

Seat No.

Total No. of Pages : 21

M. Sc. Entrance Examination 2026**M. Sc. Chemistry (Inorganic/Organic/Physical/Analytical/
Industrial/Applied)****Sub. Code: 58713**

Day and Date : Tuesday, 21/07/2026**Total Marks : 100****Time : 12:30 pm to 02:00 pm**

Instructions:

- 1) All questions are compulsory.
 - 2) Each question carries 1 mark.
 - 3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
 - 4) Follow the instructions given on OMR sheet.
 - 5) Rough work shall be done on the sheet provided at the end of question paper.
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- 1) A decrease in the value of Gibb's free energy at constant pressure and temperature is a measure of maximum reversible work done by the system.

a) Mechanical	b) Non-mechanical
c) Total	d) Free
- 2) The ratio of fugacity of substance in a given state to that in its standard state is known as of a substance.

a) Activity	b) Molarity
c) Concentration	d) Chemical potential
- 3) According to Freundlich adsorption isotherm, $a=KP$

a) $1/T$	b) $1/n$
c) $1/V$	d) $1/n^2$

- 9) When is a separation process not required in a manufacturing process?
- a) When there is a decomposition reaction
 - b) When there is a complete conversion of reactant to product
 - c) When the byproducts are in the form of gases
 - d) When the reaction is reversible
- 10) Chemicals that are produced and handled in large lots and are often in a crude state called
- a) Industrial
 - b) Toxic
 - c) Heavy
 - d) King
- 11) Solvay process is used to make
- a) Potassium carbonate
 - b) Sodium carbonate
 - c) Sodium hydroxide
 - d) Sodium chloride
- 12) In an associative substitution reaction, the intermediate has
- a) Lower coordination number than starting material
 - b) Higher coordination number than the starting material
 - c) Same coordination number as starting material
 - d) None of these
- 13) Who first introduced the electrochemical theory of corrosion?
- a) Whitney
 - b) Evans
 - c) Philips
 - d) Haber

- 14) Which gas is evolved at the cathode in aqueous medium?
 - a) Chlorine
 - b) Hydrogen
 - c) Oxygen
 - d) Nitrogen
- 15) Gas-solid chromatography is best suited for separating
 - a) Thermally stable organic components
 - b) Low molecular weight gaseous species
 - c) Thermally stable inorganic components
 - d) Volatile organic components
- 16) The choice of mobile phase for elution in ion-exchange chromatography is
 - a) Acidic solution
 - b) Basic solution
 - c) Buffer solution
 - d) Polar solution
- 17) principle is used in water purification technology
 - a) High-performance liquid chromatography
 - b) Size exclusion chromatography
 - c) Ion exchange chromatography
 - d) Affinity chromatography
- 18) Compounds with low R_f value can be effectively separated by paper chromatography.
 - a) Ascending
 - b) Descending
 - c) Radial/Circular
 - d) None of these

- 19) Gradient elution means
- a) Combination of A, B, and C mobile phases with varying polarity
 - b) Polar mobile phase and nonpolar stationary phase
 - c) Polar stationary phase and nonpolar mobile phase
 - d) Mobile phases A and B with a ratio of 1:2
- 20) The solution used for elution is called
- a) Eluent
 - b) Effluent
 - c) Eluate
 - d) Elution
- 21) Which of the following detectors have high sensitivity to all organic compounds?
- a) Sulphur chemiluminescence detector
 - b) Thermionic emission detector
 - c) Flame ionization detector
 - d) Argon ionization detector
- 22) Which analytical method is based on the weight of the precipitate?
- a) Acid-base Titration
 - b) Complexometric Titration
 - c) Precipitation titration
 - d) Gravimetry
- 23) Which sentence is false about gravimetric analysis?
- a) It is used for inorganic ions.
 - b) It is used to assay volatile organic compounds
 - c) It is used to assay barium sulphate.
 - d) It is used to assay aluminium.

- 24) How many types of gravimetric analysis?
- a) One
 - b) Two
 - c) Three
 - d) Four
- 25) Gravimetric analysis is governed by
- a) The law of mass action and reversible reactions
 - b) The principle of solubility product
 - c) The common ion effect
 - d) All the above
- 26) In gravimetric analysis, crucibles are used when the precipitates are dried in the muffle furnace.
- a) Crucible made of porcelain
 - b) Crucible made of silica
 - c) None of the above
 - d) Both porcelain or silica
- 27) In which step, ions or elements are aggregated in Gravimetric analysis?
- a) Supersaturation
 - b) Nucleation
 - c) Particle growth
 - d) None of the above
- 28) OSTWALD ripening is
- a) Re-precipitation
 - b) Dissolved small precipitate
 - c) Produced larger precipitate
 - d) All of the above

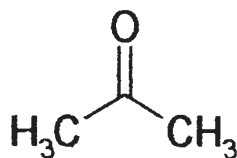
- 40) Petroleum resources are highest in
- | | |
|----------|-------------------------|
| a) Iraq | b) Venezuela |
| c) India | d) United Arab Emirates |
- 41) In a Chemical Cell, EMF is due to
- | | |
|-------------------------|---------------------------|
| a) Diff Electrode conc. | b) Diff. Electrolyte conc |
| c) Chemical Reaction | d) Both a & b |
- 42) During electrolysis current produces due to.....
- | | |
|-----------------|----------------------|
| a) Flow of ions | b) Flow of electrons |
| c) Both a and b | d) None of these |
- 43) Which of the following are the reactions in which molecules absorbing light do not themselves react but induce other molecules to react?
- | |
|------------------------------|
| a) Photosensitized reactions |
| b) Free radical reactions |
| c) Chain reactions |
| d) Reversible reactions |
- 44) Photosynthesis is an example of.....
- | | |
|----------------------|-----------------------|
| a) Fluorescence | b) Phosphorescence |
| c) Chemiluminescence | d) Photosensitization |
- 45) The SeO_2 reagent is primarily used to oxidize position
- | | |
|-----------------|--------------------|
| a) Allylic | b) Benzylic |
| c) Both a and b | d) Neither a nor b |

- 46) Rearrangement involving a change in carbon skeleton through carbocation intermediate is called as
- a) Wagner-Meerwein
 - b) Knoevenagel
 - c) Diels-Alder
 - d) Wittig
- 47) The molecule whose synthesis is being planned is called as
- a) Target molecule
 - b) New molecule
 - c) Synthons
 - d) Synthetic equivalent
- 48) Cinnamaldehyde can be prepared by using benzaldehyde and acetaldehyde.
- a) Aldol condensation
 - b) Claisen condensation
 - c) Perkin reaction
 - d) Diels-Alder reaction
- 49) The addition of halogen to triple-bond hydrocarbons produces.
- a) Dihaloalkane
 - b) Tetrahaloalkane
 - c) Alcohol
 - d) Aldehyde
- 50) Propene on reaction with HBr in the presence of peroxide forms
- a) 1-bromo propane
 - b) 2-bromo propene
 - c) 1,2-dibromo propene
 - d) 1,3-dibromo propene

- 51) Which of the following is NOT a natural product?
- | | |
|------------------|--------------|
| a) Terpenoids | b) Alkaloids |
| c) Nanocomposite | d) Proteins |
- 52) Nicotine reacts with methyl iodide to form dimethiodide and two monomethiods but it does not form acetyl or benzyl derivatives which indicate.
- a) Two nitrogen atoms in nicotine are tertiary
- b) One nitrogen atom is secondary and the other is tertiary
- c) Two nitrogen atoms in nicotine are primary
- d) One nitrogen atom is primary and the other is tertiary
- 53) Lime defecation of cane juice is used to remove
- | | |
|-------------------------|-------------------------|
| a) Soluble impurities | b) Suspended impurities |
| c) Insoluble impurities | d) All of these |
- 54) Decolorization of cane juice is done using
- | | |
|-------------------------|-----------------------|
| a) Activated carbon | b) Ion exchange resin |
| c) Sulphitation process | d) All of these |
- 55) The density scale used to measure sugar concentration is
- | | |
|---------|--------------|
| a) Trix | b) Brix |
| c) Pan | d) Calendria |
- 56) In a hydrothermal method for the synthesis of nanomaterial, the instrument in which the reaction is carried out is called as
- | | |
|---------------|--------------|
| a) Furnace | b) Autoclave |
| c) Water bath | d) Oven |

- 57) An antipyretic is a drug used to.....
- a) Control sleep
 - b) Induce sleep
 - c) Lower body temperature
 - d) Elevate body temperature
- 58) A polymers are grouped on the basis of their
- a) Origin
 - b) Structure
 - c) Property
 - d) Any of these
- 59) The Conducting Polymers are used in
- a) Storage batteries
 - b) Gas sensors
 - c) PCBs
 - d) All of these
- 60) The concept of matter wave was suggested by
- a) de Broglie
 - b) Schrodinger
 - c) Laplace
 - d) Heisenberg
- 61) The total probability of finding the particle in space must be.
- a) Zero
 - b) Unity
 - c) Infinity
 - d) Double
- 62) Flame photometry is concerned with the measurement of intensity of light when a metal is introduced into the flame.
- a) Absorbed
 - b) Emitted
 - c) Both a and b
 - d) None of these

- 63) In flame emission photometers, the measurement of is used for qualitative analysis.
- a) Velocity b) Colour
- c) Intensity c) Frequency
- 64) The Nernst distribution law equation $C_1/C_2 = K_D$ applies when:
- a) The molecular state of the solute is the same in both the solvents
- b) The molecular state of the solute is different in both the solute
- c) The molecular state of the solute may be the same or different in both the solute
- d) None of the above
- 65) The formula, $K = \frac{C_1}{\sqrt{C_2}}$ indicates that the solute is present as a solvent. molecule in second
- a) Single b) Double
- c) Triple d) None of these
- 66) How many peaks will be observed in the ¹H NMR spectrum of the following molecule?



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

- 67) How many peaks will be observed in the ^1H NMR spectrum of the following molecule?



- a) 1 b) 2
- c) 3 d) 4
- 68) Which of the following solvent is not used for scanning NMR?
- a) D₂O b) CHCl₃
- c) CCl₄ d) CDCl₃
- 69) Which among the following functional group protons show highest chemical shift in ¹H NMR?
- a) Alcohols b) Carboxylic acid
- c) Ketone d) Vinylic
- 70) Which of the following produces magnetic anisotropy?
- a) Hydrogen bonding
- b) Aromatic ring system
- c) Electronegativity
- d) pH
- 71) Nuclei with an even number of protons and even number of neutrons will have spin quantum number
- a) 0 b) 1/2
- c) 3/2 d) 1

- 72) At what stretching frequency C=O from saturated acyclic ketone depicts band in IR spectrum?

a) 1200-1250 cm^{-1}

b) 2190-2200 cm^{-1}

c) 1710-1720 cm⁻¹

d) 3230-3550 cm^{-1}

- 73) At what stretching frequency -OH depict the band in the IR spectrum?

a) 1700 cm^{-1}

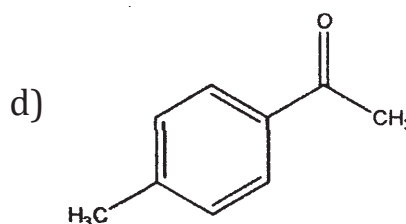
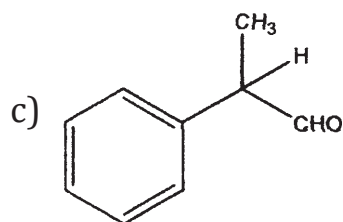
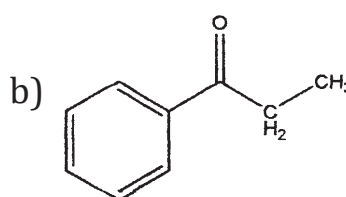
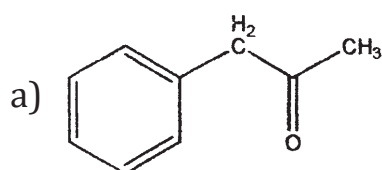
b) 2200 cm^{-1} c) 1250 cm^{-1}

d) 3230-3550 cm⁻¹

- 74) Deduce the structure of the organic compound from the following spectroscopic data

MF: C₉H₁₀O Mass: 134, 91.43 IR: 1715 cm⁻¹

NMR: δ 2.1 (3H, s); 3.7 (2H, s); 7.1-7.4 (5H, m)



- 75) A compound with molecular formula C_4H_8O having δ value: 3.00 ppm (q, 2H), 2 ppm (s, 3H), 2.5 ppm (t, 3H). What is the possible molecular structure of this compound?

a) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$

b) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CHO}$

c) $\text{CH}_3\text{-CH}_2\text{-CO-CH}_3$

d) $\text{CH}_3\text{-CH(OH)-CH}_3$

- 76) Deduce the structure of the compound from the following spectral data
 M.F. C_3H_7ON
 IR-3500, 3400, 3370, 1670, 1800 cm^{-1}
 PMR- δ 2.25 (q, 2H); 6.40 (s, 2H); 1.20 (t, 3H)
- $CH_3-CH(NH_2)-CHO$
 - $CH_3-CO-CH_2-NH_2$
 - $CH_3-CH_2-CO-NH_2$
 - $CHO-CH_2-CH_2-NH_2$
- 77) What is the purpose of a standard solution in titrimetric analysis?
- To react with the analyte and form a product
 - To determine the concentration of the analyte
 - To calibrate the titration apparatus
 - To increase the sensitivity of the titration reaction.
- 78) Which of the following factors can affect the accuracy of titrimetric analysis?
- Temperature
 - pH
 - Concentration of the titrant solution.
 - All of the above
- 79) Which of the following is a characteristic of a chelating agent?
- Forms covalent bonds with metal ions
 - Decreases the solubility of metal ions
 - Decreases the stability of metal ions
 - Forms a ring structure with metal ions.

- 80) Classification of chelating agents is made on the basis of
- | | |
|---------------------------|------------------------|
| a) Oxygen atoms | b) Nitrogen atoms |
| c) Number of donor groups | d) Number of electrons |
- 81) Which of the following statements about the periodicity of elements is correct?
- a) The periodicity of elements is based on the atomic weight of each element.
- b) The periodicity of elements is based on the atomic number of each element.
- c) The periodicity of elements is based on the number of protons in the nucleus of each element.
- d) The periodicity of elements is based on the number of neutrons in the nucleus of each element.
- 82) Which of the following elements has the highest number of valence electrons?
- | | |
|--------------|--------------|
| a) Sodium | b) Magnesium |
| c) Aluminium | d) Silicon |
- 83) What is the charge on Ni in $\text{Ni}(\text{CO})_5$?
- | | |
|------|------|
| a) 0 | b) 1 |
| c) 3 | d) 4 |
- 84) Which one of the following is an organometallic compound?
- | | |
|-----------------------------|-----------------------------|
| a) $\text{Co}(\text{CN})_6$ | b) $\text{Ni}(\text{CO})_4$ |
| c) $\text{Fe}(\text{CN})_6$ | d) All of these |
- 85) What is the geometry of $\text{Fe}(\text{CO})_5$?
- | | |
|----------------|-------------------------|
| a) Octahedral | b) Pentagonal |
| c) Tetrahedral | d) Trigonal bipyramidal |

- 86) The IUPAC name of $\text{CH}_3\text{-Be-C}_2\text{H}_5$ is
- Methylethylberyllium
 - Dialkylberyllium
 - Ethylmethylberyllium
 - None of these
- 87) Which of the following factors influences the activity of heterogeneous catalysts?
- Total surface area.
 - Method of preparation
 - Number of active sites
 - All of these
- 88) Which of the following theory is best suitable to explain heterogeneous catalysis?
- Nucleate
 - Intermediate compound formation theory
 - Valence bond theory
 - Absorption theory
- 89) The radioisotope, 'x' has a half-life of 16 years. If the initial amount of 'x' is 400g, how many grams of it would remain after 64 years?
- | | |
|-----------|---------|
| a) 12.5 g | b) 25 g |
| c) 50 g | d) 80 g |

- 90) Emission of an alpha particle from a nucleus of an atom leads to
- Decrease of 2 units in the charge of the atom
 - Decrease of 2 units in the mass of the atom
 - Increase of 2 units in the mass of the atom
 - Increase of 4 units in the mass of the atom
- 91) The age determination of organic fossils using carbon dating method is based on the fact that
- C^{14} fraction is the same in all objects
 - Ratio of Carbon-14 and Carbon-12 is constant
 - C^{14} is highly insoluble
 - All of these
- 92) X-rays are generated by
- Coolidge tube
 - Geiger tube
 - Goniometer
 - Scintillation tube
- 93) Which of the following is Bragg's diffraction law?
- $\lambda = 2d\sin\theta$
 - $n\lambda = 2d\sin\theta$
 - $n\lambda = d\sin\theta$
 - $\lambda = d\sin\theta$
- 94) Phenol on nitration gives a mixture of o-nitrophenol and p-nitrophenol. This is an example of type of reaction
- Opposing
 - Competing
 - Chain
 - Consecutive

- 95) 50 ml of water is boiled at 373 K temperature to convert it in vapors, then the entropy of this process will be.
 - a) Positive
 - b) Negative
 - c) Zero
 - d) Infinite
- 96) of the following is a non-reducing sugar.
 - a) Galactose
 - b) Glucose
 - c) Lactose
 - d) Sucrose
- 97) Dimerization of the sample produces
 - a) Bathochromic shift
 - b) Hypochromic shift
 - c) Absence of absorbance
 - d) No effect
- 98) Benzene is aromatic while is non-aromatic.
 - a) Cyclopentadiene
 - b) Pyridine
 - c) Cyclopropene cation
 - d) Anthracene
- 99) Metals are good conductors because of free.....
 - a) Neutrons
 - b) Electrons
 - c) Protons
 - d) Atoms
- 100) Which of the following is an intrinsic semiconductor?
 - a) P
 - b) Si
 - c) Ga
 - d) As



ROUGH WORK