Seat No.	

ENT-01

Total No. of Pages : 20

P. G. Entrance Examination, 2025
Inorganic/Organic/Physical/Analytical/Industrial/Applied)
Subject Code: 58713

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Day and Date : Tuesday, 15-05-2025 **Total Marks : 100**

Time : 10.00 p.m. to 12.00 p.m.

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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) In the equation: $HF + H_2O \rightarrow H_3O + F^-$

   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

2) Acidity of BF_3 can be explained on the basis of .....

   a) Arrehnius concept b) Lewis concept

   c) Bronsted-Lowry concept d) Both a b and c

3) CFSE for d6 octahedral complex in weak field is ..... Dq.

   a) +4 b) -6

   c) -4 d) -12

4) Which of the following complex ion is orange yellow?

   a) $[Ti (H_2O)^6]^{3+}$ b) $[Co (NH_3)_6]^{3+}$

   c) $[CoF^6]^{3-}$ d) $[Ni(NH_3)_6]^{2+}$

5) Which of the following is a dopant in N-type extrinsic semiconductor?

a) B b) Al

c) Ni d) As

6) Superconductivity is observed for

a) DC and low frequency b) AC and high frequency

c) Infrared frequency d) None of this

7) Which one of the following is used as a catalyst for polymerization at industrial scale?

a) $Al(C_2H_5)_3$, $TiCl_4$ b) Fe_3O_4

c) $PdCl_2$ d) Ni $(CO)_4$

8) Which one of the following molecule is electron deficient?

a) $Co(CN)_6$ b) $Ni(CO)_4$

c) $Fe(C_5H_5)_2$ d) $Be(CH_3)_2$

9) Which of the following theory is best suitable to explain the heterogeneous catalysis?

a) Nucleate

b) Intermediate compound formation theory.

c) Paratoid

d) Absorption theory

10) Haber process of ammonia synthesis involves. ..... metal as catalyst and .....as promoter?

a) Fe, KOH b) Mo, KOH

c) Fe, NaOH d) Mo, NaOH

11) Which relationship is true regarding molecular energy levels?

a) E (vibrational) > E(electronic) > E(rotational)

b) E (rotational) > E(vibrational) > E(electronic)

c) E (electronic) > E(rotational) > E(vibrational)

d) E (electronic) > E(vibralional) > E(rotational)

12) For copper sulphate solution transmitted colour is bluish, while hat lambda max will appear in range of.....

a) 400-435 nm b) 480-490 nm

c) 610-750 nm d) 490-500 nm

13) The wavelength in the UV ranges from..... to..... nm

a) 400, 760 b) 200, 760

c) 200, 400 d) 600, 400

14) The possible transitions for water molecule in UV visible region are.....

a) $\sigma > \sigma^*$ b) n > σ^*

c) n > π^* d) None of these

15) The carbonyl stretching frequency is least in.....

a) Carboxylic acid b) Amide

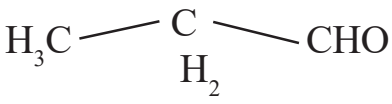
c) Ketone d) Acid chloride

16) The fundamental modes of vibrations for water molecules are calculated by.....

a) 3N-4 b) 3N-5

c) 3N-6 d) 3N-7

17) How many peaks will be observed in 'H NMR spectrum of the following molecule?



a) 1 b) 2

c) 3 d) 4

18) What is the significance of Double Bond Equivalence (DBE) = 2 ?

a) presence of one triple bond

b) presence of two double bond

c) presence of one double bond and one ring

d) all of above

19) McLafferty rearrangement is given by .....

a) 3-pentanone

b) 3-methyl-2-butanone

c) 2-pentanone

d) Propanone

20) The mass spectra of hydroxyl compound show a peak at m / c = 31 So, it can be .....

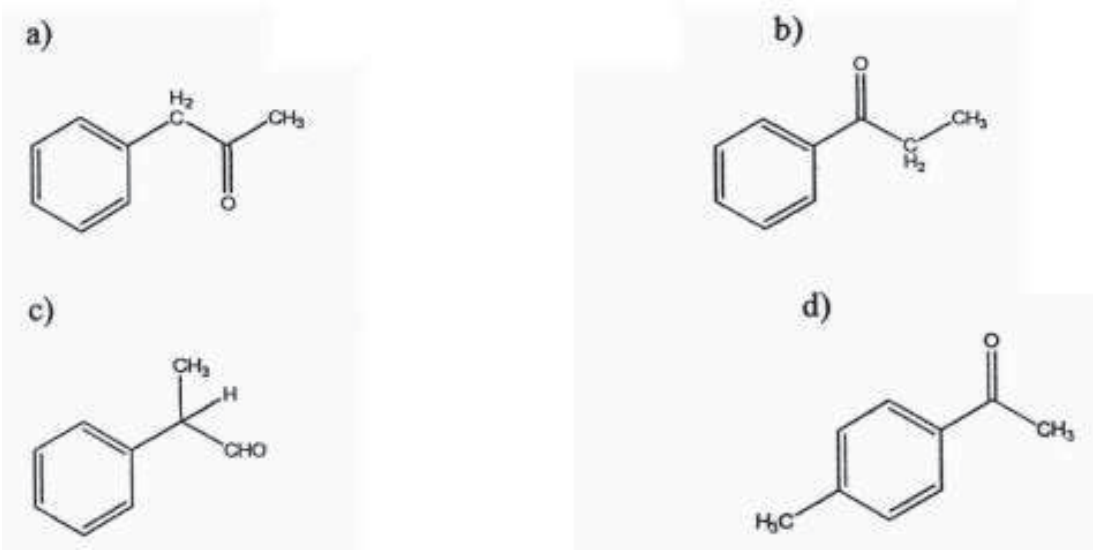
a) Phenol b) Primary alcohol

c) Carboxylic acid d) Tertiary alcohol

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

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

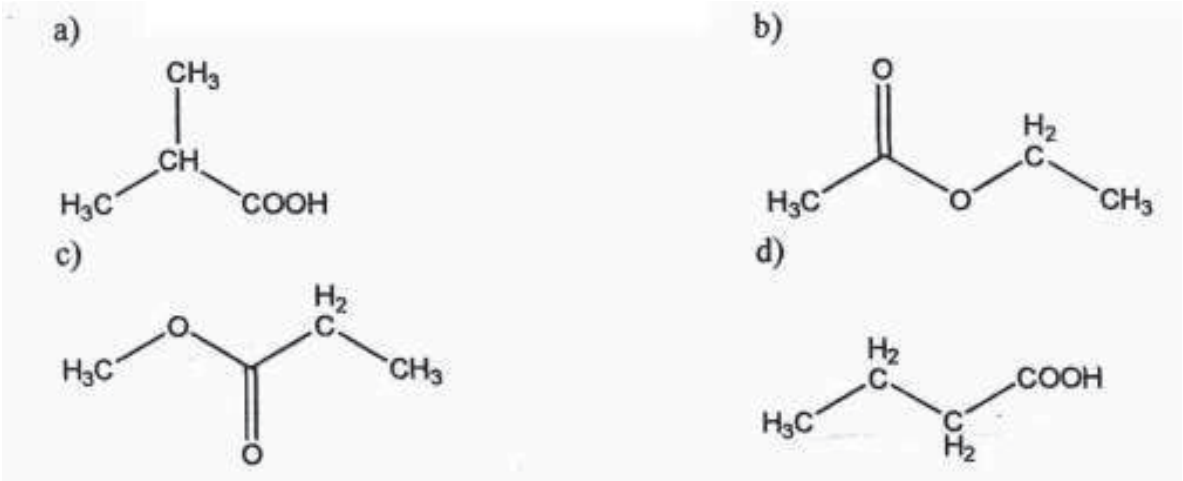
NMR: 8 2.1 (3H, s); 3.7 (2H, s),7.1-7. 4 (5H,m)



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

MF: $C_4H_8O_2$ Mass: 88, 43 IR: 1735 cm^{-1}

NMR: 81.3 (3H,t); 2 (3H,s); 4.2 (2H,q)



23) The operator nabla ∇^2 is called ..... operator.

a) Poisson b) Laplacian

c) vector d) Hamiltonian

24) The total probability of finding the particle in space must be.....

a) zero b) unity

c) infinity d) double

25) The Rotational energy level for 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) $E_J = J(J+1)$

26) The frequency of infrared radiation lies between.....

a) Visible and Micro-waves

b) Microwave and X-rays

c) Microwave and Gamma rays

d) Microwave and radio waves

27) Which of the following is not correct for an ideal solution?

a) $\nabla S_{mix} = 0$

b) $\nabla H_{mix} = 0$

c) $\nabla V_{mix} = 0$

d) it obeys Raoult's law for entire concentration range and temperature.

28) Critical solution temperature (CST) for nicotine-water system will be.....

a) lower 381K and upper 433K

b) upper 481 K and lower 333 K

c) upper 341K and lower 310K

d) upper 420K and lower 320K

29) Two solutions of different composition co-existing with one another are called as .....solutions.

a) conjugate b) miscible

c) true d) all of these

30) Chemical cell without transference is a combination of.....

a) Electrode reversible to cation and metal insoluble salt electrode

b) Two electrodes reversible to cations

c) Two electrodes reversible to anions

d) None of these

31) During electrolysis current produces due to....

a) Flow of ions b) Flow of electrons

c) Both a and b d) None of these

32) The potential of the glass electrode at 298 K, E_G x pH

a) 0.06998 - 0.0591 x pH b) 0.4540 - 0.0591 x pH

c) E^0_G - 0.0591 x pH d) E_R-E_L

33) Which indicator is used in potentiometric titration?

a) Methyl orange b) Electrolyte solution

c) No indicator is used d) None of these

34) Which of the following is not a limitation of Beer Lambert's law, which gives the relation between absorption, thickness and concentration?

a) Concentration must be lower

b) Radiation must have higher bandwidth

c) Radiation source must be monochromatic

d) Does not consider factors other than thickness and concentration that affect absorbance

35) Decolorization of cane juice is done using.....

a) activated carbon b) ion exchange resin

c) sulphitation process d) all of these

36) The density scale used to measure sugar concentration is .....

a) trix b) brix

c) pan d) calendria

37) Brine is saturated solution of.....

a) NaCl b) NaOH

c) KCL d) CsCl

38) Industrial process used for manufacture of nitic acid

a) Haber process b) Ostwald's process

c) Lead chamber process d) Contact process

39) In gas chromatography, the separation of compounds is best achieved by

a) temperature programming b) gradient elution

c) isocratic elution d) gravimetric separation

40) Non-volatile compounds can be best analysed by.....

a) gas chromatography

b) liquid column chromatography

c) thin layer chromatography

d) size exclusion chromatography

41) Which of the following organisations is responsible for promoting the protection of intellectual property worldwide?

a) WIPO b) WTO

c) UNDP d) UNESCO

42) A reaction sequence in which an intermediate of reduced coordination number is formed by the departure of the leaving group is called:

a) an associative mechanism b) a dissociative mechanism

c) an interchange mechanism d) None of these

43) Which of the following classes of ligands has strongest trans effect?

a) π donor groups b) π acceptor groups

c) σ donor groups d) σ acceptor groups

44) 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

45) Emission of an alpha particle from a nucleus of an atom leads to a.....

a) The atomic number of the atom decreases by 2 units

b) The mass of the atom decrease of 2 units

c) The mass of the atom increase of 2 units

d) The mass of the atom increase of 4 units

46) In f-block elements the successive addition of electrons is in .....

a) (n-2) b) (n-3)

c) (n-1) d) (n-4)

47) The observed electronic configuration of holmium is .....

a) [Xe] $4f^{9}5d^{0}6s^{2}$ b) [Xe] $4f^{12}5d^{0}6s^{2}$

c) [Xe] $4f^{11}5d^{0}6s^{2}$ d) [Xe] $4f^{44}5d^{0}6s^{2}$

48) 2 $Fe_2O_3.3H_2O$ is .....

a) magnetite black b) spathic iron

c) haematite red d) limonite brown

49) The process of heating the hardened steel to a temperature much below redness and cooling it slowly is known as

a) tempering b) nitriding

c) hardening d) annealing

50) A macrocyclic ligand present in chlorophyll is .....

a) porphyrin b) corin

c) chlorin d) histidine

51) In 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+}

52) Betain intermediates is formed in ..... reaction.

a) B.V. oxidation b) Wagner-Meerwein

c) Wittig d) Hoffmann

53) The SeO_2 reagent is primarily used to oxidize ..... position.

a) allylic b) benzylic

c) both a and b d) neither a nor b

54) Cinnamaldehyde can be prepared by ..... using benzaldehyde and acetaldehyde.

a) Aldol condensation

b) Claisen condensation

c) Perkin reaction

d) Diels-Alder reaction

55) Synthetic equivalent for alkyl anion is .....

a) Grignards reagent b) alkyl halide

c) Tollen's reagent d) alkane

56) Propene on reaction with HBr in presence of peroxide forms

a) 1-bromo-propene b) 2-bromo propene

c) 1,2-dibromo propene d) 1,3-dibromo propene

57) Alkenes form 1-2 diols on reaction with.....

a) dil. H_2SO_4 b) BH_3 and H_2O_2

c) cold aq $KMnO_4$ solution d) dilute alkali

58) Isoprene may turn into rubber on. .....

a) Heating at 280°C b) On distillation

c) Polymerization d) None of these

59) Nicotine reacts with methyl iodide to form dimethiodide and two monomethiods but it does not form acetyl or benzyl derivatives which indicates..

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

60) Drug used as an antimalerial is.....

a) proguanil b) isoniazide

c) phenobarbitone d) benzocaine

61) An antipyretic is a drug used to .....

a) control sleep b) induce sleep

c) lower body temperature d) elevate body temperature

62) In case of salt-water system, the corresponding eutectic point is called.....

a) Cryohydric point b) Quadrupole point

c) Both (a) & (b) d) None of these

63) The equilibrium system of decomposition of $CaCO_3$ involved.....phases.

a) three b) one

c) zero d) two

64) Generally the dotted lines in the phase diagram represent

a) stable equilibria b) true equilibria

c) metastable equilibria d) both a and c

65) $-(\Delta G)_{p,T}$ = ...

a) $-(\Delta A)_T$ b) W_{rev}

c) zero d) W_{net}

66) 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

67) The Miller indices of the plane cuts the three axes at 2, -1 and are .....

a) (1 2 0) b) $(1\ \bar{2}\ 0)$

c) $(1\ \bar{2}\ \infty)$ d) $(1\ \bar{2}\ \infty)$

68) The ratio d_{100} : dno: $d_{111} = 1 : 1/\sqrt{2} : 2/\sqrt{3}$, then the crystal belongs to ..... lattice.

a) Face centered cubic b) Boby centered cubic

c) Simple cubic d) Edge centered cubic

69) Which of the following properties of colloids does not depend on the charge on particles?

a) Coagulation b) Electro-osmosis

c) Electrophoresis d) Tyndall effect

70) Deriphat is..... surfactant

a) Anionic b) Cationic

c) Amphoteric d) None of this

71) Conducting polymers carry.....

a) extended conjugation b) doped impurities

c) blending of conducting element d) all of these

72) Bakelite polymer is made from which monomers?

a) Phenol and formaldehyde b) Ketone and styrene

c) Phenol and ethylene d) Ketone and aniline

73) In flame emission photometers, the measurement of.....is used for qualitative analysis.

a) velocity b) colour

c) intensity d) frequency

74) Flame photometry cannot be used for the direct detection and determination of..... metals.

a) noble b) alkali

c) non-metals d) all of these

75) Which is not a nitrogenous fertilizer

a) Superphosphate of Lime b) Urea

c) Ammonium nitrate d) Ammonium sulphate

76) In scanning electron microscopy (SEM) sample is placed at .....of assembly.

a) bottom b) middle

c) top d) anywhere

77) In electrodeposition method, the nanoparticles are deposited on .....

a) cathode b) Any electrode

c) Anode d) Positive electrode

78) ..... is an analytical technique used to determine the total nitrogen content in organic and inorganic substances

a) Gravimetric method b) Kjeldahl method

c) Photometry d) None of this

79) 50 mL of water is boiled at 373 K temperature to convert it in vapours, then the entropy of this process will be.....

a) Positive b) Negative

c) Zero d) Infinite

80) The enthalpy of formation of CO_2 is-395.5kJ. Then the enthalpy of combustion of carbon is ..... kJ

a) 395.5/12 b) 395.5

c) -395.5 d) -395,5/12

81) For a certain reaction, Rate of reaction = $k_1 \left(\frac{k_2}{k\text{-}_2}\right)^{3/2}$ [A][B]½ , then the order of reaction with respect to reactant 'A' is .....

a) 1 b) 3/2

c) ½ d) 2

82) Which of the following quantity is kept constant in Boyle's law?

a) Gas mass only

b) Gas Temperature only

c) Gas Mass and Gas Pressure

d) Gas Mass and Gas Temperature

83) The forces between two different types of molecules are termed as.....forces

a) Cohesive b) van der Walls

c) adhesive d) retention

84) According to Freundlich adsorption isotherm, a = KP ?

a) 1/T b) 1/n

c) 1/V d) $1/n^2$

85) When the foreign ions gets trapped in the growing crystal, it is called as. ....

a) Inclusion b) Mechanical Entrapment

c) Surface adsorption d) Occlusion

86) Gravimetric analysis in which weight change as a function of temperature/ time is measured is .....

a) Electrogravimetry

b) Thermogravimetry

c) Volatilisation gravimetry

d) Precipitation gravimetry

87) Who introduced first the electrochemical theory of corrosion?

a) Whitney b) Evans

c) Philips d) Haber

88) Which metal is used for the galvanization of iron?

a) Cr b) Ni

c) Zn d) Al

89) ..... principle is used in water purification technology.

a) High performance liquid chromatography

b) Size exclusion chromatography

c) Ion exchange chromatography

d) Affinity chromatography

90) The detector commonly used in liquid chromatography are.....

a) flame ionization detector b) thermal conductivity detector

c) refractive index detector d) both a and b

91) Lowest temperature at which a liquid ignites under ignition source is....

a) cetane index b) octane number

c) calorific value d) flash point

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

a) n-heptane and isooctane

c) hexadecane and isooctane

b) alpha methyl naphthalene and hexadecane

d) n-heptane and hexadecane

93) 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

94) Which of the following chelating agents is commonly used in the preservation of food?

a) Ethylene diamine tetraacetic acid (EDTA)

b) Dimercaprol

c) Deferoxamine

d) Penicillamine

95) Starch is a polysaccharide consisting of ...alcohols is most easily takes place.

a) amylose and cellulose b) amylopectin and cellulose

c) amylose and amylopectin d) cellulose and lactose

96) The methylation followed by oxidation for determination of ring size of D-glucose yields the final product .....

a) xylotrimethoxy glutaric acid b) osazone

c) glutaric acid d) gluconic acid

97) Which of the following elements has the highest number of valence electrons?

a) Sodium b) Magnesium

c) Aluminium d) Silicon

98) Cyclopentadiene is in nature

a) aromatic b) non aromatic

c) anti aromatic d) bicyclic

99) overlapping is not observed in benzene

a) sp^2-sp^2 b) sp^2-s

c) sp - sp d) p - p

100) The number of moles of solute present in 1000 grams of solvent is called as.....

a) Molarity b) Molality

c) Normality d) mole fraction

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