

FINAL JEE-MAIN EXAMINATION – JUNE, 2022

(Held On Tuesday 28th June, 2022)

TIME : 3 : 00 PM to 6 : 00 PM

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

1. Compound A contains 8.7% Hydrogen, 74% Carbon and 17.3% Nitrogen. The molecular formula of the compound is,

Given : Atomic masses of C, H and N are 12, 1 and 14 amu respectively.

The molar mass of the compound A is 162 g mol^{-1} .

- (A) $\text{C}_4\text{H}_6\text{N}_2$ (B) $\text{C}_2\text{H}_3\text{N}$
(C) $\text{C}_5\text{H}_7\text{N}$ (D) $\text{C}_{10}\text{H}_{14}\text{N}_2$

Official Ans. by NTA (D)

Ans. (D)

Sol.

C	74%	$\frac{74}{12} = 6.16$	$\frac{6.16}{1.23} = 5$
N	17.3%	$\frac{17.3}{14} = 1.23$	$\frac{1.23}{1.23} = 1$
H	8.7%	$\frac{8.7}{1} = 8.7$	$\frac{8.7}{1.23} = 7$

Empirical formula = C_5NH_7

Empirical weight = 81

Multiplying factor = $\frac{162}{81} = 2$

Molecular formula = $\text{C}_{10}\text{N}_2\text{H}_{14}$

2. Consider the following statements :
- (A) The principal quantum number 'n' is a positive integer with values of 'n' = 1, 2, 3,
- (B) The azimuthal quantum number 'l' for a given 'n' (principal quantum number) can have values as 'l' = 0, 1, 2, n
- (C) Magnetic orbital quantum number 'm_l' for a particular 'l' (azimuthal quantum number) has (2l + 1) values.

(D) $\pm 1/2$ are the two possible orientations of electron spin.

(E) For l = 5, there will be a total of 9 orbital.

Which of the above statements are **correct**?

- (A) (A), (B) and (C)
(B) (A), (C), (D) and (E)
(C) (A), (C) and (D)
(D) (A), (B), (C) and (D)

Official Ans. by NTA (C)

Ans. (C)

- Sol.** (A) Number of values of n = 1, 2, 3 ... ∞
(B) Number of values of l = 0 to (n - 1)
(C.) Number of values of m = -l to +l

Total values = 2l + 1

(D) Values of spin = $\pm \frac{1}{2}$

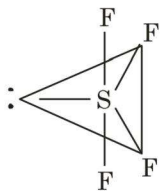
(E) For l = 5 number of orbitals = 2l + 1 = 11

3. In the structure of SF_4 , the lone pair of electrons on S is in.
- (A) equatorial position and there are two lone pair-bond pair repulsions at 90°
(B) equatorial position and there are three lone pair-bond pair repulsions at 90°
(C) axial position and there are three lone pair – bond pair repulsion at 90° .
(D) axial position and there are two lone pair – bond pair repulsion at 90° .

Official Ans. by NTA (A)

Ans. (A)

Sol.



sp^3d , See-Saw

4. A student needs to prepare a buffer solution of propanoic acid and its sodium salt with pH 4. The ratio of $\frac{[CH_3CH_2COO^-]}{[CH_3CH_2COOH]}$ required to make buffer is

Given : $K_a(CH_3CH_2COOH) = 1.3 \times 10^{-5}$

- (A) 0.03 (B) 0.13
(C) 0.23 (D) 0.33

Official Ans. by NTA (B)

Ans. (B)

Sol. $pH = pK_a + \log \frac{[Salt]}{[Acid]}$

$$4 = 5 - \log 1.3 + \log \frac{[CH_3CH_2COO^-]}{[CH_3CH_2COOH]}$$

$$\log \frac{[CH_3CH_2COO^-]}{[CH_3CH_2COOH]} = \log 1.3 - 1 = \log \frac{1.3}{10}$$

$$\frac{[CH_3CH_2COO^-]}{[CH_3CH_2COOH]} = 0.13$$

5. Match List-I with List-II.

List-I		List-II	
(A)	Negatively charged sol	(I)	$Fe_2O_3 \cdot xH_2O$
(B)	Macromolecular colloid	(II)	CdS sol
(C)	Positively charged sol	(III)	Starch
(D)	Cheese	(IV)	a gel

Choose the correct answer from the options given below :

- (A) (A) – (II), (B) – (III), (C) – (IV), (D) – (I)
(B) (A) – (II), (B) – (I), (C) – (III), (D) – (IV)
(C) (A) – (II), (B) – (III), (C) – (I), (D) – (IV)
(D) (A) – (I), (B) – (III), (C) – (II), (D) – (IV)

Official Ans. by NTA (C)

Ans. (C)

- Sol. Negative charged sol = CdS (II)
Macromolecular colloid = starch (III)
Positively charged sol = $Fe_2O_3 \cdot xH_2O$ (I)
Cheese = gel (IV)
6. Match List-I with List-II.

List-I (Oxide)		List-II (Nature)	
(A)	Cl_2O_7	(I)	Amphoteric
(B)	Na_2O	(II)	Basic
(C)	Al_2O_3	(III)	Neutral
(D)	N_2O	(IV)	Acidic

Choose the correct answer from the options given below :

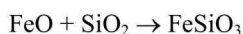
- (A) (A) – (IV), (B) – (III), (C) – (I), (D) – (II)
(B) (A) – (IV), (B) – (II), (C) – (I), (D) – (III)
(C) (A) – (II), (B) – (IV), (C) – (III), (D) – (I)
(D) (A) – (I), (B) – (II), (C) – (III), (D) – (IV)

Official Ans. by NTA (B)

Ans. (B)

- Sol. Cl_2O_7 Acidic
 Na_2O Basic
 Al_2O_3 Amphoteric
 N_2O Neutral

7. In the metallurgical extraction of copper, following reaction is used :



FeO and $FeSiO_3$ respectively are.

- (A) gangue and flux (B) flux and slag
(C) slag and flux (D) gangue and slag

Official Ans. by NTA (D)

Ans. (D)

- Sol. FeO = Gangue
 $FeSiO_3$ = Slag

8. Hydrogen has three isotopes : protium (^1H), deuterium (^2H or D) and tritium (^3H or T). They have nearly same chemical properties but different physical properties. They differ in

- (A) number of protons
 (B) atomic number
 (C) electronic configuration
 (D) atomic mass

Official Ans. by NTA (D)

Ans. (D)

Sol. They have different neutrons and mass number

9. Among the following basic oxide is :

- (A) SO_3 (B) SiO_2
 (C) CaO (D) Al_2O_3

Official Ans. by NTA (C)

Ans. (C)

Sol. SO_3 , SiO_2 = Acidic

CaO = Basic

Al_2O_3 = Amphoteric

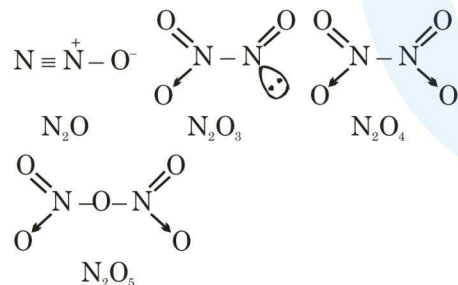
10. Among the given oxides of nitrogen; N_2O , N_2O_3 , N_2O_4 and N_2O_5 , the number of compound(s) having N-N bond is :

- (A) 1 (B) 2
 (C) 3 (D) 4

Official Ans. by NTA (C)

Ans. (C)

Sol.



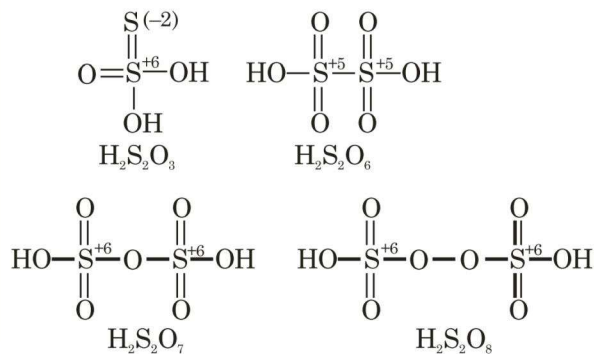
11. Which of the following oxoacids of sulphur contains "S" in two different oxidation states?

- (A) $\text{H}_2\text{S}_2\text{O}_3$ (B) $\text{H}_2\text{S}_2\text{O}_6$
 (C) $\text{H}_2\text{S}_2\text{O}_7$ (D) $\text{H}_2\text{S}_2\text{O}_8$

Official Ans. by NTA (A)

Ans. (A)

Sol.



12. Correct statement about photo-chemical smog is :

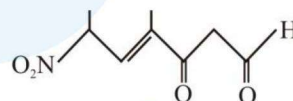
- (A) It occurs in humid climate.
 (B) It is a mixture of smoke, fog and SO_2
 (C) It is reducing smog.
 (D) It results from reaction of unsaturated hydrocarbons.

Official Ans. by NTA (D)

Ans. (D)

Sol. Photo chemical smog results from the action of sunlight on unsaturated hydro carbons and nitrogen oxide

13. The correct IUPAC name of the following compound is :

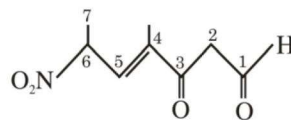


- (A) 4-methyl-2-nitro-5-oxohept-3-enal
 (B) 4-methyl-5-oxo-2-nitrohept-3-enal
 (C) 4-methyl-6-nitro-3-oxohept-4-enal
 (D) 6-formyl-4-methyl-2-nitrohex-3-enal

Official Ans. by NTA (C)

Ans. (C)

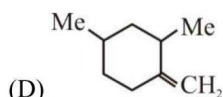
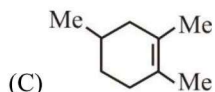
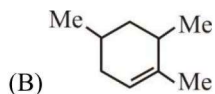
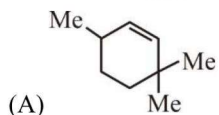
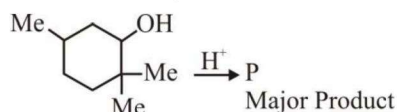
Sol.



4-Methyl-6-nitro-3-oxohept-4-enal

14. The major product (P) of the given reaction is

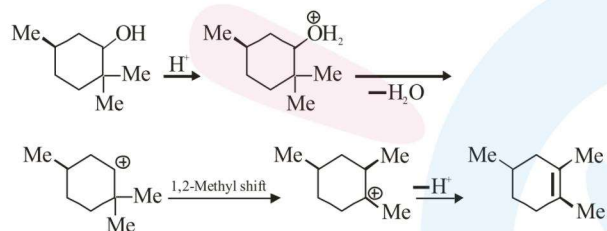
(where, Me is $-\text{CH}_3$)



Official Ans. by NTA (C)

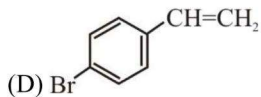
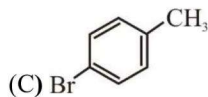
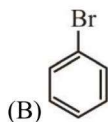
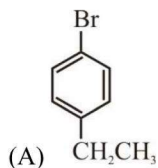
Ans. (C)

Sol.



15. $\text{A} \xrightarrow[\text{(iii) H}_2\text{O/H}^+]{\text{(i) Cl}_2/\Delta, \text{(ii) CN}^-}$ 4-Bromophenyl acetic acid.

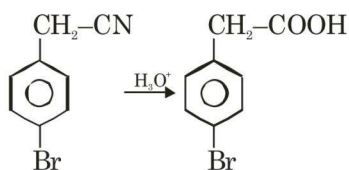
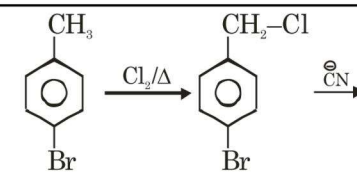
In the above reaction 'A' is



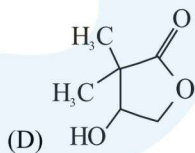
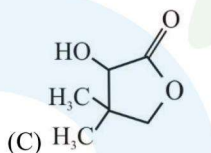
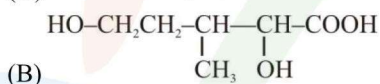
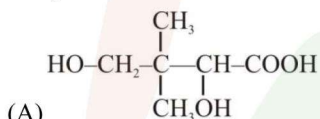
Official Ans. by NTA (C)

Ans. (C)

Sol.



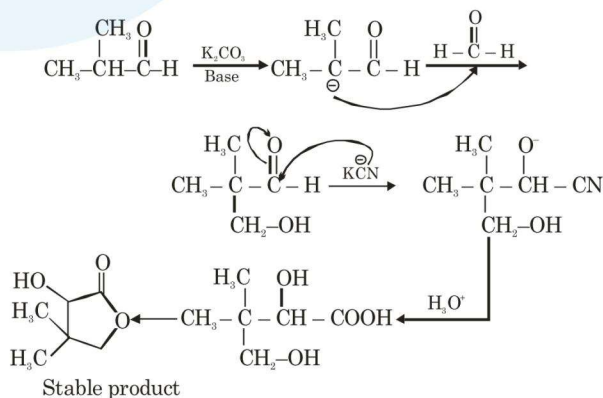
16. Isobutyraldehyde on reaction with formaldehyde and K_2CO_3 gives compound 'A'. Compound 'A' reacts with KCN and yields compound 'B', which on hydrolysis gives a stable compound 'C'. The compound 'C' is :



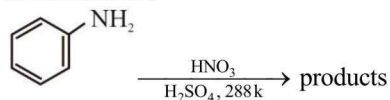
Official Ans. by NTA (C)

Ans. (C)

Sol.



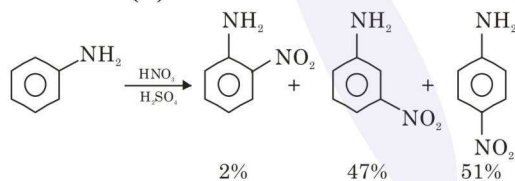
17. With respect to the following reaction, consider the given statements :



- (A) o-Nitroaniline and p-nitroaniline are the predominant products
 (B) p-Nitroaniline and m-nitroaniline are the predominant products
 (C) HNO₃ acts as an acid
 (D) H₂SO₄ acts as an acid
 (A) (A) and (C) are correct statements.
 (B) (A) and (D) are correct statements.
 (C) (B) and (D) are correct statements.
 (D) (B) and (C) are correct statements.

Official Ans. by NTA (C)

Ans. (C)



Sol.



18. Given below are two statements, one is Assertion (A) and other is Reason (R).

Assertion (A) : Natural rubber is a linear polymer of isoprene called cis-polyisoprene with elastic properties.

Reason (R) : The cis-polyisoprene molecules consist of various chains held together by strong polar interactions with coiled structure.

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

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A)
 (B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
 (C) (A) is true but (R) is false.
 (D) (A) is false but (R) is true.

Official Ans. by NTA (C)

Ans. (C)

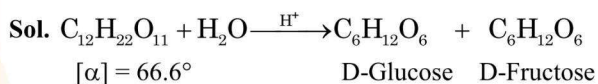
- Sol. Natural rubber is linear polymer of isoprene (2-methyl-1,3-butadiene) and is also called cis-1,4-polyisoprene. The cis-polyisoprene molecules consists of various chains held together by weak Vander Waal's interactions and has a coiled structure

19. When sugar 'X' is boiled with dilute H₂SO₄ in alcoholic solution, two isomers 'A' and 'B' are formed. 'A' on oxidation with HNO₃ yields saccharic acid where as 'B' is laevorotatory. The compound 'X' is :

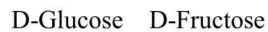
- (A) Maltose (B) Sucrose
 (C) Lactose (D) Strach

Official Ans. by NTA (B)

Ans. (B)

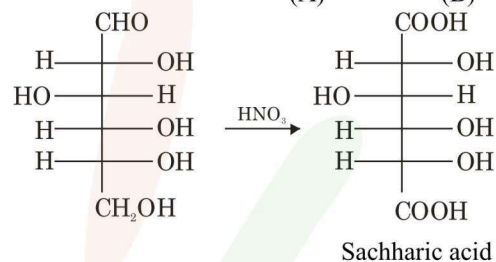


$$[\alpha] = 66.6^\circ$$

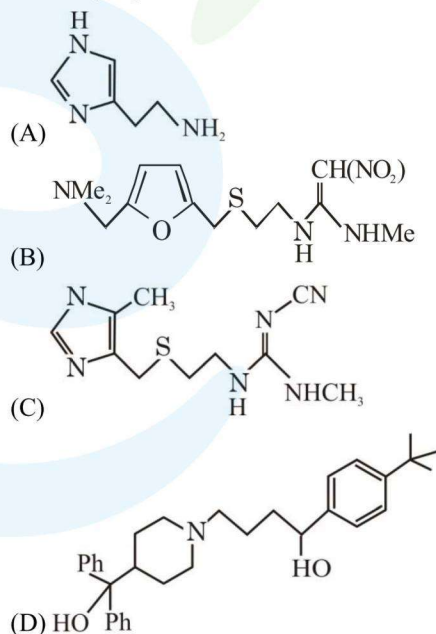


$$[\alpha] = +52.7^\circ \quad [\alpha] = -92.2^\circ$$

(A) (B)



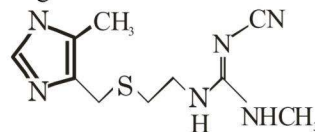
20. The drug tegamet is :



Official Ans. by NTA (C)

Ans. (C)

- Sol. Tegamet is the brand name of Cimetidine



SECTION-B

1. 100 g of an ideal gas is kept in a cylinder of 416 L volume at 27°C under 1.5 bar pressure. The molar mass of the gas is _____ g mol⁻¹. (Nearest integer) (Given : R = 0.083 L bar K⁻¹ mol⁻¹)

Official Ans. by NTA (4)

Ans. (4)

Sol. $1.5 \times 416 = \frac{100}{M} \times 0.083 \times 300$

M = 3.99

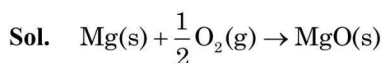
Ans. 4

2. For combustion of one mole of magnesium in an open container at 300 K and 1 bar pressure, $\Delta_c H^\ominus = -601.70 \text{ kJ mol}^{-1}$, the magnitude of change in internal energy for the reaction is _____ kJ. (Nearest integer)

(Given : R = 8.3 J K⁻¹ mol⁻¹)

Official Ans. by NTA (600)

Ans. (600)



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

$-601.70 \times 10^3 = \Delta U - \frac{1}{2} \times 8.3 \times 300$

$-601.70 \text{ kJ} = \Delta U - 1.245 \text{ kJ}$

$\Delta U = -600.455 \text{ kJ}$

Ans. 600

3. 2.5 g of protein containing only glycine (C₂H₅NO₂) is dissolved in water to make 500 mL of solution. The osmotic pressure of this solution at 300 K is found to be 5.03×10^{-3} bar. The total number of glycine units present in the protein is _____

(Given : R = 0.083 L bar K⁻¹ mol⁻¹)

Official Ans. by NTA (330)

Ans. (330)

Sol. $\pi = CRT$

$5.03 \times 10^{-3} = C \times 0.083 \times 300$

$C = 0.202 \times 10^{-3} \text{ M}$

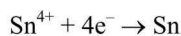
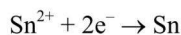
Moles of protein = $0.202 \times 10^{-3} \times 0.5$
= $10^{-4} \times 1.01$

$1.01 \times 10^{-4} = \frac{2.5}{M}$

M(molar mass of protein) = 24752

\therefore No. of glycine units = $\frac{24752}{75} = 330.03$

4. For the given reactions



The electrode potentials are; $E_{\text{Sn}^{2+}/\text{Sn}}^\ominus = -0.140 \text{ V}$

and $E_{\text{Sn}^{4+}/\text{Sn}}^\ominus = 0.010 \text{ V}$. The magnitude of

standard electrode potential for Sn⁴⁺/Sn²⁺ i.e.

$E_{\text{Sn}^{4+}/\text{Sn}^{2+}}^\ominus$ is _____ $\times 10^{-2} \text{ V}$. (Nearest integer)

Official Ans. by NTA (16)

Ans. (16)



$\Delta G_3^\ominus = \Delta G_2^\ominus - \Delta G_1^\ominus$

$-2 \times E^\ominus \times F = -(0.04 + 0.28) \times F$

$E^\ominus = 0.16 \text{ volt} = 16 \times 10^{-2} \text{ V}$

Ans 16

5. A radioactive element has a half life of 200 days. The percentage of original activity remaining after 83 days is _____ . (Nearest integer)

(Given : antilog 0.125 = 1.333, antilog 0.693 = 4.93)

Official Ans. by NTA (75)

Ans. (75)

Sol. $t = \frac{t_{1/2}}{0.3} \log \frac{[A]_0}{[A]_t}$

$83 = \frac{200}{0.3} \log \frac{[A]_0}{[A]_t}$

$0.125 = \log \frac{[A]_0}{[A]_t}$

$\frac{[A]_0}{[A]_t} = 1.333 \cong \frac{4}{3}$

$\therefore \frac{[A]_t}{[A]_0} \times 100 = \frac{3}{4} \times 100 = 75\%$

Ans. 75

6. $[\text{Fe}(\text{CN})_6]^{4-}$
 $[\text{Fe}(\text{CN})_6]^{3-}$
 $[\text{Ti}(\text{CN})_6]^{3-}$
 $[\text{Ni}(\text{CN})_4]^{2-}$
 $[\text{Co}(\text{CN})_6]^{3-}$
 Among the given complexes, number of paramagnetic complexes is _____.

Official Ans. by NTA (2)

Ans. (2)

- Sol.** $[\text{Fe}(\text{CN})_6]^{4-}$ Diamagnetic
 $[\text{Fe}(\text{CN})_6]^{3-}$ Paramagnetic (1 unpaired electron)
 $[\text{Ti}(\text{CN})_6]^{3-}$ Paramagnetic (1 unpaired electron)
 $[\text{Ni}(\text{CN})_4]^{2-}$ Diamagnetic
 $[\text{Co}(\text{CN})_6]^{3-}$ Diamagnetic

Ans. 2

7. (a) $\text{CoCl}_3 \cdot 4 \text{NH}_3$
 (b) $\text{CoCl}_3 \cdot 5 \text{NH}_3$
 (c) $\text{CoCl}_3 \cdot 6 \text{NH}_3$ and
 (d) $\text{CoCl}(\text{NO}_3)_2 \cdot 5 \text{NH}_3$

Number of complex(es) which will exist in cis-trans is/are

Official Ans. by NTA (1)

Ans. (1)

- Sol.** (a) $\text{CoCl}_3 \cdot 4 \text{NH}_3 = [\text{Co}(\text{NH}_3)_4 \text{Cl}_2] \text{Cl}$
 Can exhibit G.I.
 (b) $\text{CoCl}_3 \cdot 5 \text{NH}_3 = [\text{Co}(\text{NH}_3)_5 \text{Cl}] \text{Cl}_2$
 Can't exhibit G.I.
 (c) $\text{CoCl}_3 \cdot 6 \text{NH}_3 = [\text{Co}(\text{NH}_3)_6] \text{Cl}_3$
 Can't exhibit G.I.
 (d) $\text{CoCl}(\text{NO}_3)_2 \cdot 5 \text{NH}_3 = [\text{Co}(\text{NH}_3)_5 \text{Cl}] (\text{NO}_3)_2$
 OR
 $= [\text{Co}(\text{NH}_3)_5 (\text{NO}_3)] \text{Cl} (\text{NO}_3)$

Both can't exhibit G.I.

8. The complete combustion of 0.492 g of an organic compound containing 'C', 'H' and 'O' gives 0.793 g of CO_2 and 0.442 g of H_2O . The percentage of oxygen composition in the organic compound is _____. (nearest integer)

Official Ans. by NTA (46)

Ans. (46)

Sol. Mole of $\text{CO}_2 = \text{Moles of C} = \frac{0.793}{44}$

Weight of 'C' = $\frac{0.793}{44} \times 12 = 0.216 \text{ gm}$

Moles of 'H' = $\frac{0.442}{18} \times 2$

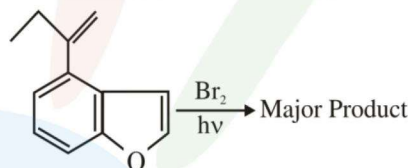
Weight of 'H' = $\frac{0.442}{18} \times 2 \times 1 = 0.049 \text{ gm}$

\therefore Weight of 'O' = $0.492 - 0.216 - 0.049 = 0.227 \text{ gm}$

% of 'O' = $\frac{0.227}{0.492} \times 100 = 46.13\%$

Ans. 46

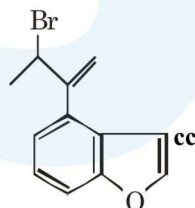
9. The major product of the following reaction contains _____ bromine atom(s).



Official Ans. by NTA (1)

Ans. (1)

Sol.



No. of Br atoms = 1

10. 0.01 M KMnO_4 solution was added to 20.0 mL of 0.05 M Mohr's salt solution through a burette. The initial reading of 50 mL burette is zero. The volume of KMnO_4 solution left in the burette after the end point is _____ mL. (nearest integer)

Official Ans. by NTA (30)

Ans. (30)

Sol. $N_1 V_1 = N_2 V_2$

$0.01 \times 5 \times V_1 = 0.05 \times 1 \times 20$

$V_1 = 20 \text{ ml used}$

\therefore Volume left = $50 - 20 = 30 \text{ ml}$