

CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

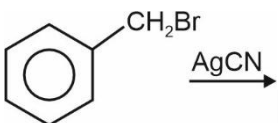
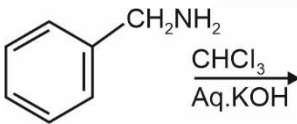
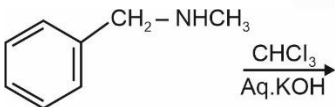
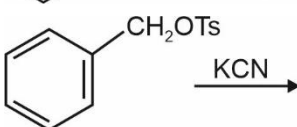
31. During the qualitative analysis of SO_3^{2-} using dilute H_2SO_4 , SO_2 gas is evolved which turns $\text{K}_2\text{Cr}_2\text{O}_7$ solution (acidified with dilute H_2SO_4) :

- (1) red (2) black
(3) blue (4) green

Answer (4)

Sol. $\text{SO}_2 + \text{Cr}_2\text{O}_7^{2-} \xrightarrow{\text{(green)}} \text{Cr}^{3+} + \text{SO}_4^{2-}$

32. Benzyl isocyanide can be obtained by:

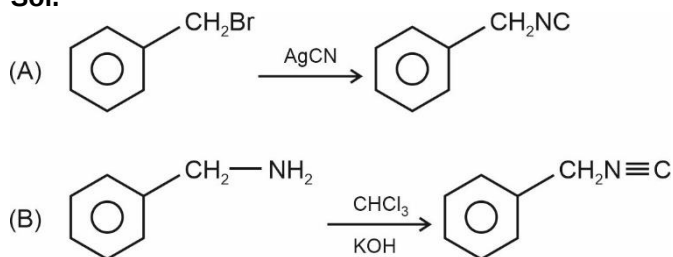
- A.  $\xrightarrow{\text{AgCN}}$
B.  $\xrightarrow[\text{Aq. KOH}]{\text{CHCl}_3}$
C.  $\xrightarrow[\text{Aq. KOH}]{\text{CHCl}_3}$
D.  $\xrightarrow{\text{KCN}}$

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

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

Answer (3)

Sol.



33. 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) Co^{2+} (2) Zn^{2+}
(3) Ni^{2+} (4) Fe^{3+}

Answer (4)

Sol. Fe^{3+} belongs to IIIrd group

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

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

Answer (3)

Sol. Ranitidine is not an antacid.

35. 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) B only (2) A and B
(3) B and C (4) A only

Answer (2)

Sol. BeSO_4 and MgSO_4 are readily soluble in water.

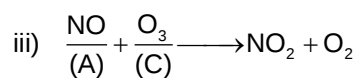
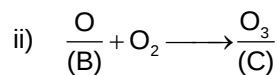
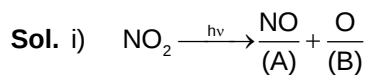
36. Formation of photochemical smog involves the following reaction in which A, B and C are respectively.

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

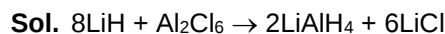
Answer (2)



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

- (1) LiH and $\text{Al}(\text{OH})_3$ (2) LiCl and Al_2H_6
 (3) LiCl, Al and H_2 (4) LiH and Al_2Cl_6

Answer (4)



38. For OF_2 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

Answer (4)

Sol.

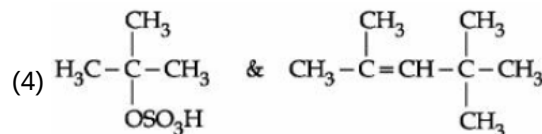
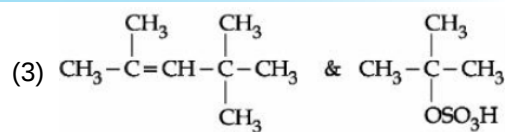
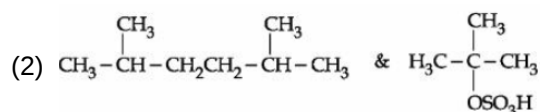
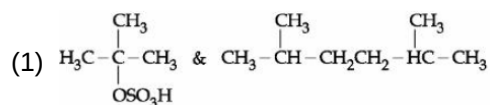
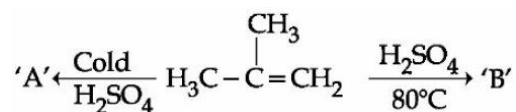


A : No. of lone pairs on oxygen = 2

B : ($\theta < \text{Bond angle in } \text{H}_2\text{O} (104.5^\circ)$)

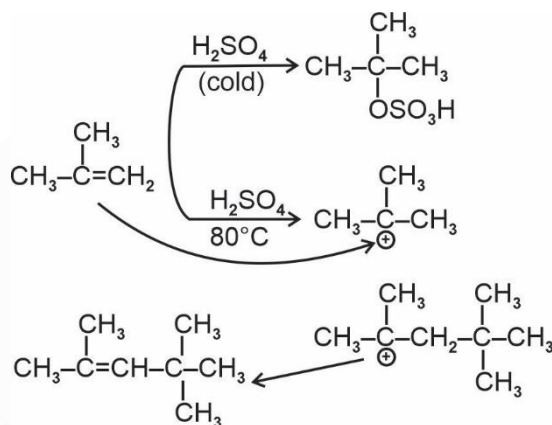
D : molecule is bent "v" shaped

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



Answer (4)

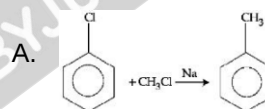
Sol.



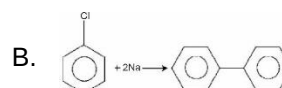
40. Match List I with List II

List I

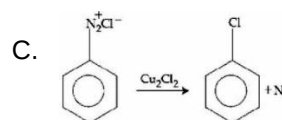
List II



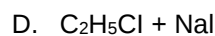
I. Fittig reaction



II. Wurtz Fittig reaction



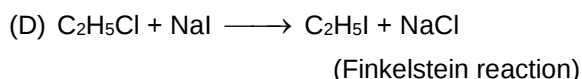
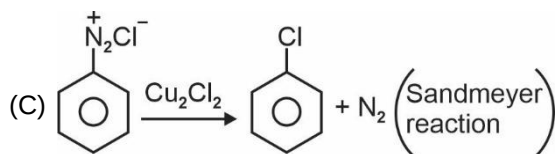
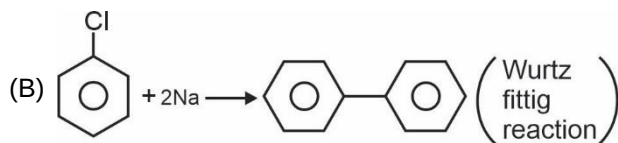
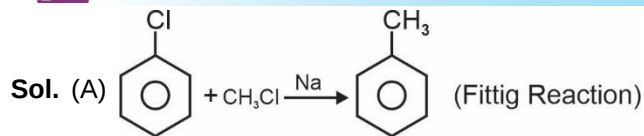
III. Finkelstein reaction



Choose the correct answer from the options given below:

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

Answer (2)



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

Answer (4)

Sol. Assertion is correct and Reason is correct explanation of Assertion.

Silica gel adsorbs moisture and thus protects the instrument from water corrosion (rusting) and prevents malfunctioning

42. 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) C and D only
- (2) B and D only
- (3) A and B only
- (4) A and C only

Answer (2)

Sol. Cis-platin is $[Pt(NH_3)_2Cl_2]$; cis platin and other complexes of Pt are used to inhibit the growth of tumours.

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

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

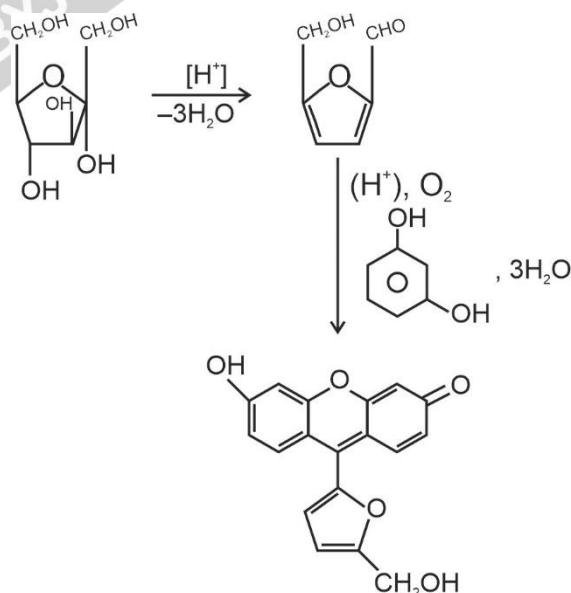
Reason (R) : Ketoses undergo β -elimination followed by formation of furfural.

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

- (1) **(A)** is 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)**

Answer (1)

Sol.

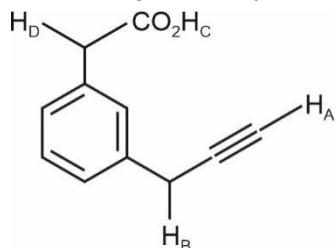


This test relies on the principle that, when heated, ketoses are more rapidly dehydrated than Aldoses.

Ketose $\rightarrow$ Red color formed immediately

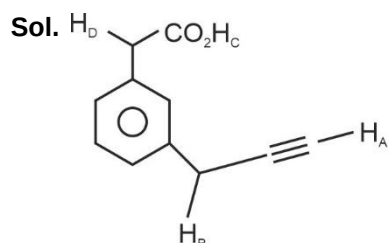
Aldose $\rightarrow$ light pink color formed slowly

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



- (1) $H_C > H_A > H_D > H_B$ (2) $H_D > H_C > H_B > H_A$
 (3) $H_C > H_D > H_B > H_A$ (4) $H_C > H_D > H_A > H_B$

Answer (4)



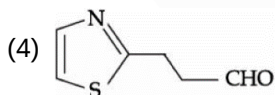
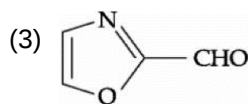
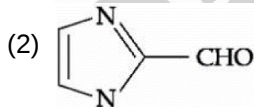
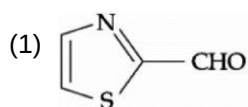
$H_C > H_D > H_A > H_B$

H_C is hydrogen of carboxylic acid

H_D removal will lead to stable carbanion.

45. 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 prussian blue.



Answer (4)

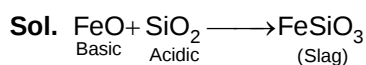
Sol. Fehling solution is not given by aromatic aldehydes.

1, 2, 3 are aromatic aldehydes

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

- (1) Decrease the temperature needed for roasting of Cu_2S
 (2) Remove calcium as $CaSiO_3$
 (3) Separate CuO as $CuSiO_3$
 (4) Remove FeO as $FeSiO_3$

Answer (4)



47. 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-IV, B-III, C-II, D-I
 (3) A-IV, B-II, C-I, D-III (4) A-I, B-III, C-IV, D-II

Answer (3)

Sol.

37 – s-Block

78 – d-Block

52 – p-Block

65 – f-Block

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

- (1) $NH_3 < en < CO < S^{2-} < C_2O_4^{2-}$
 (2) $S^{2-} < NH_3 < en < CO < C_2O_4^{2-}$
 (3) $S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$
 (4) $CO < en < NH_3 < C_2O_4^{2-} < S^{2-}$

Answer (3)

Sol. Ligand field strength

$S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$

49. 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-I, C-II, D-III
(3) A-II, B-I, C-IV, D-III (4) A-IV, B-III, C-II, D-I

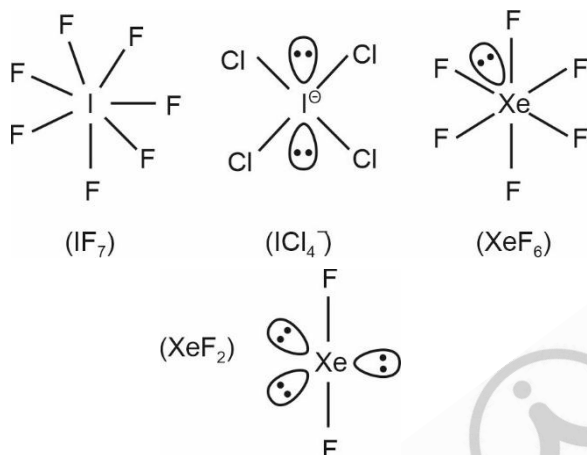
Answer (4)

Sol. (A) IF_7 – 0 lone pairs

(B) ICl_4^- – 2 lone pairs

(C) XeF_6 – 1 lone pair

(D) XeF_2 – 3 lone pairs

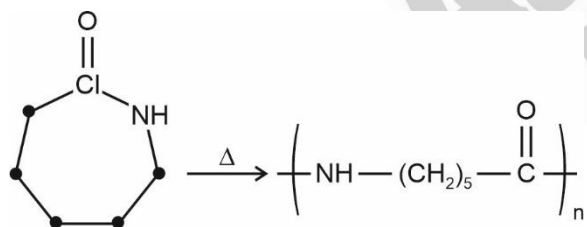


50. Caprolactam when heated at high temperature in presence of water, gives

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

Answer (2)

Sol. Caprolactam $\xrightarrow{\Delta}$ Nylon – 6



SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, -00.33, -00.30, 30.27, -27.30) using the mouse andw the on-screen virtual numeric keypad in the place designated to enter the answer.

51. 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 K kg mol⁻¹

Answer (100)

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

$$(0.52) = (0.52) (m)$$

$$m = 1 = \frac{2(1000)}{(mw)(20)}$$

$$mw = 100$$

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

Answer (1362)

Sol. Moles = 0.3×0.2

$$\begin{aligned} \text{Volume at STP} &= 0.3 \times 0.2 \times 22.7 \\ &= 1.362 \text{ litre} \\ &= 1362 \text{ mL} \end{aligned}$$

53. 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

$N_A = 6.022 \times 10^{23}$ mol⁻¹]

Answer (798)

Sol. $E = nh\nu$

$$\begin{aligned} &= (6.022 \times 10^{23}) (6.626 \times 10^{-34}) \times (2 \times 10^{12}) \\ &= 798.03 \text{ J} \\ &\approx 798 \text{ J} \end{aligned}$$

54. 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 $\text{CHCl}_3 = 1.49$ g cm⁻³

Answer (148)

Sol. Mass of $\text{CHCl}_3 = 671.141 \times 1.49$

$$= 1000 \text{ gm}$$

$$2.6 \times 10^{-3} = \frac{\text{moles of } \text{CH}_2\text{Cl}_2}{0.671141}$$

$$\Rightarrow \text{moles of CH}_2\text{Cl}_2 = 1.74496 \times 10^{-3}$$

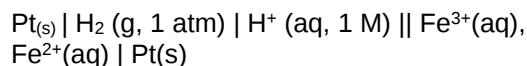
$$\text{mass of CH}_2\text{Cl}_2 = 148.32 \times 10^{-3} \text{ gm}$$

$$\text{Composition of CH}_2\text{Cl}_2 = \frac{148.32 \times 10^{-3}}{1000} \times 10^6$$

$$= 148.32 \text{ ppm}$$

$$\approx 148$$

55. Consider the cell



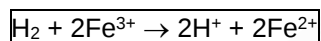
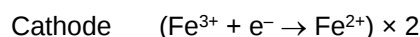
When the potential of the cell is 0.712 V at 298 K, the ratio $[\text{Fe}^{2+}] / [\text{Fe}^{3+}]$ is _____.

(Nearest integer)

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

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

Answer (10)



$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.059}{2} \log \left(\frac{[\text{Fe}^{2+}]^2}{[\text{Fe}^{3+}]} \right)$$

$$0.712 = 0.771 - 0.059 \log \frac{[\text{Fe}^{2+}]}{[\text{Fe}^{3+}]}$$

$$-0.059 = -0.059 \log \frac{[\text{Fe}^{2+}]}{[\text{Fe}^{3+}]}$$

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

56. 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)

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

Answer (623)

Sol. $t = \frac{2.303}{k} \log \frac{C_0}{C_t}$

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

$$= \frac{2.303 \times 10^3}{2.011} (.845 - .301)$$

$$= 622.99$$

$$\approx 623 \text{ sec.}$$

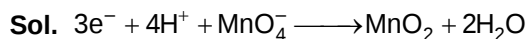
57. When 2 litre of ideal gas expands isothermally into vacuum to a total volume of 6 litre, the change in internal energy is _____ J. (Nearest integer)

Answer (0)

Sol. For isothermal process of an ideal gas; $\Delta E = 0$

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

Answer (3)



59. 600 mL of 0.01 M HCl is mixed with 400 mL of 0.01 M H_2SO_4 . The pH of the mixture is _____ $\times 10^{-2}$. (Nearest integer)

$$[\text{Given } \log 2 = 0.30]$$

$$\log 3 = 0.48$$

$$\log 5 = 0.69$$

$$\log 7 = 0.84$$

$$\log 11 = 1.04]$$

Answer (186)

Sol. $[\text{H}^+] = \frac{6+8}{1000} = 14 \times 10^{-3}$

$$\text{pH} = 3 - \log 14$$

$$= 3 - .3 - .84$$

$$= 1.86 = 186 \times 10^{-2}$$

60. 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 _____.

Answer (4)

Sol. A : $\text{C}_{10}\text{H}_{12}\text{O}_2$

$$\text{DU of A} = \frac{22-12}{2} = 5$$

1 DU is due to Ring (Benzene ring)

4 π -bonds will be there

(3 π -bonds in ring and 1 π -bond outside ring) as it decolorises alkaline KMnO_4 .