



INDIAN ASSOCIATION OF PHYSICS TEACHERS
NATIONAL STANDARD EXAMINATION IN CHEMISTRY (NSEC) 2023
(QUESTION PAPER CODE 32)

Date : 26/11/2023

Time : 120 Minute

Maximum Marks: 216

Write the question paper code (mentioned above) on YOUR OMR Answer Sheet (in the space provided), other wise your Answer Sheet will NOT be evaluated, Note that the same Question paper code appears on each page of the question paper.

INSTRUCTIONS

1. Use of mobile phone, smart watches, 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 bubbles.
5. Your **fourteen-digit roll number and date of birth** entered in the OMR Answer sheet shall remain your login credentials means login id and password respectively for accessing your performance result.
6. Question paper has two parts. In part A1 (**Q. No.1 to 48**) each question has four alternatives, out of which only one is correct. Choose the correct alternative (s) and fill the appropriate bubbles(s), as shown.

Q.No.12



In part A2 (**Q. No. 49 to 60**) each question has four alternative 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 bubbles(s), as shown

Q.No.52



7. For **Part A1**, each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer. In **Part A2**, you get 6 marks. If all the correct alternative are marked. No negative marks in this part.
8. Rough work should be done only in the space provided. There are ___ 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 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 or overwriting may result in wrong score.

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

Name of Student :

Batch :

Enrolment No.

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INDIAN ASSOCIATION OF PHYSICS TEACHERS

NATIONAL STANDARD EXAMINATION IN
CHEMISTRY (NSEC) 2023

PAPER CODE-32

Date of Examination – 26th November, 2023

SOLUTIONS

Attempt All Sixty Questions

(NSEA) PART : A-1

ONLY ONE OUT OF FOUR OPTIONS IS CORRECT, BUBLE THE CORRECT OPTION.

[:Q.1] Among the following, the correct statements about the compressibility factor (Z) of real gases are:

- (i) If $Z < 1$, intermolecular repulsive forces are more dominant.
- (ii) If $Z < 1$, intermolecular attractive forces are more dominant.
- (iii) If $Z > 1$, intermolecular repulsive forces are more dominant.
- (iv) If $Z > 1$, intermolecular attractive forces are more dominant.

[:A] (i) and (iv)

[:B] (i) and (iii)

[:C] (ii) and (iv)

[:D] (ii) and (iii)

[:ANS] D

[:SOLN]

$Z < 1$,

$$Z = \frac{V_{m\text{Real}}}{V_{m\text{Ideal}}}; V_{m\text{Real}} < V_{m\text{Ideal}}$$

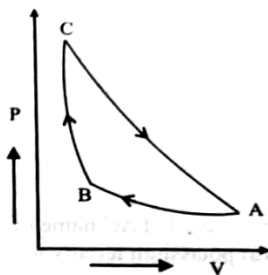
i.e. Intermolecular attractive force are more dominating

$$Z = \frac{V_{m\text{Real}}}{V_{m\text{Ideal}}}; Z > 1$$

$$V_{m\text{Real}} > V_{m\text{Ideal}}$$

i.e. Intermolecular repulsive force are more dominating.

[:Q.2] The figure represents the processes AB, BC and CA undertaken by a certain mass of an ideal gas. Along the path AB, the gas is isothermally compressed with release of 800 J heat to the surroundings. It is then compressed adiabatically along the path BC and the work done is 500 J. The gas then returns to the state A along path CA and absorbs 100 J heat from the surroundings. The work done by the gas along the path CA is :



[:A] -300 J

[:B] -900 J

[:C] -600 J

[:D] -400 J

[:ANS] C

[:SOLN] AB \otimes Isothermal compression

$$W = +800 \text{ J}, q = -800 \text{ J}$$

BC \otimes Adiabatic compression

$$\Delta U = +500 \text{ J} \quad W = +500 \text{ J}$$

CA

$$Q = +100 \text{ J}$$

Cyclic path ABCA

$$\Delta U = W_{\text{total}} + q_{\text{total}}$$

$$0 = (+800 \text{ J} + 500 \text{ J} + W) + (-800 \text{ J} + 100 \text{ J})$$

$$W = -600 \text{ J}$$

[:Q.3] Two flasks I and II of equal volume are evacuated and connected by a tube of negligible volume fitted with a stopcock. They are then placed in two different constant temperature baths of 250 K and 750 K respectively. 20 moles of an ideal gas are introduced into the system of these flasks through the stopcock. When the system reaches equilibrium, the ratio of the moles of the gas in flasks I and II is :

[:A] 1 : 1

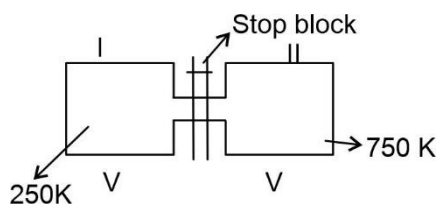
[:B] 2 : 1

[:C] 3 : 1

[:D] 4 : 1

[:ANS] C

[:SOLN]



20 mole given to the system, after opening of stopcock for equilibrium, both container having equal pressure so

$$n_1 T_1 = n_2 T_2$$

$$\frac{n_1}{n_2} = \frac{T_2}{T_1} = \frac{750}{250} = 3:1$$

[:Q.4] When a certain amount of a univalent salt AB (molar mass = 54 g mol⁻¹) was dissolved in 0.1 dm³ of water, the relative lowering of the vapour pressure was found to be 3.55%. The molality of the resulting solution is :

(Assume complete dissociation of the salt under given condition. Density of water = 1 g cm⁻³)

[:A] 0.5 m

[:B] 1.0 m

[:C] 2.0 m

[:D] 4.0 m

[:ANS] B

[:SOLN]
$$\frac{P_A^\circ - P_s}{P_A^\circ} = 2 \cdot x_B$$

$$\frac{3.55}{100} = 2 \cdot x_B$$

$$x_B = \frac{3.55}{200}$$

$$m = \frac{x_B \cdot 1000}{x_A \cdot m_{\text{solvent}}} = \frac{x_B \cdot 1000}{(1 - x_B) \cdot m_{\text{solvent}}} = \frac{\frac{3.55}{200} \cdot 1000}{1 - \frac{3.55}{200}} = 1.0039$$

Molality = 1 m

[:Q.5] The rate constant values for the decay of radioisotopes X and Y, used in radio-medicine are 0.05 h⁻¹ and 0.025 h⁻¹ respectively. In a hospital, at a time 'to' the activity of a sample of X was

found to be twice that of Y. The activities of the two radioisotopes will be approximately equal when the time elapsed is :

[A] twice the half-life of Y

[B] twice the half-life of X

[C] equal to the half-life of X

[D] equal to $\frac{1}{2}$ the half-life of Y

[ANS] B

[SOLN] $A_{x_0} = 2A_{y_0}$

At time t,

$$A_x = A_y$$

$$A_{x_0} \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2x}}} = A_{y_0} \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2y}}}$$

$$2A_{y_0} \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2x}}} = A_{y_0} \left(\frac{1}{2}\right)^{\frac{t}{2t_{1/2x}}}$$

$$\lambda_x = 2\lambda_y$$

$$t_{1/2x} = \frac{1}{2}t_{1/2y}$$

$$\left(\frac{1}{2}\right)^{\frac{t}{t_{1/2x}}} = \left(\frac{1}{2}\right)^{\frac{t}{2t_{1/2x}} + 1}$$

$$\frac{t}{t_{1/2x}} = \frac{t}{2t_{1/2x}} + 1$$

$$\frac{t}{t_{1/2x}} \left(1 - \frac{1}{2} \right) = 1$$

$$t = 2t_{1/2x}$$

[:Q.6] Electrolysis of aqueous CuSO₄ (0.1 M) was carried out in two cells I and II. In I, the electrodes are of Cu and in II they were of Pt. As the electrolysis proceeds pH of the electrolyte solution will :

[:A] decrease in II and remain the same in I

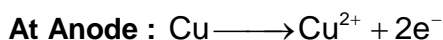
[:B] remain the same in both I and II

[:C] increase in both I and II

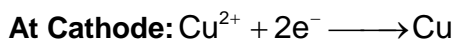
[:D] increase in I and decrease in II

[:ANS] A

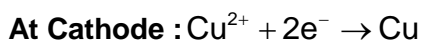
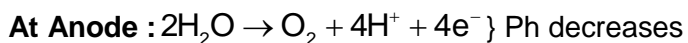
[:SOLN] In 1st cell with Cu-electrodes



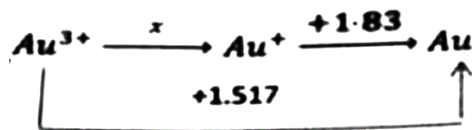
} No change in PH



In 2nd cell, with Pt-electrodes



[:Q.7] Latimer diagrams are the compact representations of electrochemical equilibria in substances of multiple oxidation states. The value of the potential, x, in the Latimer diagram of gold (at pH = 1.0) is :



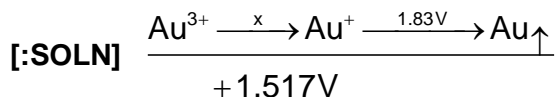
[:A] 2.72 V

[:B] 3.18 V

[:C] -3.18 v

[:D] 1.36 v

[:ANS] D



$$E_{\text{net}} = \frac{2x + 1 \times 1.83}{3}$$

$$1.517 \times 3 = 2x + 1.83$$

$$x = \frac{1.517 \times 3 - 1.83}{2} = 1.36\text{V}$$

[:Q.8] The ligand with which the homoleptic octahedral complex of Co^{3+} will be most stable is :

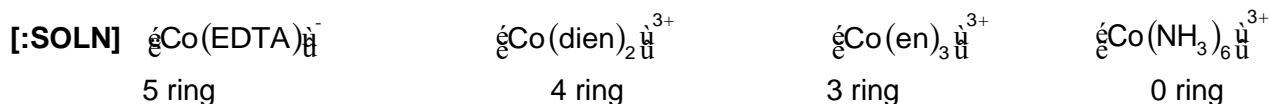
[:A] Ethylenediamine tetra acetate ion

[:B] Dien (N-(2-aminoethyl)-1, 2-ethanediamine)

[:C] Ethane-1, 2-diamine

[:D] Ammonia

[:ANS] A

[:Q.9] Which of the following properties may have positive values of ΔH ?

(i) Lattice enthalpy

(ii) Hydration enthalpy

(iii) Electron gain enthalpy for noble gases

(iv) Ionisation enthalpy

[A] (i) and (ii)

[B] (iii) and (iv)

[C] Only (iv)

[D] (ii), (iii) and (iv)

[ANS] B

[SOLN] $U_o, \Delta H_{eg}$ Noble gas, I.E. = +ve

[Q.10] The correct IUPAC name of potassium permanganate is :

[A] potassium tetraoxomanganate (VI)

[B] potassium tetraoxidopermanganate(VII)

[C] potassium tetraoxidomanganese(VII)

[D] potassium tetraoxidomanganate(VII)

[ANS] D

[SOLN] $K[MnO_4]$ -Potassium tetraoxidomaganate (VII)

[Q.11] Which of the following statements is true with respect to sodium salts of oxoanions of phosphorus NaH_2PO_2 and Na_2HPO_3

[A] NaH_2PO_2 is reducing and Na_2HPO_3 is oxidizing

[B] NaH_2PO_2 is more reducing than Na_2HPO_3

[C] NaH_2PO_2 is more oxidizing than Na_2HPO_3

[D] NaH_2PO_2 is oxidizing and Na_2HPO_3 is reducing

[ANS] B

[SOLN] $NaH_2PO_2 > Na_2HPO_3$

- -

$H_3PO_2 > H_3PO_3$ -R.A

[Q.12] The fluoride/s of xenon, XeF_n ($n = 2$ or 4 or 6), which on complete hydrolysis gives back xenon as one of the products, is/are _____.

I. XeF_2 II. XeF_4 III. XeF_6

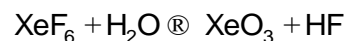
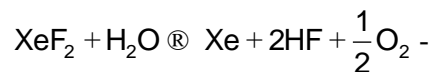
[A] II only

[:B] I and II

[:C] III only

[:D] I, II and III

[:ANS] B

[:SOLN] XeF_n 

[:Q.13] If an element after oganesson (Og, atomic number 118 and electronic configuration $[\text{Rn}] 5f^{14}6d^{10} 7s^2 7p^6$) was discovered, in which of the following orbital, will the 119th electron be accommodated?

[:A] 7d

[:B] 6f

[:C] 8s

[:D] 5g

[:ANS] C

[:SOLN] $Z_{119} - [\text{Rn}]5f^{14}6d^{10}7s^27p^68s^1$

[:Q.14] The number of 'two-center-two electron' and 'three-center-two electron' bonds in $[\text{Al}(\text{BH}_4)_3]$ are respectively

[:A] twelve and zero

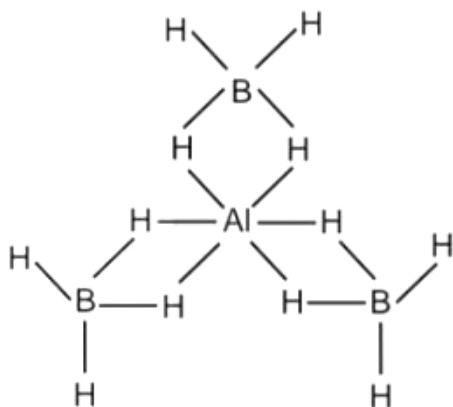
[:B] twelve and three

[:C] six and six

[:D] nine and three

[:ANS] C

[:SOLN] $[\text{Al}(\text{BH}_4)_3]$



No. of two -Center-two electron bonds = 6

No. of three Center-two electron bonds = 6

[:Q.15] Identify the correct matching of the following oxides in column M with their property in column N.

M	N
(i) Aluminum trioxide	(P) Acidic oxide
(ii) Calcium oxide	(Q) Basic oxide
(iii) Arsenic pentoxide	(R) Amphoteric oxide

[:A] (i)-(p), (ii)-(q), (iii)-(r)

[:B] (i)-(q), (ii)-(r), (iii)-(p)

[:C] (i)-(r), (ii)-(q), (iii)-(p)

[:D] (i)-(r), (ii)-(p), (iii)-(q)

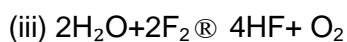
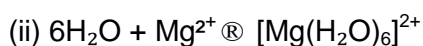
[:ANS] C

[:SOLN] (i) Al_2O_3 - Amphoteric

(ii) CaO - Basic oxide

(iii) As_2O_5 - Acidic oxide

[:Q.16] In each of the following reactions, role of water is:



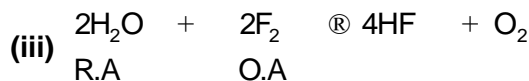
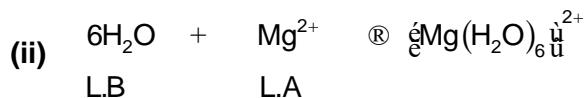
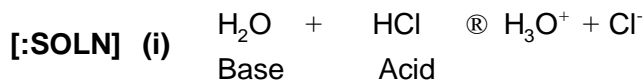
[:A] (i) oxidant; (ii) reductant; (iii) base

[:B] (i) reductant; (ii) oxidant; (iii) base

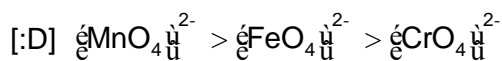
[:C] (i) base; (ii) base; (iii) reductant

[:D] (i) acid; (ii) base; (iii) reductant

[:ANS] C

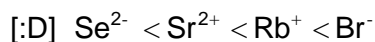
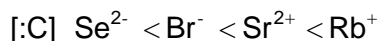
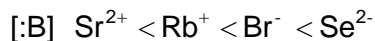
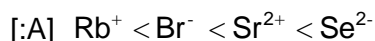


[:Q.17] The correct order of the following oxidizing agents in basic aqueous medium is:



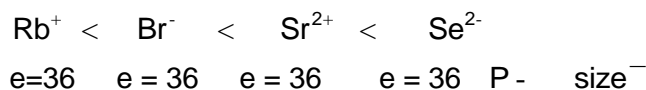
[:ANS] B

[:SOLN] Higher +ve SRP better O.A

[:Q.18] The correct order of ionic radii of Rb^+ , Br^- , Sr^{2+} and Se^{2-} is

[:ANS] B

[:SOLN] Ionic radii:



37P 35 P 38 P 34P

[:Q.19] Consider the following statements:

- (i) Calcination is carried out in absence of air below the melting point of the ore
- (ii) Roasting and calcination are carried out in presence of flux
- (iii) Calcination is carried out in limited supply of air above the melting point of the ore
- (iv) Roasting is carried out in air below the melting point of ore

The correct set of statements is

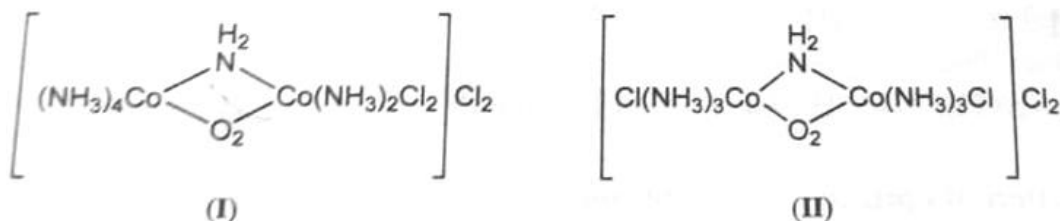
- [:A] (i) and (iv)
- [:B] (ii) and (iii)
- [:C] (i), (iii) and (iv)
- [:D] (iii) and (iv)

[:ANS] A

[:SOLN] Factual

Both calcination and roasting carried out below the m.p. in absence of air / limited supply of and present of air.

[:Q.20] The cobalt complexes (I) and (II) given below are examples of



- [:A] linkage isomers
- [:B] coordination isomers
- [:C] ligand isomers
- [:D] coordination position isomers

[:ANS] D

[:SOLN] If no. of particular type of ligand either side of bridge called as co-ordination position isomer.

[:Q.21] The magnetic moment (in units of BM) of copper in $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ and $[\text{Cu}(\text{NH}_3)_4]^{2+}$ respectively is:

- [:A] 1.73 and 0
- [:B] 1.73 and 1.73
- [:C] 2.83 and 2.83

[:D] 0 and 2.83

[:ANS] B

[:SOLN]

$\text{Cu}^{2+} - 3d^9 \quad n=1 \quad \mu_s = \sqrt{3} = 1.73 \text{ B.M.}$

[:Q.22] In qualitative inorganic analysis of a water-soluble salt mixture (salt AB + salt XY) both the cations were identified as sulphides. In the tests for anions sodium carbonate extract when treated with AgNO_3 gave yellowish precipitate soluble with difficulty in NH_4OH while the other anion can be confirmed with brown ring test. (Given K_{sp} for AS = 1×10^{-44} and XS = 1.4×10^{-24}).

Identify the INCORRECT statement about the analysis.

[:A] H_2S can be used under appropriate conditions of pH to separate and identify the cations.

[:B] Cation A will be precipitated under acidic condition as the concentration of sulphides ions required is low.

[:C] The anions are NO_3 and Cl.

[:D] Cation X will be precipitated as sulphides under alkaline condition, as the concentration of sulphides ions required is very high.

[:ANS] C

[:SOLN]

(Salt AB + Salt XY)

Cation Identify by sulphide group – II + IV

Give yellowish precipitate with AgNO_3 and insoluble in NH_4OH salt may be contain I^- anion

Other anion give brown ring test may be - NO_3^- | NO_2^-

(a) K_{sp} of AS very low compare to XS this indicate that A^{+2} cation given ppt of sulphide in acidic condition and low concentration while K_{sp} of XS is high this indicate that X^{+2} give ppt of sulphide of in alkaline condition and high concentration.

(b) K_{sp} AS - lower ppt in Acidic condition low case of sulphide

[:Q.23] The correct statement about the solubilities of Group 2 hydroxides is:

[:A] The solubilities increase because lattice energy increases as we go down Group 2

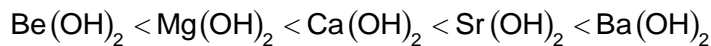
[:B] The solubilities increase because lattice energy decreases as we go down Group 2

[:C] The solubilities decrease because atomic size increases as we go down Group 2

[:D] The solubilities decrease because lattice energy decreases as we go down Group 2

[:ANS] B

[:SOLN] Solubility- down the group



Insoluble

Soluble

[:Q.24] A solution of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in methanol has $[\text{Cu}^{2+}] = 1.00$ mg per 1000 g of methanol. The molarity of Cu^{2+} in this solution is $Y \times 10^{-5} \text{ mol L}^{-1}$. Y is :

(Given – density of methanol = 0.792 g mL^{-1})

[:A] 1.57

[:B] 5.04

[:C] 1.25

[:D] 3.99

[:ANS] C

[:SOLN] Cu^{2+} in Methanol = 1 mg per 1000 g methanol = $1 \times 10^{-3} \text{ g Cu}^{2+}$

$$= \frac{1 \times 10^{-3}}{63.5} \text{ mole in 1000 g solution}$$

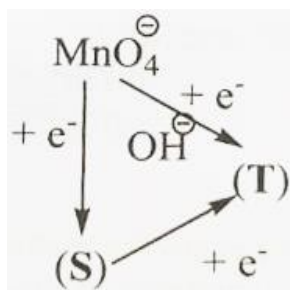
$$= 1.575 \times 10^{-5} \text{ mole in } \frac{1000}{0.792} \text{ ml}$$

$$[\text{Cu}^{2+}] = \frac{1.575 \times 10^{-5}}{\frac{1000}{0.792}} \times 1000 = 1.247 \times 10^{-5}$$

$$\square 1.25 \times 10^{-5} = Y \times 10^{-5}$$

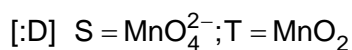
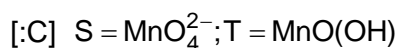
$$Y = 1.25$$

[:Q.25] Following is the reaction flow chart for manganese oxidocomplexes under different alkaline pH conditions. Compounds (S) and (T) respectively are:



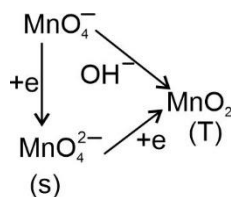
[:A] S= $\text{MnO}(\text{OH})_2$; T= $\text{Mn}(\text{OH})_2$

[:A] S= MnO_2 ; T= $\text{MnO}(\text{OH})$

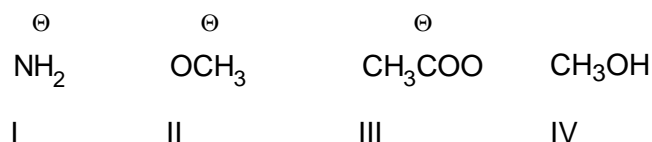


[:ANS] D

[:SOLN]



[:Q.26] The correct order of relative strength for the following nucleophilic species is:



[:A] $\text{IV} > \text{III} > \text{II} > \text{I}$

[:B] $\text{II} > \text{III} > \text{IV} > \text{I}$

[:C] $\text{I} > \text{II} > \text{IV} > \text{III}$

[:D] $\text{I} > \text{II} > \text{III} > \text{IV}$

[:ANS] D

[:SOLN] Nucleophilicity μ Basicity

[:Q.27] The product obtained on reaction of optically pure 1-bromo-1-phenyl ethane with CH_3OH , is;

[:A] phenyl ethene.

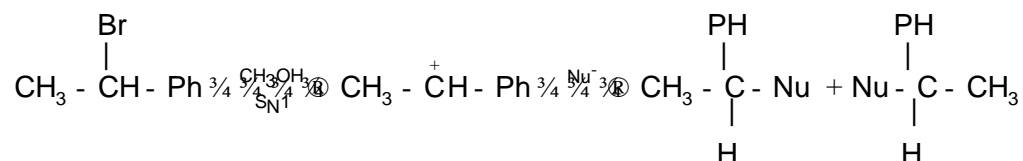
[:B] 1-methoxy-1-phenyl ethane with inverted configuration only.

[:C] 1-methoxy-1-phenyl ethane with retention of configuration.

[:D] a racemic mixture of 1-methoxy-1-phenyl ethane.

[:ANS] D

[:SOLN]



Racemic mixture

Equal possibility to attack on carbocation both side.

[:Q.28] An alkane [X] contains five 1° , two 2° , one 3° and one 4° carbon atoms. The IUPAC name of [X] is:

[:A] 2, 4, 4-trimethylhexane

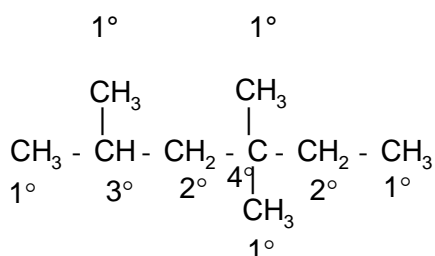
[:B] 3, 5-dimethylheptane

[:C] 2, 4-dimethylheptane

[:D] 4, 4-dimethylheptane

[:ANS] A

[:SOLN]



[:Q.29] The number of isomeric alkenes with molecular formula C_5H_{10} is (taking stereoisomers into account):

[:A] 4

[:B] 5

[:C] 6

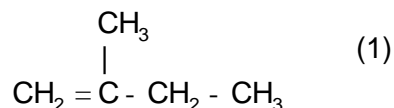
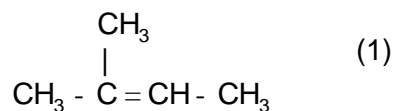
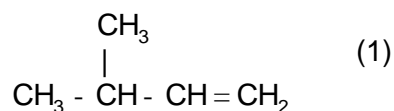
[:D] 7

[:ANS] C

[:SOLN] $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_2\text{CH}_3$ (1)

$\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_3$ (2)

Cis and trans



[:Q.30] At 0°C , 1 equivalent bromine is added to 2, 4-hexadiene to produce 4, 5-dibromo-2-hexene and its isomer 'X' is;

[:A] 5, 5-dibromo-2-hexene

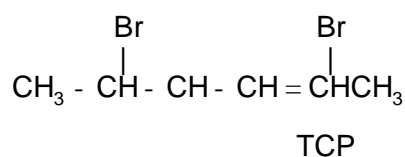
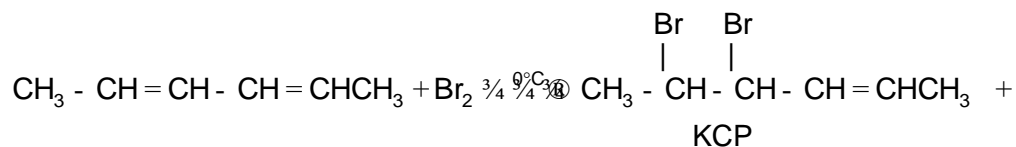
[:B] 2, 5-dibromo-3-hexene

[:C] 2, 2-dibromo-3-hexene

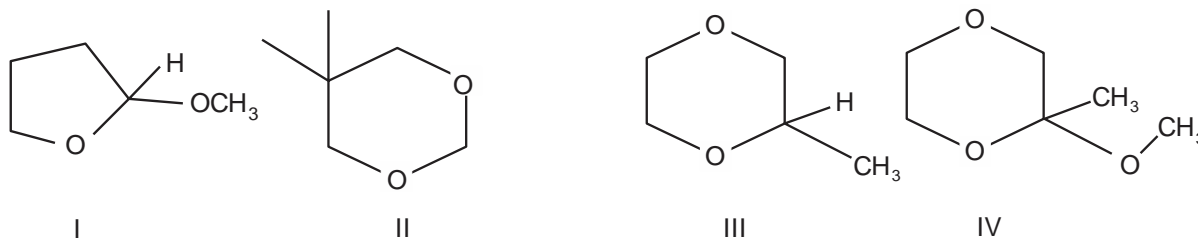
[:D] 2, 3-dibromo-4-hexene

[:ANS] B

[:SOLN]



[:Q.31] Which of the following is/are example/s of an acetal?



[:A] I and II

[:B] III and IV

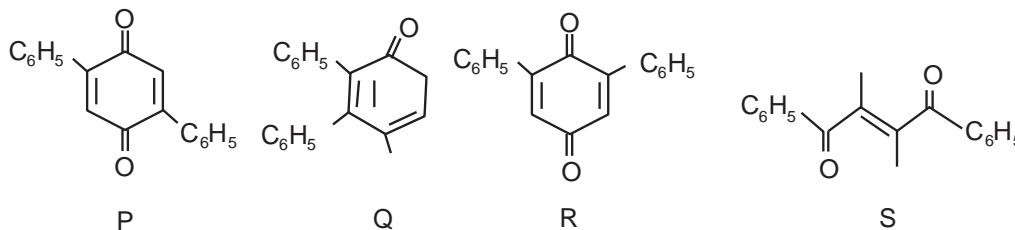
[:C] Only IV

[:D] I, II and III

[:ANS] A

[:SOLN]

[:Q.32] The compound which can be produced by double aldol condensation of 1-phenyl-1, 2-propanedione:



[:A] P

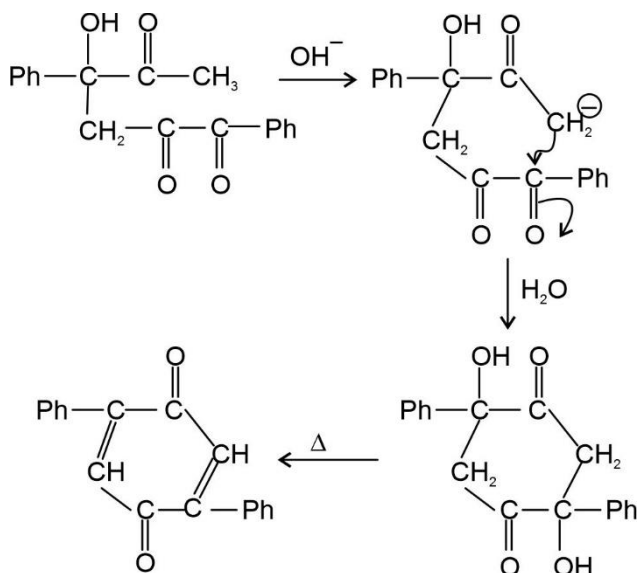
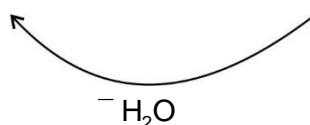
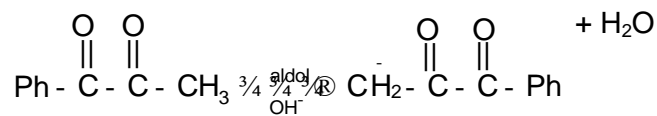
[:B] Q

[:C] R

[:D] S

[:ANS] A

[:SOLN]



[:Q.33] 2, 2-Dimethyl-1, 3-propanediol is formed by heating 2-methylpropanal with an excess of formaldehyde and $\text{Ca}(\text{OH})_2$. The sequence of reactions taking place in this synthesis is:

[:A] dehydrogenation to 2-methyl-2-propenal followed by addition of formaldehyde.

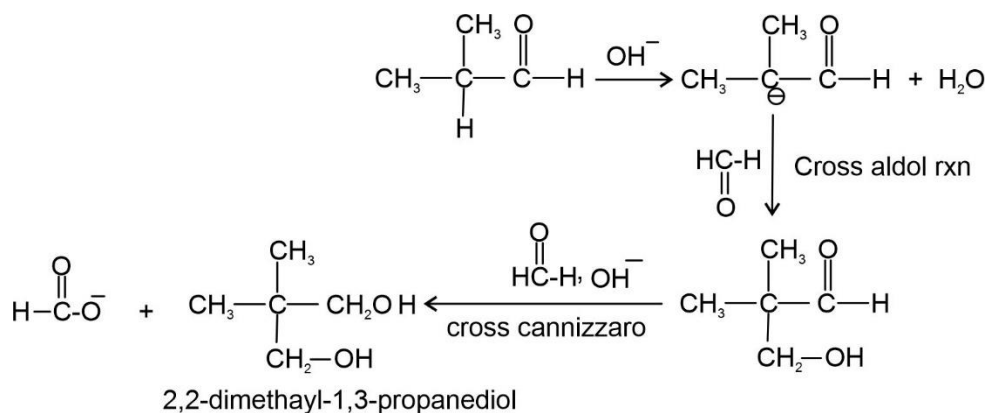
[:B] dehydrogenation to penta-2, 3-diene followed by addition of formaldehyde.

[:C] a crossed aldol reaction followed by a crossed Cannizzaro reaction.

[:D] a crossed Cannizzaro reaction followed by a crossed aldol reaction.

[:ANS] C

[:SOLN]

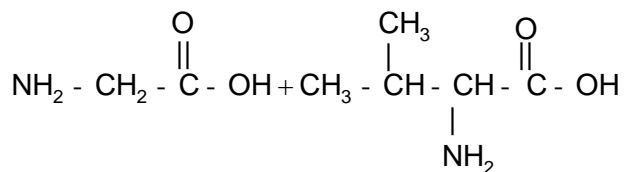


[:Q.34] Number of different types of dipeptides produced using a mixture of glycine and L-valine, and number of optically active dipeptides formed in this mixture will be:

- [:A] Four dipeptides, all optically active
 [:B] Two dipeptides, all optically active
 [:C] Four dipeptides, three optically active
 [:D] Two dipeptides, none optically active

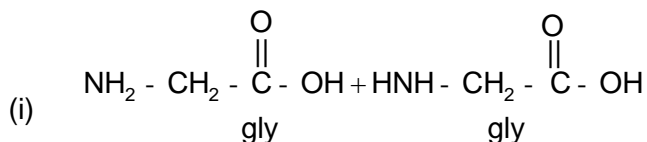
[:ANS] C

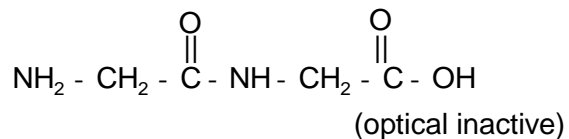
[:SOLN]



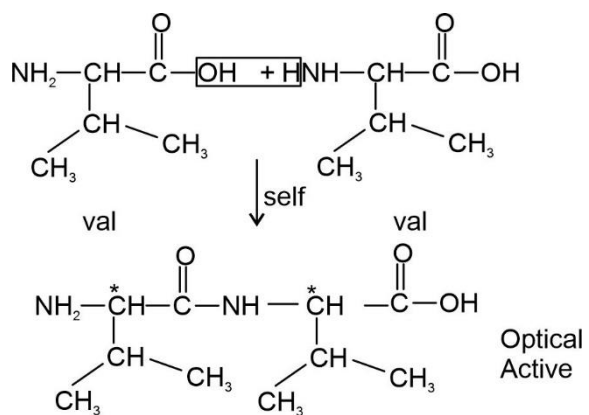
Glycine

L-valine

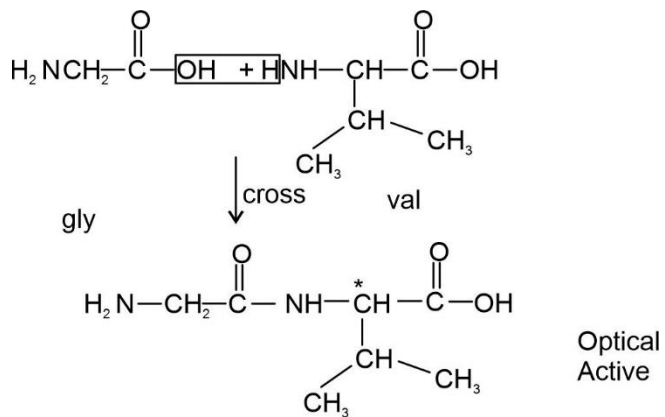

 $\frac{3}{4} \frac{\text{self}}{4} \text{ 30}$



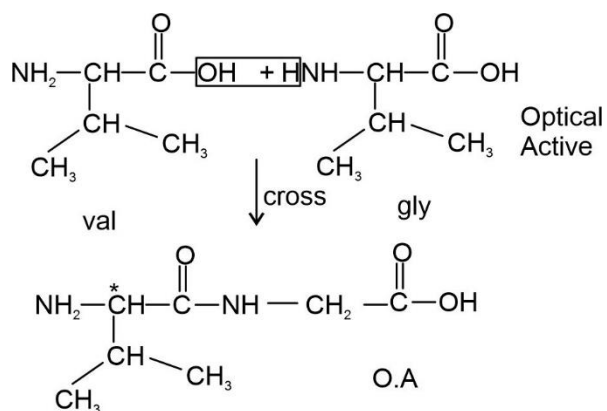
(ii)



(iii)



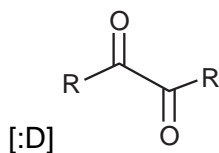
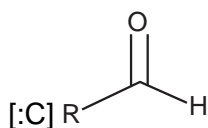
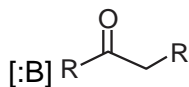
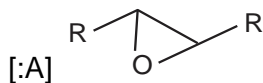
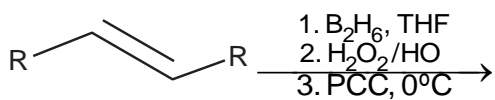
(iv)



Four dipeptide among them three are optical active.

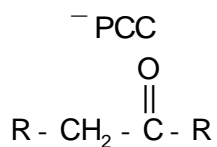
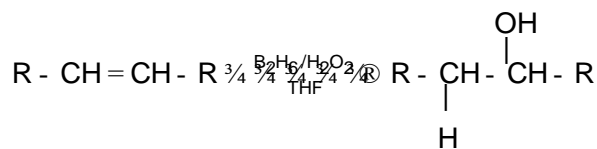
[:Q.35] Predict the major product in the following reaction.

PCC is pyridinium chlorochromate

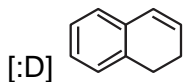
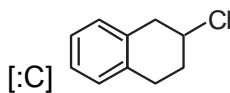
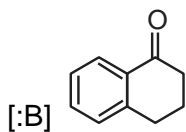
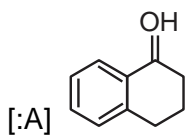
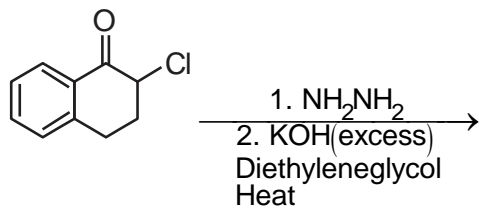


[:ANS] B

[:SOLN]

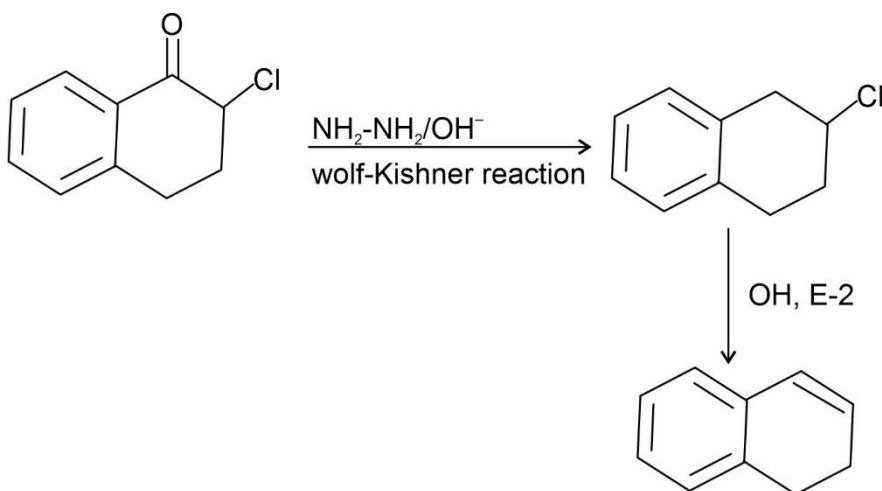


[:Q.36] Find out the product in the following reaction

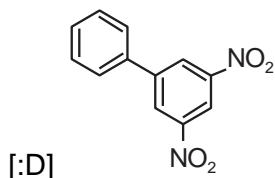
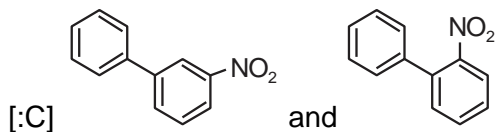
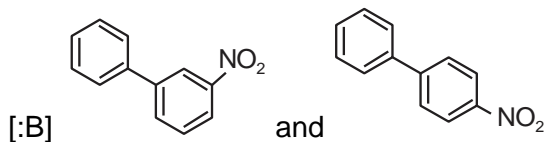
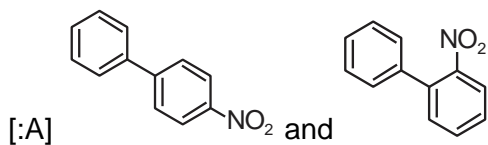


[:ANS] D

[:SOLN]

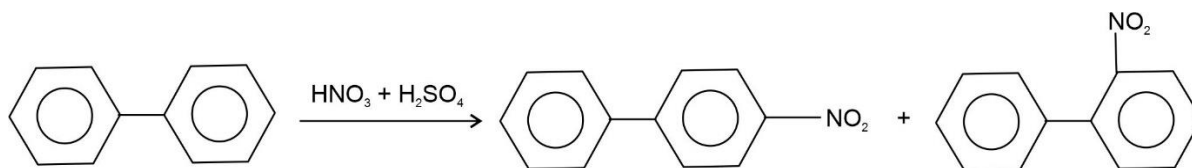


[:Q.37] The product/s obtained on reaction of biphenyl (Ph-Ph) with nitrating mixture ($\text{HNO}_3 + \text{H}_2\text{SO}_4$)



[ANS] A

[SOLN]



Phenyl group act as ortho-para directing activating group.

[Q.38] Chlorination of propane gives four dichloro products. One of them is optically active. The number of trichloro products possible from the optically active dichloro product is (excluding stereoisomers):

[A] 1

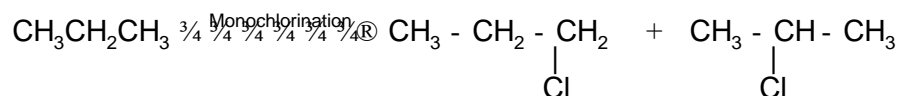
[B] 2

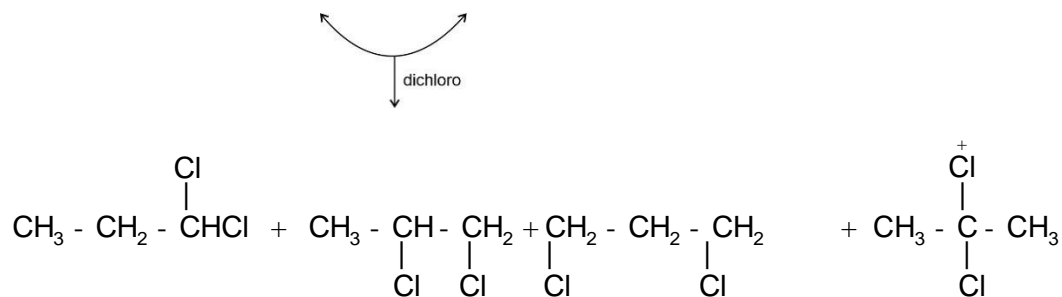
[C] 3

[D] 4

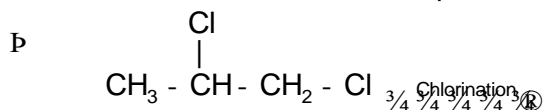
[ANS] C

[SOLN]

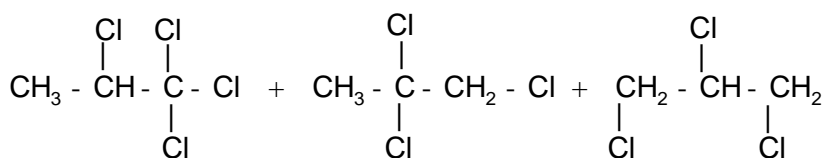




Optical active



O.A



Total 3

[:Q.39] The suitable reagent for the following transformation is :



[:A] Na/liq. NH₃

[:B] H₂. Pd/C

[:C] LiAlH₄

[:D] Zn-Hg. HCl, heat

[:ANS] Correct choice is not given

[:Q.40] Column A represents a set of functional groups and Column B their respective electronic effects. The correct match is:

Column A

[:A] -NH₂, -COCl, -SO₃H, -COOH

Column B

: m-directing, EWG, activating, o/p-

	Directing
[B] $-X, -NHCOCH_3, -CHO, -CH_3$: o/p directing, EDG, m-directing, Activating
[C] $-COCl, -COCH_3, -CONH_2$: EDG, EWG, deactivating, m-directing
[D] $-SO_3H, -NH_2, -OCH_3, -CONH_2$: activating, deactivating, EWG, EWG

[EDG: Electron donating group and EWG: Electron withdrawing group]

[:ANS] B

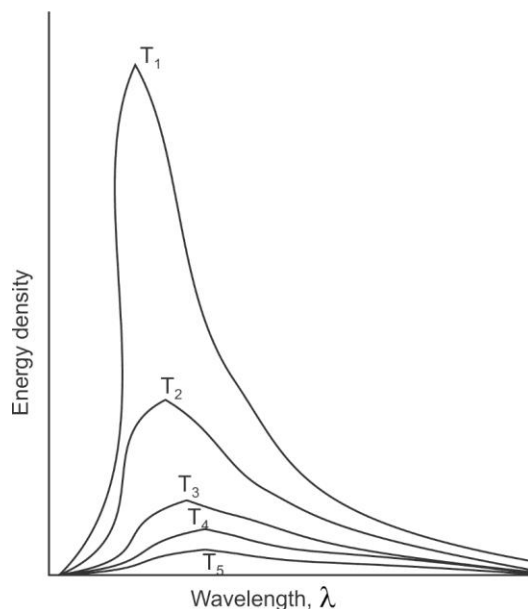
[:Q.41] The correct order of reactivity of $-CHO, -COR, -COOR, -CONR_2$ groups toward $MeMgI$ in Either is :

- [A] $-CONR_2 > -COOR > -COR > -CHO$
 [B] $-CHO > -COR > -COOR > -CONR_2$,
 [C] $-CONR_2 > -CHO > -COR > -COOR$
 [D] $-CHO > -CONR_2 > -COOR > -COR$

[:ANS] B

[:Q.42] The plots of energy density (energy per unit area) vs wavelength for blackbody radiation at various temperatures is given below.

The correct option among the following is:



- (i) $T_1 > T_2 > T_3 > T_4 > T_5$
 (ii) As temperature increases, the wavelength at which the intensity is maximum shifts towards the higher energy regions of the electromagnetic spectrum.

(iii) Radiations of all wave lengths are emitted, absorbed, reflected, and refracted by the black body.

(iii) The total energy density increases as the temperature is decreased.

[A] (i) and (ii)

[B] (ii) and (iii)

[C] (i), (ii) and (iv)

[D] (ii), (iii) and (iv)

[ANS] A

[SOLN] Increase in temperature will lead to increase in energy density < as

$$T_1 > T_2 > T_3 > T_4 > T_5$$

- It will lead to decrease in wavelength
- Blackbody does not either reflect or refract.

[Q.43] A student add 'x' g of iron (Fe) powder to dil. HCl and measures the work done by the reaction between HCl and the added Fe to be 1000 J. If the experiment was conducted at constant pressure of 1 atm at 27°C, mass of Fe powder added is ;

[A] 22.4 g

[B] 2.24 g

[C] 11.2 g

[D] 1.12 g

[ANS] A

[SOLN] $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$
 (s) (aq) (aq) (g)

$$w = -P\Delta V = -\Delta n_g RT$$

$$\Delta n_g RT = 1000$$

$$\Delta n_g = n_{\text{H}_2} \frac{1000}{8.314 \times 300} = \frac{1000}{2494.2} = 0.4 \text{ mole}$$

$$(n_{\text{H}_2})_{\text{formed}} = (n)_{\text{added}} = 0.4 \text{ mole}$$

$$\begin{aligned} \text{Mass of Fe added} &= 0.4 \times 56 \\ &= 22.45 \text{ gm} \end{aligned}$$

[Q.44] Antacids are medicines that temporarily neutralize the acid in the stomach and prevent heartburns. The volume of an antacid syrup containing 2.9 g of $\text{Mg}(\text{OH})_2$ per 100 mL to be given to a patient whose stomach contains 2 L of gastric juice with HCl concentration of $6.0 \times 10^{-3} \text{ M}$ is : (Molar mass of $\text{Mg}(\text{OH})_2 = 58.0 \text{ gmol}^{-1}$)

[A] 4.0 m L

[B] 7.8 m L

[C] 12.0 mL

[D] 120 mL

[:ANS] C

[:SOLN] For the neutralization rxn

No. of (gm. eq) will be equal

$$(\text{gm - eq})_{\text{HCl}} = (\text{gm - eq})_{\text{Mg(OH)}_2}$$

$$6.0 \times 10^{-3} \times 1 = \text{mole of Mg(OH)}_2 \times 2$$

Mass of Mg(OH)₂ present

$$= 6 \times 10^{-3} \times 58$$

$$= 348 \times 10^{-3} \text{ gm}$$

$$= 0.348 \text{ gm}$$

Now 2.9 gm = 100 ml

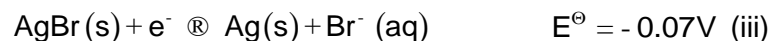
$$0.348 \text{ gm} = \frac{100}{2.9} \times 0.348$$

$$= 12 \text{ ml}$$

[:Q.45] A half – cell reaction represented by (i) as given below



takes place in two different electrochemical cells, I and II, in which the other half cell reactions are (ii) and (iii) respectively :



The correct option that represents the redox reactions in cells I and II is :

[:A] Fe is oxidised in cell I; Fe is oxidised in cell II

[:B] Fe is oxidised in cell I; Fe is reduced in cell II

[:C] Fe is reduced in cell I; Fe is reduced in cell II

[:D] Fe is reduced in cell I; Fe is oxidised in cell II

[:ANS] D

[SOLN] Based on given (S.R.P) value

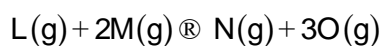
$$(E_{R.P}^{\circ})_{AgBr} > E_{Fe(OH)_2}^{\circ} > E_{Al^{+3}}^{\circ}$$

Higher S.R.P will reduce preferably

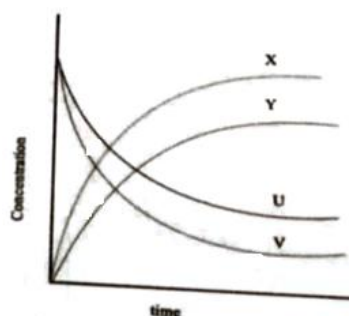
F – Reduce in Cell I

- Oxidised in Cell II

[Q.46] The following are the concentration vs time plots of the reactants and products represented by the reaction



The curves that represent M(g) and N(g) qualitatively are respectively



[A] X, Y

[B] Y, U

[C] V, Y

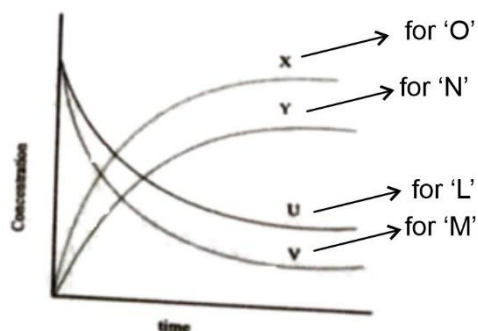
[D] U, X

[ANS] C

[SOLN] $L(g) + 2M(g) \rightarrow N(g) + 3O(g)$

If L and M have same amount taken then M may be limiting if completely react so, lower graph V for M.

'O' form higher amount then 'N' so, x should be 'O' and Y should be Y.



- [:Q.47]** The current produced due to photoelectric effect
- [:A] increases with the increase of frequency of the incident radiation
 - [:B] increases with the increase in intensity of the incident radiation.
 - [:C] decreases with time of irradiation
 - [:D] is independent of the intensity of incident radiation.

[:ANS] B

- [:SOLN]** Intensity \propto Photon number
And one photon can eject one electron
So, Photoelectric current \propto Intensity

- [:Q.48]** The property of radiation that is not different at various regions of the electromagnetic spectrum is :
- [:A] energy
 - [:B] frequency
 - [:C] velocity
 - [:D] wavelength

[:ANS] C

- [:SOLN]** Electromagnetic Radiation can move with speed of light and this fix.

(NSEA) PART : A-2

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

MARKS WILL BE AWARDED ONLY IF ALL THE CORRECT OPTIONS ARE BUBBLED.

- [:Q.49]** 2,4, 6 – trinitrophenol is more acidic than phenol. Identify the correct statement (s)
- [:A] pK_a for 2, 4, 6 – trinitrophenol is less than that of phenol.
 - [:B] phenol is stabilized by intramolecular π hydrogen bonding.
 - [:C] The conjugate base of 2, 4, 6 – trinitrophenol delocalizes the negative charge on the oxygen atom to a very large extent.
 - [:D] The conjugate base of phenol delocalizes the negative charge to greater extent

than the conjugate base of 2, 4, 6 – trinitrophenol

[ANS] AC

[SOLN] Acidic strength - pK_a –
Acidic strength μ stability of conjugate base.

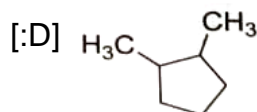
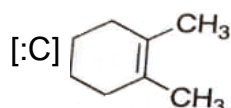
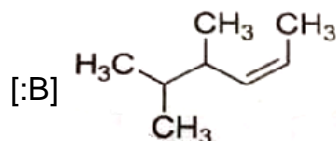
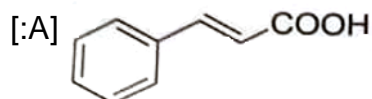
[Q.50] The correct statement for 1, 3 – butadiene from following are:

- [A] Molar addition of Br_2 yields only 1, 4 – dibromo – 2 – butene as the major product when the reaction is performed for longer time period
- [B] Molar addition of Br_2 yields only 1, 2 – dibromo – 2 – butene for longer time period
- [C] $C_1 - C_2$ and $C_3 - C_4$ bonds are slightly longer than a $C = C$ bond
- [D] $C_2 - C_3$ single bond is slightly shorter than a $C - C$ bond

[ANS] ACD

[SOLN]

[Q.51] Which of the following representation will exhibit cis – trans isomerism ?



[ANS] ABD

[SOLN]

[Q.52] For an elementary dimerization reaction of the type $2R \rightarrow R_2$, the value of the steric factor was found to be 2. This indicates that

- [A] the experimentally obtained rate is 2.5 times faster than the theoretical rate.

[B] ratio of the number of collisions calculated from collision theory and that actually take place is 1: 2.5.

[C] the activation energy of the reaction is the same for both the experimental and calculated values.

[D] the molecules of reactant R may be of some complex structure.

[ANS] ACD

[SOLN]

[Q.53] The correct statement / s among the following is / are

[A] The charge on the diffused layer of AgI colloidal solution by the addition of few drops of dilute aqueous solution of KI to an aqueous solution of AgNO_3 is negative.

[B] The charge on the diffused layer of AgI colloidal solution by the addition of few drops of dilute aqueous solution of AgNO_3 to an aqueous solution of KI is positive.

[C] When the ionic strength of a colloidal solution is increased, thickness of the double layer is increased, and the colloid gets precipitated.

[D] When the ionic strength of a colloidal solution is increased, thickness of the double layer is decreased, and the colloid gets precipitated.

[ANS] ABC

[SOLN] (A) $\text{AgI} / \text{Ag}^+ \text{---} \text{I}^-$

(B) $\text{AgI} / \text{I}^- \text{---} \text{Ag}^+$

(C) Ionic strength increased then precipitation increases.

[Q.54] In reverse osmosis the flow of solvent across semi permeable membrane occurs

[A] when hydrostatic pressure is greater than osmotic pressure

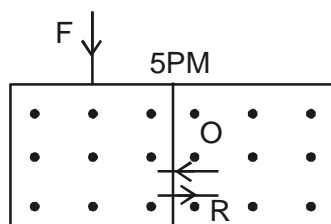
[B] when hydrostatic pressure is lower than osmotic pressure

[C] from higher concentrated solution to lower concentrated solution

[D] from lower concentrated solution to higher concentrated solution

[ANS] A,C

[:SOLN]



Pressure of $F > O \rightarrow$ Reverse Osmosis

(a)

In, Osmosis solvent particles moves from lower concentration to higher concentration SO,
In reverse osmosis, solvent moves from higher to lower conc.

(c)

[:Q.55] Choose the correct statement(s) regarding zeolites.

[:A] Silicon atoms are replaced by aluminium atoms in the zeolites.

[:B] The pores and cavities of the zeolites as well as size and shape of reactant decides the reaction taking place in the zeolites.

[:C] The cracking of hydrocarbons and isomerisation reactions are catalyzed by zeolites in the petrochemical industries.

[:D] Zeolites act as molecular sieves and can separate the molecules of different sizes.

[:ANS] ABCD

[:SOLN] Synthetic zeolite widely used as catalyst in performance/industry.

Zeolites are able to separate molecule of the different dimension

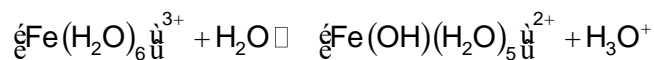
Molecular sieve refers to a particular properties of material i.e., the ability to selectively sort molecule based on size

[:Q.56] Crystalline iron(III) nitrate nonahydrate, $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ has a very pale violet colour.

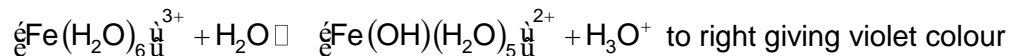
When added to water, the crystals dissolve to form a brown solution. Treatment of this brown solution with concentrated nitric acid yields a very pale violet solution while treatment with HCl yields a yellow solution.

[:A] The brown colour is due to $\text{Fe}(\text{OH})(\text{H}_2\text{O})_5^{2+}$, $\text{Fe}(\text{OH})_2(\text{H}_2\text{O})_4^{+}$ [:B] Violet colour is due to $\text{Fe}(\text{H}_2\text{O})_6^{3+}$ and yellow colour due $[\text{FeCl}_4]^-$

[:C] Addition of HNO_3 shifts the equilibrium

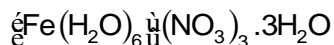


[:D] Addition of HNO_3 shifts the equilibrium

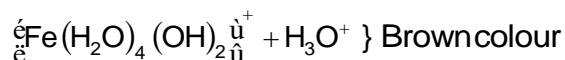
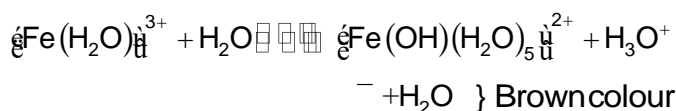


[:ANS] ABC

[:SOLN] $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ -water soluble paramagnetic salt

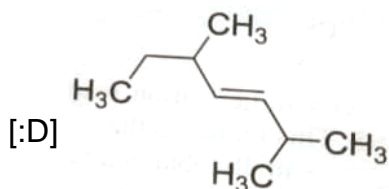
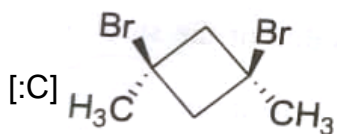
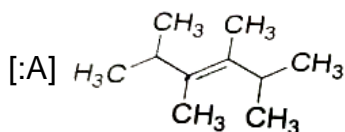


Hexaaqua Iron (III) nitratetrihydrate



Add of HNO_3^- PH- conc of NO_3^- both avoiding formation of aqua complex of ferric cation shift the equilibrium in backward direction.

[:Q.57] The optically active compounds from the following are:

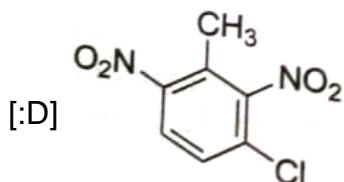
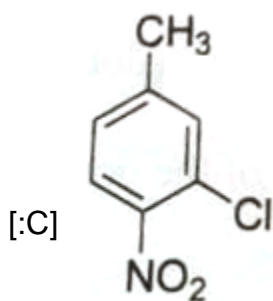
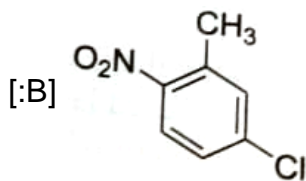
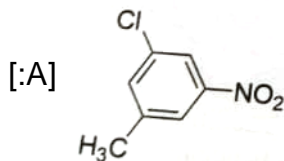


[:ANS] BD

[:SOLN]

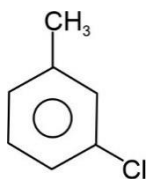
[Both (b) and (d) contain one chiral

[:Q.58] 3- chlorotoluene is reacted with a mixture of conc. H_2SO_4 and HNO_3 . The product/s formed is / are:



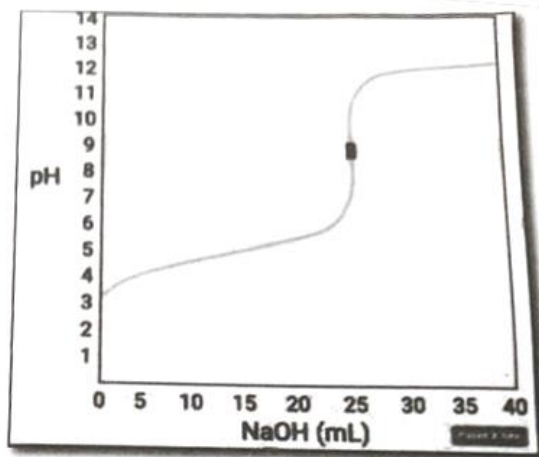
[:ANS] B and C

[:SOLN]



Electrophile will come according to more electron donating group i.e., - CH_3 group

[:Q.59] Given below is the plot pH vs volume of NaOH added in an acid – base titration. The correct statement/s among the following is / are



[A] Before the equivalence point, a series of buffer solution determine the pH.

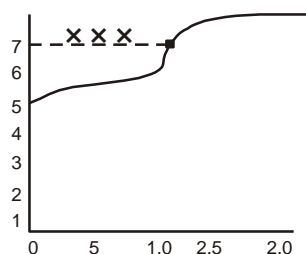
[B] The graph represents the titration of a strong acid with NaOH.

[C] At the equivalence point, hydrolysis of the anion of the acid determines the pH

[D] After the equivalence point acid/ salt buffer solution determines the pH.

[ANS] AC

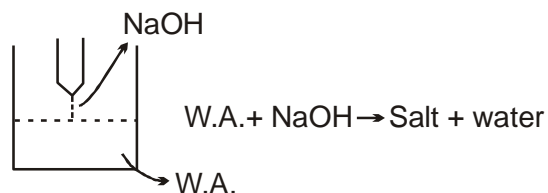
[SOLN]



It is titration of W.A Vs S.8. \rightarrow (6) \times

(a) Series of buffer

soln. determine the PH.



[Q.60] The correct statement /s among the following is / are :

[A] The probability density (ψ^2) for a hydrogen atom is zero at $r = 0$.

[B] In an atom, orbitals with the same quantum number have different energies.

[C] The energy of a given orbital with same principal quantum number decreases as the atomic number 'Z' , increases.

[D] For a given atomic number, the configuration having the maximum number of parallel spins is of the lowest than any other arrangement arising from the same configuration.

[ANS] DC

[SOLN] For hydrogen atom $[\psi]^2$ is max^m at $r = 0 \rightarrow$ (a)

Hurd's Rule states \rightarrow Max^m value of 8 in multiplicity

\Rightarrow lowest energy (d)

(c) $E_n \propto \frac{n^2}{Z^2} \rightarrow$ Hence, (c) is correct