

Seat No.

Total No. of Pages : 14

Ph.d Entrance Examination March - April, 2026
Chemistry/Applied Chemistry/ Industrial Chemistry
Subject Code : 58806

Day and Date : Wednesday, 07-Oct-2026**Total Marks : 100****Time : 01.00 pm to 03.00 pm**

Instructions :

- 1) All questions are compulsory.
 - 2) Each question carries 2 marks.
 - 3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
 - 4) Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR answer sheet.
 - 5) Follow the instructions given on OMR Sheet.
 - 6) Rough work shall be done on the sheet provided at the end of question paper.
 - 7) Only non-programmable calculators are allowed.
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SECTION -I

- 1) Research can be classified as:
 - a) Basic, Applied and Action Research
 - b) Philosophical, Historical, Survey and Experimental Research
 - c) Quantitative and Qualitative Research
 - d) All the above

- 2) PubMed is a free search engine and database of the National Institutes of Health (NIH)
- a) Providing access to biomedical and life sciences literature
 - b) Providing access to Chemical sciences literature
 - c) Providing access to physical sciences literature
 - d) All of the above
- 3) Which of the following has graphics interface and searched for Chemical structures and reactions.
- a) Google Scholar
 - b) Web of Science
 - c) Google
 - d) Sci finder
- 4) Characteristics of Effective Research Objectives are
- a) Specific
 - b) Action-oriented
 - c) Achievable:
 - d) All of these
- 5.) Novel research is a study that introduces
- a) Unique concept
 - b) Unique method
 - c) Both a and b
 - d) None of these
- 6) Standard deviation formula is.....
- a) $CV \times \text{Mean}/100$
 - b) $CV \times \text{Mean}/1000$
 - c) $KV \times \text{Mean}/100$
 - d) $KV \times \text{Mean}/1000$

- 7) Coefficient of variation is
- a) SD/Mean
 - b) SD/Error
 - c) SD/Relative error
 - d) SD/precession
- 8) What is the intelligence quotient for normal child?
- a) 120 to 140
 - b) 110 to 120
 - c) 80 to 90
 - d) 90 to 110
- 9) Which of the fallowing software is used for plagiarism checking?
- a) Java
 - b) pythan
 - c) C++
 - d) iThenticate
- 10) Hydrothermal method represents
- a) High temperature and low-pressure
 - b) High temperature and high pressure
 - c) Low temperature and high pressure
 - d) All of these

- 11) Single crystal is
- a) Atoms or molecules are arranged in a continuous, unbroken, and uniform three-dimensional lattice structure
 - b) Atoms or molecules are arranged in a noncontinuous, broken, and uniform three-dimensional lattice structure
 - c) Atoms or molecules are arranged in a noncontinuous, broken, and uniform two-dimensional lattice structure
 - d) Atoms or molecules are arranged in a non-continuous, unbroken, and uniform three-dimensional lattice structure
- 12) The Shapiro reaction is organic reaction in which ketone or aldehyde is converted to an
- a) Alkene
 - b) Alkane
 - c) Acids
 - d) Both alkene and alkane
- 13) Zone refining techniques is
- a) Purification method
 - b) Identification method
 - c) Quantitative method
 - d) All of these
- 14) Which one of the following orders has abundant application in biological process?
- a) First
 - b) Second
 - c) Third
 - d) Zero

- 15) Photocatalysis is a process that uses light to accelerate a chemical reaction, employing a photocatalyst-typically
- a) Metal
 - b) Semiconductor
 - c) Insulator
 - d) All of these
- 16) Shapiro reaction is carried out with two equivalents of an
- a) Organo-lithium compound.
 - b) Organic-potassium compound
 - c) Organo-mercury compound
 - d) Organo-sodium compound
- 17) Rayleigh scattering is the elastic scattering of electromagnetic radiation by particles
- a) Much smaller than the radiation's wavelength
 - b) Equal to the radiation's wavelength
 - c) Much greater than the radiation's wavelength
 - d) None of these
- 18) Which of the following is a characteristic property of a symmetric top molecule?
- a) All three principal moments of inertia are different.
 - b) Two of the principal moments of inertia are equal.
 - c) It is a linear molecule.
 - d) It lacks any rotational axis of symmetry.

- 19) The Tyndall effect is observed in:
- a) True solutions
 - b) Colloidal solutions
 - c) Suspensions only
 - d) Both colloidal solutions and suspensions
- 20) The movement of colloidal particles in an electric field is called
- a) Brownian motion
 - b) Tyndall effect
 - c) Electrophoresis
 - d) Electro-osmosis
- 21) The measurement of intensity of fluorescent X-rays provides a simple and ---
..... way of..... analysis.
- a) Destructive, quantitative
 - b) Non-destructive, quantitative
 - c) Destructive, qualitative
 - d) Non-destructive, qualitative
- 22.) Which of the following an analytical technique can help to elucidate an elemental fingerprint without the need to analyse the material destructively
- a) Spectrophotometry
 - b) Atomic absorption spectroscopy
 - c) X-ray fluorescence
 - d) Potentiometry
- 23) In X-ray photon spectroscopy which two common X ray sources are used?
- a) Cu and Cr $K\alpha$ line
 - b) Mg and Al $K\alpha$ line
 - c) Cu and Pb $K\alpha$ line
 - d) Cu and Ni $K\alpha$ line

24) X-ray Photoelectron Spectroscopy, was developed by.....

- a) Kai Siegbahn b) Einstein
- c) C. V. Raman d) John J. Hopfield

25) Mössbauer spectroscopy is also known as

- a) Nuclear magnetic resonance b) Nuclear gamma resonance
- c) Electron Spin Resonance d) Nuclear alpha resonance

SECTION-II

26) Which of the following is a characteristic feature of an E2 elimination reaction?

- a) It proceeds through a carbocation intermediate.
- b) It is first order with respect to the substrate.
- c) It requires a strong base and anti-periplanar geometry.
- d) All of these

27) Elcb (Elimination, unimolecular, conjugate base) mechanism is most favored when:

- a) The leaving group is very strong
- b) The β -hydrogen is highly acidic
- c) A weak base is present
- d) The reaction is carried out at high temperature under pressure.

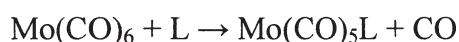
- 28) The correct order of reactivity towards electrophilic substitution is:
- a) Nitrobenzene > Benzene > Toluene > Phenol
 - b) Phenol > Toluene > Benzene > Nitrobenzene
 - c) Toluene > Phenol > Benzene > Nitrobenzene
 - d) Benzene > Phenol > Nitrobenzene > Toluene
- 29) Which of the following statements is true about halogen substituents on benzene?
- a) They are activating and meta-directing
 - b) They are activating and ortho/para-directing
 - c) They are deactivating but ortho/para-directing
 - d) They are deactivating and meta-directing
- 30) Which one of the following compounds is achiral due to symmetry?
- a) cis-1,2-Dichlorocyclohexane
 - b) trans-1,2-Dichlorocyclohexane
 - c) 2-Chlorobutane
 - d) 1-Bromo-2-chloropropane
- 31) The hypsochromic shift (blue shift) is caused by:
- a) Increase in conjugation by electron donating groups.
 - b) Presence of auxochrome
 - c) Increase in resonance
 - d) Removal of conjugation or polarity of solvent

- 32) Which of the following is a photo-Fries rearrangement?
- a) UV irradiation of aryl esters $\longrightarrow$ hydroxyaryl ketones
 - b) Photolysis of ketones $\longrightarrow$ alkanes
 - c) Photocyclization of dienes $\longrightarrow$ aromatics
 - d) None of the above.
- 33) The regioselectivity of Birch reduction depends on:
- a) Only the solvent
 - b) Nature of substituents on the aromatic ring
 - c) Temperature
 - d) Pressure of NH_3
- 34) Hydroboration of cis-2-butene followed by oxidation gives:
- a) Trans 2-butanol only
 - b) Optically active 2-butanol
 - c) Cis-2-butanol only
 - d) Racemic 2-butanol
- 35) Identify the product
- $$\text{B}_2\text{H}_6 + \text{NH}_3 (\text{excess}) \xrightarrow{\text{Higher temperature}}$$
- a) Boron nitride
 - b) Diammonia diborane
 - c) Borazine
 - d) All of above
- 36) What is the molecular geometry of the BrF_5 molecule?
- a) Trigonal bipyramidal
 - b) Octahedral
 - c) Pentagonal planar
 - d) Square pyramidal

37) Arrange the following, tripositive lanthanide ions in increasing order of their magnetic moment values

- a) $\text{Ce}^{3+} < \text{Yb}^{3+} < \text{Tm}^{3+} < \text{Gd}^{3+}$
- b) $\text{Yb}^{3+} < \text{Ce}^{3+} < \text{Gd}^{3+} < \text{Tm}^{3+}$
- c) $\text{Gd}^{3+} < \text{Tm}^{3+} < \text{Yb}^{3+} < \text{Ce}^{3+}$
- d) $\text{Ce}^{3+} < \text{Gd}^{3+} < \text{Yb}^{3+} < \text{Tm}^{3+}$

38) Consider the following reaction:



If the rate of this substitution reaction is independent of the concentration of the incoming ligand L, what is the likely mechanism?

- a) Oxidative addition
- b) Reductive elimination
- c) Dissociative mechanism
- d) Associative mechanism

39) The solutions of (i) $[\text{Cr(OH}_2)_6]^{3+}$ ions are pale blue-green, but the chromite ion (ii) $[\text{CrO}_4]^{2-}$ is an intense yellow due to:

- a) d-d transitions in (i) and (ii)
- b) d-d transition in (i) and charge transfer transition in (ii)
- c) Charge transfer transition in (i) and d-d transition in (i)
- d) Charge transfer in (i) and (ii)

- 40) Wilkinson's catalyst, $[\text{RhCl}(\text{PPh}_3)_3]$, is an effective catalyst for the hydrogenation of alkenes. Which of the following is a key step in its catalytic cycle?
- Insertion of CO into a metal-carbon bond
 - Beta-hydride elimination
 - Elimination of CH
 - Oxidative addition of H_2
- 41) Which of the following compounds is expected to have the lowest CO stretching frequency (ν_{CO}) in its IR spectrum?
- $[\text{Fe}(\text{CO})_6]^{2+}$
 - $\text{Fe}(\text{CO})_5$
 - $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 - $[\text{Fe}(\text{CO})_4]^{2-}$
- 42) Which of the following molecules has a C_{2h} point group?
- Diborane
 - Cis-1,2-dichloroethylene
 - Trans-1,2-dichloroethylene
 - Chloroform
- 43) Which of the following factors increases the rate of physisorption?
- Increase in temperature
 - Increase in pressure
 - Increase in surface area
 - Both B and C

44) The Freundlich adsorption isotherm is expressed as:

- a) $x/m = kP^n$
- b) $x/m = k/P^n$
- c) $x/m = kP^{1/n}$
- d) $x/m = k \log P$

45) According to the Third Law of Thermodynamics, as the temperature of a system approaches absolute zero, the entropy.....

- a) Increases exponentially
- b) Remains constant
- c) Approaches infinity
- d) Approaches zero

46) Which of the following quantities remains constant in a microcanonical ensemble?

- a. Temperature, Volume, Number of particles
- b. Energy, Volume, Number of particles
- c. Temperature, Pressure, Number of particles
- d. Pressure, Volume, Temperature

47) Polarography is an electrochemical method of analysis based on the measurement of.....

- a. Electrical conductivity
- b. Current as a function of applied voltage
- c. Resistance
- d. pH

48) The Ilkovic equation is used to calculate:

- a. Resistance of solution
- b. pH of solution
- c. Diffusion current
- d. Cell potential

49) Which of the following will decrease the surface tension of water?

- a. Increasing temperature
- b. Cooling the water
- c. Adding salt
- d. Compressing the water

50) What is the main function of the Dropping Mercury Electrode (DME) in polarography?

- a. To measure temperature
- b. To act as a counter electrode
- c. To serve as a renewable working electrode
- d. To filter the solution

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ROUGH WORK