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KSET 2023 Chemical Sciences Question Paper

EXAM	YEAR	TYPE
KSET	2023	Question Paper

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ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆ - 2023

ಪತ್ರಿಕೆ – II

ವಿಷಯ: ರಸಾಯನಿಕ ವಿಜ್ಞಾನಗಳು

ವಿಷಯ ಸಂಕೇತ:27

ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ ಸಂಕೇತ	ಅವಧಿ	ಒಟ್ಟು ಪ್ರಶ್ನೆಗಳ ಸಂಖ್ಯೆ	ಗರಿಷ್ಠ ಅಂಕಗಳು	ನಿಮ್ಮ ನೋಂದಣಿ ಸಂಖ್ಯೆಯನ್ನು ನಮೂದಿಸಿ						
CHE202327	ಎರಡು ಘಂಟೆಗಳು	100	200							

ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಸೂಚನೆಗಳು

ಮಾಡಿ:

1. ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರು ಈ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯನ್ನು ನಿಮಗೆ ಎರಡನೇ ಬೆಲ್ ಆದ ನಂತರ ಕೊಡುತ್ತಾರೆ.
2. ನೊಂದಣಿ ಸಂಖ್ಯೆಯನ್ನು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಬರೆದು ಅದಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವೃತ್ತಗಳನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ತುಂಬಿದ್ದೀರೆಂದು ಖಾತ್ರಿಪಡಿಸಿಕೊಳ್ಳತಕ್ಕದ್ದು.
3. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ವರ್ಷನ್ ಕೋಡ್ ಅನ್ನು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಬರೆದು ಅದಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವೃತ್ತಗಳನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ತುಂಬಬೇಕು.
4. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ವರ್ಷನ್ ಕೋಡ್ ಮತ್ತು ಕ್ರಮ ಸಂಖ್ಯೆಯನ್ನು ನಾಮಿನಲ್ ರೋಲ್‌ನಲ್ಲಿ ತಪ್ಪಿಲ್ಲದೆ ಬರೆಯಬೇಕು.
5. ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯ ಕೆಳಭಾಗದ ನಿಗದಿತ ಜಾಗದಲ್ಲಿ ಕಡ್ಡಾಯವಾಗಿ ಸಹಿ ಮಾಡಬೇಕು.

ಮಾಡಬೇಡಿ:

1. ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಮುದ್ರಿತವಾಗಿರುವ **ಟೈಮಿಂಗ್** & **ಮಾರ್ಕನ್ನು** ತಿದ್ದಬಾರದು / ಹಾಳುಮಾಡಬಾರದು / ಅಳಿಸಬಾರದು.
2. ಮೂರನೇ ಬೆಲ್ ಆಗುವವರೆಗೂ,
   - ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಬಲಭಾಗದಲ್ಲಿರುವ ಸೀಲ್ ಅನ್ನು ತೆಗೆಯಬಾರದು.
   - ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಒಳಗಡೆ ಇರುವ ಪ್ರಶ್ನೆಗಳನ್ನು ನೋಡಲು ಪ್ರಯತ್ನಿಸಬಾರದು ಮತ್ತು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಉತ್ತರಿಸಲು ಪ್ರಾರಂಭಿಸಬಾರದು.

ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಮುಖ್ಯ ಸೂಚನೆಗಳು

1. ಪ್ರಶ್ನೆಗಳಲ್ಲಿ ಬಳಸಿರುವ signs and symbols ಗಳನ್ನು, ಬೇರೆ ರೀತಿಯಲ್ಲಿ ಹೇಳದ ಹೊರತು, ನಿಗದಿತ ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿನ ಅರ್ಥವನ್ನು ಪರಿಗಣಿಸಬೇಕು.
2. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಒಟ್ಟು **100** ಪ್ರಶ್ನೆಗಳಿದ್ದು, ಪ್ರತಿ ಪ್ರಶ್ನೆಗೂ 4 ಬಹು ಆಯ್ಕೆ ಉತ್ತರಗಳು ಇರುತ್ತವೆ. ಪ್ರತಿ ಪ್ರಶ್ನೆಯ ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ನಾಲ್ಕು ಬಹು ಆಯ್ಕೆಯ ಉತ್ತರಗಳಲ್ಲಿ ಸರಿಯಾದ ಒಂದು ಉತ್ತರವನ್ನು ಆಯ್ಕೆ ಮಾಡಿ.
3. ಮೂರನೇ ಬೆಲ್ ಆದ ನಂತರ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯ ಬಲಭಾಗದಲ್ಲಿರುವ ಸೀಲ್ ತೆಗೆದು ಈ ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಯಾವುದೇ ಪುಟಗಳು ಮುದ್ರಿತವಾಗಿಲ್ಲದೇ ಇರುವುದು ಕಂಡು ಬಂದಲ್ಲಿ ಅಥವಾ ಹರಿದು ಹೋಗಿದ್ದಲ್ಲಿ ಅಥವಾ ಯಾವುದೇ ಅಕ್ಷರಗಳು ಬಿಟ್ಟುಹೋಗಿದ್ದಲ್ಲಿ ಎಂಬುದನ್ನು ಖಚಿತಪಡಿಸಿಕೊಂಡು, ಈ ರೀತಿ ಆಗಿದ್ದರೆ ಪ್ರಶ್ನೆಪತ್ರಿಕೆಯನ್ನು ಬದಲಾಯಿಸಿ ಕೊಳ್ಳುವುದು. ನಂತರ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಉತ್ತರಿಸಲು ಪ್ರಾರಂಭಿಸುವುದು.
4. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿನ ಪ್ರಶ್ನೆಗೆ ಅನುಗುಣವಾಗಿರುವ ಸರಿ ಉತ್ತರವನ್ನು ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಅದೇ ಕ್ರಮ ಸಂಖ್ಯೆಯ ಮುಂದೆ ನೀಡಿರುವ ಸಂಬಂಧಿಸಿದ ವೃತ್ತವನ್ನು ನೀಲಿ ಅಥವಾ ಕಪ್ಪು ಬಾಲ್ ಪಾಯಿಂಟ್ ಪೆನ್‌ನಿಂದ ಸಂಪೂರ್ಣ ತುಂಬುವುದು.

ಸರಿಯಾದ ಕ್ರಮ CORRECT METHOD	ತಪ್ಪು ಕ್ರಮಗಳು WRONG METHODS
(A) ● (C) (D)	✗ (B) (C) (D)　(A) (B) (C) ✓　(A) ● ● (D) ● (B) (C) (D)　(A) ● (C) (D)

5. ಈ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯನ್ನು ಸ್ಕ್ಯಾನ್ ಮಾಡುವ ಸ್ಕ್ಯಾನರ್ ಬಹಳ ಸೂಕ್ಷ್ಮವಾಗಿದ್ದು ಸಣ್ಣ ಗುರುತನ್ನು ಸಹ ದಾಖಲಿಸುತ್ತದೆ. ಆದ್ದರಿಂದ ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯಲ್ಲಿ ಉತ್ತರಿಸುವಾಗ ಎಚ್ಚರಿಕೆ ವಹಿಸಿ.
6. ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಯಲ್ಲಿ ಕೊಟ್ಟಿರುವ ಖಾಲಿ ಜಾಗವನ್ನು ರಫ್ ಕೆಲಸಕ್ಕೆ ಉಪಯೋಗಿಸಿ. ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯನ್ನು ಇದಕ್ಕೆ ಉಪಯೋಗಿಸಬೇಡಿ.
7. **ಕೊನೆಯ ಬೆಲ್ ಆದ ನಂತರ ಉತ್ತರಿಸುವುದನ್ನು ನಿಲ್ಲಿಸಿ, ಓ.ಎಂ.ಆರ್. ಉತ್ತರ ಪತ್ರಿಕೆಯನ್ನು ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರಿಗೆ ಯಥಾಸ್ಥಿತಿಯಲ್ಲಿ ನೀಡಿರಿ.**
8. ಕೊಠಡಿ ಮೇಲ್ವಿಚಾರಕರು ಮೇಲ್ಭಾಗದ ಹಾಳೆಯನ್ನು ಪ್ರತ್ಯೇಕಿಸಿ (ಕಚೇರಿ ಪ್ರತಿ) ತಮ್ಮ ವಶದಲ್ಲಿ ಇಟ್ಟುಕೊಂಡು ತಳಬದಿಯ ಯಥಾಪ್ರತಿಯನ್ನು (ಅಭ್ಯರ್ಥಿಯ ಪ್ರತಿ) ಅಭ್ಯರ್ಥಿಗಳಿಗೆ ಕೊಡುತ್ತಾರೆ.
9. ಎಲ್ಲಾ ಪ್ರಶ್ನೆಗಳಿಗೆ ಸಮಾನ ಅಂಕಗಳಿರುತ್ತದೆ. ಋಣಾತ್ಮಕ ಮೌಲ್ಯಮಾಪನವಿರುವುದಿಲ್ಲ.
10. ಯಾವುದೇ ರೀತಿಯ ಮೊಬೈಲ್ ಫೋನ್, ಕ್ಯಾಲ್ಕ್ಯುಲೇಟರ್ ಮತ್ತು ಇತರೆ ರೀತಿಯ ಎಲೆಕ್ಟ್ರಾನಿಕ್/ಕಮ್ಯುನಿಕೇಷನ್ ಸಾಧನಗಳು ಇತ್ಯಾದಿಗಳನ್ನು ಪರೀಕ್ಷಾ ಕೇಂದ್ರದ ಅವರಣದೊಳಗೆ ತರುವುದನ್ನು ನಿಷೇಧಿಸಿದೆ.

1. A particle is constrained in a one-dimensional box of length 2a with potential $V(x) = \infty$; $x < -a$, $x > a$ and $V(x) = 0$; $-a \leq x \geq a$. Energy difference between levels $n = 3$ and $n = 2$ is

(A) $\frac{5h^2}{8ma^2}$ (B) $\frac{9h^2}{8ma^2}$ (C) $\frac{9h^2}{32ma^2}$ (D) $\frac{5h^2}{32ma^2}$

2. Suppose the ground stationary state of a harmonic oscillator with force constant 'k' is given by

$$\psi_0 = \exp[-Ax^2]$$

Then, A should depend on K as

(A) $A \propto K^{-1/2}$ (B) $A \propto K$ (C) $A \propto K^{1/2}$ (D) $A \propto K^{1/3}$

3. For non-degenerate perturbation theory for ground state, with $E_0^{(0)}$ as zeroth order energy, $E_0^{(1)}$ as the first-order perturbation correction and E_0 as the exact energy which of the following is true ?

(A) $\left(E_0^{(0)} + E_0^{(1)}\right)$ is always equal to E_0 (B) $\left(E_0^{(0)} + E_0^{(1)}\right) \leq E_0$

(C) $\left(E_0^{(0)} + E_0^{(1)}\right) \geq E_0$ (D) $E_0^{(0)} \leq \left(E_0 + E_0^{(1)}\right)$

4. The trial wavefunction of a system is expanded as $\psi_t = C_1\phi_1 + C_2\phi_2$. The matrix elements of the Hamiltonian are $\langle\phi_1|H|\phi_1\rangle = 0$; $\langle\phi_1|H|\phi_2\rangle = 2{\cdot}0 = \langle\phi_2|H|\phi_1\rangle$ and $\langle\phi_2|H|\phi_2\rangle = 3{\cdot}0$. The approximate ground state energy of the system from the linear variation principle is

(A) $-1{\cdot}0$ (B) $-2{\cdot}0$ (C) $+4{\cdot}0$ (D) $+5{\cdot}0$

5. The ground state term symbol for Nb (atomic number 41) is ^6D. The electronic configuration corresponding to this term symbol is

(A) [Kr] $4d^3\,5s^2$ (B) [Kr] $4d^4\,5s^1$

(C) [Kr] $4d^5\,5s^0$ (D) [Kr] $4d^3\,5s^1\,5p^1$

6. The number of microstates that are possible, when two particles are distributed in four states such that the resulting wave functions are antisymmetric with respect to exchange of the particles, is

(A) 16 (B) 12 (C) 8 (D) 6

7. Using Hückel molecular orbital approximation, the two roots of secular equation of ethane are

(A) $\alpha + \sqrt{2}\beta$, $\alpha - \sqrt{2}\beta$ (B) $\alpha + \beta$, α

(C) $\alpha + \beta$, $\alpha - \beta$ (D) $\alpha + 2\beta$, $\alpha - 2\beta$

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8. One molecular orbital of a polar molecule AB has the form $C_A\psi_A + C_B\psi_B$, where ψ_A and ψ_B are normalized atomic orbitals centered on A and B, respectively. The electron in this orbital is found on atom B with a probability of 90%. Neglecting the overlap between ψ_A and ψ_B, a possible set of C_A and C_B is

(A) $C_A = 0{\cdot}95, C_B = 0{\cdot}32$ (B) $C_A = 0{\cdot}10, C_B = 0{\cdot}90$

(C) $C_A = -0{\cdot}95, C_B = 0{\cdot}32$ (D) $C_A = 0{\cdot}32, C_B = 0{\cdot}95$

9. A square pyramidal, MX_4 molecule belongs to C_{4v} point group. The symmetry operations are; E, $2C_4$, C_2, $2\sigma_v$ and $2\sigma_d$. The trace for the reducible representation, when symmetry operations of C_{4v} applied to MX_4 is :

(A) 51113 (B) 11111 (C) 51111 (D) 41113

10. For the NH_3 molecule, the IR-active modes of vibration are

(A) A_1 and B_1 (B) A_1 and E (C) A_1 and A_2 (D) B_1 and E

11. Using cuvettes of 0·5 cm path length, a 10^{-4} M solution of a chromophore shows 50% transmittance at certain wavelength. The molar extinction coefficient of the chromophore at this wavelength is (log 2 = 0·301)

(A) 1500 M^{-1} cm^{-1} (B) 3010 M^{-1} cm^{-1} (C) 5000 M^{-1} cm^{-1} (D) 6020 M^{-1} cm^{-1}

12. Bond length of homonuclear diatomic molecules can be determined with the help of both

(A) Rotational and Vibrational spectroscopy
(B) Rotational and Rotational Raman spectroscopy
(C) Rotational Raman and Electronic spectroscopy
(D) Vibrational and Electronic spectroscopy

13. 1 mole of N_2, 2 moles of O_2 and 1 mole of CO_2 were mixed at 300 K. The entropy of mixing is

(A) 34·57 J/K (B) 46·10 J/K (C) 0·066 J/K (D) 40·04 J/K

14. Of the following inequivalities, the criterion/criteria for spontaneity of a chemical reaction is/are

(i) $(\Delta G)_{T,P} < 0$;
(ii) $(\Delta U)_{S,V} > 0$;
(iii) $(\Delta S)_{U,V} > 0$.

(A) (i) only (B) (ii) only (C) (i) and (ii) (D) (i) and (iii)

15. For the liquid $\rightleftharpoons$ vapour equilibrium of a substance $\frac{dP}{dT}$ at 1 bar and 400 K is 8×10^{-3} bar K^{-1}. If the molar volume in the vapour form is 200 L mol^{-1} and the molar volume in the liquid form is negligible, the molar enthalpy of vapourisation is (1·0 bar L = 100 J)

(A) 640 kJ mol^{-1} (B) 100 kJ mol^{-1} (C) 80 kJ mol^{-1} (D) 64 kJ mol^{-1}

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16. Molar composition of a mixture of P and Q at equilibrium is 3 : 1 (P : Q). A small disturbance in composition results in change of chemical potential of 'P' by 10 J mol^{-1}. The chemical potential of Q will change (in J mol^{-1}) by

(A) 30 (B) 3·3 (C) – 30 (D) – 3·3

17. The relative population in two states with energies E_1 and E_2 satisfying Boltzmann distribution is given by $n_1/n_2 = (3/2)\exp[-(E_1 - E_2)/k_BT]$. The relative degeneracy g_2/g_1 is

(A) 2 (B) 2/3 (C) 3/2 (D) 3

18. The low and high temperature limits of vibrational partition function are ($\theta = \frac{h\nu}{k}$)

(A) $e^{-\theta/T}$ and $\frac{T}{\theta}e^{-\theta/T}$ (B) $e^{-\theta/2T}$ and $\frac{T}{\theta}e^{-\theta/2T}$

(C) $e^{-\theta/2T}$ and $\frac{T}{\theta}e^{-\theta/T}$ (D) $e^{-\theta/2T}$ and $\frac{\theta}{T}e^{-\theta/2T}$

19. The e.m.f. and the standard e.m.f. of a cell in the following reaction is 5 V and 5·06 V at room temperature,

$$Ni_{(s)} + 2Ag^{+}_{(n)} \rightarrow Ni^{2+}_{(0\cdot02M)} + 2Ag_{(s)}.$$

What is the concentration of Ag^+ ions ?

(A) 0·0125 M (B) 0·0174 M (C) 0·0625 M (D) 0·0314 M

20. Kohlrausch's law is applicable to a dilute solution of

(A) Potassium chloride in hexane (B) Acetic acid in water

(C) Hydrochloric acid in water (D) Benzoic acid in benzene

21. According to the transition state theory, one of the vibrations in the activated complex is a loose vibration. The partition function for this loose vibration is equal to (k_B is the Boltzmann's constant and h is the Planck's constant)

(A) $\frac{k_BT}{h}$ (B) $\frac{h\nu}{k_BT}$ (C) k_BT (D) $\frac{k_BT}{h\nu}$

22. For the reaction,

$2NH_3 \rightarrow N_2 + 3H_2$, if $\frac{-d[NH_3]}{dt} = k_1[NH_3]$, $\frac{d[N_2]}{dt} = k_2[NH_3]$, $\frac{d[H_2]}{dt} = k_3[NH_3]$.

Then, the relation between k_1, k_2 and k_3 is

(A) $k_1 = k_2 = k_3$ (B) $k_1 = 3k_2 = 2k_3$

(C) $1{\cdot}5\,k_1 = 3k_2 = k_3$ (D) $2k_1 = k_2 = 3k_3$

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23. The stability of lyophobic colloids is a consequence of the
(A) electrical double layer at the surface of the particles
(B) van der Waals between the particles
(C) small particle size
(D) shape of the particles

24. When colloids are subjected to an electric field, the particles move towards an electrode and precipitate. Name the process.
(A) Peptization (B) Electrophoresis
(C) Brownian movement (D) Tyndall effect

25. A plane of spacing 'd' shows first order Bragg diffraction at angle θ. A plane of spacing 2d
(A) shows Bragg diffraction at 2θ
(B) shows Bragg diffraction at θ/2
(C) shows Bragg diffraction at $\sin^{-1}\left(\frac{\sin\theta}{2}\right)$
(D) shows Bragg diffraction at $\sin^{-1}\left(\frac{\sin 2\theta}{2}\right)$

26. A one-dimensional crystal of lattice dimension 'a' is metallic. If the structure is distorted in such a way that the lattice dimension is enhanced to '2a'
(A) The electronic structure remains unchanged
(B) The width of conduction band decreases and a band gap is generated
(C) The width of conduction band increases
(D) The width of the conduction band remains unchanged

27. For a polydispersed macromolecular colloid, osmometry gives
(A) Weight-average molecular weight
(B) Number-average molecular weight
(C) Both weight-average and number-average molecular weight
(D) Viscosity-average molecular weight

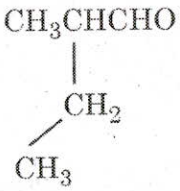
28. In radical chain polymerization, the quantity given by the rate of monomer depletion, divided by the rate of propagating radical formation is called
(A) Kinetic chain length (B) Propagation efficiency
(C) Propagation rate constant (D) Polymerization time

29. In the titration of 50 mL of 0·1 M HCl with 0·1 M NaOH using methyl orange as an indicator, the end point (colour change) occurs as pH reaches 4·0. The titration error is
(A) – 0·2% (B) – 84·7% (C) + 0·2% (D) + 84·2%

30. If $y^2 = 4x$ and 0·1% error is incurred for x, the percentage error involved in 'y' will be
(A) 0·4 (B) 0·025 (C) 0·1 (D) 0·05

Space for Rough Work

31. What will be the IUPAC name of the following compound ?



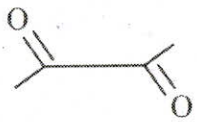
(A) butan-2-aldehyde

(B) 2-methylbutanal

(C) 3-methyl isobutyraldehyde

(D) 3-methylbutanal

32. The correct IUPAC name of



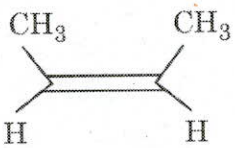
(A) Ethanediol

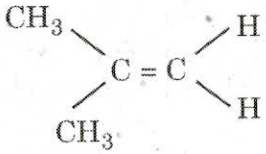
(B) 2-ketopropanal

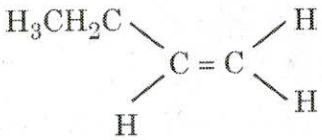
(C) Butane-2,3-dione

(D) Ethanedione

33. Which of the following compounds will show geometrical isomerism ?

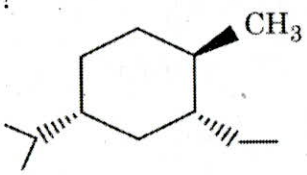
(A) 

(B) 

(C) 

(D) $CH_3CH = CH_2$

34. In the lowest energy conformation of the compound below, how many alkyl substituents are axial ?

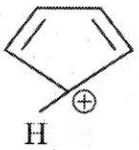


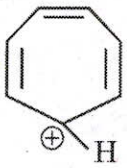
(A) 2 (B) 1 (C) 3 (D) 6

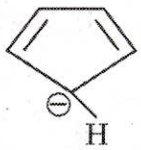
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35. Which of the following is ***not*** aromatic ?

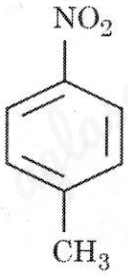
(A) 

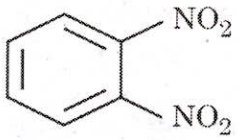
(B) 

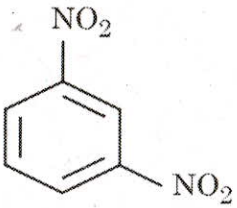
(C) 

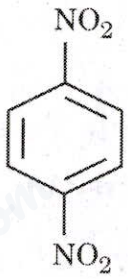
(D) 

36. Which one of the following compounds on further substitution can yield theoretically only one substitution product ?

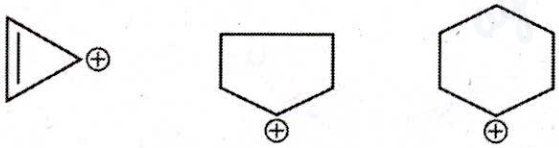
(A) 

(B) 

(C) 

(D) 

37.



i ii iii

Which of the following orders is correct for the stability of these carbocations ?

(A) i > ii > iii

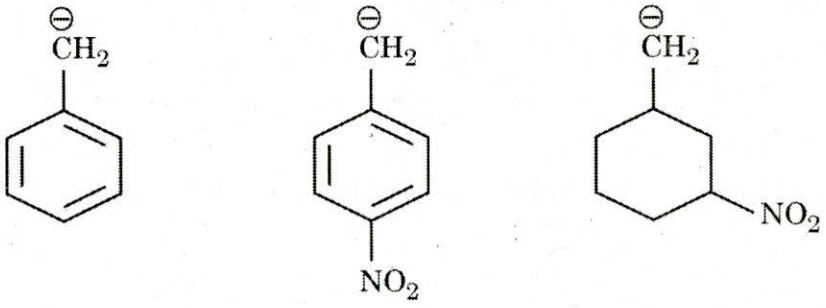
(B) iii > ii > i

(C) i > iii > ii

(D) ii > i > iii

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38.



i ii iii

Which of the following orders is correct for the stability of these carbanions ?

(A) i > ii > iii (B) iii > ii > i (C) ii > i > iii (D) ii > iii > i

39. Which mechanism is followed by the reaction ?

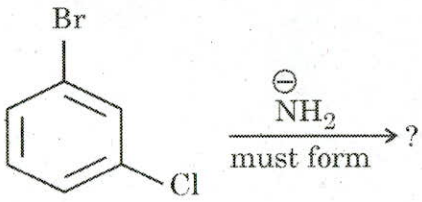
$$R - OSOCl \longrightarrow RCl + SO_2$$

(A) S_N1 (B) S_N2 (C) S_Ni (D) SET

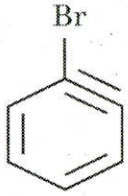
40. In substrates of the form XCH_2Z, where Z is _____, the rate of S_N1 reaction increases.

(A) RO (B) RCO (C) CN (D) HCO

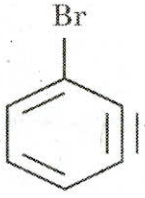
41. Predict the correct intermediate in the following reaction :



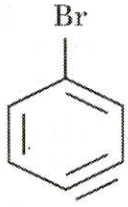
(A)



(B)



(C)



(D) None of these

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42. Which of the following reaction generating carbene intermediate is correct ?

(A) $CHCl_3 \xrightarrow{KOH/\Delta} : CCl_2 + KCl + H_2O$

(B) $CCl_3 - \overset{\overset{O}{\|}}{C} - O^-Na^+ \xrightarrow{\Delta} : CCl_2 + CO_2 + NaCl$

(C) Both (A) and (B)

(D) None of these

43. Which carbonyl compound is the main product of the following reaction of a diol ?

$$CH_3CH_2-\underset{\underset{OH}{|}}{\overset{\overset{Ph}{|}}{C}}-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3 \xrightarrow[H_2O]{H_2SO_4}$$

(A) $CH_3CH_2-\underset{\underset{O}{\|}}{C}-\overset{\overset{CH_3}{|}}{\underset{\underset{Ph}{|}}{C}}-CH_3$

(B) $Ph-\underset{\underset{O}{\|}}{C}-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_2CH_3}{|}}{C}}-CH_3$

(C) $CH_3CH_2-\underset{\underset{CH_3}{|}}{\overset{\overset{Ph}{|}}{C}}-\underset{\underset{O}{\|}}{\overset{}{C}}-CH_3$

(D) $CH_3-\underset{\underset{Ph}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{O}{\|}}{\overset{\overset{CH_2CH_3}{|}}{C}}$

44. Fries rearrangement of phenyl propionate gives

(A) o-hydroxyphenyl ethyl ketone

(B) p-hydroxyphenyl ethyl ketone

(C) m-hydroxyphenyl ethyl ketone

(D) ortho and para-hydroxyphenyl ethyl ketone

45. Name the following reaction :

$$Ph_3P = CH_2 + Ph_2C = O \longrightarrow Ph_2C = CH_2 + Ph_3P = O$$

(A) Chichibabin reaction

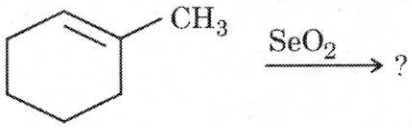
(B) Vilsmeier-Haack reaction

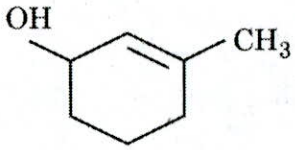
(C) Wittig reaction

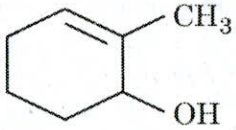
(D) Fries reaction

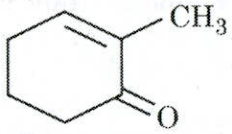
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46. Complete the following reaction :



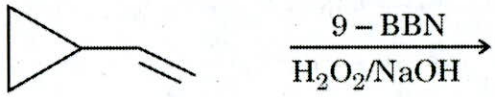
(A) 

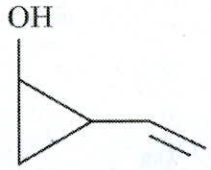
(B) 

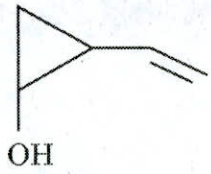
(C) 

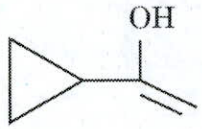
(D) None of these

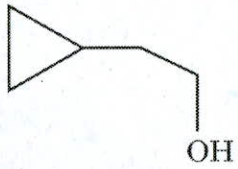
47. Complete the following reaction :



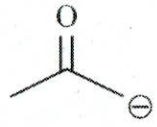
(A) 

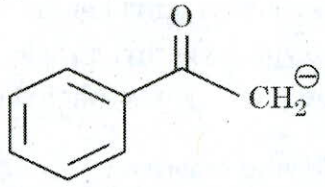
(B) 

(C) 

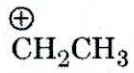
(D) 

48. Which of the following synthons is an example of Umpolung ?

(A) 

(B) 

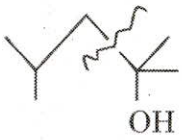
(C) 

(D) 

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49. The following marked disconnection can be called as

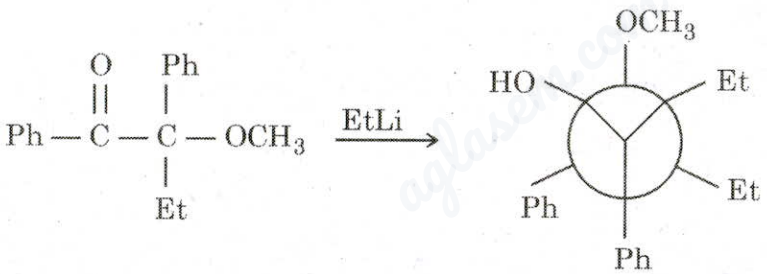


(A) 1, 1 C–C-disconnection
(B) 1, 2 C–C-disconnection
(C) 1, 3 C–X-disconnection
(D) 1, 2 C–X-disconnection

50. If a prochiral ketone was converted enantioselectively to a chiral alcohol with a Grignard reagent under asymmetric conditions, which of the following statements would be false ?

(A) The reaction centre is an sp^2 hybridized carbon
(B) Nucleophilic attack by the Grignard reagent will be selective for one enantiotopic face over the other
(C) A chiral product would be obtained regardless of which Grignard reagent is used
(D) The prochiral ketone has different groups linked to the carbonyl group

51. In the following reaction, the stereochemistry of the major product is predicted by the



(A) Cram's model
(B) Cram's chelation model
(C) Felkin model
(D) Felkin-Ahn model

52. Cope rearrangement involves which sigmatropic shift ?

(A) [1, 3] (B) [1, 5] (C) [3, 3] (D) [2, 3]

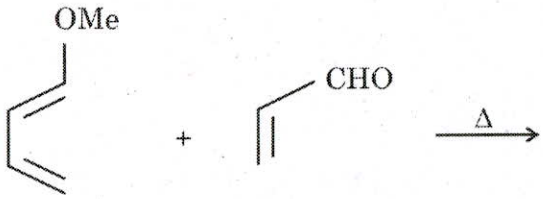
53. Barton reaction is used to functionalize the

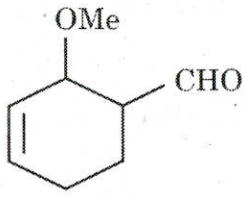
(A) α-position
(B) β-position
(C) δ-position
(D) γ-position

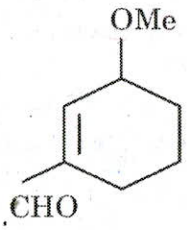
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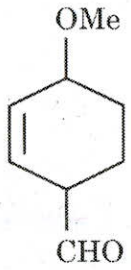
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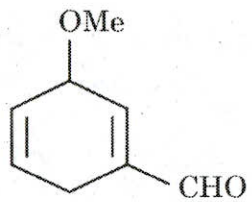
54. Which will be the major product of the following reaction ?



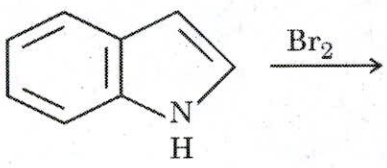
(A) 

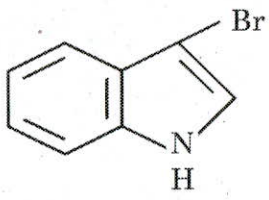
(B) 

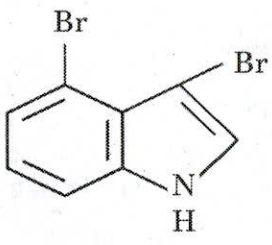
(C) 

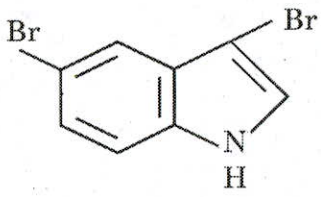
(D) 

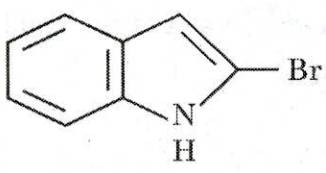
55. Which is the most probable main product of the following reaction ?



(A) 

(B) 

(C) 

(D) 

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56. Oxidation of isoquinoline with $KMnO_4$ gives which of the following compounds as one of the products ?

(A) Benzoic acid (B) Pyridine

(C) Phthalic acid (D) Salicylic acid

57. Zerewitinoff method is used for the determination of

(A) $-OCH_3$ group (B) Carbonyl group

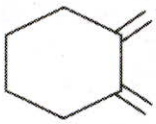
(C) Active hydrogens (D) Anode group

58. Which of the following is a reducing sugar ?

(A) Dihydroxyacetone (B) Erythrulose

(C) Glucose (D) All of the above

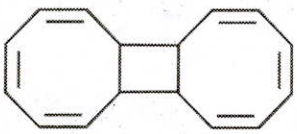
59. Predict the λ_{max} of the following given compound.



(A) 237 (B) 247

(C) 227 (D) 240

60. How many peaks do you expect in the proton decoupled ^{13}C-NMR spectrum of the following compound ?



(A) 2 (B) 4

(C) 6 (D) 8

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61. The highest electro negativity difference is observed in this pair :

(A) Li, Cl (B) K, F (C) Na, Cl (D) Li, F

62. The series with correct decreasing order of size is

(A) $K^+ > Ca^{2+} > S^{2-} > Cl^-$ (B) $K^+ > Cl^- > Ca^{2+} > S^{2-}$

(C) $S^{2-} > Cl^- > K^+ > Ca^{2+}$ (D) $Cl^- > K^+ > S^{2-} > Ca^{2+}$

63. From MOT, the bond order of O_2^+ ion is

(A) 3 (B) 1·5 (C) 2·5 (D) 2

64. Select the correct statement about ClF_3 molecule

(A) It has two axial lone pairs

(B) It has one axial and one equatorial lone pairs

(C) It has all fluorines of equal bond length

(D) It has two equatorial lone pairs

65. Which of the following substance is classified as weak acid ?

(A) NO_3^- (B) ClO_4^- (C) NH_4^+ (D) CO_3^{2-}

66. Identify the protic solvent among the following :

(A) Tetrahydrofuran (B) Dimethyl formamide

(C) Carbon tetrachloride (D) Hydrofluoric acid

67. The chemical formula of Oleum is

(A) H_2SO_4 (B) H_2SO_5 (C) $H_2S_2O_7$ (D) $H_2S_2O_8$

68. Which compound gives photochemical smog as brownish colour ?

(A) NO_2 (B) NO (C) HNO_2 (D) N_2O_3

69. The hybridization of sulphur in sulphuric acid is

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

70. What is the major mineral present in the phosphate rock ?

(A) NaH_2PO_4 (B) Na_2HPO_4 (C) $CaOCl_2$ (D) $Ca_3(PO_4)_2$

71. The crystal field splitting energy for octahedral (Δ_0) and tetrahedral (Δ_t) complexes is related as

(A) $\Delta_t = \frac{4}{9}\Delta_0$ (B) $\Delta_t = \frac{1}{2}\Delta_0$ (C) $\Delta_0 \approx 2\Delta_t$ (D) $\Delta_0 \approx \frac{4}{9}\Delta_t$

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72. For Mn^{3+} ion P = 28,000 cm^{-1} Δ_0 for $[Mn(H_2O)_6]^{3+}$ and $[Mn(CN)_6]^{3-}$ are 21,000 cm^{-1} and 38,500 cm^{-1} respectively, then,

(A) $[Mn(H_2O)_6]^{3+}$ and $[Mn(CN)_6]^{3-}$ both are low spin complexes

(B) $[Mn(H_2O)_6]^{3+}$ is low spin and $[Mn(CN)_6]^{3-}$ is a high spin complex

(C) $[Mn(H_2O)_6]^{3+}$ is a high spin and $[Mn(CN)_6]^{3-}$ is a low spin complex

(D) $[Mn(H_2O)_6]^{3+}$ and $[Mn(CN)_6]^{3-}$ both are high spin complex

73. Amongst $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$,

(A) $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ are diamagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic

(B) $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[Ni(CO)_4]$ is paramagnetic

(C) $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic

(D) $[Ni(CO)_4]$ is diamagnetic and $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic

74. The actual (experimental) magnetic moment shows a large deviation from the magnetic moments calculated from the formula $\mu_J = g\sqrt{J(J+1)}$ BM in the case of

(A) Nd^{3+} (B) Gd^{3+} (C) Eu^{3+} (D) Lu^{3+}

75. UV-vis absorption bands of lanthanide ions are sharp because :

(A) spin-orbit coupling is more than crystal field splitting

(B) Laporte-forbidden f-f transition

(C) the transitions are $4f^n \rightarrow 5d^1$ type Laporte-allowed

(D) f-shell is well shielded from the vibration of ligands

76. Which among the following is called Collman's reagent ?

(A) $Na_2[Fe(CO)_4]$ (B) $Na[HFe(CO)_4]$

(C) $Na_2[Ru(CO)_4]$ (D) $[I_2Fe(CO)_4]$

77. Which one of the following compounds will be most likely to undergo reductive elimination of ethane ?

(A) $[(PPh_3)_2V(CO)_2(CH_3)_2]$ (B) $[P(OMe)_3O_3(CH_3)_2(CH_3CN)_3]$

(C) $[(CH_3)_3Pt(CH_3CN)(PPh_3)(PMe_3)]^+$ (D) $[(PPh_3)_2Pt(CH_3)_2(CH_3CN)_2]$

78. Which among the following Beryllium alkyl compounds are stable ?

(i) $Be(Me)_2$ (ii) $Be(Et)_2$

(iii) $Be(Bu^+)_2$ (iv) $Be(CH_2Bu^+)_2$

(A) (i) and (iv) (B) (ii) and (iii) (C) (ii) and (iv) (D) (i) and (iii)

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79. Among the following compounds, which one is ***not*** an example for Zintl ion ?

(A) $[Sn_9]^{4-}$ (B) $[Pb_5]^{2-}$ (C) $[Bi_4]^{2-}$ (D) $PbMo_6S_8$

80. Hawthorne $[C_2B_9H_{11}]^{2-}$ anion is isoelectronic with

(A) $C_5H_5^+$ (B) $C_5H_5^-$ (C) C_6H_6 (D) C_5H_5

81. Correct statement with respect to the separation of Zn(II) and Mg(II) from its mixtures, using ion exchange resins is

(A) Mg(II) is absorbed from acid solutions by anion exchange resins while Zn(II) is not

(B) Mg(II) is absorbed from acid solutions by cation exchange resins while Zn(II) is not

(C) Zn(II) is absorbed from acid solutions by anion exchange resins while Mg(II) is not

(D) Zn(II) is absorbed from acid solutions by cation exchange resins while Mg(II) is not

82. In excitation fluorescence spectra,

(A) excited at a fixed wavelength and the emission intensity recorded as a function of wavelength

(B) excited at varied wavelength and the fluorescence intensity is measured at a fixed wavelength

(C) excited at a fixed wavelength and the emission intensity recorded at a fixed wavelength

(D) excited at varied wavelength and the emission intensity recorded as a function of wavelength

83. In simultaneous TGA/DTA, a sharp exothermic peak without mass change indicates

(A) Melting (B) Decomposition

(C) Crystallization (D) Glass transition

84. Choose the correct statements for oxymyoglobin and cytochrome P_{450} from the following :

(i) Both contain dianion of protoporphyrin-IX.

(ii) They have same fifth ligand bonded to metal centre from the protein backbone.

(iii) They contain single active site.

(iv) They contain metal ion in +3 oxidation state.

(A) (i), (ii) and (iii) (B) (i), (iii) and (iv)

(C) (i), (ii) and (iv) (D) (ii) and (iii)

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85. Choose the correct statements from the following :

(i) Vitamin B12 and Vitamin B12 coenzyme are synthesized from animal and/or plant body.

(ii) Vitamin B12 and Vitamin B12 coenzyme are not synthesized from animal and/or plant body.

(iii) Vitamin B12 and Vitamin B12 coenzyme are synthesized from bacteria in the plants.

(iv) Vitamin B12 and Vitamin B12 coenzyme are synthesized from fungi in the plants.

(A) (i) and (iii) (B) (i) and (iv) (C) (ii) and (iii) (D) (ii) and (iv)

86. The d-d absorption band of $[Fe(H_2O)_6]^{2+}$ is split due to

(A) presence of octahedral geometry

(B) static Jahn-Teller distortion

(C) dynamic Jahn-Teller distortion

(D) presence of trigonal bipyramidal geometry

87. Fluorine NMR spectrum of BrF_5 consists of

(A) intense quartet and weak triplet (B) intense triplet and weak quartet

(C) intense quintet and weak doublet (D) intense doublet and weak quintet

88. In scanning electron microscopy (SEM), the signal used for obtaining high-resolution image is

(A) primary electrons (B) secondary electrons

(C) both scattered electrons (D) X-rays

89. The nuclides among the following, capable of undergoing fission by thermal neutrons, are

(A) ^{233}U, ^{235}U and ^{232}Th (B) ^{233}U, ^{239}Pu and ^{232}Th

(C) ^{235}U, ^{239}Pu and ^{232}Th (D) ^{233}U, ^{235}U and ^{239}Pu

90. After the emission of a β-particle followed by α-particle from $_{83}Bi^{214}$, the number of neutrons in the atom is

(A) 127 (B) 128 (C) 129 (D) 130

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91. Which type of nanoparticle is composed of a core-shell structure with a core material surrounded by a shell material ?

(A) Homogenous nanoparticle

(B) Monolithic nanoparticle

(C) Core-shell nanoparticle

(D) Shell-core nanoparticle

92. What is the term for a process in which nanoparticles are formed from a liquid on solution precursor ?

(A) Chemical vapour deposition

(B) Sol-gel synthesis

(C) Physical vapour deposition

(D) Laser ablation

93. What is the goal of atom economy in green chemistry ?

(A) Maximizing the use of atoms in a reaction

(B) Minimizing the use of atoms in a reaction

(C) Maximizing the waste production

(D) Minimizing the efficiency of a reaction

94. Which type of catalysis involves the catalyst and reactants being in different phases ?

(A) Homogeneous catalysis

(B) Heterogeneous catalysis

(C) Homolytic catalysis

(D) Heterolytic catalysis

95. Which property of a drug molecule is related to the ability to reach its target within the body ?

(A) Lipophilicity (B) Melting point

(C) Molecular weight (D) Solubility

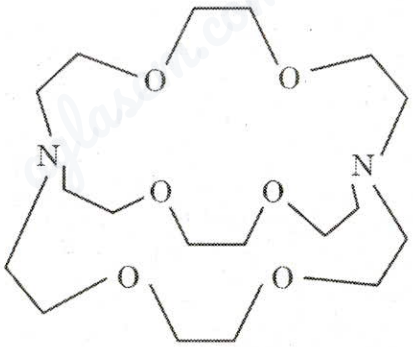
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96. Which type of drug administration route bypasses the digestive system and delivers a drug directly into the bloodstream ?

(A) Oral
(B) Intravenous (IV)
(C) Subcutaneous (SC)
(D) Intramuscular (IM)

97. Name the following compound :



(A) Cryptand [2, 2, 2]
(B) Spherand [2, 2, 2]
(C) Helicand [2, 2, 2]
(D) Katapinand [2, 2]

98. Three-dimensional cage like compounds with an internal cavity that is capable of holding one or more guest species is

(A) Molecular container
(B) Zeolites
(C) Clathrates
(D) Helicates

99. What is the role of alum in the purification of water ?

(A) Softens hard water
(B) Pathogenic bacteria gets destroyed
(C) Coagulation of impurities
(D) To improve the mineral content

100. Which of the following pollutants ***cannot*** be degraded by natural process ?

(A) DDT
(B) Nuclear waste
(C) Heavy metals
(D) All of the above

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COMPETITIVE EXAMINATION-2023
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SUBJECT: CHEMICAL SCIENCES **SUBJECT CODE:27**

PAPER CODE	DURATION	TOTAL NO. OF QUESTIONS	MAXIMUM MARKS	MENTION YOUR REGISTER NUMBER
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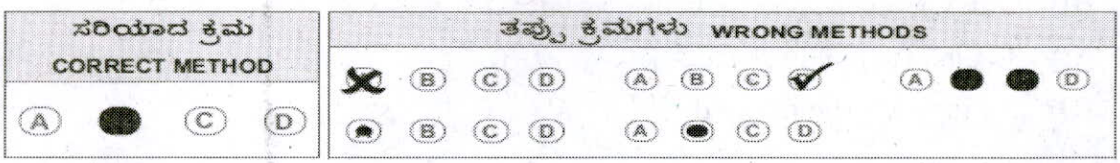
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4. Completely **darken / shade** the relevant circle with a **blue or black ink ballpoint pen against the question number on the OMR answer sheet.**



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