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JEE (Main)

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

2023

COMPUTER BASED TEST (CBT)

Questions & Solutions

Date: 11 April, 2023 (SHIFT-1) | TIME : (9.00 a.m. to 12.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

61. Match List-I with List-II:

List-I	List-II
A. K	I. Themomumclear reactions
B. KCl	II. Fertilizer
C. KOH	III. Sodium potassium pump
D. Li	IV. Absorbent of CO_2

Choose the correct answer from the options given below:

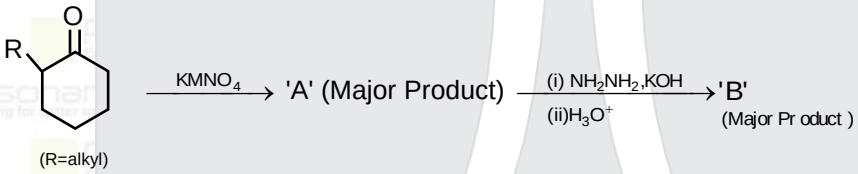
(1) A-III. B-IV, C-II, D-I (2*) A-III, B-II, C-IV, D-I

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

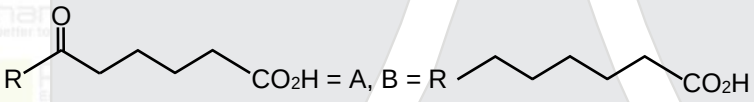
Ans. **NTA (2)**

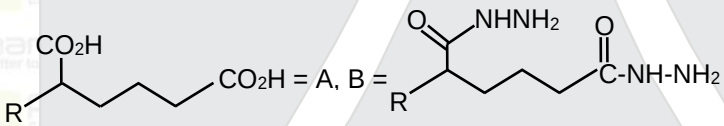
Sol. KCl used in fertilier CO_2 absorbed in KOH.

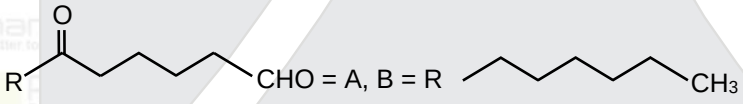
Liquid Li used in nuclear plants.

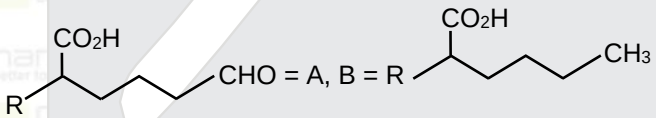
62. 

'A' and 'B' in the above reactions are :

(1) 

(2) 

(3) 

(4) 

Ans. **NTA (1)**

63. Match List-I with List-II:

List-I Species	List-II Geometry/ Shape
A. H_3O^+	I. Tetrahedral
B. Acetylide anion	II. Linear
C. NH_4^+	III. Pyramidal
D. ClO_2^-	IV. Bent

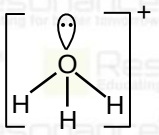
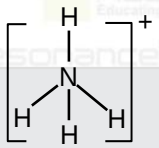
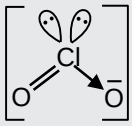
Choose the correct answer from the options given below:

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

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

Ans. **NTA (3)**

Sol.

Molecule/Species	Structure	Shape
H_3O^+		Pyramidal
Acetalide	$H-C\equiv\overset{-}{C}$	Linear
NH_4^+		Tetrahedral
ClO_2^-		Bent

64. 25 mL of silver nitrate solution (1M) is added dropwise to 25 mL of potassium iodide (1.05 M) solution. The ion(s) present in very small quantity in the solution is/are

(1) Ag^+ and I^- both (2) I^- only (3) K^+ only (4) NO_3^- only

Ans. **NTA (1)**

Sol. $AgNO_3$ = 25 millmole

KI = 26.25 millmole

$AgNO_3 + KI \longrightarrow AgI + KNO_3$

so most of the $Ag^+ + KNO_3$

precipitated as AgI (sparingly soluble salt)

so ion remaining in small quantities are Ag^+ and I^-.

65. When a solution of mixture having two inorganic salts was treated with freshly prepared ferrous sulphate in acidic medium. a dark brown ring was formed whereas on treatment with neutral $FeCl_3$. it gave deep red colour which disppeared on boiling and a brown red ppt was formed. The mixture contains

(1) $C_2O_4^{2-}$ & NO_3^- (2) SO_3^{2-} & $C_2O_4^{2-}$ (3) CH_3COO^- & NO_3^- (4) SO_3^{2-} & CH_3COO^-

Ans. **NTA (3)**

Sol. CH_3COO^- gives deep red colour with $FeCl_3$ NO_3^- ion gives brown ring test with $FeSO_4$.

66. The complex that dissolves in water as

(1) $[Fe_3(OH)_2(OAc)_6]Cl$ (2) $K_3[Co(NO_2)_6]$

(3) $(NH_4)_3[As(Mo_3O_{10})_4]$ (4) $Fe_4[Fe(CN)_6]_3$

Ans. **NTA (1)**

Sol. Factual.

67. The set which does not have ambidentate ligand(s) is

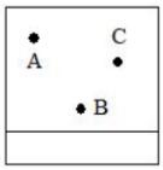
(1) $EDTA^{4-}$ NCS^-, $C_2O_4^{2-}$ (2) $C_2O_4^{2-}$ NO_2^-, NCS^-

(3) NO_2^-, $C_2O_4^{2-}$, $EDTA^{4-}$ (4) $C_2O_4^{2-}$, ethylene diammine, H_20

Ans. **NTA (4)**

Sol. NCS^-, NO_2^- are ambidentate ligand.

68. Thin layer chromatography of a mixture shows the following observation:



The correct order of elution in the silica gel column chromatography is

(1) B, A, C (2) A, C, B (3) B, C, A (4) C, A, B

Ans. **NTA (2)**

Sol. Less polar will be less adsorbed on silica gel and will rise more with eluent (mobile phase) so correct order of elution (rising) is A > C > B

69. Which of the following complex has a possibility to exist as meridional isomer?

(1) $[Co(en)_2Cl]$ (2) $[Co(NH_3)_3(NO_2)_3]$ (3) $[Co(en)_3]$ (4) $[Pt(NH_3)_2Cl_2]$

Ans. **NTA (2)**

Sol. $[Ma_3b_3]$ can show facial and meridional isomerism.

70. In the extraction process of copper. the product obtained after carrying out the reactions

(i) $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

(ii) $2Cu,O + Cu_2S \rightarrow 6Cu + SO_2$ is called

(1) Copper matte (2) Blister copper (3) Copper scrap (4) Reduced copper

Ans. **NTA (2)**

Sol. During this process obtained copper has blistered appearance due to the evolution of SO_2 so it is called as blister copper.

71. For compound having the formula GaA1C14, the correct option from the following is

(1) Cl forms bond with both Al and Ga in $GaA1C1_4$

(2) Oxidation state of Ga in the salt $GaAlCl_4$ is +3.

(3) Ga is more electronegative than Al and is present as a cationic part of the salt $GaAlCl_4$

(4) Ga is coordinated with Cl in $GaAlCl_4$

Ans. **NTA (3)**

Sol. $\overset{+1}{Ga}[AlCl_4]^-$

$E_N \rightarrow B > Tl > Ga > Al > In$

72. Given below are two statements:

Statement-I : Methane and steam passed over a heated Ni catalyst produces hydrogen gas.

Statement-II: Sodium nitrite reacts with NH_4Cl to give H_2O,N_2 and NaCl.

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

(1) Statement I is incorrect but Statement ¡lis correct

(2) Both the statements I and II are incorrect

(3) Statement I is correct but Statement II is incorrect

(4) Both the statements I and II are correct

Ans. **NTA (4)**

Sol. $CH_4 + H_2O \xrightarrow{Ni,\ \Delta} \underset{\text{Water gas}}{CO(g) + 3H_2(g)}$

$NaNO_2(ag) + NH_4Cl(s) \longrightarrow NaCl + NH_4NO_2 \longrightarrow N_2(g) + 2H_2O$

73. The polymer X - consists of linear molecules and is closely packed. It is prepared in the presence of triethylaluminium and titanium tetrachloride under low pressure. The polymer X is

(1) Polytetrafluoroethane (2) High density polythene

(3) Polyacrylonitrile (4) Low density polythene

Ans. **NTA (2)**

Sol. $CH_2=CH_2 \xrightarrow[TiCl_4 + Al(C_2H_5)_3]{} \underset{HDP}{[CH_2-CH_2]}$

74. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: In the photoelectric effect. the electrons are ejected from the metal surface as soon as the beam of light of frequency greater than threshold frequency strikes the surface.

Reason R: When the photon of any energy strikes an electron in the atom, transfer of energy from the photon to the electron takes place.

In the light of the above statements. choose the most appropriate answer from the options given below :
(1) A is correct but R is not correct
(2) A is not correct but R is correct
(3) Both A and R are correct and R is the correct explanation of A
(4) Both A and R are correct but R is NOT the correct explanation of A

Ans. **NTA (1)**

Sol. Electron are ejected if light has more frequency than threshold frequency. Photon is energy itself. It is absorbed.

75. Given below are two statements:
Statement I: If BOD is 4 ppm and dissolved oxygen is 8 ppm. then it is a good quality water.
Statement II: If the concentration of zinc and nitrate salts are 5 ppm each, then it can be a good quality water.
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

Ans. **NTA (4)**

Sol. Environmental chemistry **refer table**

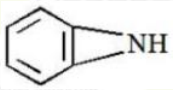
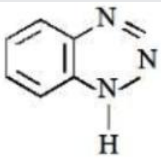
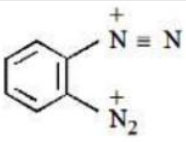
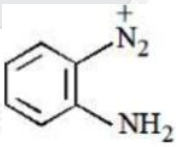
76. For elements B, C, N. Li. Be. O and F, the correct order of first ionization enthalpy is
(1) Li < B < Be < C < O < N < F
(2) Li < Be < B < C < O < N < F
(3) B >Li > Be > C > N > O > F
(4) Li < Be < B < C < N < O < F

Ans. **NTA (1)**

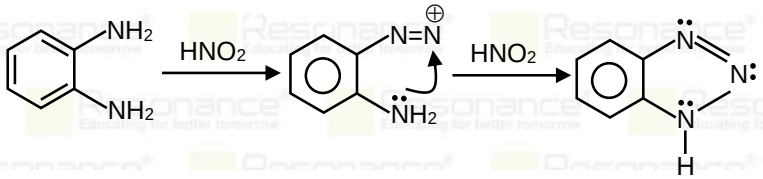
Sol. The correct increasing order of first ionization enthalpies is
Li < B < Be < C < O < N < F

77. o-Phenylenediamine $\xrightarrow{HNO_2}$ 'X'
Major Product

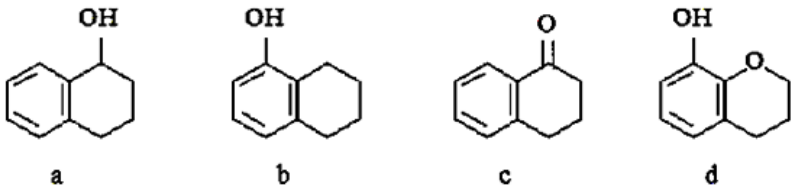
'X' is

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

Ans. **NTA (2)**

Sol. 

78. Arrange the following compounds in increasing order of rate of aromatic electrophilic substitution reaction



(1) b, c, a, d (2) d, b, a, c (3) d, b, c, a (4) c, a, b, d

Ans. **NTA (4)**

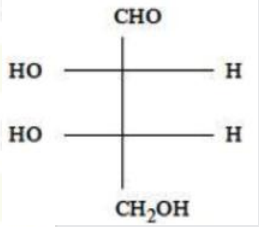
Sol. As increase electron density in due ring rate of ArS_E^2 increases, ERG increases the electron density.

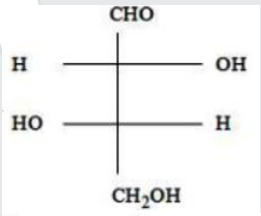
79. L⁻ isomer of tetrose X ($C_4H_8O_4$) gives positive Schiff s test and has two chiral carbons. On acetylation, 'X' yields triacetate. 'X' also undergoes following reactions

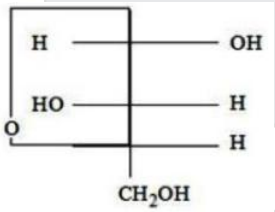
'A' $\xleftarrow{HNO_3}$ 'X' $\xrightarrow{NaBH_4}$ 'B'

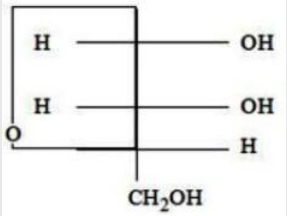
Chiral compound

'X' is:

(1) 

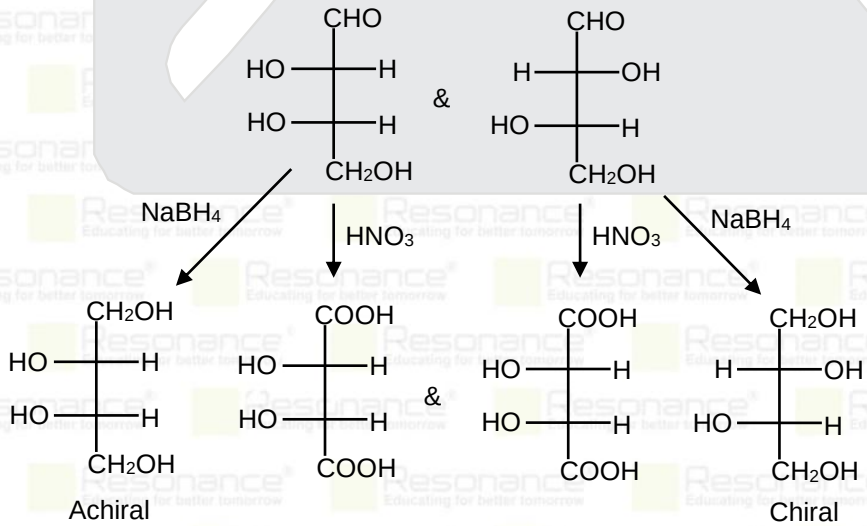
(2) 

(3) 

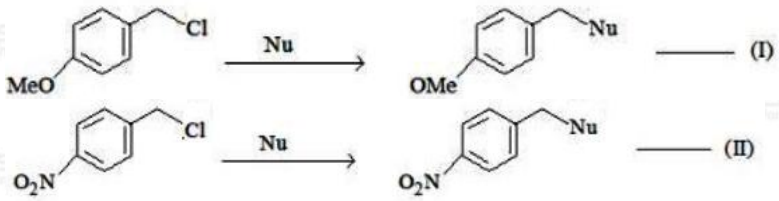
(4) 

Ans. **NTA (2)**

Sol.



80.



'Where Nu = Nucleophile
Find out the correct statement from the options given below for the above 2 reactions.
(1) Reactions (I) and (II) both are of 1st order
(2) Reactions (I) and (II) both are of 2nd order
(3) Reaction (I) is of 1st order and reaction (II) is of 2nd order
(4) Reaction (I) is of 2nd order and reaction (II) is of 1st order

Ans. **NTA (3)**

Sol. Reaction I will proceed by S_N1, required stable carbocation that is supported by –OMe while reaction II will proceeded by S_N2 supported by $–NO_2$

81. 0.004 M K_2SO_4 solution is isotonic with 0.01 M glucose solution. Percentage dissociation of K2S04 is _____ (Nearest integer)

Ans. **NTA (75)**

Sol. Isotonic (Glucose) $i_2 = 1$

$i_1C_1 = i_2C_2$

$i_1 \times 0.004 = 1 \times 0.01$

$$i_1 = \frac{0.01}{0.004} \times \frac{1000}{100}$$

$$i_1 = \frac{10}{4} = \frac{5}{2} = 2.5$$

$i = 1 + (n - 1)\alpha$

$i = 1 + 2\alpha$

$2.5 = 1 + 2\alpha$

$\alpha = 0.75$

$\%\alpha = 75\ \%$

82. In an electrochemical reaction of lead. at standard temperature. if $E°_{(pb2+ / pb)}$=m Volt and $E°_{(Pb4+/Pb)}$=n Volt. then the value of $E°_{(Pb^{2+}/Pb^{4+})}$ is given by m — xn. The value of x is_____. (Nearest integer)

Ans. **NTA (2)**

Sol. $Pb^{2+} + 2e^- \longrightarrow Pb \quad E_1^0 = M\ ;\ \Delta G_1^0 = -2\ FM$

$Pb^{4+} + 4e^- \longrightarrow Pb \quad E_2^0 = N\ ;\ \Delta G_2^0 = -4\ FM$

Target eq.

$Pb^{4+} + 2e^- \longrightarrow Pb^{2+} \quad E_3^0 = ?\ ;\ \Delta G_3^0 = -2\ F E_3^0$

Target eq. = eq. 2 – eq 1

$-2F\ E_3^0 = -4FN - (-2FM)$

$E_3^0 = 2N - M = |M - 2N|$

$X = 2$

83. The ratio of spin-only magnetic moment values μ_{eff} $[Cr(CN)_6]^{3-}$ / μ_{eff} $[Cr(H_2O)_6]^{3+}$ is _____.

Ans. **NTA (1)**

Sol. $[Cr(CN)_6]^{3-}$ $Cr^{+3} \rightarrow 3d^3 \Rightarrow t_{2g}^{1,1,1}\ e_g^{0,0}$, $\mu = \sqrt{n(n+2)}$ BM

$= \sqrt{3(3+2)} = \sqrt{15}$ BM

$[Cr(H_2O)_6]^{3+}$ $Cr^{+3} \rightarrow 3d^3 \Rightarrow t_{2g}^{1,1,1}\ e_g^{0,0}$, $\mu = \sqrt{n(n+2)}$ BM

$= \sqrt{3(3+2)} = \sqrt{15}$ BM

Ratio of magnetic moments = $\frac{\sqrt{15}}{\sqrt{15}} = 1$.

84. A solution of sugar is obtained by mixing 200 g of its 25% solution and 500 g of its 40% solution (both by mass). The mass percentage of the resulting sugar solution is _____ (Nearest integer)

Ans. **NTA (36)**

Sol. Mass of sugar = $\frac{25}{100} \times 200 + \frac{40}{100} \times 500 \Rightarrow 250$ g

% w/w of solution = $\frac{250}{700} \times 100 = 35.71\% \approx 36\%$

85. An atomic substance A of molar mass 12 g mol^{-1} has a cubic crystal structure with edge length of 300 pm. The no. of atoms present in one unit cell of A is _____. (Nearest integer)
Given the density of A is 3.0 g mL^{-1} and N_A. = 6.02×10^{23} mol^{-1}

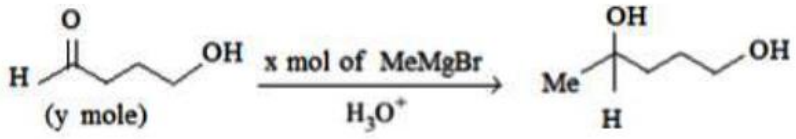
Ans. **NTA (4)**

Sol. $d = \left\{\frac{Z \times M}{N_A \times a^3}\right\}$

$3 = \frac{Z \times 12}{6 \times 10^{23} \times (3 \times 10^{-8})^3}$

$Z = 4$

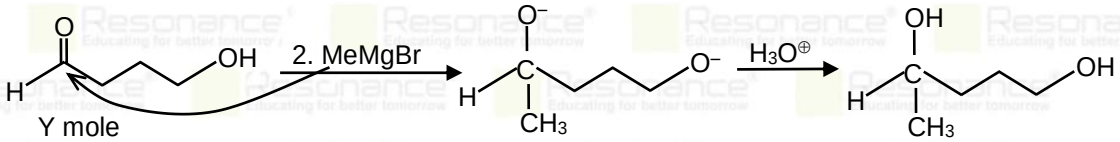
86.



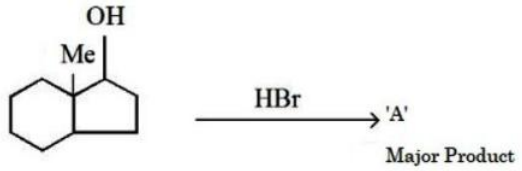
The ratio x/y on completion of the above reaction is _____.

Ans. **NTA (2)**

Sol.



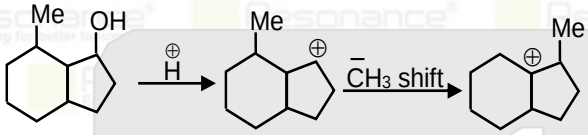
87.



The number of hyper conjugation structures involved to stablize carbocation formed in the above reaction is.

Ans. **NTA (7), Reso ans. (4).**

Sol.



Number of hyper conjugative structures are 4

88. A mixture of 1 mole of H_2O and 1 mole of CO is taken in a 10 litre container and heated to 725K. At equilibrium 40% of water by mass reacts with carbon monoxide according to the equation:
$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$. The equilibrium constant $K_c \times 10^2$ for the reaction is_____.
(Nearest integer)

Ans. **NTA (44)**

Sol.

	CO	+	H_2O	$\rightleftharpoons$	CO_2	+	H_2
t = 0	1		1		0		0
eq.	1–0.4		1–0.4		0.4		0.4

V = 10 L $\qquad K_C = \dfrac{0.4\times0.4}{0.6\times0.6} = \dfrac{4}{9} = 0.44$

$K_C \times 100 = 44$

89. Solid fuel used in rocket is a mixture of Fe_2O_3 and Al (in ratio 1:2). The heat evolved (kJ) per gram of the mixture is _____ (Nearest integer)
Given: $\Delta H_f^{\theta}(Al_2O_3) = -1700$ kJ mol^{-1}
$\Delta H_f^{q}(Fe_2O_3) = -840$ kJ mol^{-1}
Molar mass of Fe. Al and O are 56, 27 and 16 g mol^{-1} respectively

Ans. **NTA (4), Reso ans. Bonus.**

Sol. ratio = 1 : 2 (not given that it is by mass or by mole)

90. $KClO_3\ 6FeSO_4 + 3H_2SO_4 \longrightarrow KCl + 3Fe_2(SO_4)_3 \pm 3H_2O$
The above reaction was studied at 300 K by monitoring the concentration of $FeSO_4$ in which initial concentration was 10 M and after half an hour became 8.8 M. The rate of production of $Fe_2(SO_4)_3$ is _____ $\times 10^{-6}$ mol L^{-1} s^{-1}.
(Nearest integer)

Ans. **NTA (333)**

Sol. $KClO_3 + 6FeSO_4 + 3H_2 \longrightarrow KCl + 3Fe_2(SO_4)_3 + 3H_2O$
Initial conc. of $FeSO_4$ = 10 M
after 1 hr. = 8.8
rate of consumption of $FeSO_4$

$$-\frac{d}{dt}[FeSO_4] \Rightarrow \frac{1.2}{30\times60\,sec} = 0.000667 \text{ m/sec}$$

$$\frac{-\frac{d[FeSO_4]}{dt}}{6} = \frac{+\frac{d[Fe_2(SO_4)_3]}{dt}}{3}$$

rate of production of $Fe_2(SO_4)_3$ = 0.000333 M sec^{-1}.