

Set No. 1

18P/206/21

1522

Total No. of Printed Pages : 32

Question Booklet No.....

(To be filled up by the candidate by blue/black ball-point pen)

Roll No.

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Roll No. (Write the digits in words).....

Serial No. of OMR Answer Sheet

Centre Code No.

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Day and Date

(Signature of Invigilator)

INSTRUCTIONS TO CANDIDATES

(Use only **blue/black ball-point pen** in the space above and on both sides of the OMR Answer Sheet)

1. Within 30 minutes of the issue of the Question Booklet, check the Question Booklet to ensure that it contains all the pages in correct sequence and that no page/question is missing. In case of faulty Question Booklet bring it to the notice of the Superintendent/Invigilators immediately to obtain a fresh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall *except the Admit Card*.
3. A separate OMR Answer Sheet is given. *It should not be folded or mutilated. A second OMR Answer Sheet shall not be provided. Only the OMR Answer Sheet will be evaluated.*
4. Write all the entries by blue/black ball-point pen in the space provided above.
5. **On the front page of the OMR Answer Sheet, write by pen your Roll Number in the space provided at the top, and by darkening the circles at the bottom. Also, write the Question Booklet Number, Centre Code Number and the Set Number (wherever applicable) in appropriate places.**
6. No overwriting is allowed in the entries of Roll No., Question Booklet No. and Set No. (if any) on OMR Answer Sheet and also Roll No. and OMR Answer Sheet Serial No. on the Question Booklet.
7. Any change in the aforesaid entries is to be verified by the Invigilator, otherwise it will be taken as unfair means.
8. Each question in this Booklet is followed by four alternative answers. *For each question, you are to record the correct option on the OMR Answer Sheet by darkening the appropriate circle in the corresponding row of the OMR Answer Sheet, by ball-point pen as mentioned in the guidelines given on the first page of the OMR Answer Sheet.*
9. For each question, darken only one circle on the OMR Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. *Note that the answer once filled in ink cannot be changed. If you do not wish to attempt a question, leave all the circles in the corresponding row blank (such question will be awarded zero mark).*
11. For rough work, use the inner back page of the title cover and the blank page at the end of this Booklet.
12. On completion of the Test, the Candidate must handover the OMR Answer Sheet to the Invigilator in the examination room/hall. However, candidates are allowed to take away Text Booklet and copy of OMR Answer Sheet with them.
13. Candidates are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

[संयुक्त विदेशी विन्दी में अन्तिम आवरण-पृष्ठ पर दिये गए हैं]

SPACE FOR ROUGH WORK

रफ़ कार्य के लिए जगह

18P/206/21 Set No. 1

No. of Questions : 120

Time : 2 Hours

Full Marks : 360

- Note :**
- (1) Attempt as many questions as you can. Each question carries **3** marks. **One** mark will be deducted for each incorrect answer. Zero mark will be awarded for each unattempted question.
 - (2) If more than one alternative answers seem to be approximate to the correct answer, choose the closest one.

1. In the equation $\hat{H}\psi = E\psi$, which one of the following is correct?

- (1) ψ is independent of time
- (2) \hat{H} stands for the sum of potential and kinetic energies
- (3) E stands for the sum of average values of kinetic and potential energies
- (4) $|\psi|^2$ is a function of time

2. The ground state energy of an electron ($m = 10^{-30}$ kg) confined to a box of the size of an atom (10^{-10} m) is 35 eV. If the energy is 3500 MeV, the size of the box is

- (1) 10^{-14} m (2) 10^{-18} m (3) 10^{-6} m (4) 10^{-2} m

3. The uncertainty product $\Delta p_x \cdot \Delta y$ is

- (1) $\frac{h}{2\pi}$ (2) $\frac{h}{4\pi}$ (3) ∞ (4) 0

4. IR spectrum of HCl shows 03 bands. The most intense one is at 2890 cm^{-1} while the weaker ones are at

- (1) 1445 cm^{-1} and 722.5 cm^{-1} (2) 5780 cm^{-1} and 11560 cm^{-1}
(3) 5780 cm^{-1} and 8670 cm^{-1} (4) 5668 cm^{-1} and 8347 cm^{-1}

5. The width of an emission line during transition of an atom from one of its excited states to the ground state is 0.33 cm^{-1} . The life-time of the excited state is

- (1) 0 (2) 3s (3) 100 ps (4) ∞

6. For a particle in a cubic box of edge a , how many states have energies in the range up to $\frac{16h^2}{8ma^2}$? The number is

- (1) 4 (2) 6 (3) 12 (4) 17

7. Which one of the following atoms has the simplest NMR spectrum?

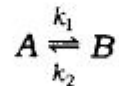
- (1) ^1H (2) ^2D (3) ^3He (4) ^4He

8. IR spectrum of CO_2 contains
 (1) 2 bands (2) 3 bands (3) 4 bands (4) No band
9. Which one of the following molecules belong to the point group of C_{2v} ?
 (1) B_2H_6 (2) C_2F_4 (3) NH_2Cl (4) Thiophene
10. What would be the spin function component in the spin-orbital of the ground state H_2 ?
 (1) $\alpha(1)\alpha(2)$ (2) $\beta(1)\beta(2)$
 (3) $\alpha(1)\beta(2) + \alpha(2)\beta(1)$ (4) $\alpha(1)\beta(2) - \alpha(2)\beta(1)$
11. One instrument uses a permanent magnet with 0.1750 tesla of magnetic field. The proton resonance frequency in this instrument will be
 (1) 6.5403 MHz (2) 7.4501 MHz (3) 8.0154 MHz (4) 10.5402 MHz
12. A gradual decrease in the spacing between successive lines with increase in rotational quantum is observed in the microwave spectrum of an AB molecule
 (1) in the region of first few J
 (2) throughout the entire series of J
 (3) in the region of high J
 (4) in the region of very high J
13. The high temperature limit of Boltzmann distribution law for two energy levels E_i and E_j of degeneracy g_i and g_j respectively is
 (1) 1 (2) $\frac{g_i}{g_j}$ (3) $1 - \frac{g_i}{g_j}$ (4) 0

14. The molecular translational partition function of N_2 molecule changes with T ($/K$) as
 (1) $T^{5/2}$ (2) $T^{3/2}$ (3) $T^{1/2}$ (4) independent of T
15. Which molecular partition function (q) of a diatomic molecule is proportional to T ($/K$)?
 (1) q_{rot} (2) q_{vib} (3) q_{el} (4) q_{nu}
16. According to Debye-Hückel limiting law, the mean activity coefficient ($\log \gamma_{\pm}$) of a m molal $BaCl_2$ solution in water at $25^\circ C$ is
 (1) $-0.51 m^{1/2}$ (2) $-1.77 m^{1/2}$ (3) $-1.53 m^{1/2}$ (4) $-2.04 m^{1/2}$
17. The standard EMF of the cell

$$Pt, H_2 | HCl(aq), Hg_2Cl_2(s) | Hg$$
 is 269 mV at $20^\circ C$ and 266 mV at $30^\circ C$. The standard entropy change for the full stoichiometric cell reaction at $25^\circ C$ is
 (1) $60 JK^{-1} mol^{-1}$ (2) $30 JK^{-1} mol^{-1}$
 (3) $0.3 kJ mol^{-1}$ (4) $30 JK^{-1}$
18. The effective resistance of a $1 cm^2$ electrode-electrolyte interface of $Hg, H_2 | H^+$ at $25^\circ C$ for an overpotential less than 10 mV is (given : the exchange current density = $0.79 \times 10^{-12} A cm^{-2}$)
 (1) $6.8 \times 10^{10} ohm$ (2) $3.3 \times 10^{10} ohm$
 (3) $1.7 \times 10^{10} ohm$ (4) 60 ohm

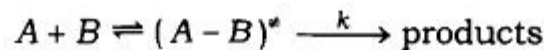
19. For the reaction



where k_1 and k_2 are $5 \times 10^4 \text{ s}^{-1}$ and 50 s^{-1} , the relaxation time is

- (1) 20 ms (2) 2 ms (3) 20 μs (4) 2 μs

20. The number of internal degrees of freedom of a linear activated complex for the reaction



where A and B are monoatomic reactants, is

- (1) 0 (2) 1 (3) 3 (4) 5

21. According to the Arrhenius theory, the limiting value of the specific reaction rate when the temperature increases is

- (1) A (2) k/e (3) A/e (4) ∞

22. The thermodynamic condition for osmotic equilibrium is

- (1) $\pi V_{1,m}^0 = -RT \ln x_2$ (2) $\pi V_{1,m}^0 = -RT \ln x_1$
 (3) $\pi \bar{V}_1 = -RT \ln x_2$ (4) $\pi \bar{V}_1 = -RT \ln x_1$

where the symbols have their usual meanings.

23. Duhem-Margules equation

- (1) relates chemical potential of two components of a binary liquid system to their mole fractions
 (2) applies exclusively to ideal liquid mixtures
 (3) applies to only non-ideal liquid mixtures
 (4) applies to both ideal and non-ideal liquid mixtures

24. Mo is known to crystallize in cubic form. The powder diffraction pattern of Mo obtained using K_{α} - X-rays from Cu ($\lambda = 154$ pm) shows reflections at values of $\sin^2 \theta = 0.1198, 0.2395, 0.3588, 0.4793, 0.5984 \dots$ The type of cubic crystal formed by Mo is

- (1) primitive (2) edge-centred (3) face-centred (4) body-centred

25. The BET equation reduces to Langmuir's isotherm when

- (1) $P^* \gg P$ (2) $P^* = P$ (3) $P^* < P$ (4) $P^* \ll P$

where P is the pressure of the gas in the bulk and P^* is the saturated vapour pressure of the adsorbate at the same temperature.

26. How many atoms are there in a unit cell for the diamond lattice?

- (1) 2 (2) 4 (3) 6 (4) 8

27. At 0° K, the molar absolute entropy of CO molecules in a perfect crystal is

- (1) $0 \text{ JK}^{-1} \text{ mol}^{-1}$ (2) $-5.76 \text{ JK}^{-1} \text{ mol}^{-1}$
 (3) $5.76 \text{ JK}^{-1} \text{ mol}^{-1}$ (4) $11.52 \text{ JK}^{-1} \text{ mol}^{-1}$

28. A chemical reaction is known to be of zero order with $k = 5 \times 10^{-8} \text{ mol L}^{-1} \text{ s}^{-1}$. How long does it take for the concentration of the reactant to decrease from $4 \times 10^{-4} \text{ mol L}^{-1}$ to $2 \times 10^{-4} \text{ mol L}^{-1}$?

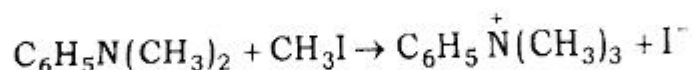
- (1) $4 \times 10^3 \text{ s}$ (2) $2 \times 10^7 \text{ s}$ (3) $2.5 \times 10^8 \text{ s}$ (4) $1 \times 10^6 \text{ s}$

29. If ϕ is a normalised trial function for the state of a system with Hamiltonian \hat{H} and true ground state energy E_0 and excited state energies E_i , the integral $\int \phi^* \hat{H} \phi dT$ is

- (1) $< E_0$ (2) E_0 always (3) $\geq E_0$ (4) $\geq E_i$

30. Which one of the following functions is quantum mechanically not acceptable?
 (1) $\exp(kx^2)$ (2) $\exp(ikx)$ (3) $\exp(-kx^2)$ (4) $\exp(-kx)$
31. To determine the stiffness of the bond of a diatomic molecule in its excited state, one should analyse the molecule's
 (1) rotational spectrum (2) rotation-vibration spectrum
 (3) vibration spectrum (4) vibronic spectrum
32. Which one of the following derivatives equals volume?
 (1) $\left(\frac{\partial A}{\partial T}\right)_v$ (2) $\left(\frac{\partial G}{\partial T}\right)_p$ (3) $\left(\frac{\partial A}{\partial V}\right)_T$ (4) $\left(\frac{\partial G}{\partial p}\right)_T$
33. If the activation energy for the reaction $H_2 + I_2 \rightarrow 2HI$ is 167 kJ and ΔE for the reaction is -8.2 kJ. What is the activation energy for the decomposition of HI?
 (1) 158.8 kJ (2) 175.2 kJ (3) 167 kJ (4) 8.2 kJ
34. The Maxwell distribution for an individual component of molecular velocities depends on the individual component (u) as
 (1) $\exp(-u^2)$ only (2) both u^2 and $\exp(-u^2)$
 (3) both $u^{1/2}$ and $\exp(-u)$ (4) u^2 only

35. The rate constant of the reaction



is $10^{-4} \text{ L mol}^{-1} \text{ s}^{-1}$ in nitrobenzene at 25°C . If equal volumes of solutions that are 0.10 mol L^{-1} in dimethylaniline and aniline are mixed how much time is required for 80% of the reactants to disappear?

- (1) $4 \times 10^5 \text{ s}$ (2) $8 \times 10^5 \text{ s}$
 (3) $3 \times 10^3 \text{ s}$ (4) $6.93 \times 10^3 \text{ s}$
36. In which one of the following cases the value of x is maximum?
 (1) $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ (2) $\text{CaSO}_4 \cdot x\text{H}_2\text{O}$
 (3) $\text{SrSO}_4 \cdot x\text{H}_2\text{O}$ (4) $\text{BaSO}_4 \cdot x\text{H}_2\text{O}$
37. KO_2 is used in submarines because
 (1) it absorbs CO only (2) it absorbs CO_2 only
 (3) it releases O_2 only (4) it absorbs CO_2 and releases O_2
38. Group 13 metals Ga and In form compounds of general formula M_2Cl_4 . Which one of the following statements is incorrect?
 (1) These compounds are ionic
 (2) These compounds have M in + II state
 (3) The complex ion in these compounds are in + III state
 (4) These compounds have M in + I and III states

39. When sodium metal is added in liquid ammonia a blue solution is obtained. The blue colour is due to
- (1) solvated Na metal (2) solvated Na^+ ion
(3) solvated electron (4) cluster formation
40. Which one of the following compounds consists of a P—P linkage?
- (1) Hypophosphoric acid (2) Pyrophosphoric acid
(3) Hypophosphorous acid (4) Pyrophosphorous acid
41. The correct basicity-order is
- (1) $\text{NF}_3 > \text{NH}_3 > \text{NH}_2\text{NH}_2 > \text{NH}_2\text{OH}$ (2) $\text{NF}_3 > \text{NH}_2\text{OH} > \text{NH}_3 > \text{NH}_2\text{NH}_2$
(3) $\text{NH}_3 > \text{NF}_3 > \text{NH}_2\text{NH}_2 > \text{NH}_2\text{OH}$ (4) $\text{NH}_3 > \text{NH}_2\text{NH}_2 > \text{NH}_2\text{OH} > \text{NF}_3$
42. In the complex metaborate ion the states of hybridization of boron is/are
- (1) sp^3 (2) sp^2 (3) sp^2 and sp^3 (4) sp and sp^2
43. Impure sodium chloride (metal excess) is coloured because of
- (1) $s-p$ transition (2) $d-d$ transition
(3) polarization by Na^+ ions (4) presence of F centres
44. The flickering light often seen in the marshy lands (will-o'-the-wisp) originates from
- (1) PH_3 (2) CH_4 (3) P_2H_4 (4) NH_3

45. Which one of the following does not obey $18e^-$ rule?
(1) $\text{Fe}(\eta^5\text{-C}_5\text{H}_5)_2$ (2) $\text{Co}_2(\text{CO})_8$
(3) $[\text{Ru}(\eta^6\text{-C}_6\text{Me}_6)_2]^{2+}$ (4) $\text{V}(\text{CO})_6$
46. In a metal alkyl compound which σ bonded R group shows most facile elimination?
(1) Me (2) Et (3) CH_2Ph (4) CH_2CMe_3
47. Organometallic compounds of Li are stable in
(1) water (2) ethanol (3) air (4) ether
48. Product of the following reaction is $\text{CH}_3\text{COOH} + \text{LiAlH}_4 \rightarrow ?$
(1) $\text{CH}_3\text{-CHO}$ (2) $\text{CH}_3\text{CH}_2\text{-OH}$ (3) $\text{CH}_3\text{-OH}$ (4) $\text{CH}_3\text{-CH}_3$
49. The correct set of biologically essential elements is
(1) Fe, Cu, Co, Ru (2) Cu, Mn, Zn, Ag
(3) Fe, Ru, Zn, Mg (4) Fe, Na, P, K
50. Fe^{2+} -porphyrins fail to exhibit reversible oxygen transport and cannot differentiate CO from O_2 , however, these problems are not there with haemoglobin because
(A) Fe-CO bond strength is lower in the case of haemoglobin as compared to Fe^{2+} -porphyrins
(B) Fe^{2+} -porphyrin undergo peroxo, $(\text{Fe}-\text{O}-\text{O}-\text{Fe})$ complex formation which is prevented in the case of haemoglobin
(C) Fe-CO is linear while Fe- O_2 is bent which is recognised in haemoglobin
(D) the interlinked 4-units in haemoglobin overcomes these problems due to cooperativity
(1) (A) and (B) (2) (B) and (C) (3) (C) and (D) (4) (D) and (A)

55. In Mn_3O_4 the number of manganese in tetrahedral and octahedral sites are respectively

- (1) one Mn^{2+} and two Mn^{3+} (2) one Mn^{3+} and two Mn^{2+}
(3) one Mn^{2+} and one Mn^{3+} (4) two Mn^{2+} and two Mn^{2+}

56. The total number of possible microstates for a p^3 configuration is

- (1) 6 (2) 15 (3) 20 (4) 30

57. In $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ $d-d$ transitions are

- (1) Laporte forbidden and spin allowed
(2) Laporte allowed and spin forbidden
(3) Both Laporte and spin allowed
(4) Both Laporte and spin forbidden

58. There is only one electron in the d orbitals of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$. However, its electronic spectrum shows a broad band with a shoulder. Reasons for broadening and appearance of the shoulder are respectively

- (1) spin-orbit coupling and Jahn-Teller distortion
(2) non-rigid structure and polarization
(3) spin-orbit coupling and charge transfer
(4) non-rigid structure and Jahn-Teller distortion

59. For a free ion the ground term is F, the Mulliken symbols for the possible spectroscopic states are

- (1) $T_{2g} + E_g$ (2) $T_{1g} + T_{2g} + T_{1u}$
 (3) $T_{1g} + T_{2g} + A_{2g}$ (4) $T_{1g} + A_{1g} + T_{2g}$

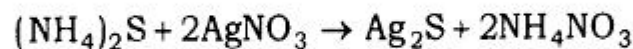
60. Select the correct statement

- (1) Electrical conductivity of a metal increases with temperature
 (2) Electrical conductivity of a semi-conductor increases with temperature
 (3) Electrical conductivity of a super-conductor increases with temperature
 (4) Electrical conductivities of metals and semiconductors remain unaffected by variations in temperature

61. An example of a compound that crystallizes with a layer structure is

- (1) ZnS (2) CaF₂ (3) CdI₂ (4) TiO₂

62. Consider the following reaction taking place in liquid ammonia



select the correct statement given below

- (1) $(\text{NH}_4)_2\text{S}$ is acid and AgNO_3 is base
 (2) $(\text{NH}_4)_2\text{S}$ is base and AgNO_3 is acid
 (3) $(\text{NH}_4)_2\text{S}$ is base and an H^+ donor is essential additionally
 (4) This is not an acid-base reaction

51. Which one of the following is expected to exhibit geometrical isomerism?

- (1) $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ (2) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
 (3) $[\text{Zn}(\text{NH}_3)_2\text{Cl}_2]$ (4) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

52. Which one of the following complexes is optically active?

- (1) $[\text{Co}(\text{OX})_3]^{3-}$ (2) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
 (3) *cis*- $[\text{Co}(\text{en})_2\text{Cl}_2]$ (4) *trans*- $[\text{Co}(\text{en})_2\text{Cl}_2]$

53. In case of $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$ there are three unpaired electrons and the calculated μ_s value is 3.87 BM which is somewhat lower than the experimentally observed value. This difference is due to

- (1) change from high-spin to low-spin state
 (2) *d-d* transition
 (3) *M* → *L* charge transfer
 (4) contribution of the orbital motion of electrons

54. On the basis of crystal field theory, select the complexes those show same μ_s value

- (A) $[\text{CoF}_6]^{3-}$ (B) $[\text{IrCl}_6]^{3-}$
 (C) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (D) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$

- (1) (A) and (B) (2) (A) and (C) (3) (B) and (C) (4) (A) and (D)

63. Which one of the following is expected to be linear on the basis of VSEPR model?

- (1) I_3^- (2) I_3^+ (3) SO_2 (4) NO_2

64. A compound is insoluble in water, used as a white pigment and turns yellow on heating. The compound may be

- (1) Fe_2O_3 (2) MnO_2 (3) Cu_2O (4) ZnO

65. Which one of the following statements is wrong regarding copper sulphate?

- (1) It reacts with KCl to give Cl_2
(2) It reacts with KI to give I_2
(3) It gives CuO on heating strongly
(4) Its tartarate complex reacts with $NaOH$ and glucose to give Cu_2O

66. A compound alloy Cu_3Au crystallizes in a cubic lattice with Cu at the face centers and Au at the corners. How many formula units of the compound are there in each unit cell?

- (1) 4 (2) 3 (3) 2 (4) 1

67. Which one of the following compounds would be drawn most strongly into a magnetic field?

- (1) $TiCl_4$ (2) VCl_3 (3) $FeCl_2$ (4) $CuCl_2$

68. Arrange the following compounds in order of increasing dipole moment

BF_3 , H_2S and H_2O

- (1) $BF_3 < H_2S < H_2O$ (2) $BF_3 > H_2S > H_2O$
(3) $BF_3 < H_2S > H_2O$ (4) $BF_3 > H_2S < H_2O$

69. What are the bond orders for CN^- , CN and CN^+ ?
- (1) 3, $2\frac{1}{2}$ and 2 (2) 2, $2\frac{1}{2}$ and 3
(3) 3, $2\frac{1}{2}$ and $2\frac{1}{2}$ (4) $2\frac{1}{2}$, 2 and $2\frac{1}{2}$
70. How many geometrical and optical isomers are possible for $[\text{Co}(\text{en})\text{Br}_3\text{Cl}]^-$ ion (en = ethylenediamine)?
- (1) Two geometrical and two optical isomers
(2) Two geometrical and one optical isomers
(3) Two geometrical; however, no optical isomers
(4) only two optical isomers
71. Sensitivity may be defined as
- (1) the ability to distinguish the spectral features into different entities
(2) the ability to distinguish two different concentrations of an analyte
(3) the ability to distinguish the analyte among the interferences
(4) the speed at which an analyte can be determined
72. Limit of detection is generally calculated based on the value of
- (1) three times the variance of the blank
(2) ten times the variance of the blank
(3) ten times the standard deviation of the blank
(4) three times the standard deviation of the blank

73. *Ferroun* is

- (1) Bis(1,10-phenanthroline)iron(III) sulphate
- (2) Tris(1,10-phenanthroline)iron(III) sulphate
- (3) Bis(1,10-phenanthroline)iron(II) sulphate
- (4) Tris(1,10-phenanthroline)iron(II) sulphate

74. The technique of isotopic dilution method was used for the analysis of Hg in a catalyst sample. To a 1.0 g sample of catalyst was added 1.0 g of a mixture containing 1.0% of ^{203}Hg with a specific activity of 2400 cpm/g. Then 0.100 g of Hg was separated which showed an activity of 30 cpm. What is the percentage of Hg in the catalyst sample?

- (1) 0.7% (2) 79% (3) 7.9% (4) 7.0%

75. Karl Fisher reagent contains

- (1) a mixture of bromine, sulphur trioxide, anhydrous methanol and pyrrole
- (2) a mixture of iodine, sulphur dioxide, anhydrous methanol and pyridine
- (3) a mixture of iodine, sulphur trioxide, anhydrous methanol and pyridine
- (4) a mixture of iodine, sulphur dioxide, anhydrous methanol and pyrrole

76. Thin layer chromatography is a type of

- (1) ion-exchange chromatography (2) gas chromatography
- (3) electro chromatography (4) planar chromatography

77. If 4.0 g of butyric acid is to be extracted from 500 mL of water with 500 mL ether, then what will be the weight of extracted butyric acid if the distribution coefficient for the system is 3.0
- (1) 2.9 g (2) 3.0 g (3) 3.2 g (4) 4.0 g
78. Concentration of a solute in parts per million (ppm) can also be given as
- (1) g/mL (2) mg/L (3) mg/mL (4) $\mu\text{g/L}$
79. Absorbance (A) and transmittance (T) can be related as
- (1) $T = 2 - \log A$ (2) $A = \log \% T - 2$
(3) $A = -\log T$ (4) $A = \log \% T + 2$
80. Among the following statements which statements are true?
- (A) Precision may be expressed in terms of relative error.
(B) Precision expresses the reproducibility of a measurement.
(C) Accuracy may be defined as the disagreement between within a set of measurements.
(D) Accuracy expresses the correctness of a measurement.
- (1) (A) and (B) (2) (B) and (D)
(3) (B), (C) and (D) (4) (B) and (C)
81. Chloramine-T is
- (1) used as an alternative of Eriochrome black-T
(2) used as a reducing agent
(3) used as a source of electrophilic chlorine
(4) used for the determination of trace amount of H_2O present in non-aqueous solvents

82. In a planar chromatographic analysis of organic compounds (W, X, Y and Z), the solvent front was 18.0 cm and the fronts due to the compounds W, X, Y and Z were 16.6, 14.3, 10.2 and 5.5 cm, respectively. If the R_f value of the unknown compound is 0.79, identify the unknown compound among the W, X, Y and Z compounds

- (1) W (2) X (3) Y (4) Z

83. When an aqueous solution of chromate is made strongly acidic

- (1) a negative deviation to the Beer's law is observed
(2) a positive deviation to the Beer's law is observed
(3) Beer's law is obeyed
(4) Beer's law becomes invalid

84. Addition of excess KBr to an acidic solution of 1.0 mole $KBrO_3$ gives

- (1) 1.0 mole of Br_2 (2) 1.3 mole of Br_2
(3) 3.0 mole of Br_2 (4) 3.1 mole of Br_2

85. To deionise tap water by ion exchange for laboratory use, the best approach would be to employ

- (1) a column containing a strong acid cation exchanger in the hydrogen form
(2) a column containing a strong base anion exchanger in the hydroxyl form
(3) a mixed bed column containing a strong acid cation exchanger in the solution form and a strong base anion exchanger in the chloride form
(4) a mixed bed column containing a strong acid cation exchanger in the hydrogen form and a strong base anion exchanger in the hydroxyl form

86. Which one of the following is not correct for S_N1 reactions of alkyl halides?

- (1) Rearrangements are possible in these reactions
- (2) Nucleophilicity of the base has an effect on the rate of reaction
- (3) Alkenes are formed in small quantities in these reactions
- (4) Polar solvents enhance the rate of reaction

87. Match List—I with List—II and select the correct answer using the codes given below the lists :

<i>List—I</i> (Reactions)	<i>List—II</i> (Reactive intermediate formed)
(A) $(C_6H_5)_3C-Cl + Ag$	(1) Carbocation
(B) $CH_3NO_2 + C_2H_5O^-$	(2) Free radical
(C) $CH_3CH_2NH_2 + HNO_2$	(3) No reactive intermediate
(D) $CH_3Br + HO^-$	(4) Carbanion

Codes :

	(A)	(B)	(C)	(D)
(1)	1	2	3	4
(2)	2	4	1	3
(3)	3	4	2	1
(4)	2	1	4	3

88. The relative rates of nitration of C_6H_6 and C_6D_6 are close to unity. What does this indicate about the breaking of C—H and C—D bonds in this reaction?

- (1) They are broken during the rate-determining step
- (2) They are broken before the rate-determining step
- (3) They are broken after the rate-determining step
- (4) They are not broken at all

89. The most suitable catalyst for the hydrogenation of 2-Pentyne \rightarrow *cis*-2-Pentene is

- (1) Pd—CaCO₃/Quinoline
- (2) 10% Pd—C
- (3) Raney Ni
- (4) Li/NH₃

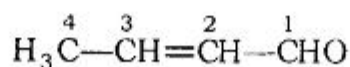
90. Arrange the following compounds in the decreasing order of reactivity towards S_N2 displacement

- (A) 1-Bromobutane
- (B) 1-Bromo-2,2-dimethyl propane
- (C) 1-Bromo-2-methylbutane
- (D) 1-Bromo-3-methylbutane

Codes :

- (1) (B) > (D) > (C) > (A)
- (2) (B) > (C) > (D) > (A)
- (3) (A) > (D) > (C) > (B)
- (4) (A) > (B) > (C) > (D)

91. The molecule shown below has four different types of hydrogens present in it. Which one is most acidic?

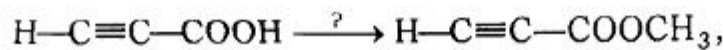


- (1) 1
- (2) 2
- (3) 3
- (4) 4

92. In the mechanism of chlorination of methane, which one of the following steps is not actually involved?

- (1) $\text{Cl}_2 \xrightarrow{h\nu} 2\text{Cl}\cdot$ (2) $\text{Cl}\cdot + \text{CH}_4 \longrightarrow \text{CH}_3\text{Cl} + \text{H}\cdot$
 (3) $\text{Cl}\cdot + \text{CH}_4 \longrightarrow \text{HCl} + \text{CH}_3\cdot$ (4) $\text{CH}_3\cdot + \text{Cl}_2 \longrightarrow \text{CH}_3\text{Cl} + \text{Cl}\cdot$

93. A convenient method for the transformation shown as



is to use the reagent

- (1) $\text{CH}_3\text{OH}, \text{H}_2\text{SO}_4$ (2) $(\text{CH}_3)_2\text{SO}_4, \text{NaOH}$
 (3) CH_2N_2 (4) CH_3I

94. Which one of the following statements is not true about α -terpineol?

- (1) It contains two double bonds
 (2) It is optically active
 (3) It contains a tertiary alcoholic group
 (4) It forms *p*-cymene when heated with sulphuric acid

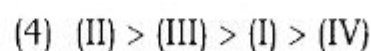
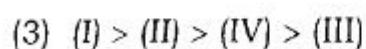
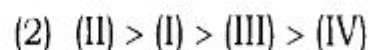
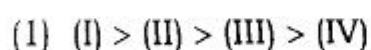
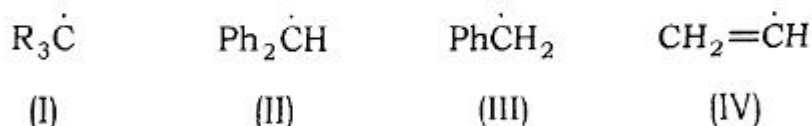
95. Identify the sugars from the following which are formed on warming glucose with dilute NaOH solution?

Fructose	Glucose	Mannose	Galactose
(A)	(B)	(C)	(D)

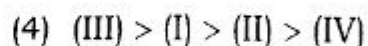
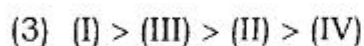
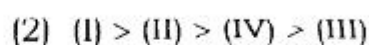
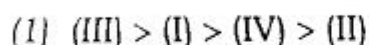
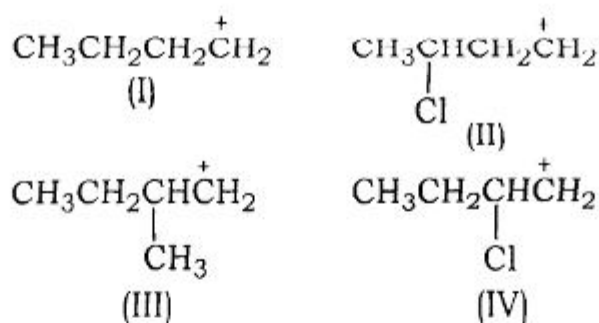
Codes :

- (1) (A) and (B) only (2) (B), (C) and (D) only
 (3) (A), (B) and (C) only (4) (A), (C) and (D) only

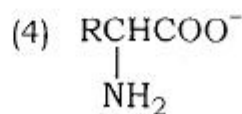
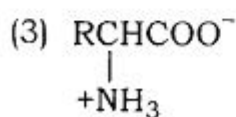
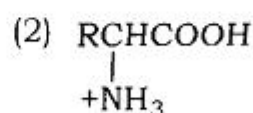
96. Arrange the following free radicals in order of decreasing stability



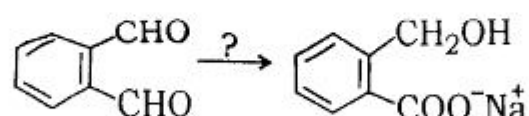
97. Arrange the following carbocations in order of their decreasing stability



98. When an α -amino acid is dissolved in water and the pH of the solution adjusted to 7, which of the following species is predominant?



99. Select suitable reagent to bring out the following transformation



- (1) *conc.* NaOH
(2) C₂H₅ONa
(3) SeO₂, NaBH₄
(4) B₂H₆, then H₂O₂, NaOH

100. The order of decreasing acidity of the following hydrocarbons is



(A)



(B)



(C)



(D)

- (1) (A) > (B) > (C) > (D)
(2) (D) > (C) > (B) > (A)
(3) (D) > (C) > (A) > (B)
(4) (B) > (A) > (C) > (D)

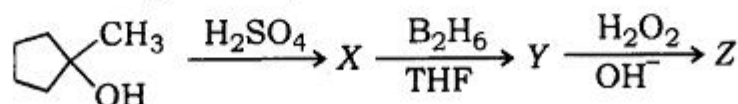
101. In Skraup synthesis of quinoline, one of the steps in the reaction involves oxidation. The oxidizing agent is

- (1) glycerol (2) C₆H₅NO₂ (3) H₂SO₄ (4) FeSO₄

102. Zerewitinoff determination of active hydrogen in a compound is based upon reaction with

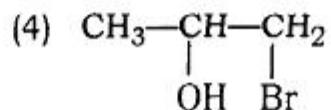
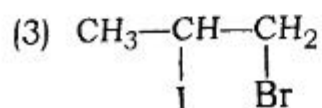
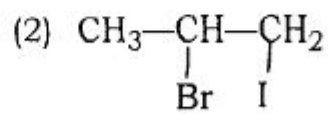
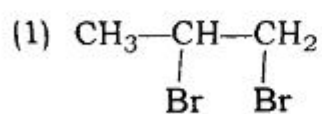
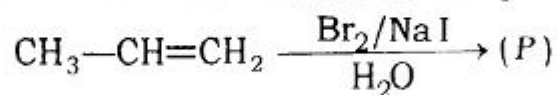
- (1) Na (2) CH₃MgI
(3) *n*-Butyl-lithium (4) LiAlH₄

103. The product Z in the given sequence of reactions is

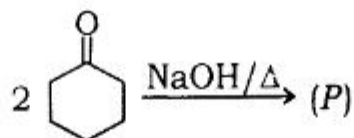


- (1) 2-methylcyclopentanol (2) 1-methylcyclopentene
(3) 1-methylcyclopentanol (4) cyclohexanol

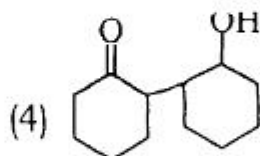
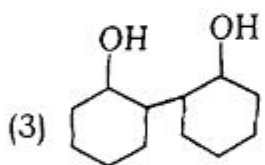
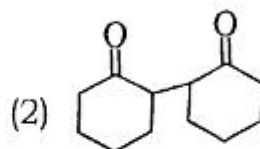
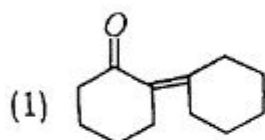
104. In the given reaction which one will not be the product (*P*)?



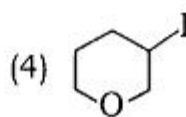
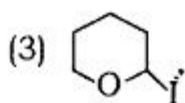
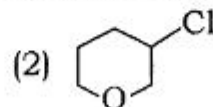
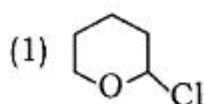
105. In the following reaction



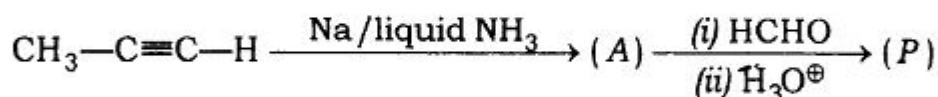
the product (*P*) will be



106. Which one of the following is most reactive in S_N1 reaction?



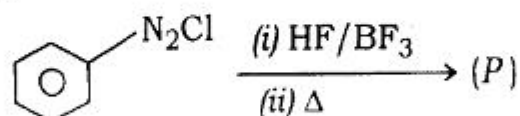
107. Which one of the following alkenes will give meso-isomer with Br_2/CCl_4 ?
- (1) 1-Butene (2) Propene
(3) *cis*-2-butene (4) *trans*-2-butene
108. Glucose on treatment with CH_3OH in the presence of dry HCl gas gives α - and β -methyl glucosides because it contains
- (1) a $-\text{CH}_2\text{OH}$ group (2) an aldehydic group
(3) a hemiacetal group (4) five $-\text{OH}$ groups
109. Which one of the following pairs is not correctly matched?
- (1) Isocyanate—Hofmann bromamide reaction
(2) Free radicals—photohalogenations
(3) Carbanion—Aldol condensation
(4) Carbocation—Reimer-Tiemann reaction
110. In the reaction sequence



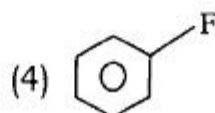
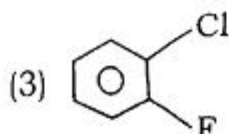
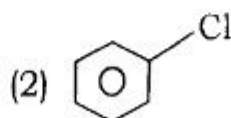
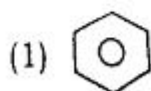
the product (P) is

- (1) $\begin{array}{c} \text{H}_3\text{C} \quad \text{CH}_2\text{OH} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \\ \text{H} \quad \text{H} \end{array}$ (2) $\begin{array}{c} \text{H} \quad \text{CH}_2\text{OH} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \\ \text{H}_3\text{C} \quad \text{H} \end{array}$
(3) $\text{CH}_3-\text{C}\equiv\text{C}-\text{CH}_2\text{OH}$ (4) $\text{CH}_3-\text{C}\equiv\text{C}-\text{COOH}$

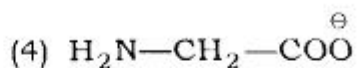
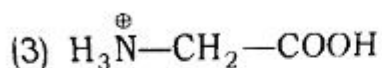
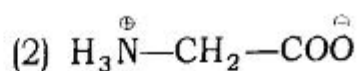
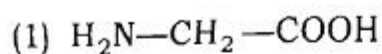
111. In the given reaction



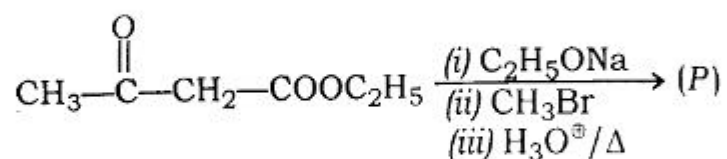
the product (P) is



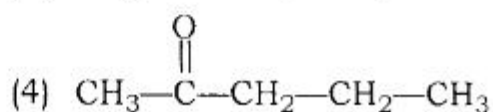
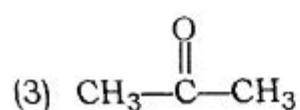
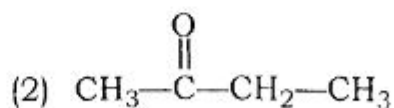
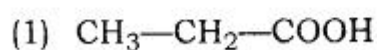
112. At pH = 3, the correct structure of glycine is



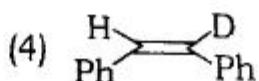
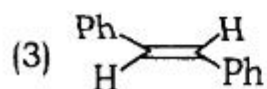
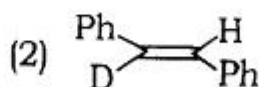
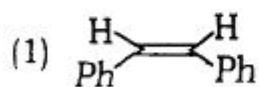
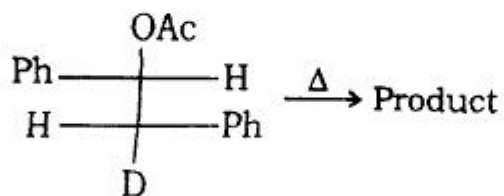
113. In the following reaction



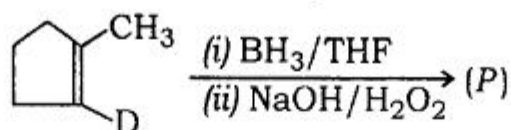
the product (P) will be



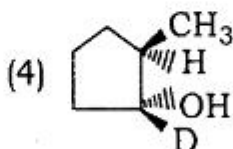
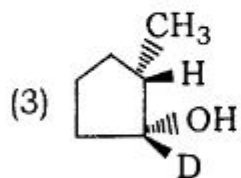
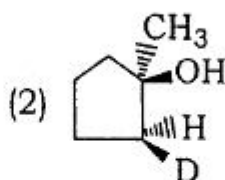
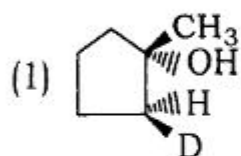
114. Which one is the major product of the following reaction?



115. In the reaction



the product (P) is



116. Which one of the following alkenes will give racemic mixture with Baeyer reagent?

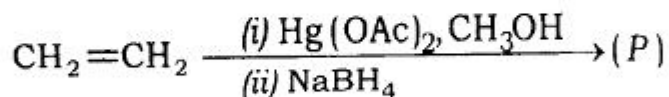
(1) 1-Butene

(2) *cis*-2-butene

(3) *trans*-2-butene

(4) Propene

117. In the given reaction



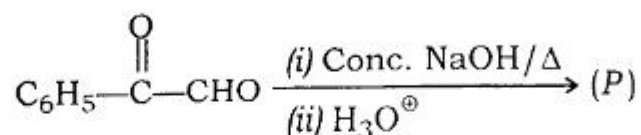
the product (*P*) is

- (1) $\text{CH}_3\text{CH}_2\text{OH}$ (2) $\text{CH}_3-\text{O}-\text{CH}_2\text{CH}_3$
 (3) CH_3-CHO (4) CH_3-CH_3

118. Bakelite is formed by the condensation of

- (1) urea and formaldehyde (2) phenol and acetaldehyde
 (3) melamine and formaldehyde (4) phenol and formaldehyde

119. In the reaction



the product (*P*) is

- (1) $\text{C}_6\text{H}_5\text{COOH}$ (2) $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$
 (3) $\text{C}_6\text{H}_5-\text{CHOH}-\text{CH}_2\text{OH}$ (4) $\text{C}_6\text{H}_5-\text{CHOH}-\text{COOH}$

120. Which one of the following does not undergo mutarotation?

- (1) Sucrose (2) Glucose (3) Fructose (4) Mannose

SPACE FOR ROUGH WORK

रफ़ कार्य के लिए जगह

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण-पृष्ठ पर तथा ओ०एम०आर० उत्तर-पत्र के दोनों पृष्ठों पर केवल नीली/काली बाल-प्वाइंट पेन से ही लिखें)

1. प्रश्न-पुस्तिका मिलने के 30 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई पृष्ठ या प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।
2. परीक्षा भवन में प्रवेश-पत्र के अतिरिक्त, लिखा या सादा कोई भी खुला कागज साथ में न लायें।
3. ओ०एम०आर० उत्तर-पत्र अलग से दिया गया है। इसे न तो मोड़ें और न ही विकृत करें। दूसरा ओ०एम०आर० उत्तर-पत्र नहीं दिया जायेगा। केवल ओ०एम०आर० उत्तर-पत्र का ही मूल्यांकन किया जायेगा।
4. सभी प्रविष्टियाँ प्रथम आवरण-पृष्ठ पर नीली/काली बाल पेन से निर्धारित स्थान पर लिखें।
5. ओ०एम०आर० उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक एवं केन्द्र कोड नम्बर तथा सेट का नम्बर उचित स्थानों पर लिखें।
6. ओ०एम०आर० उत्तर-पत्र पर अनुक्रमांक संख्या, प्रश्न-पुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्न-पुस्तिका पर अनुक्रमांक सं० और ओ०एम०आर० उत्तर-पत्र सं० की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।
7. उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।
8. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिये आपको ओ०एम०आर० उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को ओ०एम०आर० उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।
9. प्रत्येक प्रश्न के उत्तर के लिये केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।
10. ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है। यदि आप किसी प्रश्न का उत्तर नहीं देना चाहते हैं, तो सम्बन्धित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।
11. रफ़ कार्य के लिये प्रश्न-पुस्तिका के मुखपृष्ठ के अन्दर वाले पृष्ठ तथा अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा की समाप्ति के बाद अभ्यर्थी अपना ओ०एम०आर० उत्तर-पत्र परीक्षा कक्ष/हाल में कक्ष निरीक्षक को सौंप दें। अभ्यर्थी अपने साथ प्रश्न-पुस्तिका तथा ओ०एम०आर० उत्तर-पत्र की प्रति ले जा सकते हैं।
13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।
14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।