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JEE (Main)

PAPER-1 (B.E./B. TECH.)

2023

COMPUTER BASED TEST (CBT)
Questions & Solutions

Date: 29 January, 2023 (SHIFT-2) | TIME : (3.00 p.m. to 6.00 p.m.)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

31. A doctor prescribed the drug Equanil to a patient. The patient was likely to have symptoms of which disease?

(1) Anxiety and stress (2) Hyperacidity

(3) Depression and hypertension (4) Stomach ulcers

NTA. (3)

RESO. (3)

Sol. Equanil is a tranquilizer and it is used to treat depression and hypertension.

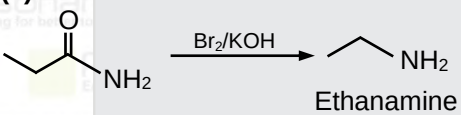
32. Reaction of propanamide with Br_2/KOH(aq) produces:

(1) Propanenitrile (2) Ethylamine (3) Propylamine (4) Ethylnitrile

NTA. (2)

RESO. (2)

Sol.



Ethanamine

Hoffmann degradation reaction

33. Which of the following relations are correct?

(A) $\Delta U = q + p\Delta V$

(B) $\Delta G = \Delta H - T\Delta S$

(C) $\Delta S = \frac{q_{rev}}{T}$

(D) $\Delta H = \Delta U - \Delta nRT$

Choose the most appropriate answer from the options given below:

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

NTA. (2)

RESO. (2)

Sol. (A) $\Delta U = q + w$

$\Delta U = q - P\Delta V$

(B) $\Delta G = \Delta G - T\Delta S$

(C) $\Delta S = \frac{q_{rev}}{T}$

(D) $\Delta H = \Delta V + \Delta ngRT$

So correct option are B & C only.

34. Match List I and List II

List-I		List-II	
(A)	Van't Hoff factor (i)	(I)	Cryoscopic constant
(B)	K_f	(II)	Isotonic solutions
(C)	Solutions with same osmotic pressure	(III)	$\frac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$
(D)	Azeotropes	(IV)	Solutions with same composition of vapour above it

Choose the correct answer from the options given below:

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

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

NTA. (3)

RESO. (3)

Sol. (A) Van't Hoff factor (i) $\Rightarrow \left\{\frac{\text{Normal molar mass}}{\text{Abnormal molar mass}}\right\}$.

(B) K_f $\Rightarrow$ Cryoscopic constant.

(C) Solutions with same osmotic pressure $\Rightarrow$ Isotonic solution.

(D) Azeotropes $\Rightarrow$ Solutions with same composition of vapour above it.

35. Given below are two statements:

Statement-I : Nickel is being used as the catalyst for producing syn gas and edible fats.

Statement-II : Silicon forms both electron rich and electron deficient hydrides.

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

(1) Statement-I is correct but statement-II is incorrect

(2) Statement-I is incorrect but statement-II is correct

(3) Both the statements-I and II are correct

(4) Both the statements-I and II are incorrect

NTA. (1)

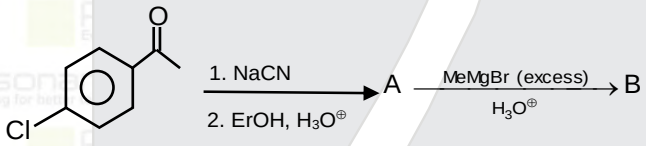
RESO. (1)

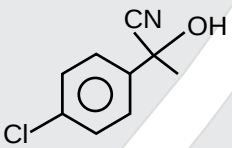
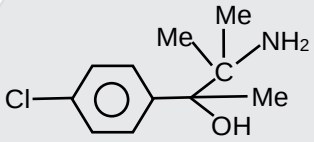
Sol. $CH_4(g) + H_2O(g) \xrightarrow[Ni]{1270\,K} CO(g) + 3H_2(g)$

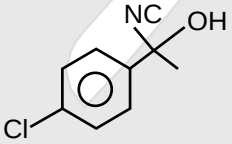
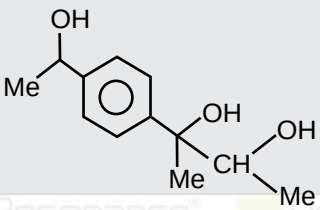
Hydrogenation of vegetable oils using Ni catalyst gives edible fats.

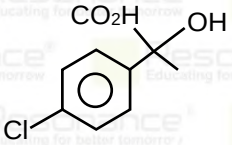
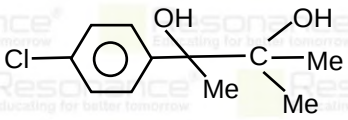
$C(s) + H_2O(g) \xrightarrow{1270\,K} CO(g) + H_2(g)$ (coal gasification)

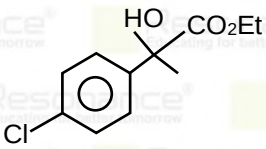
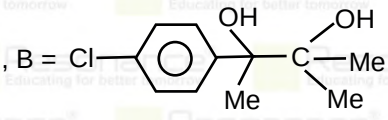
36. Find out the major products from the following reaction sequence.



(1) A =  , B = 

(2) A =  , B = 

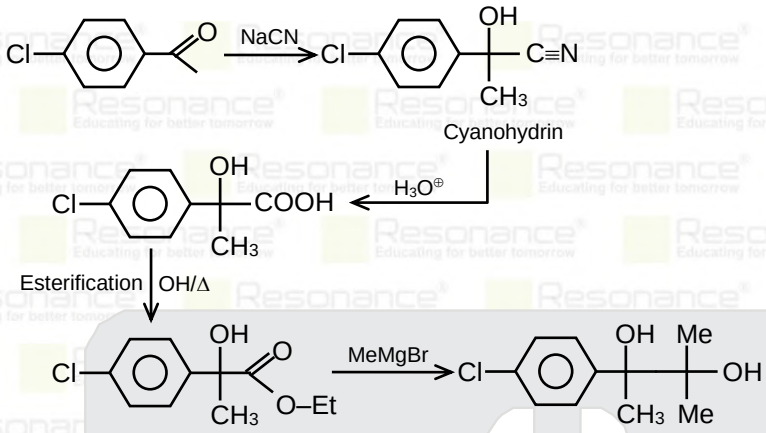
(3) A =  , B = 

(4) A =  , B = 

NTA. (4)

RESO. (4)

Sol.



37. The set of correct statements is:

(i) Manganese exhibits +7 oxidation state in its oxide.

(ii) Ruthenium and Osmium exhibit +8 oxidation in their oxides.

(iii) Sc shows +4 oxidation state which is oxidizing in nature.

(iv) Cr shows oxidising nature in +6 oxidation state.

(1) (ii), (iii) and (iv) (2) (ii) and (iii) (3) (i) and (iii) (4) (i), (ii) and (iv)

NTA. (4)

RESO. (4)

Sol. $_{21}Sc = 3d^14s^2$ can show maximum +3 oxidation state it does not show +4 oxidation state.

38. When a hydrocarbon A undergoes combustion in the presence of air, it requires 9.5 equivalents of oxygen and produces 3 equivalents of water. What is the molecular formula of A?

(1) C_9H_6 (2) C_6H_6 (3) C_8H_6 (4) C_9H_9

NTA. (3)

RESO. (3)

Sol. $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

No. of equivalents of O_2 = No. of equivalents of H_2O

No. of equivalents of $H_2O = \frac{y}{2} = 3$

y = 6

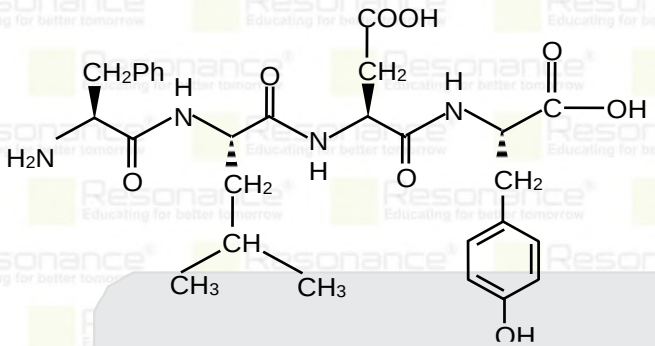
No. of equivalents of $O_2 = x + \frac{y}{4} = 9.5$

$x + \frac{6}{4} = 9.5$

x = 9.5 – 1.5 = 8

$C_xH_y = C_8H_6$

39. Following tetrapeptide can be represented as



(F, L, D. Y, I, Q. P are one letter codes for amino acids)

(1) YQLF (2) FLDY (3) FIQY (4) PLDY

NTA. (2)

RESO. (2)

Sol. Amino acid chain or peptide chain is often named starting from N terminal ending towards C–Terminal. So FLDY is best combination.

40. Correct order of spin only magnetic moment of the following complex ions is: (Given At.no. Fe: 26, Co:27)

(1) $[FeF_6]^{3-} > [Co(C_2O_4)_3]^{3-} > [CoF_6]^{3-}$ (2) $[Co(C_2O_4)_3]^{3-} > [CoF_6]^{3-} > [FeF_6]^{3-}$

(3) $[FeF_6]^{3-} > [CoF_6]^{3-} > [Co(C_2O_4)_3]^{3-}$ (4) $[CoF_6]^{3-} > [FeF_6]^{3-} > [Co(C_2O_4)_3]^{3-}$

NTA. (3)

RESO. (3)

Sol.

Complex	**Central Metal ion E. C.**	**NO. of unpaired electron**	**Magnetic moment** $\mu = \sqrt{n(n+2)}$ BM
(1) $[FeF_6]^{3-}$	Fe^{3+}–$3d^5$– $t_{2g}^{1,1,1}\, {}_{eg}^{1,1}$	5	$\sqrt{35}$ BM
(2) $[CoF_6]^{3-}$	Co^{3+}–$3d^6$– $t_{2g}^{2,1,1}\, {}_{eg}^{1,1}$	4	$\sqrt{24}$ BM
(3) $[Co(C_2O_4)_3]^{3-}$	Co^{3+}–$3d^6$– $t_{2g}^{2,2,2}\, {}_{eg}^{0,0}$	0	0 BM

41. **Match List I with List II**

List I	**List II**
A. Elastomeric polymer	I. Urea formaldehyde resin
B. Fibre Polymer	II. Polystyrene
C. Thermosetting Polymer	III. Polyester
D. Thermoplastic Polymer	IV. Neoprene

Choose the correct answer from the options given below:

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

NTA. (1)

RESO. (1)

Sol. Fact based question.

42. Given below are two statements :
Statement I : The decrease in first ionization enthalpy from B to Al is much larger than that from Al to Ga.
Statement II : The d orbitals in Ga are completely filled.
In the light of the above statements, choose the most appropriate answer from the options given below
(1) Both the statements I and II are incorrect
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct
(4) Both the statements I and II are correct

NTA. (4)
RESO. (4)
Sol.

Element	B	Al	Ga	In	Tl
IE_1 (KJ/mol)	801	577	579	558	589

ΔIE_1 of B & Al in greater than ΔIE_1 of Al & Ga.
This is due to completely filled d-orbitals in Ga and d-electron have low screening effect to compensate the increase in nuclear charge.

43. The major component of which of the following ore is sulphide based mineral?
(1) Calamine (2) Malachite (3) Sphalerite (4) Siderite

NTA. (3)
RESO. (3)
Sol. Calamine – $ZnCO_3$
Siderite – $FeCO_3$
Sphalerite – ZnS
Malachite – $CuCO_3.Cu(OH)_2$

44. Match **List - I** and **List - II**

List – I	**List - II**
A. Osmosis	I. Solvent molecules pass through semi permeable membrane towards solvent side.
B. Reverse osmosis	II. Movement of charged colloidal particles under the influence of applied electric potential towards oppositely charged electrodes.
C. Electro osmosis	III. Solvent molecules pass through semi permeable membrane towards solution side.
D. Electrophoresis	IV. Dispersion medium moves in an electric field.

Choose the correct answer from the options given below:
(1) A-I, B-III, C-II, D-IV (2) A-I, B-III, C-IV, D-II
(3) A-III, B-I, C-II, D-IV (4) A-III, B-I, C-IV, D-II

NTA. (4)
RESO. (4)
Sol. (i) **Electro osmosis:** When movement of colloidal particles is prevented by some suitable means (porous diaphragm or semi permeable membranes), it is observed that the D.M. begins to move in an electric field. This phenomenon is termed electrosmosis.
(ii) Solvent molecules pass through semi-permeable membrane towards solvent side is termed as reverse osmosis.
(iii) When an electric potential is applied across two platinum electrodes dipping in a colloidal solution, the colloidal particles move towards one or the other electrode. The movement of colloidal particles under an applied electric potential is called electrophoresis.
(iv) Solvent molecules pass through semipermeable membrane towards the solution side is termed as osmosis.

45. The one giving maximum number of isomeric alkenes on dehydrohalogenation reaction is (excluding rearrangement)

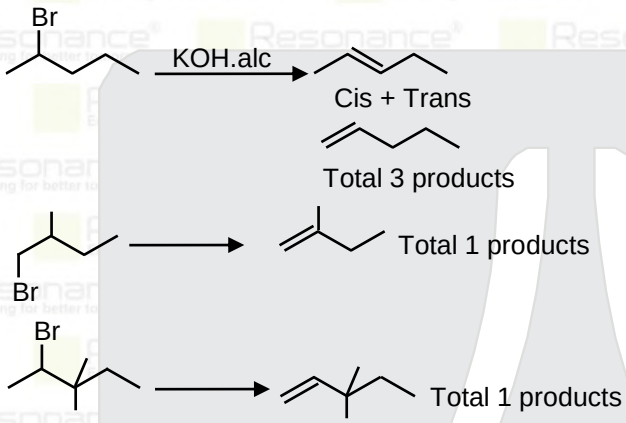
(1) 2-Bromopentane (2) 1-Bromo-2-methylbutane

(3) 2-Bromopropane (4) 2-Bromo-3,3-dimethylpentane

NTA. (1)

RESO. (1)

Sol. dehydrohalogenation is molecular emanation reaction.



46. A solution of CrO_5 in amyl alcohol has a _____ colour.

(1) Yellow (2) Blue (3) Green (4) Orange-Red

NTA. (2)

RESO. (2)

Sol. CrO_5 is more soluble in organic solvent like amyl alcohol & blue coloured organic layer is obtained.

47. The concentration of dissolved Oxygen in water for growth of fish should be more than X ppm and Biochemical Oxygen Demand in clean water should be less than Y ppm. X and Y in ppm are, respectively.

(1) X Y
6 5

(2) X Y
6 12

(3) X Y
4 8

(4) X Y
4 15

NTA. (1)

RESO. (1)

Sol. Fact based

48. An indicator 'X' is used for studying the effect of variation in concentration of iodide on the rate of reaction of iodide ion with H_2O_2 at room temp. The indicator 'X' forms blue colored complex with compound 'A' present in the solution. The indicator 'X' and compound 'A' respectively are

(1) Methyl orange and iodine (2) Starch and iodine

(3) Methyl orange and H_2O_2 (4) Starch and H_2O_2

NTA. (2)

RESO. (2)

Sol. $2Na_2S_2O_3 + I_2 \xrightarrow{\text{Starch}} 2NaI + Na_2S_4O_6$.

49. According to MO theory the bond orders for O_2^{-2}, CO and NO^+ respectively, are

(1) 1, 3 and 3 (2) 2, 3 and 3 (3) 1, 2 and 3 (4) 1, 3 and 2

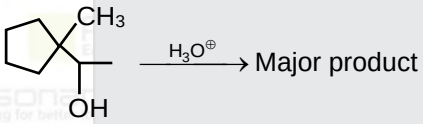
NTA. (1)

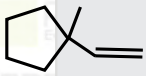
RESO. (1)

Sol.

Species	Molecular Orbital configuration	Band order = $\frac{1}{2}(N_b - B_a)$
CO	$KK^*\sigma_{2s^2}^*\sigma_{2s^2}^*\left(\pi_{2p_x}^2 \equiv \pi_{2p_y}^2\right)\sigma_{2p_z^2}$	$\frac{1}{2}(10-4)=3$
NO^+	$KK^*\sigma_{2s^2}\sigma_{2s^2}^*\sigma_{2p_z^2}\left(\pi_{2p_x}^2 \equiv \pi_{2p_y}^2\right)\left(\pi_{2p_x^0}^* \equiv \pi_{2p_y^0}^*\right)$	$\frac{1}{2}(10-4)=3$
O_2^{-2}	$KK^*\sigma_{2s^2}\sigma_{2s}^*\ \sigma_{2p_z^2}\left(\pi_{2p_x^2} = \pi_{2p_y^2}\right)\left(\pi_{2p_x^2}^* \equiv \pi_{2p_y^2}^*\right)$	$\frac{1}{2}(10-8)=1$

50. Find out the major product for the following reaction.

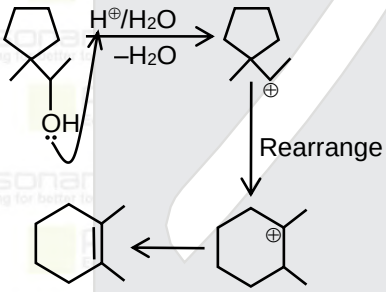


(1)  (2)  (3)  (4) 

NTA. (3)

RESO. (3)

Sol.



Major product
SAYTZEV ALKENE

51. The denticity of the ligand present in the Fehling's reagent is_____.

NTA. (4)

RESO. (4)

52. The volume of HCl, containing 73 g L^{-1}, required to completely neutralise NaOH obtained by reacting 0.69 g of metallic sodium with water, is_____mL. (Nearest Integer) (Given: molar Masses of Na, Cl, O, H, are 23, 35.5, 16 and 1 g mol^{-1} respectively)

NTA. (15)

RESO. (15)

Sol. $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

Number of moles of Na = No. of moles of NaOH

$n_{NaOH} = \frac{0.69}{23} = 0.03$

$NaOH + HCl \longrightarrow NaCl + H_2O$

Moles of HCl = moles of NaOH

$(Molarity \times V)_{HCl}$ = Number of moles of NaOH

$\left(\frac{73}{36.5 \times 1}\right) \times V = 0.03$

$V = 15 \times 10^{-3}$ Lit = 15 mL.

53. Total number of acidic oxides among

N_2O_3, NO_2, N_2O, $C1_20_7$, SO_2, CO, CaO, Na_2O and NO is_____,

NTA. (4)

RESO. (4)

Sol.

Acidic oxides	Basic oxides	Neutral oxides
N_2O_3	Na_2O	N_2O
NO_2	CaO	NO
Cl_2O_7		
SO_2		

54. The equilibrium constant for the reaction

$Zn(s) + Sn^{2-}(aq) \rightleftharpoons Zn^{2+}(aq) + Sn(s)$ is 1×10^{20} at 298 K. The magnitude of standard electrode potential of Sn/Sn^{2+} if $E^{\theta}_{Zn^{2+}/Zn} = -0.76$ V is_____ $\times 10^{-2}$ V.

(Nearest integer).

Given: $\frac{2.303RT}{F} = 0.059$ V

NTA. (17)

RESO. (17)

Sol. $E^o = \frac{0.059}{2} \log K_{eq}$.

$= \frac{0.059}{2} \log 10^{20} \quad \Rightarrow \quad \frac{0.059}{2} \times 20$

$= 0.59V$

$E^o_{cell} = E^o_{Sn^{2+}/Sn} - E^o_{Zn^{2+}/Zn}$

$0.59 = E^o_{Sn^{2+}/Sn} - (-0.76)$

$E^o_{Sn^{2+}/Sn} = -0.76 + 0.59$

$= -0.17$

$E^o_{Sn/Sn^{2+}} = 0.17$

$= 17 \times 10^{-2}$

Ans. = 17

55. On heating, $LiNO_3$ gives how many compounds among the following?_____
Li_2O, N_2, O_2, $LiNO_2$, NO_2

NTA. **(3)**

RESO. **(3)**

Sol. $4LiNO_3 \longrightarrow 2Li_2O + 4NO_2 + O_2$

56. A metal M forms hexagonal close-packed structure. The total number of voids in 0.02 mol of it is _____ $x10^{21}$ (Nearest integer).
Given $N_A = 6.02 \times 1023$

NTA. **(36)**

RESO. **(36)**

Sol. Given mole of compound = 0.02 mol
Number of atoms in 0.02 mol = $0.02 \times 6 \times 10^{23} = 12 \times 10^{21}$
Number of octahedral voids = No. of atoms = 12×10^{21}
Number of tetrahedral voids = $2 \times$ No. of atoms = $2 \times 12 \times 10^{21} = 24 \times 10^{21}$
Total number of voids = no. of octahedral voids + no. of tetrahedral voids
Total no. voids in 0.02 mole compound = $12 \times 10^{21} + 24 \times 10^{21} = 36 \times 10^{21}$

57. At 298K

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) K_1 = 4 \times 10^5$

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)\ K_2 = 1.6 \times 10^{12}$

$H_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons H_2O(g), K_3 = 1.0 \times 10^{-13}$

Based on above equilibria, the equilibrium constant of the reaction, $2NH_3(g) + \frac{5}{2}O_2(g) \rightleftharpoons 2NO(g) + 3H_2O(g)$ is _____ $\times 10^{-33}$ (Nearest integer).

NTA. **(4)**

RESO. **()**

Sol. Target equation = eq(2) –eq(1) + 3eq(3)

$$K = \frac{K_2 \times (K_3)^3}{K_1} = \frac{1.6 \times 10^{12} \times (1 \times 10^{-13})^3}{(4 \times 10^5)}$$

$$= \frac{16 \times 10^{11} \times 10^{-39}}{(4 \times 10^5)} = 4 \times 10^{-33}$$

Ans. = 4

58. Assume that the radius of the first Bohr orbit of hydrogen atom is 0.6 Å. The radius of the third Bohr orbit of He^+ is_____ picometer. (Nearest Integer)

NTA. **(270)**

RESO. **(270)**

Sol. $r_n = r_0 \frac{n^2}{z}$

$(r_1)_H = r_0 \frac{(1)^2}{1} = 0.6Å$

$(r_3)_{He^+} = r_0 \frac{(n)^2}{z}$

$= 0.6\left(\frac{3^2}{2}\right) = 0.6 \times \frac{9}{2}$ = 2.7Å = 270 picometer.

59. When 0.01 mol of an organic compound containing 60% carbon was burnt completely, 4.4 g of CO_2 was produced. The molar mass of compound is_____ g mol^{-1} (Nearest integer).

NTA. (200)

RESO. (200)

Sol. Liebig method

$O_2 + \underset{12g}{C} \longrightarrow \underset{44g}{CO_2}$

Number to produce

4.4g $CO_2 \longrightarrow$ 1.2 g C

as 60% by weight

0.01 mol $\longrightarrow 1.2 \times \frac{100}{60}$

1 mol $\longrightarrow 1.2 \times \frac{100}{60} \times 100 = 200$

60. For conversion of compound A→B. the rate constant of the reaction was found to be 4.6 x 10^{-5} L mol^{-1} s^{-1}. The order of the reaction is_____.

NTA. (2)

RESO. (2)

Sol. For nth order reaction

Units of k = $\frac{\text{Rate}}{(\text{conc})^n}$ = mol^{1-n} L^{n-1} S^{-1}

For a given reaction unit of k mol^{-1} L sec^{-1}

∴ Order of the reaction (n) = 2

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for Class XII Passed Student
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TARGET: JEE (Main) 2024
for Class XII Passed Student
ABHYAAS COURSE
MODE: OFFLINE / ONLINE
CLASS STARTS 10th & 24th April

SCHOLARSHIP ON THE BASIS OF JEE (MAIN) 2023 %ILE / AIR

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