

U.G./P.G. ENTRANCE EXAMINATION, APRIL 2021 :

APPLIED CHEMISTRY

Time : Two Hours

Maximum : 100 Marks

*Answer all questions.
Each question carries 1 mark.*

- The colour of potassium dichromate is due to :
 - d-d transition.
 - Transition in K^+ ions.
 - Ligand to metal charge transfer.
 - Metal to ligand charge transfer.
- The ionic radii of Ca^{2+} and F^- are 100 p.m. and 133 p.m. respectively. The co-ordination number of Ca^{2+} in the ionic solid will be :
 - 8.
 - 6.
 - 4.
 - 2.
- The half-life of a radioactive nuclide is 20 years. If a sample of this nuclide has an activity of 6400 disintegrations per minute today, its activity after 100 years would be :
 - 850.
 - 1,600.
 - 200.
 - 400.
- Which among the following has an -O-O- linkage :
 - $H_2S_2O_6$.
 - $H_2S_2O_8$.
 - $H_2S_2O_3$.
 - $H_2S_4O_6$.
- According to K, Fajan's rule, polarization is high with :
 - Small cations and small anions.
 - Small cations and large anions.
 - Large cations and large anions.
 - Large cations and small anions.

Turn over

6. The oxidation state of chlorine is +7 in :
- (A) HClO_4 . (B) ClO_2 .
(C) HClO_3 . (D) HOCl .
7. Oxygen is not evolved when ozone reacts with :
- (A) Potassium iodide. (B) Mercury.
(C) Sulfur dioxide. (D) Hydrogen peroxide.
8. Inorganic benzene is :
- (A) BN . (B) $\text{B}_3\text{N}_3\text{H}_6$.
(C) B_2H_6 . (D) $\text{B}_3\text{O}_3\text{H}_6$.
9. Copper displaces the metal in the salt solution of :
- (A) Silver nitrate. (B) Zinc sulfate.
(C) Ferrous sulfate. (D) Ferric sulfate.
10. The similarity between Li and Mg is due to :
- (A) Their high reactivity. (B) High electropositive nature.
(C) Similar ionic radii. (D) Low electronegative nature.
11. The geometry of XeF_4 is :
- (A) Tetrahedral. (B) Triangular bipyramidal.
(C) Square planar. (D) Planar.
12. The rare gas which shows the greatest chemical reactivity is :
- (A) Neon. (B) Krypton.
(C) Xenon. (D) Argon.

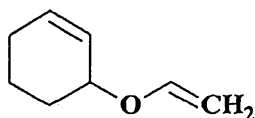
13. Which of the following chloride is not hydrolyzed by water :
- (A) CCl_4 . (B) TiCl_4 .
(C) SiCl_4 . (D) VCl_4 .
14. H_3PO_2 is a :
- (A) Monobasic acid. (B) Dibasic acid.
(C) Amphoteric. (D) Tribasic acid.
15. When glass is treated with HF ——— is produced.
- (A) NaF . (B) CaF_2 .
(C) H_2SiF_6 . (D) SiF_6 .
16. The chief raw material in the manufacture of cement are :
- (A) Sand and limestone. (B) Gypsum and clay.
(C) Sodium and calcium silicates. (D) Limestone and clay.
17. Sodalime is :
- (A) CaO . (B) NaOH . CaO .
(C) $\text{Ca}(\text{OH})_2$. (D) Na_2CO_3 .
18. Variable valency is exhibited by :
- (A) Strontium. (B) Beryllium.
(C) Copper. (D) Aluminium.
19. Sodium metal is obtained by the :
- (A) Electrolysis of aqueous NaCl . (B) Heating Na_2O with H_2 .
(C) Heating fused NaCl . (D) Electrolysis of fused NaCl .

Turn over

20. Bleaching action of SO_2 is due to its :

- (A) Acidic nature. (B) Oxidizing action.
 (C) Reducing action. (D) Ability to hydrolysis.

21. Thermal rearrangement of the following compound will give :



- (A) (B)
- (C) (D)

22. During Wittig reaction, a phosphorus ylide gets converted to :

- (A) R_3P . (B) $\text{R}_3\text{P} = \text{O}$.
 (C) $\text{R}_3\text{P}^+\text{HOH}^-$. (D) $\text{R}_2\text{P} - \text{PR}_2$.

23. The major product obtained in the photochemical bromination of methyl cyclopentane is :

- (A) (B)
- (C) (D)

24. Which among the following is the most stable carbocation ?
- (A) $(\text{CH}_3)_3\text{C}^+$. (B) $(\text{C}_6\text{H}_5)_3\text{C}^+$.
(C) $(\text{CH}_3)_2\text{CH}^+$. (D) $(\text{C}_6\text{H}_5)_2\text{CH}^+$.
25. The catalyst used in Rosenmund reduction is :
- (A) Zn/Hg. (B) Pd/BaSO₄.
(C) LiAlH₄. (D) Na/C₂H₅OH.
26. Anti-Markownikoff addition of hydrogen halides to unsymmetrical olefins occurs in the presence of :
- (A) Diphenylamine. (B) Iodine.
(C) Organic peroxides. (D) Anhydrous AlCl₃.
27. Oppenauer oxidation is the oxidation of :
- (A) Primary alcohol to aldehyde. (B) Secondary alcohol to ketone.
(C) Ketones to acids. (D) Aldehydes to acids.
28. Which among the following on reduction with LiAlH₄ does not give a primary alcohol ?
- (A) Carboxylic acid. (B) Ester.
(C) Acid anhydride. (D) Ketone.
29. Grignard when reagent reacts with _____ gives secondary alcohol.
- (A) Water. (B) Acetaldehyde.
(C) Acyl chloride. (D) Ethylacetate.
30. Phenol can easily be separated from benzoic acid effectively by the use of :
- (A) Sodium bicarbonate. (B) Sodium hydroxide.
(C) Diethyl ether. (D) Hot water.

Turn over

31. The halide which does not give a precipitate when warmed with alcoholic silver nitrate is :
- (A) Allyl chloride. (B) Benzyl chloride.
(C) Chlorobenzene. (D) *t*-butyl chloride.
32. The Sandmeyer reaction of a diazonium salt is the replacement of nitrogen (N_2) by :
- (A) Hydrogen. (B) Halogen.
(C) Hydroxyl group. (D) Carbonyl group.
33. The reduction product of a cyanide is a :
- (A) Primary amine. (B) Secondary amine.
(C) Tertiary amine. (D) Alkane.
34. Benzene on treatment with chlorine in presence of sunlight gives :
- (A) Ortho-dichlorobenzene. (B) 2, 4, 6-trichlorobenzene.
(C) Chlorobenzene. (D) Benzene hexachloride.
35. Phenol on heating with Zinc powder gives :
- (A) Benzene. (B) Cyclohexane.
(C) Cyclohexene. (D) Cyclohexanol.
36. Picric acid is obtained by the nitration of :
- (A) Phenol. (B) Aniline.
(C) Nitrobenzene. (D) Cresol.
37. Glucose on oxidation with bromine water gives :
- (A) Gluconic acid. (B) Glutaric acid.
(C) Glycolic acid. (D) Glycerol.

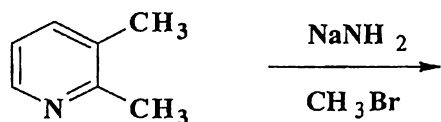
38. When benzaldehyde on heating with concentrated NaOH gives ?

- (A) Benzyl alcohol + sodium phenolate.
- (B) Benzoic acid + sodium phenolate.
- (C) Benzyl alcohol + sodium benzoate.
- (D) Sodium phenolate + sodium benzoate.

39. Aniline is prepared by the :

- (A) Reaction of benzene with ammonia.
- (B) Reduction of nitrobenzene with Sn/HCl.
- (C) Dehydrogenation of nitrobenzene.
- (D) Reaction of nitrobenzene with $I_2/NaOH$.

40. The major product in the following reaction is :



- (A)
- (B)
- (C)
- (D)

41. The pH of a 1×10^{-8} M HCl is close to :

- (A) 8.0.
- (B) 7.1.
- (C) 6.9.
- (D) 6.0.

Turn over

42. When 100 g of water is reversibly heated from 50°C to 75°C at 1.0 atm, the change in entropy (JK^{-1}) of the universe is :
- (A) 0. (B) 0.31.
(C) - 2.31. (D) 3.1
43. The maximum number of phases that can co-exist in equilibrium for a one component system is :
- (A) 1. (B) 2.
(C) 3. (D) 4.
44. The work done during the process when one mole of gas is allowed to expand freely into vacuum is _____.
- (A) 1. (B) 0.
(C) 3. (D) 4.
45. The dissociation constant of a substituted benzoic acid is 1.0×10^{-4} (at 25°C). The pH of a 0.01 M solution of its sodium salt is :
- (A) 8. (B) 6.
(C) 4. (D) 5.
46. The unit of rate constant (k) for a zero order reaction is :
- (A) s^{-1} . (B) $\text{L Mole}^{-1} \text{s}^{-1}$.
(C) s . (D) $\text{Mole L}^{-1} \text{s}^{-1}$.
47. Copper crystallizes in 'fcc' with a unit cell length of 361 pm. The radius of copper atom is :
- (A) 181 pm. (B) 108 pm.
(C) 127 pm. (D) 157 pm.
48. In the case of an ideal gas undergoing isothermal transformation, its energy :
- (A) Increases as pressure increases. (B) Decreases as volume decreases.
(C) Decreases as pressure increases. (D) Decreases as volume increases.

49. For two moles of an ideal gas :

(A) $C_p - C_v = R$.

(B) $C_p - C_v = R/2$.

(C) $C_v - C_p = -2R$.

(D) $C_p - C_v = 0$.

50. Attractive forces and size effects in a gas become negligible :

(A) At low pressure and high temperature.

(B) At high pressure and high temperature.

(C) When both temperature and pressure are low.

(D) When both temperature and pressure are high.

51. The average speed of a molecule is :

(A) Directly proportional to the square of temperature.

(B) Directly proportional to the square root of temperature.

(C) Directly proportional to the temperature.

(D) Independent of the temperature.

52. The amount of gas absorbed on charcoal increases with :

(A) Temperature and pressure.

(B) Temperature.

(C) Temperature decrease and pressure increase.

(D) Temperature and decrease with pressure.

53. Viscosity of a gas is :

(A) Independent of pressure at constant temperature.

(B) Invariably proportional to the mean free path.

(C) Decrease with temperature.

(D) Independent of temperature.

54. The surface tension of a liquid has the dimensions of :

(A) Work per unit area.

(B) Force per unit area.

(C) Work per unit length.

(D) Force per unit length.

Turn over

55. The inversion temperature of a gas is :
- (A) Lower than the critical temperature.
 - (B) Higher than the critical temperature.
 - (C) Depends on the nature of the gas.
 - (D) Equal to the critical temperature.
56. In the colloidal state, the particle size ranges from _____ Å.
- (A) 1 to 20.
 - (B) 20 to 50.
 - (C) 50 to 2000.
 - (D) Above 2000.
57. The inductance cell is platinized to :
- (A) Prolong its service.
 - (B) Avoid temperature effects.
 - (C) Avoid capacitance of the cell.
 - (D) Avoid polarization effects.
58. The Collision theory is satisfactory for _____ reactions.
- (A) Bimolecular.
 - (B) Uni-molecular.
 - (C) Zero order.
 - (D) Fractional order.
59. Total number of variables defining a system of 'C' components with 'P' phases is :
- (A) $C(P - 1)$.
 - (B) $C - P + 2$.
 - (C) $C + P + 2$.
 - (D) $P(C - 1) + 1$.
60. Fluidity is defined as :
- (A) Reciprocal of surface tension.
 - (B) Reciprocal of viscosity.
 - (C) Square of surface tension.
 - (D) Square of viscosity.
61. For a particle in a cubic box, the total number of quantum numbers needed to specify the states are :
- (A) 1.
 - (B) 2.
 - (C) 3.
 - (D) 9.

62. The fundamental particle responsible for keeping the nucleus together is :
- (A) Meson. (B) Hyperon.
(C) Positron. (D) Muon.
63. ——— Series of lines in the atomic spectrum of hydrogen is in the visible region.
- (A) Lyman. (B) Paschen.
(C) Balmer. (D) Pfund.
64. The Bohr concept of the electron orbit in an atom contradicts :
- (A) De Broglie Relation. (B) Uncertainty Principle.
(C) Plank's Hypothesis. (D) Coulomb's Law.
65. The photo-electric effect is an example of the :
- (A) Wave nature of electrons. (B) Wave nature of light.
(C) Particle nature of electrons. (D) Particle nature of light.
66. The neutral atoms of all of the isotopes of the same element have :
- (A) Different numbers of protons. (B) Equal numbers of neutrons.
(C) The same number of electrons. (D) The same mass numbers.
67. The emission spectrum of gold shows a line of wavelength 2.676×10^{-7} m. How much energy is emitted as the excited electron falls to the lower energy level ?
- (A) 7.43×10^{-19} J. (B) 5.30×10^{-20} J.
(C) 6.05×10^{-19} J. (D) 3.60×10^{-20} J.
68. All of the following properties of the alkaline earth metals increase going down the group *except* :
- (A) Atomic radius. (B) First ionization energy.
(C) Ionic radius. (D) Atomic volume.

Turn over

69. A neutral molecule having the general formula AB_3 has two unshared pair of electrons on A. What is the hybridization of A ?
- (A) sp^2 . (B) sp^3 .
(C) sp^3d^2 . (D) sp^3d .
70. Antibonding molecular orbitals are produced by :
- (A) Constructive interaction of atomic orbitals.
(B) Destructive interaction of atomic orbitals.
(C) The overlap of the atomic orbitals of two negative ions.
(D) The overlap of the atomic orbitals of two positive ions.
71. Which among the following does not cause hardness of water ?
- (A) $CaCl_2$. (B) $MgCl_2$.
(C) $CaSO_4$. (D) Na_2SO_4 .
72. In the Bronsted-Lowry system, a base is defined as :
- (A) A proton donor. (B) A hydroxide donor.
(C) A proton acceptor. (D) An electron-pair acceptor.
73. The volume of a sample of nitrogen is 6.00 liters at $35^\circ C$ and 740 torr. What volume will it occupy at STP ?
- (A) 5.18 L. (B) 51.8 L.
(C) 0.518 L. (D) 1.36 L.
74. A real gas most closely approaches the behaviour of an ideal gas under conditions of :
- (A) High pressure and low temperature.
(B) Low pressure and high temperature.
(C) Low pressure and temperature.
(D) High pressure and temperature.

75. What is the freezing point of an aqueous 1.00 m. NaCl solution ?
($K_f = 1.86 \text{ }^\circ\text{C/m.}$) (Assume complete dissociation of the salt.)
- (A) $- 1.86^\circ\text{C.}$ (B) $- 3.72^\circ\text{C.}$
(C) $+ 1.86^\circ\text{C}$ (D) $- 0.93^\circ\text{C.}$
76. The equilibrium constant for a reaction that has a ΔG° value of $- 41.8 \text{ kJ}$ at 100°C is :
- (A) 13.5. (B) $7.1 \times 10^5.$
(C) $- 5.87.$ (D) $1.4 \times 10^{-6}.$
77. Which of the following combinations *cannot* produce a buffer solution ?
- (A) HClO_4 and $\text{NaClO}_4.$ (B) HNO_2 and $\text{NaNO}_2.$
(C) NH_3 and $(\text{NH}_4)_2\text{SO}_4.$ (D) NH_3 and $\text{NH}_4\text{Br.}$
78. In the process known as 'roasting,' _____ is chemically converted to _____.
- (A) A sulfide; an oxide. (B) A carbonate; an oxide.
(C) A sulphate; an oxide. (D) A phosphate; a phosphide.
79. The "magic numbers" for atoms are :
- (A) Numbers of electrons that confer atomic stability.
(B) Numbers of protons and/or neutrons that confer nuclear stability.
(C) Atomic masses that confer nuclear stability.
(D) Atomic masses that indicate fissile isotopes.
80. "Oil of mirbane" is the most common name of which among the following ?
- (A) Phenol. (B) Toluene.
(C) Phenolphthalein. (D) Nitrobenzene.
81. Rose metal is an alloy of :
- (A) Nickel, Tin and Palladium. (B) Bismuth, Copper and Zinc.
(C) Palladium, Tin and Lead. (D) Bismuth, Tin and Lead.

Turn over

82. Which of the following is the purest form of Iron ?
- (A) Pig iron. (B) Cast iron.
(C) Wrought iron. (D) Steel.
83. What is the probability of finding an electron at a point within an atom ?
- (A) Proportional to the square of the orbital wave function.
(B) Proportional to the orbital wave function.
(C) Proportional to the twice of the orbital wave function.
(D) Proportional to the cube of the orbital wave function.
84. The catalyst used in Ziegler-Natta process is :
- (A) AlCl_3 . (B) V_2O_5 .
(C) Ni. (D) TiCl_4 and Et_3Al .
85. The acid added in permanganate titration is :
- (A) Sulfuric acid. (B) Nitric acid.
(C) Oxalic acid. (D) Hydrochloric acid.
86. Sodium bismuthate is used for testing :
- (A) Co. (B) Ni.
(C) Mn. (D) Al.
87. In the flame test, concentrated hydrochloric acid is added to :
- (A) Dissolve the solid sample.
(B) Form volatile chlorides.
(C) Oxidize the anionic component present in the sample.
(D) Reduce the anionic component present in the sample.

88. Lead nitrate on heating leaves a yellow residue. The residue is :
- (A) PbO_2 . (B) PbO .
(C) Pb_3O_4 . (D) HPbO_4 .
89. EDTA is ——— ligand.
- (A) An octa-dentate. (B) A tetra-dentate.
(C) A bi-dentate. (D) A hexa-dentate.
90. A sintered glass crucible is used for :
- (A) Filtration under suction. (B) Filtering colloidal substances.
(C) Drying precipitate. (D) Igniting precipitate.
91. Which of the following is used both in acid-base and red-ox titrations ?
- (A) Potassium hydroxide. (B) Potassium dichromate.
(C) Acetic acid. (D) Oxalic acid.
92. Which among the following is a primary standard ?
- (A) Sodium thiosulfate. (B) Sodium hydroxide.
(C) Sodium carbonate. (D) Potassium permanganate.
93. Thin Layer Chromatography is used to :
- (A) Determine the molecular weight of compounds.
(B) Identify the number of compounds.
(C) Analyse the compounds.
(D) Separate the compounds.
94. Which among the following will form a picrate ?
- (A) Urea. (B) Glucose.
(C) Naphthalene. (D) Acetone.

Turn over

95. Alkaline KMnO_4 solution is known as :
- (A) Baeyer's reagent. (B) Borsches reagent.
(C) Luca's reagent. (D) Schiff's reagent.
96. A substance containing N and S, on fusion with Na give a Lassaigne's solution containing.
- (A) Na_2S and NaCN . (B) NaCNS only.
(C) NaCN and CS_2 . (D) NaNH_2 and NaS .
97. Among the solvents used in the laboratory, the most inflammable is :
- (A) Carbon tetrachloride. (B) Acetone.
(C) Diethyl ether. (D) Benzene.
98. The composition of 'golden spangles' is :
- (A) As_2S_3 . (B) PbCrO_4 .
(C) BaCrO_4 . (D) PbI_2 .
99. Mohr's salt is :
- (A) $(\text{NH}_4)_2 \text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$. (B) $\text{NH}_4 \cdot \text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$.
(C) $(\text{NH}_4)_2 \text{Fe}(\text{SO}_4)_2 \cdot 24 \text{H}_2\text{O}$. (D) $\text{NH}_4 \text{Fe}(\text{SO}_4)_2 \cdot 5\text{H}_2\text{O}$.
100. The indicator phenolphthalein changes colour at pH - 9.0. This is not suitable for accurate determination of the end point in the titration of :
- (A) CH_3COOH with NaOH . (B) HCl with NH_4OH .
(C) HCl with NaOH . (D) HCl with KOH .