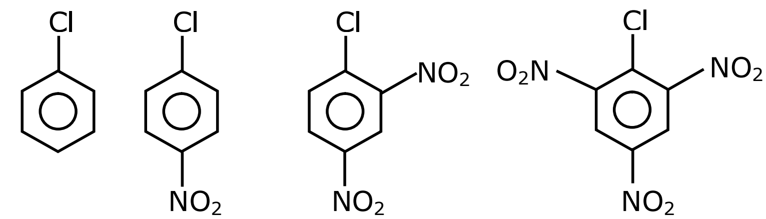
24th Feb. 2021 | Shift - 2
CHEMISTRY

JEE I NEET I Foundation

1. The correct order of the following compounds showing increasing tendency towards nucleophilic substitution reaction is :



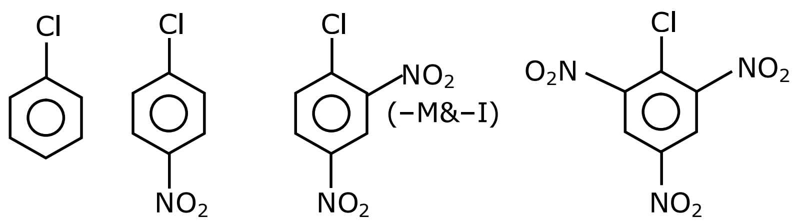
(i) (ii) (iii) (iv)

(1) (iv) < (i) < (iii) < (ii) (2) (iv) < (i) < (ii) < (iii)

(3) (i) < (ii) < (iii) < (iv) (4) (iv) < (iii) < (ii) < (i)

Ans. **(3)**

Sol.



(i) (ii) (−M & −I) (iii) (−M & −I), (−M&−I) (iv) (−M & −I)

Reactivity ∝ − m group present at O/P position.

2. Match List-I with List-II

List- I (Metal)	List-II (Ores)
(a) Aluminium	(i) Siderite
(b) Iron	(ii) Calamine
(c) Copper	(iii) Kaolinite
(d) Zinc	(iv) Malachite

Choose the correct answer from the options given below :

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

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

Ans. **(3)**

Sol.

Siderite	$FeCO_3$
Calamine	$ZnCO_3$
Kaolinite	$Si_2Al_2O_5(OH)_4$ or $Al_2O_3.2SiO_2.2H_2O$
Malachite	$CuCO_3.Cu(OH)_2$

3. Match List-I with List-II

List- I	List-II
(Salt)	(Flame colour wavelength)
(a) LiCl	(i) 455.5 nm
(b) NaCl	(ii) 970.8 nm
(c) RbCl	(iii) 780.0 nm
(d) CsCl	(iv) 589.2 nm

Choose the correct answer from the options given below :

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

Ans. (2)

Sol. Range of visible region : - 390nm – 760nm
VIBGYOR
Violet Red

LiCl	Crimson Red
NaCl	Golden yellow
RbCl	Violet
CsCl	Blue

So Licl Which is crimson have wave length closed to red in the spectrum of visible region which is as per given data is.

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

Assertion A : Hydrogen is the most abundant element in the Universe, but it is not the most abundant gas in the troposphere.

Reason R : Hydrogen is the lightest element.

In the light of the above statements, choose the correct answer from the 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) A is true but R is false
(4) Both A and R are true but R is NOT the correct explanation of A

Ans. (2)

Sol. Hydrogen is most abundant element in universe because all luminous body of universe i.e. stars & nebulae are made up of hydrogen which acts as nuclear fuel & fusion reaction is responsible for their light.

5. Given below are two statements :

Statement I : The value of the parameter "Biochemical Oxygen Demand (BOD)" is important for survival of aquatic life.

Statement II : The optimum value of BOD is 6.5 ppm.

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 false

(2) Statement I is false but Statement II is true

(3) Statement I is true but Statement II is false

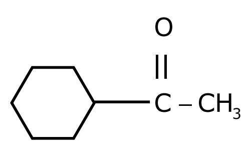
(4) Both Statement I and Statement II are true

Ans. (3)

Sol. For survival of aquatic life dissolved oxygen is responsible its optimum limit 6.5 ppm and optimum limit of BOD ranges from 10-20 ppm & BOD stands for biochemical oxygen demand.

6. Wich one of the following carbonyl compounds cannot be prepared by addition of wate on an alkyne in the presence of $HgSO_4$ and H_2SO_4 ?

(1) $CH_3-CH_2-\overset{\overset{\displaystyle O}{||}}{C}-H$

(2) 

(3) $CH_3-\overset{\overset{\displaystyle O}{||}}{C}-H$

(4) $CH_3-\overset{\overset{\displaystyle O}{||}}{C}-CH_2CH_3$

Ans. (1)

Sol. Reaction of Alkyne with $HgSO_4$ & H_2SO_4 follow as

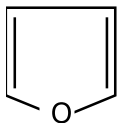
$$CH\equiv CH \xrightarrow[H_2O]{HgSO_4, H_2SO_4} CH_3CHO$$

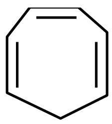
$$CH_3-C\equiv CH \xrightarrow[H_2O]{HgSO_4, H_2SO_4} CH_3-\overset{\overset{\displaystyle O}{||}}{C}-CH_3$$

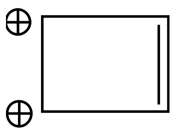
Hence, by this process preparation of CH_3CH_2CHO

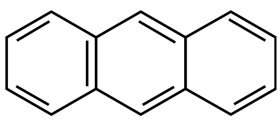
Cann't possible.

7. Which one of the following compounds is non-aromatic ?

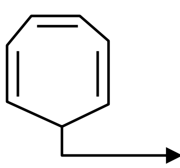
(1) 

(2) 

(3) 

(4) 

Ans. **(2)**

Sol. 

sp^3 carbon atom (Not planer)

Hence It is non-aromatic.

8. The incorrect statement among the following is :

(1) $VOSO_4$ is a reducing agent

(2) Red colour of ruby is due to the presence of CO^{3+}

(3) Cr_2O_3 is an amphoteric oxide

(4) RuO_4 is an oxidizing agent

Ans. **(2)**

Sol. Red colour of ruby is due to presence of CrO_3 or Cr^{+6} not CO^{3+}

9. According to Bohr's atomic theory :

(A) Kinetic energy of electron is $\propto \frac{Z^2}{n^2}$

(B) The product of velocity (v) of electron and principal quantum number (n). 'vn' $\propto Z^2$.

(C) Frequency of revolution of electron in an orbit is $\propto \frac{Z^3}{n^3}$.

(D) Coulombic force of attraction on the electron is $\propto \frac{Z^3}{n^4}$.

Choose the most appropriate answer from the options given below:

(1) (C) only
(2) (A) and (D) only
(3) (A) only
(4) (A), (C) and (D) only

Ans. (2) Correction on NTA

Sol. (A) KE = –TE = 13.6 × $\frac{Z^2}{n^2}$eV

KE $\propto \frac{Z^2}{n^2}$

(B) V = 2.188 × 10^6 × $\frac{Z}{n}$ m/sec.

So, Vn $\propto$ Z

(C) Frequency = $\frac{V}{2\pi r}$

So, F $\propto \frac{Z^2}{n^3}$ $\left[\therefore r \propto \frac{n^2}{z} \text{ and } v \propto \frac{Z}{n}\right]$

(D) Force $\propto \frac{z}{r^2}$

So, F $\propto \frac{Z^3}{n^4}$

So, only statement (A) is correct

10. Match List-I with List-II

List- I	List-II
(a) Valium	(i) Antifertility drug
(b) Morphine	(ii) Pernicious anaemia
(c) Norethindrone	(iii) Analgesic
(d) Vitamin B_{12}	(iv) Tranquilizer

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

Ans. (4)

Sol.

(a) Valium	(iv) Tranquilizer
(b) Morphine	(iii) Analgesic
(c) Norethindrone	(i) Antifertility drug
(d) Vitamin B_{12}	(ii) Pernicious anaemia

11. The Correct set from the following in which both pairs are in correct order of melting point is :

(1) LiF > LiCl ; NaCl > MgO
(2) LiF > LiCl ; MgO > NaCl
(3) LiCl > LiF ; NaCl > MgO
(4) LiCl > LiF ; MgO > NaCl

Ans. **(2)**

Sol. Generally

M.P. $\propto$ Lattice energy = $\dfrac{KQ_1Q_2}{r^+ + r^-}$

$\propto$ (packing efficiency)

12. The calculated magnetic moments (spin only value) for species $[FeCl_4]^{2-}$, $[Co(C_2O_4)_3]^{3-}$ and MnO_4^{2-} respectively are :

(1) 5.92, 4.90 and 0 BM
(2) 5.82, O and 0 BM
(3) 4.90, 0 and 1.73 BM
(4) 4.90, 0 and 2.83 BM

Ans. **(3)**

Sol. $[FeCl_4]^{2-}$ Fe^{2+} $3d^6 \rightarrow$ 4 unpaired electron. as Cl^- in a weak field liquid.

$\mu_{spin} = \sqrt{24}$ 8M

= 4.9 BM

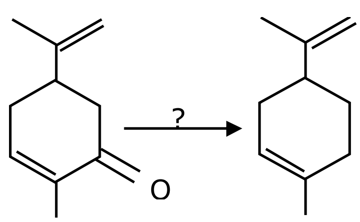
$[Co(C_2O_4)_3]^{3-}$ Co^{3+} $3d^6 \rightarrow$ for Co^{3+} with coodination no. 6 $C_2O_4^{2-}$ is strong field ligend & causes pairing & hence no. unpaired electron

μ_{spin} = 0

$[MnO_4]^{2-}$ Mn^{+6} it has one unpaired electron.

μ_{spin} = $\sqrt{3}$ BM

13.

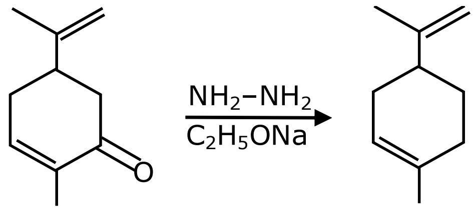


Which of the following reagent is suitable for the preparation of the product in the above reaction.

(1) Red P + Cl_2
(2) $NH_2-NH_2/C_2H_5\overset{\ominus}{O}\overset{\oplus}{Na}$
(3) Ni/H_2
(4) $NaBH_4$

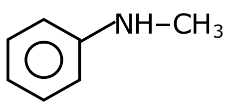
Ans. **(2)**

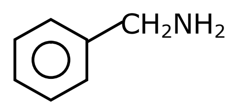
Sol.

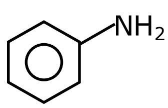


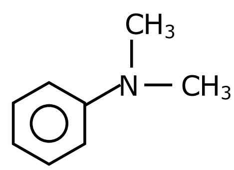
It is wolf-kishner reduction of carbonyl compounds.

14. The diazonium salt of which of the following compounds will form a coloured dye on reaction with β-Naphthol in NaOH ?

(1) 

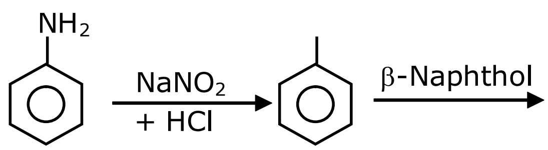
(2) 

(2) 

(4) 

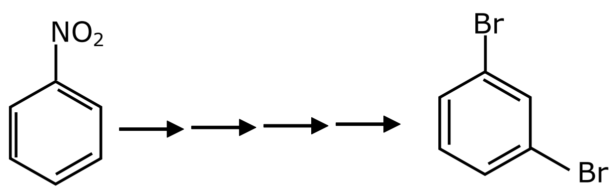
Ans. **(3)**

Sol.



Orange bright dye.

15. What is the correct sequence of reagents used for converting nitrobenzene into m-dibromobenzene ?



(1) $\xrightarrow{Sn/HCl}$ / $\xrightarrow{Br_2}$ / $\xrightarrow{NaNO_2}$ / $\xrightarrow{NaBr}$

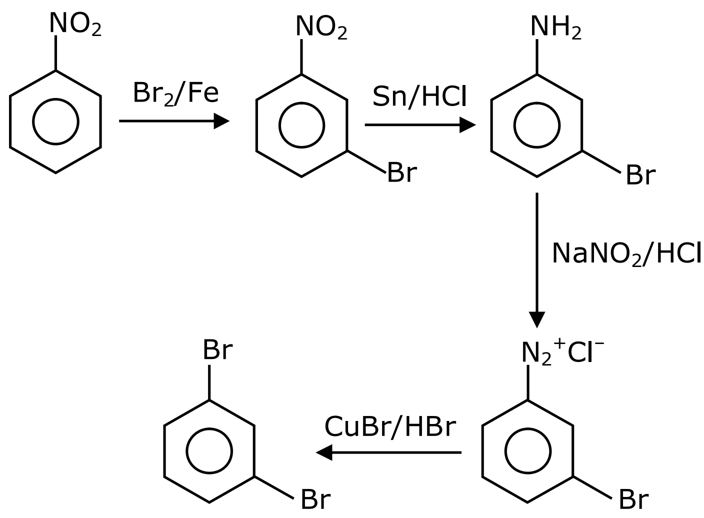
(2) $\xrightarrow{Sn/HCl}$ / $\xrightarrow{KBr}$ / $\xrightarrow{Br_2}$ / $\xrightarrow{H^+}$

(3) $\xrightarrow{NaNO_2}$ / $\xrightarrow{HCl}$ / $\xrightarrow{KBr}$ / $\xrightarrow{H^+}$

(4) $\xrightarrow{Br_2/Fe}$ / $\xrightarrow{Sn/HCl}$ / $\xrightarrow{NaNO_2/HCl}$ / $\xrightarrow{CuBr/HBr}$

Ans. **(4)**

Sol.



16. The correct shape and I-I-I bond angles respectively in I_3^- ion are :

(1) Trigonal planar; 120º

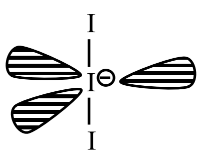
(2) Distorted trigonal planar; 135º and 90º

(3) Linear; 180º

(4) T-shaped; 180º and 90º

Ans. **(3)**

Sol. I_3^- sp^3d hybridisation (2BP + 3L.P.) Linear geometry



17. What is the correct order of the following elements with respect to their density ?

(1) Cr < Fe < Co < Cu < Zn

(2) Cr < Zn < Co < Cu < Fe

(3) Zn < Cu < Co < Fe < Cr

(4) Zn < Cr < Fe < Co < Cu

Ans. **(4)**

Sol. Fact Based

Density depend on many factor like atomic mass. atomic radius and packing efficiency.

18. Match List-I and List-II.

List – I	List-II
(a) $R-\overset{\overset{O}{\|\|}}{C}-Cl \rightarrow R-CHO$	(i) $Br_2/NaOH$
(b) $R-CH_2-COOH \rightarrow R-\underset{\underset{Cl}{\|}}{CH}-COOH$	(ii) $H_2/Pd\text{-}BaSO_4$
(c) $R-\overset{\overset{O}{\|\|}}{C}-NH_2 \rightarrow R-NH_2$	(iii) Zn(Hg)/Conc. HCl
(d) $R-\overset{\overset{O}{\|\|}}{C}-CH_3 \rightarrow R-CH_2-CH_3$	(iv) Cl_2/Red P, H_2O

Choose the correct answer from the options given below :

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

Ans. (4)

Sol.
(a) $R-\overset{\overset{O}{||}}{C}-Cl \xrightarrow{H_2/Pd-BaSO_4} R-CHO$ (Rosenmunt reaction)

(b) $R-CH_2-COOH \xrightarrow{Cl_2/\text{Red P},\ H_2O} R-\underset{\underset{Cl}{|}}{CH}-COOH$ (HVZ reaction)

(c) $R-\overset{\overset{O}{||}}{C}-NH_2 \xrightarrow{Br_2/NaOH} R-NH_2$ (Hoffmann Bromamide reaction)

(d) $R-\overset{\overset{O}{||}}{C}-CH_3 \xrightarrow{Zn(Hg)/conc.HCl} R-CH_2-CH_3$ (Clemmensen reaction)

19. In polymer Buna-S ; 'S' stands for :
(1) Styrene (2) Sulphur (3) Strength (4) Sulphonation

Ans. (1)
Sol. Buna-S is the co-polymer of buta- 1, 3 diene & styrene.

20. Most suitable salt which can be used for efficient clotting of blood will be :
(1) $Mg(HCO_3)_2$ (2) $FeSO_4$ (3) $NaHCO_3$ (4) $FeCl_3$

Ans. **(4)**

Sol. Blood is a negative sol. According to hardy-Schulz's rule, the cation with high charge has high coagulation power. Hence, $FeCl_3$ can be used for clotting blood.

Section -B

1. The magnitude of the change in oxidising power of the MnO_4^- / Mn^{2+} couple is x × 10^{-4} V, if the H^+ concentration is decreased from 1M to 10^{-4} M at 25ºC. (Assume concentration of MnO_4^- and Mn^{2+} to be same on change in H^+ concentration). The value of x is _____.
(Rounded off to the nearest integer)

$$\left[\text{Given : } \frac{2303RT}{F} = 0.059\right]$$

Ans. **3776**

Sol. $5e^- + MnO_4^- + 8H^+ \longrightarrow Mn^{+2} + 4H_2O$

$$Q = \frac{[Mn^{+2}]}{[H^+]^8[MnO_4^-]} \quad \Rightarrow \quad E_1 = E^\circ - \frac{0.059}{5}\log(Q_1)$$

$$E_2 = E^\circ - \frac{0.059}{5}\log(Q_2) \quad \Rightarrow \quad E_2 - E_1 = \frac{0.059}{5}\log\left(\frac{Q_1}{Q_2}\right)$$

$$= \frac{0.059}{5}\log\left\{\frac{[H^+]_{II}}{[H^+]_I}\right\}^8 \quad \Rightarrow \quad = \frac{0.059}{5}\log\left(\frac{10^{-4}}{1}\right)^8$$

$$(E_2 - E_1) = \frac{0.059}{5}\times(-32) \quad \Rightarrow \quad |(E_2 - E_1)| = 32\times\frac{0.059}{5} = x\times10^{-4}$$

$$= \frac{32\times590}{5}\times10^{-4} = x\times10^{-4} \quad \Rightarrow \quad = 3776 \times 10^{-4} \qquad x = 3776$$

2. Among the following allotropic forms of sulphur, the number of allotropic forms, which will show paramagnetism is ______.

(1) α-sulphur (2) β-sulphur (3) S_2-form

Ans. **(1)**

Sol. S_2 is like O_2 i;e paramagnetic as per molecular orbital theory.

3. C_6H_6 freezes at 5.5ºC. The temperature at which a solution of 10 g of C_4H_{10} in 200 g of C_6H_6 freeze is ________ºC. (The molal freezing point depression constant of C_6H_6 is) 5.12ºC/m)

Ans. **1**

Sol. $\Delta T_f = i \times K_f \times m$

$= (1) \times 5.12 \times \frac{10/58}{200} \times 1000 \quad \Rightarrow \quad \Delta T_f = \frac{5.12 \times 50}{58} = 4.414$

$T_{f(solution)} = T_{K(solvent)} - \Delta T_f$

$= 5.5 - 4.414$

$= 1.086°C$

$\approx 1.09°C = 1$ (nearest integer)

4. The volume occupied by 4.75 g of acetylene gas at 50ºC and 740 mmHg pressure is ________L. (Rounded off to the nearest integer)
(Given R = 0.0826 L atm K^{-1} mol^{-1})

Ans. **5**

Sol. T = 50ºC = 323.15 K

P = 740 mm of Hg = $\frac{740}{760}$ atm

V = ?

moles (n) = $\frac{4.75}{26}$

$$V = \frac{4.75}{26} \times \frac{0.0821 \times 323.15}{740} \times 760$$

$V = 4.97 \simeq 5$ Lit

5. The solubility product of PbI_2 is 8.0×10^{-9}. The solubility of lead iodide in 0.1 molar solution of lead nitrate is x $\times 10^{-6}$ mol/L. The value of x is ________(Rounded off to the nearest integer)
[Given $\sqrt{2} = 1.41$]

Ans. **141**

Sol. $K_{SP}(PbI_2) = 8 \times 10^{-9}$

$$PbI_2(s) \rightleftharpoons Pb^{+2}(aq) + 2I^-(aq)$$

$$\qquad\qquad S + 0.1 \quad 2S$$

$K_{SP} = [Pb^{+2}][I^-]^2$

$8 \times 10^{-9} = (S + 0.1)(2S)^2 \Rightarrow 8 \times 10^{-9} \simeq 0.1 \times 4S^2$

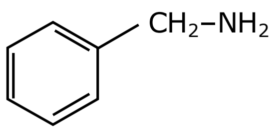
$\Rightarrow S^2 = 2 \times 10^{-8}$

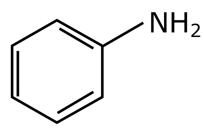
$S = 1.414 \times 10^{-4}$ mol/Lit

$= x \times 10^{-6}$ mol/Lit $\qquad \therefore\ x = 141.4 \simeq 141$

6. The total number of amines among the following which can be synthesized by Gabriel synthesis is _______.

(1) $\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!> CH-CH_2-NH_2$ (2) $CH_3CH_2NH_2$

(3) 

(4) 

Ans. **(3)**

Sol. Only aliphatic amines can be prepared by Gabriel synthesis.

7. 1.86 g of aniline completely reacts to form acetanilide. 10% of the product is lost during purificatiion. Amount of acetanilide obtained after purification (in g) is ____$\times 10^{-2}$.

Ans. **243**

Sol.
$$\underset{\substack{(C_6H_7N) \\ \text{Molar mass} = 93}}{Ph-NH_2} \longrightarrow \underset{\substack{(\text{Acetanilide})(C_8H_9NO) \\ \text{Molar mass} = 135}}{Ph-NH-\overset{\overset{\displaystyle O}{||}}{C}-CH_3}$$

93 g Aniline produce 135 g acetanilide

1.86 g produce $\dfrac{135 \times 1.86}{93} = 2.70\,g$

At 10% loss, 90% product will be formed after purification.

$\therefore$ Amount of product obtained = $\dfrac{2.70 \times 90}{100} = 2.43\,g = 243 \times 10^{-2}$ g

8. The formula of a gaseous hydrocarbon which requires 6 times of its own volume of O_2 for complete oxidation and produces 4 times its own volume of CO_2 is C_xH_y. The value of y is ....

Ans. **8**

Sol. $C_xH_y + 6O_2 \longrightarrow 4CO_2 + \dfrac{y}{2} H_2O$

Applying POAC on 'O' atoms

$6 \times 2 = 4 \times 2 + y/2 \times 1$

$y/2 = 4 \Rightarrow y = 8$

9. Sucrose hydrolyses in acid solution into glucose and fructose following first order rate law with a half-life of 3.33 h at 25ºC. After 9h, the fraction of sucrose remaining is f. The value of $\log_{10}\left(\frac{1}{f}\right)$ is __________ $\times 10^{-2}$ (Rounded off to the nearest integer)
[Assume: ln10 = 2.303, ln2 = 0.693]

Ans. **81**

Sol. Sucose $\xrightarrow{\text{Hydrolysis}}$ Glucose + Fructose

$t_{1/2} = 3.33h = \frac{10}{3}h \quad \Rightarrow \quad C_t = \frac{C_o}{2^{t/t_{1/2}}}$

Fraction of sucrose remaining $= f = \frac{C_t}{C_o} = \frac{1}{2^{t/t_{1/2}}}$

$$\frac{1}{f} = 2^{t/t_{1/2}}$$

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

$$= \frac{9}{10/3} \times 0.3 = \frac{8.1}{10} = 0.81 \quad = x \times 10^{-2} \quad x = 81$$

10. Assuming ideal behaviour, the magnitude of log K for the following reaction at 25ºC is $x \times 10^{-1}$. The value of x is ___________.(Integer answer)

$$3HC \equiv CH_{(g)} \rightleftharpoons C_6H_{6(\ell)}$$

[Given : $\Delta_f G°(HC \equiv CH) = -2.04 \times 10^5$] mol^{-1}; $\Delta_f G°(C_6H_6) = -1.24 \times 10^5\ J\ mol^{-1}$;
$R = 8.314\ J\ K^{-1}\ mol^{-1}$]

Ans. **855**

Sol. $3HC \equiv CH(g) \rightleftharpoons C_6H_6(\ell)$

$$\Delta G_r^o = \Delta G_f^o\left[C_6H_8(\ell)\right] - 3 \times \Delta G_f^o\left[HC \equiv CH\right]$$

$= [-1.24 \times 10^5 - 3x(-2.04 \times 10^5)]$

$= 4.88 \times 10^5$ J/mol

$\Delta G_r^o = -RT\ln(K_{eq})$

$$\log(K_{eq}) = \frac{-\Delta G^\circ}{2.303RT}$$

$$= \frac{-4.88 \times 10^5}{2.303 \times 8.314 \times 298}$$

$= -8.55 \times 10^1 = 855 \times 10^{-1}$