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ENT - 68

Total No. of Pages : 26

M. Sc. Entrance Examination, 2024
CHEMISTRY
(Inorganic/Organic/Physical/Analytical/Industrial/Applied)
Sub. Code: 58713

Day and Date : Monday, 29-07-2024

Total Marks : 100

Time : 12.30 p.m. to 2.00 p.m.

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.

- 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) $1/n^2$

4) Condensation of gases in the narrow capillary pores of the adsorbent at pressures even below the saturation pressure of the gas is known as condensation of the gas.

- a) Molecular
b) Partial
c) Complete
d) Capillary

5) In the equation: $\text{HF} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ \text{F}^-$

- a) H_2O is a base and HF is its conjugate acid
- b) H_2O is an acid and HF is the conjugate base
- c) HF is an acid and F^- is its conjugate base
- d) HF is a base and H_3O^+ is its conjugate acid

6) HSAB concept can be used to determine:

- a) Stability of complexes
- b) Predicting the feasibility of reactions
- c) Solubility of compounds in a given solvent
- d) All the above

- 7) A macrocyclic ligand present in chlorophyll is.....
- a) Porphyrin
 - b) Corin
 - c) Chlorin
 - d) Histidine
- 8) In a biological system, the metal ions involved in electron transport are
- a) Zn^{2+} and Mg^{2+}
 - b) Na^{2+} and K^{2+}
 - c) Ca^{2+} and Mg^{2+}
 - d) Cu^{2+} and Fe^{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

29) Which radiation has a rotational phenomenon?

- a) Microwave
- b) Infrared
- c) X-rays
- d) Visible

30) The Rotational energy level for a particular state (Jth state) is given as

- a) $E_J = \frac{\hbar^2}{2I} J(J+1)$
- b) $E_J = \frac{\hbar^2}{2I} J(J+2)$
- c) $E_J = \frac{\hbar^2}{I} J(J+1)$
- d) $E_J = J(J+1)$

31) For copper sulphate solution transmitted color is Bluish, while Amas will appear in range..... of.....

- a) 400-435 nm
- b) 480-490 nm
- c) 610-750 nm
- d) 490-500 nm

32) Optical density, OD is given by.....

- a) $OD = \log I/I_0$
- b) $OD = \log I/I^2$
- c) $OD = \log I_0/I$
- d) OD none of these

33) A device for measuring a response of photocell is called.....

- a) Voltmeter
- b) Conductometer
- c) Galvanometer
- d) All of these

34) In f-block elements the successive addition of electrons in

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

35) are the anomalous oxidation states of lanthanides.

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

36) As per Huckel's rule planar, cyclic, conjugated compounds containing electrons are aromatic in nature,

- a) $4n$
- b) $2n^2$
- c) $4n - 1$
- d) $4n + 2$

37) Steel contains about percent of chromium with carbon and nickel is called stainless steel

- a) 5-10 b) 16-20
c) 10-15 d) 16-25

38) The lowest temperature at which a liquid ignites under an ignition source is.....

- Cetane index
- Octane number
- Calorific value
- Flashpoint

39) The standards used to assign octane numbers are.....

- a) n-heptane and isooctane
- b) Alpha methyl naphthalene and hexadecane
- c) Hexadecane and isooctane
- d) n-heptane and hexadecane

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

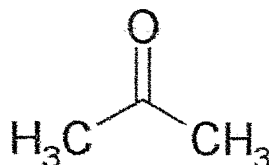
- a) Storage batteries b) Gas sensors
c) PCBs d) All of these

60) The concept of matter wave was suggested by

- a) de Broglie b) Schrodinger
c) Laplace d) Heisenberg

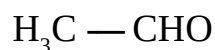
- 61) The total probability of finding the particle in space must be
- a) Zero
 - b) Unity
 - c) Infinity
 - d) Double
- 62) Flame photometry is concerned with the measurement of intensity of light when a metal is introduced into the flame.
- a) Absorbed
 - b) Emitted
 - c) Both a and b
 - d) None of 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 $C_1/C_2 = KD$ applies when:
- a) The molecular state of the solute is the same in both the solvents a
 - 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) D_2O | b) CHCl_3 |
| c) CCl_4 | d) CDCl_3 |

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) $1200-1250\text{ cm}^{-1}$
- b) $2190-2200\text{ cm}^{-1}$
- c) $1710-1720\text{ cm}^{-1}$
- d) $3230-3550\text{ cm}^{-1}$

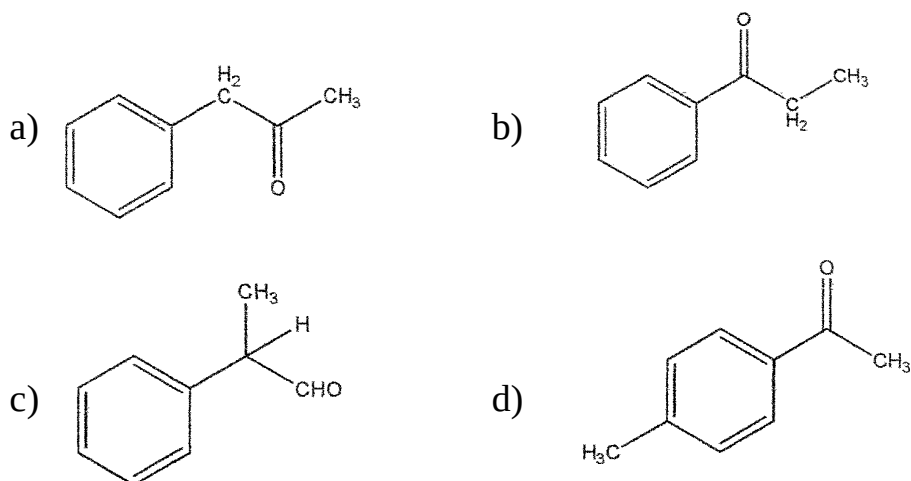
73) At what stretching frequency-OH depict the band in the IR spectrum?

- a) 1.700 cm^{-1}
- b) 2200 cm^{-1}
- c) 1250 cm^{-1}
- d) $3230-3550\text{ cm}^{-1}$

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

MF: $C_9H_{10}O$ Mass: 134, 91, 43 IR: 1715 cm^{-1}

NMR: 82.1 (3H, s); 3.7 (2H, s), 7.1-7.4 (SH_2m)



75) A compound with molecular formula C_4H_8O having 8 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) $CH_3-CH_2-CH_2-OH$
- b) $CH_3-CH_2-CH_2-CHO$
- c) $CH_3-CH_2-CO-CH_3$
- d) $CH_3-CH(OH)-CH_3$

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-8 2.25 (q, 2H); 6.40 (s, 2H), 1.20 (1, 3H)

a) $CH_3-CH(NH_2)-CHO$

b) $CH_3-CO-CH_2-NH_2$

c) $CH_3-CH_2-CO-NH_2$

d) $CHO-CH_2-CH_2-NH_2$

77) What is the purpose of a standard solution in titrimetric analysis?

a) To react with the analyte and form a product

b) To determine the concentration of the analyte

c) To calibrate the titration apparatus

d) To increase the sensitivity of the titration reaction.

78) Which of the following factors can affect the accuracy of titrimetric analysis?

a) Temperature

b) pH

c) Concentration of the titrant solution

d) All of the above

79) Which of the following is a characteristic of a chelating agent?

- a) Forms covalent bonds with metal ions
- b) Decreases the solubility of metal ions
- c) Decreases the stability of metal ions
- d) 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?

weight of each element.

- a) The periodicity of elements is based on the atomic a
- 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 Ni(CO)_4 ?

- a) 0
- b) 1
- c) 3
- d) 4

84) Which one of the following is an organometallic compound?

- a) Co(CN)_6
- b) Ni(CO)_4
- c) Fe(CN)_6
- d) All of these

85) What is the geometry of Fe(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

- a) Methylethylberyllium
- b) Dialkylberyllium
- c) Ethylmethylberyllium
- d) None of these

- 87) Which of the following factors influences the activity of heterogeneous catalysts?
- a) Total surface area
 - b) Method of preparation
 - c) Number of active sites
 - d) All of these
- 88) Which of the following theory is best suitable to explain heterogeneous catalysis?
- a) Nucleate
 - b) Intermediate compound formation theory
 - c) Valence bond theory
 - d) 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
- a) Decrease of 2 units in the charge of the atom
 - b) Decrease of 2 units in the mass of the atom
 - c) Increase of 2 units in the mass of the atom
 - d) 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
- a) C^{14} fraction is the same in all objects
 - b) Ratio of Carbon-14 and Carbon-12 is constant
 - c) C^{14} is highly insoluble
 - d) All of these
- 92) X-rays are generated by
- a) Coolidge tube
 - b) Geiger tube
 - c) Goniometer
 - d) Scintillation tube
- 93) Which of the following is Bragg's diffraction law?
- a) $\lambda = 2d\sin\theta$
 - b) $n\lambda = 2d\sin\theta$
 - c) $n\lambda = d\sin\theta$
 - d) $\lambda = d\sin\theta$
- 94) Phenol on nitration gives a mixture of *o*-nitrophenol and *p*-nitrophenol. This is an example of type of reaction
- a) Opposing
 - b) Competing
 - c) Chain
 - d) 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 |

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