

## ASSOCIATION OF CHEMISTRY TEACHERS

### National Standard Examination in Chemistry – 2024

Date of Examination: November 24, 2024

Time: 11:30 AM to 1:30 PM

Question Paper Code: 31

Student's Roll No:																			
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*Write the Question Paper Code (mentioned above) on YOUR OMR Answer Sheet (in the space provided), otherwise your Answer Sheet will NOT be evaluated. Note that the same Question Paper Code appears on each page of the Question Paper.*

#### Instructions to Candidates:

1. Use of mobile phone, smart watch, and iPad during examination is STRICTLY PROHIBITED.
2. In addition to this Question Paper, you are given OMR Answer Sheet along with candidate's copy.
3. On the OMR sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.  
**Incomplete/ incorrect/ carelessly filled information may disqualify your candidature.**
4. On the OMR Answer Sheet, use only **BLUE** or **BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Your **Eleven-digit roll number and date of birth** entered on the OMR Answer Sheet shall remain your login credentials means login id and password respectively for accessing your performance / result in National Standard Examination in Chemistry – 2024.

Question paper has two parts. In part A-1 (Q. No.1 to 48) each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

**Q.No.12**     a         c     d    c

In part A-2 (Q. No. 49 to 60) each question has four alternatives out of which any number of alternative(s) (1, 2, 3, or 4) may be correct. You have to choose **all** correct alternative(s) and fill the appropriate bubble(s), as shown

**Q.No.52**     a         c   

7. Attempt all sixty questions. For **Part A-1**, each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer. In **Part A-2**, you get 6 marks if all the correct alternatives are marked and no incorrect. No negative marks in this part.
8. Rough work may be done in the space provided. There are **16** printed pages in this paper
9. Use of **Non-programmable scientific** calculator is allowed.
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting Answer Paper, take away the Question Paper & Candidate's copy of OMR sheet for your future reference.

**Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the OMR Answer Sheet.**

**OMR Answer Sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED. Scratching or overwriting may result in a wrong score.**

**DO NOT WRITE ON THE BACK SIDE OF THE OMR ANSWER SHEET.**

**Instructions to Candidates (Continued) :**

*You may read the following instructions after submitting the Answer Sheet.*

12. **Comments/Inquiries/Grievances regarding this Question Paper, if any, can be shared on the Inquiry/Grievance column on [www.iapt.org.in](http://www.iapt.org.in) on the specified format till Dec 3, 2024.**
13. **The answers/solutions to this Question Paper will be available on the website: [www.iapt.org.in](http://www.iapt.org.in) by Dec 2, 2024.** The score card may be downloaded after Dec 24, 2024
14. **CERTIFICATES and AWARDS:**  
Following certificates are awarded by IAPT/ACT to students, successful in the National Standard Examination in Chemistry – 2024
- “CENTRE TOP 10 %” To be downloaded from [iapt.org.in](http://iapt.org.in) after 30.01.25
  - “STATE TOP 1 %” Will be dispatched to the examinee
  - “NATIONAL TOP 1 %” Will be dispatched to the examinee
  - “GOLD MEDAL & MERIT CERTIFICATE” to all students who attend OCSC – 2025 at HBCSE Mumbai
- Certificate for centre toppers shall be uploaded on [iapt.org.in](http://iapt.org.in)
15. List of students (with centre number and roll number only) having score above **Minimum Admissible Score (MAS)** will be displayed on the website: [www.iapt.org.in](http://www.iapt.org.in) by **Dec 25, 2024**. See the **MAS clause** on the student’s brochure on the web.
16. List of students eligible to appear for Indian National Chemistry Olympiad (INChO – 2025) shall be displayed on [www.iapt.org.in](http://www.iapt.org.in) by Dec 30, 2024.

**Useful constants**

$$\begin{aligned} \text{Charge of electron, } e &= 1.602 \times 10^{-19} \text{ C} \\ \text{Mass of electron, } m_e &= 9.1 \times 10^{-31} \text{ kg} \\ \text{Planck's constant, } h &= 6.63 \times 10^{-34} \text{ J s} \\ \text{Speed of light, } c &= 3.0 \times 10^8 \text{ ms}^{-1} \\ \text{Avogadro constant, } N_A &= 6.022 \times 10^{23} \text{ mol}^{-1} \\ \text{Faraday constant } F &= 96500 \text{ C mol}^{-1} \\ \text{Molar gas constant, } R &= 0.082 \text{ Latm mol}^{-1} \text{ K}^{-1} \\ &= 8.314 \text{ J mol}^{-1} \text{ K}^{-1} \end{aligned}$$

**ASSOCIATION OF CHEMISTRY TEACHERS**  
**NATIONAL STANDARD EXAMINATION IN CHEMISTRY**  
**(NSEC - 2024)**

Time: 120 minute

Max. Marks: 216

*Attempt All Sixty Questions*

A – 1

**ONLY ONE OUT OF FOUR OPTIONS IS CORRECT. BUBBLE THE CORRECT OPTION.**

- A closed vessel with rigid walls contains 1.0 mol of component M (vapour pressure  $p_M^*$ ): 0.9 mol liquid and 0.1 mol vapor. 0.1 mol of component N (vapour pressure  $p_N^*$ ) is added slowly to maintain equilibrium conditions. Assume M and N form an ideal solution. The total pressure at the end of the addition will:
  - decrease if  $p_M^* < p_N^*$
  - decrease irrespective of relation between  $p_M^*$  and  $p_N^*$
  - increase if  $p_M^* < p_N^*$
  - increase irrespective of relation between  $p_M^*$  and  $p_N^*$
- A scuba diver accidentally surfaces from a depth of 100 feet in water (pressure = 4 atm). The solubility of nitrogen from air (78%  $N_2$  in air) in water in standard conditions is  $15 \text{ mg L}^{-1}$  at  $37^\circ\text{C}$ . The volume of  $N_2$  gas released into the bloodstream of the diver from each litre of blood is: (Assume blood to behave similarly as water)
  - 14 mL
  - 41 mL
  - 55 mL
  - 12 mL
- A 35 degree drop in temperature from  $25^\circ\text{C}$  causes a 8.2-fold decrease in the rate of a first order reaction. If the half-life of the reaction is 3.2 h, what will be the half-life at a temperature of  $-10^\circ\text{C}$ ?
  - 12.8 h
  - 19.8 h
  - 26.2 h
  - 23.4 min
- An ideal-gas reaction equilibrium is represented as  $A + B \rightleftharpoons C + D$ . Considering, the fact that all components are ideal and that only A and B are present initially, which of the following options is **ALWAYS true** at equilibrium? 'N' is the number of moles of the species.
  - $N_C = N_A$
  - $N_C + N_D = N_A + N_B$
  - $N_C = N_D$
  - $N_A = N_B$
- Which of the following statements is **correct**?
  - The addition of neon to a gas-phase reaction mixture at equilibrium at constant  $T$  and constant  $V$  does not alter the equilibrium.
  - For a reversible reaction in a closed system with constant  $T$  and constant  $P$  if  $\left(\frac{\partial G}{\partial \xi}\right)_{T,P} > 0$ , the reaction proceeds in the reverse direction. Here ' $\xi$ ' is the extent of the reaction.
  - Complete dissociation of a weak electrolyte takes place in the limit of infinite dilution in aqueous solution.
  - The standard state of a species is always a pure substance.
- Consider the following statements about the given mechanism:
 
$$\begin{array}{l} A + B \rightarrow C + D \\ \quad \quad \quad 2C \rightarrow F \\ F + B \rightarrow 2A + G \end{array}$$
  - The overall reaction is  $3B \rightarrow 2D + G$
  - A is a catalyst and B is a reactant.
  - C and F are intermediates.
  - D and G are products

The correct set of statements is

- (i) and (ii) only
- (iii) and (iv) only
- (ii), (iii) and (iv) only
- All (i), (ii), (iii) and (iv)

7. For one mole of a van der Waal gas with  $b = 0$ , the plot of  $PV$  versus  $1/V$  at 298 K gives an intercept of  $24.4 \text{ L atm K mol}^{-1}$  and slope of  $-2.5 \text{ L}^2 \text{ atm mol}^{-2}$ . The value of the van der Waal constant  $a$  is  
 (a)  $12.5 \text{ L}^2 \text{ atm mol}^{-2}$  (b)  $5.0 \text{ L}^2 \text{ atm mol}^{-2}$  (c)  $4.5 \text{ L}^2 \text{ atm mol}^{-2}$  (d)  $2.5 \text{ L}^2 \text{ atm mol}^{-2}$
8. The following three plots show the variation of conductance with mL of titrant added for three titrations of aqueous solutions of  $\text{Na}_2\text{SO}_4$ ,  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{BaCl}_2$

Given: Molar ionic conductivities in  $\text{S cm}^2 \text{ mol}^{-1}$  are

$\text{Ba}^{2+}$	$\text{Cl}^-$	$\text{Na}^+$	$\text{SO}_4^{2-}$	$\text{NH}_4^+$
127.3	76.4	50.1	160	73.6

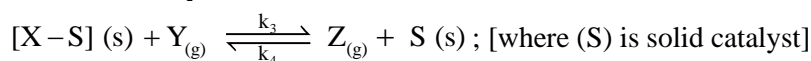
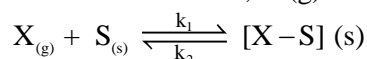
Titration	Analyte	Titrant
A	$\text{BaCl}_2$	$(\text{NH}_4)_2\text{SO}_4$
B	$\text{Na}_2\text{SO}_4$	$\text{BaCl}_2$
C	$\text{BaCl}_2$	$\text{Na}_2\text{SO}_4$



Assign the plots to the respective titrations

- (a) I-A, II-B, III-C (b) I-B, II-C, III-A (c) I-C, II-A, III-B (d) I-B, II-A, III-C
9. 150 g of liquid water at  $20^\circ\text{C}$  is mixed with 40 g of ice at  $0^\circ\text{C}$  in a coffee cup calorimeter. The final temperature (in  $^\circ\text{C}$ ) reached will be (assuming no heat loss or gain by the surroundings)  
 Latent heat of ice =  $334.72 \text{ J/g}$   
 Specific heat of water =  $4.2 \text{ J/g } ^\circ\text{C}$   
 (a) 1.35 (b) -1.35 (c) 0 (d) 4

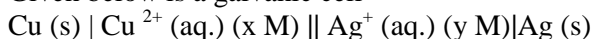
10. A chemical reaction,  $\text{X}(\text{g}) + \text{Y}(\text{g}) \rightarrow \text{Z}(\text{g})$  has following mechanism:



The overall equilibrium constant for above reaction can be represented as

- (a)  $K = \frac{k_1.k_2}{k_3.k_4}$  (b)  $K = \frac{k_1.k_3}{k_2.k_4}$  (c)  $K = \frac{k_4.k_1}{k_2.k_3}$  (d)  $K = \frac{k_4.k_2}{k_3.k_1}$

11. Given below is a galvanic cell



The possible condition for the galvanic cell to develop emf of 0.5 V is:

[Given:  $E^\circ_{\text{Cu}^{2+}/\text{Cu}} = 0.34\text{V}$  and  $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.8\text{V}$ ]

- (a)  $x = 0.015$  and  $y = 0.3$  (b)  $x = 0.05$  and  $y = 0.25$   
 (c)  $x = 0.04$  and  $y = 0.2$  (d)  $x = 0.011$  and  $y = 0.5$

12. If 5A current is passed for an hour through one  $\text{dm}^3$  0.5 M aqueous solution of sodium acetate, then the amount of ethane produced will be:  
 (a) 2.79 g (b) 4.2 g (c) 1.39 g (d) 5.58 g

13. The results obtained when the finely divided metal powders of P, Q, R and S added to the aqueous solutions of different metal nitrates are given below:

Metal	Silver Nitrate	Lead Nitrate	Nickel Nitrate	Zinc Nitrate
<b>P</b>	√	√	√	x
<b>Q</b>	√	√	√	√
<b>R</b>	√	√	x	x
<b>S</b>	√	x	x	x

Displacement = √, No reaction = x

[Given:  $E_{\text{Ag}^+/\text{Ag}}^\circ = 0.80 \text{ V}$ ,  $E_{\text{Zn}^{2+}/\text{Zn}}^\circ = -0.76 \text{ V}$ ,  $E_{\text{Ni}^{2+}/\text{Ni}}^\circ = -0.25 \text{ V}$ ,  $E_{\text{Pb}^{2+}/\text{Pb}}^\circ = -0.13 \text{ V}$ ]

If these elements are to be arranged as per their positions in the electrochemical series, then which of the following will represent the above set of observations?

- (a)  $P > Q > R > S$       (b)  $S > R > P > Q$       (c)  $Q > P > R > S$       (d)  $S > R > Q > P$
14. The molarity of the commercially available concentrated sulphuric acid solution with label on the bottle is as shown below is:

<b>Sulphuric Acid</b>	
<b>H<sub>2</sub>SO<sub>4</sub></b>	<b>FW 98.00</b>
Assay as H <sub>2</sub> SO <sub>4</sub> .....	95% w/w
Density .....	1.84 g/cm <sup>3</sup>
Heavy metal ions .....	Negligible
Anions .....	Negligible

- (a) 19.38 M      (b) 17.83 M      (c) 20.77 M      (d) 18.34 M
15. Oxide ions with ions of metals A and B together, form a crystal. The oxide ions get organized into a cubic closed packed (ccp) lattice. In the oxide lattice, the metal ion A occupy 25% of the octahedral voids and the metal ion B occupies 50% of the tetrahedral voids. Oxidation states of A and B respectively are:

- (a) +3, +1      (b) +4, +1      (c) +1, +3      (d) +2, +4

16. Consider the statements

- (i) Energy of the electron in the fourth orbit of  $\text{He}^+$  ion is less than the energy of the electron in the fourth orbit of hydrogen atom.  
(ii) Radius of the first orbit of  $\text{He}^+$  ion is  $0.529 \text{ \AA}$ .  
(iii) In the Lyman series as the energy liberated during the transition increases then the distance between the spectral lines goes on decreasing.  
(iv) If the radius of the 2<sup>nd</sup> orbit of  $\text{Li}^{2+}$  is  $x$ , the expected radius of the 3<sup>rd</sup> orbit of  $\text{Be}^{3+}$  is  $\frac{9}{4}x$ .  
(v) In hydrogen atom, 3p and 3d orbitals are not degenerate orbitals.

The correct set of statements is

- (a) (i) and (ii)      (b) (i) and (iii)      (c) (ii), (iii) and (iv)      (d) (i), (iii) and (v)

17. The mixture of  $\text{Al}(\text{OH})_3$  and  $\text{Fe}(\text{OH})_3$  can be separated by:

- (i) leaching method      (ii) froth floatation method  
(iii) gravity separation method      (iv) magnetic separation method

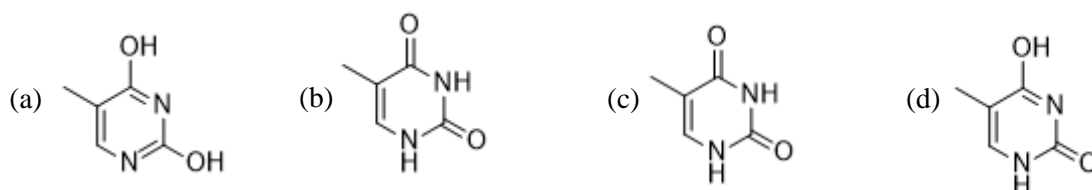
- (a) (i) and (ii) only      (b) (ii) and (iii) only      (c) (i) and (iv) only      (d) (iii) and (iv) only





31. Out of the following substances, the one that forms a white solid, has a high melting point and dissociates in water to form a basic solution is-
- (a)  $\text{CO}_2$  (b)  $\text{P}_4\text{O}_{10}$  (c)  $\text{Na}_2\text{O}$  (d)  $\text{Cl}_2\text{O}_7$

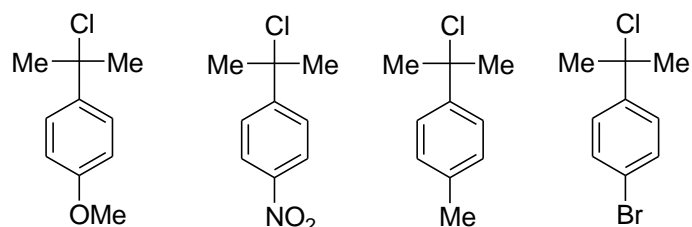
32. The form in which thymine, the base present in DNA, remains at pH  $\sim 10$ , is:



33. The compound not having a planar molecular configuration is:

- (a)  $\text{H}_2\text{C} = \text{CH}_2$  (b)  $\text{H}_2\text{C} = \text{CH} - \text{C} \equiv \text{CH}$   
 (c)  $\text{H}_2\text{C} = \text{C} = \text{CHCl}$  (d)  $\text{H}_2\text{C} = \text{C} = \text{C} = \text{CH}_2$

34. For the following molecules, the correct order of reactivity towards  $\text{S}_\text{N}1$  reaction is:



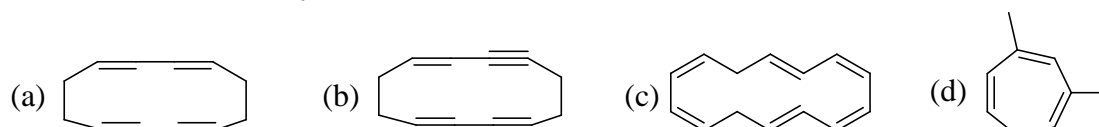
- (a) (III) > (II) > (I) > (IV) (b) (II) > (IV) > (III) > (I)  
 (c) (I) > (III) > (IV) > (II) (d) (IV) > (II) > (III) > (I)

35. Relationship of X and Y is :

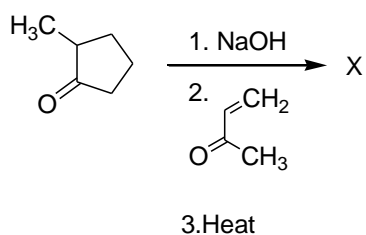


- (a) same molecules (b) enantiomers (c) diastereoisomers (d) positional isomers

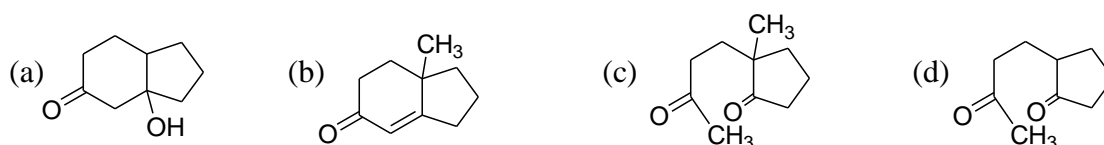
36. An unsaturated hydrocarbon "M" on oxidative ozonolysis gave a mixture of butanedioic acid and oxalic acid. The structure of the hydrocarbon "M" is:



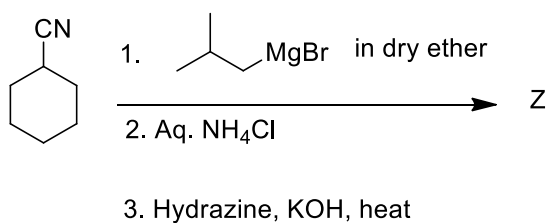
37. When 2-Methylcyclopentanone is treated with but-3-en-2-one under alkaline condition followed by heating gives the major product 'X'.



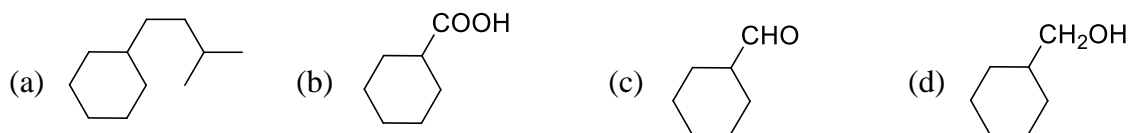
This 'X' is:



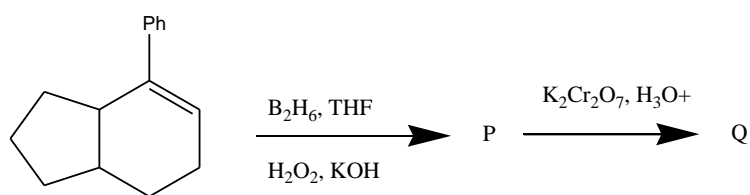
38. Consider the following chemical reaction



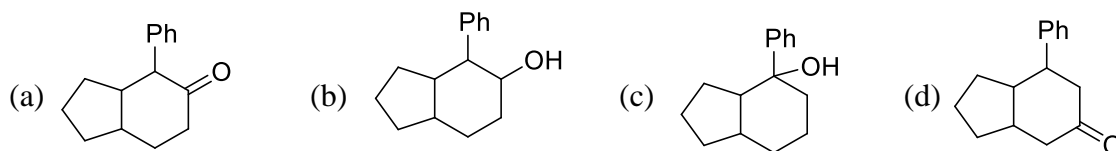
The major product 'Z' formed in the reaction is:



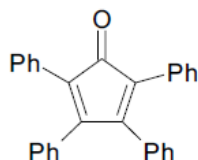
39. Consider the set of the following reactions



The final major product 'Q' is:



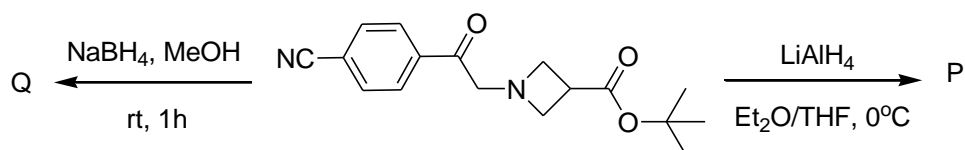
40. The following product 'P' given below is obtained by Aldol condensation of ...



product 'P'

- (a) 2 moles of dibenzyl ketone,  $(\text{PhCH}_2)_2\text{CO}$   
 (b) 1 mole of dibenzyl ketone,  $(\text{PhCH}_2)_2\text{CO}$  and 1 mole of acetone  $\text{CH}_3\text{COCH}_3$   
 (c) 1 mole of dibenzyl ketone,  $(\text{PhCH}_2)_2\text{CO}$  and 1 mole of benzil ( $\text{PhCOCOPh}$ )  
 (d) 2 moles of benzophenone,  $\text{PhCOPh}$ .

41. The structures of 'P' and 'Q' formed in the following reactions are :



- (a)   
 Structure Q:
- (b)   
 Structure Q:
- (c)   
 Structure Q:
- (d)   
 Structure Q:

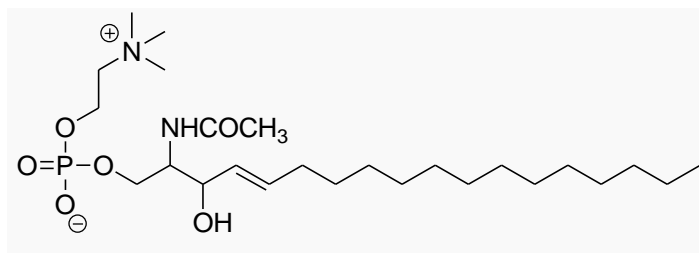
42. An amount of 0.45 g of an organic compound X containing C, H and N on combustion produces 1.1 g of  $\text{CO}_2$  and 0.3 g of water. Empirical formula of X is:

- (a)  $\text{CH}_2\text{N}_2$                       (b)  $\text{C}_2\text{H}_3\text{N}$                       (c)  $\text{C}_3\text{H}_4\text{N}$                       (d)  $\text{C}_2\text{H}_5\text{N}$

43. Heptane-2,6-dione was treated with aqueous alkali and heated. The major product obtained is:

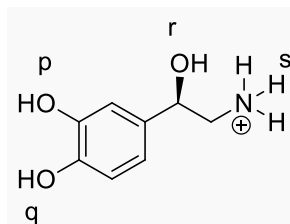
- (a) 2, 3-dimethylcyclohex-1-ene-2-one                      (b) 2, 3-dimethylcyclohex-1-ene-3-one  
 (c) 2, 3-dimethylcyclohex-2-ene-1-one                      (d) 3-methylcyclohex-2-enone

44. The number of chiral carbon(s) in Sphingomyelin, an important constituent of a class of lipids with the following structure is:



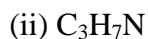
- (a) 2                                      (b) 1                                      (c) 3                                      (d) 4

45. In the following ion the strongest hydrogen bond donor site is:



- (a) p                                      (b) q                                      (c) r                                      (d) s

46. The double bond equivalents for the compounds with the following molecular formulae are respectively:



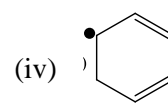
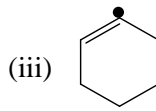
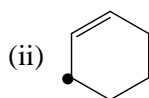
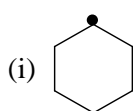
- (a) 1, 5, 6                                      (b) 5, 6, 1                                      (c) 9, 1, 7                                      (d) 7, 9, 1

47. Match the following in which acetaldehyde is converted into different compounds (Column 1) using specific reagents (Column 2).

Column 1	Column 2
i. $CH_3CH=CHCHO$	1. $EtMgI$ in dry ether, $H_3O^+$ , acid dichromate
ii. $CH_3COCl$	2. Dilute $NaOH/Heat$
iii. $CHI_3$	3. Acid dichromate, $PCl_5$
iv. $CH_3COEt$	4. $I_2, NaOH$

- (a) i - 1, ii - 3, iii - 4, iv - 2                                      (b) i - 4, ii - 3, iii - 2, iv - 1  
 (c) i - 2, ii - 4, iii - 1, iv - 3                                      (d) i - 2, ii - 3, iii - 4, iv - 1

48. The increasing order of stability of the following free radicals is:



- (a) iv < ii < iii < i                                      (b) iii < i < ii < iv                                      (c) iii < ii < i < iv                                      (d) ii < i < iii < iv

ANY NUMBER OF OPTIONS (4, 3, 2 or 1) MAY BE CORRECT  
MARKS WILL BE AWARDED ONLY IF ALL THE CORRECT OPTIONS ARE BUBBLED AND NO INCORRECT.

49. A 2 g piece of “dry ice” is dropped in a 5 L glass vessel containing air at 1 atm and 25 °C and the vessel is sealed. After some time, dry ice disappeared.

(Assume that the temperature is kept constant throughout.)

Identify the **correct** statement(s).

- Partial pressure of oxygen increases with respect to its initial value in air.
- Partial pressure of CO<sub>2</sub> increases with respect to its initial value in air.
- Total pressure of the vessel increases with respect to its initial value in air.
- Disappearance of dry ice is due to the evaporation process.

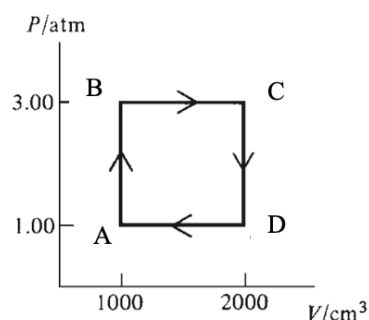
50. A thermo-dynamical process is represented by the cycle shown below in which 0.1 mol of a perfect gas undergoes the reversible cyclic process A → B → C → D → A

Given that  $C_{v,m} = \frac{3}{2}R$  independent of temperature

All symbols have their usual meaning

Identify the correct statement(s)

- $T_B = 365.8 K$
- $q_{B \rightarrow C} = 760.5 J$
- $w_{B \rightarrow C} = -30 J$
- $\left(\frac{\partial U}{\partial V}\right)_T = 0$  for a perfect gas



51. Identify the correct statement(s) for the binary solutions

- The volume of a solution at T and P equals the sum of the volumes of its pure components at T and P.
- At constant T and P, the values of  $\Delta G_{mix}$  and  $\Delta S_{mix}$  are negative and positive respectively.
- Inter-molecular interactions are negligible in an ideal solution.
- The mixture of n-hexane and n-heptane form a nearly ideal solution.

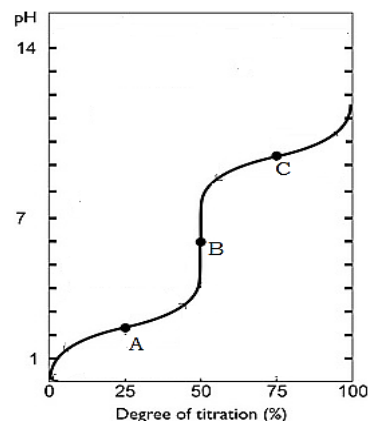
52. The heat of combustion (kJ mol<sup>-1</sup>) of ethane, propane and butane are -1560, -2220, -2878 respectively. When 100 g of each undergo complete combustion. Which of the following statement/s is/are correct?

- The heat generated by combustion of propane will be maximum.
- The heat generated by combustion of butane will be minimum.
- At constant temperature and pressure, the work done during the combustion of ethane is minimum.
- At constant temperature and pressure, the work done during the combustion of butane is maximum.

53. pH titration curve of aqueous solution of simple aliphatic amino acid with general formula NH<sub>2</sub>-CHR-COOH (where R = Alkyl group) against NaOH is represented below.

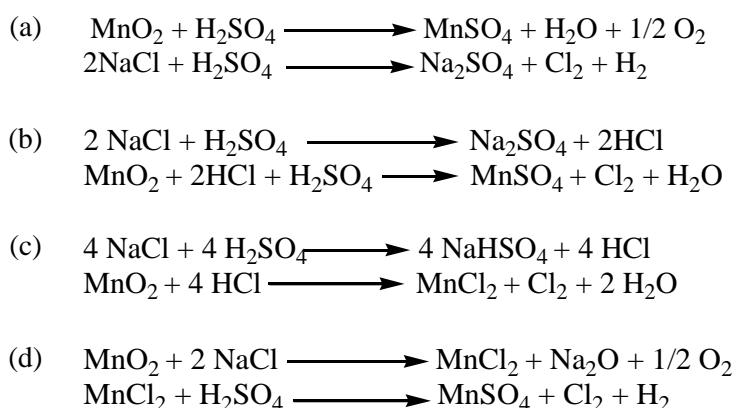
Identify the **correct** statement(s) pertaining to it:

- In aqueous solution, amino acid mainly exists as <sup>+</sup>NH<sub>3</sub>-CHR-COOH
- At point ‘A’, [<sup>+</sup>NH<sub>3</sub>-CHR-COOH] = [<sup>+</sup>NH<sub>3</sub>-CHR-COO<sup>-</sup>]
- At point ‘B’ amino acid exists in zwitter ion form.
- At point ‘C’, [NH<sub>2</sub>-CHR-COO<sup>-</sup>] = [<sup>+</sup>NH<sub>3</sub>-CHR-COO<sup>-</sup>]



54. An aqueous solution of  $\text{CuSO}_4(\text{X})$  is treated with certain reagents. Identify the **incorrect** statement/s.
- Addition of  $\text{NH}_4\text{OH}$  to the aqueous solution of X develops green colour.
  - X is treated with  $\text{H}_2\text{S}$  in acidic medium giving black precipitate soluble in hot aqueous  $\text{KOH}$  solution.
  - X on treatment with  $\text{KI}$  in weakly acidic medium gives white precipitate of  $\text{CuI}_2$  liberating  $\text{I}_2$  gas.
  - An aqueous solution of X when treated with  $\text{BaCl}_2$  solution gives white precipitate.

55. Chlorine ( $\text{Cl}_2$ ) gas can be prepared by the action of concentrated (or Conc.)  $\text{H}_2\text{SO}_4$  on a mixture of sodium chloride ( $\text{NaCl}$ ) and manganese dioxide ( $\text{MnO}_2$ ). Identify the set(s) of correct reactions.



56. The 18-valence electron rule asserts that transition metal compounds are thermodynamically stable when they have a total of 18 valence electrons on the central metal, which include the metal's d electrons and the electrons provided by the ligands attached to the metal.

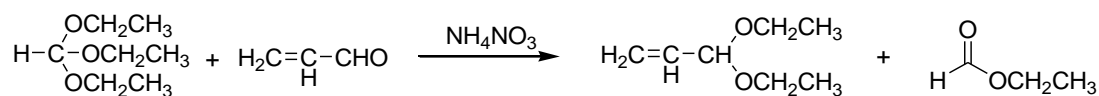
The 18-electron rule is obeyed by:

- (a)  $[\text{Fe}(\text{CO})_5]$                       (b)  $[\text{Mn}(\text{CO})_5]$                       (c)  $[\text{Ni}(\text{CO})_4]$                       (d)  $[\text{Cr}(\text{CO})_6]$

57. Identify the correct statement(s) from the following:

- The number bridging carbonyl groups in  $\text{Co}_2(\text{CO})_8$  is 2
- The number of lone pair (s) in  $\text{XeOF}_4$  is zero
- $\text{B}_5\text{H}_{10}$  is not an example of borane
- The number of bonding and lone pairs of electrons in  $\text{XeF}_2$  are 2 and 6, respectively.

58. Consider the following reaction:



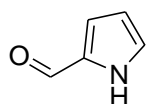
triethyl orthoformate    acrylaldehyde

ethyl formate

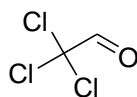
The correct statement(s) pertinent to the above mentioned reaction is/are:

- It is an example of acetal exchange reaction.
- It is an example of rearrangement reaction.
- Conventional reaction of acraldehyde and ethanol will produce better yield of the acetal.
- Water produced in the reaction is taken out of the equilibrium by the hydrolysis of the orthoester.

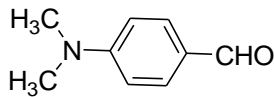
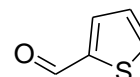
59. Tendency to undergo Cannizaro reaction depends upon the electrophilic nature of the carbonyl group.



pyrrole-2-aldehyde



chloral

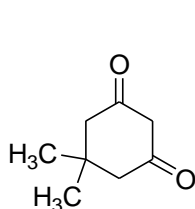
*p*-*N,N*-dimethylaminobenzaldehyde

thiophene-2-aldehyde

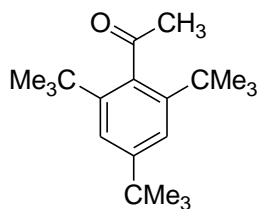
Identify the **incorrect** statement(s) from those listed below

- Thiophene-2-aldehyde will undergo Cannizaro reaction.
- Only chloral will not undergo Cannizaro reaction but others will follow.
- pyrrole-2-aldehyde, chloral and *p*-*N,N*-dimethylaminobenzaldehyde will not follow Cannizaro reaction.
- All the four molecules will undergo Cannizaro reaction since no one contains any enolisable  $\alpha$  - hydrogen atom.

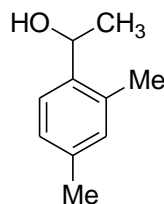
60. In the haloform reaction, the trihalogenated intermediate ( $-\text{CO}-\text{CX}_3$ ) formed is then subjected to a nucleophilic attack by the hydroxide ion ( $\text{OH}^-$ ) at the carbonyl carbon ( $\text{C}=\text{O}$ ) producing a tetrahedral intermediate, which eventually breaks down, expelling the  $-\text{CX}_3$  group and leading to the formation of a carboxylate anion.



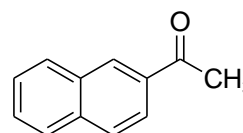
P



Q



R



S

Identify the **correct** statement(s) regarding iodoform reaction:

- 'Q', 'R' and 'S' will take part in iodoform reaction.
- 'P', 'R' and 'S' will take part in iodoform reaction.
- 'P' and 'Q' will not take part in iodoform reaction.
- 'Q' will not take part in iodoform reaction.



**Rough Work**