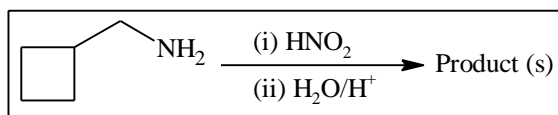
Q. 81 The possible structure of a compound,  $C_{10}H_{12}O$ , whose mass spectrum shows  $m/z$  values of 15, 43, 57, 91, 105 and 148 is

- (a)  $C_6H_5-CH_2CH_2COCH_3$
- (b)  $C_6H_5-COCH_2CH_2CH_3$
- (c)  $C_6H_5-CH_2CH_2CH_2CHO$
- (d)  $C_6H_5-CH_2COCH_2CH_3$

Q. 82 Acetylacetone on heating with  $P_2S_5$  gives

- (a) Thiophene
- (b) 3,4-Dimethylthiophene
- (c) 2,5-Dimethylthiophene
- (d) 2,4-Dimethylthiophene

Q. 83 The major product(s) in the following reaction is/are



- (a) Cyclobutylmethanol
- (b) Cyclopentanol
- (c) Cyclopropylmethanol
- (d) both (a) and (b)

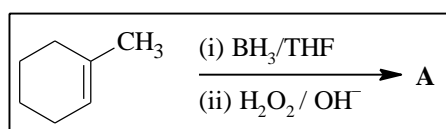
Q. 84 Which is used as catalyst in Benzoin condensation

- (a) KCN
- (b) PTSA
- (c) NaOH
- (d)  $NaNH_2/NH_3$

Q. 85 Which of the following alkyl halides is least reactive in Williamson's reaction

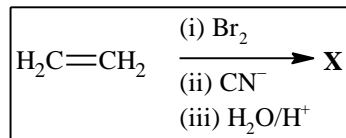
- (a)  $ClCH_2-CH=CH_2$
- (b)  $ClCH_2CH_2CH_3$
- (c)  $BrCH_2C(CH_3)_3$
- (d)  $BrCH_2CH_2CH_3$

Q. 86 In the following reaction (A) is



- (a) 2-methylcyclohexanone
- (b) 2-methylcyclohexan-1-ol
- (c) 2-methylcyclohex-1-en-2-ol
- (d) 1-methylcyclohexan-1-ol

Q. 87 In the following reaction (X) is



- (a) Butane-1,4-dioic acid
- (b) Butane-1,4-dinitrile
- (c) Butanoic acid
- (d) Butanenitrile

Q. 88 Neutralization of 0.3504 g of an acid, A having molecular wt. 172.1, requires 27.24 mL of 0.15 M NaOH. How many ionizable H's are present in A?

- (a) 1
- (b) 2
- (c) 3
- (d) 4

Q. 89 Cyclopentadiene on photochemical disrotation reaction gives

- (a) bicyclo[2,1,0]-pentene
- (b) bicyclo[2,2,0]-pentene
- (c) bicyclo[2,2,2]-pentene
- (d) bicyclo[2,1,0]-pentane

Q. 90 2-Chloroanisole on reaction with  $NaNH_2$  in  $NH_3$  gives

- (a) *o*-Aminoanisole
- (b) *m*-Aminoanisole
- (c) *p*-Aminoanisole
- (d) All the above