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JEE (Main)

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

2023

COMPUTER BASED TEST (CBT)
Questions & Solutions

Date: 30 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. Boric acid is solid, whereas BF_3 is gas at room temperature because of :

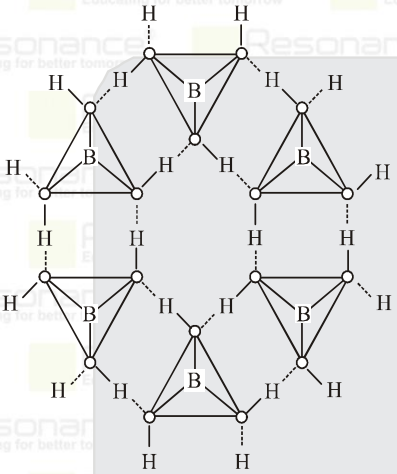
(1) Strong hydrogen bond in Boric acid (2) Strong van der Waal's interaction in Boric acid

(3) Strong covalent bond in BF_3 (4) Strong ionic bond in Boric acid

NTA. (1)

RESO. (1)

Sol.



Boric acid have strong hydrogen bonding so it is solid at room temperature. While BF_3 have weak vander waal's interaction so it is gas at room temperature,

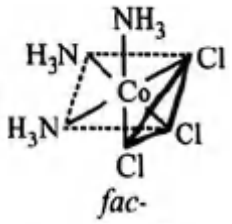
32. The Cl–Co–Cl bond angle values in a Fac-$[Co(NH_3)_3Cl_3]$ complex is/are :

(1) 180º (2) 90º (3) 90º and 180º (4) 90º and 120º

NTA. (2)

RESO. (2)

Sol. Fac-$[Co(NH_3)_3Cl_3]$



fac-

So, Cl–O–Cl bond angle – 90º.

33. $KMnO_4$ oxidises I^- in acidic and neutral/faintly alkaline solution, respectively, to :

(1) IO_3^- and IO_3^- (2) I_2 and IO_3^- (3) I_2 and I_2 (4) IO_3^- and I_2

NTA. (2)

RESO. (2)

Sol. In acidic medium

$2MnO_4^- + 10\ I^- + 16H^+ \longrightarrow 2Mn^{2+} + 8H_2O + 5I_2$

In neutral or faintly alkaline medium

$2MnO_4^- + I^- + H_2O \longrightarrow 2MnO_2 + 2OH^- + IO_3^-$

34. The water quality of a pond was analysed and its BOD was found to be 4. The pond has :

(1) Water has high amount of fluoride compounds (2) Highly polluted water

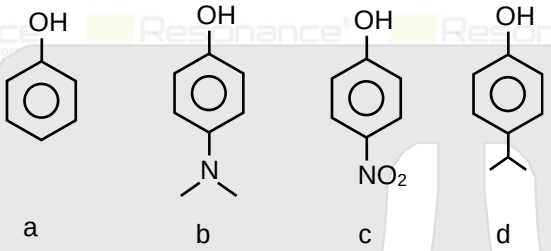
(3) Very clean water (4) Slightly polluted water

NTA. (3)

RESO. (3)

Sol. If BOD value less than 5 than water is clean water. (Given in NCERT Page No. 415 in class 11)

35. The correct order of pK_a values for the following compounds is :



a b c d

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

NTA. (3)

RESO. (3)

Sol. $pK_a \propto \frac{1}{K_a}$ K_a increase by electron withdrawing group.

K_a = C > a > d > b pK_a = b > d > a > c

36. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A: Antihistamines do not affect the secretion of acid in stomach.

Reason R: Antiallergic and antacid drugs work on different receptors.

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

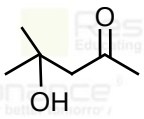
NTA. (2)

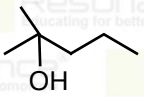
RESO. (2)

Sol. "Antihistamines not affect the secretion of acid in stomach" The reason is that antiallergic and antacid drugs work on different receptors.

NCERT (XII) Vol – II, Page No. 451-452.

37. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: 

can be easily reduced using Zn-Hg/HCl to 

.

Reason R: Zn-Hg/HCl is used to reduce carbonyl group to —CH_2– group.

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 but R is not the correct explanation of A

(3) A is true but R is false

(4) Both A and R are true and R is the correct explanation of A

NTA. (1)

RESO. (1)

Sol. Zn-Hg/HCl (Clemmensen reduction reduces the carbonyl group to $-CH_2$ but also affect acid sensitive functional groups as alkene, alcohol, ether and ester.)

38. Given below are two statements:

Statement I: During Electrolytic refining, the pure metal is made to act as anode and its impure metallic form is used as cathode.

Statement II: During the Hall-Heroult electrolysis process, purified Al_2O_3 is mixed with Na_3AlF_6 to lower the melting point of the mixture.

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 correct

(2) Both Statement I and Statement II are incorrect

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

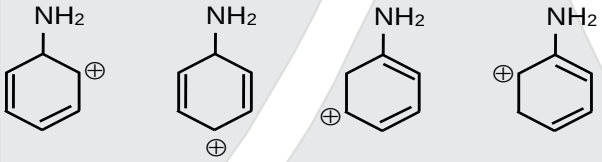
(4) Statement I is incorrect but Statement II is correct

NTA. (4)

RESO. (4)

Sol. During electrolytic refining, the pure metal is made to act as cathode and its impure metallic form is used as anode.

39. The most stable carbocation for the following is:



a b c d

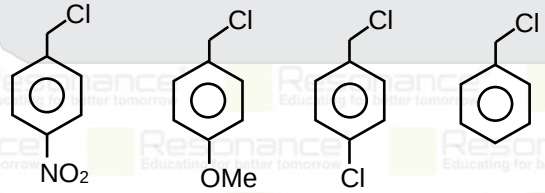
(1) c (2) d (3) b (4) a

NTA. (1)

RESO. (1)

Sol. Because +ve charge delocalise with 2p-bonds and long pair of 'N' atom in NH_2 groups. In structure c.

40. Decreasing order towards SN1 reaction for the following compounds is :



a b c d

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

NTA. (2)

RESO. (2)

Sol. Rate S_N1 depends upon stability of carbocation.

41. Bond dissociation energy of "E-H" bond of the "H_2E" hydrides of group 16 elements (given below), follows order.

A. O
B. S
C. Se
D. Te

Choose the correct from the options given below :

(1) D > C > B > A (2) B > A > C > D (3) A > B > D > C (4) A > B > C > D

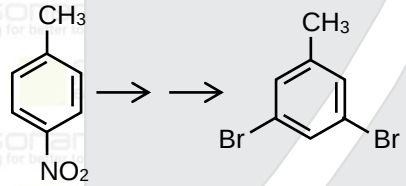
NTA. (4)
RESO. (4)
Sol. In the given compound the order of bond length
H–Te < H–Se < H–S < H–O
So the bond strength for H–O is maximum.

42. Maximum number of electrons that can be accommodated in shell with n = 4 are:

(1) 72 (2) 16 (3) 32 (4) 50

NTA. (3)
RESO. (3)
Sol. Maximum no. of election in given shell is given as
$2n^2$, n = principal quantum no. or shell no.
Here, n = 4, then maximum no. of electron will be = $2 \times (4)^2 = 32\ e^-$

43.

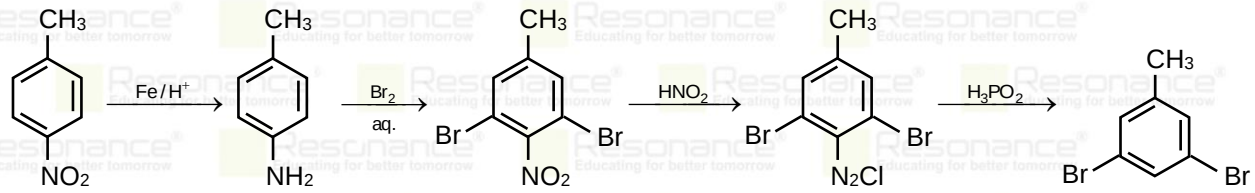


(X) (Y)

In the above conversion of compound (X) to product (Y), the sequence of reagents to be used will be:

(1) (i) Fe, H^+ (ii) Br_2(aq) (iii) HNO_2 (iv) CuBr
(2) (i) Fe, H^+ (ii) Br_2(aq) (iii) HNO (iv) H_3PO_2
(3) (i) Br_2, Fe (ii) Fe, H^+ (iii) $LiAlH_4$
(4) (i) Br_2(aq) (ii) $LiAlH_4$ (iii) H_3O^+

NTA. (2)
RESO. (2)
Sol.



44. Match List I with List II:

List I (Complexes)		List II (Hybridisation)	
A.	$[Ni(CO)_4]$	I.	sp^3
B.	$[Cu(NH_3)_4]^{2+}$	II.	dsp^2
C.	$[Fe(NH_3)_6]^{2+}$	III.	sp^3d^2
D.	$[Fe(H_2O)_6]^{2+}$	IV.	d^2sp^3

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

NTA. (3)

RESO. (3)

Sol. A. $[Ni(CO)_4]$ sp^3

B. $[Cu(NH_3)_4]^{2+}$ dsp^2

C. $[Fe(NH_3)_6]^{2+}$ d^2sp^3

D. $[Fe(H_2O)_6]^{2+}$ sp^3d^2

45. Match List I with List II:

List I (Mixture)		List II (Separation Technique)	
A.	$CHCl_3 + C_6H_5NH_2$	I.	Steam distillation
B.	$C_6H_{14} + C_5H_{12}$	II.	Differential extraction
C.	$C_6H_5NH_2 + H_2O$	III.	Distillation
D.	Organic compound in H_2O	IV.	Fractional distillation

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

NTA. (2)

RESO. (2)

Sol. $CHCl_3 + C_6H_5NH_2 \rightarrow$ Distillation

$C_6H_{14} + C_5H_{12} \rightarrow$ Fractional distillation

$C_6H_5NH_2 + H_2O \rightarrow$ Steam distillation

Organic compound in $H_2O \rightarrow$ Differential extraction

46. Formulae for Nessler's reagent is :

(1) $KHgI_3$ (2) HgI_2 (3) K_2HgI_4 (4) KHg_2I_2

NTA. (3)

RESO. (3)

Sol. Nessler's reagent is a mercury (ii) iodide (HgI_2) solution in potassium iodide (KI) and potassium hydroxide (KOH).

Nessler's reagent: $K_2HgI_4 + KOH$

It is used for confirmation test of NH_4^+ ion.

47. 1 L, 0.02 M solution of $[Co(NH_3)_5SO_4]$ Br is mixed with 1 L, 0.02 M solution of $[Co(NH_3)_5Br]SO_4$. The resulting solution is divided into two equal parts (X) and treated with excess of $AgNO_4$ solution and $BaCl_2$ solution respectively as shown below:

1 L Solution (X) + $AgNO_3$ solution (excess) $\rightarrow$ Y

1 L Solution (X) + $BaCl_2$ solution (excess) $\rightarrow$ Z

The number of moles of Y and Z respectively are

(1) 0.02, 0.02 (2) 0.02, 0.01 (3) 0.01, 0.01 (4) 0.01, 0.02

NTA. (3)
RESO. (3)
Sol. On mixing equal volume concentration is Half.

$[Co(NH_3)_5SO_4]Br$, $[Co(NH_3)_5Br]SO_4$
0.01 M 0.01 M

(i) X $[Co(NH_3)_5SO_4]Br + AgNO_3 \longrightarrow AgBr\downarrow$

$\left(\frac{0.02}{2}\right)$ mole 0.01 mole

'Y'

(ii) X $[Co(NH_3)_5Br]SO_4 + BaCl_2 \longrightarrow BaSO_4\downarrow$

$\left(\frac{0.02}{2}\right)$ mole 0.01 mole

'Y'

48. The wave function (Ψ) of 2s is given by

$$\Psi_{2s} = \frac{1}{2\sqrt{2\pi}}\left(\frac{1}{a_0}\right)^{1/2}\left(2-\frac{r}{a_0}\right)e^{-r/2a_0}$$

At r = r_0, radial node is formed. Thus, r_0 in terms of a_0

(1) $r_0 = \frac{a_0}{2}$ (2) $r_0 = 2a_0$ (3) $r_0 = 4a_0$ (4) $r_0 = a_0$

NTA. (2)
RESO. (2)
Sol. At node $\Psi_{2s}^2 = 0$

$\Psi_{2s} = 0$

So, $\left(2-\frac{r}{a_0}\right) = 0$

$2 - \frac{r_0}{a_0} = 0$

$2 - \frac{r_0}{a_0} \Rightarrow r_0 = 2a_0$

49. Which of the following reaction is correct?

(1) $2LiNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$ (2) $4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 2N_2O_4 + O_2$

(3) $2LiNO_3 \longrightarrow 2Li + 2NO_2 + O_2$ (4) $4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$

NTA. (4)
RESO. (4)
Sol. On heating $LiNO_3$ we get Li_2O, NO_2 and O_2

$4LiNO_3 \rightarrow 2Li_2O + 4NO_2 + O_2$

50. Chlorides of which metal are soluble in organic solvents:

(1) Mg (2) Ca (3) K (4) Be

NTA. (4)
RESO. (4)

Sol. Due to smaller size, Be^{2+} will show more polarising power, Hence $BeCl_2$ will have maximum covalent character & most soluble in organic solvents.

51. The strength of 50 volume solution of hydrogen peroxide is _____ g/L (Nearest integer).
Given: Molar mass of H_2O_2 is 34 g mol^{-1}
Molar volume of gas at STP = 22.7 L.

NTA. (150)
RESO. (150)

Sol. $2H_2O_2(l) \longrightarrow H_2O(l) + O_2(g)$

$\left(2\times\frac{50}{22.7}\right)$ mole $\qquad\qquad$ $\left(\frac{50}{22.7}\right)$ mole

$$W_{H_2O_2} = \left(\frac{2\times 50}{22.7}\right) \times 34$$

= 149.78 gram

Ans. 150

52. Lead storage battery contains 38% by weight solution of H_2SO_4. The van't Hoff factor is 2.67 at this concentration. The temperature in Kelvin at which the solution in the battery will freeze is _____ (Nearest integer).
Given K_f = 1.8 K kg mol^{-1}

NTA. (243)
RESO. (243)

Sol. $\Delta T_f = i_{max} \times K_f \times$ molality
Consider 100 g solution
$W(H_2SO_4)$ = 38 gm
W (Water) = 62 g

$$\text{Molality} = \frac{38\times 1000}{98\times 62} = 6.254$$

$\Delta T_f = i \times K_f \times$ molality
= 2.67 × 1.8 × 6.254 = 30ºC
Freezing point of liquid in battery is –30°C
The temperature in Kelvin at which the solution in the battery will freeze is
= 273 + (–30ºC) = 273 – 30ºC = 243 K

53. The electrode potential of the following half cell at 298 K
X I X^{2+}(0.0011 M) II Y^{2+} (0.01 M) I Y is _____ × 10^{-2} V (Nearest integer).
Given: $E^{\circ}_{X^{2+}|X}$ = –2.36 V
$E^{\circ}_{Y^{2+}|Y}$ = +0.36 V

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

NTA. (275)
RESO. (275)

Sol. $E^o_{cell} = E^o_{Y^{2+}|Y} - E^o_{X^{2+}|X} = 0.36 - (-2.36) = 2.72$

$$E_{cell} = E^o_{cell} - \frac{0.06}{2}\log\frac{[X^{2+}]}{[Y^{2+}]}$$

$$= 2.72 - 0.03 \log\left(\frac{11\times10^{-4}}{10^{-2}}\right)$$

$= 2.72 - 0.03 \log (11 \times 10^{-2})$

$= 2.72 - 0.03 [\log 11 - 2]$

$= 2.72 - 0.03 [1 - 2]$

$= 2.72 + 0.03$

$= 2.75$

Ans. 275

54. The graph of $\log\frac{x}{m}$ vs log p for an adsorption process is a straight line inclined at an angle of 45º with intercept equal to 0.6020. The mass of gas adsorbed per unit mass of adsorbent at the pressure of 0.4 atm is _____ $\times 10^{-1}$ (Nearest integer).

Given: log 2 = 0.3010

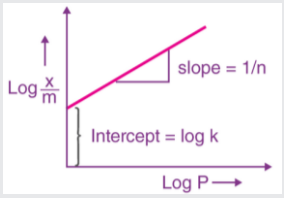
NTA. (16)

RESO. (16)

Sol. $\frac{x}{m} = kP^{\frac{1}{n}}$

$\log(x/m) = \log k + \frac{1}{n}\log P$

log (x/m) vs logP graph will be straight ling with



slope = $\frac{1}{n} = \tan 45^o = 1$

y = intercept = log k_1 = 0.6020 = log 4 $\Rightarrow$ k = 4

$\log\frac{x}{m} = \log 4 + \log 0.4$

$\log\frac{x}{m} = \log 1.6$

$\frac{x}{m} = 1.6 \quad \Rightarrow \quad 16 \times 10^{-1}$

55. An organic compound undergoes first order decomposition. If the time taken for the 60% decomposition is 540 s, then the time required for 90% decomposition will be is _____ s. (Nearest integer).
Given: in 10 = 2.3; log 2 = 0.3

NTA. (1350)

RESO. (1350)

Sol. First order reaction

$$t = \frac{1}{k} \ln \frac{C_0}{C_t}$$

$$540 = \frac{1}{k} \ln \frac{100}{40} \quad ....(1)$$

$$t = \frac{1}{k} \ln \frac{100}{40} \quad ....(2)$$

from (1) and (2)

$$\frac{540}{t} = \frac{\ln \frac{100}{40}}{\ln \frac{100}{10}} = \frac{\log 100 - \log 40}{\log 100 - \log 10}$$

$$\frac{540}{t} = \frac{2 - 1.6}{2 - 1} = 0.4$$

$$t = \frac{540}{0.4} = 1350$$

56. 1 mole of ideal gas is allowed to expand reversibly and adiabatically from a temperature of 27°C. The work done is 3 kJ mol^{-1}. The final temperature of the gas is _____K (Nearest integer). Given C_V = 20 J mol^{-1} K^{-1}

NTA. (150)

RESO. (150)

Sol. $W = -q = -nC_V [T_2 - T_1] = 3 \times 10^3$ J

$\Rightarrow \quad -1 \times 20 [T_2 - 300] = 3 \times 100$

$\Rightarrow \quad -(T_2 - 300) = \frac{3000}{20}$

$\therefore \quad T_2 = 150$

57. Consider the following equation:
$2SO_4(g) + O_2(g) \rightarrow 2SO_3(g)$, $\Delta H = -190$ kJ
The number of factors which will increase the yield of SO_3 at equilibrium from the following is _____.
A. Increasing temperature
B. Increasing pressure
C. Adding more SO_2
D. Adding more O_2
E. Addition of catalyst

NTA. (3)

RESO. (3)

Sol. (i) As reaction is exothermic. So on increase in temperature equilibrium shift in backward direction.
(ii) On increasing pressure equilibrium shift in forward direction.
(iii) Addition of catalyst does not affect equilibrium it only increase rate of reaction.
(iv) Addition of catalyst does not affect equilibrium it only increase rate of reaction.

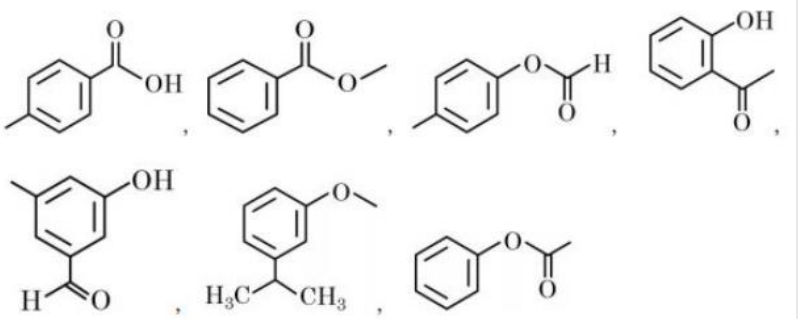
58. A short peptide on complete hydrolysis produces 3 moles of glycine (G), two moles of leucine (L) and two moles of valine (V) per mole of peptide. The number of peptide linkages in it are …….. .

NTA. (6)

RESO. (6)

Sol. 3 moles of glycine (G), two moles of leucine (L) and two moles of valine (V) per mole of peptide show that peptide chain has 7 amino acid that is a heptapeptide chain The number of peptide linkages in it are 6.

59. Number of compounds from the following which will not dissolve in cold $NaHCO_3$ and NaOH solution but will dissolve in hot NaOH solution is



NTA. (3)

RESO. (3)

Sol. not dissolve in cold $NaHCO_3$ and NaOH solution show that this not carboxylic acid and phenol group. but will dissolve in hot NaOH solution means that a ester functional group.

60. Iron oxide FeO, crystallises in a cubic lattice with a unit cell edge length of 5.0 Å. If density of the FeO in the crystal is 4.0 g cm^{-3}, then the number of FeO units present per unit cell is …… . (Nearest integer)
(Given: Molar mass of Fe and O is 56 and 16 g mol^{-1} respectively.
$N_A = 6.0 \times 10^{23}$ mol^{-1}

NTA. (4)

RESO. (4)

Sol. $d = \dfrac{Z \times M}{N_A \times V}$

$$4 = \frac{Z \times 72}{6 \times 10^{23} \times [5 \times 10^{-8}]^3}$$

$$4 = \frac{Z \times 72}{6 \times 125 \times 10^{-1}}$$

$$Z = \frac{4 \times 6 \times 125}{72 \times 10}$$

$Z = 4$

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SANSKAR SHAURYA
Roll No.: 21925113

AIR-50
ANIRUDH GARG
Roll No.: 21220122

AIR-54
SOUMITRA D. NAYAK
Roll No.: 21220554

AIR-58
KANISHK SHARMA
Roll No.: 21220454

ADMISSIONS OPEN FOR ACADEMIC SESSION 2023-24

TARGET: JEE (Adv.) 2024
for Class XII Passed Student
VISHESH COURSE
MODE: OFFLINE / ONLINE
CLASS STARTS 10th & 17th April

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

Resonance Eduventures Limited
REGISTERED & CORPORATE OFFICE: CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Rajasthan) - 324005
Tel. No.: 0744-2777777, 2777700 | **CIN:** U80302RJ2007PLC024029

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