CHEMICAL SCIENCES
Paper - II

Signature of Invigilators

1. .....

2. .....

Roll No. ☐☐☐☐☐
(In figures as in Admit Card)

Dec-08/03

Roll No. .....

.....
(in words)

Name of the Areas/Section (if any) .....

Time Allowed : 75 Minutes] **[Maximum Marks : 100**

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page.
2. This paper consists of fifty (50) multiple choice type questions. All questions are compulsory.
3. Each item has upto four alternative responses marked (A), (B), (C) and (D). The answer should be a capital letter for the selected option. The answer letter should entirely be contained within the corresponding square.

   Correct method [A] Wrong method [A] OR [A]
4. Your responses to the items for this paper are to be indicated on the ICR Answer Sheet under Paper II only.
5. Read instructions given inside carefully.
6. Extra sheet is attached at the end of the booklet for rough work.
7. You should return the test booklet to the invigilator at the end of paper and should not carry any paper with you outside the examination hall.

પરીક્ષાર્થીઓ માટે સૂચનાઓ :

૧. આ પાનાની ટોચમાં દર્શાવેલી જગ્યામાં તમારો રોલનંબર લખો.

૨. આ પ્રશ્નપત્રમાં બહુવૈકલ્પિક ઉત્તરો ધરાવતા કુલ પચાસ (૫૦) પ્રશ્નો આપેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.

૩. પ્રત્યેક પ્રશ્ન વધુમાં વધુ ચાર બહુવૈકલ્પિક ઉત્તરો ધરાવે છે. જે (A), (B), (C) અને (D) વડે દર્શાવવામાં આવ્યા છે. પ્રશ્નનો ઉત્તર કેપીટલ સંજ્ઞા વડે આપવાનો રહેશે. ઉત્તરની સંજ્ઞા આપેલ ખાનામાં બરાબર સમાઈ જાય તે રીતે લખવાની રહેશે.

   ખરી રીત : [A] ખોટી રીત : [A] , [A]

૪. આ પ્રશ્નપત્રના જવાબ આપેલ ICR Answer Sheet ના Paper II વિભાગની નીચે આપેલ ખાનાઓમાં આપવાના રહેશે.

૫. અંદર આપેલ સૂચનાઓ કાળજીપૂર્વક વાંચો.

૬. આ બુકલેટની પાછળ આપેલું પાનું રફ કામ માટે છે.

૭. પરીક્ષા સમય પૂરો થઈ ગયા પછી આ બુકલેટ જે તે નિરીક્ષકને સોંપી દેવી. કોઈપણ કાગળ પરીક્ષા ખંડની બહાર લઈ જવો નહીં.

CHEMICAL SCIENCES
PAPER - II

Note : This paper contains **FIFTY (50)** multiple-choice questions. Each question carrying **TWO (2)** marks. Attempt **All** the questions.

નોંધ : આ પ્રશ્નપત્રમાં પચાસ (૫૦) બહુવિકલ્પીય પ્રશ્નો, સાચું-ખોટું અને જોડકાં બનાવવાના પ્રશ્નો છે. તમામ પ્રશ્નોના જવાબ લખવાના છે. પ્રત્યેક પ્રશ્નના બે (૨) ગુણ છે.

---

1. The molecules O_2, O_3 and H_2O_2 have O–O bond. Which of the following is the *correct* arrangement in order of increasing bond length ?

   (A) $H_2O_2 < O_3 < O_2$ (B) $O_3 < O_2 < H_2O_2$

   (C) $O_2 < O_3 < H_2O_2$ (D) $O_2 < H_2O_2 < O_3$

2. Which of the nickel compounds has the least oxidation state ?

   (A) $Ni(CO)_4$ (B) $NiCl_2$

   (C) Ni_2O_3 (D) NiO_2

3. If a molecule MX_3 has a zero dipole moment, the bonding orbitals used by M is :

   (A) pure '*p*' orbitals (B) *sp* hybrid orbitals

   (C) sp^2 hybrid orbitals (D) sp^3 hybrid orbitals

4. The electronic configuration of Ti (At No. = 22) in the ground state is :

   (A) [Ar] $3d^2\ 4s^2$ (B) [Ar] $4s^2\ 3d^2$

   (C) [Ar] $3d^4\ 4s^0$ (D) [Ar] $3d^2\ 4s^0$

5. Among the following, which one is an odd electron species ?

(A) K_2O (B) $^1O_2$

(C) KO_2 (D) K_2O_2

6. The maximum number of covalent bonds formed by boron is :

(A) 3 (B) 4

(C) 1 (D) 2

7. A compound is an insulator in the solid state, however it becomes a good conductor on dissolving in water. The compound is :

(A) a covalent solid (B) an ionic solid

(C) a molecular solid (D) a metallic solid

8. Graphite has a sheet structure, where the sheets are held together by :

(A) Covalent bonds (B) Ionic bonds

(C) Hydrogen bonds (D) van der Waals' interactions

9. The increasing order of < ONO angle in NO_3^-, NO_2, NO_2^-, NO_2^+ is :

(A) $NO_2^- < NO_3^- < NO_2 < NO_2^+$ (B) $NO_3^- < NO_2^- < NO_2^+ < NO_2$

(C) $NO_2 < NO_2^+ < NO_2^- < NO_3^-$ (D) $NO_2^+ < NO_2^- < NO_2 < NO_3^-$

10. Atmospheric ozone protects the earth's inhabitants by absorbing :

(A) UV radiations (B) ir radiations

(C) Visible radiations (D) γ-radiations

11. Slag in iron extraction contains :

(A) $CaCO_3$ (B) CaO

(C) $CaSiO_3$ (D) SiO_2

12. In adduct I_3^-, I_2 acts as Lewis acid. The orbital involved in acceptance of electrons is :

(A) *d* (B) *p*

(C) σ^* (D) π

13. The elements, which occur in nature as axions, are obtained from their ores by :

(A) Thermit process (B) Thermal decomposition

(C) Reduction (D) Oxidation

14. An organometallic complex involving platinum is :

(A) Wilkinson's catalyst (B) Ziesse's salt

(C) Cis-platin (D) Vaska's complex

15. Which one of the following fluorides is expected to exhibit John-Teller distortion ?

(A) MnF_2 (B) FeF_6

(C) CoF_2 (D) NiF_2

16. The IUPAC name of $K_2[OSCl_5N]$ is :

(A) Potassium pentachloronitrido osmate (VI)

(B) Potassium pentachloronitrido osmium (VI)

(C) Potassium pentachloronitrogen osmium (VI)

(D) Potassium pentachloronitride osmate (VI)

17. The percentage of a constituent A in a mixture AB were found to be 48.32, 48.36, 48.23, 48.11 and 48.38. What is the relative mean deviation ?

(A) 0.19 ppt (B) 1.9 ppt

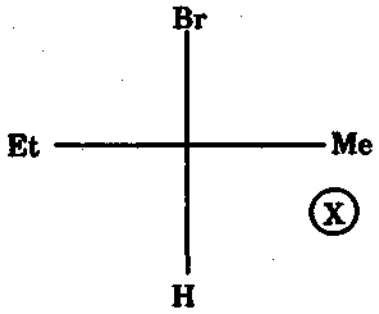
(C) 2.2 ppt (D) 0.019 ppt

18. How many significant figures are present in the number 0.0025 ?

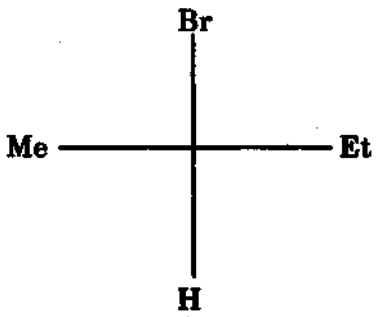
(A) 5 (B) 4

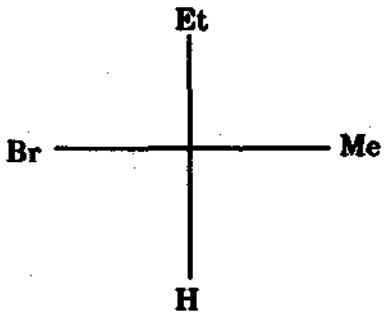
(C) 2 (D) 6

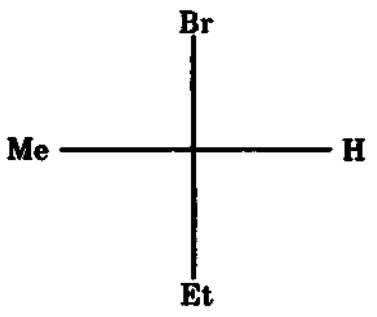
19. The formula of (S)-2-Bromobutane is X (given below).

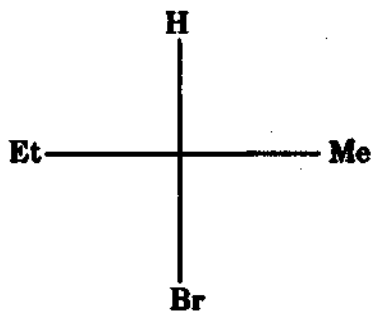


Indicate which of the given structures is identical with X ?

(A)


(B)


(C)


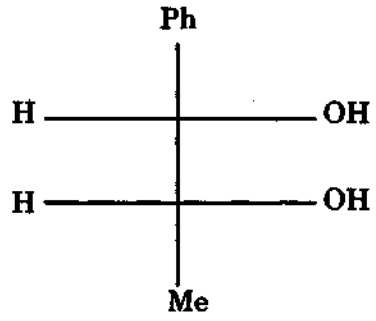
(D)


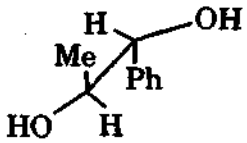
20. Which of the following chloropentanes is chiral ?

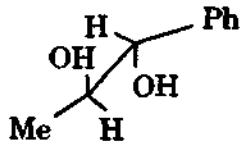
(A) 1-chloropentane (B) 2-chloropentane

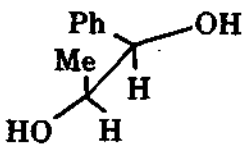
(C) 3-chloropentane (D) 2-chloro-2-methylpentane

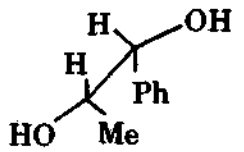
21. Choose the *correct* Sawhorse formula for the following Fischer projection formula :



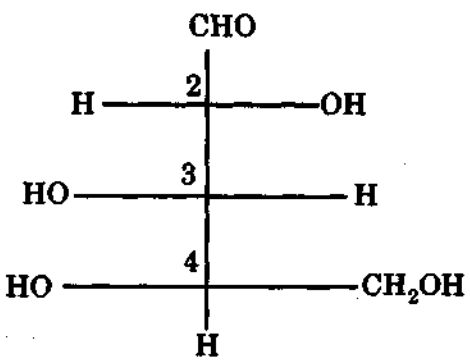
(A) 

(B) 

(C) 

(D) 

22. Designate *correct* configuration R/S to various chiral centres present in the following molecule :



(A) 2R, 3R, 4R

(B) 2S, 3S, 4S

(C) 2R, 3S, 4R

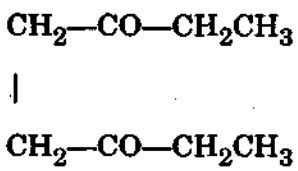
(D) 2R, 3S, 4S

23. Indicate which of the following spectroscopic techniques can help to detect Br and Cl in any organic compound.

(A) IR (B) Mass

(C) UV (D) NMR

24. The multiplicity pattern of signals in the PMR spectrum of the following molecule is :



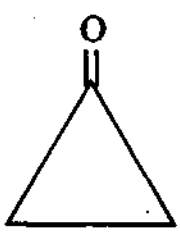
(A) Triplet, triplet, quartet

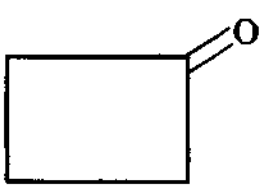
(B) Triplet, triplet, triplet

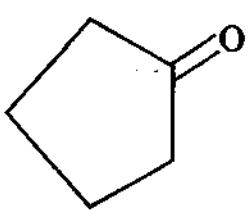
(C) Singlet, singlet, quartet

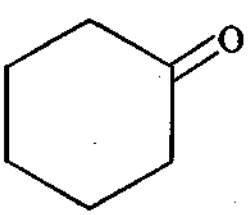
(D) Singlet, triplet, quartet

25. The decreasing order of correct IR carbonyl absorption frequency for the following ketones :

(*i*) 

(*ii*) 

(*iii*) 

(*iv*) 

(A) (*iv*) > (*iii*) > (*ii*) > (*i*) (B) (*i*) > (*ii*) > (*iii*) > (*iv*)

(C) (*ii*) > (*iii*) > (*i*) > (*iv*) (D) (*iii*) > (*ii*) > (*i*) > (*iv*)

26. Choose the reagent that can reduce an alkyne to E alkene :

(A) Lindlar catalyst (B) H_2/Raney Ni

(C) H_2/Pd-C (D) Na–liq. NH_3

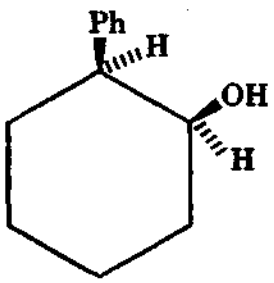
27. Cinnamic acid can be prepared from benzaldehyde by :

(A) Aldol condensation (B) Stobbe condensation

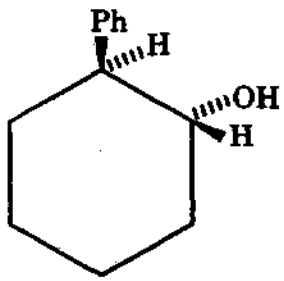
(C) Perkin condensation (D) Dieckmann condensation

28. The hydroboration of 1-phenyl cyclohexene followed by oxidation with $NaOH–H_2O_2$ will form :

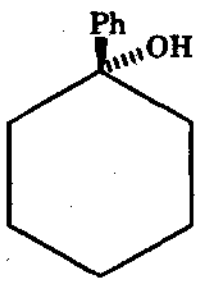
(A)



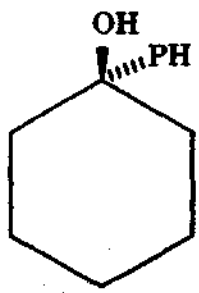
(B)



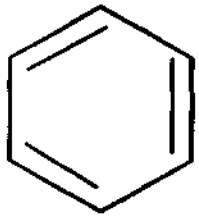
(C)

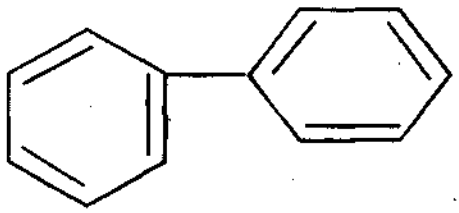


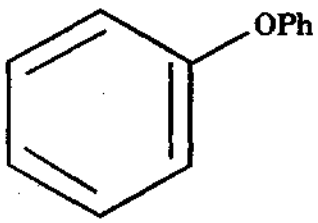
(D)

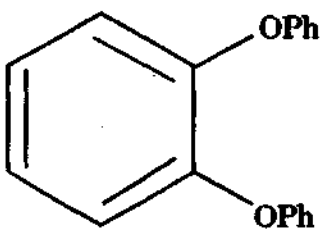


29. The reaction of benzyne with phenol will give :

(A) 

(B) 

(C) 

(D) 

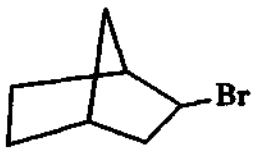
30. If the concentration of both the reactants in the following reaction, is doubled, the rate of the reaction will :

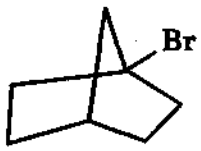
$$CH_3\text{–}CH_2\text{–}CH_2\text{–}CH_2\text{–}Cl + I^{\ominus} \longrightarrow CH_3CH_2CH_2CH_2I + Cl^{\ominus}$$

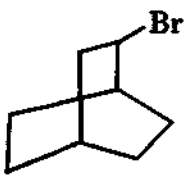
(A) double (B) unaffected

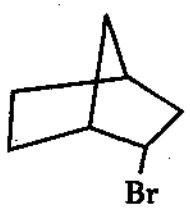
(C) increase by four-fold (D) become half

31. Which of the following compounds *cannot* undergo elimination of HBr upon reaction with base :

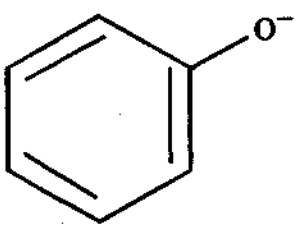
(A) 

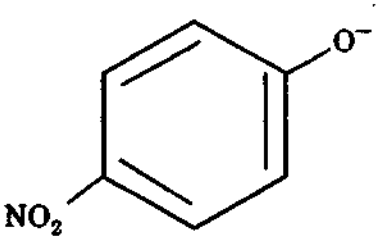
(B) 

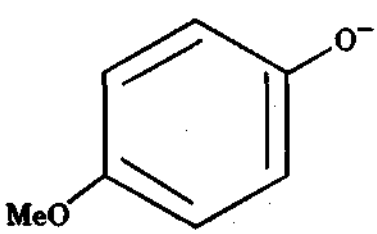
(C) 

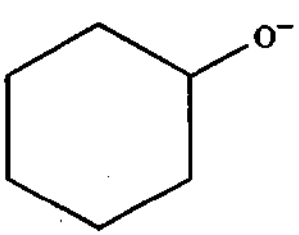
(D) 

32. Select the most basic alkoxide from the following :

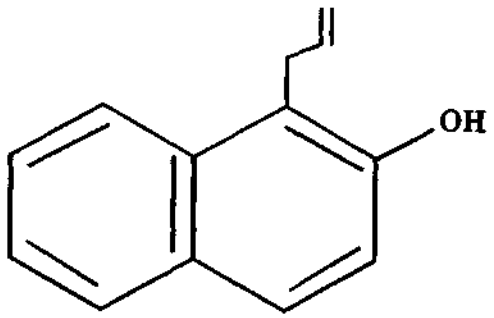
(A) 

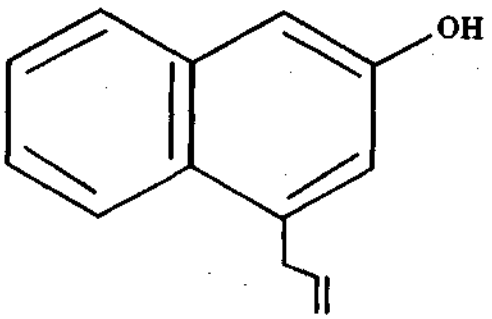
(B) 

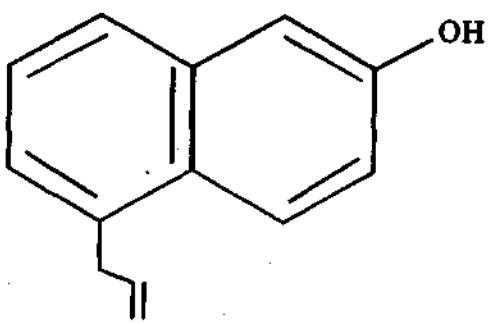
(C) 

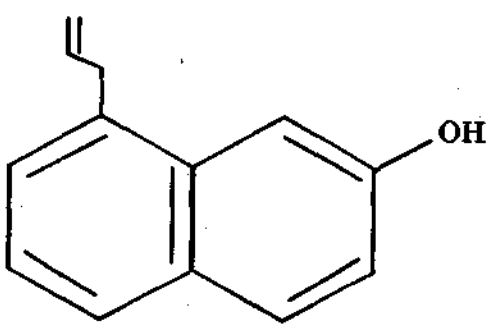
(D) 

33. The product obtained by heating allyl ether of β-naphthol is :

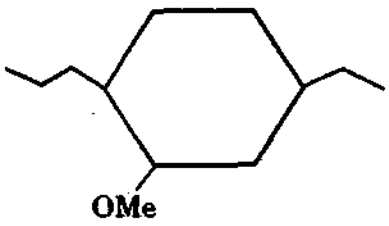
(A) 

(B) 

(C) 

(D) 

34. The IUPAC name of the following compound is :



(A) 1–Ethyl–3–methoxy–4–propyl cyclohexane

(B) 2–Methoxy–4–ethyl–1–propyl cyclohexane

(C) 4-Ethyl–2–methoxy–1–propyl cyclohexane

(D) 5–Ethyl–1–methoxy–2–propyl cyclohexane

35. The solutions which have the same osmotic pressure are called :

(A) azeotropic mixture (B) isotonic solution

(C) isothermal solution (D) none of these

36. The standard reduction potentials of A, B and C are 0.68 V, –2.54 V and –0.50 V. The order of their reducing power is :

(A) A > B > C (B) A > C > B

(C) C > B > A (D) B > C > A

37. The chemical equilibrium of a reversible reaction is *not* influenced by :

(A) catalyst (B) pressure

(C) temperature (D) concentration

38. Which of the following is temperature independent ?

(A) A (Arrhenius factor) (B) E_a (Energy of activation)

(C) k (rate constant) (D) none of these

39. What will be the order of the reaction if the value of the rate constant of the reaction is 175 liter $mole^{-1}$ sec^{-1} ?

(A) Zero (B) First

(C) Third (D) Second

40. At constant temperature for a first order reaction the value of k is 6.93×10^{-2} min^{-1}. What will be the value of $t_{1/2}$ for the same reaction ?

(A) 100 minute (B) 3.465×10^{-4} minute

(C) 10 minute (D) 0.1 minute

41. The activation energy in a chemical reaction is defined as :

(A) the difference in energies of reactants and products

(B) the sum of energies of reactants and products

(C) the difference in energy of intermediate complex with the average energy of reactants and products

(D) the difference in energy of intermediate complex and the average energy of reactants

42. For a reversible process, the value of ΔS is given by the expression :

(A) $q_{rev} - T$ (B) $q_{rev} + T$

(C) $\frac{q_{rev}}{T}$ (D) $q_{rev} \times T$

43. Which of the following statements is *false* ?

(A) Temperature is a state function

(B) Work is a state function

(C) Work appears at the boundary of the system

(D) Change of state is completely defined when initial and final states are specified

44. Choose the intensive property among the following :

(A) Heat capacity (B) Internal energy

(C) Temperature (D) None of these

45. The pH of a solution is 2. Its pH is to be changed to 4. The H^+ ion concentration of original solution has to be :

(A) halved

(B) doubled

(C) increased 100 times

(D) decreased 100 times

46. The second law of thermodynamics states that :

(A) entropy of the universe is decreasing continuously

(B) energy can neither be created nor destroyed

(C) all spontaneous processes are thermodynamically irreversible

(D) at absolute zero free energy is zero

47. An isotope has an atomic weight 232 and an atomic number 90. How many α and β particles it should lose to get converted into an isotope of atomic weight 220 and atomic number 86 ?

(A) 2α and 3β (B) 2α only

(C) 3α and 2β (D) 3α and 3β

48. Which of the following processes causes the emission of X-rays ?

(A) α-emission (B) γ-emission

(C) β^+ emission (D) Electron capture

49. If μ is dipole moment, α is polarizability and r displacement, the condition for IR activity is :

(A) $\mu \neq 0$ (B) $\frac{d\mu}{dr} \neq 0$

(C) $\alpha \neq 0$ (D) $\frac{d\alpha}{dr} \neq 0$

50. The oxidation number of arsenic atom in H_3AsO_4 is :

(A) –1 (B) –3

(C) +3 (D) +5

ROUGH WORK

ROUGH WORK