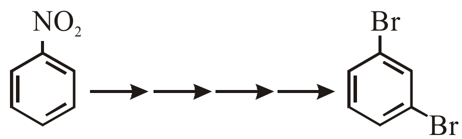
FINAL JEE–MAIN EXAMINATION – FEBRUARY, 2021

(Held On Wednesday 24th February, 2021) TIME : 3 : 00 PM to 6 : 00 PM

CHEMISTRY — TEST PAPER WITH SOLUTION

SECTION-A

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



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

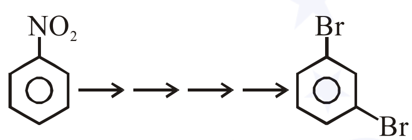
(2) $\xrightarrow{Br_2/Fe}$ / $\xrightarrow{Sn/HCl}$ / $\xrightarrow{NaNO_2/HCl}$ / $\xrightarrow{CuBr/HBr}$

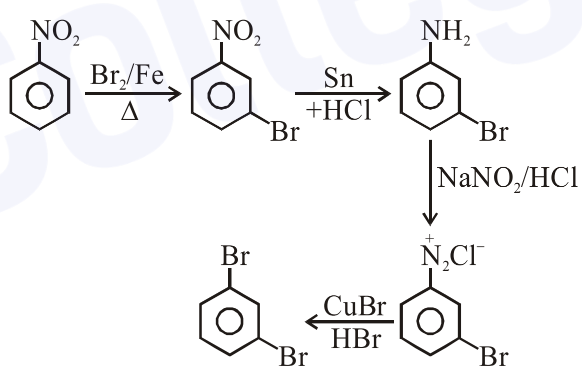
(3) $\xrightarrow{Sn/HCl}$ / $\xrightarrow{KBr}$ / $\xrightarrow{Br_2}$ / $\xrightarrow{H^+}$

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

Official Ans. by NTA (2)

Sol. Correct sequence of reagents for the following conversion.





2. Most suitable salt which can be used for efficient clotting of blood will be :-

(1) $NaHCO_3$ (2) $FeSO_4$

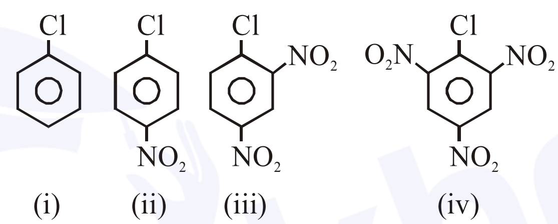
(3) $Mg(HCO_3)_2$ (4) $FeCl_3$

Sol. Blood : negatively charged sol

According to Hardly-schulz rule, for the negatively charged sol, most (+) ve ion is needed for its efficient coagulation.

Ans. : $FeCl_3$

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



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

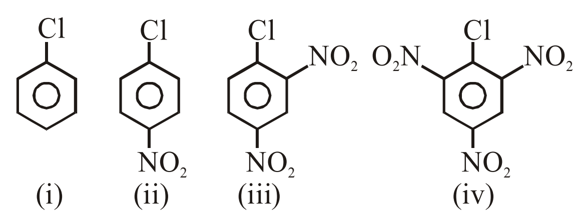
(2) (iv) < (i) < (ii) < (iii)

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

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

Official Ans. by NTA (4)

Sol. For nucleophile substitution in aromatic halides



Correct order is :

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

More No. of NO_2 substituted aromatic halide, increase the rate of nucleophile substitution

4. 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) Only

(3) (A), (C) and (D) only

(4) (A) and (D) only

Official Ans. by NTA (3)

Official Ans. by (4)

Sol. According to Bohr's theory :

(A) $KE = 13.6\frac{z^2}{n^2}\frac{eV}{atom} \Rightarrow KE \alpha \frac{z^2}{n^2}$

(B) speed of $e^- \ \alpha \frac{z}{n}$

$\therefore$ $\boxed{v \times n \alpha z}$

(C) Frequency of revolution of $e^- = \frac{v}{2\pi r}$

$\therefore$ $\boxed{\text{frequency}\ \alpha \frac{z^2}{n^3}}$

(D) $F = \frac{kq_1q_2}{r^2} = \frac{kze^2}{r^2}$ $\left\{ r \alpha \frac{n^2}{z} \right.$

$\Rightarrow F \alpha \frac{z}{\left(\frac{n^2}{z}\right)^2}$

$\Rightarrow \boxed{F \alpha \frac{z^3}{4}}$

5. Match list - I and List - II.

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

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

Official Ans. by NTA (3)

Sol. Match list-I & list-II

(a) $R-\overset{O}{\overset{\Vert}{C}}-Cl \xrightarrow[Pd-BaSO_4]{H_2} R-\overset{O}{\overset{\Vert}{C}}H$ (a) – (ii)

Rosenmund Reduction

(b) $R-CH_2-COOH \xrightarrow[H_2O]{Cl_2/P} R-\underset{Cl}{\underset{\vert}{CH}}-COOH$

HVZ reaction (b)-(iv)

(c) $R-\overset{O}{\overset{\Vert}{C}}-NH_2 \xrightarrow[NaOH]{Br_2} R-NH_2$ (c) - (i)

Hoffmann Bromamide reaction

(c) $R-\overset{O}{\overset{\Vert}{C}}-CH_3 \xrightarrow[con.\ HCl]{Zn(Hg)} R-CH_2-CH_3$ (d) - (iii)

Clemmenson reduction

6. 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) 5.82, 0 and 0 BM

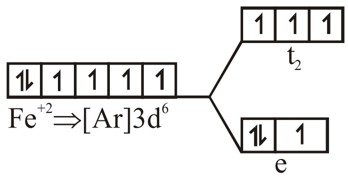
(2) 4.90, 0 and 1.73 BM

(3) 5.92, 4.90 and 0 BM

(4) 4.90, 0 and 2.83 BM

Sol.

(i) $[FeCl_4]^{-2} \Rightarrow$

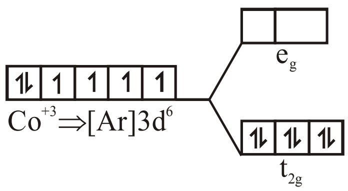


$\mu = \sqrt{n(n+2)}$ BM

$= \sqrt{4(4+2)}$ BM

$= \sqrt{24}$ BM $\Rightarrow$ 4.90 BM

(ii) $[Co(C_2O_4)_3]^{-3}$



$\mu = 0$

(iii) MnO_4^{-2}

$Mn^{+6} \Rightarrow [Ar]3d^1$ $\quad \mu = \sqrt{n(n+2)}$ BM

$= \sqrt{1(1+2)}$ BM

$= \sqrt{3}$ BM $\Rightarrow$ 1.73 BM

7. Match List-I with List-II :

	List-I (Salt)		**List-II (Flame colour wavelength)**
(a)	LiCl	(i)	455.5 nm
(b)	NaCl	(ii)	670.8 nm
(c)	RbCl	(iii)	780.0 nm
(d)	CsCl	(iv)	589.2 nm

Choose the correct answer from the options given below :

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

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

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

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

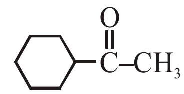
Official Ans. by NTA (4)

Sol.

	Colour	**λ/nm**
Li	Crimson red	670.8
Na	Yellow	589.2
Rb	Red violet	780.0

8. Which one of the following carbonyl compounds cannot be prepared by addition of water on an alkyne in the presence of $HgSO_4$ and H_2SO_4 ?

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

(2) 

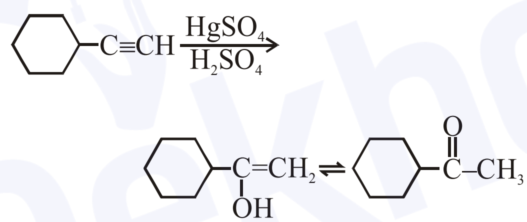
(3) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-H$

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

Official Ans. by NTA (3)

Sol. Reaction of $HgSO_4$/dil.H_2SO_4 with alkyne gives addition of water as per markonikoff's rule.

(1) $HC\equiv CH \xrightarrow[H_2SO_4]{HgSO_4} CH_2=\underset{OH}{\underset{|}{CH}} \rightleftharpoons CH_3-\overset{O}{\overset{\|}{C}}H$

(2) 

(3) $CH_3-C\equiv CH \xrightarrow[H_2SO_4]{HgSO_4} CH_3-\underset{OH}{\underset{|}{C}}=CH_2 \rightleftharpoons CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

Hence CH_3-CH_2-CHO cannot be form.

(4) $CH_3-C\equiv C-CH_3 \xrightarrow[H_2SO_4]{HgSO_4} CH_3-\underset{OH}{\underset{|}{C}}=CH-CH_3 \rightleftharpoons CH_3-\underset{O}{\underset{\|}{C}}-CH_2-CH_3$

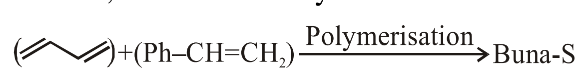
9. In polymer Buna-S: 'S' stands for :-

(1) Sulphonation (2) Strength

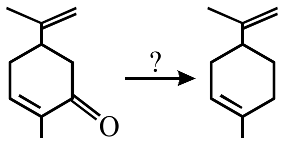
(3) Sulphur (4) Styrene

Official Ans. by NTA (4)

Sol. BUN-S, 'S' stand for styrene.



Buta-1,3-diene styrene

10. 

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

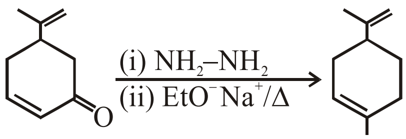
(1) $NaBH_4$

(2) $NH_2–NH_2/C_2H_5\overset{\ominus}{O}\overset{\oplus}{Na}$

(3) Ni/H_2

(4) Red P + Cl_2

Official Ans. by NTA (2)

Sol. 

To reduce the carbonyl groups into alkane wolf – kischner reduction is used, without affecting the double bond.

11. Match List-I and 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)–(iv), (b)–(iii), (c)–(i), (d)–(ii)
(3) (a)–(ii), (b)–(iv), (c)–(iii), (d)–(i)
(4) (a)–(i), (b)–(iii), (c)–(iv), (d)–(ii)

Official Ans. by NTA (2)

Sol. (a) Valium – Tranquilizer (a)-(iv)
(b) Morphine – Analgesic (b)-(iii)
(c) Norethindrone – Antifertility Drug (c)-(i)
(d) Vitamin B_{12} – Pernicious anaemia (d)-(ii)

12. Match List-I with List-II.

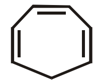
	List-I (Metal)		List-II (Ores)
(a)	Aluminium	(i)	Siderite
(b)	Iron	(ii)	Calamine
(c)	Copper	(iii)	Kaolinite
(d)	Zinc	(iv)	Malachite

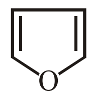
Choose the correct answer from the options given below :

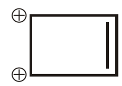
(1) (a)–(iv), (b)–(iii), (c)–(ii), (d)–(i)
(2) (a)–(ii), (b)–(iv), (c)–(i), (d)–(iii)
(3) (a)–(i), (b)–(ii), (c)–(iii), (d)–(iv)
(4) (a)–(iii), (b)–(i), (c)–(iv), (d)–(ii)

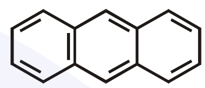
Sol. Siderite – $FeCO_3$
Calamine – $ZnCO_3$
Kaolinite – $Al_2(OH)_4.Si_2O_5$
Malachite – $Cu(OH)_2.CuCO_3$

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

(1) 

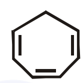
(2) 

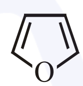
(3) 

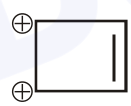
(4) 

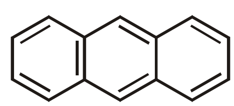
Official Ans. by NTA (1)

Sol. For the following ion/compounds

(1)  – Non aromatic

(2)  – Aromatic

(3)  – Aromatic

(4)  – Aromatic

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

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

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

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

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

Official Ans. by NTA (3)

Sol. Zn < Cr < Fe < Co < Cu

	Zn	Cr	Fe	Co	Cu
Density/g cm^{-3}	7.1	7.19	7.8	8.7	8.9

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

Official Ans. by NTA (3)

Sol. Clean water would have BOD value of less than 5 ppm whereas highly polluted water could have a BOD value of 17 ppm or more.

16. The **incorrect** statement among the following is :-

(1) $VOSO_4$ is a reducing agent
(2) Cr_2O_3 is an amphoteric oxide
(3) RuO_4 is an oxidizing agent
(4) Red colour of ruby is due to the presence of Co^{3+}

Official Ans. by NTA (4)

Sol.

(i) In $VOSO_4$, 'V' is in +4 oxidation state. So it act as oxidising agent.

(ii) Cr_2O_3 is an amphoteric oxide.

(iii) In RuO_4, 'Ru' is in +8 oxidation state. So it act as oxidising agent.

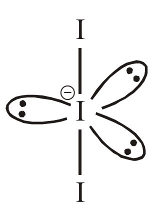
(iv) Red colour of ruby is due to the presence of Cr^{+3} ions in Al_2O_3.

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

(1) Distorted trigonal planar; 135° and 90°
(2) T-shaped; 180° and 90°
(3) Trigonal planar; 120°
(4) Linear; 180°

Official Ans. by NTA (4)

Sol.



18. 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.

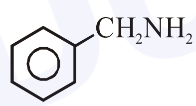
In the light of the above statements, choose the correct answer from the options given below :

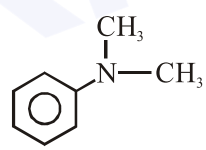
(1) **A** is true but **R** is false
(2) Both **A** and **R** are true and **R** is the correct explanation of **A**
(3) **A** is false but **R** is true
(4) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

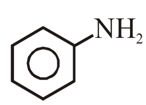
Official Ans. by NTA (2)

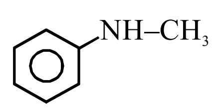
Sol. Most abundant gas in the troposphere is nitrogen.

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

(1) 

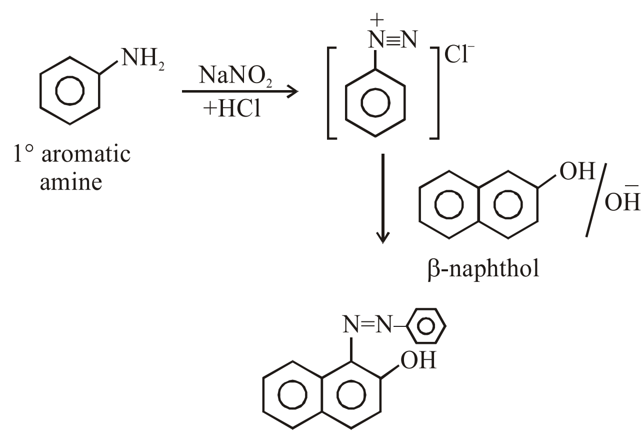
(2) 

(3) 

(4) 

Official Ans. by NTA (3)

Sol.



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

(1) LiF > LiCl ; MgO > NaCl

(2) LiCl > LiF ; NaCl > MgO

(3) LiF > LiCl ; NaCl > MgO

(4) LiCl > LiF ; MgO > NaCl

Official Ans. by NTA (1)

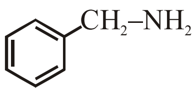
Sol. L.E. ∝ M.P.

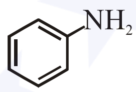
L.E. : LiF > LiCl, MgO > NaCl

SECTION-B

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

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

(C) 

(D) 

Official Ans. by NTA (3)

Sol. Gabriel phthalimide synthesis is used to prepare 1° aliphatic/alicyclic amine in common.

Hence amine which can synthesised by Gabriel phthalimide synthesis method is :

(A) $Me_2CH-CH_2-NH_2$ (B) $CH_3CH_2NH_2$

(C) $Ph-CH_2-NH_2$

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

(A) α-sulphur (B) β-sulphur

(C) S_2-form

Official Ans. by NTA (1)

Sol. α-sulphur and β-sulphur are diamagnetic.

S_2-form is paramagnetic.

3. 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 _______.

Sol. Combustion rx^n :

$$C_xH_{y(g)} + \left(x+\frac{y}{4}\right)O_2(g) \rightarrow xCO_2(g) + \frac{y}{2}H_2O(\ell)$$

V	6V	–	
–	–	Vx = 4V	

$\Rightarrow \boxed{x=4}$

Sinc : (I) $Vo_2 = 6\times V_{C_xH_y}$

$$\Rightarrow V\left(x+\frac{y}{4}\right) = 6V$$

$$\Rightarrow \boxed{\left(x+\frac{y}{4}\right)=6} \Rightarrow 4+\frac{y}{4}=6$$

$$\Rightarrow \boxed{y=8}$$

4. The volume occupied by 4.75 g of acetylene gas at 50°C and 740 mmHg pressure is _____ L. (Rounded off to the nearest integer)

[Given R = 0.0826 L atm K^{-1} mol^{-1}]

Official Ans. by NTA (5)

Sol. Given Mass = 4.75 g ⇒ $C_2H_2(g)$

$$\Rightarrow \text{Moles} = \frac{4.75}{26} \text{ mol}$$

Temp = 50 + 273 = 323 K

$$P = \frac{740}{760} \text{atm}$$

$$R = 0.0826 \frac{\ell\,\text{atm}}{\text{mol K}}$$

$$\Rightarrow V = \frac{nRT}{P} = \frac{4.75}{26}\times\frac{0.0826\times 323}{\left(\frac{740}{760}\right)}$$

$$\Rightarrow V = \frac{96314.078}{19240} = 5.0059\,\ell \simeq 5\ell$$

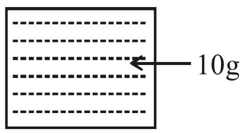
5. C_6H_6 freezes at 5.5°C. The temperature at which a solution 10 g of C_4H_{10} in 200 g of C_6H_6 freeze is _______ °C. (The molal freezing point depression constant of C_6H_6 is 5.12°C/m.)

Official Ans. by NTA (1)

Sol. Pure Solvent : $C_6H_6\ (\ell)$

Given : $T_f^{\circ} = 5.5°C$

$K_f = 5.12\,°C/m$



200 g C_6H_6

: Solute is non dissociative

$\because\ \Delta T_f = k_f \times m$

$$\Rightarrow \left(T_f^0 - T_f^{'}\right) = 5.12 \times \frac{\left(\frac{10}{58}\right)\text{mol}}{\left(\frac{200}{1000}\right)\text{kg}}$$

$$\Rightarrow 5.5 - T_f^{'} = \frac{5.12 \times 5 \times 10}{58}$$

$$\Rightarrow \boxed{T_f^{'} = 1.086\,°C \simeq 1°C}$$

6. 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 1 M to 10^{-4} M at 25°C. (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)

$\left[\text{Given} : \frac{2.303\ RT}{F} = 0.059\right]$

Official Ans. by NTA (3776)

Sol. Eqn is-

$MnO_4^- + H^{\oplus} + 5e^- \rightarrow Mn^{+2} + 4H_2O$

Nernst equation:

$$E_{cell} = E_{Cell}^0 - \frac{0.059}{5}\log\frac{[Mn^{+2}]}{[MnO_4^-]}\left[\frac{1}{H^+}\right]^8$$

(I) Given $[H^{\oplus}] = 1M$

$$E_1 = E^0 - \frac{0.059}{5}\log\frac{[Mn^{+2}]}{[MnO_4^-]}$$

(II) Now : $[H^{\oplus}] = 10^{-4}\,M$

$$E_2 = E^0 - \frac{0.059}{5}\log\frac{[Mn^{+2}]}{[MnO_4^-]} \times \frac{1}{(10^{-4})^8}$$

$$= E^0 - \frac{0.059}{5}\log\frac{Mn^{+2}}{[MnO_4^-]} + \frac{0.059}{5}\log 10^{-32}$$

therefore : $|E_1 - E_2| = \frac{0.059}{5} \times 32$

= 0.3776 V = 3776 × 10^{-4}

x = 3776

7. 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 × 10^{-6} mol/L. The value of x is __________. (Rounded off to the nearest integer)

$[\text{Given} : \sqrt{2} = 1.41]$

Official Ans. by NTA (141)

Sol. Given : $[K_{sp}]_{PbI_2} = 8 \times 10^{-9}$

To calculate : solubility of PbI_2 in 0.1 M sol of Pb $(NO_3)_2$

(I) Pb $(NO_3)_2 \rightarrow Pb^{+2}_{(aq)} + 2NO_3^-(aq)$

0.1 M	–	–
–	0.1M	0.2M

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

s 2s

= s + 0.1

$\simeq 0.1$

Now : K_{sp} = 8 × 10^{-9} = $[Pb^{+2}]\ [I^-]^2$

$\Rightarrow$ 8 × 10^{-9} = 0.1 × $(2s)^2$

$\Rightarrow$ 8 × 10^{-8} = $4s^2$ $\Rightarrow$ s = $\sqrt{2} \times 10^{-4}$

$\Rightarrow \boxed{S = 141 \times 10^{-6}\,M}$

8. Sucrose hydrolyses in acid solution into glucose and fructose following first order rate law with a half-life of 3.33 h at 25°C. After 9 h, the fraction of sucrose remaining is *f*. The value of $\log_{10}\left(\frac{1}{f}\right)$ is _______ × 10^{-2}. (Rounded off to the nearest integer)
[Assume : ln 10 = 2.303, ln 2 = 0.693]
Official Ans. by NTA (81)

Sol. Given :

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[t_{1/2}=\frac{10}{3}hr]{\text{I order}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

t = 0 a = $[A]_0$ – –
t = 9hr a –x = $[A]_t$

from I order kinetic : $\frac{k \times t}{2.303} = \log\frac{|A|_0}{|A|_t}$

$$\Rightarrow \frac{\ell n2 \times 9}{\frac{10}{3} \times 2.303} = \log\left(\frac{1}{f}\right)$$

$$\Rightarrow \frac{0.693 \times 9 \times 3}{23.03} = \log\left(\frac{1}{f}\right)$$

$$\Rightarrow \log\left(\frac{1}{f}\right) = 0.81246 = 81.24 \times 10^{-2}$$

⇒ x = 81

9. 1.86 g of aniline completely reacts to form acetanilide. 10% of the product is lost during purification. Amount of acetanilide obtained after purification (in g) is _______ × 10^{-2}.
Official Ans. by NTA (243)

Sol.

$$\underset{\substack{\text{(Aniline)} \\ \boxed{M = 98}}}{C_6H_5NH_2} \xrightarrow{\text{90\% efficiency}} \underset{\substack{\text{(Acetanilide)} \\ \boxed{M = 135}}}{C_6H_5-NH-\overset{\overset{O}{||}}{C}-CH_3}$$

Given 1.86 g

$\Rightarrow$ 1 mol $C_6H_5NH_2$ give 1 mol $C_6H_5NH\overset{\overset{O}{||}}{C}CH_3$

$$\Rightarrow \frac{1.86}{93} = \frac{W_{acetanilide}}{135}$$

$$\Rightarrow W_{acelanilide} = \frac{1.86 \times 135}{93} g = 2.70 g$$

But efficiency of reaction is 90% only

∴ Mass of acetanilide produced $= 2.70 \times \frac{90}{100} g$

= 2.43 g

= 243 × 10^{-2}g

⇒ x = 243

10. Assuming ideal behaviour, the magnitude of log K for the following reaction at 25°C is x × 10^{-1}. The value of x is _______. (Integer answer)

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

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

Official Ans. by NTA (855)

Sol. $3HC \equiv CH_{(g)} \rightarrow C_6H_6(\ell) : \Delta G^0 = -RT \ln k$

$$\Delta G_f^0 \; -2.04 \times 10^5 \frac{J}{mol} \; -1.24 \times 10^5 J/mol$$

$$\Rightarrow \Delta G^0 = \sum\left(\Delta G_f^0\right)_P - \sum\left(\Delta G_f^0\right)_R$$

$$\Rightarrow -RT\,\ell nk = 1 \times \left(-124 \times 10^5\right) - \left(-3 \times 2.04 \times 10^5\right)$$

$$\Rightarrow -2.303 \times R \times T \log k = 4.88 \times 10^5$$

$$\Rightarrow \log k = -\frac{4.88 \times 10^5}{2.303 \times R \times T} = -\frac{488000}{5705.848} = -85.52$$

= 855 × 10^{-1}