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# JEE

## (Main)

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

# 2023

## **COMPUTER BASED TEST (CBT) Questions & Solutions**

**Date: 13 April, 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**

61. Which of the following are the green house gases?

- A. Water vapour
- B. Ozone
- C. I<sub>2</sub>
- D. Molecular hydrogen

Choose the most appropriate answer from the options given below

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

Ans. NTA (1)

Sol. Based on fact.

62. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A:** Isotopes of hydrogen have almost same chemical properties, but difference in their rates of reaction.

**Reason R:** Isotopes of hydrogen have different enthalpy of bond dissociation.

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

- (1) Both A and R are correct and R is the correct explanation of A
- (2) A is not correct but R is correct
- (3) A is correct but R is not correct
- (4) Both A and R are correct but R is NOT the correct explanation of A

Ans. NTA (1)

Sol. Due to difference in bond enthalpy the rate of reaction of isotopes of hydrogen is different.

63. Given below are two statements:

**Statement I:** SO<sub>2</sub> and H<sub>2</sub>O both possess V-shaped structure.

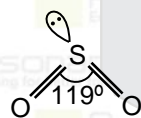
**Statement II:** The bond angle of SO<sub>2</sub> is less than that of H<sub>2</sub>O.

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

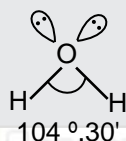
- (1) Statement I is incorrect but Statement II is correct
- (2) Both Statement I and Statement II are correct
- (3) Statement I is correct but Statement II is incorrect
- (4) Both Statement I and Statement II are incorrect

Ans. NTA (3)

Sol.

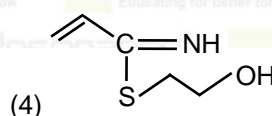
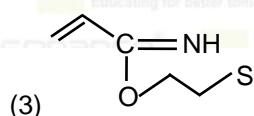
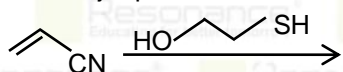


Hybridisation = sp<sup>2</sup>  
no of lone pair = 1



Hybridisation = sp<sup>3</sup>  
no of lone pair = 2

64. The major product for the following reaction is:



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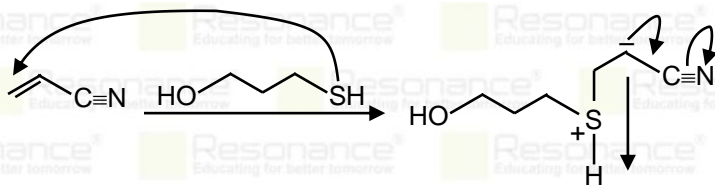
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Ans. NTA : (2)



Sol.



65. Match List I with List II

List-I		List-II	
A.	Weak intermolecular forces of attraction	I.	Hexamethylenediamine + adipic acid
B.	Hydrogen bonding	II.	AlEt <sub>3</sub> + TiCl <sub>4</sub>
C.	Heavily branched polymer	III.	2-chloro - 1,3 - butadiene

Choose the correct answer from the options given below:

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

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

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

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

Ans. NTA : (1)

Sol. (i) Formation of high density polythene uses Zeigler-Natta catalyst.

(ii) Phenol formaldehyde resin is highly branched.

(iii) Nylon-6,6 is formed by Hexamethylenediamine and adipic acid and it has inter molecular H-bonding due to amide group.

66. Given below are two statements related to Ellingham diagram:

**Statement I** : Ellingham diagrams can be constructed for formation of oxides, sulfides and halides of metals.

**Statement II** : It consists of plots of  $\Delta H$  vs T for formation of oxides of elements.

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

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

(2) Both Statement I and Statement II are correct

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

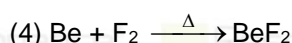
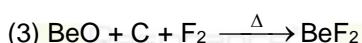
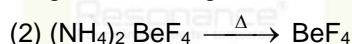
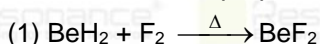
(4) Both Statement I and Statement II are incorrect

Ans. NTA (4)

Sol. S<sub>1</sub> : Ellingham diagrams can be constructed for formation of oxides of metals.

S<sub>2</sub> : It consists of plots of  $\Delta G$  vs T for formation of oxides of elements.

67. Better method for preparation of BeF<sub>2</sub> among the following is



Ans. NTA (2)

Sol. Thermal decomposition of (NH<sub>4</sub>)<sub>2</sub>BeF<sub>4</sub> is the best route for the preparation of BeF<sub>2</sub>



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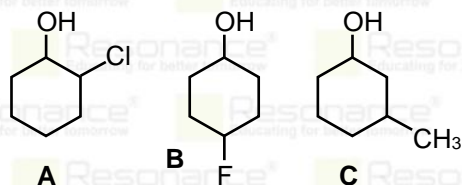
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68. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R**.  
**Assertion A** : Order of acidic nature of the following compounds is A > B > C.



Reason R : Fluoro is a stronger electron withdrawing group than Chloro group.

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

- (1) Both A and R are correct and R is the correct explanation of A
- (2) A is not correct but R is correct
- (3) A is correct but R is not correct
- (4) Both A and R are correct but R is NOT the correct explanation of A

**Ans. NTA : (3)**

**Sol.** Chlorine at  $\alpha$  carbon is more electron withdrawing  $-I$  than F at  $\alpha$  carbon, where  $\text{CH}_3$  is  $+I$  group.

69. The naturally occurring amino acid that contains only one basic functional group in its chemical structure is

- (1) Arginine
- (2) Histidine
- (3) Lysine
- (4) Asparagine

**Ans. NTA : (4)**

**Sol.** Lysine, Arginine and Histidine are basic amino acids with one extra basic functional group, whereas Asparagine has additional-amide group, which is not classified as basic functional group.

70. Which of the following complexes will exhibit maximum attraction to an applied magnetic field?

- (1)  $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$
- (2)  $[\text{Co}(\text{en})_3]^{3+}$
- (3)  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
- (4)  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$

**Ans. NTA (3)**

**Sol.**

Complex	Electronic configuration	No. of unpaired electrons
$[\text{Co}(\text{en})_6]^{3+}$	$\text{Co}^{3+}: 3d^6 \Rightarrow t_{2g}^{2,2,2}, e_g^{0,0}$	0
$[\text{Co}(\text{H}_2\text{O})_6]^{2+}$	$\text{Co}^{2+}: 3d^7 \Rightarrow t_{2g}^{2,2,1}, e_g^{1,1}$	3
$[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$	$\text{Ni}^{2+}: 3d^8 \Rightarrow t_{2g}^{2,2,2}, e_g^{1,1}$	2
$[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$	$\text{Zn}^{2+}: 3d^{10} \Rightarrow t_{2g}^{2,2,2}, e_g^{2,2}$	0

Greater the number of unpaired electrons greater is the interaction in magnetic field.

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71. Identify the correct order of standard enthalpy of formation of sodium halides.

- (1)  $\text{NaI} < \text{NaBr} < \text{NaCl} < \text{NaF}$
- (2)  $\text{NaI} < \text{NaBr} < \text{NaF} < \text{NaCl}$
- (3)  $\text{NaF} < \text{NaCl} < \text{NaBr} < \text{NaI}$
- (4)  $\text{NaCl} < \text{NaF} < \text{NaBr} < \text{NaI}$

Ans. NTA (1)

Sol. Compound	$\Delta H_f$ (KJ/mol)
NaF	-569
NaCl	-400
NaBr	-360
NaI	-288

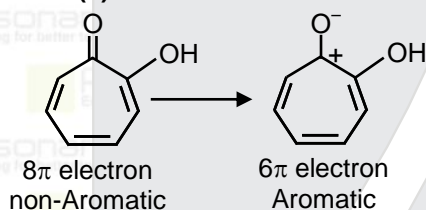
72. Given below are two statements :

**Statement I :** Tropolone is an aromatic compound and has  $8\pi$  electrons.

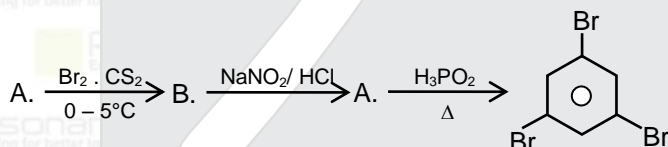
**Statement II :**  $\pi$  electrons of  $>C=O$  group in tropolone is involved in aromaticity.

- (1) Both statement I and statement II are false
- (2) Statement I is false but statement II is true
- (3) Statement I is true but statement II is false
- (4) Both statement I and statement II are true

Ans. NTA : (3)

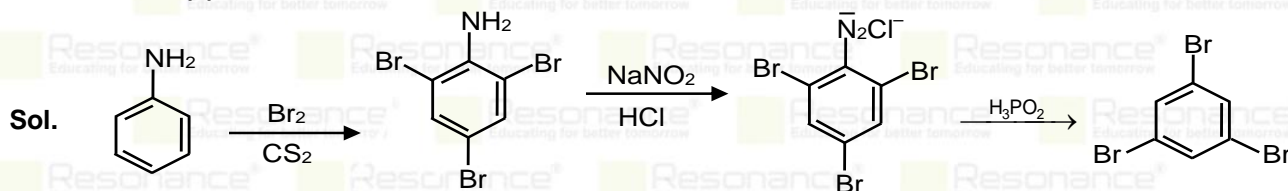


73. Compound A from the following reaction sequence is:



- (1) Salicylic acid
- (2) Benzoic acid
- (3) Phenol
- (4) Aniline

Ans. NTA : (4)



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74. Match List-I with List-II

1-Bromopropane is reacted with reagents in List I to give product in List II

	List-I – Reagent		List-II Product
A.	KOH (alc)	I.	Nitrile
B.	KCN(alc)	II.	Ester
C.	AgNO <sub>2</sub>	III.	Alkene
D.	H <sub>3</sub> CCOOAg	IV.	Nitroalkane

Choose the correct answer from the options given below:

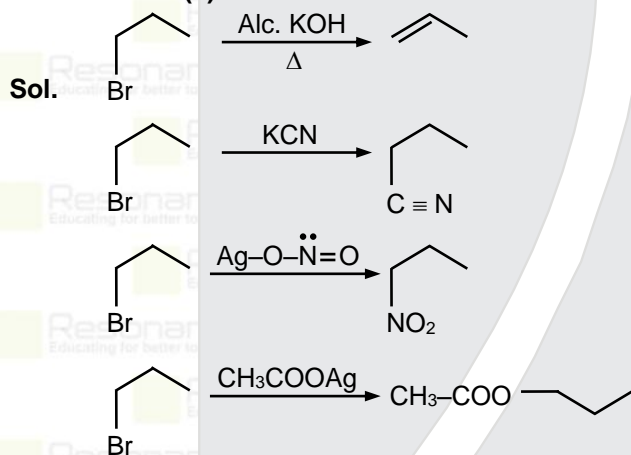
(1) A-I, B-II, C-III, D-IV

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

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

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

Ans. NTA : (3)



75. The total number of stereoisomers for the complex  $[\text{Co}(\text{ox})_2\text{ClBr}]^{3-}$  (where ox = oxalate) is:

(1) 2

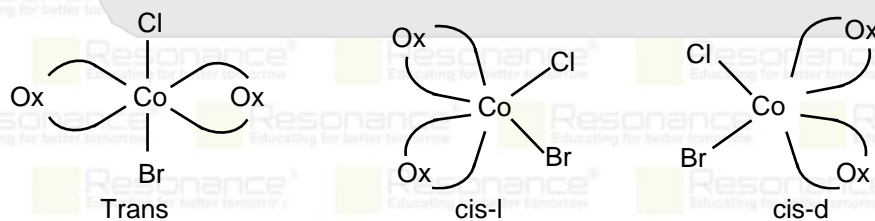
(2) 3

(3) 1

(4) 4

Ans. NTA (2)

Sol.  $[\text{Co}(\text{Ox})_2\text{ClBr}]^{3-}$  [M(AA)<sub>2</sub>ab]



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76. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.  
**Assertion A:** The diameter of colloidal particles in solution should not be much smaller than wavelength of light to show Tyndall effect.

**Reason R:** The light scatters in all directions when the size of particles is large enough.

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 correct and R is the correct explanation of A
- (3) Both A and R are correct but R is NOT the correct explanation of A
- (4) A is true but R is false

**Ans. NTA (2)**

**Sol.** The diameter of colloidal particles in solution should not be much smaller than wavelength of light to show Tyndall effect. Because the light scatters in all directions when the size of particles is large enough.

77. The correct group of halide ions which can be oxidised by oxygen in acidic medium is

- (1) I<sup>-</sup> only
- (2) Br<sup>-</sup> and I<sup>-</sup> only
- (3) Cl<sup>-</sup>, Br<sup>-</sup> and I<sup>-</sup> only
- (4) Br<sup>-</sup> only

**Ans. NTA (1)**

**Sol.** Reduction potential

$$E_{I_2/I^-}^{\circ} = 0.54V$$

$$E_{Br_2/Br^-}^{\circ} = 1.09V$$

$$E_{O_2/H_2O}^{\circ} = 1.23V$$

$$E_{Cl_2/Cl^-}^{\circ} = 1.36V$$

R.P. is in order Cl<sub>2</sub> > Br<sub>2</sub> > I<sub>2</sub>

O.P. is revers in order

So, I<sup>-</sup> and Br<sup>-</sup> ion will get oxidised.

78. What happens when methane undergoes combustion in system A and B respectively?

Adiabatic  
system

Diathermic  
container

System A

System B

1.	<b>System A</b> Temperature falls	<b>System B</b> Temperature rises
2.	<b>System A</b> Temperature rises	<b>System B</b> Temperature remains same
3.	<b>System A</b> Temperature falls	<b>System B</b> Temperature remains same
4.	<b>System A</b> Temperature remains same	<b>System B</b> Temperature rises

**Ans. NTA (2)**

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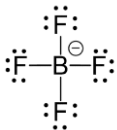
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79. The covalency and oxidation state of boron in  $[\text{BF}_4]^-$ , are

- (1) 3 and 5
- (2) 4 and 3
- (3) 3 and 4
- (4) 4 and 4

Ans. NTA (2)

Sol. Covalency = 4



For oxidation number  $x + 4(-1) = -1$

$$\therefore x = 3$$

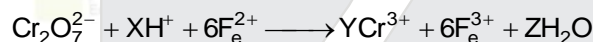
80. In the wet tests for detection of various cations by precipitation,  $\text{Ba}^{2+}$  cations are detected by obtaining precipitate of

- (1)  $\text{BaSO}_4$
- (2)  $\text{BaCO}_3$
- (3)  $\text{Ba}(\text{OAc})_2$
- (4)  $\text{Ba}(\text{ox})$  : Barium oxalate

Ans. NTA (2)

Sol. tests for detection of various cations by precipitation,  $\text{Ba}^{2+}$  cations are detected by obtaining precipitate of  $\text{BaCO}_3$

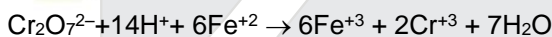
81. See the following chemical reaction:



The sum of X, Y and Z is \_\_\_\_\_.

Ans. NTA (23)

Sol. Balance reaction is :



$$X = 14 \qquad Y = 2 \qquad Z = 7$$

$$\text{Hence } (X+Y+Z) = 14+2+7 = 23$$

82.  $\text{A}(\text{g}) \rightarrow 2\text{B}(\text{g}) + \text{C}(\text{g})$  is a first order reaction. The initial pressure of the system was found to be 800 mm Hg which increased to 1600 mm Hg after 10 min. The total pressure of the system after 30 min will be \_\_\_\_\_ mm Hg. (Nearest integer)

Ans. NTA (2200)

Sol.



$$P_T = 800 - P + 2P + P$$

$$= 800 + 2P = 1600$$

$$\text{So } P = 400 \text{ mm}$$

$$\text{So } t_{\frac{1}{2}} = 10 \text{ min}$$

$$\frac{1}{2}$$

Given time 30 min

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So for 1<sup>st</sup> order Reaction  $C_t = \frac{C_0}{(2)^n}$

$$n = \frac{t}{t_1} = \frac{30}{10} = 3 ; n = \text{number of half life}$$

$$C_t = \frac{800}{(2)^3} = 100 \text{ mm of Hg}$$

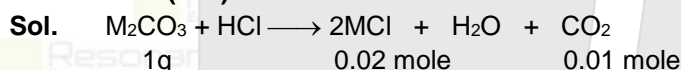
So after 30 min  $P = 700 \text{ mm}$

$$P_A = 800 - 700 = 100, \quad P_B = 1400, \quad P_C = 700$$

$$P_T \text{ of reaction mixture} = 100 + 1400 + 700 = 2200 \text{ mm of Hg}$$

83. 1g of a carbonate ( $M_2CO_3$ ) on treatment with excess HCl produces 0.01 mol of  $CO_2$ . The molar mass of  $M_2CO_3$  is \_\_\_\_\_ g  $mol^{-1}$ . (Nearest integer)

Ans. NTA (100)



POAC on C-atom

$$\text{Mole of } M_2CO_3 \times 1 = \text{Mole of } CO_2 \times 1$$

$$\frac{1}{(MM)} \times 1 = (0.01) \times 1$$

$$\text{molar mass of } M_2CO_3 = 100 \text{ g/mol}$$

84. Sodium metal crystallizes in a body centred cubic lattice with unit cell edge length of 4 Å. The radius of sodium atom is \_\_\_\_\_  $\times 10^{-1}$  Å (Nearest integer)

Ans. NTA (17)

Sol. The relation between edge length and radius in bcc lattice is  $4R = \sqrt{3}a$   
 given  $a = 4\text{Å}$

$$4R = \sqrt{3} \times 4$$

$$R = 1.732\text{Å} = 17.32 \times 10^{-1} = 17$$

85. At 298 K, the standard reduction potential for  $Cu^{2+}/Cu$  electrode is 0.34 V.

$$\text{Given : } K_{sp} Cu(OH)_2 = 1 \times 10^{-20}$$

$$\text{Take } \frac{2.303RT}{F} = 0.059V$$

The reduction potential at pH = 14 for the above couple is  $(-)\times 10^{-2}V$ .

The value of x is \_\_\_\_\_.

Ans. NTA 25

Sol. pH = 14  $\Rightarrow$  pOH = 0

$$[OH^-] = 1$$

$$K_{sp} Cu(OH)_2 = [Cu^{2+}] [OH^-]^2 = 1 \times 10^{-20}$$

$$[Cu^{2+}] = 10^{-20}$$

$$E_{Cu^{2+}/Cu} = E^0_{Cu^{2+}/Cu} - \frac{0.059}{2} \log \frac{1}{[Cu^{2+}]}$$

$$= 0.34 - \frac{0.059}{2} \log 10^{20}$$

$$= -0.25$$

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$$= -25 \times 10^{-2} \text{ V.}$$

86. If the formula of Borax is  $\text{Na}_2\text{B}_4\text{O}_x(\text{OH})_y \cdot z\text{H}_2\text{O}$ , then  $x + y + z =$  \_\_\_\_\_.

Ans. NTA 17

Sol. Formula of borax is  $\text{Na}_2\text{B}_4\text{O}_5(\text{OH})_4 \cdot 8\text{H}_2\text{O}$   
 $X + Y + Z = 5 + 4 + 8 = 17$

87. 20mL of 0.1 M NaOH is added to 50 mL of 0.1 M acetic acid solution. The pH of the resulting solution is \_\_\_\_\_  $\times 10^{-2}$  (Nearest integer)

Given :  $\text{pK}_a(\text{CH}_3\text{COOH}) = 4.76$

$\log 2 = 0.30$

$\log 3 = 0.48$

Ans. NTA 458

Sol.  $\text{NaOH} + \text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$

0.1 M, 20 ml      0.1 M, 50 ml

Millimole =  $0.1 \times 20 = 2$ ,  $0.1 \times 50 = 5$

L.R. = NaOH

So 0                       $5 - 2 = (3)$                       (2)

So Resultant solution is Acidic buffer solution

So  $\text{pH} = \text{pK}_a + \log\left(\frac{\text{salt}}{\text{acid}}\right)$

$$\text{pH} = 4.76 + \log \frac{2}{3}$$

$$\text{pH} = 4.76 + (-0.18) = 4.58 = 458 \times 10^{-2}$$

88. Sea water contains 29.25% NaCl and 19%  $\text{MgCl}_2$  by weight of solution. The normal boiling point of the sea water is \_\_\_\_\_  $^\circ\text{C}$  (Nearest integer)

Assume 100% ionization for both NaCl and  $\text{MgCl}_2$

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

Molar mass of NaCl and  $\text{MgCl}_2$  is 58.5 and  $95 \text{ g mol}^{-1}$  respectively.

Ans. NTA (116)

Sol. Total weight of solute in solution =  $29.25 + 19 = 48.25 \text{ gm}$

Total weight of solvent in solution =  $100 - 48.25 = 51.75 \text{ gm}$

So  $\Delta T_b = i \times K_b \times m = (i \times m) \times K_b$

$$\text{mole of NaCl} = \frac{29.25}{58.5} = 0.5$$

$$\text{Mole of MgCl}_2 = \frac{19}{95} = 0.2$$

$$\Delta T_b = \left( 2 \times \frac{29.25}{58.5} \times \frac{1000}{51.75} + 3 \times \frac{19}{95} \times \frac{1000}{51.75} \right) \times 0.52$$

So  $T_b$  Boiling point of solution  $T_b = 100 + \Delta T_b = 116$

89. The orbital angular momentum of an electron in 3s orbital is  $\frac{xh}{2\pi}$ . The value of x is \_\_\_\_\_

(Nearest integer)

Ans. NTA (0)

Sol. orbital angular momentum for 3s orbital = 0

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