COMMON P. G. ENTRANCE TEST – 2020

Test Booklet No. :

DEPT. OF HIGHER EDUCATION, GOVT. OF ODISHA

TEST BOOKLET

Subject Code **15** **Subject** **CHEMISTRY**

*Time Allowed : **90** Minutes* *Full Marks : **70***

: INSTRUCTIONS TO CANDIDATES :

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. You have to enter your **Hall Ticket No.** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
3. **YOU ARE REQUIRED TO FILL UP & DARKEN HALL TICKET NO. & TEST BOOKLET NO. IN THE ANSWER SHEET AS WELL AS FILL UP TEST BOOKLET SERIAL NO. & ANSWER SHEET SERIAL NO. IN THE ATTENDANCE SHEET CAREFULLY. WRONGLY FILLED UP ANSWER SHEETS ARE LIABLE FOR REJECTION AT THE RISK OF THE CANDIDATE.**
4. **This Test Booklet contains 70 items (questions). Each item (question) comprises four responses (answers). You have to select the correct response (answer) which you want to mark (darken) on the Answer Sheet. In case, you feel that there is more than one correct response (answer), you should mark (darken) the response (answer) which you consider the best. In any case, choose ONLY ONE response (answer) for each item (question).**
5. You have to mark (darken) all your responses (answers) **ONLY** on the **separate Answer Sheet** provided by **using BALL POINT PEN (BLUE OR BLACK)**. See instructions in the Answer Sheet.
6. All items (questions) carry equal marks. All items (questions) are compulsory. Your total marks will depend only on the number of correct responses (answers) marked by you in the Answer Sheet. **There is no negative marking**.
7. **After you have completed filling in all your responses (answers) on the Answer Sheet and after conclusion of the examination, you should hand over to the Invigilator the *Answer Sheet* issued to you. You are allowed to take with you the candidate's copy / second page of the Answer Sheet along with the Test Booklet, after completion of the examination, for your reference.**
8. Sheets for rough work are appended in the Test Booklet at the end.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

1. Which one of the following compounds gives a primary alcohol upon reaction with methyl magnesium bromide ?

   (A) Ethylene oxide

   (B) Propylene oxide

   (C) Ethyl formate

   (D) Carbon dioxide

2. Which one of the following statements is correct for alkyl halide ?

   (A) Alkyl halide will always show S_N1 mechanism

   (B) In a unimolecular reaction increasing the temperature does not favour E1 mechanism

   (C) E1 mechanism is favored over S_N1 mechanism for primary alkyl halides

   (D) E1 mechanism is favored over S_N1 mechanism for tertiary alkyl halides

3. Aryl halides are less reactive towards nucleophilic substitution reactions as compared to alkyl halides. This is due to :

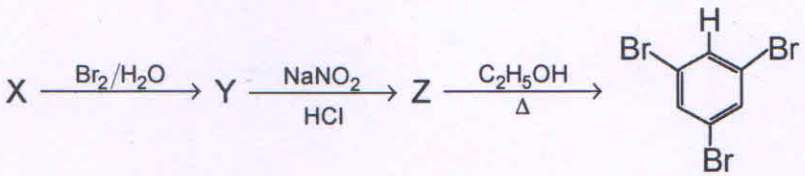
   (A) The formation of a less stable carbanion

   (B) The inductive effect

   (C) Longer carbon halogen bond

   (D) sp^2-hybridized carbon attached to the halogen

4. Identify the reactant 'X' in the following reaction sequence :



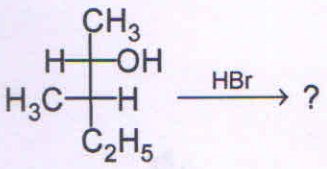
   (A) Benzoic acid

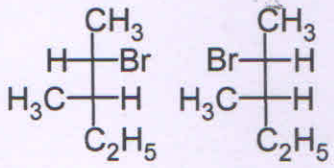
   (B) Salicylic acid

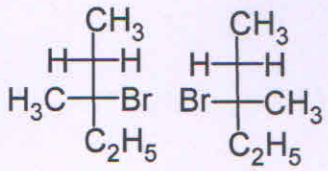
   (C) Aniline

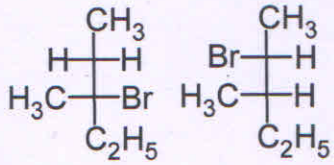
   (D) Phenol

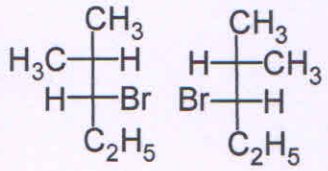
5. Which one of the following structures represent the major products in the following reaction ?



(A) 

(B) 

(C) 

(D) 

6. If 2-methyl butane will be subjected to monobromination, then how many isomers will it form ?

(A) 4

(B) 6

(C) 5

(D) 2

7. Calculate the λ_{max} value for the following compound using Woodward and Fischer rules :

(A) 254 nm

(B) 279 nm

(C) 290 nm

(D) 315 nm

8. Which one of the following compounds with molecular formula $C_4H_9NO_2$ shows ^{1}H-NMR peaks at δ 5.30 (broad, 1H), 4.10(q, 2H), 2.80 (d, 3H) and 1.20 (t, 3H) ppm ?

(A) $CH_3CH_2NHCOOCH_3$

(B) $CH_3OCH_2CONHCH_3$

(C) $CH_3NHCOOCH_2CH_3$

(D) $CH_3CH_2OCH_2CONH_2$

9. The sodium extract of an organic compound develops a blood-red color on treatment with $FeCl_3$ solution. The ion responsible for this color test is :

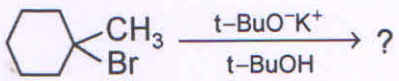
(A) CN^-

(B) NCS^-

(C) CNO^-

(D) S^{2-}

10. Which one of the following statements is correct regarding the following reaction ?



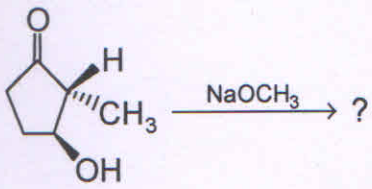
(A) Major product is endocyclic alkene formed according to Saytzeff

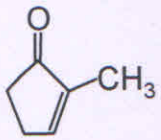
(B) Major product is exocyclic alkene formed according to Saytzeff

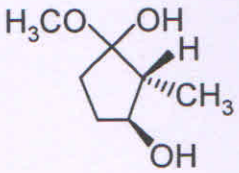
(C) Major product is endocyclic alkene formed according to Hoffmann

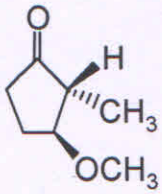
(D) Major product is exocyclic alkene formed according to Hoffmann

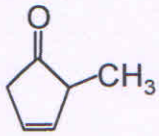
11. Suggest the product of the following reaction :



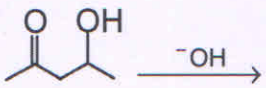
(A) 

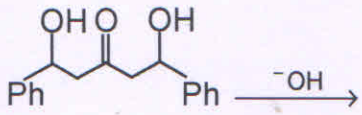
(B) 

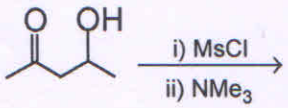
(C) 

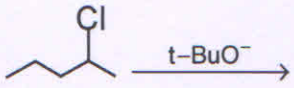
(D) 

12. Which one of the following reactions is not an example of E1CB reaction ?

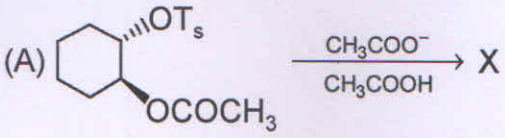
(A) 

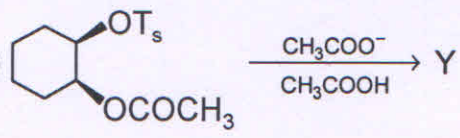
(B) 

(C) 

(D) 

13. What is the correct statement for the given reactions ?

(A) 

(B) 

(A) B reacts faster than A

(B) Both give the same product

(C) A gives *cis*- and B gives *trans*-product

(D) A gives *trans*- and B gives *cis*-product

14. Which is the correct order of nucleophilicity in the following options ?

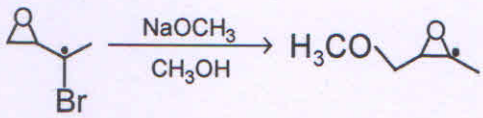
(A) $(CH_3)_3CO^- > CH_3^-$

(B) $(CH_3CH_2)_3N > (CH_3CH_2)_3P$

(C) $CH_3S^- > CH_3SH$

(D) $CH_3CH_2CH_2O^- < (CH_3)_3CO^-$

15. Which one of the following statements is true about the reaction given below ?



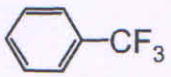
(A) It proceeds via a concerted S_N2 pathway

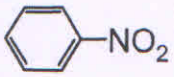
(B) It involves a carbanion intermediate

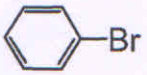
(C) It involves a carbocation intermediate

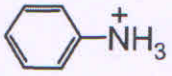
(D) It proceeds via a concerted S_N1 pathway

16. Which one of the following substituents on the benzene ring is not a meta directing group in an electrophilic substitution reaction?

(A) 

(B) 

(C) 

(D) 

17. Which one of the following alkanes exhibits optical activity ?

(A) Neopentane

(B) Isopentane

(C) 3–Methylpentane

(D) 3–Methylhexane

18. What will be the most appropriate reagent for the following transformation ?

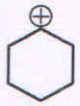
(A) CH_2N_2

(B) $Ph_3P{=}CH_2$

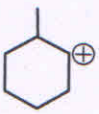
(C) CH_3Li

(D) $(CH_3)_2CuLi$

19. Which one of the following carbocations is the most stable ?

(A) 

(B) 

(C) 

(D) 

20. Name the process associated with acylation of benzene :

(A) Friedel craft reaction

(B) Wurtz reaction

(C) Wurtz fitting reaction

(D) Aldol reaction

21. Which one of the following statements is incorrect ?

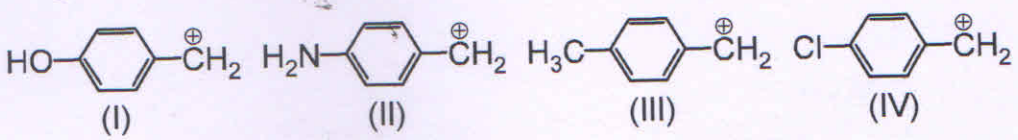
(A) First step in photochemistry is the excitation of electron

(B) When a molecule or atom in the ground state (S_0) absorbs light, one electron is excited to a higher orbital level

(C) Photochemical reactions are caused by absorption of ultraviolet light only

(D) It is possible for the excited state S_1 to undergo spin inversion

22. Arrange the following intermediates in the descending order of their stabilities :



(I) (II) (III) (IV)

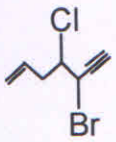
(A) I > II > III > IV

(B) II > IV > III > I

(C) II > I > IV > III

(D) II > I > III > IV

23. The IUPAC name of the following compound is :



(A) 5-bromo-4-chlorohept-1-en-6-yne

(B) 5-bromo-4-chlorohept-6-en-1-yne

(C) 3-bromo-4-chlorohept-6-en-1-yne

(D) 3-bromo-4-chlorohept-1-en-6-yne

24. Which type of macromolecule carries out catalysis in biological systems ?

(A) Proteins

(B) Carbohydrates

(C) Lipids

(D) Nucleic acids

25. A nucleotide is constituted from which of the following units ?

(A) Nitrogen base and phosphate

(B) Nitrogen base, sugar and phosphate

(C) Nitrogen base and sugar

(D) Sugar and phosphate

26. The change in free energy of a reaction at equilibrium is :

(A) Negative

(B) Positive

(C) Zero

(D) Difficult to predict

27. If doubling the initial concentration of a reactant doubles the half-life period ($t_{1/2}$) of the reaction, then the order of the reaction is :

(A) 3 (B) 2

(C) 1 (D) 0

28. If ψ is the wave function, then what is the probability of finding an electron in a given region within the atom ?

(A) ψ (B) ψ^3

(C) ψ^2 (D) $\psi^{1/2}$

29. One coulomb is the charge of :

(A) One mole of electron (B) 1/96500 mole of electron

(C) 96500 mole of electron (D) None of these

30. The pressure correction in the van der Waals equation is due to the :

(A) Attractive force of the molecules toward the interior

(B) Attractive force of the molecules toward the boundary wall

(C) Repulsive force of the molecules toward the interior

(D) Repulsive force of the molecules toward the boundary wall

31. The relationship between C_P and C_V for n mole of ideal gas is :

(A) $C_v = C_p + nR$ (B) $C_p = C_v + nR$

(C) $C_v = C_p + nRT$ (D) $C_p = C_v + nRT$

32. The relationship between the contact angle and wettability of a liquid is :

(A) Proportional (B) Inversely proportional

(C) Independent (D) None of these

33. What will be the amount of work done if 10 moles of an ideal monoatomic gas at 10 atm pressure and 27°C temperature is allowed to expand isothermally against a constant pressure of 1 atm ?

(A) – 5.36 kcal (B) 5.36 kcal

(C) – 4.32 kcal (D) 4.32 kcal

34. Which of the following is not applicable to the adsorption phenomena ?

(A) Langmuir equation (B) BET equation

(C) Henderson equation (D) Freundlich equation

35. Which one of the following terms is not associated with phase rule ?

(A) Triple point (B) Eutectic point

(C) Critical point (D) Plait point

36. Which of the following is an intensive property ?

(A) Specific heat (B) Molar volume

(C) Surface Tension (D) All of these

37. What is the degree of freedom of 0.1N aqueous solution of NaCl ?

(A) 3 (B) 2

(C) 0 (D) 1

38. What is the ionic strength of 0.2 M of Na_2HPO_4 ?

(A) 0.4 M (B) 0.5 M

(C) 0.6 M (D) 0.8 M

39. Which of the following is not the rate expression for a reaction $A+2B \longrightarrow 3P$?

(A) $-\frac{d[A]}{dt}$ (B) $-\frac{1}{2}\frac{d[B]}{dt}$

(C) $+\frac{d[A]}{dt}$ (D) $+\frac{1}{3}\frac{d[P]}{dt}$

40. At equilibrium, the process of adsorption involves :

(A) $\Delta H > 0$ (B) $\Delta H = T\Delta S$

(C) $\Delta H > T\Delta S$ (D) $\Delta H < T\Delta S$

41. If molecule A absorbs light energy around 630 nm, the colour of the solution of A will be :

(A) Red (B) Blue

(C) Green (D) Yellow

42. The half cell $A + e^- \longrightarrow A^-$ has a large negative reduction potential. The consequence will be :

(A) A is readily reduced (B) A is readily oxidized

(C) A^- is readily reduced (D) A^- is readily oxidized

43. At the end point of acid-base titration involving a strong acid and a strong base using an appropriate indicator, the pH of the solution would be :

(A) Slightly alkaline (B) Slightly acidic

(C) Neutral (D) Strongly alkaline

44. According to transition state theory for a bimolecular reaction, the activated complex has :

(A) No vibrational degrees of freedom

(B) Vibrational degrees of freedom but they never participate in product formation

(C) One high frequency vibration that leads to product formation

(D) One low frequency vibration that leads to product formation

45. The unit of molar extinction coefficient is :

(A) $Lit.mol^{-1}.cm^{-1}$ (B) $Lit.mol^{-1}.cm$

(C) $Lit.mol.cm^{-1}$ (D) $Lit^{-1}.mol^{-1}.cm^{-1}$

46. Which of the following statements is correct ?

(A) $_1H^1$ and $_1He^3$ are isotopes (B) $_6C^{14}$ and $_7N^{14}$ are isotopes

(C) $_{19}K^{39}$ and $_{20}Ca^{40}$ are isotones (D) $_9F^{19}$ and $_{11}Na^{24}$ are isobars

47. A molecule is Raman active, if :

(A) the molecule is polarisable

(B) the molecule is paramagnetic

(C) the molecule contains non-bonding electrons

(D) the molecule contains centre of symmetry

48. Cathode rays are deflected towards :

(A) Positive electrode (B) Negative electrode

(C) Both (A) and (B) (D) None of these

49. Which is not a renewable energy ?

(A) Solar Energy (B) Wind Energy

(C) Tidal Energy (D) LPG

50. After bubbling air through pure water (pH 7.0), its pH decreased. Which of the following is responsible for the pH change ?

(A) N_2 (B) CO_2

(C) H_2 (D) O_2

51. Which of the following is the correct order with respect to their relative stabilities ?

(A) $O_2^+ > O_2 > O_2^{2-} > O_2^-$ (B) $O_2^+ > O_2 > O_2^- > O_2^{2-}$

(C) $O_2 > O_2^+ > O_2^- > O_2^{2-}$ (D) $O_2^{2-} > O_2^- > O_2^+ > O_2$

52. According to Bohr's theory, the angular momentum of an electron in the 5^{th} orbit is :

(A) $25\frac{h}{\pi}$ (B) $1.0\frac{h}{\pi}$

(C) $10\frac{h}{\pi}$ (D) $2.5\frac{h}{\pi}$

53. In a crystal lattice, the Madelung constant depends on the :

(A) Ionic radius of the cation

(B) Ionic radius of the anion

(C) Nature of the crystal system

(D) Ionic radius of both cation and anions

54 Which of the following is the correct order of ionic radii ?

(A) $Na^+ < Mg^{2+} < Al^{3+} < Si^{4+}$ (B) $Al^{3+} < Si^{4+} < Na^+ > Mg^{2+}$

(C) $Si^{4+} < Al^{3+} > Mg^{2+} > Na^+$ (D) $Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$

55. Which of the following pairs corresponds to soft base pair ?

(A) N_2O, I^- (B) R_2S, O^{2-}

(C) CO, CH_3COO^- (D) $SCN^-, S_2O_3^{2-}$

56. The ionic compound which indicates pyrosilicate is :

(A) $(SiO_4)^{4-}$ (B) $(Si_3O_9)^{6-}$

(C) $[(SiO_3)_n]^{2n-}$ (D) $(Si_2O_7)^{6-}$

57. The reaction of XeF_6 with CsF produces a compound that undergoes decomposition after 50 °C. The compound is :

(A) Cs_2XeF_8 (B) Cs_2XeF_6

(C) $CsXeF_7$ (D) $Cs_3Xe_2F_{15}$

58. What are the precursors used for the synthesis of borazine in Stock's process ?

(A) B_2H_6 and NH_3 (B) NH_4Cl and $NaBH_4$

(C) NH_4Cl and BCl_3 (D) NH_3 and BCl_3

59. Which type of isomerism exists between $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5(SO_4)]Br$ compounds ?

(A) Linkage isomerism

(B) Coordination isomerism

(C) Ionization isomerism

(D) Coordination position isomerism

60. The primary and secondary valences of cobalt atom in $[Co(NH_3)_4Cl_2]Cl$ complex are :

(A) 3 and 4 (B) 1 and 6

(C) 4 and 3 (D) 3 and 6

61. The rate of reversible hydration of carbon dioxide is accelerated by which of the following biomolecules ?

(A) Carboxypeptidase (B) Carbonic anhydrase

(C) Haemoglobin (D) Catalase

62. Among the following complexes, the one which shows zero crystal field stabilization energy is :

(A) $[Mn(H_2O)_6]^{3+}$ (B) $[Fe(H_2O)_6]^{3+}$

(C) $[Co(H_2O)_6]^{2+}$ (D) $[Co(H_2O)_6]^{3+}$

63. The complex $(\eta^4\text{-}C_8H_8)M(CO)_3$ follows 18-electron rule. Which of the following first row transition metal (M) is present in it ?

(A) Co (B) Fe

(C) Mn (D) Ni

64. One mole of $[PtCl_4]^{2-}$ while reacting with two moles of NH_3 gives :

(A) *cis*-$[Pt(NH_3)_2Cl_2]$ (B) *trans*-$[Pt(NH_3)_2Cl_2]$

(C) $[Pt(NH_3)_3Cl]^+$ (D) $[Pt(NH_3)\,Cl_3]^-$

65. The reaction of NaCl and $K_2Cr_2O_7$ in the presence of conc. H_2SO_4 produces a vapor that turns aqueous solution of NaOH into yellow colour. While treating this yellow color solution with aqueous lead acetate in the presence of excess CH_3COOH, it gives yellow precipitate. Which of the following compounds does correspond to this vapor ?

(A) CrO_2Cl (B) CrO_2Cl_2

(C) Na_2CrO_4 (D) $CrOCl_2$

66. The number of radial nodes present in 3s and 3d orbitals respectively are :

(A) 2 and 0 (B) 0 and 2

(C) 3 and 2 (D) 2 and 1

67. The brown ring complex compound is formulated as $[Fe(H_2O)_5(NO)]SO_4$. The oxidation state of iron in this compound is :

(A) +3 (B) +2

(C) +1 (D) 0

68. Which of the following hybridization is present in ClF_3 molecule ?

(A) dsp^3 (B) sp^3d

(C) sp^3d^2 (D) sp^3

69. Which of the following sets of quantum numbers are correct for an electron present in the 4f orbital ?

(A) $n = 4, \ell = 3, m = +4, s = +\frac{1}{2}$ (B) $n = 3, \ell = 2, m = -2, s = +\frac{1}{2}$

(C) $n = 4, \ell = 3, m = +1, s = +\frac{1}{2}$ (D) $n = 4, \ell = 4, m = -4, s = -\frac{1}{2}$

70. Which of the following is the incorrect statement about Zeise's salt ?

(A) Zeise's salt is diamagnetic

(B) All the Pt—Cl bond lengths in Zeise's salt are equal

(C) Oxidation state of Pt in Zeise's salt is +2

(D) C—C bond length of ethylene moiety in Zeise's salt is longer than the free ethylene molecule

SPACE FOR ROUGH WORK