CET(PG)-2015

Sr. No. : 170740

Question Booklet Series : A

Important : Please consult your Admit Card / Roll No. Slip before filling your Roll Number on the Test Booklet and Answer Sheet.

Roll No. *In Figures* *In Words*

O.M.R. Answer Sheet Serial No.

Signature of the Candidate :

Subject : M.Sc. (Hons. School/2 Year Course)-Chemistry

Time : 90 minutes **Number of Questions : 75** **Maximum Marks : 75**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO

INSTRUCTIONS

1. Write your Roll No. on the Question Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Subject and Series Code of Question Booklet on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point / Black Gel pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. To open the Question Booklet remove the paper seal gently when asked to do so.
5. Please check that this Question Booklet contains **75** questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of test.
6. Each question has four alternative answers (A, B, C, D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point / Black Gel pen.**
7. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Sheet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the questions given in the Question Booklet.
9. Negative marking will be adopted for evaluation i.e., 1/4th of the mark of the question will be deducted for each wrong answer. A wrong answer means incorrect answer or wrong filling of bubble.
10. For calculations, use of simple log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the sheets marked "Rough Work" at the end of the Question Booklet be used.
12. The Answer Sheet is designed for **computer evaluation**. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e., not following the instructions completely, shall be of the candidate only.**
13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so, would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistance or found giving or receiving assistance or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
16. **Telecommunication equipment such as pager, cellular phone, wireless, scanner, etc., is not permitted inside the examination hall. Use of calculator is not allowed.**

SEAL

1. **Pick out the correct match :**

   (A) Clemmensen reduction—Na/C_2H_5OH

   (B) Wolf Kishner reduction—Zn/HCl

   (C) Meerwein-Poundorf-Verley reduction—Aluminium isopropoxide

   (D) Rosenmund's reduction—H_2/Na

2. **Which of the following contains P-O-P bond ?**

   (A) Hypophosphorus acid (B) Phosphorus acid

   (C) Pyrophosphoric acid (D) Orthophosphoric acid

3. **The correct order of stability for the following super oxides is :**

   (A) $KO_2 > RbO_2 > CsO_2$ (B) $RbO_2 > CsO_2 > KO_2$

   (C) $CsO_2 > RbO_2 > KO_2$ (D) $KO_2 > CsO_2 > RbO_2$

4. **Which of the following complex ions is tetrahedral ?**

   (A) $[PdCl_4]^{2-}$ (B) $[PtCl_4]^{2-}$

   (C) $[NiCl_4]^{2-}$ (D) $[AuCl_4]^-$

5. **Ground state term of d^5 configuration is :**

   (A) ^3P (B) ^6S

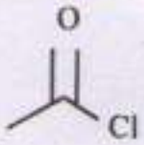
   (C) ^2D (D) ^3F

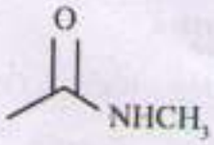
6. **The pH of a solution resulting from the addition of 15.0 mL of 0.200 M NaOH to 10.0 mL of 0.100 M HCl is :**

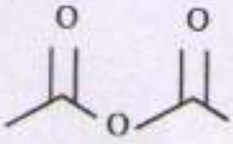
   (A) 10.35 (B) 8.70

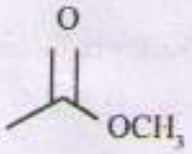
   (C) 12.90 (D) 9.75

7. **Which of the following carboxylic acid derivatives is most difficult to hydrolyze ?**

(A) 

(B) 

(C) 

(D) 

8. **The function of $AlCl_3$ in the Friedel-Crafts reactions is to :**

(A) Produce electrophile

(B) Produce nucleophile

(C) Absorb water

(D) Absorb HCl

9. **Which of the following is not a reducing sugar ?**

(A) Sucrose

(B) Mannose

(C) Lactose

(D) Fructose

10. **The compound used in manufacture of nylon-6,6 is :**

(A) Ethylene

(B) Ethylene glycol

(C) Vinyl chloride

(D) Adipic acid

11. **Reimer-Tiemer reaction involves a :**

(A) Carbocation intermediate

(B) Carboanion intermediate

(C) Carbene intermediate

(D) Mono free radical intermediate

12. **In which reaction is nitrogen reduced ?**

(A) $2NO + O_2 \rightarrow 2NO_2$

(B) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

(C) $Cu^{2+} + 2NO_3 + 2H_2O \rightarrow Cu + 4H^+ - 2NO_3^-$

(D) $4Zn + 10H^+ + NO_3^- \rightarrow 4Zn^{2+} + NH_4^+ + 3H_2O$

13. **The energy of electron in an atomic orbital is always :**

(A) Different

(B) Zero

(C) Infinite

(D) Same

14. **Which of the following statements about the photochemical reactions is false ?**

(A) The presence of light is the primary requirement for reactions to take place

(B) Temperature has a very little effect on the rate of photochemical reactions

(C) ΔG for the photochemical spontaneous reactions is +ve or –ve

(D) The presence of light does not increase the internal energy of reactants

15. **α-D-(+)-glucose and β-D-(+)-glucose are :**

(A) Conformers

(B) Isotones

(C) Enantiomers

(D) Anomers

16. **Out of the following pair which will not follow Dalton law of partial pressure ?**

(A) $NO + O_2$

(B) $N_2 + O_2$

(C) $Cl_2 + CO_2$

(D) $SO_2 + SO_3$

17. **At 25°C the exchange current density for the reaction $H^+(aq) + e^{-1} \rightarrow \frac{1}{2} H_2(g)$ on nickel surface is 1.00×10^{-2} mAcm^{-2}. Calculate the current density required to attain an over potential of 100 mV by using Butler-Volmer equation. Assume that the transfer coefficient is equal to 0.50 :**

(A) 6.85×10^{-2} mAcm^{-2} (B) 6.35×10^{-3} mAcm^{-2}

(C) 6.99×10^{-2} mAcm^{-2} (D) 6.22×10^{-3} mAcm^{-2}

18. **The mean ionic activity coefficient of 0.001 M Na_2SO_4 is :**

(A) 0.879 (B) 0.889

(C) 0.891 (D) 0.894

19. **The oxidation potential of hydrogen electrode will be greater than zero if :**

(A) E_{ox} can never be positive (B) Partial pressure of H_2 is 2 atm

(C) Conc. of $[H_3O^+]$ is 2 M (D) Conc. of $[H_3O^+]$ is 1 M

20. **The diffuse layer between compact layer of ions and the electrically neutral part of the system is known as :**

(A) Stern layer (B) Gouy-Chapman layer

(C) Electrical double layer (D) Plane of shear

21. **Zero point energy of a diatomic simple harmonic oscillator of vibrational frequency υ is :**

(A) $h\upsilon$ (B) 2/3 $h\upsilon$

(C) 2 $h\upsilon$ (D) 1/2 $h\upsilon$

22. **The wave number for stretching vibration of a C-H bond. Given k = 5×10^5 dynes/cm is :**

(A) 2805 cm^{-1}

(B) 3032 cm^{-1}

(C) 2176 cm^{-1}

(D) 3542 cm^{-1}

23. **In UV-V is spectroscopy, which of the following sequence is correct in terms of energy of transition ?**

(A) $\sigma\text{-}\sigma^* > \sigma\text{-}\pi^* > n\text{-}\sigma^* > \pi\text{-}\pi^* > n\text{-}\pi^*$

(B) $\sigma\text{-}\pi^* > \pi\text{-}\pi^* > \sigma\text{-}\sigma^* > n\text{-}\pi^* > n\text{-}\sigma^*$

(C) $n\text{-}\sigma^* > \sigma\text{-}\pi^* > \sigma\text{-}\sigma^* > \pi\text{-}\pi^* > n\text{-}\pi^*$

(D) $n\text{-}\pi^* > \sigma\text{-}\pi^* > n\text{-}\sigma^* > \pi\text{-}\pi^* > \sigma\text{-}\sigma^*$

24. **Consider the complex ion $[Mn(OH_2)_6]^{2+}$ with 5 unpaired electrons. Which response includes all the following statements that are true, and no false statements ?**

I. It is diamagnetic

II. It is a low spin complex

III. The metal ion is a d^5 ion

IV. The ligands are weak field ligands

V. It is octahedral

(A) I, II

(B) III, IV, V

(C) I, IV

(D) II, V

25. **A linear molecule with n atoms generally has fundamental vibrational modes equal to :**

(A) 3n – 5

(B) 2 n

(C) 2n – 2

(D) 3n – 3

26. **Esters having α-hydrogens on treatment with a strong base undergo self condensation to produce ketoesters. This is known as :**

(A) Aldol condensation

(B) Claisen condensation

(C) Acyloin condensation

(D) Stobbe condensation

27. **Cyclohexanone can be transformed to Cyclohex-1, 2-one using the following reagent :**

(A) $AlCl_3$

(B) SeO_2

(C) NBS

(D) $LiAlH_4$

28. **Migration of a group from carbon to electron-deficient oxygen occurs in the following rearrangement :**

(A) Baeyer-Villiger rearrangement

(B) Dienone-Phenol rearrangement

(C) Allylic rearrangement

(D) Beckmann rearrangement

29. **Which of the following condenses with ethylenic and acetylenic bonds to give heterocyclic compounds ?**

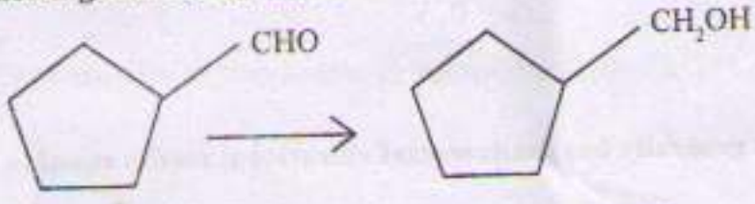
(A) Lead tetraacetate

(B) Diazomethane

(C) Boron trifluoride

(D) Raney Nickel

30. **This following conversion can be achieved with the help of :**



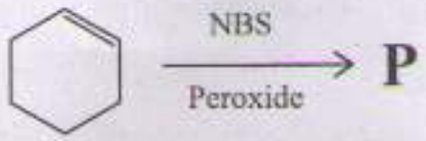
(A) $Al[OCH(CH_3)_2]_3$

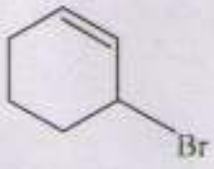
(B) $AlCl_3$

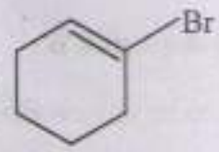
(C) OsO_4

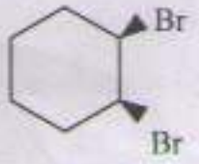
(D) BF_3

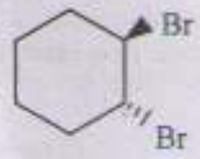
31. **The following transformation leads to the major product P, which is :**



(A) 

(B) 

(C) 

(D) 

32. **A symmetry-allowed pathways leads to overlap of :**

(A) In-phase orbitals
(B) Out-of-phase orbitals
(C) Both in-phase and out-of-phase orbitals
(D) None of the above

33. **Benzaldehyde, acetic anhydride and sodium acetate undergo a Perkin reaction to furnish :**

(A) Cinnamic acid
(B) Phthalic acid
(C) Methyl benzoate
(D) Phenylacetic acid

34. **When citral is subjected to ozonolysis, it forms :**

(A) Acetone, Oxalic acid, Glyoxal
(B) Acetone, Laevualdehyde, Glyoxal
(C) Alcohol, Laevualdehyde, Glyoxal
(D) Amine, Laevualdehyde, Benzaldehyde

35. **Among the following the softest acid is :**

(A) Al^{3+} (B) Li^{+}

(C) Ca^{2+} (D) Ag^{+}

36. **The main reason of Ozone depletion is :**

(A) Cl radical reacts with ozone in a catalytic chain reaction

(B) I radical reacts with ozone in a catalytic chain reaction

(C) Br radical reacts with ozone in a catalytic chain reaction

(D) None of the above

37. **System A is 1 mole of ice at –10°C and system B is 1 mole of super cooled water at –10°C. Choose the correct statement :**

(A) A has higher free energy than B (B) A has lower free energy than B

(C) Both A and B has same free energy (D) A has greater vapor pressure than B

38. **Which of the following represent one group of flavonoid compounds :**

(A) Narcotine (B) Camphene

(C) Anthocyanins (D) Amyrins

39. **A compound which has a M-M quadruple bond is :**

(A) $Mn_2(CO)_{10}$ (B) $Fe_2(CO)_9$

(C) $[Re_2Cl_8]^{2-}$ (D) $Cu_2(O_2CMe)_4.2H_2O$

40. **The appropriate signals and splitting patterns for $CH_3COCH_2COCH_3$:**

(A) Singlet (3.5δ), multiplet (2.0δ)

(B) Singlet (2δ), singlet (3.0δ)

(C) Singlet (3.5δ), singlet (2.2δ), singlet (3.6δ)

(D) Singlet (2δ), singlet (3.6δ), singlet (2.5δ)

41. **Variation of chemical potential with pressure results :**

(A) Partial molar entropy

(B) Partial molar internal energy

(C) Partial molar volume

(D) Partial molar enthalpy

42. **The pure rotational spectrum of CO consists of a series of equally spaced lines separated by 3.84235 cm^{-1}. The atomic masses are : $^{12}C = 19.92168\times10^{-27}$ kg and $^{16}O = 26.56136\times10^{-27}$ kg. The internuclear distance of the molecule is :**

(A) 2.312 Å

(B) 1.456 Å

(C) 1.131 Å

(D) 1.921 Å

43. **What is the coordination number of Na in Na_2O ?**

(A) 2

(B) 6

(C) 4

(D) 8

44. **A heat engine absorbs heat Q_1 temperature T_1 and heat Q_2 at temperature T_2. Work done by the engine is $(Q_1 + Q_2)$. This data :**

(A) Violates 1st law of thermodynamics

(B) Violates 1st law of thermodynamics if Q_2 is –ve

(C) Violates 1st law of thermodynamics if Q_1 is –ve

(D) Does not violate 1st law of thermodynamics

45. **The oxidation state of phosphorus varies from :**

(A) -3 to $+5$ (B) -3 to $+3$

(C) -1 to $+1$ (D) -5 to $+1$

46. **Killani-Fischer synthesis converts an aldopentose to a :**

(A) Mixture of aldohexose and ketohexose

(B) Mixture of aldohexoses differing configuration at C_2

(C) Mixture of aldohexoses differing configuration at C_6

(D) Single aldohexose

47. **The pair of containing peroxy (O-O) groups :**

(A) H_2SO_3 and PbO_2 (B) $HClO_4$ and $H_2S_2O_8$

(C) P_2O_5 and MnO_2 (D) H_2SO_5 and $H_2S_2O_3$

48. **The bond dissociation energies of three alkyl halides are as follows :**

CH_3Cl : 84 kcal/mol

$CH_2=CHCl$: 207 kcal/mol

$C_6H_5CH_2Cl$: 166 kcal/mol

(A) Two free radical (B) Two anions

(C) Two cations (D) One cation and one anion

49. **Polymerization using Ziegler-Natta catalyst is advantages over free radical polymerization because :**

(A) It can lead to polymers via anionic polymerization

(B) It permits step reaction polymerization resulting in a highly cross linked polymer

(C) It gives highly branched polymer with high degree of crystallinity

(D) It gives linear polymer molecule permitting stereochemical control

50. **Which one among the following has highest catenation power ?**

(A) O (B) S

(C) Se (D) Te

51. **The joule experiment is an example of which of the following process ?**

(1) Isothermal process

(2) Isoenthalpic process

(3) Adiabatic process

(4) Isochoric process

Select the correct code :

(A) 1 and 2 (B) 2 and 4

(C) 1 and 4 (D) 2 and 3

52. **P_4O_{10} on reacting with water does not form :**

(A) Tetra metaphosphoric acid (B) Orthophosphoric acid

(C) Phosphorus acid (D) Pyrophosphoric acid

53. **Chlorine reacts with KOH as**

$$3Cl_2 + KOH \longrightarrow 5KCl + KClO_3 + 3H_2O$$

The reaction is an example of :

(A) Neutralization reaction (B) Substitution reaction

(C) Double decomposition reaction (D) Disproportionation reaction

54. **Addition of NaOH on Zn^{2+} ion gives a white on addition of excess of NaOH dissolves. In this solution Zn exists in :**

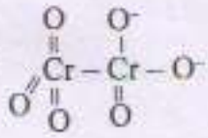
(A) Zn^{2+} form

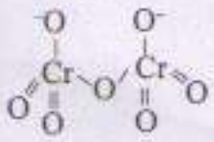
(B) Cationic form

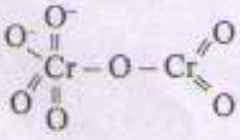
(C) Anionic form

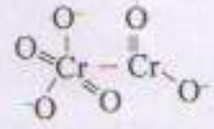
(D) Both (B) and (C)

55. **The correct structure of dichromate dianion :**

(A) 

(B) 

(C) 

(D) 

56. **Following statements regarding the periodic trends of chemical reactivity of the alkali metals and halogens are given. Which of these statements gives the correct picture ?**

(A) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group

(B) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group

(C) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens

(D) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group

57. **Oxidation state of mercury in amalgam, calomel and corrosive sublimate is :**

(A) 0, +1, +2 (B) 0, +2, +2

(C) 0, +1, +3 (D) +1, +1, +2

58. **The number of electrons lost when $KMnO_4$ reacts with H_2O_2 is equal to that of :**

(A) s electrons in Ca (at no : 20)

(B) p electrons in neon (at no : 10)

(C) d electrons in chromium (at no : 24)

(D) f electrons in lanthanum (at no : 57)

59. **A reaction involving two different reactants can never be :**

(A) Unimolecular reaction (B) Second order reaction

(C) First order reaction (D) Biomolecular reaction

60. **The number and type of bonds between two carbon atoms in calcium carbide are :**

(A) One sigma, one pi (B) Two sigma, two pi

(C) One sigma, two pi (D) None of the above

61. **The best reagent to convert pent -3-en-2-ol into pent -3-en-2-one is :**

(A) Acidic permanganate (B) Acidic dichromate

(C) Chromic anhydride in glacial acetic acid (D) Pyridinium chloro-chromate

62. **Alkyl halides react with dialkyl copper reagents to give :**

(A) Alkenes (B) Alkanes

(C) Alkyl copper halides (D) Alkenyl halides

63. **A buffer with a pH value = 5.92 that contains a weak acid with a pKa of 5.12 is diluted ten-fold. What is the new pH of the buffer solution ?**

(A) 5.92 (B) 5.40

(C) 5.62 (D) 5.30

64. **A possible mechanism for any given chemical reaction :**

(A) Can only be determined experimentally

(B) Can be derived from the balanced chemical equation for the reaction

(C) Always has the slowest step first

(D) May have steps that do not sum to give the overall balanced equation

65. $KMnO_4 + KI \xrightarrow[\text{Alkaline medium}]{\text{Acidic medium}} \begin{matrix}(A)\\(B)\end{matrix}$ **The product (A) and (B) are respectively :**

(A) KI, I_2 (B) I_2, KIO_3

(C) KIO_3, KIO_4 (D) I_2, I_2

66. **An equimolar mixture of benzoic acid and benzyl alcohol is dissolved in equal volumes of ether and 5% aqueous NaOH. The resulting mixture separates into two immiscible liquid layers. Which of the following is approximately correct ?**

(A) Both organic solutes are largely in the ether layer

(B) Both organic solutes are largely in the water layer

(C) The benzyl alcohol is in the ether layer and the benzoic acid is in the water layer

(D) The benzyl alcohol is in the water layer and the benzoic acid is in the ether layer

67. **Which of the following compounds could not be converted into pivalic acid in three or fewer steps ?**

(A) 3, 3-dimethyl-1-butene

(B) 2, 2-dimethyl-1-propanol

(C) 2, 3-dimethyl-2-butene

(D) 2-bromo-2-methylpropane

68. **Which of the following is a pyrimidine base ?**

(A) Guanine

(B) Cytosine

(C) Imidazole

(D) Adenine

69. **Fatty acids are important components of many lipids. For which of the following lipid classes or lipid derivative are fatty acids not a significant component ?**

(A) Phospholipids

(B) Waxes

(C) Triglyceride

(D) Steriods

70. **Which of the following compounds has a prochiral methylene group (i.e. the hydrogen atoms are diastereotopic) ?**

(A) Propane, $CH_3CH_2CH_3$

(B) 2-methylpropene, $CH_2=C(CH_3)_2$

(C) Cyclopropane, $(CH_2)_3$

(D) Ethanol, CH_3CH_2OH

71. **If two isomers have been classified correctly as epimers, they may also be called ..... .**

(A) Diastereomers

(B) Tautomers

(C) Enantiomers

(D) Conformers

72. **Which of the following is INSOLUBLE in water ?**

(A) Lead (II) Bromide

(B) Nickel (II) Nirate

(C) Lead (II) Nirate

(D) Copper (II) Bromide

73. **Bromate ions can be reduced to Bromine in Acid solution. When the half-reaction is written and balanced using the smallest possible integers, what is the sum of the coefficients ?**

(A) 15.5

(B) 31

(C) 30

(D) 29

74. **Which of the following compounds has a prochiral methylene group (i.e. the hydrogen atoms are diastereotopic) ?**

(A) Propane, $CH_3CH_2CH_3$

(B) 2-methylpropene, $CH_2{=}C(CH_3)_2$

(C) Cyclopropane, $(CH_2)_3$

(D) Ethanol, CH_3CH_2OH

75. **$AC_9H_{12}O_3$ compound has two strong infrared absorptions between 1100 and 1250 cm^{-1} and at 1600 cm^{-1}. The ^1H NMR spectrum has sharp singlet peaks at δ 3.6 and 6.6 ppm (intensity ratio 3 : 1). The ^{13}C NMR spectrum shows three lines at δ 165, 115 and 55 ppm. Which of the following compounds best fits this data :**

(A) 1, 3, 5-trimethoxybenzene

(B) 2, 4, 6-trimethyl-1,3,5-benzenetriol

(C) 1, 2, 3-trimethoxybenzene

(D) 1-phenyl-1, 2, 3-propanetriol