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Code No.
R-2108
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## Entrance Examination for Admission to the P.G. Courses in the Teaching Departments, 2023

CSS
CHEMISTRY/CHEMISTRY WITH SPECIALIZATION IN (RENEWABLE ENERGY/FUNCTIONAL MATERIALS)

## General Instructions



1. The Question Paper is having 100 Objective Questions, each carrying one mark.
2. The answers are to be $(\checkmark)$ 'tick marked' only in the "Response Sheet" provided.
3. Negative marking : $\mathbf{0 . 2 5}$ marks will be deducted for each wrong answer .

Time : 2 Hours
Max. Marks : 100

To be filled in by the Candidate

| Register <br> Number | in Figures |  |  |  |  |  |  |  |  |
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|  | in words |  |  |  |  |  |  |  |  |

Choose appropriate answer from the options in the questions.
(100 $\times 1$ = 100 marks)

1. Which one of the following has the smallest radius?
a) $\mathrm{Na}^{+}$
b) $\mathrm{Li}^{+}$
c) $\mathrm{Be}^{2+}$
d) $\mathrm{Mg}^{2+}$

2. When KCl gas is passed through a saturated solution of common salt, pure NaCl is precipitated because
a) The impurities disolve in HCl
b) HCl is highly soluble in water
c) Ionic product, $\left[\mathrm{Na}^{+}\right]\left[\mathrm{Cl}^{-}\right]$exceeds the solubility product of NaCl
d) The solubility product is lowered by $\mathrm{Cl}^{-}$ions from aqueous HCl
3. Which of the following products is obtained on heating, $\mathrm{B}_{2} \mathrm{H}_{6}$ with $\mathrm{NH}_{3}$ in the ratio (1:2) at higher temperatures?
a) $\mathrm{B}_{3} \mathrm{~N}_{3} \mathrm{H}_{3}$
b) $\mathrm{B}_{2} \mathrm{H}_{6} 2 \mathrm{NH}_{3}$
c) Boron nitride
d) $\mathrm{B}_{3} \mathrm{~N}_{3} \mathrm{H}_{6}$
4. Which of the following has pyramidal shape?
a) $\mathrm{BCl}_{2}$
b) $\mathrm{PF}_{3}$
c) $\mathrm{SO}_{2}$
d) $\mathrm{CO}_{3}^{2-}$
5. A molecule with highest bond energy is
a) Fluorine
b) Chlorine
c) Bromine
d) Iodine
6. In the dichromate ion $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}$
a) $4 \mathrm{Cr}-\mathrm{O}$ bonds are equivalent
b) $6 \mathrm{Cr}-\mathrm{O}$ bonds are equivalent
c) All $\mathrm{Cr}-\mathrm{O}$ bonds are equivalent
d) All $\mathrm{Cr}-\mathrm{O}$ bonds are non - equivalent
7. Which complex has square planar structure?
a) $\mathrm{Ni}(\mathrm{Co})_{4}$
b) $\quad\left[\mathrm{Ni}(\mathrm{CN})_{4}\right]_{2-}$
c) $\left[\mathrm{NiCl}_{4}\right]^{2-}$
d) $\left[\mathrm{Cu}\left(\mathrm{NH}_{3}\right)_{4}\right]^{2+}$
8. The trace metal present in insulin is
a) Iron
b) Cobalt
c) Zinc
d) Manganese
9. $\operatorname{CFSE}\left(\Delta_{0}\right)$ for high spin $d^{5}$ octahedral complex is
a) 1.8
b) 0
c) 2.0
d) 3.0
10. Which among the following is NOT an iron containing enzyme?
a) Urease
b) Catalase
c) Cytochrome P-450
d) Peroxidise
11. Which of the noble gas was observed in solar spectrum?
a) He
b) Ar
c) Ne
d) Rn
12. Which of the following is not possible?
a) $\mathrm{XeF}_{2}$
b) $\mathrm{XeF}_{4}$
c) $\mathrm{XeF}_{3}$
d) $\mathrm{XeF}_{6}$
13. The forces acting between noble gases are
a) Vander Waal's force
b) Ion-dipole force
c) London - dispersion force
d) Magnetic force
14. Which of the following phosphorous sulphides is used in the manufacture of "strike anywhere" matches?
a) $\mathrm{P}_{2} \mathrm{~S}_{3}$
b) $\quad P_{2} S_{5}$
c) $\mathrm{P}_{4} \mathrm{~S}_{3}$
d) None of the above
15. The end product of natural radioactive series is
a) bismuth
b) polonium
c) any isotope of lead
d) thorium
16. T-shaped inter halogen compound is
a) $\mathrm{ClF}_{5}$
b) ICl
c) $\mathrm{ClF}_{3}$
d) $\quad \mathrm{IF}_{5}$
17. A radioactive element has $t_{1 / 2}$ of 60 minutes. The amount of mass remaining after 3hrs is
a) $11.5 \%$
b) $12.5 \%$
c) $13.5 \%$
d) $14.5 \%$
18. Which metal oxide will react both with acid and base?
a) BeO
b) BaO
c) CaO
d) MgO
19. The splitting of the spectral lines under the influence of an electric field is called
a) Raman effect
b) Zeeman effect
c) Stark effect
d) Photoelectric effect
20. Transition metals are often paramagnetic owing to
a) Their high melting point and boiling point
b) The presence of vacant orbitals
c) The presence of one or more unpaired electrons in the system
d) Their being less electropositive than the elements of group I A and II A
21. In gel
a) Liquid is dispersed in solid
b) Gas is dispersed in solid
c) Liquid is dispersed in liquid
d) Solid is dispersed in solid
22. The catalyst used in the Haber process for the manufacture of ammonia is
a) Pt
b) Pd
c) Ni
d) Fe
23. Haemoglobin is a/an
a) Iron (II) complex
b) Cobalt (III) Complex
c) Magnesium (II) complex
d) Chromium (III) complex
24. Which of the following orbitals has zero probability of finding the electron in yz plane?
a) $p_{x}$
b) $p_{y}$
c) $p_{z}$
d) $d_{y z}$
25. According to VSEPR, the arrangement of lone pairs of an atom containing a total of four such pair is
a) Linear
b) Tetrahedron
c) Square planar
d) Octahedron
26. Cupellation is a process used for the refining of
a) Silver
b) Lead
c) Copper
d) Iron
27. The chemical processes in the production of steel from haematite ore involve
a) Reduction
b) Oxidation
c) Reduction followed by oxidation
d) Oxidation followed by reduction
28. The ratio of the energy of a photon of 200 nm wavelength to that of 400 nm radiation is
a) $1 / 4$
b) 4
c) $1 / 2$
d) 2
29. The number of nearest neighbours around each particles in a face centered cubic lattice is
a) 4
b) 6
c) 8
d) 12
30. Solution of pure buckminsterfullerene has a colour of
a) Green
b) Purple
c) Pink
d) Yellow
31. Which one of the following is an example for top-down approach?
a) Ball milling technique
b) Sol-gel process
c) Both (a) and (b)
d) None of the above
32. What property of metallic nanoparticles causes them to have an optical resonance?
a) Quantum confinement
b) Surface Plasmons
c) Stokes shifts
d) High cross sectional density correlation
33. The triple point of water is at
a) 273.16 K
b) 273.16 K and 760 Torr
c) 273.16 K and 4.58 Torr
d) 760 Torr
34. Only one absorption band is observed invisible region of spectrum of
a) $\left[\mathrm{Ni}\left(\mathrm{H}_{2} \mathrm{O}\right)_{6}\right]^{2+}$
b) $\mathrm{Ti}\left[\left(\mathrm{H}_{2} \mathrm{O}\right)_{6}\right]^{3+}$
c) $\left[\mathrm{Fe}(\mathrm{CN})_{6}\right]^{4-}$
d) $\mathrm{VO}_{4}^{3-}$
35. Which is the electrolyte used in Li-ion battery?
a) Lead dioxide
b) Lithium-based gel
c) Sulfur dioxide
d) Cobalt
36. Which of the following is also known as invert detergents?
a) Anionic detergents
b) Cationic detergents
c) Non-ionic detergents
d) All detergents comes in the category of invert detergents
37. Which of the following is NOT an example of a natural biodegradable polymer?
a) Collagen
b) Polyvinyl alcohol
c) Lignin
d) Natural rubber
38. The most stable carbocation is
a) $\mathrm{CH}_{3}-\mathrm{S}-\mathrm{CH}_{2}^{+}$
b) $\mathrm{CH}_{3}-\mathrm{C}^{+} \mathrm{H}-\mathrm{CH}_{3}$
c) $\mathrm{F}-\mathrm{C}^{+} \mathrm{H}_{2}$
d) $\mathrm{Cl}_{3}-\mathrm{C}^{+}$
39. The compound 2,3 dichloro butane has
a) Four stereo isomers
b) Two pairs of enantiomers
c) One pair of enantiomers
d) One pair of enantiomers and two meso compounds
40. Inductive effect is a polarisation of a
a) sigma bond
b) pi bond
c) co-ordinate bond
d) conjugated system
41. Which of the following compound has the highest boiling point?
a) n-hexane
b) n-pentane
c) 2,2-dimethyl propane
d) 2-methyl butance
42. The ease of dehydrohalogenation of alkyl halide with alcoholic KOH is
a) $3^{0}>2^{0}>1^{0}$
b) $3^{0}<2^{0}<1^{0}$
c) $3^{0}>2^{0}<1^{0}$
d) $3^{0}<2^{0}>1^{0}$
43. The epimer of glucose is
a) Fructose
b) Galactose
c) Ribose
d) Deoxyribose
44. $\alpha$-Helix is refers to
a) primary structure of protein
b) secondary structure of protein
c) tertiary structure of protein
d) quarternary structure of protein
45. The formula $\mathrm{C}_{3} \mathrm{H}_{9} \mathrm{~N}$ may represent
a) $1^{0}$ and $2^{0}$ amines
b) $\quad 2^{0}$ and $3^{0}$ amines
c) $1^{0}$ amine only
d) $1^{0}, 2^{0}$ and $3^{0}$ amines
46. Carbon and hydrogen are estimated by
a) Leibig's method
b) Dumas method
c) Kjeldhal's method
d) Carius method
47. A compound is chiral even if
a) mirror plane is present
b) centre of inversion exists
c) a rotation axis exists
d) an improper roatation axis is present
48. Alkyl halides can be converted into Grignard reagents by
a) Boiling them with Mg ribbon in alcoholic solution
b) Warming them with magnesium powder in dry ether
c) Refluxing them with $\mathrm{MgCl}_{2}$ solution
d) Warming them with $\mathrm{MgCl}_{2}$
49. During debromination of meso-dibromobutane, the major compound formed is
a) n-butane
b) 1-butene
c) cis-2-butene
d) trans 2-butene
50. What happens in photosystem II (pigment system)
a) $\mathrm{CO}_{2}$ fixation
b) photolysis of $\mathrm{H}_{2} \mathrm{O}$
c) $\mathrm{CO}_{2}$ reduction
d) all of these
51. $\qquad$ is produced by the polymerization of a diacid with a diol.
a) Polyethylene
b) Polyester
c) Poly-methane
d) Poly-ethane
52. Among the following phenols, the most acidic is
a) p-aminophenol
b) p-nitrophenol
c) o-chlorophenol
d) m-nitrophenol
53. Ziegler catalyst is
a) Chromium oxide supported over silica
b) Triethyl aluminium and titanium tetrachloride dispersed in an inert solvent
c) Alumina
d) Platinum/paladium
54. An electrophilic reagent must have
a) a vacant orbital
b) an orbital containing one electron
c) an orbital containing two electrons
d) all completely filled atomic orbitals
55. Which of the following belongs to $+I$ group
a) -OH
b) $-\mathrm{OCH}_{3}$
c) -COOH
d) $-\mathrm{CH}_{3}$
56. Chlorination of benzene proceeds via
a) nucleophilic substitution mechanism
b) electrophilic substitution mechanism
c) elimination-addition mechanism
d) addition-elimination mechanism
57. The two enantiomers differ in
a) their boiling and melting points
b) their chemical properties towards achiral reagents
c) their optical activities
d) their solubilities in a solvent
58. The colour of ${ }_{62} \mathrm{Sm}^{3+}$ is yellow. The expected colour of ${ }_{66} \mathrm{Dy}^{3+}$ is
a) Colourless
b) Yellow
c) Red
d) Blue
59. The Cannizzaro reaction is NOT given by
a) trimethylacetaldehyde
b) benzaldehyde
c) acetaldehyde
d) formaldehyde
60. In the Friedel-Crafts acylation, the electrophile is
a) $\mathrm{C}_{6} \mathrm{H}_{5}^{+}$
b) $\mathrm{AlCl}_{3}^{-}$
c) $\mathrm{CH}_{3} \mathrm{CO}^{+}$
d) $\mathrm{C}_{6} \mathrm{H}_{5} \mathrm{CH}_{2}^{+}$
61. Williamson's synthesis involves
a) $\mathrm{S}_{\mathrm{N}} 1$ mechanism
b) nucleophilic addition
c) $\mathrm{S}_{\mathrm{N}} 2$ mechanism
d) $S_{E}$ mechanism
62. Oxalic acid when reduced with zinc and $\mathrm{H}_{2} \mathrm{SO}_{4}$ gives
a) glyoxalic acid
b) glyoxal
c) glycolic acid
d) glycol
63. Cross aldol condensation occurs between
a) Two same aldehydes
b) Two same ketones
c) Two different aldehydes and ketones
d) None of the above
64. Night blindness may be caused by the deffciency of Vitamin
a) A
b) $B$
c) $D$
d) C
65. An azo dye is formed by interaction of an aromatic diazonium chloride with
a) A phenol
b) An aliphatic primary amine
c) Benzene
d) Nitrous acid
66. Acetic acid is manufactured by the fermentation of which of the following reaction?
a) Ethanol
b) Methanol
c) Ethanal
d) Methanal
67. Which class of compounds shows H -bonding even more than in alcohols?
a) Phenols
b) Carboxylic acids
c) Ethers
d) Aldehydes
68. Which of the following reagents is used in Oppenauer oxidation?
a) $\mathrm{SeO}_{2}$
b) $\mathrm{OsO}_{4}$
c) Ozone
d) Aluminium isopropoxide
69. Which base is present in RNA but not in DNA?
a) Cytosine
b) Guanine
c) Thymine
d) Uracil
70. If latent heat of vaporisation is $L$ at boiling point $T(K)$ then entropy of vaporisation is
a) LT
b) $\mathrm{LT}^{-1}$
c) $\mathrm{TL}^{-1}$
d) None of these
71. At lower temperatures, all gases except $\mathrm{H}_{2}$ and He show
a) Negative deviation
b) Positive deviation
c) Positive and negative deviation
d) None of the above
72. Photochemical smog is caused by
a) CO
b) $\mathrm{CO}_{3}$
c) $\mathrm{O}_{3}$
d) $\quad \mathrm{NO}_{2}$
73. In Bragg equation, $n$ represents
a) number of electrons
b) number of atoms
c) principal quantum number
d) order of diffraction
74. A $6 \%$ solution of urea is isotonic with
a) 1 M solution of glucose
b) $\quad 0.05 \mathrm{M}$ solution of glucose
c) $6 \%$ solution of glucose
d) $25 \%$ solution of glucose
75. Azeotropic mixture are
a) Constant temperature boiling mixture
b) Those which boils at different temperature
c) Mixture of two solids
d) None of the above
76. The vant's Hoff factor for $0.1 \mathrm{M} \mathrm{Ba}\left(\mathrm{NO}_{3}\right)_{2}$ solution is 2.74. The degree of dissociation is
a) $91.3 \%$
b) $87 \%$
c) $100 \%$
d) $74 \%$
77. On passing 0.1F of electricity through aluminium metal deposited at cathode is ( $\mathrm{Al}=27$ )
a) 0.3 g
b) $\quad 0.6 \mathrm{~g}$
c) 0.9 g
d) 1.2 g
78. Which of the following bonds will show an absorption band at the greatest wave number?
a) $\mathrm{C}=\mathrm{C}$
b) $\mathrm{O}-\mathrm{H}$
c) $\mathrm{C}-\mathrm{H}$
d) $\mathrm{C} \equiv \mathrm{C}$
79. A solution shows absorbance $A=1.0$. The $\%$ radiation absorbed by the sample is
a) 10
b) 50
c) 90
d) 100
80. Which is the radiation employed in NMR spectroscopy
a) Radio frequency
b) Microwave
c) X ray
d) Gamma ray
81. The EPR spectrum of phenyl radical $\left(\mathrm{C}_{6} \mathrm{H}_{5}\right)$ shows
a) 6 lines
b) 18 lines
c) 24 lines
d) 36 lines
82. The amount of heat required to raise the temperature of 100 gm water from $20^{\circ} \mathrm{C}$ to $40^{\circ} \mathrm{C}$ will be
a) 100 calorie
b) $\mathbf{2 0 0 0}$ calorie
c) 4000 calorie
d) Zero
83. The temperature which is same in ${ }^{\circ} \mathrm{C}$ and ${ }^{\circ} \mathrm{F}$ is
a) 40
b) $\quad-40$
c) 20
d) -20
84. $\mathrm{dW}=(-\mathrm{dU})$ is true for the process
a) isothermal
b) isobaric
c) adiabatic
d) isochoric
85. The molecule that has an S6 symmetry element is
a) $\mathrm{B}_{2} \mathrm{H}_{6}$
b) $\mathrm{CH}_{4}$
c) $\mathrm{PH}_{5}$
d) $\mathrm{SF}_{6}$
86. An example of an intensive property is
a) Volume
b) Mass
c) Pressure
d) Entropy
87. Which one is NOT ungerade orbital?
a) $\sigma * 1 s$
b) $\quad \sigma * 2 s$
c) $\sigma 2 \mathrm{~s}$
d) $\pi 2 p y$
88. The highest occupied molecular orbital of HF is
a) Bonding
b) Antibonding
c) Ionic
d) Non bonding
89. Lyophilic sols are stabler than lyophobic sols because the particles in lyophils are
a) Smaller
b) Larger
c) Lighter
d) Solvated
90. In the determination of gold number of a lyophil, the electrolyte employed to coagulate the sol is 1 ml of
a) $10 \% \mathrm{NaCl}$
b) $5 \% \mathrm{NaCl}$
c) $10 \% \mathrm{KCl}$
d) $5 \% \mathrm{KCl}$
91. The half life of a first order reaction varies with temperature according to
a) $\quad \ln t_{1 / 2} \propto 1 / T$
b) $\quad \ln t_{1 / 2} \propto T$
c) $t_{1 / 2} \propto 1 / T^{2}$
d) $t_{1 / 2} \propto T^{2}$
92. Phosphorescence re-emit excess radiation within
a) $10^{-6}$ to $10^{-4}$ seconds
b) $10^{-4}$ to 20 seconds
c) 10 sec to 50 seconds
d) 1 minute
93. The pick colour of phenolphthalein in alkaline medium is due to
a) the acidic form of phenolphthalein
b) the anionic form of phenolphthalein
c) OH -of the base
d) the non conjugated structure of phenolphthalein
94. Which of the following spectral series of hydrogen atom lies in the ultra violet region of electromagnetic radiation?
a) Lyman
b) Balmer
c) Paschen
d) Brackett
95. Which of the following statements is true with respect to the extent of physisorption?
a) Increases with increase in temperature
b) Decreases with increase in surface area
c) Decreases with increase in the strength of Vander Waals forces
d) Decreases with increase in temperature
96. Water $\qquad$ on melting and has the fusion curve with a $\qquad$ slope.
a) contracts, negative
b) contracts, positive
c) expands, negative
d) expands, positive
97. Diastase takes part in digestion of which one:
a) Protein
b) Starch
c) Amino acids
d) Fat
98. Which of the following is a diamagnetic material?
a) Sodium
b) Calcium
c) Oxygen (at STP)
d) Nitrogen (at STP)
99. Organic functional group vibrations appear in
a) FIR
b) MIR
c) NIR
d) UV
100. According to Faraday's second law, the masses of different substances deposited or liberated by the passage of the same quantity of electricity are proportional to their
a) Chemical equivalent weight
b) Quantity of electricity
c) Electrochemical equivalent
d) Volume

## ANSWER SHEET



