

FINAL JEE-MAIN EXAMINATION - SEPTEMBER, 2020

Held On Friday, 4 September 2020

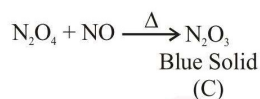
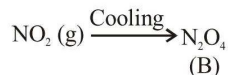
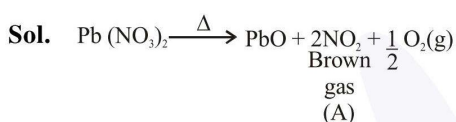
TIME : 9 : 00 AM to 12 : 00 PM

1. On heating, lead(II) nitrate gives a brown gas (A). The gas (A) on cooling changes to a colourless solid/liquid (B). (B) on heating with NO changes to a blue solid (C). The oxidation number of nitrogen in solid (C) is :

(1) +5 (2) +2

(3) +4 (4) +3

Official Ans. by NTA (4)



O.S. of nitrogen in N_2O_3 is + 3

$$\text{N}_2\text{O}_3 \quad 2x + 3(-2) = 0$$

$$x = + 3$$

2. Which of the following will react with $\text{CHCl}_3 + \text{alc. KOH}$?

(1) Adenine and lysine

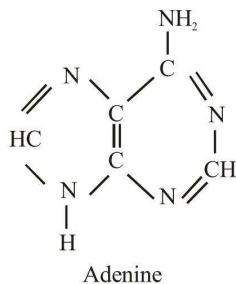
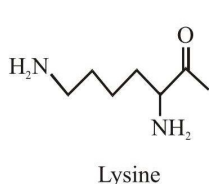
(2) Adenine and thymine

(3) Adenine and proline

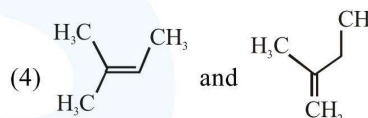
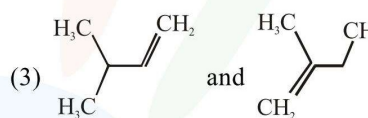
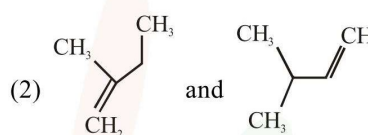
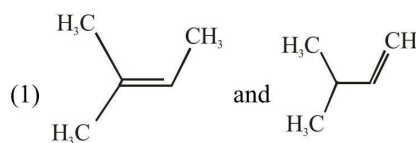
(4) Thymine and proline

Official Ans. by NTA (1)

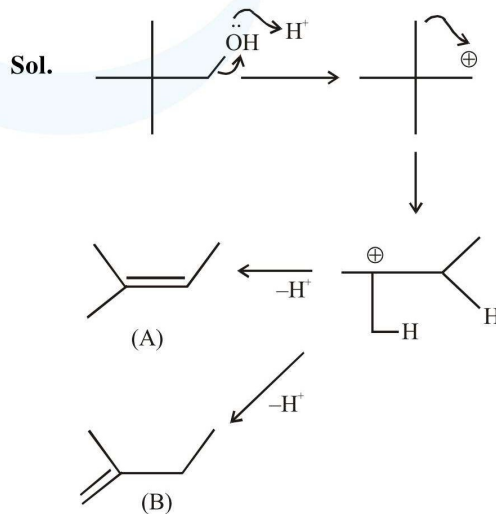
Sol. Adenine and lysine Both have primary amine react with $\text{CHCl}_3 + \text{alc. KOH}$



3. When neopentyl alcohol is heated with an acid, it slowly converted into an 85 : 15 mixture of alkenes A and B, respectively. What are these alkenes ?



Official Ans. by NTA (4)



4. Among statements (a) -(d), the correct ones are :

- (a) Lime stone is decomposed to CaO during the extraction of iron from its oxides.
 - (b) In the extraction of silver, silver is extracted as an anionic complex.
 - (c) Nickel is purified by Mond's process.
 - (d) Zr and Ti are purified by Van Arkel method.
- (1) (c) and (d) only
 (2) (a), (c) and (d) only
 (3) (b), (c) and (d) only
 (4) (a), (b), (c) and (d)

Official Ans. by NTA (4)

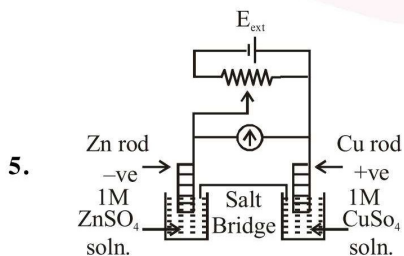
Sol. (a) $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2$ {In Blast furnace}
 lime stone

(b) Ag form cyanide complex $[\text{Ag}(\text{CN})_2]^-$ during cyaride process



- (c) Ni is purified by mond's process
 - (d) Zr and Ti are purified by van arkel method
- All (a), (b), (c), (d) are correct statements

Thus correct option is (4)



$$E^\circ_{\text{Cu}^{2+}|\text{Cu}} = +0.34\text{V}$$

$$E^\circ_{\text{Zn}^{2+}|\text{Zn}} = -0.76\text{V}$$

Identify the incorrect statement from the options below for the above cell :

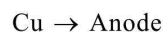
- (1) If $E_{\text{ext}} > 1.1\text{ V}$, Zn dissolves at Zn electrode and Cu deposits at Cu electrode
- (2) If $E_{\text{ext}} > 1.1\text{ V}$, e^- flows from Cu to Zn
- (3) If $E_{\text{ext}} = 1.1\text{ V}$, no flow of e^- or current occurs
- (4) If $E_{\text{ext}} < 1.1\text{ V}$, Zn dissolves at anode and Cu deposits at cathode

Official Ans. by NTA (1)

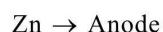
Sol. $E^\circ_{\text{cell}} = 0.34 - (-0.76)$

$$= 1.10\text{ volt}$$

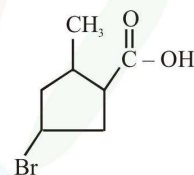
If $E_{\text{ext}} > 1.10\text{ volt}$



If $E_{\text{ext}} = 1.10\text{ volt}$

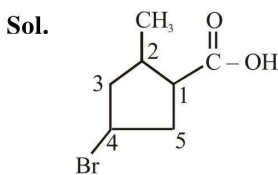


6. The IUPAC name of the following compound is :



- (1) 4-Bromo-2-methylcyclopentane carboxylic acid
- (2) 5-Bromo-3-methylcyclopentanoic acid
- (3) 3-Bromo-5-methylcyclopentane carboxylic acid
- (4) 3-Bromo-5-methylcyclopentanoic acid

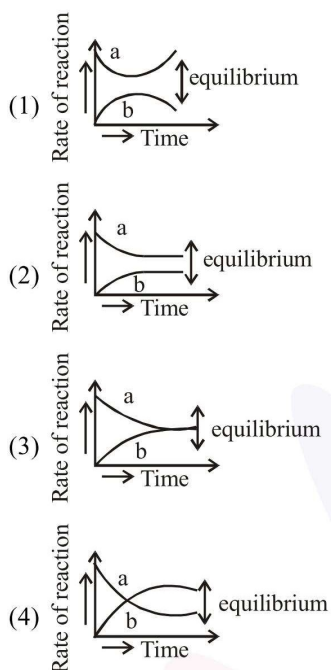
Official Ans. by NTA (1)



4-bromo-2-methyl cyclopentane carboxylic Acid



7. For the equilibrium $A \rightleftharpoons B$, the variation of the rate of the forward (a) and reverse (b) reaction with time is given by

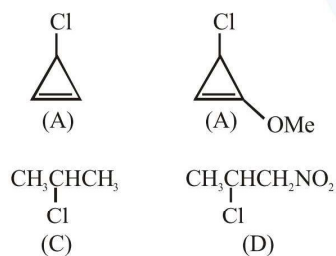


Official Ans. by NTA (3)

Sol. at equilibrium

$$r_a = r_b$$

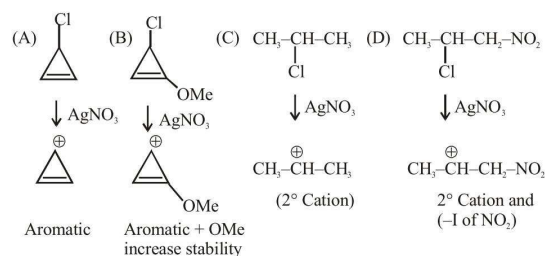
8. The decreasing order of reactivity of the following organic molecules towards AgNO_3 solution is :



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

Official Ans. by NTA (4)

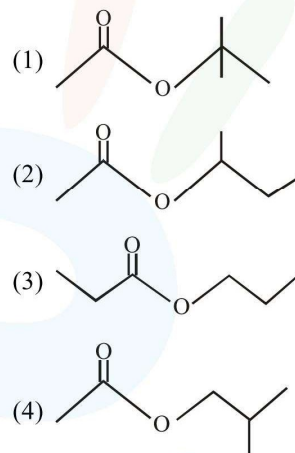
Sol.



Aromatic Aromatic + OMe increase stability

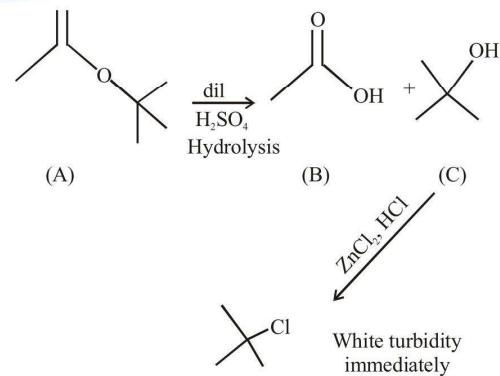
\therefore Stability Cation $B > A > C > D$

9. An organic compound (A) (molecular formula $\text{C}_6\text{H}_{12}\text{O}_2$) was hydrolysed with dil. H_2SO_4 to give a carboxylic acid (B) and an alcohol (C). 'C' give white turbidity immediately when treated with anhydrous ZnCl_2 and conc. HCl . The organic compound (A) is :



Official Ans. by NTA (1)

Sol.





10. Match the following :

- | | |
|---------------|----------------|
| (i) Foam | (a) smoke |
| (ii) Gel | (b) cell fluid |
| (iii) Aerosol | (c) jellies |
| (iv) Emulsion | (d) rubber |
| | (e) froth |
| | (f) milk |

- (1) (i)-(b), (ii)-(c), (iii)-(e), (iv)-(d)
 (2) (i)-(d), (ii)-(b), (iii)-(e), (iv)-(f)
 (3) (i)-(e), (ii)-(c), (iii)-(a), (iv)-(f)
 (4) (i)-(d), (ii)-(b), (iii)-(a), (iv)-(e)

Official Ans. by NTA (3)

Sol. Foam - Froth

Gel → Jellies

Aerosol → Smoke

Sol → Cell fluids

Solid sol → rubber

11. The elements with atomic numbers 101 and 104 belong to, respectively :

- (1) Group 11 and Group 4
 (2) Actinoids and Group 4
 (3) Actinoids and Group 6
 (4) Group 6 and Actinoids

Official Ans. by NTA (2)

Sol. Element with atomic no. 101 is an Actinoid element.

12. On combustion Li, Na and K in excess of air, the major oxides formed, respectively, are :

- (1) Li_2O , Na_2O and K_2O_2
 (2) Li_2O , Na_2O_2 and K_2O
 (3) Li_2O , Na_2O_2 and KO_2
 (4) Li_2O_2 , Na_2O_2 and K_2O_2

Official Ans. by NTA (3)

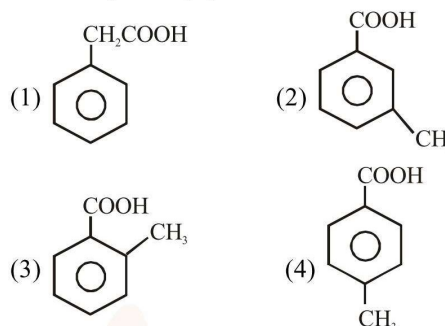
Sol. $\text{Li} + \text{O}_2 \rightarrow \text{Li}_2\text{O}$ (Major Oxides)
 excess

$\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}_2$ (")

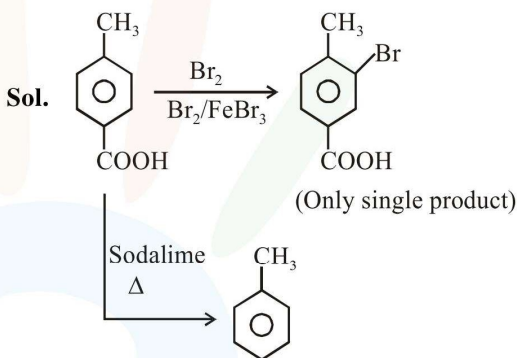
$\text{K} + \text{O}_2 \rightarrow \text{KO}_2$ (")

13. [P] on treatment with $\text{Br}_2/\text{FeBr}_3$ in CCl_4 produced a single isomer $\text{C}_8\text{H}_7\text{O}_2\text{Br}$ while heating [P] with sodalime gave toluene.

The compound [P] is :



Official Ans. by NTA (4)

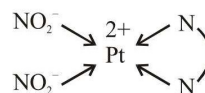


14. The number of isomers possible for $[\text{Pt}(\text{en})(\text{NO}_2)_2]$ is :

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

Official Ans. by NTA (1)

Sol. $[\text{Pt}(\text{en})(\text{NO}_2)_2] \Rightarrow$ does not show G.I. as well as optical isomerism.



This complex will have three linkage isomers as follows :-

$[\text{Pt}(\text{en})(\text{NO}_2)_2]$ I

$[\text{Pt}(\text{en})(\text{NO}_2)(\text{ONO})]$ II

$[\text{Pt}(\text{en})(\text{ONO})_2]$ III



15. The ionic radii of O_2^- , F^- , Na^+ and Mg^{2+} are in the order :

- (1) $F^- > O_2^- > Na^+ > Mg^{2+}$
- (2) $Mg^{2+} > Na^+ > F^- > O_2^-$
- (3) $O_2^- > F^- > Mg^{2+} > Na^+$
- (4) $O_2^- > F^- > Na^+ > Mg^{2+}$

Official Ans. by NTA (4)

Sol.

	O_2^-	F^-	Na^+	Mg^{2+}
z	8	9	11	12
e^-	10	10	10	10
$\frac{Z}{e}$	0.8	0.9	1.1	1.2

as $\frac{Z}{e}$ ratio increases size decreases.

Thus correct ionic radii order is

$O_2^- > F^- > Na^+ > Mg^{2+}$

Therefore correct option is (4)

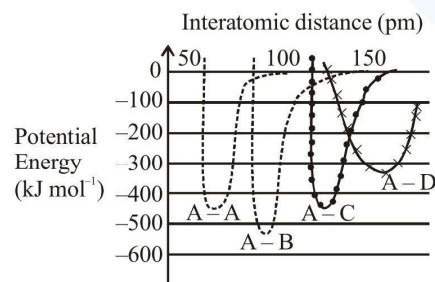
16. The region in the electromagnetic spectrum where the Balmer series lines appear is

- (1) Visible
- (2) Microwave
- (3) Ultraviolet
- (4) Infrared

Official Ans. by NTA (1)

Sol. Balmer series give visible lines For H-atom

17. The intermolecular potential energy for the molecules A, B, C and D given below suggests that :



- (1) D is more electronegative than other atoms
- (2) A-D has the shortest bond length
- (3) A-B has the stiffest bone
- (4) A-A has the largest bond enthalpy

Official Ans. by NTA (3)

Sol. From the given graph, potential energy of A-B molecule is minimum.

Thus A-B bond is most stable and have strongest bond amongst these.

B → Most electronegative

D → Least electronegative

A-B → Shortest bond length

A-B → Largest bond enthalpy

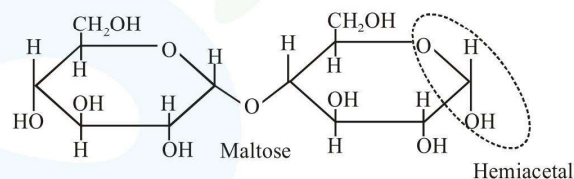
Therefore correct option is (3).

18. What are the functional groups present in the structure of maltose ?

- (1) One ketal and one hemiketal
- (2) One acetal and one hemiacetal
- (3) Two acetals
- (4) One acetal and one ketal

Official Ans. by NTA (2)

Sol.



19. For one mole of an ideal gas, which of these statements must be true ?

- (a) U and H each depends only on temperature
 - (b) Compressibility factor z is not equal to 1
 - (c) $C_{P,m} - C_{V,m} = R$
 - (d) $dU = C_V dT$ for any process
- (1) (a), (c) and (d) (2) (b), (c) and (d)
 (3) (c) and (d) (4) (a) and (c)

Official Ans. by NTA (1)

Sol. For ideal Gas

$U = f(T)$, $H = f(T)$

$Z = 1$

$C_p - C_v = R$

$dU = C_V dT$



20. The pair in which both the species have the same magnetic moment (spin only) is :

- (1) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$
- (2) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{CoCl}_4]^{2-}$
- (3) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- (4) $[\text{Co}(\text{OH})_4]^{2-}$ and $[\text{Fe}(\text{NH}_3)_6]^{2+}$

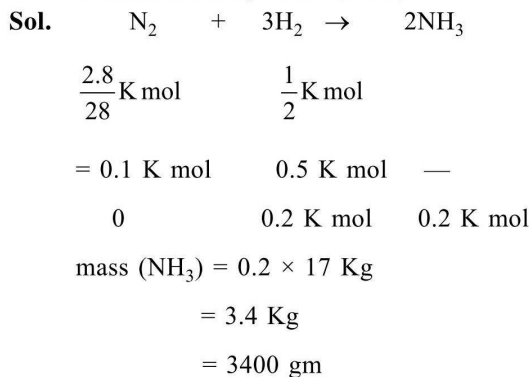
Official Ans. by NTA (3)

Sol.	Complex	e ⁻ configuration	no. of unpaired e ⁻
	$[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$	$\boxed{\uparrow\uparrow}\text{eg}$	5
	WFL	$\boxed{\uparrow\uparrow\uparrow\uparrow}\text{t}_2\text{g}$	
	$[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$	$\boxed{\uparrow}\text{eg}$	4
	WFL	$\boxed{\uparrow\uparrow\uparrow\uparrow}$	
	$[\text{CoCl}_4]^{2-}$	$\boxed{\uparrow\uparrow\uparrow\uparrow}\text{t}_2$	3
	Tetrahedral	$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\text{e}$	
	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	$\boxed{\uparrow\uparrow}\text{eg}$	4
	WFL	$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\text{t}_2\text{g}$	
	$[\text{Co}(\text{OH})_4]^{2-}$	$\boxed{\uparrow\uparrow\uparrow\uparrow}\text{t}_2$	3
	WFL	$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\text{e}$	
	Tetrahedral	$\boxed{\uparrow\uparrow}$	4
	$[\text{Fe}(\text{NH}_3)_6]^{2+}$	$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}$	

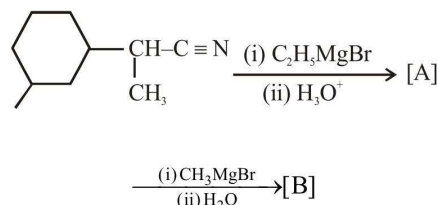
Thus complex $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ have same no. of unpaired e⁻ and hence same magnetic moment (spin only).

21. The mass of ammonia in grams produced when 2.8 kg of dinitrogen quantitatively reacts with 1 kg of dihydrogen is _____.

Official Ans. by NTA (3400)

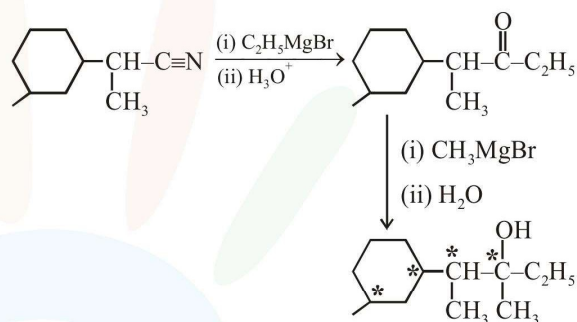


22. The number of chiral centres present in [B] is _____.



Official Ans. by NTA (4)

Sol.



23. A 20.0 mL solution containing 0.2 g impure H_2O_2 reacts completely with 0.316 g of KMnO_4 in acid solution. The purity of H_2O_2 (in %) is _____ (mol. wt. of $\text{H}_2\text{O}_2 = 34$; mol. wt. of $\text{KMnO}_4 = 158$)

Official Ans. by NTA (85)

Sol. Eq of $\text{H}_2\text{O}_2 = \text{Eq of KMnO}_4$

$$x \times 2 = \frac{0.316}{158} \times 5$$

$$x = 5 \times 10^{-3} \text{ mol}$$

$$m_{\text{H}_2\text{O}_2} = 5 \times 10^{-3} \times 34 = 0.17 \text{ gm}$$

$$\% \text{H}_2\text{O}_2 = \frac{0.17}{0.2} \times 100 = 85$$



24. If 75% of a first order reaction was completed in 90 minutes, 60% of the same reaction would be completed in approximately (in minutes) _____.

(Take : $\log 2 = 0.30$; $\log 2.5 = 0.40$)

Official Ans. by NTA (60)

Sol. $t_{0.75} = 2 \times \frac{\ln 2}{k} = 90$

$$k = \frac{\ln 2}{45} \text{ min}^{-1}$$

$$kt = \ln \frac{1}{1-0.6} = \ln 2.5$$

$$\frac{\ln 2}{45} \times t = \ln 2.5$$

$$t = 45 \times \frac{\log 2.5}{\log 2} = 45 \times \frac{0.4}{0.3} = 60 \text{ min}$$

25. At 300 K, the vapour pressure of a solution containing 1 mole of n-hexane and 3 moles of n-heptane is 550 mm of Hg. At the same temperature, if one more mole of n-heptane is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. What is the vapour pressure in mm Hg of n-heptane in its pure state _____ ?

Official Ans. by NTA (600)

Sol. $550 = P_A^{\circ} \times \frac{1}{4} + P_B^{\circ} \times \frac{3}{4}$

$$2200 = P_A^{\circ} + 3P_B^{\circ} \quad \dots(i)$$

$$2800 = P_A^{\circ} + 4P_B^{\circ} \quad \dots(ii)$$

$$560 = P_A^{\circ} \times \frac{1}{5} + P_B^{\circ} \times \frac{4}{5}$$

$$P_B^{\circ} = 600, P_A^{\circ} = 400$$