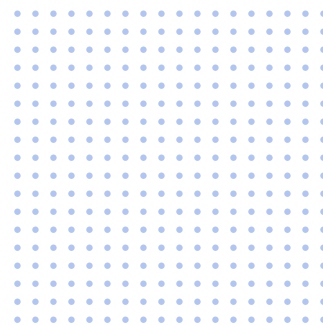




FOR KUET EXAM PREPARATION

KUET 2024 Question Paper · M.Sc. Chemistry

EXAM	YEAR	TYPE	SUBJECT
KUET	2024	Question Paper	M.Sc. Chemistry

541

Sr. No.

ENTRANCE TEST-2024**SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCES****CHEMISTRY**

Question Booklet Series

A

Total Questions : 60

Time Allowed : 70 Minutes

Roll No. :

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Instructions for Candidates :

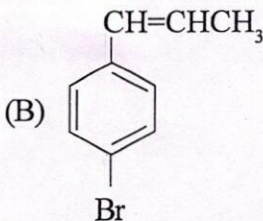
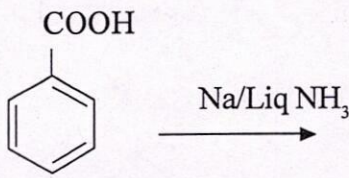
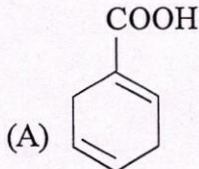
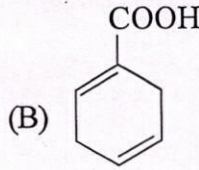
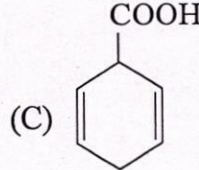
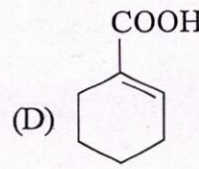
1. Write your Entrance Test Roll Number in the space provided at the top of this page of Question Booklet and fill up the necessary information in the spaces provided on the OMR Answer Sheet.
2. OMR Answer Sheet has an Original Copy and a Candidate's Copy glued beneath it at the top. While making entries in the Original Copy, candidate should ensure that the two copies are aligned properly so that the entries made in the Original Copy against each item are exactly copied in the Candidate's Copy.
3. All entries in the OMR Answer Sheet, including answers to questions, are to be recorded in the Original Copy only.
4. Choose the correct / most appropriate response for each question among the options A, B, C and D and darken the circle of the appropriate response completely. The incomplete darkened circle is not correctly read by the OMR Scanner and no complaint to this effect shall be entertained.
5. Use only blue/black ball point pen to darken the circle of correct/most appropriate response. In no case gel/ink pen or pencil should be used.
6. Do not darken more than one circle of options for any question. A question with more than one darkened response shall be considered wrong.
7. There will be '**Negative Marking**' for wrong answers. Each wrong answer will lead to the deduction of 0.25 marks from the total score of the candidate.
8. Only those candidates who would obtain positive score in Entrance Test Examination shall be eligible for admission.
9. Do not make any stray mark on the OMR sheet.
10. Calculators and mobiles shall not be permitted inside the examination hall.
11. Rough work, if any, should be done on the blank sheets provided with the question booklet.
12. OMR Answer Sheet must be handled carefully and it should not be folded or mutilated in which case it will not be evaluated.
13. Ensure that your OMR Answer Sheet has been signed by the Invigilator and the candidate himself/herself.
14. At the end of the examination, hand over the OMR Answer Sheet to the invigilator who will first tear off the original OMR sheet in presence of the Candidate and hand over the Candidate's Copy to the candidate.

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[Turn over]

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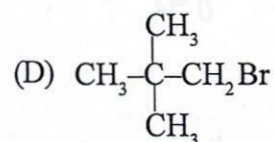
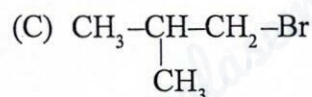
1. Which among the following conformers of cyclohexane has highest energy ?
- (A) Chair form
(B) Boat form
(C) Twist boat form
(D) Half chair form
2. α -D-glucose and β -D-glucose differ from each other due to differences in one of the carbon atoms with respect to its :
- (A) Size of hemiacetal ring
(B) Number of OH groups
(C) Configuration
(D) Conformation
3. Allenes show chirality because of the presence of :
- (A) Chiral carbon atom
(B) Chiral axis
(C) Chiral plane
(D) Chiral helix
4. Which of the following will facilitate the electrophile attack on the benzene ring ?
- (A) $-\text{NO}_2$
(B) $-\text{CHO}$
(C) $-\text{Cl}$
(D) $-\text{SO}_3\text{H}$
5. The reaction of $\text{C}_6\text{H}_5\text{CH}=\text{CHCH}_3$ with HBr produces :
- (A) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}(\text{Br})\text{CH}_3$
(B) 
(C) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
(D) $\text{C}_6\text{H}_5\text{CH}(\text{Br})\text{CH}_2\text{CH}_3$
6. The product formed in the following reaction
- 
- (A) 
(B) 
(C) 
(D) 

7. In an S_N2 substitution reaction of the type :

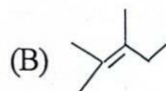
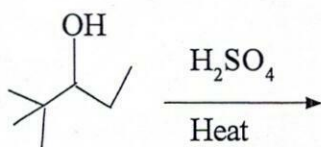


Which one of the following has the highest relative rate ?

- (A) CH_3CH_2Br
 (B) $CH_3-CH_2-CH_2Br$



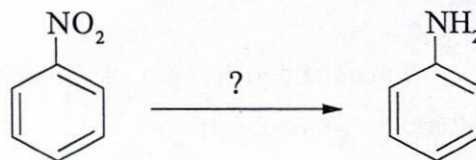
8. Which alkene would you expect to be the major product of the following dehydration ?



9. Pick out the correct match :

- | | |
|--------------------------------------|---------------------|
| (A) Birch Reduction | H_2/N_2 |
| (B) Wolf-Kishner reduction | Zn/HCl |
| (C) Clemenson Reduction | Anhyd. $AlCl_3$ |
| (D) Meerwin-Ponndorf-Verly reduction | $Al[OCH(CH_3)_2]_3$ |

10. Which of the following reagents is/are used in the given reaction ?



- (A) H_2/Pd , Ethanol
 (B) $Sn + HCl$
 (C) $Fe + HCl$
 (D) All of the above

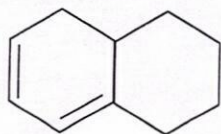
11. When Aryl diazonium salt is treated with hypophosphorous acid, it is reduced to which of the following compound ?

- (A) Arene
 (B) Methane
 (C) Ethyl alcohol
 (D) Amines

12. Which of the following reactions involves a carbene as an intermediate ?

- (A) Reformatsky reaction
 (B) Reimer-Tiemann reaction
 (C) Wittig reaction
 (D) Perkin reaction

13. The $\lambda(\text{max})$ of the given compound lies at :



- (A) 230 nm
- (B) 273 nm
- (C) 270 nm
- (D) 246 nm

14. The stretching vibration frequencies of alkyl cyanide $-\text{C}\equiv\text{N}$ is in the region of (in cm^{-1}) :

- (A) 1400 to 1250
- (B) 2260 to 2240
- (C) 2950 to 2650
- (D) 3590 to 4420

15. Among the following the NMR inactive nucleus is :

- (A) $^{14}\text{N}_7$
- (B) $^{31}\text{P}_{15}$
- (C) $^{24}\text{Mg}_{12}$
- (D) $^{29}\text{Si}_{14}$

16. How many ^1H -NMR signals are observed for propanol in low-resolution NMR ?

- (A) One
- (B) Two
- (C) Three
- (D) Four

17. The pH at which a protein ionizes as acid and also as a base to the same extent is called :

- (A) Eutectic point
- (B) Isomeric point
- (C) Isotonic point
- (D) Iso-electric point

18. Among the following the amino acid which is basic in nature is :

- (A) Tyrosine
- (B) Asparagine
- (C) Leucine
- (D) Arginine

19. Cholesterol belongs to which class of natural products ?

- (A) Alkaloid
- (B) Terpenoid
- (C) Steroid
- (D) Flavonoids

20. Which purine and pyrimidine bases are paired together by hydrogen bonds in DNA ?

- (A) GC and AT
- (B) TC and AG
- (C) GC and AT; TC and AG
- (D) UC and AT

21. Which of the following is not tetrahedral ?

- (A) P_4
- (B) SiF_4
- (C) $\text{Ni}(\text{CO})_4$
- (D) XeF_4

22. Which statement is incorrect ?
- A molecule of white phosphorus, P_4 , contains six homonuclear bonds
 - A molecule of NH_3 contains heteronuclear bonds
 - S_6 is a cyclic molecule and it contains six S-S covalent bonds
 - A molecule of H_2O_2 contains two homonuclear bonds
23. Which of the following observations in ^{19}F NMR describe the VSEPR structure of ClF_3 molecule ?
- Three chemical shifts for three fluorine
 - Single chemical shift for three fluorine
 - Two chemical shifts for three fluorine
 - Two chemical shifts for two fluorine
24. Which statement about organoaluminium compounds is incorrect ?
- $Al_2\{CH(SiMe_3)_2\}_4$ contains an Al-Al bond
 - In $Al_2Ph_4(\mu-C\equiv CPh)_2$, the bridge bonds can be described in a similar way to those in $Al_2Me_4(\mu-Ph)_2$
 - The bonding in $Al_2Me_4Cl_2$ molecule with bridging Cl can be described in terms of a localized scheme
 - Dimer of $AlMe_3$ possesses three centre Al-C-Al bonding interactions
25. Which oxidation states correctly represent the usual range exhibited by the stated f block metal ?
- U: + 2, + 3 and + 4
 - Th: + 1 and + 4
 - Ce: + 3 and + 4
 - Pu: + 3, + 4, + 5 and + 6
26. What is the main difference between NMR-spectroscopy and X-ray diffraction in structural analysis ?
- Simple NMR analysis of molecules in solutions does not yield details on bond angles, lengths and inter-particle contacts
 - X-ray diffraction does not yield details on bond angles and lengths
 - NMR gives the identity of constituents in molecules while X-ray diffraction does not
 - Both yield the same results; choosing one or the other is a matter of preference or availability
27. Transmetallation a common reaction of s-block metals essentially involves :
- Breaking metal-carbon bonds and forming new metal-carbon bonds but with a different metal
 - Breaking metal-carbon bonds and forming metal-metal and carbon-carbon bonds
 - Breaking metal-carbon bonds and forming carbon-carbon bonds and elemental metal
 - Any of these
28. What is correct for B_5H_9 ?
- 24 skeletal electrons giving nido structure
 - 14 skeletal electrons giving arachno structure
 - 7 skeletal electrons giving nido structure
 - None of these
29. "Lithium therapy" for bipolar disorders generally uses :
- $LiCl$ or Li_2CO_3 salt
 - A pill with Li silicate as an active ingredient
 - An injection of Li-containing phosphate buffer
 - Any of these depending on choice

30. What is incorrect for Jahn Teller distortion in octahedral complexes ?
- It describes the general instability of octahedral complexes
 - It can be explained using crystal field theory
 - It is always present in d^9 systems irrespective of ligand field strength
 - It has lowest magnitude in case of d^4 high spin complexes
31. In case of the Allred-Rochow electronegativity scale, electronegativity values are :
- Inversely proportional to square of effective nuclear charge
 - Directly proportional to square of effective nuclear charge
 - Inversely proportional to the covalent radius r
 - None of these
32. Pick the odd one out among the following for the type of π bonding :
- BO_3^-
 - CO_3^{2-}
 - NO_3^-
 - SO_3^{2-}
33. Identify correct statement for P_4O_{10} :
- It has a peroxide linkage connecting phosphorus atoms
 - It has direct P-P bonds
 - Two phosphorous atoms are in different chemical bonding to other two
 - Each phosphorus makes a total 5 bonds acquiring its + 5 oxidation state
34. Permanganate ion MnO_4^- is pink coloured while perrhenate ion ReO_4^- is colour less because :
- d-d transition in the Re^{+7} compounds is of higher energy than in Mn^{+7} compound
 - d-d transition in the Re compound is forbidden but allowed in Mn compound
 - charge drift from O^- to Re^{+7} is of lower energy
 - charge drift from O^- to Mn^{+7} is of lower energy
35. What is the correct statement ?
- Ag_2S has lower solubility product than MnS
 - Ag_2S has higher aqueous solubility than MnS
 - Soft soft interaction gives Ag_2S lower solubility product than MnS
 - Borderline soft interaction gives MnS a lower solubility product than Ag_2S
36. Volume is a unique concentration term used in case of H_2O_2 , (considering density = 1) if 5 gm of hydrogen peroxide are present in 56 mL of solution, the solution will approximately correspond to :
- 10 volumes
 - 20 volumes
 - 30 volumes
 - 2 volumes
37. Which of the following f-block trivalent metal ions has highest number of unpaired electrons ?
- Pr^{3+}
 - Pm^{3+}
 - Eu^{3+}
 - Er^{3+}

38. Using EAN concept, identify compound having sigma as well as pi bonded ligands to metal centre: (Cp: cyclopentadienyl ring system):
- (A) $\text{Fe}(\text{Cp})_2$
 (B) $\text{Fe}(\text{Cp})_2(\text{CO})_2$
 (C) $\text{Mn}(\text{Cp})_2$
 (D) $\text{Be}(\text{Cp})_2$
39. Identify the correct match for Titrations as analytical methods:
- | I | II |
|--------------------------------|--------------------|
| I. Acid Base Titration | a. Xylenol Orange |
| II. Redox Titration | b. Methyl Orange |
| III. Complexometric Titrations | c. Diphenylamine |
| IV. Mohr Titration | d. Sodium chromate |
- (A) I-b; II-d; III-c; IV-a
 (B) I-b; II-c; III-d; IV-a
 (C) I-d; II-c; III-a; IV-b
 (D) I-b; II-c; III-a; IV-d
40. The deep blue colour of $[\text{CoCl}_4]^{4-}$ and light pink colour of $[\text{Co}(\text{OH}_2)_6]^{2+}$ are due to:
- (A) MLCT transition in the first and d-d transition in second
 (B) LMCT transition in both
 (C) d-d transition in both
 (D) d-d transition in the first and MLCT transition in the second
41. According to Kinetic theory of gases, which among the following statements is not correct?
- (A) Gases are made up of non-interacting constituents
 (B) In their random motion, the constituents of a gas perfectly follow the laws of conservation of energy and Newton's second law of motion
 (C) The total energy of a gas sample is partly kinetic and partly potential
 (D) Pressure of a gas sample is independent of the volume of its constituents
42. According to kinetic theory of gases, the average translational kinetic energy per mole of C_2H_2 ideal gas is:
- (A) $9RT$
 (B) $\frac{19}{2}RT$
 (C) $6RT$
 (D) $\frac{9}{2}RT$
43. For the crystal plane that cuts the crystal axes at $(2a, -3b, -3c)$, the Miller indices are:
- (A) $(2\ -3\ -3)$
 (B) $(-2\ 3\ 3)$
 (C) $(3\ -2\ -2)$
 (D) $(-3\ 2\ 2)$
44. The number of Bravais Lattices possible for Cubic, Orthorhombic and Tetragonal Crystal systems respectively are:
- (A) 3, 3, 3
 (B) 3, 4, 2
 (C) 3, 2, 2
 (D) 3, 2, 4

45. For a first-order reaction with just one reactant and a product, select the most appropriate statement :
- The concentration of reactant decreases linearly with time
 - If estimated, the rate of the reaction would be highest at the beginning of the reaction
 - The concentration of product increases linearly with time
 - Both (A) and (C)
46. According to collision theory of reaction rates :
- Increase of the size of reactants increases rate constant of the reaction
 - Increase of molecular mass of the reactants decreases its apparent rate constant
 - Chemical reactions have activation barrier
 - All of the above
47. For Photochemical $\text{H}_2 - \text{Cl}_2$ reaction :
- Rate of reaction is first order with respect to the concentration of Cl_2
 - Rate of reaction varies as the square root of the intensity of absorbed radiations
 - The reaction starts with photochemical dissociation of H_2
 - All of the above
48. The activation energy of reaction R_1 is Twice as that of reaction R_2 . Both the reactions were investigated for variation of their rate constants with temperature. Which among the following shall correctly represent the apparent variation of rate constants for similar changes of the temperature ?
- The apparent variation of the rate constant of reaction R_1 is greater than that of reaction R_2
 - The apparent variation of rate constant of reaction R_2 is greater than that of reaction R_1
 - The apparent variation of rate constant of reaction R_1 is similar to that of reaction R_2
 - The apparent variation of rate constant of reaction R_1 can be greater or smaller than that of reaction R_2
49. For isothermal expansion of an ideal gas from volume V_1 to V_2 :
- $\Delta H = \Delta U \neq 0$
 - $q = w$
 - $w = nRT \ln \frac{V_2}{V_1}$
 - $q = \Delta U$
50. In the adiabatic expansion of one mole of an ideal gas from volume of V_1 to volume V_2 , where T_1 and T_2 are the temperatures in initial and final state, and ratio $\frac{C_p}{C_v} = \gamma$
- $\Delta U = -w$
 - $\Delta U = -C_v (T_2 - T_1)$
 - $\frac{T_2}{T_1} = \left(\frac{V_1}{V_2} \right)^{1-\gamma}$
 - $\Delta H = \Delta U + R(T_2 - T_1)$
51. The maximum work that can be done by a Carnot engine from 600 kJ of heat it absorbs if operated with source and sink temperatures of 100°C and 0°C respectively will be :
- 600 kJ
 - 160.8 kJ
 - 219.8 kJ
 - Will depend upon the nature of the gas used in the engine
52. The chemical potential of a component :
- Is an extensive property that increases with increase of pressure
 - Is an intensive property that decreases with increase of pressure
 - Is an extensive property that decreases with increase of temperature
 - Is an intensive property that decreases with increase of temperature

SP-4474-A



53. In the phase diagram of water :
- The curves imply two phase univariant states
 - The areas imply one phase bivariant states
 - The intersection of curves imply two phase nonvariant state
 - Both (A) and (B)
54. The molar conductance of a weak electrolyte at infinite dilution is $0.04 \text{ Sm}^2\text{mol}^{-1}$ at 298 K. What will be its degree of dissociation at 0.02 M if the specific conductance of its said solution is 0.016 Sm^{-1} ?
- 0.02
 - 0.2
 - 0.04
 - 0.4
55. The extent of solvation is known to depend upon the ionic size and increasing ionic size decreases the extent of solvation. Assuming that higher solvated size implies smaller ionic mobility (μ_i), which among the following correctly depicts the correct order of ionic mobilities in water ?
- $\mu_{\text{H}^+} > \mu_{\text{Li}^+} > \mu_{\text{Na}^+} > \mu_{\text{K}^+}$
 - $\mu_{\text{H}^+} < \mu_{\text{Li}^+} < \mu_{\text{Na}^+} < \mu_{\text{K}^+}$
 - $\mu_{\text{H}^+} > \mu_{\text{K}^+} > \mu_{\text{Na}^+} > \mu_{\text{Li}^+}$
 - $\mu_{\text{K}^+} > \mu_{\text{Na}^+} > \mu_{\text{Li}^+} > \mu_{\text{H}^+}$
56. In the conductometric titration of a strong acid with weak base :
- Conductance initially decreases and then remains constant after equivalence point
 - Conductance initially decreases and then increases after equivalence point
 - Conductance initially increases slowly and then increases sharply after equivalence point
 - Conductance initially remains constant and then increases sharply after equivalence point
57. In a galvanic cell :
- Electrical energy is converted into chemical energy
 - The electrical energy will be equal to enthalpy of cell reaction if temperature coefficient of cell EMF is zero
 - The electrical energy will be more than enthalpy of cell reaction if temperature coefficient of cell EMF is positive
 - Both (B) and (C)
58. If rotational spectrum is recorded for a homo-diatomic molecule :
- The spectrum will consist of series of successive spectral lines with spacing equal to $2B$
 - The spectrum will consist of series of successive spectral lines with spacing equal to B
 - The spectrum will consist of series of successive spectral lines with spacing equal to $B/2$
 - No rotational spectrum can be recorded
59. Which among the following will be microwave active ?
- CH_4
 - CO_2
 - H_2O_2
 - BF_3
60. The number of Vibrational degrees of freedom for CO_2 , NO_2 and SO_2 are :
- 4, 4, 4
 - 4, 4, 3
 - 4, 3, 3
 - 3, 3, 3