

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

TEST BOOKLET

Sl. No. **3152**

Subject Code : 04

Subject : Chemistry

LECTURERS FOR NON-GOVT. AIDED COLLEGES OF ODISHA

Time Allowed : 2 Hours

Maximum Marks : 150

: INSTRUCTIONS TO CANDIDATES :

- 1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET CONTAINS 23 PAGES AND 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 Roll No. on the Test Booklet in the Box provided alongside. DO NOT write anything else on the Test Booklet.**
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- 3. The Test Booklet contains 100 questions. Each question comprises four answers. You have to select the correct answer which you want to mark (darken) on the Answer Sheet (OMR Sheet). In any case choose ONLY ONE answer for each question. If more than one answer is darkened, it will be considered as wrong.**
 - 4. You have to mark (darken) all your answers only on the OMR Answer Sheet using BLACK BALL POINT PEN provided by the State Selection Board. You have to do rough work only in the space provided at the end of the Test Booklet. See instructions in the Answer Sheet.**
 - 5. All questions carry equal marks i.e. of one and half mark for each correct answer and each wrong answer will result in negative marking of 0.50 mark.**
 - 6. Before you proceed to mark (darken) the answers in the OMR Answer Sheet to the questions in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per the instructions in your Admit Card.**
 - 7. On completion of the examination, you should hand over the original Answer Sheet (OMR Sheet) issued to you to the Invigilator before leaving the Examination Hall. You are allowed to take with you the candidate's copy (carbon copy) of the OMR Answer Sheet along with the Test Booklet for your reference.**

SEAL

Candidate's full signature

Invigilator's signature

IW - 17/26

(Turn over)

2021

1. The wave function of a particle confined in a box of length "a" is

$$\psi(x) = \sqrt{\frac{2}{a}} \sin \frac{\pi x}{a}, 0 \leq x \leq a.$$

The probability of finding the particle

in the region $0 < x < \frac{a}{2}$ is :

- (A) $\frac{1}{3}$
- (B) $\frac{3}{2}$
- (C) 2
- (D) $\frac{1}{2}$
2. For what type of gas molecules, the total K. E. of a molecule and its translational K. E. are the same ?
- (A) Monoatomic
- (B) Diatomic
- (C) Triatomic
- (D) Heteroatomic
3. The solubility of A_2X_3 in pure water, (assuming that neither kind of ion reacts with water) at 25°C is _____ given that the solubility product of A_2X_3 is 1.1×10^{-23} .

(A) 10^{-10}

(B) 10^{-5}

(C) 10^{-4}

(D) 10^{-6}

4. For irreversible process, the entropy will be :

(A) $\Delta S_{\text{universe}} > 0$

(B) $\Delta S_{\text{universe}} < 0$

(C) $\Delta S_{\text{universe}} = 0$

(D) $\Delta S_{\text{universe}} \leq 0$

5. Sucrose decomposes in acid solution into glucose and fructose according to a first order rate law, with a half life of 3.33h at 25°C . The fraction of the sample of sucrose that remains after 9.00h will be :

(A) 1.153

(B) 0.153

(C) 153.0

(D) 3.33

6. The ratio of cation concentration for which $E = 0$ for the cell reaction, $\text{Pb} + \text{Sn}^{2+} \rightarrow \text{Pb}^{2+} + \text{Sn}$ $E_{\text{Pb/Pb}^{2+}}^\circ = 0.13\text{V}$; $E_{\text{Sn}^{2+}/\text{Sn}}^\circ = -0.14\text{V}$ is :

(A) 0.21

(B) 0.59

(C) 0.12

(D) 1.2

7. If A is a Hermitian operator and ψ is its eigen function, then $\langle A^2 \rangle$ will be :
- (A) $\langle A^2 \rangle \geq 0$
 (B) $\langle A^2 \rangle \neq 0$
 (C) $\langle A^2 \rangle \leq 0$
 (D) None of these
8. For one mole of an ideal gas $\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial V}{\partial P}\right)_T$ is :
- (A) $\frac{-R^2}{P^2}$
 (B) $\frac{R^2}{P^2}$
 (C) 0
 (D) -1
9. According to equipartition energy, the molar heat capacity of Ne is :
- (A) R
 (B) $1.5 R$
 (C) $2 R$
 (D) $1.66 R$
10. The molecular term symbol for O_2 in excited state is :
- (A) ${}^3\Sigma_u^-$
 (B) ${}^2\pi_u$
 (C) ${}^3\Sigma_g^-$
 (D) ${}^3\Sigma_u^-$
11. At its melting point 0°C , the enthalpy of fusion of water is 1.435 Kcal/mol . What is the molar entropy change for the melting of ice at 0°C ?
- (A) 5.26
 (B) 52.6
 (C) 0.526
 (D) 526
12. The activation energy for a reaction (which doubles in rate when the temp. is raised from 18°C to 28°C) is _____.
- (A) 120
 (B) 1.2
 (C) 12.0
 (D) 0.12
13. For the reaction $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ $K_p = 1.16 \text{ atm}$ at 800°C . If 20.0 g of CaCO_3 was put into a 10L container and heated to 800°C , what is the percent of the CaCO_3 that would remain unreacted at equilibrium ?
- (A) 30%
 (B) 31%
 (C) 33%
 (D) 34%

14. If n represents the no. of eigen states of a hydrogen atom, then its discrete energy levels are proportional to :

- (A) n
- (B) n^2
- (C) $\frac{1}{n}$
- (D) $\frac{1}{n^2}$

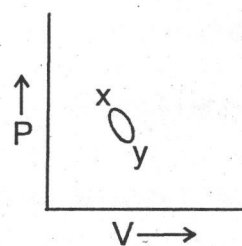
15. The term symbol for the ground state of nitrogen atom is :

- (A) 3P_0
- (B) $^4P_{\frac{3}{2}}$
- (C) 1P_1
- (D) $^4S_{\frac{3}{2}}$

16. Which of the following statement about kinetics of the reaction $H_2(g) + Br_2(g) \longrightarrow 2 HBr(g)$ is definitely true ?

- (A) The reaction is 1st order with respect to Br_2
- (B) The reaction is second order overall
- (C) The presence of HBr inhibits the rate of the reaction
- (D) It is not possible to determine anything about kinetics of reaction from the stoichiometry

17. A piston containing an ideal gas is originally in the state X (see the figure). The gas is taken through a thermal cycle $X \rightarrow Y \rightarrow X$ as shown.



The work done by the gas is positive, if the direction of the thermal cycle is :

- (A) Clockwise
- (B) Counter-clockwise
- (C) Neither clockwise nor counter-clockwise
- (D) Clockwise from $X \rightarrow Y$ and counter-clockwise from $Y \rightarrow X$

18. The rotational spectrum of HI is found to contain a series of lines with a separation of 12.8 cm^{-1} . Moment of inertia for the molecule is :

- (A) $4.36 \times 10^{-40} \text{ g cm}^2$
- (B) $1.13 \times 10^{-39} \text{ g cm}^2$
- (C) $2.23 \times 10^{-40} \text{ g cm}^2$
- (D) $8.72 \times 10^{-40} \text{ g cm}^2$

19. The standard emf of a galvanic cell involving cell reaction with $n = 2$ is found to be 0.295V at 25°C . The equilibrium constant of the reaction would be :
- (A) 2×10^{11}
 (B) 4×10^{12}
 (C) 1×10^2
 (D) 1×10^{10}
20. The combined form of first and second law of thermodynamics is given by :
 (P = Pressure, V = Volume, T = Temperature, U = Internal energy, S = Entropy, Q = Quantity of heat) :
- (A) $Tds = dU + PdV$
 (B) $dQ = Tds + PdV$
 (C) $dU = Tds + dQ$
 (D) $Tds = dU - PdV$
21. The CFSE of the following d^3 metal ions (V^{2+} , Cr^{3+} , Mo^{3+}) decreases in the following order :
- (A) $\text{V}^{2+} > \text{Mo}^{3+} > \text{Cr}^{3+}$
 (B) $\text{Mo}^{3+} > \text{Cr}^{3+} > \text{V}^{2+}$
 (C) $\text{Cr}^{3+} > \text{Mo}^{3+} > \text{V}^{2+}$
 (D) $\text{Cr}^{3+} > \text{V}^{2+} > \text{Mo}^{3+}$
22. How many isomers are possible for the $\text{B}_{10}\text{C}_2\text{H}_{12}$ molecule ?
- (A) 4
 (B) 3
 (C) 1
 (D) 2
23. The origin of the yellow colour of an aqueous solution of K_2CrO_4 is due to :
- (A) H_2O to Cr^{6+} charge transfer
 (B) O^{2-} to Cr^{6+} charge transfer
 (C) d-d transition
 (D) O^{2-} to K^+ charge transfer
24. The pair of normal and inverse spinels respectively are :
- (A) NiFe_2O_4 and CO_3O_4
 (B) Fe_3O_4 and Mn_3O_4
 (C) Fe_3O_4 and CO_3O_4
 (D) Mn_3O_4 and NiFe_2O_4

25. The experimental magnetic moment of $K_3[Fe(CN)_6]$ is $2.3 \mu_B$ and is attributable to the :

- (A) Spin only value of a low spin Fe
- (B) Spin only value of a high spin Fe
- (C) Low Spin Fe with orbital contribution
- (D) High Spin Fe with orbital contribution

26. Aqueous $FeCl_3$ forms acidic solution due to hydrolysis and produces dimer at pH 4 – 5. The structure of the dimer is :

- (A) $(H_2O)_5 Fe - Fe (H_2O)_5$
- (B) $[(H_2O)_5 Fe \begin{array}{c} \diagup \diagdown \\ O \\ \diagdown \diagup \end{array} Fe (H_2O)_5]^{4+}$
- (C) $[(H_2O)_4 Fe \begin{array}{c} \diagup \diagdown \\ OH \\ \diagdown \diagup \\ OH \end{array} Fe (H_2O)_5]^{2-}$
- (D) $[(H_2O)_5 Fe \begin{array}{c} \diagup \diagdown \\ OH \\ \diagdown \diagup \\ OH \end{array} Fe (H_2O)_5]^{4+}$

27. Silver phosphite, Ag_2HPO_3 is warmed with water and the silver is precipitated as the metal. The change of oxidation state of phosphorus is :

- (A) 5 units
- (B) 2 units
- (C) 3 units
- (D) 1 unit

28. The complex $[Ti(H_2O)_6]^{3+}$ shows :

- (A) Jahn-Teller distortion
- (B) Dynamic Jahn-Teller distortion
- (C) Tetragonal elongation
- (D) Colour due to charge transfer

29. The order of the Irving-William Series is :

- (A) $CO^{2+} < Ni^{2+} < Cu^{2+} > Zn^{2+}$
- (B) $CO^{2+} < Ni^{2+} < Cu^{2+} < Zn^{2+}$
- (C) $Zn^{2+} < Cu^{2+} < Ni^{2+} < CO^{2+}$
- (D) $Cu^{2+} > Zn^{2+} > CO^{2+} > Ni^{2+}$

30. Which of the following system has maximum no. of unpaired electrons ?

- (A) d^4 (octahedral, low spin)
- (B) d^7 (octahedral, high spin)
- (C) d^6 (tetrahedral, high spin)
- (D) d^9 (octahedral)

31. The dipole moments of the given molecules follow the order :
- (A) $\text{NH}_3 > \text{NF}_3 > \text{BF}_3$
 (B) $\text{BF}_3 > \text{NF}_3 > \text{NH}_3$
 (C) $\text{NF}_3 > \text{NH}_3 > \text{BF}_3$
 (D) $\text{NH}_3 > \text{BF}_3 > \text{NF}_3$
32. The correct d-electron configuration showing spin orbit coupling is :
- (A) $t_{2g}^6 e_g^2$
 (B) $t_{2g}^6 e_g^0$
 (C) $t_{2g}^4 e_g^0$
 (D) $t_{2g}^3 e_g^2$
33. Which one of the following pairs, molecules / ions have similar shape ?
- (A) CO_2 and H_2O
 (B) BF_3 and t_{Butyl} carbocation
 (C) CCl_4 and PtCl_4
 (D) NH_3 and BF_3
34. Which element has the highest first ionisation potential ?
- (A) H
 (B) Ne
 (C) He
 (D) N
35. For an octahedral complex, which of the following d-electron configurations will give maximum CFSE ?
- (A) High spin d^6
 (B) Low spin d^4
 (C) High spin d^5
 (D) High spin d^7
36. Using MoT to determine the bond order for O_2^+ ion, the answer is :
- (A) 3
 (B) 1.5
 (C) 2.5
 (D) 2
37. The total no. of geometrical and optical isomers for the complex ion dichlorobis (ethylene diamine) Rhodium (III) is :
- (A) 2
 (B) 3
 (C) 4
 (D) 6
38. Which of the complexes is expected to have lowest Δ_o value ?
- (A) $[\text{CoF}_6]^{3-}$
 (B) $[\text{Co}(\text{NH}_3)_6]^{3+}$
 (C) $[\text{Ir}(\text{NH}_3)_6]^{3+}$
 (D) $[\text{Rh}(\text{NH}_3)_6]^{3+}$

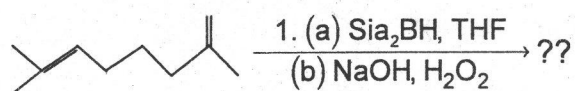
39. Which of the ions is expected to have zero CFSE in octahedral field ?

- (A) Fe^{3+} (low spin)
- (B) Fe^{3+} (high spin)
- (C) Cr^{3+} (high spin)
- (D) Co^{2+} (low spin)

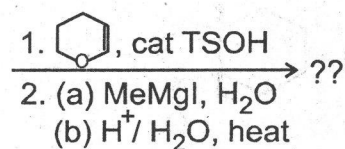
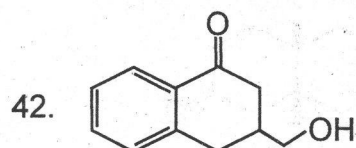
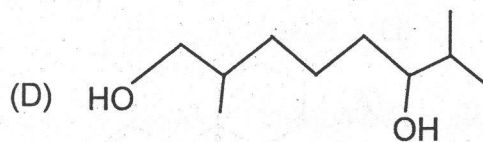
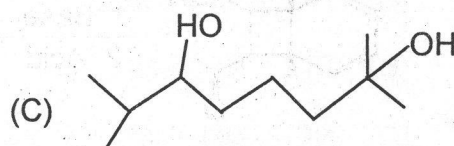
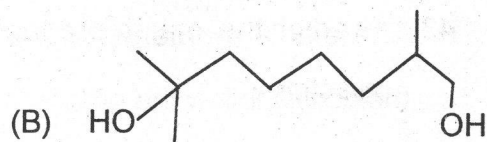
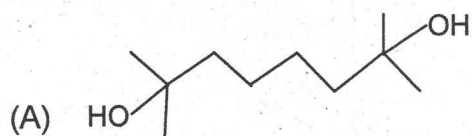
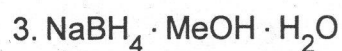
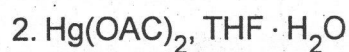
40. Me_3B , BH_3 and BF_3 are three Lewis acids. Which one of the following is the correct sequence of these acids in order of their increasing acid strength ?

- (A) $\text{Me}_3\text{B} < \text{BH}_3 < \text{BF}_3$
- (B) $\text{Me}_3\text{B} < \text{BF}_3 < \text{BH}_3$
- (C) $\text{BF}_3 < \text{BH}_3 < \text{Me}_3\text{B}$
- (D) $\text{BF}_3 < \text{Me}_3\text{B} < \text{BH}_3$

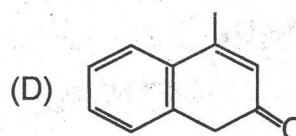
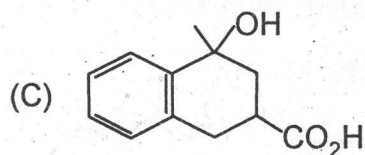
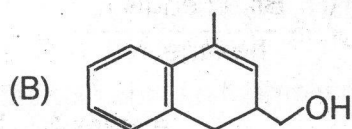
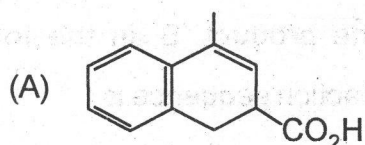
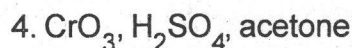
41. Predict the major product of the following reaction :



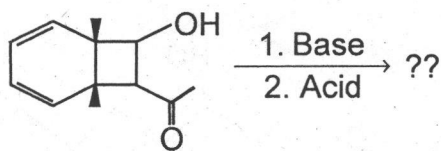
(Major product)



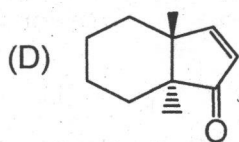
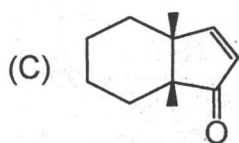
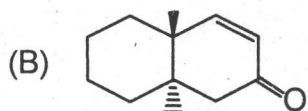
(Major product)



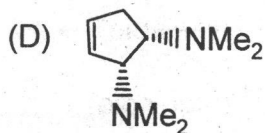
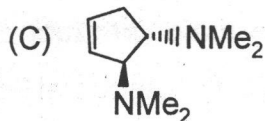
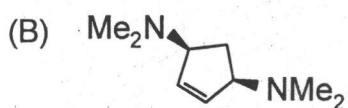
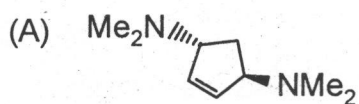
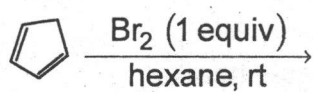
43. Predict the major product of the reaction :



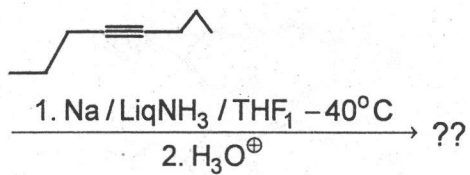
(Major product)



44. The product 'B' in the following reaction sequence is :



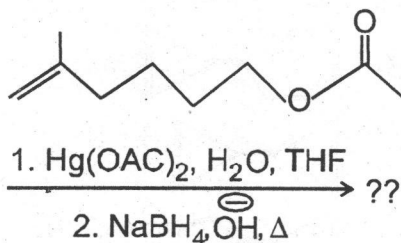
45.



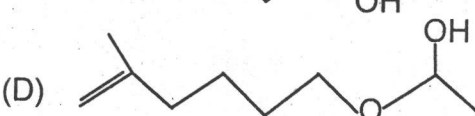
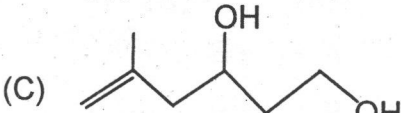
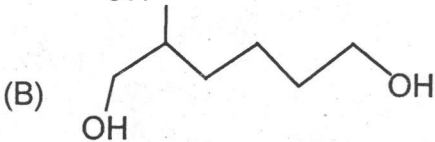
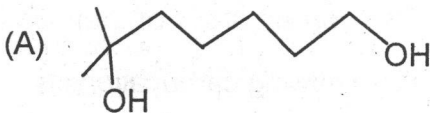
(Major product)



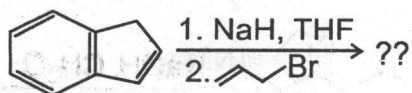
46. Predict the major product in the following reaction :



(Major product)



47. Predict the major product of the reaction :



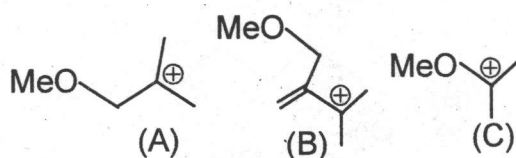
(Major product)

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

48. Which one of the following has the highest dipole moment ?

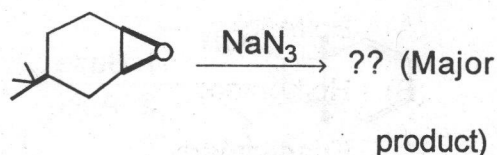
- (A)
- (B)
- (C)
- (D)

49. The correct order of the stability of the following carbocations is :



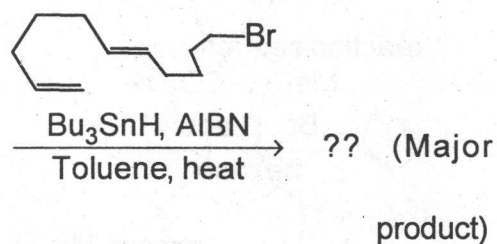
- (A) $A > C > B$
- (B) $B > C > A$
- (C) $C > A > B$
- (D) $C > B > A$

50. Predict the major product of the following reaction :



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

51. Predict the major product of the following reaction :



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