

JEE Main July 2021
Question Paper With Text Solution
27 July. | Shift-1

CHEMISTRY



JEE Main & Advanced | XI-XII Foundation | VI-X Pre-Foundation

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JEE MAIN JULY 2021 | 27TH JULY SHIFT-1**SECTION - A**

1. The statement that is INCORRECT about Ellingham diagram is :

- (1) provides idea about changes in the phases during the reaction.
- (2) provides idea about the reaction rate.
- (3) provides idea about reduction of metal oxide.
- (4) provides idea about free energy change.

Ans. Official Answer NTA (2)

Sol. Ellingham diagram does not give idea about rate of Reaction

2. The product obtained from the electrolytic oxidation of acidified sulphate solutions, is :

- (1) $\text{HO}_3\text{SOOSO}_3\text{H}$
- (2) $\text{HO}_2\text{SOSO}_2\text{H}$
- (3) HSO_4^-
- (4) $\text{HO}_3\text{SOSO}_3\text{H}$

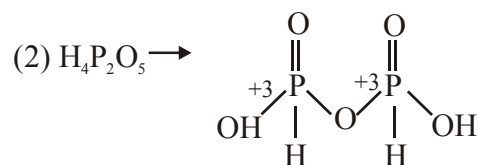
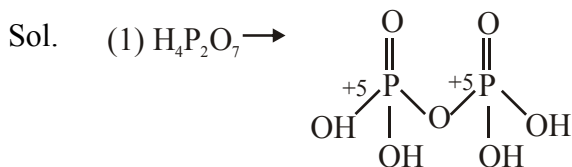
Ans. Official Answer NTA (1)

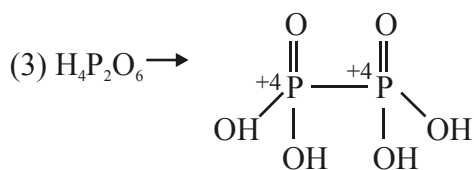
Sol. Electrolysis of concentrated solution of acidified solution yields $\text{H}_2\text{S}_2\text{O}_8$.

3. The oxidation states of 'P' in $\text{H}_4\text{P}_2\text{O}_7$, $\text{H}_4\text{P}_2\text{O}_5$ and $\text{H}_4\text{P}_2\text{O}_6$, respectively, are :

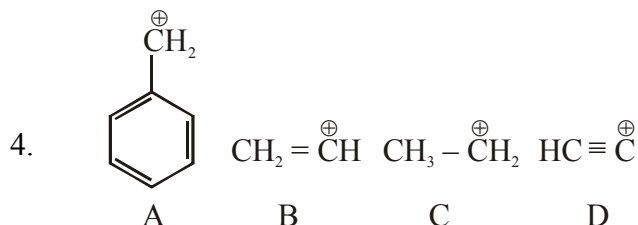
- (1) 7, 5 and 6
- (2) 5, 3 and 4
- (3) 5, 4 and 3
- (4) 6, 4 and 5

Ans. Official Answer NTA (2)

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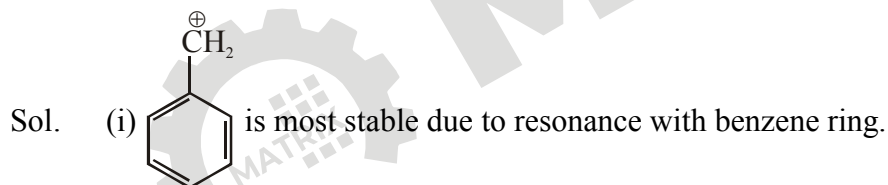
oxidation state of P = +4



The correct order of stability of given carbocations is :

- (1) $\text{D} > \text{B} > \text{C} > \text{A}$
- (2) $\text{C} > \text{A} > \text{D} > \text{B}$
- (3) $\text{D} > \text{B} > \text{A} > \text{C}$
- (4) $\text{A} > \text{C} > \text{B} > \text{D}$

Ans. Official Answer NTA (4)



(ii) $\text{CH}_3 - \overset{\oplus}{\text{C}}\text{H}_2$ is second most stable due to hyper conjugation.

(iii) As the electronegativity of carbon increases, the stability of carbocation decreases.

SO $\text{CH}_2 = \overset{\oplus}{\text{C}}\text{H}$ is more stable than $\text{HC} \equiv \overset{\oplus}{\text{C}}$

So, correct order of stability $\text{A} > \text{C} > \text{B} > \text{D}$.

5. For a reaction of order n, the unit of the rate constant is :

- (1) $\text{mol}^{1-n} \text{L}^{2n} \text{s}^{-1}$
- (2) $\text{mol}^{1-n} \text{L}^{n-1} \text{s}^{-1}$
- (3) $\text{mol}^{1-n} \text{L}^{1-n} \text{s}^{-1}$
- (4) $\text{mol}^{1-n} \text{L}^{n-1} \text{s}$

Ans. Official Answer NTA (2)

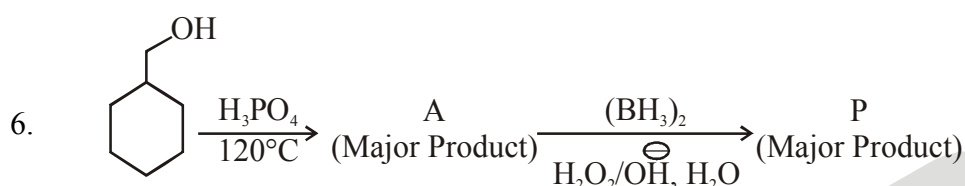
Sol. Order of Reaction = n

$$R = K (\text{Conc})^n$$

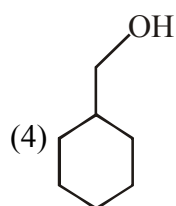
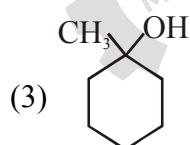
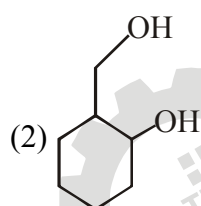
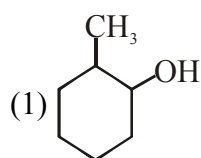
$$K = \frac{\text{conc} / \text{sec}}{(\text{conc})^n}$$

$$K = (\text{Conc})^{1-n} \text{ s}^{-1}$$

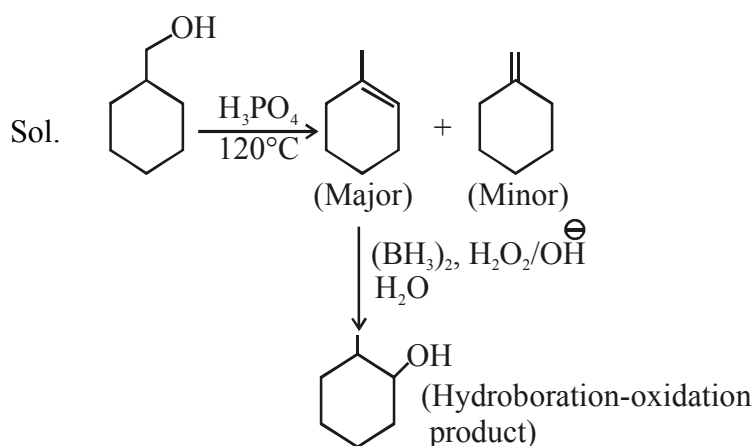
$$K = \text{Mol}^{1-n} \text{ L}^{n-1} \text{ s}^{-1}$$



Consider the above reaction and identify the Product P :



Ans. Official Answer NTA (1)



7. Which one of the following statements is NOT correct ?

- (1) Eutrophication leads to anaerobic conditions
- (2) The dissolved oxygen concentration below 6 ppm inhibits fish growth
- (3) Eutrophication indicates that water body is polluted
- (4) Eutrophication leads to increase in the oxygen level in water

Ans. Official Answer NTA (4)

Sol. Eutrophication leads to decrease in the oxygen level in water and Rest Statements are true.
So 4th statement is incorrect.

8. Given below are two statements :

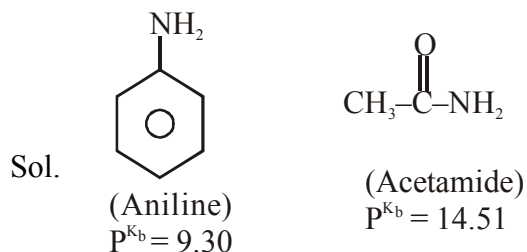
Statement I : Aniline is less basic than acetamide.

Statement II : In aniline, the lone pair of electrons on nitrogen atom is delocalised over benzene ring due to resonance and hence less available to a proton.

Choose the most appropriate option :

- (1) Statement I is true but statement II is false.
- (2) Both statement I and statement II are true.
- (3) Both statement I and statement II are false.
- (4) Statement I is false but statement II is true.

Ans. Official Answer NTA (4)



Therefore, Aniline is more basic than acetamide.

9. Match List - I with List - II :

List - I

(Drug)

- (a) Furacin
- (b) Arsphenamine
- (c) Dimetone
- (d) Valium

List - II

(Class of Drug)

- (i) Antibiotic
- (ii) Tranquilizers
- (iii) Antiseptic
- (iv) Synthetic antihistamines

Choose the most appropriate match :

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

Ans. Official Answer NTA (3)

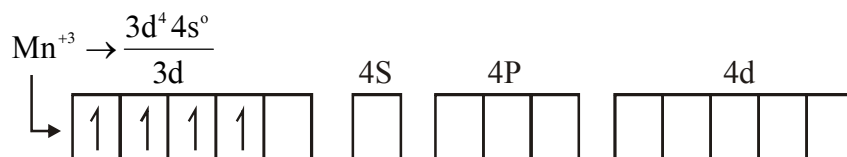
Sol.	(a) furacin	-	(i) Antiseptic
	(b) Arsphenamine	-	(ii) Anitbiotic
	(c) Dimetone	-	(iii) Synthetic antihistamines
	(d) Valium	-	(iv) Tranquilizers

10. The type of hybridisation and magnetic property of the complex $[\text{MnCl}_6]^{3-}$, respectively, are :

- (1) sp^3d^2 and paramagnetic
- (2) d^2sp^3 and diamagnetic
- (3) sp^3d^2 and diamagnetic
- (4) d^2sp^3 and paramagnetic

Ans. Official Answer NTA (1)

Sol. $[\text{MnCl}_6]^{-3} \rightarrow \text{Mn}^{+3}, \text{Cl} \rightarrow \text{weak field ligand}$



Hybridisation = sp^3d^2

No. of unpaired $e^- = 4$

Paramagnetic

11. Match List - I with List - II ;

List - I

- (a) NaOH
- (b) $\text{Be}(\text{OH})_2$
- (c) $\text{Ca}(\text{OH})_2$
- (d) $\text{B}(\text{OH})_3$
- (e) $\text{Al}(\text{OH})_3$

List - II

- (i) Acidic
- (ii) Basic
- (iii) Amphoteric

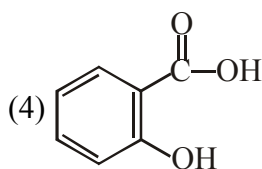
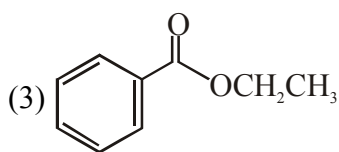
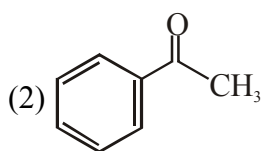
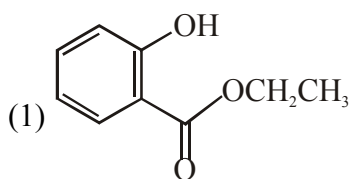
Choose the most appropriate answer from the options given below :

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

Ans. Official Answer NTA (3)

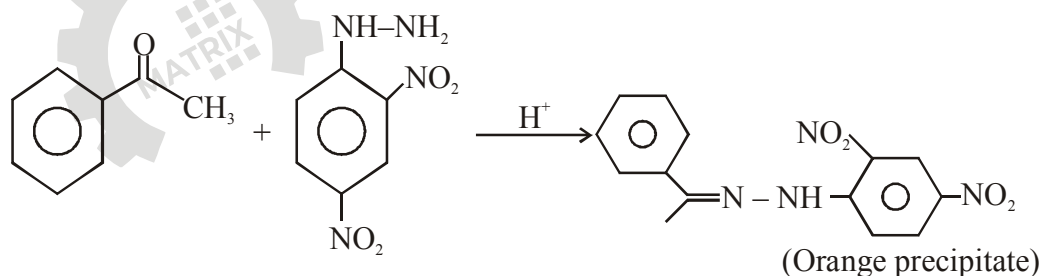
- Sol.
- (a) NaOH $\rightarrow$ basic
 - (b) $\text{Be}(\text{OH})_2 \rightarrow$ Amphoteric
 - (c) $\text{Ca}(\text{OH})_2 \rightarrow$ basic
 - (d) $\text{B}(\text{OH})_3 \rightarrow$ acidic
 - (e) $\text{Al}(\text{OH})_3 \rightarrow$ Amphoteric

12. Which one of the following compounds will give orange precipitate when treated with 2,4-dinitrophenyl hydrazine?



Ans. Official Answer NTA (2)

Sol. Carbonyl compounds (aldehyde and ketone) give orange precipitate with 2, 4-dinitrophenyl hydrazine.



13. Which one among the following chemical tests is used to distinguish monosaccharide from disaccharide ?

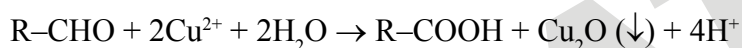
- (1) Tollen's test
- (2) Iodine test
- (3) Barfoed's test
- (4) Seliwanoff's test

Ans. Official Answer NTA (3)

Sol. Barfoed's test is used for distinguishing monosaccharides from reducing disaccharides. Monosaccharides usually react in about 1-2 minutes while the reducing disaccharides take much longer time between 7-12 minutes to react with the reagent.

Brick red color is obtained in this test which is due to formation of cuprous oxide.

Reaction involved :



14. Given below are two statements :

Statement I : Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom.

Statement II : Bohr's model of hydrogen atom contradicts Heisenberg's uncertainty principle.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both statement I and statement II are true.
- (2) Statement I is true but statement II is false.
- (3) Both statement I and statement II are false.
- (4) Statement I is false but statement II is true.

Ans. Official Answer NTA (1)

Sol. Statement-I → Line Spectrum of Hydrogen is explained by Bohr's model

Statement-II → Yes because in Bohr's model, position and velocity of electron can be calculated.

So both are true

15. Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Lithium halides are some what covalent in nature.

Reason R : Lithium possess high polarisation capability.

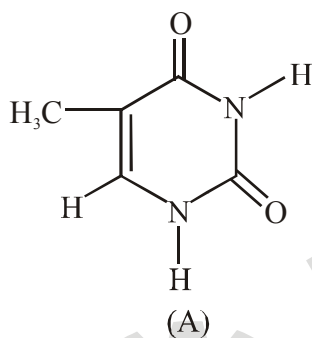
In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) A is false but R is true.
- (2) Both A and R are true and R is the correct explanation of A.
- (3) Both A and R are true but R is NOT the correct explanation of A.
- (4) A is true but R is false.

Ans. Official Answer NTA (2)

Sol. Due to small size of Li, Li have high polarisation power So LiF will be covalent Compound

16.



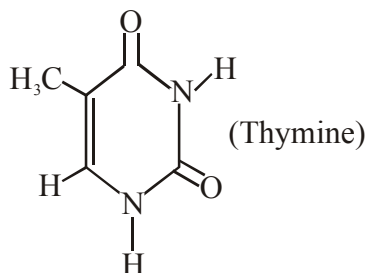
The compound 'A' is a

The compound 'A' is a complementary base of _____ in DNA strands.

- (1) Adenine
- (2) Cytosine
- (3) Uracil
- (4) Guanine

Ans. Official Answer NTA (1)

Sol. The complementary base of thymine is Adenine.



17. The number of geometrical isomers found in the metal complexes $[\text{PtCl}_2(\text{NH}_3)_2]$, $[\text{Ni}(\text{CO})_4]$, $[\text{Ru}(\text{H}_2\text{O})_3\text{Cl}_3]$ and $[\text{CoCl}_2(\text{NH}_3)_4]^+$ respectively, are :

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

Ans. Official Answer NTA (2)

Ans. Answer by Matrix (1)

Sol.	Coordination compound	G.I
	$[\text{PtCl}_2(\text{NH}_3)_2] \rightarrow [\text{MA}_2\text{B}_2]$	2
	$[\text{Ni}(\text{CO})_4] \rightarrow [\text{MA}_4]$	0
	$[\text{Ru}(\text{H}_2\text{O})_3\text{Cl}_3] \rightarrow [\text{MA}_3\text{B}_3]$	2
	$[\text{Co}(\text{Cl})_2(\text{NH}_3)_4]^+ \rightarrow [\text{MA}_2\text{B}_4]$	2

18. Staggered and eclipsed conformers of ethane are :

- (1) Rotamers
- (2) Mirror images
- (3) Enantiomers
- (4) Polymers

Ans. Official Answer NTA (1)

Sol. The conformational Isomerism arises due to the rotation about the single bond.

Therefore, staggered and eclipsed conformers are rotamers.

19. The parameters of the unit cell of a substance are $a = 2.5$, $b = 3.0$, $c = 4.0$, $\alpha = 90^\circ$, $\beta = 120^\circ$, $\gamma = 90^\circ$. The crystal system of the substance is :

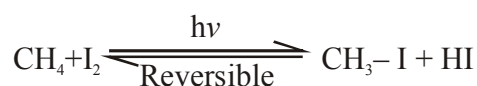
- (1) Monoclinic
- (2) Orthorhombic
- (3) Triclinic
- (4) Hexagonal

Ans. Official Answer NTA (1)

Sol. $a \neq b \neq c$ $\alpha = 90$
 $a = 2.5$ $b = 120 \neq 90$
 $b = 3$ $\gamma = 90^\circ$
 $c = 4$

So crystal system is monoclinic.

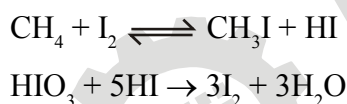
20. Presence of which reagent will affect the reversibility of the following reaction, and change it to a irreversible reaction :



- (1) Liquid NH_3
- (2) dilute HNO_2
- (3) Concentrated HIO_3
- (4) HOC1

Ans. Official Answer NTA (3)

Sol. The photoiodination is very slow and a reversible reaction. It is carried out in the presence of oxidizing agents like concentrated HIO_3 or concentrated HNO_3 .



SECTION - B

1. The number of geometrical isomers possible in triamminetrinitrocobalt (III) is X and in trioxalatochromate (III) is Y. Then the value of $X + Y$ is _____.

Ans. Official Answer NTA (2)

Sol. (Coordination compound) No. of G.I
 $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3] \rightarrow [\text{MA}_3\text{B}_3]$ $2 = X$
 $[\text{Cr}(\text{Ox})_3] \rightarrow [\text{M}(\text{AA})_3 \text{O} = \text{Y}]$ $0 = Y$
 Value of $X + Y = 2$

2. In gaseous triethyl amine the " $\text{C} - \text{N} - \text{C}$ " bond angle is _degree.

Ans. Official Answer NTA (108)

Sol. In gaseous triethyl amine angle is 108.

3. The conductivity of a weak acid HA of concentration 0.001 mol L^{-1} is $2.0 \times 10^{-5} \text{ S cm}^{-1}$. If $\Lambda_m^\circ(\text{HA}) = 190 \text{ S cm}^2 \text{ mol}^{-1}$, the ionization constant (K_a) of HA is equal to _____ $\times 10^{-6}$.

(Round off to the Nearest Integer)

Ans. Official Answer NTA (12)

Sol. $\lambda_m = \frac{k \times 1000}{M} = \frac{2 \times 10^{-5} \times 10^3}{10^{-3}} = 20$

degree of dissociation of weak acid

$$\alpha = \frac{\lambda_m}{\lambda_m^0} = \frac{20}{190} = \frac{2}{19}$$

$$\text{ionisation constant } (K_a) = \frac{C\alpha^2}{1-\alpha} = \frac{10^{-3} \times \left(\frac{2}{19}\right)^2}{\frac{17}{19}}$$

$$K_a = 12.38 \times 10^{-6}$$

So answer is 12.

4. The density of NaOH solution is 1.2 g cm^{-3} . The molality of this solution is _____ m.

(Round off to the Nearest Integer)

[Use : Atomic masses : Na : 23.0 u O : 16.0 u H : 1.0 u Density of H_2O : 1.0 g cm^{-3}]

Ans. Official Answer NTA (5)

Sol. $d_{\text{NaOH}} = 1.2 \text{ gm/ml}$

assume 1 litre Solution

$$V_{\text{sol}} = 1000 \text{ ml} \quad M_{\text{Sol}} = 1200 \text{ gm}$$

$$V_{\text{water}} = 1000 \text{ ml}, M_{\text{water}} = 1000 \text{ gm}$$

$$M_{\text{NaOH}} = M_{\text{Sol}} - M_{\text{water}} = 200 \text{ gm}$$

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Moles of NaOH = 5

$$\text{Molality} = \frac{5 \times 1000}{1000} = 5$$

5. For water at 100°C and 1 bar,

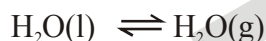
$$\Delta_{\text{vap}} H - \Delta_{\text{vap}} U = \text{_____} \times 10^2 \text{ J mol}^{-1}. \text{ (Round off to the Nearest Integer)}$$

[Use : $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$]

[Assume volume of $\text{H}_2\text{O}(l)$ is much smaller than volume of $\text{H}_2\text{O}(g)$. Assume $\text{H}_2\text{O}(g)$ can be treated as an ideal gas]

Ans. Official Answer NTA (31)

Sol. $\Delta H = \Delta U + \Delta n_g RT$



$$\Delta H - \Delta U = \Delta n_g RT$$

For permole

$$= 1 \times 8.314 \times 373$$

$$\Delta n_g = 1$$

$$= 3101.22 \text{ J}$$

$$= 31.01 \times 10^2 \text{ J}$$

So ans is 31

6. An organic compound is subjected to chlorination to get compound A using 5.0 g of chlorine. When 0.5 g of compound A is reacted with AgNO_3 [Carius Method], the percentage of chlorine in compound A is _____ when it forms 0.3849 g of AgCl . (Round off to the Nearest Integer)

(Atomic masses of Ag and Cl are 107.87 and 35.5 respectively)

Ans. Official Answer NTA (19)

Sol. $\text{Percentage of chlorine (\% Cl)} = \frac{\text{Atomic mass of chlorine} \times m_1 \times 100}{\text{molar mass of AgCl} \times m}$

Given, mass of AgCl formed (m_1) = 0.3849 g
mass of organic compound (m) taken = 0.5 g

$$\% \text{ Cl} = \frac{35.5 \times 0.3849}{143.37 \times 0.5} \times 100$$

$$\% \text{ Cl} = 19.06$$

7. 1.46 g of a biopolymer dissolved in a 100 mL water at 300 K exerted an osmotic pressure of 2.42×10^{-3} bar. The molar mass of the biopolymer is _____ $\times 10^4$ g mol⁻¹. (Round off to the Nearest Integer)

[Use : R = 0.083 L bar mol⁻¹ K⁻¹]

Ans. Official Answer NTA (15)

Sol. $\pi = CRT$

$$2.42 \times 10^{-3} = \frac{1.46}{\frac{M_w}{100}} \times 1000 \times .83 \times 300$$

$$2.42 \times 10^{-3} = \frac{1.46}{M_w} \times 83 \times 3$$

$$M_w = \frac{1.46 \times 83 \times 3}{2.42} \times 10^3$$

$$= 150.22 \times 10^3$$

$$M_w = 15.022 \times 10^4$$

8. The difference between bond orders of CO and NO⁺ is $\frac{x}{2}$ where x = _____. (Round off to the Nearest Integer)

Ans. Official Answer NTA (0)

Sol. According to M.O.T

$$\text{B.O of CO} = 3$$

$$\text{B.O of NO}^+ = 3$$

$$\text{difference between B.O} = 0$$

$$\text{So value of } \frac{x}{2} = 0$$

9. CO₂ gas adsorbs charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of CO₂, adsorbed becomes 64 times when the pressure of CO₂ is doubled. The value of n in the Freundlich isotherm equation is _____ $\times 10^{-2}$. (Round off to the Nearest Integer)

Ans. Official Answer NTA (17)



Sol. $\frac{x}{M} = K(P)^{\frac{1}{n}}$ (i)

$x \frac{64}{M} = K(2P)^{\frac{1}{n}}$ (ii)

divide equ. (i) and equ. (ii)

$$\frac{1}{64} = \frac{1}{(2)^{\frac{1}{n}}}$$

$$\frac{1}{2^6} = \frac{1}{(2)^{\frac{1}{n}}}$$

$$\Rightarrow n = \frac{1}{6} \Rightarrow n = 0.167 = 16.7 \times 10^{-2}$$

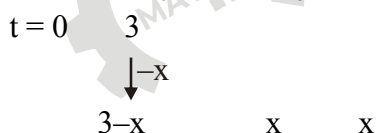
So answer is 17



3.0 moles of PCl_5 is introduced in a 1 L closed reaction vessel at 380 The Hie number of moles of PCl_5 at equilibrium is _____ $\times 10^{-3}$. (Round off to the Nearest Integer)

Ans. Official Answer NTA (1400)

Ans. Answer by Matrix (1396)



$$K_c = \frac{x \cdot x}{3-x} = 1.844$$

$$x^2 = 1.844(3-x)$$

$$x^2 + x \cdot 1.844^{-3} \times 1.844 = 0$$

$$x = 1.604$$

$$\text{Left moles of } \text{PCl}_5 = 3 - 1.6$$

$$= 1.396$$

$$= 1396 \times 10^{-3}$$