

FINAL JEE-MAIN EXAMINATION – JANUARY, 2023

(Held On Monday 30th January, 2023)

TIME : 9 : 00 AM to 12 : 00 NOON

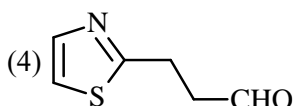
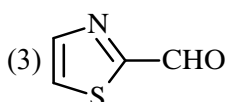
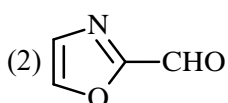
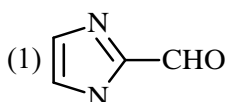
CHEMSITRY

SECTION-A

31. Which of the following compounds would give the following set of qualitative analysis ?

(i) Fehling's Test : Positive

(ii) Na fusion extract upon treatment with sodium nitroprusside gives a blood red colour but not

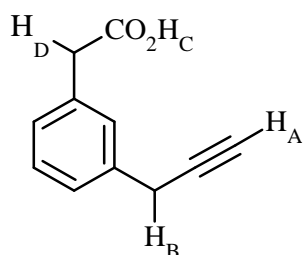


Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Aromatic aldehydes do not give Fehling's test.. Both nitrogen and sulfur must be present to obtain blood red colour Sodium nitroprusside gives blood red colour with S & N.

32. What is the correct order of acidity of the protons marked A–D in the given compounds ?



(1) $H_C > H_D > H_B > H_A$

(2) $H_C > H_D > H_A > H_B$

(3) $H_D > H_C > H_B > H_A$

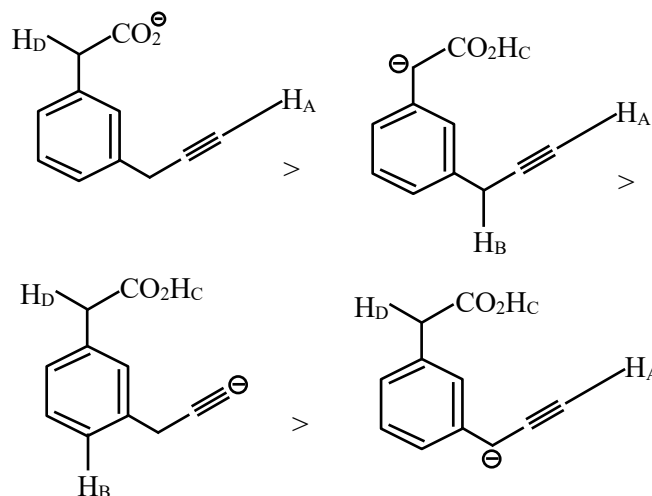
(4) $H_C > H_A > H_D > H_B$

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. acidity of an acid depends upon the stability of its conjugate base

TEST PAPER WITH SOLUTION



33. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Ketoses give Seliwanoff's test faster than Aldoses.

Reason (R) : Ketoses undergo β -elimination followed by formation of furfural.

In the light of the above statements, choose the correct 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) (A) is true but (R) is false

(4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Seliwanoff's test is a differentiating test for Ketose and aldose. This test relies on the principle that the keto hexose are more rapidly dehydrated to form 5-hydroxy methyl furfural when heated in acidic medium which on condensation with resorcinol, Cherry red or brown red coloured complex is formed rapidly indicating a positive test.

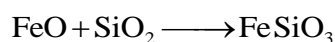
34. In the extraction of copper, its sulphide ore is heated in a reverberatory furnace after mixing with silica to :

- (1) separate CuO as CuSiO_3
- (2) remove calcium as CaSiO_3
- (3) decrease the temperature needed for roasting of Cu_2S
- (4) remove FeO as FeSiO_3

Official Ans. by NTA (4)

Allen Ans. (4)

- Sol.** The copper ore contains iron, it is mixed with silica before heating in reverberatory furnace. FeO slags off as FeSiO_3 .



35. Amongst the following compounds, which one is an antacid ?

- (1) Ranitidine
- (2) Meprobamate
- (3) Terfenadine
- (4) Brompheniramine

Official Ans. by NTA (1)

Allen Ans. (1)

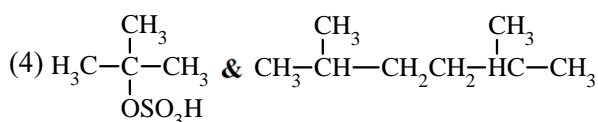
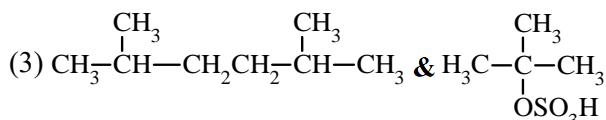
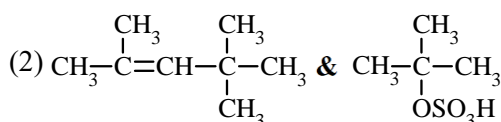
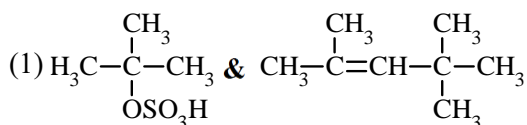
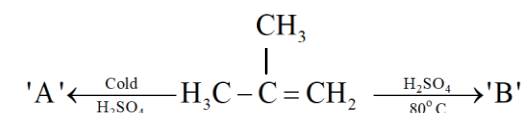
- Sol.** 1. **Ranitidine:** Antacid

2. **Meprobamate:** Tranquilizer

3. **Terfenadine:** Antihistamine

4. **Brompheniramine:** Antihistamine

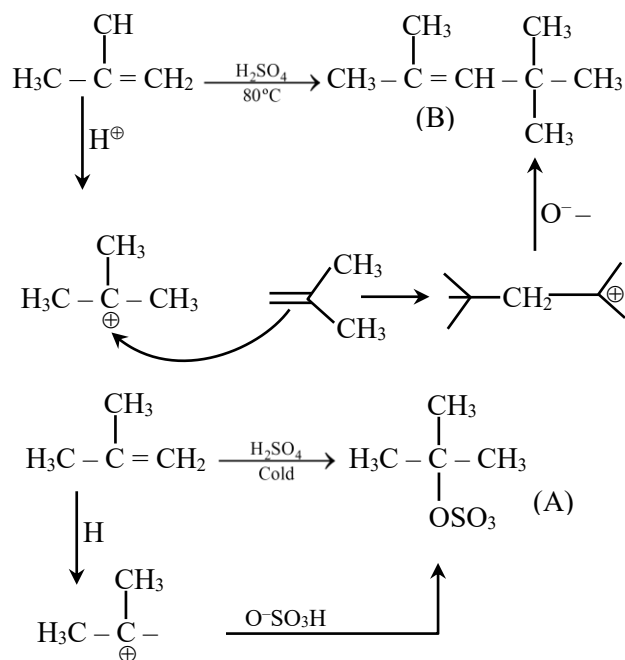
36. The major products 'A' and 'B', respectively, are



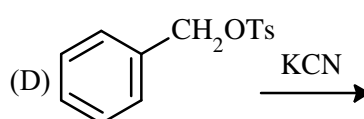
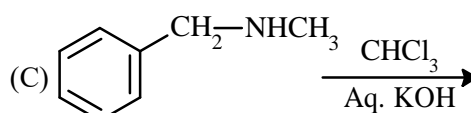
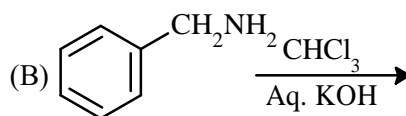
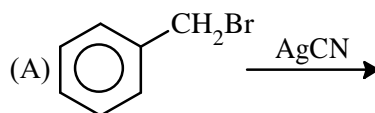
Official Ans. by NTA (1)

Allen Ans. (1)

Sol.



37. Benzyl isocyanide can be obtained by :



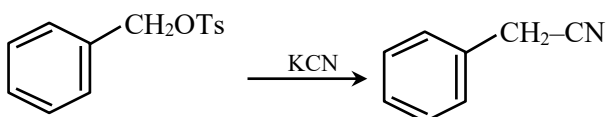
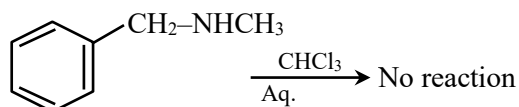
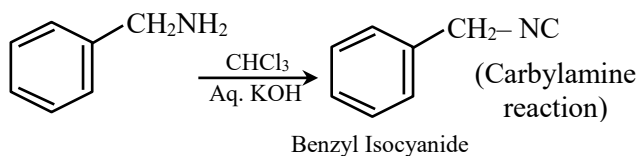
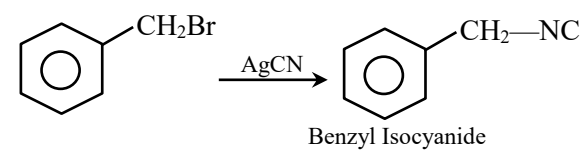
Choose the correct answer from the options given below :

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

Official Ans. by NTA (3)

Allen Ans. (3)

Sol.



38. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : In expensive scientific instruments, silica gel is kept in watch-glasses or in semipermeable membrane bags.

Reason (R) : Silica gel adsorbs moisture from air via adsorption, thus protects the instrument from water corrosion (rusting) and / or prevents malfunctioning.

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

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

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Silica gel prevents water corrosion (rusting) and instrument malfunction by adsorbing moisture from the air.

39. Match List I with List II

List I		List II	
A	$\text{C}_6\text{H}_5\text{Cl} + \text{CH}_3\text{Cl} \xrightarrow{\text{Na}} \text{C}_6\text{H}_5\text{CH}_3$	I	Fitting reaction
B	$\text{C}_6\text{H}_5\text{Cl} + 2\text{Na} \rightarrow \text{C}_6\text{H}_5\text{C}_6\text{H}_5$	II	Wurtz Fitting reaction
C	$\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- \xrightarrow{\text{Cu}_2\text{Cl}_2} \text{C}_6\text{H}_5\text{Cl} + \text{N}_2$	III	Finkelstein reaction
D	$\text{C}_2\text{H}_5\text{Cl} + \text{NaI} \rightarrow \text{C}_2\text{H}_5\text{I} + \text{NaCl}$	IV	Sandmeyer reaction

(1) A – II, B – I, C – III, D – IV

(2) A – III, B – II, C – IV, D – I

(3) A – IV, B – II, C – III, D – I

(4) A – II, B – I, C – IV, D – III

Official Ans. by NTA (4)

Allen Ans. (4)

Sol.

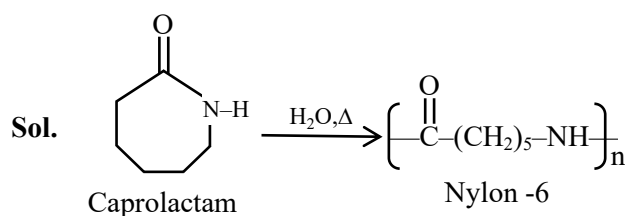
LIST-I		LIST-II
A.	$\text{C}_6\text{H}_5\text{Cl} + \text{CH}_3\text{Cl}$	Wurtz-fitting reaction
B.	$\text{C}_6\text{H}_5\text{Cl} + 2\text{Na} \rightarrow \text{C}_6\text{H}_5\text{C}_6\text{H}_5$	Fitting reaction
C.	$\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- \xrightarrow{\text{Cu}_2\text{Cl}_2} \text{C}_6\text{H}_5\text{Cl} + \text{N}_2$	Sandmeyer reaction
D.	$\text{C}_2\text{H}_5\text{Cl} + \text{NaI} \rightarrow \text{C}_2\text{H}_5\text{I} + \text{NaCl}$	Finkelstein reaction

40. Caprolactam when heated at high temperature in presence of water, gives

- (1) Teflon
- (2) Dacron
- (3) Nylon 6, 6
- (4) Nylon 6

Official Ans. by NTA (4)

Allen Ans. (4)



41. The alkaline earth metal sulphate(s) which are readily soluble in water is/are:

- (A) BeSO_4
(B) MgSO_4
(C) CaSO_4
(D) SrSO_4
(E) BaSO_4

Choose the **correct** answer from the options given below:

- (1) A only (2) B only
(3) A and B (4) B and C

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Due to high hydration energy Be^{2+} and Mg^{2+} , BeSO_4 and MgSO_4 are readily soluble in water.

42. Which of the following is correct order of ligand field strength?

- (1) $\text{CO} < \text{en} < \text{NH}_3 < \text{C}_2\text{O}_4^{2-} < \text{S}^{2-}$
(2) $\text{S}^{2-} < \text{C}_2\text{O}_4^{2-} < \text{NH}_3 < \text{en} < \text{CO}$
(3) $\text{NH}_3 < \text{en} < \text{CO} < \text{S}^{2-} < \text{C}_2\text{O}_4^{2-}$
(4) $\text{S}^{2-} < \text{NH}_3 < \text{en} < \text{CO} < \text{C}_2\text{O}_4^{2-}$

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. The increasing order of field strength of ligands (according to spectrochemical series)



43. Formation of photochemical smog involves the following reaction in which A, B and C are respectively.

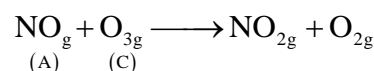
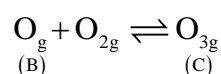
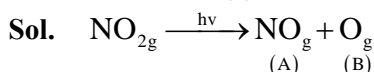
- (i) $\text{NO}_2 \xrightarrow{h\nu} \text{A} + \text{B}$
(ii) $\text{B} + \text{O}_2 \rightarrow \text{C}$
(iii) $\text{A} + \text{C} \rightarrow \text{NO}_2 + \text{O}_2$

Choose the correct answer from the options given below:

- (1) O, NO & NO_3^- (2) O, N_2O & NO
(3) N, O_2 & O_3 (4) NO , O & O_3

Official Ans. by NTA (4)

Allen Ans. (4)

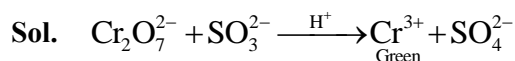


44. During the qualitative analysis of SO_3^{2-} using dilute H_2SO_4 , SO_2 gas is evolved which turns $\text{K}_2\text{Cr}_2\text{O}_7$ solution (acidified with dilute H_2SO_4):

- (1) Black (2) Red
(3) Green (4) Blue

Official Ans. by NTA (3)

Allen Ans. (3)



45. To inhibit the growth of tumours, identify the compounds used from the following:

- (A) EDTA
(B) Coordination Compounds of Pt
(C) D – Penicillamine
(D) Cis – Platin

Choose the correct answer from the option given below:

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

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Cis – Platin is used in chemotherapy to inhibits the growth of tumors. ($\text{cis}[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$)

46. In the wet tests for identification of various cations by precipitation, which transition element cation doesn't belong to group IV in qualitative inorganic analysis?

- (1) Fe^{3+}
(2) Zn^{2+}
(3) Co^{2+}
(4) Ni^{2+}

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $\text{Zn}^{2+}, \text{Co}^{2+}, \text{Ni}^{2+} = \text{IV}^{\text{th}}$ Group
 $\text{Fe}^{3+} = \text{III}^{\text{rd}}$ Group

47. Match List I with List II

LIST-I (molecules/ions)		LIST-II (No. of lone pairs of e ⁻ on central atom)	
(A)	IF ₇	I.	Three
(B)	ICl ₄ ⁻	II.	One
(C)	XeF ₆	III.	Two
(D)	XeF ₂	IV.	Zero

Choose the **correct** answer from the options given below:

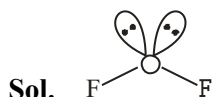
- (1) A – II, B – III, C – IV, D – I
 (2) A – IV, B – III, C – II, D – I
 (3) A – II, B – I, C – IV, D – III
 (4) A – IV, B – I, C – II, D – III

Official Ans. by NTA (2)**Allen Ans. (2)****Sol.** IF₇ zero lone pairICl₄⁻ two lone pairXeF₆ one lone pairXeF₂ three lone pair48. For OF₂ molecule consider the following:

- (A) Number of lone pairs on oxygen is 2.
 (B) FOF angle is less than 104.5°.
 (C) Oxidation state of O is –2.
 (D) Molecule is bent 'V' shaped.
 (E) Molecular geometry is linear.

Correct options are:

- (1) C, D, E only
 (2) B, E, A only
 (3) A, C, D only
 (4) A, B, D only

Official Ans. by NTA (4)**Allen Ans. (4)**

- Two lone pair one oxygen
- Molecule is 'v' shaped
- Bond angle is less than 104.5°(102°)
- O.S. of 'O' is +2

49. Lithium aluminium hydride can be prepared from the reaction of

- (1) LiCl and Al₂H₆
 (2) LiH and Al₂Cl₆
 (3) LiCl, Al and H₂
 (4) LiH and Al(OH)₃

Official Ans. by NTA (2)**Allen Ans. (2)****Sol.** 8LiH + Al₂Cl₆ → 2LiAlH₄ + 6LiCl

50. Match List – I with List – II

LIST-I (Atomic number)		LIST-II (Block of periodic table)	
(A)	37	I.	p-block
(B)	78	II.	d-block
(C)	52	III.	f-block
(D)	65	IV.	s-block

Choose the **correct** answer from the options given below:

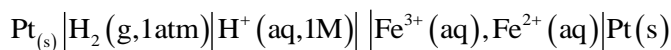
- (1) A – II, B – IV, C – I, D – III
 (2) A – I, B – III, C – IV, D – II
 (3) A – IV, B – III, C – II, D – I
 (4) A – IV, B – II, C – I, D – III

Official Ans. by NTA (4)**Allen Ans. (4)****Sol.**

Atomic number	Block
37 (K)	s-block
78 (Pt)	d-block
52 (Te)	p-block
65 (Tb)	f-block

SECTION-B

51. Consider the cell



When the potential of the cell is 0.712 V at 298 K, the ratio $\frac{[\text{Fe}^{2+}]}{[\text{Fe}^{3+}]}$ is _____.

(Nearest integer)

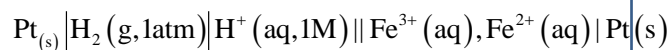
Given: $\text{Fe}^{3+} + e^- = \text{Fe}^{2+}$, $E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} | \text{Pt} = 0.771$

$$\frac{2.303RT}{F} = 0.06 \text{ V}$$

Official Ans. by NTA (10)

Allen Ans. (10)

Sol



at anode $\text{H}_2 \longrightarrow 2\text{H}^+ + 2e^-$

At cathode $\text{Fe}^{3+}_{\text{aq}} + e^- \longrightarrow \text{Fe}^{2+}_{\text{aq}}$

$$E^\circ = E^\circ_{\text{H}_2/\text{H}^+} + E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 0.771 \text{ V}$$

$$E = E^\circ - \frac{0.06}{1} \log \frac{\text{Fe}^{2+}}{\text{Fe}^{3+}}$$

$$0.712 = (0 + 0.771) - \frac{0.06}{1} \log \frac{\text{Fe}^{2+}}{\text{Fe}^{3+}}$$

$$\log \frac{\text{Fe}^{2+}}{\text{Fe}^{3+}} = \frac{0.059}{0.06} \approx 1$$

$$\boxed{\frac{\text{Fe}^{2+}}{\text{Fe}^{3+}} = 10}$$

52. A 300 mL bottle of soft drink has 0.2 M CO_2 dissolved in it. Assuming CO_2 behaves as an ideal gas, the volume of the dissolved CO_2 at STP is _____ mL. (Nearest integer)

Given: At STP, molar volume of an ideal gas is 22.7 L mol^{-1}

Official Ans. by NTA (1362)

Allen Ans. (1362 ml)

Sol. Mole of $\text{CO}_2 = 0.2 \text{ M} \times (300 \times 10^{-3}) \text{ L}$
 $= 0.06 \text{ Mole}$
 Volume of 0.06 mole CO_2 at S.T.P
 $= 0.06 \times 22.7$
 $= 1.362 \text{ L}$

53. A solution containing 2 g of a non-volatile solute in 20 g of water boils at 373.52 K. The molecular mass of the solute is _____ g mol^{-1} . (Nearest integer)

Given, water boils at 373 K, K_b for water $= 0.52 \text{ K kg mol}^{-1}$

Official Ans. by NTA (100g)

Allen Ans. (100g)

Sol. $\Delta T_b = 373.52 - 373$
 $= 0.52$

$$\Delta T_b = K_b \cdot m$$

$$0.52 = 0.52 \times \frac{2}{\text{Molar Mass}} \times \frac{1}{20 \times 10^{-3}}$$

Molar Mass = 100g/mol

54. If compound A reacts with B following first order kinetics with rate constant $2.011 \times 10^{-3} \text{ s}^{-1}$. The time taken by A (in seconds) to reduce from 7 g to 2 g will be _____. (Nearest Integer)

[$\log 5 = 0.698, \log 7 = 0.845, \log 2 = 0.301$]

Official Ans. by NTA (623)

Allen Ans. (623)

Sol. $A + B \rightarrow P$

$t = 0$ 7g

$t = t$ 2g

at constant volume

$$t = \frac{2.303}{K} \log \frac{[A]_0}{[A]_t}$$

$$= \frac{2.303}{2.011 \times 10^{-3}} \log \frac{7}{2}$$

$$= \frac{2.303 \times 0.544}{2.011 \times 10^{-3}}$$

$$= 622.989$$

$$\approx 623$$

55. The energy of one mole of photons of radiation of frequency 2×10^{12} Hz in J mol^{-1} is _____. (Nearest integer)

(Given: $h = 6.626 \times 10^{-34}$ Js

$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$)

Official Ans. by NTA (798)

Allen Ans. (798)

Sol. For one photon $E = h\nu$

For one mole photon,

$$E = 6.023 \times 10^{23} \times 6.626 \times 10^{-34} \times 2 \times 10^{12} \\ = 798.16 \text{ J} \\ \approx 798 \text{ J}$$

56. The number of electrons involved in the reduction of permanganate to manganese dioxide in acidic medium is _____.

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $\text{MnO}_4^- + 4\text{H}^+ + 3\text{e}^- \longrightarrow \text{MnO}_2 + 2\text{H}_2\text{O}$

57. When 2 litre of ideal gas expands isothermally into vacuum to a total volume of 6 litre, the change in internal energy is _____ J. (Nearest integer)

Official Ans. by NTA (0)

Allen Ans. (0)

Sol. For ideal gas $U = f(T)$

and for isothermal process, $\Delta U = 0$

58. 600 mL of 0.01M HCl is mixed with 400 mL of 0.01 M H_2SO_4 . The pH of the mixture is _____ $\times 10^{-2}$. (Nearest integer)

[Given $\log 2 = 0.30$, $\log 3 = 0.48$

$\log 5 = 0.69$ $\log 7 = 0.84$

$\log 11 = 1.04$]

Official Ans. by NTA (186)

Allen Ans. (186)

Sol. Total milimoles of $\text{H}^+ = (600 \times 0.01) + (400 \times 0.01 \times 2)$
 $= 14$

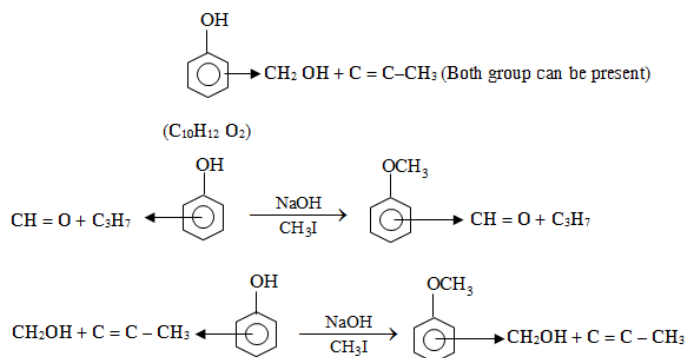
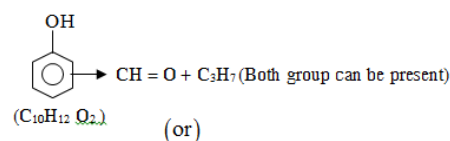
$$[\text{H}^+] = \frac{14}{1000} = 14 \times 10^{-3}$$

$$\text{pH} = 3 - \log 14 \\ = 1.86 \\ = 186 \times 10^{-2}$$

59. A trisubstituted compound 'A', $\text{C}_{10}\text{H}_{12}\text{O}_2$ gives neutral FeCl_3 test positive. Treatment of compound 'A' with NaOH and CH_3Br gives $\text{C}_{11}\text{H}_{14}\text{O}_2$, with hydroiodic acid gives methyl iodide and with hot conc. NaOH gives a compound B, $\text{C}_{10}\text{H}_{12}\text{O}_2$. Compound 'A' also decolorises alkaline KMnO_4 . The number of π bond/s present in the compound 'A' is _____.

59 Official Ans. by NTA (4)

Allen Ans. (4)



60. Some amount of dichloromethane (CH_2Cl_2) is added to 671.141 mL of chloroform (CHCl_3) to prepare 2.6×10^{-3} M solution of CH_2Cl_2 (DCM). The concentration of DCM is _____ ppm (by mass).

Given: Atomic mass : C = 12; H : 1; Cl = 35.5
 density of $\text{CHCl}_3 = 1.49 \text{ g cm}^{-3}$

Official Ans. by NTA (221)

Allen Ans. (148)

Sol. Molarity = $\frac{\text{mole}}{\text{volume}}$

$$2.6 \times 10^{-3} = \frac{x / 85}{0.67141}$$

$$x = 0.148 \text{ g}$$

$$\text{conc. of DCM in ppm} = \frac{0.148}{1.49 \times 671.141} \times 10^6 \\ = 148 \text{ ppm}$$