INDIAN OLYMPIAD QUALIFIER (IOQ) 2021-2022

INDIAN OLYMPIAD QUALIFIER IN CHEMISTRY (IOQC), 2022

QUESTIONS & SOLUTIONS (PART A)

Sunday, March 20, 2022 | Time: 75 Minutes | Max. Marks : 120

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INSTRUCTIONS

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 **14-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 Indian **Olympiad Qualifier in Physics 2020-21 (Part I).**
6. Question paper has two parts. In part A-1 (Q.No.1 to 24) each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

   In part A-2 (Q.No. 25 to 32) 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

7. 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 should be done only in the space provided. There are **10** 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 and candidate's copy of OMR for your 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 overwriting may result in a wrong score.

DO NOTWRITE ONTHE BACK SIDE OFTHE OMRANSWER 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.iaptexam.in on the specified format.**

13. **The answers/solutions to this question paper will be available on the website: www.iapt.org.in.**

14. **CERTIFICATES and AWARDS:**
Following certificates are awarded by IAPT to students, successful in the Indian Olympiad Qualifier in Physics 2021-22 (Part I)
(i) "CENTRETOP10 %"
(ii) "STATETOP1 %"
(iii) "NATIONALTOP1 %"
(iv) "GOLD MEDAL& MERITCERTIFICATE" to all students who attend OCSC-2022 at HBCSE Mumbai

15. All these certificates (except gold medal) will be downloadable from IAPT website : www.iapt.org.in.

16. List of students (with centre number and roll number only) having score above MAS will be displayed on the website: www.iapt.org.in. See the Minimum Admissible score Clause on the Student's brochure on the web.

17. List of Students eligible for evaluation of IOQP 2021-22 (Part II) shall be displayed on www.iapt.org.in

Useful constants

Charge of electron, $e = 1.602 \times 10^{-19}$ C

Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg

Planck's constant, $h = 6.626 \times 10^{-34}$ Js

Speed of light, $c = 3.0 \times 10^{8}$ ms^{-1} 3.0 10 u

Avogadro constant, $N_A = 6.022 \times 10^{23}$ mol^{-1}

Molar gas constant, $R = 0.082$ L atm mol^{-1} K^{-1}

$= 8.314$ J mol^{-1} K^{-1}

Question Paper Code: 32

CHEMISTRY 2021-22 (Part I) (NSEC 2021-22)

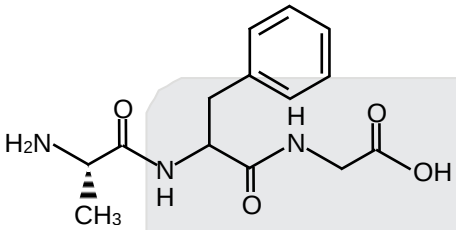
Time: 75 Minute **Max. Marks: 120**

Attempt All Thirty Two Questions

A-1

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

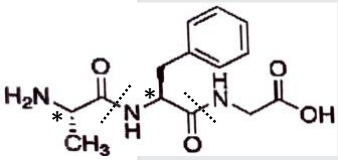
1. In compound X, the number of chiral centers and the number of peptide linkages are, respectively



(a) 2, 3 (b) 3, 2 (c) 2, 2 (d) 3, 3

Ans. (c)

Sol.



* Marked carbon are chiral = 2

... Represent peptide linkage = 2.

2. Which of the following reactions is NOT an example of Lewis acid-Lewis base reaction ?

(a) $Zn + I_3^- \rightarrow Zn^{2+} + 3I^-$ (b) $I_2 + I_3^- \rightarrow I_5^-$

(c) $CoCl_3 + Cl^- \rightarrow CoCl_4^-$ (d) $SO_3 + H_2O \rightarrow H^+ + HSO_4^-$

Ans. (a)

Sol. Redox reaction

b, c, d are lewis acid-Base reaction.

3. A student intended to prepare 100 mL of a 10 ppm solution of K^+ from KCl. He made appropriate calculations, weighed the salt accordingly and prepared the solution. However, after making the solution, he realized that the salt he used was KNO_3 and not KCl. The concentration of K^+ (ppm) in this prepared solution is

(a) 7.37 (b) 10.00 (c) 13.35 (d) 3.86

Ans. (a)

Sol. Conc. in PPM = $\frac{W_{solute}}{Volume\ of\ solution} \times 10^6$

Concentration of K^+ ion = $\frac{W_{K^+}}{10^3} \times 10^6$

so weight of K^+ is = 10^{-2} gram

Mole of K^+ = $\frac{10^{-2}}{39}$ so mole of KCl = $\frac{10^{-2}}{39}$

Weight of KCl = $\frac{10^{-2}}{39} \times 74.5$ gram

Equivalent weight of KNO_3 = $\frac{10^{-2}}{39} \times 74.5$ gram

Mole of KNO_3 = $\left[\frac{10^{-2}}{39} \times 74.5\right] \times \frac{1}{101}$

Mole of K^+ = $\left[\frac{10^{-2}}{39} \times 74.5\right] \times \frac{1}{101}$

Weight of K^+ = $\left[\frac{10^{-2}}{39} \times \frac{74.5}{101}\right] \times 39$

= $10^{-2} \times \frac{74}{101}$ gram

Conc. of K^+ (in PPM) = $\frac{10^{-2} \times 74}{101 \times 10^3} \times 10^6 = \frac{740}{101}$ = 7.37 gram **Ans. = a**

4. Oxide A is soluble in NaOH, oxide B in HCl and oxide C in both. The correct set of A, B and C is :

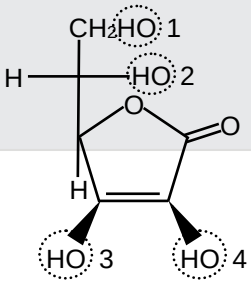
	A	**B**	**C**
(a)	CO_2	SO_2	PbO_2
(b)	CO_2	Na_2O	ZnO
(c)	SO_2	ZnO	SnO_2
(d)	SO_2	BaO	Na_2O

Ans. (b)

Sol.

S.No.	Oxide	Solubility	Nature	Example
(i)	A	NaOH	Acidic	CO_2
(ii)	B	HCl	Basic	Na_2O
(iii)	C	Both	Amphoteric	ZnO

5. Ascorbic acid (Vitamin C), a naturally occurring water soluble vitamin and abundantly found in lemon, shows antioxidant properties. In ascorbic acidic, the OH with the lowest pKa is :



Ascorbic Acid

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

Ans. (c)

Sol. Lowest pKa = most acidic H. Here the –OH (3) is most acidic as the conjugate base is stabilized by resonance.

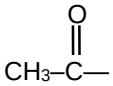
6. Compound 'X' ($C_7H_{12}O_2$) gives -i) a positive silver mirror test and ii) a yellow precipitate on treatment with I_2/NOH. The compound 'X' is :

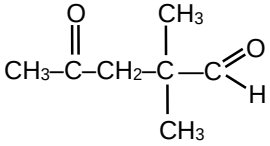
(a) 2-hydroxy-3,3-diemthylcyclopentanone (b) 2,5-heptanedione

(c) 2,2-diemthyl-3-oxopentanal (d) 2,2-diemthyl-4-oxopentanal

Ans. (d)

Sol. $C_7H_{12}O_2 \rightarrow$ (i) Positive silver mirror test $\Rightarrow$ 

(ii) Yellow ppt with I_2/NaOH $\Rightarrow$ 



7. If the ratio of the concentrations of the oxidized and reduced from of a species in an electrochemical reaction can be given as [Ox]/[Red] = 1.0×10^{-3}, the correct expression among the following at 25°C is :

(a) $E = E^o + \frac{1}{3}(0.0592/n)$ (b) $E - E^o = 3 \times (0.0592/n)$

(c) $E = E^o - \frac{1}{3}(0.0592/n)$ (d) $E - E^o = (0.0592/n)$

Ans. (b)

Sol. $A \longrightarrow A^{n+} + ne^-$

Reduced form Oxidised form

$$E_{OP} = E^0_{OP} - \frac{0.059}{n}\log\frac{[A^{n+}]}{[A]}$$

$$= E^0_{OP} - \frac{0.059}{n}\log[1\times10^{-3}]$$

$$E = E^o + 3\left[\frac{0.059}{n}\right]$$

$$(E - E^o) = 3\left[\frac{0.059}{n}\right]$$ **Ans. (b)**

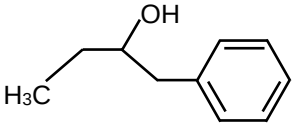
8. Among the following numbers, the one is which all the zeros are significant is :

(a) 0.0004 (b) 0.0400 (c) 40.000 (d) 0.0040

Ans. (c)

Sol. Zeros located to the lest of the first non-zero digit are not significant. Zeros located to the right of non-zero significant digits are significant.

9. Among the following sets of compounds, the one is which a reaction between them followed by hydrolysis that *does not* lead to the formation of 1-phenly-2-butanol is :



1-phenyl-2-butanol

(a) phenylacetaldehyde and ethylmagnesium bromide

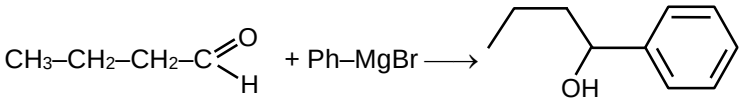
(b) butanal and phenylmagnesium bromide

(c) propanal and benzylmagnesium bromide

(d) 1-phenyl-2-butanone and $NaBH_4$

Ans. (b)

Sol. Reaction between butanal and phenyl magnesium bromide result in formation of 1-phenyl-1-butanol.



1-phenyl-1-butanal

10. The correct order of CFSE of the following complex ions is.

$[Zn(NH_3)_4]^{3+} > [Co(NH_3)_6]^{2+} > [Co(NH_3)_6]^{3+} > [Ir(NH_3)_6]^{3+}$

(a) $[Ir(NH_3)_6]^{3+} > [Co(NH_3)_6]^{3+} > [Co(NH_3)_6]^{2+} > [Zn(NH_3)_4]^{3+}$

(b) $[Zn(NH_3)_4]^{3+} > [Co(NH_3)_6]^{2+} > [Co(NH_3)_6]^{3+}\ [Ir(NH_3)_6]^{3+}$

(c) $[Ir(NH_3)_6]^{3+} > [Co(NH_3)_6]^{3+} > [Zn(NH_3)_4]^{3+} > [Co(NH_3)_6]^{2+}$

(d) $[Co(NH_3)_6]^{3+} > [Ir(NH_3)_6]^{3+} > [Co(NH_3)_6]^{2+} > [Zn(NH_3)_4]^{3+}$

Ans. (a)

Sol. Order of CFSE : $[Ir(NH_3)_6]^{3+} > [Co(NH_3)_6]^{3+} > [Co(NH_3)_6]^{2+} > [Zn(NH_3)_4]^{2+}$

11. Solvents are classified as polar and nonpolar based on their dipole moments. Given below are some solvents.

(p) 1,2-dibromobenzne (q) diisopropylether (r) trans-1,2-dichloroethene

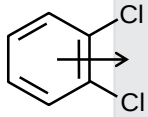
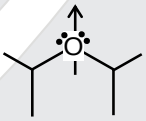
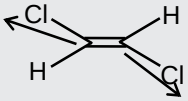
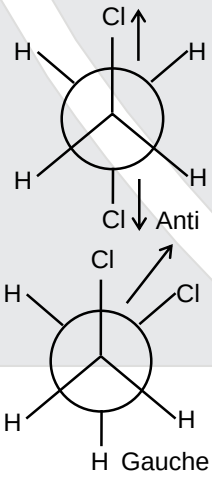
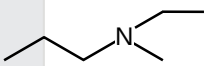
(s) 1,2-dichloroethane (t) N-ethyl-N-methylpropan-1-amine

The set in which all solvents are polar is :

(a) p, s, t (b) p, q, r (c) r, s, t (d) q, r, t

Ans. (a)

Sol.

p	q	r	s	t
				
$\mu \neq 0$	$\mu \neq 0$	$\mu = 0$	$\mu \neq 0$	$\mu \neq 0$
Polar	Polar	Non-polar	Polar	Polar

Correct answer should be “p,s,t” among given.

12. Which of the following statement/s is/are correct ?

I. Half-life is 50% of the total time taken for the completion of a reaction

II. Collision frequency (Z), which is the number of collisions per second per unit volume, is same as the rate constant of the reaction

III. A change in the activation energy of a reaction at a particular temperature will result in a proportional change in the rate and rate constant of the reactions at the same temperature

IV. All first order reactions are not unimolecular

V. For a zero order reaction, slope of a plot of $t_{1/2}$ Vs. initial concentration will be zero

(a) I, IV (b) II only (c) IV only (d) II, III, V

Ans. (c)

Sol. (i) Half life is time taken to become 50% of initial concentration. So statement-I is incorrect.

(ii) Arrhenius equation

$K = A.e^{-Ea/RT}$

$K = (PZ)\ e^{-Ea/RT}$

Z = Collision Frequency is the number of collision per unit volume per unit time.

so statement 'II' is not correct.

(iii) As $K \propto e^{-Ea/RT}$

so statement III not correct

(iv) All first order reactions are not unimolecular. It is corret statement.

(v) For zero order reaction $t_{1/2} = \frac{C_0}{2K}$

slope of $t_{1/2}$ C_o is $\left(\frac{1}{2K}\right)$

13. The orange colour of $K_2Cr_2O_7$ and yellow colour of K_2CrO_4 are, respectively, due to

(a) charge transfer transitions and d-d transitions

(b) d-d transition and change transfer transitions

(c) charge transfer transitions in both

(d) d-d transition in both

Ans. (c)

Sol. In $K_2Cr_2O_7$ and K_2CrO_4 main reason of colour is charge transfer.

14. One mole of neon (atomic mass = 20 g mol^{-1}) and one mole of argon (atomic mass = 40 g mol^{-1}) are stored in two separate containers I and II, at temperature T and 2T respectively. If both the gases are assumed to behave ideally

(a) K.E. and average velocity of the gas molecules will be the same in both I and II

(b) K.E. and average velocity of the gas molecules in II will be twice that of the gas molecules in I

(c) K.E. of the gas molecules in II will be twice that in I and average velocity of the gas molecules in both I and II will be he same

(d) Both K.E. and average velocity of the gas molecules in I will be twice that of the gas molecules in II

Ans. (c)

Sol. For ideal gas kinetic energy is function of temperature only.

$KE = \frac{3}{2}nRT$

1 Mole Ne — Temperature = T — $(KE)_{Ne} \propto T$

1 Mole Ar — Temperature = 2T — & $(KE)_{Ar} \propto 2T$

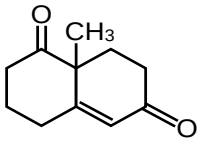
Average velocity $U_{av} = \sqrt{\frac{8RT}{\pi M}}$

so $(KE)_{II} = 2(KE)_I$

$(U_{av})_I \propto \sqrt{\frac{T}{20}}$ $\quad (U_{av})_{II} \propto \sqrt{\frac{2T}{40}}$ $\quad (U_{av})_{II} \propto \sqrt{\frac{T}{20}}$

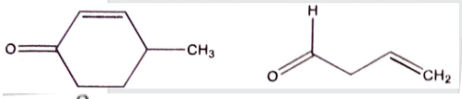
so $(U_{av})_I = (U_{av})_{II}$ — so correct answer is (c)

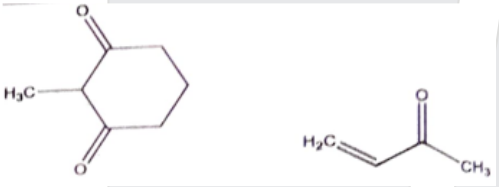
15. An aldehyde/ketone in the presence of a base forms a carbanion at the α-position which can react with a carbonyl group in an Aldol type of reaction. It can also react with an olefinic double bond which is activated by groups like CO, CN, NO_2 attached to the double bond. The latter reaction is an addition reaction across the double bond. Wieland-Miescher ketone is an important synthetic intermediate used to synthesize many compounds.

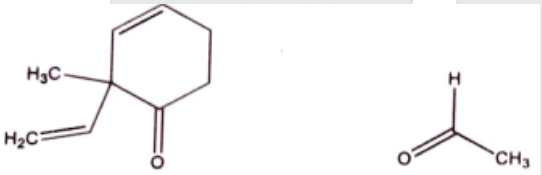


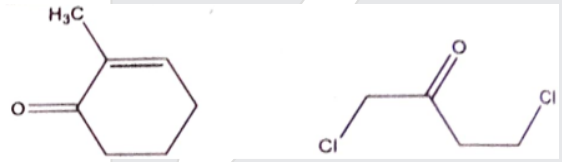
Wieland-Miescher Ketone

The pair of starting materials suitable for preparation of Wieland-Miescher ketone through a base catalyzed reaction is

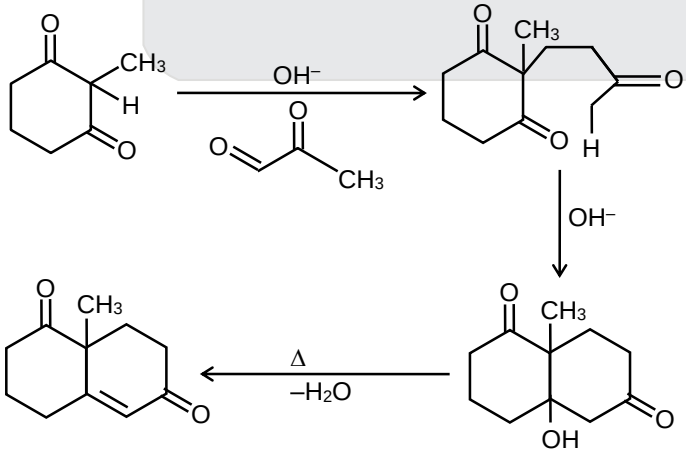
(a) 

(b) 

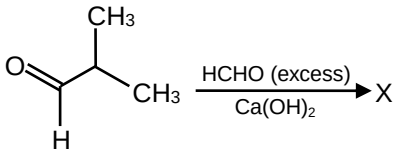
(c) 

(d) 

Ans. (b)

Sol. 

16. 'X' in the following reaction is

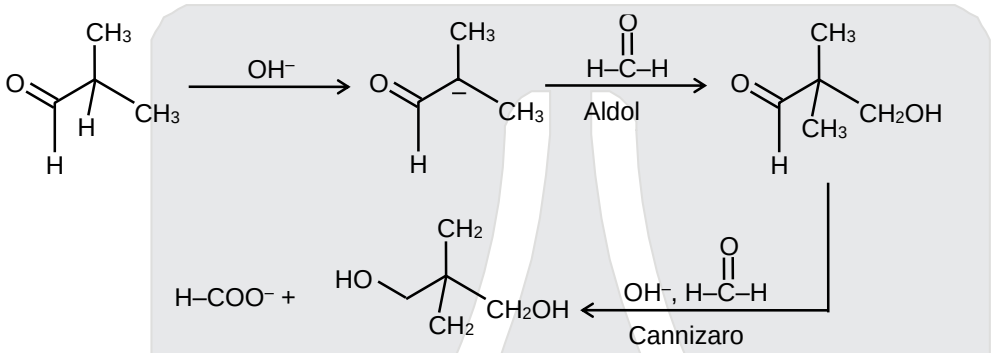


2-methylpropanal

(a) 2,2-Dimethyl-1,3-propanediol (b) 2-Methylpropan-l-ol
(c) iso-butyric acid (d) 3-Hydoxy-2,2-dimethylpropanal

Ans. (a)

Sol.



17. When 0.805 g of the potassium salt $(CH_2)_n(COOK)_2$ of a dibasic organic acid was reduced, 0.323 g of potassium was obtained. Molar mass of the acid is :

(a) 194 (b) 116 (c) 118 (d) 156

Ans. (c)

Sol. $(CH_2)_n(COOK)_2 \longrightarrow 2K^+$

0.805 gram 0.323 gram

$2(n_{salt}) = [n_{K^+}]$

$$2\left[\frac{0.805}{14n+166}\right] = \left[\frac{0.323}{39}\right]$$

$$2\left(\frac{0.805}{14n+166}\right) = 0.0083$$

$$14n + 166 = \frac{2\times 0.805}{0.0083} = 194$$

$14n = 194 - 166 = 28$

$$n = \frac{28}{14} = 2$$

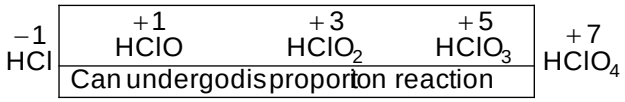
Molar mass of the acid $(CH_2)_2(COOH)_2$ is 118

18. Among (i) HCl, (ii) HOClO, (iii) $HOClO_2$ and (iv) $HOClO_3$, which cannot undergo a disproportionation reaction ?

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

Ans. (c)

Sol.



19. The electronic transition in He^+ ion that will occur at the same wavelength as that of the n = 2 to n = 1 transition in H atom is:

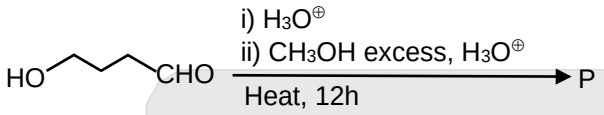
(a) n = 2 to n = 1 (b) n = 3 to n = 1 (c) n = 3 to n = 2 (d) n = 4 to n = 2

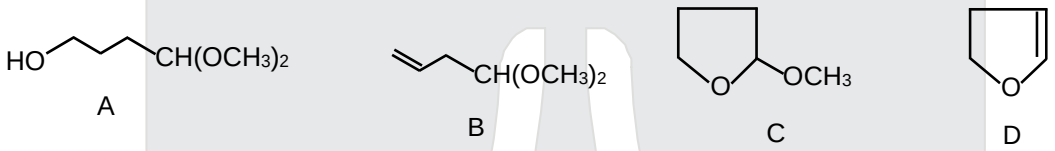
Ans. (d)

Sol. $(E_{He^+}) = (E_H)_{2\to1}$

$(E_{He^+})_{4\to2}$ = 10.2 eV

20. 'P' in the following reaction is

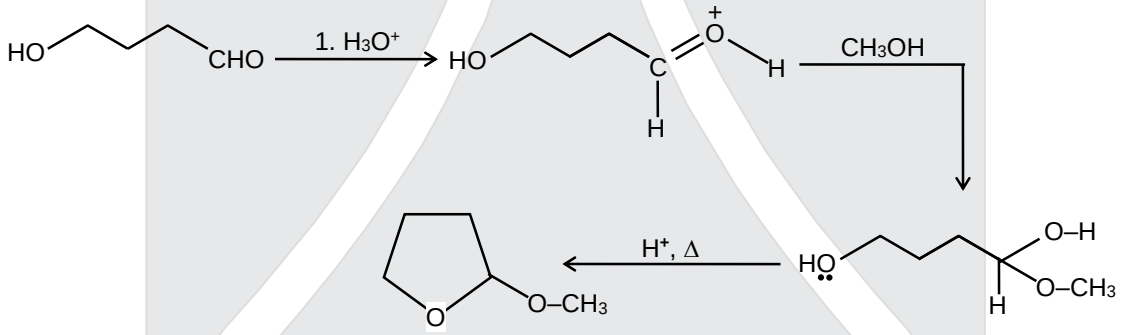




(a) A (b) B (c) C (d) D

Ans. (c)

Sol.



21. The number of stereoisomers is maximum for (ox = $C_2O_4^{2-}$)

(a) $[Co(ox)_3]^{3-}$ (b) $[Co(ox_2ClBr]^{3-}$ (c) $[Co(ox)Cl_2Br_2]^{3-}$ (d) $[CoCl_3Br_3]^{3-}$

Ans. (c)

Sol.

S.No.	Complex	Total Stereoisomers
(a)	$[Co(OX)_3]^{3-}$	2
(b)	$[Co(OX)_2ClBr]^{3-}$	3
(c)	$[Co(OX)Cl_2Br_2]$	4
(d)	$[CoCl_3Br_3]^{3-}$	2

22. Maximum number of electrons with m_s = 1/2 which can be accommodated in subshells having total three nodes is:

(a) 10 (b) 16 (c) 20 (d) 32

Ans. (b)

Sol. Total node (n – 1) = 3

n = 4

Total possible electron in n = 4 is 32 but only Maximum 50% electron can have $m_s = \frac{1}{2}$

So total electron with n = 4 & $m_s = \frac{1}{2}$ are 16.

23. The Hinsberg test of the compound X produces a solid compound Y that is insoluble in 10% aq. NaOH. Y dissolves in 10% aq. sulphuric acid. The compound X is

(a) $NH_2CH_2CH_2CH_2N(CH_3)_2$ (b) $(CH_3)_2NCH_2CH_2NHCH_3$

(c) $NH_2CH_2C(CH_3)_2CH_2NH_2$ (d) $(CH_3)_2NCH_2N(CH_3)_2$

Ans. (b)

Sol. X-produce a solid compound Y, that is insoluble is 10% aq NaOH. It indicates that the compound must not have a primary amine group and must have a sec. amine group. Therefore the logical answer is (b)

24. An ionic speices, M^{3+}, is isoelectronic with $CuCl_2$ and has (Z + 2) neutrons. The molar mass of M^{3+} is :

(a) 128 (b) 62 (c) 68 (d) 134

Ans. (d)

Sol. M^{3+} is iso electronic with $CuCl_2$

total electron in $CuCl_2$ = 63

so total electron in M^{3+} is = 63

Total electron in M are = 66

No. of proton = 66

No. of neutron = (Z + 2) = 68

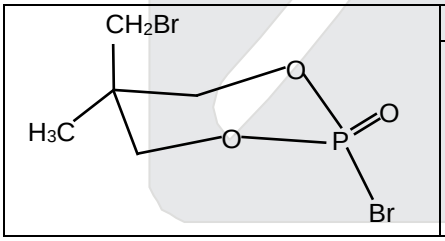
so molarmass = (66 + 68) = 134

A-2

ANY NUMBER OF OPTIONS 4, 3, 2 or 1 MAY BE CORRECT

MARKS WILL BE AWARDED ONLY IF ALL CORRECT OPTIONS ARE BUBBLED AND NO WRONG OPTION

25. For the given compound, % s character of phosphorous hybrid orbitals which contribute to various bonds are given in the table below.



Bond	% s character
P=O	40
P–Br	<20
P–O	20

This difference in % 's' character of various phosphorous bonds could be due to

(a) The large size of bromine atom

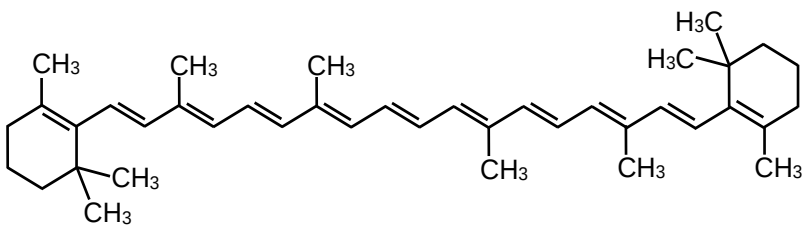
(b) The large electronegativity difference between P and O

(c) Increased overlap of σ-orbitals of terminal P-O bond

(d) Stronger covalent character of P-O in cyclic oxygen atoms

Ans. (a, c)

26. β-carotene and related compounds are plant pigments that give red, orange and yellow vegetables their vibrant colour. The structure of β-carotene is given below.



It is approved as a food additive in many countries. The correct statements that describe/s β-carotene is/are

(a) It is a strong oxidizing agent

(b) It reacts with singlet oxygen, an excited form of O_2, to produce an epoxide

(c) It absorbs red/yellow light of electromagnetic spectrum

(d) It comes in the oil phase when carrots are cooked in oil and water in a curry

Ans. (b, d)

Sol. β-carotene is not a strong oxidizing agent, rather it is antioxidant. It react with singlet oxygen to produce an epoxide. It is fat soluble and comes out in a curry.

27. At room temperature, NaCl(s) and KCl(s) were taken in equal masses and dissolved in equal volumes of water in two separate closed containers I and II respectively. Of the following, correct option/s is/are.

(a) To compare molarities in (I) and (II), masses of both the solutions need to be known

(b) Molalities cannot be compared with out measuring the mass of water added in each case

(c) If (I) and (II) are completely transferred into another container (III), $[Cl^-]$ in (III) will be su of that in (I) and (II)

(d) Information given is sufficient to compare the vapour pressures in (I) and (II)

Ans. (d)

Sol. Mole of NaCl(s) = $\left(\frac{10}{58.5}\right)$ mole

Mole of KCl(s) = $\left(\frac{10}{74.5}\right)$ mole

Molarity (M) = $\left(\frac{\text{Mole of solute}}{V_{solution}.(\text{inLit})}\right)$

(a) as mole of NaCl(s) > mole of KCl
So molarity of NaCl > Molarity of KCl
So molarity can be compared

(b) As volume of water in both case is equal so we can compare molality.

(c) In III container

$$[Cl^-]_{III} = \frac{[Cl^-]_I + [Cl^-]_{II}}{2}$$

(d) As mole of NaCl > Mole of KCl
So $(Vp)_{NaCl} < (Vp)_{KCl}$
Correct answer (c, d)

28. In a pair of isomers of molecular formula C_5H_8, both the compounds undergo catalytic hydrogenation to form compounds of molecular formula C_5H_{10}. On Ozonolysis followed by oxidative workup (H_2O_2), one of the isomers gives a diacid ($C_5H_8O_4$) while the other isomer gives a ketoacid ($C_5H_8O_3$) The pair/s which give/s above set of reactions is/are

(a) 3-ethylcyclopropene and 1-pentyne

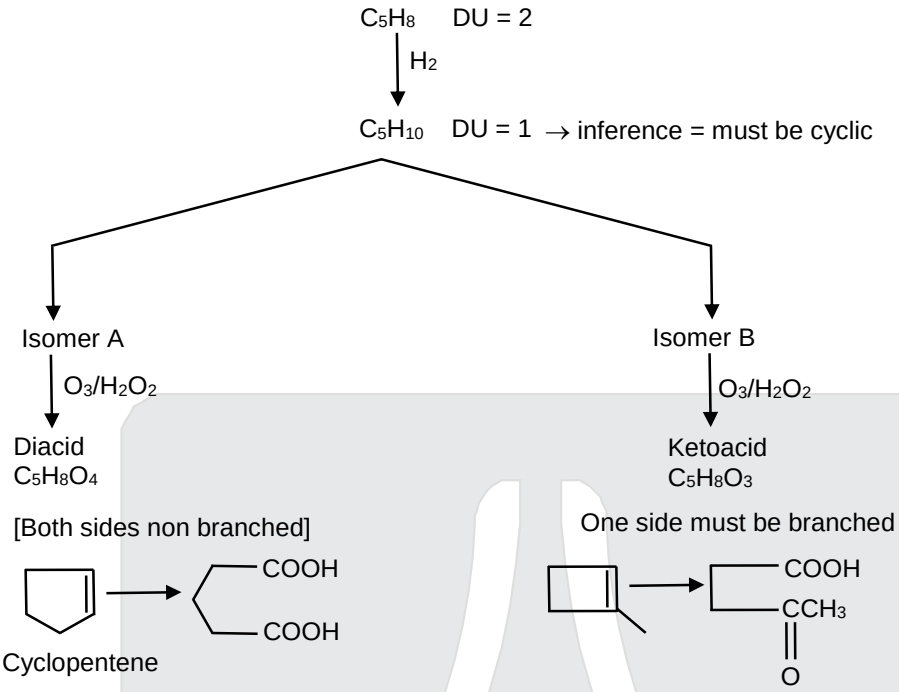
(b) cyclopentene and 1-methycyclobutene

(c) 1-methylcyclobutene and 3-methylcyclobutene

(d) 1,2-dimethylcyclopropene and 3-methylcyclobutene

Ans. (b, c)

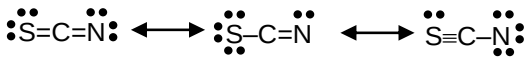
Sol.



Similarly 'c' also

29. The resonance structures of SCN^- are given below along with the S–C and C–N bond lengths.

	S–C (in pm)	C–N (in pm)
SCN^-	165	117
Single bond	181	147
Double bond	155	128
Triple bond	-------	116



(i) (ii) (iii)

Among the following, the incorrect statement/s is/are

(a) The contribution from resonance structures (i) and (ii) is more important than that from structure (iii)

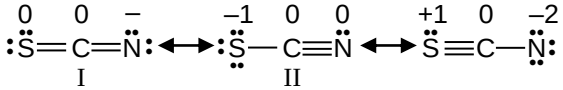
(b) The formal charge on S in structure (iii) in zero

(c) the degree of contribution of these structures is in the order: i>ii>iii

(d) The formal charge on N in structure (ii) is zero

Ans. (b,c)

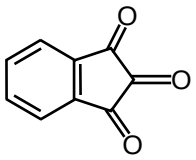
Sol. Formal charge (FC) = $\left\{\begin{matrix}\text{Total no. of}\\ \text{Valence e}^-\\ \text{in free atom}\end{matrix}\right\} - \left\{\begin{matrix}\text{Total no. of}\\ \text{non bonding}\\ \text{(lone pair}\\ \text{electron)}\end{matrix}\right\} - \frac{1}{2}\left\{\begin{matrix}\text{Total no. of}\\ \text{bonding}\\ \text{electron}\end{matrix}\right\}$

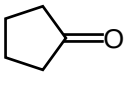


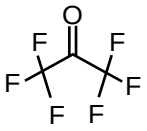
* Lewis dot structure with minimum formal charge is most stable.

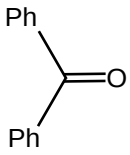
So option a = correct
b = incorrect
c = Incorrect
d = correct

30. The compound/s which form/s stable hydrate/s is/are


(a)


(b)

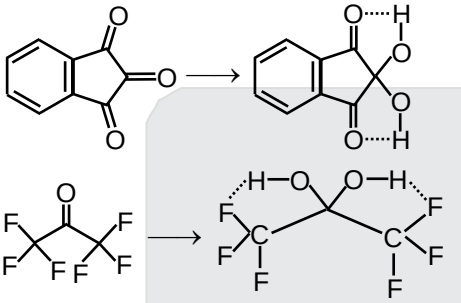

(c)


(d)

(a) a (b) b (c) c (d) d

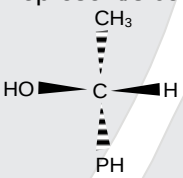
Ans. (a, c)

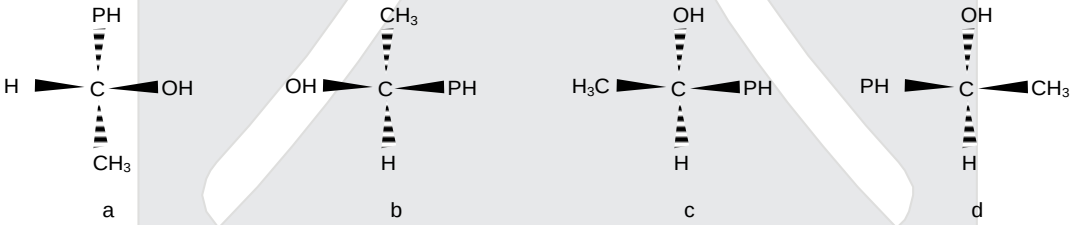
Sol.



Both A and C form stable hydrate because of Intramolecular H-bonding and minization of charge.

31. The formula/e which also represent/s compound with formula X is/are

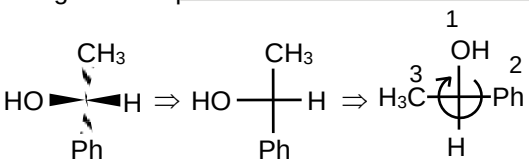

X


a b c d

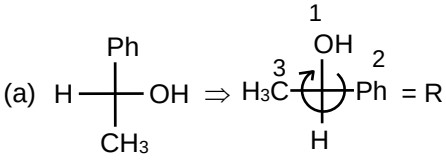
(a) a (b) b (c) c (d) d

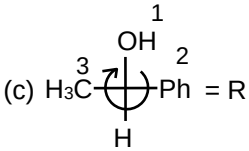
Ans. (a, c)

Sol. The given compounds

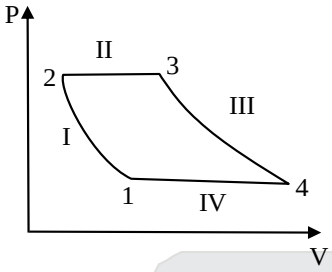


only (a) and (c) have R-configuration





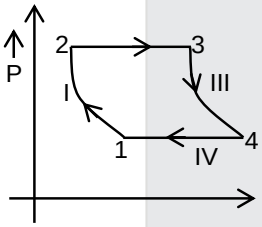
32. Following is the P vs V plot of a cyclic process 1 → 2, 2 → 3, 3 → 4, 4 → 1, denoted as I, II, III and IV respectively for a system of one mole of an ideal gas.
Assume that there is heat exchange between the system and surroundings only in II and IV. Which of the following is/are correct?



(a) In II and IV ΔS is zero
(b) In I and III ΔS is zero
(c) I and III are isothermal and reversible
(d) In II and IV, change in internal energy of the gas (ΔU) is zero

Ans. **(b)**

Sol.



For 1 mole of ideal gas.
Process II & IV isobaric process & in this process Heat is exchange.
Process II $\Rightarrow$ isobaric Heat absorption
IV $\Rightarrow$ isobaric Heat rejection.
*(a) In II & IV $\Delta s \neq 0$
(b) As in process I & III no heat is exchange between system & surrending.
So process is adiabatic reversible process. In adiabatic process $\Delta s = 0$
(c) I & III are adiabatic process
(d) In II & IV change in internal energy of gas not equal to zero.
so correct answer is (b)

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