

CHEMICAL SCIENCES**Paper II****Time Allowed : 75 Minutes]****[Maximum Marks : 100**

Note : This paper contains **Fifty (50)** multiple choice questions, each question carrying **Two (2)** marks. Attempt *All* questions.

- | | |
|---|---|
| <p>1. The number of nodes in a 3s orbital is :</p> <p>(A) 0</p> <p>(B) 1</p> <p>(C) 2</p> <p>(D) 3</p> | <p>3. The three unpaired electrons on the nitrogen atom is ascribed to :</p> <p>(A) Pauli's exclusion principle</p> <p>(B) Aufbau principle</p> <p>(C) Hund's rule</p> <p>(D) Uncertainty principle</p> |
| <p>2. The energy of an orbital in the hydrogen atom depends on the quantum number :</p> <p>(A) n</p> <p>(B) l</p> <p>(C) m</p> <p>(D) s</p> | <p>4. In PCl_5, the hybridization of the orbitals of the P atom is :</p> <p>(A) d^2sp^2</p> <p>(B) dsp^3</p> <p>(C) d^3sp</p> <p>(D) d^3p^3</p> |

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5. Haber's process for preparation of ammonia is exothermic. It is carried out at a high temperature so as to ensure :
- (A) Faster rate of production of ammonia
 - (B) Vaporization of reactants/products
 - (C) Declogging of the surface of the catalyst
 - (D) Greater yield
6. Increase in entropy of the system marks the spontaneity of a process for :
- (A) All systems
 - (B) Isolated systems
 - (C) Isothermal processes
 - (D) Isobaric processes
7. If T_0 is the boiling point of a pure solvent, then the increase in boiling point of a solution in this solvent varies as :
- (A) T_0^2
 - (B) $1/T_0^2$
 - (C) T_0
 - (D) $1/T_0$
8. Upon increasing the temperature :
- (A) The pH of water remains constant
 - (B) The pH of water increases
 - (C) Water becomes acidic
 - (D) The pH of water decreases

9. In 1.0 M NaCl solution, activity of water will approximately be :
- (A) 1
(B) > 1
(C) < 1
(D) The data is insufficient
10. The pre-exponential factor in Arrhenius function *does not* depend on :
- (A) Frequency of collisions
(B) Temperature
(C) Viscosity of the medium
(D) Activation energy
11. A catalyst increases the rate of a reaction by :
- (A) Decreasing the activation energy
(B) Increasing the activation energy
(C) Making the reaction endothermic
(D) Making the reaction exothermic
12. The symmetry point group for allene is :
- (A) D_{2h}
(B) C_{2h}
(C) C_{2d}
(D) D_{2d}
13. Number of bending vibrational modes for a polyatomic linear molecule having N atoms is :
- (A) $3N - 5$
(B) $2N - 4$
(C) $2N - 5$
(D) $3N - 6$

14. The following figure is of packing of ions into the unit cell. If the cube is divided into 8 small cubes, then the centre of each such small sub-cube is called :
- (A) Body centre void
(B) Tetrahedral void
(C) Octahedral void
(D) Face centered void
15. One Faraday of electricity is passed through molten Al_2O_3 , aqueous solution of CuSO_4 and molten NaCl taken in three different electrolytic cells connected in series. The mole ratio of Al, Cu and Na deposited at the respective cathodes is :
- (A) 2 : 3 : 6
(B) 6 : 2 : 3
(C) 6 : 3 : 2
(D) 1 : 2 : 3
16. The coefficient of variation (CV) in the Pb ($100 \mu\text{g} \pm 10 \mu\text{g}$, $\bar{x} = 50 \mu\text{g}$ per kg) found in the industrial effluent is :
- (A) 5%
(B) 10%
(C) 20%
(D) 50%
17. The IUPAC name of the following compound is :
- (A) 6-(1, 2-dimethylbutyl)-5-ethyldecane
(B) 5-(1, 2-dimethylbutyl)-6-ethyldecane
(C) 6-butyl-7, 8-dimethyl-5-ethyldecane
(D) 6-butyl-5-ethyl-7, 8-dimethyldecane

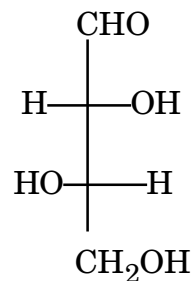
18. The stereochemical notations of double bonds is :

- (A) 2E, 5E, 7E
- (B) 2Z, 5Z, 7E
- (C) 2E, 5Z, 7E
- (D) 2E, 5Z, 7Z

19. The correct molecule having the absolute configuration as (2S, 3R)-3-chloro-2-pentanol is :

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

20. The following compound is :



- (A) D-Erythrose
- (B) L-threose
- (C) L-Erythrose
- (D) D-threose

21. The most stable isomer between all 1, 2-dimethylcyclohexane is :

- (A) Di-equatorial
1,2-dimethylcyclohexane
- (B) Equatorial, axial
1,2-dimethylcyclohexane
- (C) Di-axial 1,2-dimethylcyclohexane
- (D) All equally stable isomers

22. The above reaction is an example of :



- (A) Fries rearrangement
- (B) Lossen rearrangement
- (C) Schmidt rearrangement
- (D) Curtius rearrangement
23. $\text{H}_5\text{C}_2\text{OOC}-(\text{CH}_2)_4-\text{COOC}_2\text{H}_5$ on reaction with sodium in toluene followed by acidification gave a cyclic five membered beta-keto ester. The reaction is :
- (A) Aldol reaction
- (B) Dieckmann condensation
- (C) Claisen condensation
- (D) Perkin reaction

24. In the following conversion, the suitable reagents used are :

- (A) $\text{Br-CH}_2\text{-COOEt}$, Zn followed by acidic hydrolysis
- (B) $\text{Br-CH}_2\text{-COOEt}$, Mg followed by acidic hydrolysis
- (C) $\text{Br-CH}_2\text{-COOEt}$, Cu followed by acidic hydrolysis
- (D) $\text{Br-CH}_2\text{-COOEt}$, Mg + CdCl_2 followed by acidic hydrolysis

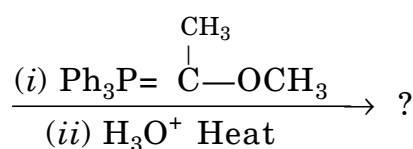
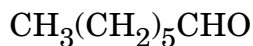
25. The product of the following reaction is :

- (A) $\text{CH}_3-\overset{\text{OH}}{\underset{|}{\text{CH}}}-\text{CH}_2-\text{CH}_3$
 (B) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$
 (C) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CHO}$
 (D) $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{OH}}{\underset{|}{\text{C}}}}-\text{CH}_3$

26. The Diels-Alder reaction of 1, 3-butadiene with *cis*-cinnamic acid gives :

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

27. The following reaction gives :



- (A) $\text{CH}_3-(\text{CH}_2)_5\text{CH}=\overset{\text{CH}_3}{\underset{|}{\text{C}}}-\text{OCH}_3$
 (B) $\text{CH}_3-(\text{CH}_2)_5-\text{CH}_2-\text{CO}-\text{CH}_3$
 (C) $\text{CH}_3-(\text{CH}_2)_5-\text{CH}_2-\overset{\text{OCH}_3}{\underset{|}{\text{C}}}=\text{CH}_2$
 (D) $\text{CH}_3-(\text{CH}_2)_5\text{CH}_2-\overset{\text{OH}}{\underset{|}{\text{CH}}}-\text{CH}_3$

28. Which of the following statements is correct ?

- (A) *cis*-1, 2-dichlorobutene has dipole moment and has higher B.P. than the *trans* isomer
 (B) *trans*-1, 2-dichlorobutene has dipole moment and has higher B.P. than the *cis* isomer
 (C) *cis*-1, 2-dichlorobutene has dipole moment and has lower B.P. than the *trans* isomer
 (D) *trans*-1, 2-dichlorobutene has dipole moment and has lower B.P. than the *cis* isomer

29. Bromination of ethyl benzene under light gives :
- (A) $\text{Ph-CH}_2\text{-CH}_2\text{-Br}$
- (B) Ph-CH(Br)-CH_3
- (C)
- (D)
30. The major product formed in the nitration reaction of *m*-nitro benzoic acid is :
- (A) 3,6-dinitrobenzoic acid
- (B) 2,3-dinitrobenzoic acid
- (C) 3,4-dinitrobenzoic acid
- (D) 3,5-dinitrobenzoic acid
31. In case of alkenes the McLafferty rearrangement produces ions of general formula :
- (A) C_nH_n
- (B) $\text{C}_n\text{H}_{2n+2}$
- (C) $\text{C}_n\text{H}_{2n-2}$
- (D) C_nH_{2n}
32. The ^1H NMR signal of CHBr_3 appears at 2064 Hz in 300 MHz NMR spectrometer. The corresponding chemical shift in δ is :
- (A) 6.58
- (B) 5.88
- (C) 7.27
- (D) 6.88

33. Heme is a prosthetic group in a large number of metalloproteins and metalloenzymes, whose absorption spectra is characterized by an intense band at 400 nm and weaker bands at 520-550 nm. The origin of these bands are :
- (A) LMCT transitions
(B) MLCT transitions
(C) $\pi-\pi^*$ transitions
(D) $d-d$ transitions
34. The metal ion present in the active site of the enzyme carbonic anhydrase is :
- (A) Zn^{2+}
(B) Cu^{2+}
(C) Mn^{2+}
(D) Mg^{2+}
35. Aqueous ammonia is added to an aqueous solution containing chlorides of Al^{3+} , Cu^{2+} , Fe^{3+} , Ni^{2+} and Mn^{2+} to attain pH ~ 10 and the solution filtered. Which one of the following pairs of ions will pass into the filtrate in some or the other form :
- (A) Fe^{3+} , Mn^{2+}
(B) Cu^{2+} , Ni^{2+}
(C) Al^{3+} , Cu^{2+}
(D) Mn^{2+} , Ni^{2+}
36. A blood red colour is obtained when aqueous ferric ion solution reacts with :
- (A) $[Fe(CN)_6]^{3-}$
(B) KCN
(C) $[Fe(CN)_6]^{4-}$
(D) KSCN

37. A 50 mL solution of KMnO_4 having absorbance value of 1.0 (at 525 nm) is diluted to 100 mL. The absorbance of the diluted solution will be :
- (A) 2.0
(B) 1.0
(C) 0.5
(D) 0.25
38. The window material used in X-ray diffractometer tube is made up of :
- (A) Cu
(B) Be
(C) W
(D) Mo
39. The catalyst used in Zeiglar-Natta process is :
- (A) $[\text{HCo}(\text{CO})_4]$
(B) $[\text{PdCl}_4]^{2-}$
(C) V_2O_5
(D) $\text{TiCl}_4 + \text{Al}(\text{C}_2\text{H}_5)_3$
40. The crystal structure of high temperature superconductor $\text{YBa}_2\text{Cu}_3\text{O}_7$ is based on :
- (A) Perovskite
(B) Rutile
(C) Fluorite
(D) Wurtzite

41. What is the oxidation state of vanadium in the complex $[(\text{H}_2\text{O})_4\text{V}(\mu\text{-OH})_2\text{V}(\text{OH}_2)_4]^{4+}$?
- (A) +1
(B) +4
(C) +3
(D) +2
42. The type(s) of isomerism possible in a molecule with the formula, $[\text{Os}(\text{acac})_2(\text{SCN})_2]$?
(acac=acetylacetonate)
- (A) geometrical, optical
(B) linkage, geometrical
(C) geometrical, optical, coordination
(D) linkage, geometrical, optical
43. Which of the following metal ions will form a low spin octahedral complex with the highest magnetic moment value ?
- (A) Fe^{3+}
(B) Co^{3+}
(C) Co^{2+}
(D) Cr^{3+}
44. For $M_L = 3$ and $M_S = 1$ system, the ground term symbol is :
- (A) ${}^4\text{D}_3$
(B) ${}^3\text{F}_2$
(C) ${}^4\text{F}_2$
(D) ${}^3\text{F}_3$
45. Which of the following possesses non-equivalent F atoms ?
- (A) SF_6
(B) $[\text{PF}_6]^-$
(C) SbF_5
(D) XeF_4

46. Which one of the following compounds readily forms dimers ?
- (A) AsCl_3
(B) AlCl_3
(C) PCl_3
(D) BCl_3
47. Mercury, though metal, is liquid at normal temperatures because of its :
- (A) low cohesive energy
(B) low atomic number
(C) low heat of dissociation
(D) weak van der Waals forces
48. What should be the approximate pH of a solution when 10 mL of 1×10^{-6} M HCl solution is diluted to 1 litre of water ?
- (A) 6.96
(B) 7.16
(C) 6.04
(D) 8.04
49. Which of the following metal ions *does not* form a bent metallocene ?
- (A) Zr^{2+}
(B) Ti^{2+}
(C) Mo^{3+}
(D) Fe^{2+}
50. Which of the following will form clathrates ?
- (A) Fe
(B) He
(C) CH_4
(D) C_6H_6

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CHEMICAL SCIENCES

(In figures as in Admit Card)

Paper II

Seat No. (In words)

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Answer Sheet No.

Time Allowed : 75 Minutes]**[Maximum Marks : 100**Number of Pages in this Booklet : **16****Instructions for the Candidates**

- Write your Seat Number in the space provided on the top of this page. Write your Answer Sheet No. in the space provided for Answer Sheet No. on the top of this page.
- Write and darken Test Booklet No. on OMR Answer Sheet.
- This paper consists of **Fifty (50)** multiple choice type of questions.
- Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the responses as indicated below on the correct response against each item.
Example : (A) (B) (C) (D)
Where (C) is the correct response.
- Your responses to the items for this paper are to be indicated on the Answer Sheet only. Responses like (x) (□) (/) and **light shaded responses will not be considered/evaluated.**
- Read instructions given inside carefully.
- One Sheet is attached at the end of the booklet for rough work.
- You should return the test booklet and answer sheet **both** to the invigilator at the end of the paper and should not carry any paper with you outside the examination hall.
- Answers marked on the body of the question paper will not be evaluated.

परीक्षार्थीसाठी सूचना

- या पानावरील वरच्या कोपऱ्यात आपला आसन क्रमांक तसेच आपणास दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
- प्रश्नपत्रिका क्रमांक OMR उत्तरपत्रिकेवर दिलेल्या रकान्यात लिहून त्याप्रमाणे काळा करावा.
- या प्रश्नपत्रिकेत **पन्नास** बहुनिवड प्रश्न आहेत.
- प्रत्येक प्रश्नासाठी (A), (B), (C) आणि (D) अशी चार विकल्प उत्तरे दिली आहेत. त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा करावा.
उदा. (A) (B) (C) (D)
जर (C) हे योग्य उत्तर असेल तर.
- या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे उत्तरपत्रिकेमध्येच द्यावीत. उत्तराच्या रकान्यामध्ये (x) (□) (/) व **अस्पष्टपणे काळे केलेले उत्तर ग्राह्य धरले जाणार नाही.**
- आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
- कच्च्या कामासाठी प्रश्नपत्रिकेच्या शेवटी कोरे पान जोडले आहे.
- या पेपरची परीक्षा संपल्यानंतर प्रश्नपत्रिका व उत्तरपत्रिका **दोन्ही** पर्यवेक्षकांना परत करावी. यातील कोणताही कागद तुमच्या बरोबर परीक्षा केंद्राबाहेर नेण्यास सक्त मनाई आहे.
- प्रश्नपत्रिकेवर दर्शविलेली उत्तरे तपासली जाणार नाहीत.