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JEE (MAIN) 2025

QUESTIONS & SOLUTIONS

SHIFT-1

DATE & DAY: 29th January 2025 & Wednesday

PAPER-1

Duration: 3 Hrs.

Time: 09:00 – 12:00 IST

SUBJECT: CHEMISTRY

Selections in JEE (Advanced)/
IIT-JEE Since 2002

52395

Selections in JEE (Main)/
AIEEE Since 2009

257576

Selections in NEET (UG)/
AIPMT/AIIMS Since 2012

22494

Admission Open for 2025-26

Target: JEE (Advanced) | JEE (Main) | NEET (UG) | PCCP (Class V to X)

100% Scholarship on the basis of Class 10th & 12th
& JEE (Main) 2025 %ile/ AIR



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TARGET: JEE (Adv.) 2024



AIR
31

JEE (Adv.) 2024

ISHAAN GUPTA

SCHOLARSHIP UPTO **100%**

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VISHESH COURSE

For 12th Passed Students

Course Features*

- ▶ Course Duration: **42 Weeks**
- ▶ Total No. of Lectures: **630** (P:210 | C: 210 | M: 210)
- ▶ Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- ▶ Classroom Teaching Hours.: **945 Hrs.**
- ▶ Testing Duration: **51 Hrs.**
- ▶ Total Academic Hours.: **996 Hrs.**

*Tentative



CLASS STARTS
7th April 2025

TARGET: JEE (Main) 2026

ABHYAAS COURSE

For 12th Passed Students

Course Features*

- ▶ Course Duration: **39 Weeks**
- ▶ Total No. of Lectures: **577** (P: 192 | C: 193 | M: 192)
- ▶ Duration of One Lecture: **1.5 Hrs.** (90 Minutes)
- ▶ Classroom Teaching Hours.: **865 Hrs.**
- ▶ Testing Duration: **36 Hrs.**
- ▶ Total Academic Hours.: **901 Hrs.**

*Tentative

AIR
102

JEE (MAIN) 2024

RITAM BANERJEE



SCHOLARSHIP UPTO **100%**

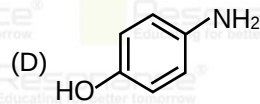
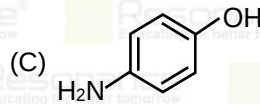
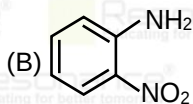
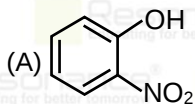
on the basis of Class 10th & 12th &
JEE (Main) 2025 %ile/ AIR



CLASS STARTS
7th April 2025

PART : CHEMISTRY

51. The steam volatile compounds among the following are:



Choose the correct answer from the options given below:

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

Ans. (1)

Sol. Due to intra molecular H-bonding in A & B.

52. The standard reduction potential values of some of the p-block ions are given below. Predict the one with the strongest oxidising capacity.

(1) $E_{\text{Sn}^{4+}/\text{Sn}^{2+}}^- = +1.15\text{V}$

(2) $E_{\text{Pb}^{4+}/\text{Pb}^{2+}}^- = +1.67\text{V}$

(3) $E_{\text{Al}^{3+}/\text{Al}}^- = -1.66\text{V}$

(4) $E_{\text{Tl}^{3+}/\text{Tl}}^- = +1.26\text{V}$

Ans. (2)

Sol. Oxidising agent is itself reduced and as S.R.P↑; Tendency to get reduced↑; Tendency of oxidising behaviour↑. Hence Pb^{4+} is best Oxidising agent.

53. Match List - I with List - II.

List - I (Carbohydrate)		List - II (Linkage Source)	
(A)	Amylose	(I)	$\beta\text{-C}_1\text{-C}_4$, plant
(B)	Cellulose	(II)	$\alpha\text{-C}_1\text{-C}_4$, animal
(C)	Glycogen	(III)	$\alpha\text{-C}_1\text{-C}_4$, $\alpha\text{-C}_1\text{-C}_6$, plant
(D)	Amylopectin	(IV)	$\alpha\text{-C}_1\text{-C}_4$, plant

Choose the correct answer from the options given below:

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

Ans. (1)

Sol. Conceptual.

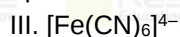
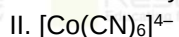
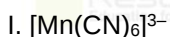
54. The correct options with order of melting points of the pairs (Mn, Fe), (Tc, Ru) and (Re, Os) is :

- (1) $\text{Mn} < \text{Fe}$, $\text{Tc} < \text{Ru}$ and $\text{Os} < \text{Re}$ (2) $\text{Fe} < \text{Mn}$, $\text{Ru} < \text{Tc}$ and $\text{Os} < \text{Re}$
 (3) $\text{Mn} < \text{Fe}$, $\text{Tc} < \text{Ru}$ and $\text{Re} < \text{Os}$ (4) $\text{Fe} < \text{Mn}$, $\text{Ru} < \text{Tc}$ and $\text{Re} < \text{Os}$

Ans. (1)

Sol.

55. The correct increasing order of stability of the complexes based on Δ_0 value is :



(1) $\text{I} < \text{II} < \text{IV} < \text{III}$

(2) $\text{III} < \text{II} < \text{IV} < \text{I}$

(3) $\text{IV} < \text{III} < \text{II} < \text{I}$

(4) $\text{II} < \text{III} < \text{I} < \text{IV}$

Ans. (NTA ans. 1, Reso ans. Bonus)

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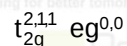
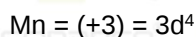
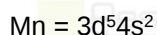
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Sol. As C.F.S-E becomes more '-Ve' stability increases.



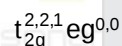
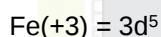
$$\text{O.N.} = +3$$



$$\text{C.F.S.E} = -0.16\Delta_0$$



$$\text{O.N} = +3$$

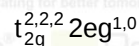
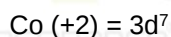
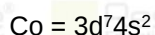


$$\text{C.F.S.E} = -2.0\Delta_0$$

Hence (1) is correct.



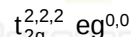
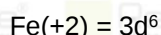
$$\text{O.N.} = +2$$



$$\text{C.F.S.E} = -1.8\Delta_0$$

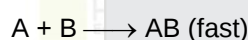
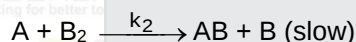
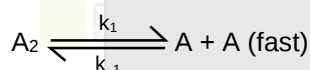


$$\text{Fe} = +2$$



$$\text{C.F.S.E} = -2.4\Delta_0$$

56. The reaction $\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB}$ follows the mechanism



The overall order of the reaction is :

(1) 3

(2) 2

(3) 2.5

(4) 1.5

Ans. (4)

Sol. A & B are intermediates from r.d.s.

$$r = k[\text{A}] [\text{B}_2]$$

...(1)

$$K_{eq} = \frac{k_1}{k_{-1}} = \frac{[\text{A}]^2}{[\text{A}_2]}$$

$$\text{or } [\text{A}] = \sqrt{k_{eq}} [\text{A}_2]^{\frac{1}{2}} \quad \dots(2)$$

Substituting value of [A] from (2) to (1)

$$r = k \sqrt{k_{eq}} [\text{A}_2]^{\frac{1}{2}} [\text{B}_2]$$

$$r = k' [\text{A}_2]^{\frac{1}{2}} [\text{B}_2]$$

$$\text{order} = 1.5$$

57. The molar conductivity of a weak electrolyte when plotted against the square root of its concentration, which of the following is expected to be observed?

(1) A small increase in molar conductivity is observed at infinite dilution.

(2) Molar conductivity increases sharply with increase in concentration.

(3) Molar conductivity decreases sharply with increase in concentration.

(4) A small decrease in molar conductivity is observed at infinite dilution.

Ans. (3)

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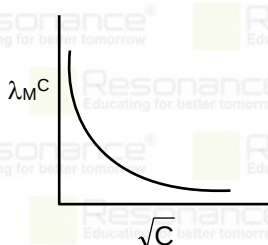
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Sol. For weak electrolyte



58. For a $\text{Mg} | \text{Mg}^{2+}(\text{aq}) || \text{Ag}^{+}(\text{aq}) | \text{Ag}$ the correct Nernst Equation is :

(1) $E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{RT}{2F} \ln \frac{[\text{Mg}^{2+}]}{[\text{Ag}^{+}]}$

(2) $E_{\text{cell}} = E_{\text{cell}}^{\circ} + \frac{RT}{2F} \ln \frac{[\text{Ag}^{+}]^2}{[\text{Mg}^{2+}]}$

(3) $E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{RT}{2F} \ln \frac{[\text{Ag}^{+}]}{[\text{Mg}^{2+}]}$

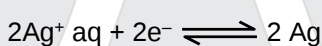
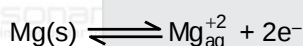
(4) $E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{RT}{2F} \ln \frac{[\text{Ag}^{+}]^2}{[\text{Mg}^{2+}]}$

Ans. (2)

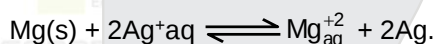
Sol. $\text{Mg} | \text{Mg}^{2+}(\text{aq}) || \text{Ag}^{+}(\text{aq}) | \text{Ag}$

Anode

Cathode



over all cell reaction



Applying nearest equation.

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{RT}{2F} \ln \frac{[\text{Mg}^{2+}]}{[\text{Ag}^{+}]^2}$$

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} + \frac{RT}{2F} \ln \frac{[\text{Ag}^{+}]^2}{[\text{Mg}^{2+}]}$$

59. If a_0 is denoted as the Bohr radius of hydrogen atom, then what is the de-Broglie wavelength (λ) of the electron present in the second orbit of hydrogen atom? [n : any integer]

(1) $\frac{4\pi a_0}{n}$

(2) $\frac{2a_0}{n\pi}$

(3) $\frac{8\pi a_0}{n}$

(4) $\frac{4n}{\pi a_0}$

Ans. (NTA ans. 3, Reso ans. Bonus)

Sol. For H atom $z = 1$; $a_0 = 0.529 \text{ \AA}$; $n = 2$

$$2\pi r_2 = 2\lambda$$

$$\Rightarrow 2\pi \times \frac{0.529 \times 4}{1} = 2\lambda$$

$$2\pi \times 4a_0 = 2\lambda$$

$$\lambda = \frac{8\pi a_0}{2}$$

Ans. (1) for $n = 1$

Ans. (3) for $n = 2$

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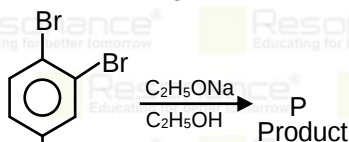
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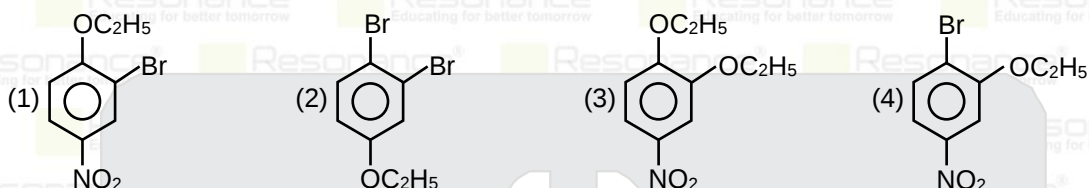
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60. In the following substitution reaction :



Product 'P' formed is:



Ans. (1)

Sol. $\text{S}_{\text{N}}2\text{-Ar}$ mechanism.

61. Match List-I with List-II.

List - I (Complex)	List - II (Hybridisation & Magnetic characters)
(A) $[\text{MnBr}_4]^{2-}$	(I) d^2sp^3 & diamagnetic
(B) $[\text{FeF}_6]^{3-}$	(II) sp^3d^2 & paramagnetic
(C) $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$	(III) sp^3 & diamagnetic
(D) $[\text{Ni}(\text{CO})_4]$	(IV) sp^3 & paramagnetic

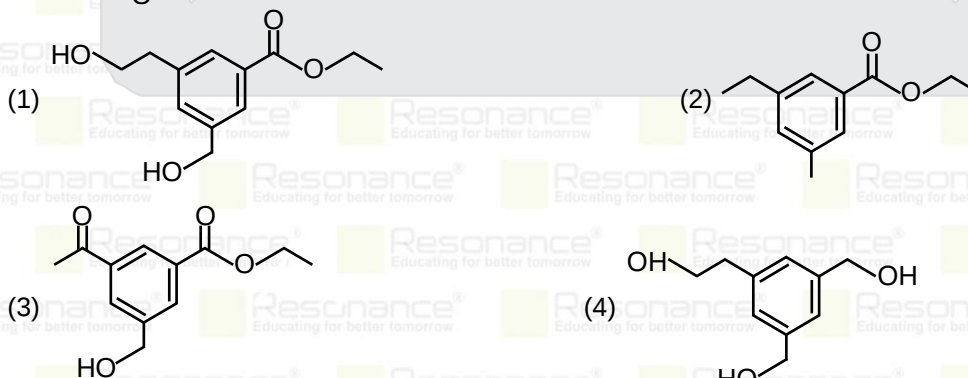
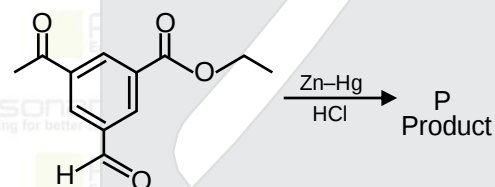
Choose the correct answer from the options given below:

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

Ans. (2)

Sol.

62. The product (P) formed in the following reaction is :



Ans. (2)

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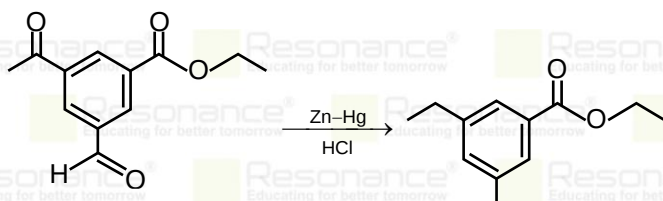
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Sol.



(Clemmensen reduction) It is reduced carbonyl compounds ($>C=O$) into ($>CH_2$).

63. Match List - I with List - II.

List - I (Structure)		List - II (IUPAC Name)	
(A)	$H_3C-CH_2-\underset{\substack{ \\ C_2H_5}}{CH}-CH_2-\underset{\substack{ \\ CH_3}}{CH}-C_2H_5$	(I)	4-Methylpent-1-ene
(B)	$(CH_3)_2C(C_3H_7)_2$	(II)	3-Ethyl-5-methylheptane
(C)		(III)	4, 4-Dimethylheptane
(D)		(IV)	2-Methyl-1,3-pentadiene

Choose the correct answer from the options given below:

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

Ans. (4)

Sol. Conceptual.

64. Given below are two statements:

Statement (I) : The radii of isoelectronic species increases in the order.

$Mg^{2+} < Na^+ < F^- < O^{2-}$.

Statement (II) : The magnitude of electron gain enthalpy of halogen decreases in the order.

$Cl > F > Br > I$.

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 incorrect.
 (2) Both statement I and Statement II are correct.
 (3) Statement I is incorrect but Statement II is correct.
 (4) Statement I is correct but Statement II is incorrect

Ans. (2)

Sol.

	Mg^{2+}	Na^+	F^-	O^{2-}
e	10	10	10	10
p	12	11	9	8

For isoelectronic species as Nuclear charge decreases, size increases.

Element	CL	F	Br	I
$ \Delta H_{eg} $ kJ/mol	349	328	325	295

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65. 1.24 g of AX_2 (molar mass 124 g mol^{-1}) is dissolved in 1 kg of water to form a solution with boiling point of 100.0156°C , while 25.4 g of AY_2 (molar mass 250 g mol^{-1}) in 2 kg of water constitutes a solution with a boiling point of 100.0260°C .

$$K_b(\text{H}_2\text{O}) = 0.52 \text{ K kg mol}^{-1}$$

Which of the following is correct?

- (1) AX_2 is completely unionised while AY_2 is fully ionised.
- (2) AX_2 and AY_2 (both) are completely unionised.
- (3) AX_2 is fully ionised while AY_2 is completely unionised.
- (4) AX_2 and AY_2 (both) are fully ionised.

Ans. (3)

Sol. For solution of AX_2 in water

$$\text{Molarity} = 10^{-2}$$

$$(\Delta T_b)_{\text{obs}} = 0.0156$$

$$(\Delta T_f)_{\text{obs}} = i \times K_b \times \text{molarity}$$

$$0.0156 = i \times 0.52 \times 10^{-2}$$

$$i = 3$$

Hence AX_2 is 100% ionised.

For solution of AY_2 in water

$$\text{Molarity} = \frac{25.4/250}{2} = 0.0508$$

$$(\Delta T_b)_{\text{obs}} = 0.0260 = i \times K_b \times \text{molarity}$$

$$\frac{0.0260}{0.52 \times 0.0508} = i = 1$$

completely unionised

66. An element 'E' has the ionisation enthalpy value of 374 kJ mol^{-1} . 'E' reacts with elements A, B, C and D with electron gain enthalpy values of -328 , -349 , -325 and -295 kJ mol^{-1} , respectively. The correct order of the products EA, EB, EC and ED in terms of ionic character is:

- (1) $EA > EB > EC > ED$ (2) $ED > EC > EB > EA$ (3) $EB > EA > EC > ED$ (4) $ED > EC > EA > EB$

Ans. (NTA ans. (3), Reso ans. (BONUS).)

Sol. E is metal and A, B, C & D are non-metal.

For non metals as ΔH_{eg} becomes more negative more metallic character also increases.

67. 500 J of energy is transferred as heat to 0.5 mol of argon gas at 298 K and 1.00 atm. The final temperature and the change in internal energy respectively are:

- (1) 368 K and 500 J (2) 348 K and 300 J (3) 378 K and 300 J (4) 378 K and 500 J

Ans. NTA ans. (4), Reso ans. (2)

68. At temperature T, compound $AB_{2(g)}$ dissociates as $AB_{2(g)} \rightleftharpoons AB_{(g)} + \frac{1}{2} B_{2(g)}$ having degree of dissociation x (small compared to unity). The correct expression for x in terms of K_p and p is:

- (1) $\sqrt[3]{\frac{2K_p}{p}}$ (2) $\sqrt{K_p}$ (3) $\sqrt[4]{\frac{2K_p}{p}}$ (4) $\sqrt[3]{\frac{2K_p^2}{p}}$

Ans. (4)

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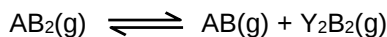
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Sol.



Initial moles	1	0	0
Moles at equ.	$1-x$	x	$\frac{x}{2}$; $\Sigma n = 1 + \frac{x}{2}$
M.F.	$\frac{1-x}{1+\frac{x}{2}}$	$\frac{x}{1+\frac{x}{2}}$	$\frac{x}{2(1+\frac{x}{2})}$
M.F.	1	x	$\frac{x}{2}$
P.P	p	p_x	$p \frac{1}{2}$

$$K_p = \frac{p_x \times \sqrt{p_x}}{\sqrt{2p}} = \frac{\sqrt{p} x^3}{\sqrt{2}}$$

$$x^3 = \frac{\sqrt{2} K_p}{\sqrt{p}}$$

$$x^3 = \frac{2K_p^2}{p}$$

$$x = \sqrt[3]{\frac{2K_p^2}{p}}$$

69.

Choose the correct statements.

- (A) Weight of a substance is the amount of matter present in it.
 (B) Mass is the force exerted by gravity on an object.
 (C) Volume is the amount of space occupied by a substance.
 (D) Temperatures below 0°C are possible in Celsius scale, but in Kelvin scale negative temperature is not possible.
 (E) Precision refers to the closeness of various measurements for the same quantity.

Choose the correct answer from the options given below:

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

Ans. (1)

Sol. For A_r $n = \frac{1}{2}$

$$C_{VM} = \frac{1}{2} R = \frac{3}{2} R$$

$$\Delta E = q_v = 500 = n C_{VM} \Delta T$$

so $\Delta E = 500J$

$$500 = \frac{1}{2} \times \frac{3}{2} \times 8.3 \times \Delta T$$

$$\frac{2000}{24.9} = \Delta T \approx 80$$

$$T_2 - 298 = 80$$

$$T_2 = 378 K$$

Ans. (4)

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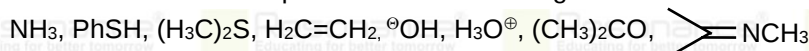
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70. Total number of nucleophiles from the following is :



- (1) 4 (2) 5 (3) 7 (4) 6

Ans. (2)

Sol. -ve charge ions & alkene are nucleophiles.

71. The sum of sigma (σ) and pi (π) bonds in Hex-1,3-dien-5-yne is _____.

Ans. (15)

Sol.

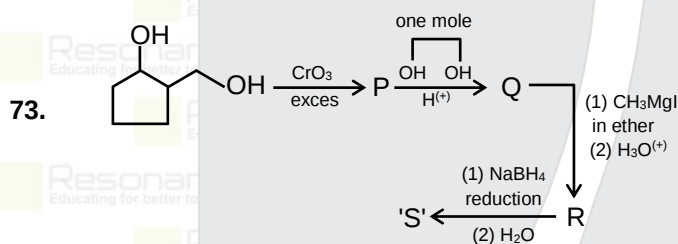
72. If A_2B is 30% ionised in an aqueous solution, then the value of van't Hoff factor (i) is _____ $\times 10^{-1}$.

Ans. (16)

Sol. A_2B is ternary type of electrolyte

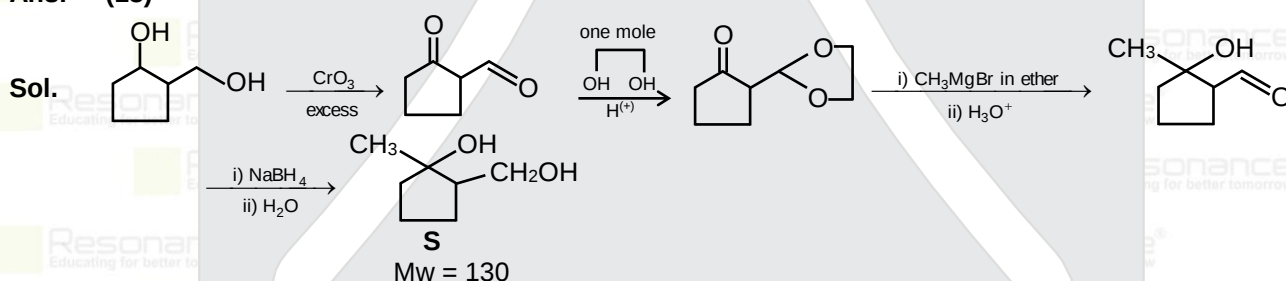
$$\text{Hence } i = 1 + 2\alpha = 1.6$$

Ans. 16.00



0.1 mole of compound 'S' will weight _____ g.
(Given molar mass in g mol^{-1} C : 12, H : 1, O : 16)

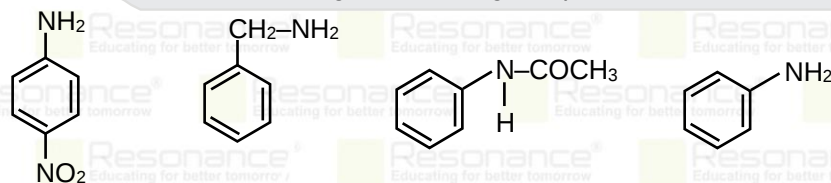
Ans. (13)



the weight of 1 mol compound (S) = 130 g

so, the weight of 0.1 mol compound (S) = 13 g

74. Given below are some nitrogen containing compounds



Each of them is treated with HCl separately. 1.0 g of the most basic compound will consume _____ mg of HCl.

(Given molar mass in g mol^{-1} C : 12, H : 1, O : 16, Cl : 35.5)

Ans. (341)

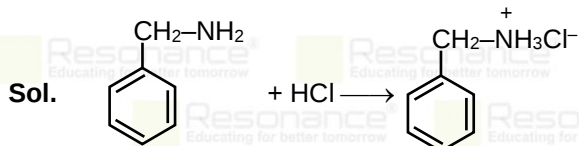
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1 mole of $\text{Ph-CH}_2\text{-NH}_2 \equiv 1$ mole of HCl

Molar mass of $\text{Ph-CH}_2\text{-NH}_2 = 107 \text{ g mol}^{-1}$

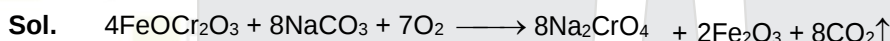
Molar mass of $\text{HCl} = 36.5 \text{ g mol}^{-1}$

107 g will react with = 36.5 g HCl

1 g will react with = $\frac{36.5}{107} \text{ g HCl} = \frac{36.5}{107} \times 10^3 \text{ mg of HCl} = 341 \text{ mg}$

75. The molar mass of the water insoluble product formed from the fusion of chromite ore (FeCr_2O_4) with Na_2CO_3 in presence of O_2 is _____ g mol^{-1} .

Ans. (160)



↓
water
Soluble

↓
water
insoluble
Molar mass
= 160

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