FINAL JEE–MAIN EXAMINATION – SEPTEMBER, 2020

(Held On Friday 04th SEPTEMBER, 2020) TIME : 9 AM to 12 PM

CHEMISTRY TEST PAPER WITH ANSWER & SOLUTION

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)

Sol. $Pb(NO_3)_2 \xrightarrow{\Delta} PbO + \underset{\text{Brown gas (A)}}{2NO_2} + \frac{1}{2}O_2(g)$

$NO_2(g) \xrightarrow{\text{Cooling}} \underset{\text{(B)}}{N_2O_4}$

$N_2O_4 + NO \xrightarrow{\Delta} \underset{\text{Blue Solid (C)}}{N_2O_3}$

O.S. of nitrogen in N_2O_3 is + 3

N_2O_3 $2x + 3(-2) = 0$

$x = +3$

2. Which of the following will react with $CHCl_3$ + alc. KOH ?

(1) Adenine and lysine

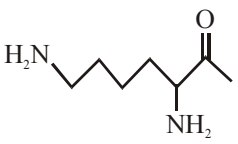
(2) Adenine and thymine

(3) Adenine and proline

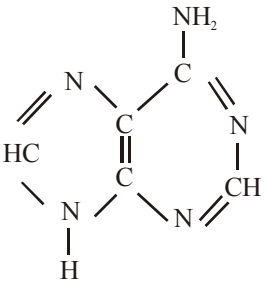
(4) Thymine and proline

Official Ans. by NTA (1)

Sol. Adenine and lysine Both have primary amine react with $CHCl_3$ + alc. KOH

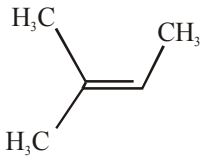
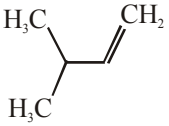


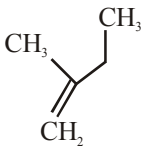
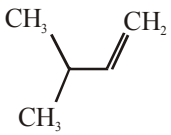
Lysine

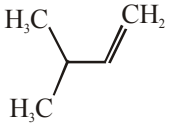
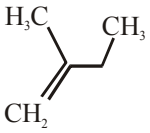


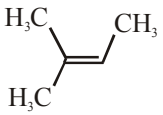
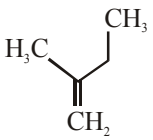
Adenine

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 ?

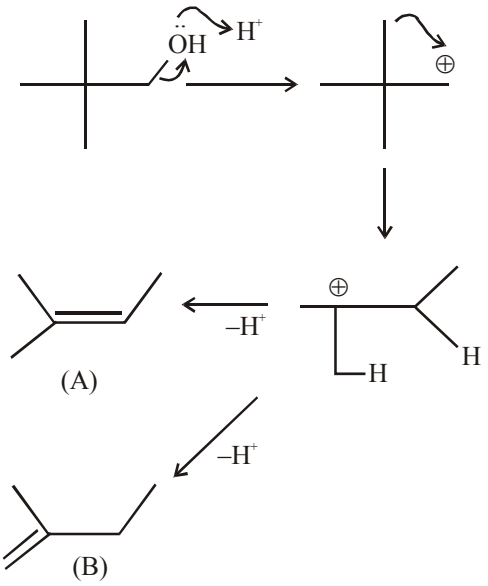
(1)  and 

(2)  and 

(3)  and 

(4)  and 

Official Ans. by NTA (4)

Sol. 

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) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$ {In Blast furnace}

lime stone

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

$Ag / Ag_2S + CN^{\ominus} \rightarrow [Ag(CN)_2]^-$

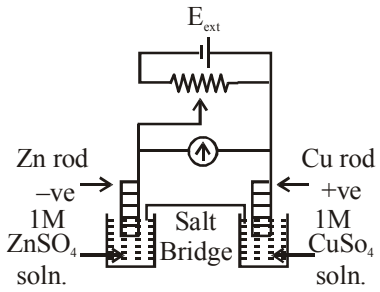
(c) Ni is purified by mond's process

(d) Zr and Ti are purified by van arkel method

All (a), (b), (c), (d) are correct statements

Thus correct option is (4)

5.



$E^{o}_{Cu^{2+}|Cu} = +0.34V$

$E^{o}_{Zn^{2+}|Zn} = -0.76V$

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

(1) If E_{ext} > 1.1 V, Zn dissolves at Zn electrode and Cu deposits at Cu electrode

(2) If E_{ext} > 1.1 V, e^- flows from Cu to Zn

(3) If E_{ext} = 1.1 V, no flow of e^- or current occurs

(4) If E_{ext} < 1.1 V, Zn dissolves at anode and Cu deposits at cathode

Official Ans. by NTA (1)

Sol. $E^{o}_{cell} = 0.34 - (-0.76)$

$= 1.10$ volt

If $E_{ext} > 1.10$ volt

Cu $\rightarrow$ Anode

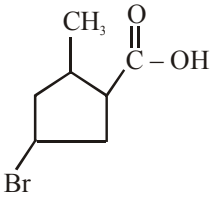
Zn $\rightarrow$ Cathode

If $E_{ext} = 1.10$ volt

Zn $\rightarrow$ Anode

Cu $\rightarrow$ Cathode

6. The IUPAC name of the following compound is :



(1) 4-Bromo-2-methylcyclopentane carboxylic acid

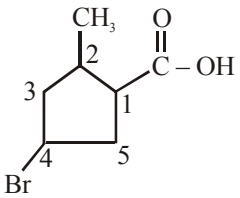
(2) 5-Bromo-3-methylcyclopentanoic acid

(3) 3-Bromo-5-methylcyclopentane carboxylic acid

(4) 3-Bromo-5-methylcyclopentanoic acid

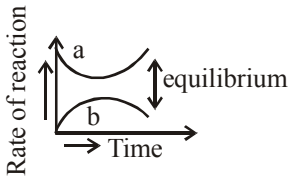
Official Ans. by NTA (1)

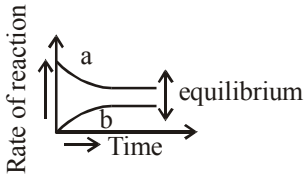
Sol.

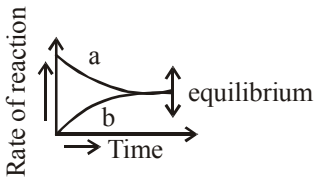


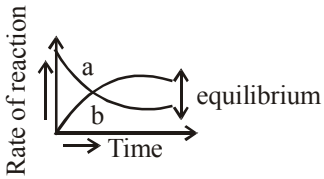
4-bromo-2-methyl cyclopentane carboxylic Acid

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

(1) 

(2) 

(3) 

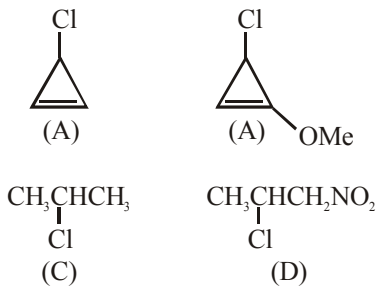
(4) 

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)

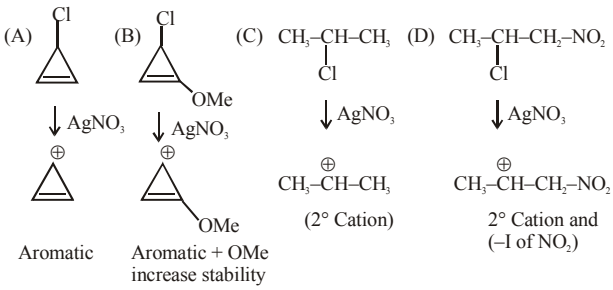
(2) (A) > (B) > (C) > (D)

(3) (C) > (D) > (A) > (B)

(4) (B) > (A) > (C) > (D)

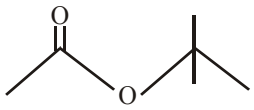
Official Ans. by NTA (4)

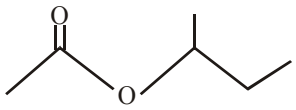
Sol.

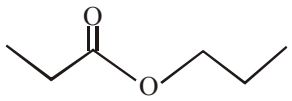


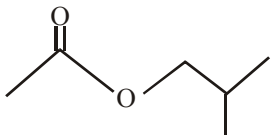
∴ Stability Cation B > A > C > D

9. An organic compound (A) (molecular formula $C_6H_{12}O_2$) 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 :

(1) 

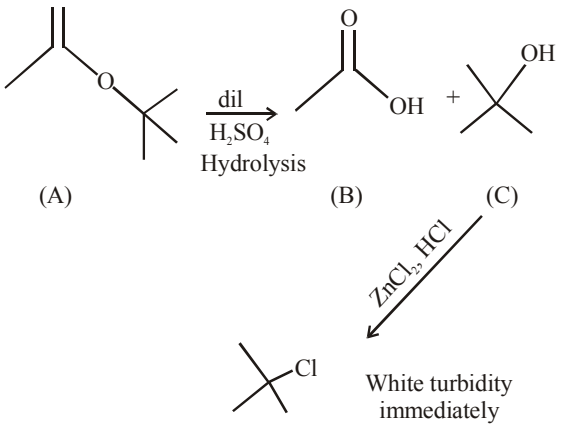
(2) 

(3) 

(4) 

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 $\rightarrow$ Jellies

Aerosol $\rightarrow$ Smoke

Sol $\rightarrow$ Cell fluids

Solid sol $\rightarrow$ 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)

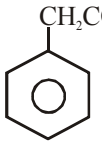
Sol. $Li + O_2 \rightarrow Li_2O$ (Major Oxides)
excess

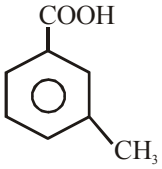
Na + " $\rightarrow$ Na_2O_2 (")

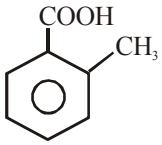
K + " $\rightarrow$ KO_2 (")

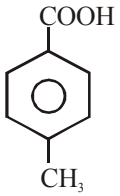
13. [P] on treatment with $Br_2/FeBr_3$ in CCl_4 produced a single isomer $C_8H_7O_2Br$ while heating [P] with sodalime gave toluene.

The compound [P] is :

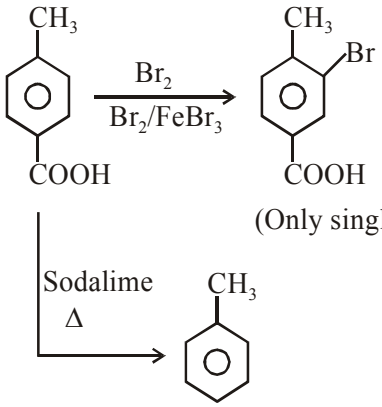
(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (4)

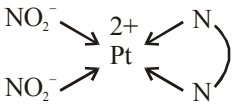
Sol. 

14. The number of isomers possible for $[Pt(en)(NO_2)_2]$ is :

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

Official Ans. by NTA (1)

Sol. $[Pt\ (en)\ (NO_2)_2] \Rightarrow$ does not show G.I. as well as optical isomerism.



This complex will have three linkage isomers as follows :-

[Pt (en) (NO_2)2] I

[Pt (en) (NO_2)(ONO)] II

[Pt (en) $(ONO)_2$] 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

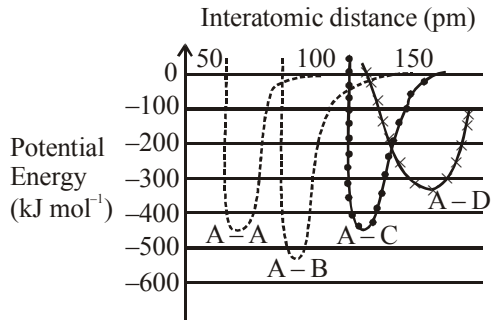
(3) Ultraviolet

(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

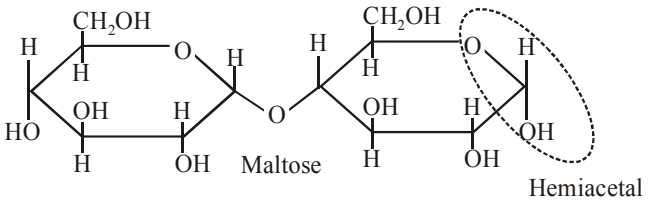
(2) One acetal and one hemiacetal

(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) $[Mn(H_2O)_6]^{2+}$ and $[Cr(H_2O)]^{2+}$

(2) $[Cr(H_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$

(3) $[Cr(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{2+}$

(4) $[Co(OH)_4]^{2-}$ and $[Fe(NH_3)_6]^{2+}$

Official Ans. by NTA (3)

Sol.

Complex	e⁻ configuration	no. of unpaired e⁻
$[Mn(H_2O)_6]^{2+}$ WFL	↑ ↑ eg; ↑ ↑ ↑ t2g	5
$[Cr(H_2O)_6]^{2+}$ WFL	↑ eg; ↑ ↑ ↑	4
$[COCl_4]^{2-}$ Tetrahedral	↑ ↑ ↑ t_2; ↿⇂ ↿⇂ e	3
$[Fe(H_2O)_6]^{2+}$ WFL	↑ ↑ eg; ↿⇂ ↑ ↑ t_2g	4
$[Co(OH)_4]^{2-}$ WFL	↑ ↑ ↑ t_2; ↿⇂ ↿⇂ e	3
Tetrahedral $[Fe(NH_3)_6]^{2+}$	↑ ↑; ↿⇂ ↑ ↑	4

Thus complex $[Cr(H_2O)_6]^{2+}$ and $[Fe(H_2O)_6]^{2+}$ 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)

Sol. $N_2 + 3H_2 \rightarrow 2NH_3$

$\frac{2.8}{28}$ K mol $\quad \frac{1}{2}$ K mol

= 0.1 K mol $\quad$ 0.5 K mol $\quad$ —

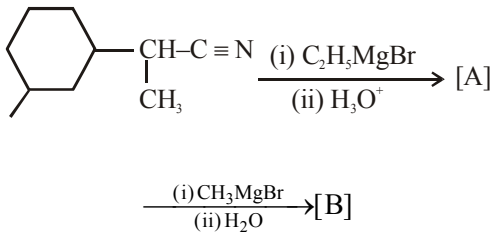
0 $\quad$ 0.2 K mol $\quad$ 0.2 K mol

mass (NH_3) = 0.2 × 17 Kg

= 3.4 Kg

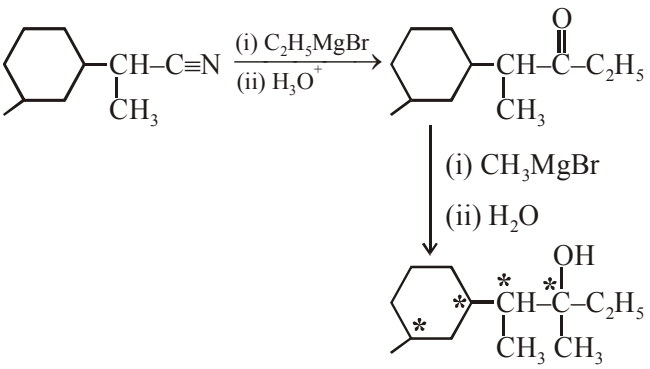
= 3400 gm

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 H_2O_2 = 34; mol. wt. of $KMnO_4$ = 158)

Official Ans. by NTA (85)

Sol. Eq of H_2O_2 = Eq of $KMnO_4$

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

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

$$m_{H_2O_2} = 5 \times 10^{-3} \times 34 = 0.17 \text{gm}$$

$$\%H_2O_2 = \frac{0.17}{0.2} \times 100 = 85$$

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

$2200 = P_A^o + 3P_B^o$ .....(i)

$2800 = P_A^o + 4P_B^o$ ....(ii)

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

$P_B^o = 600, P_A^o = 400$