FINAL JEE–MAIN EXAMINATION – APRIL,2019

(Held On Wednesday 10th APRIL, 2019) TIME : 2 : 30 PM To 5 : 30 PM

CHEMISTRY

TEST PAPER WITH ANSWER & SOLUTION

1. The correct match between Item-I and Item-II is:

	Item-I		Item-II
(a)	High density polythene	(I)	Peroxide catalyst
(b)	Polyacrylonitrile	(II)	Condensation at high temperature & pressure
(c)	Novolac	(III)	Ziegler-Natta Catalyst
(d)	Nylon 6	(IV)	Acid or base catalyst

(1) (a)→(III), (b)→(I), (c)→(II), (d)→(IV)

(2) (a)→(IV), (b)→(II), (c)→(I), (d)→(III)

(3) (a)→(II), (b)→(IV), (c)→(I), (d)→(III)

(4) (a)→(III), (b)→(I), (c)→(IV), (d)→(II)

Official Ans. by NTA (4)

Sol.

(a)	High density polythene	(III)	Ziegler-Natta Catalyst
(b)	Polyacrylonitrile	(I)	Peroxide catalyst
(c)	Novolac	(IV)	Acid or base catalyst
(d)	Nylon 6	(II)	Condensation at high temperature & pressure

2. Which of the following is NOT a correct method of the preparation of benzylamine from cyanobenzene ?

(1) (i) HCl/H_2O (ii) $NaBH_4$

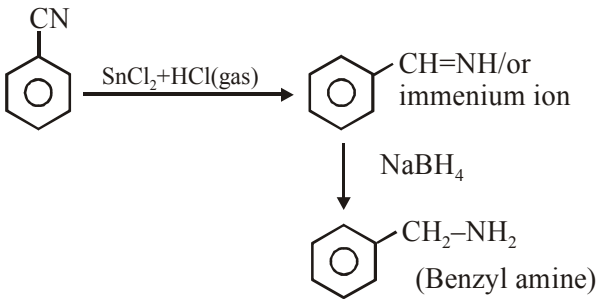
(2) (i) $LiAlH_4$ (ii) H_3O^+

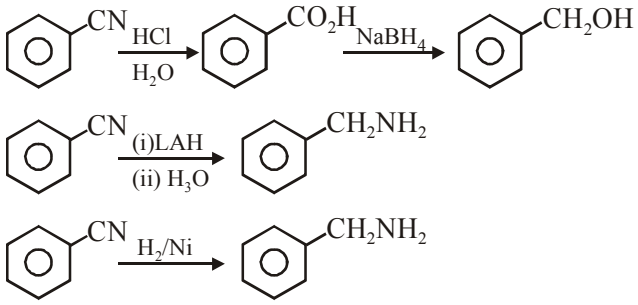
(3) (i) $SnCl_2$+HCl(gas) (ii) $NaBH_4$

(4) H_2/Ni

Official Ans. by NTA (1)

Sol.





3. Which of these factors does not govern the stability of a conformation in acyclic compounds ?

(1) Torsional strain

(2) Angle strain

(3) Steric interactions

(4) Electrostatic forces of interaction

Official Ans. by NTA (2)

Sol. in acyclic compounds angle strain does not govern the stability of a conformation.

4. The difference between ΔH and ΔU (ΔH–ΔU), when the combustion of one mole of heptane (1) is carried out at a temperature T, is equal to:

(1) 3RT (2) –3RT (3) –4RT (4) 4RT

Official Ans. by NTA (3)

Sol. $C_7H_{16}(\ell) + 11O_2(g) \longrightarrow 7CO_2(g) + 8H_2O(\ell)$

$\Delta n_g = n_p - n_r = 7 - 11 = -4$

$\because \Delta H = \Delta U + \Delta n_g RT$

$\therefore \Delta H - \Delta U = -4\ RT$

5. For the reaction of H_2 with I_2, the rate constant is 2.5×10^{-4} dm^3 mol^{-1} s^{-1} at 327°C and 1.0 dm^3 mol^{-1} s^{-1} at 527°C. The activation energy for the reaction, in kJ mol^{-1} is:

(R=8.314J K^{-1} mol^{-1})

(1) 72 (2) 166 (3) 150 (4) 59

Official Ans. by NTA (2)

Sol. $H_2(g) + I_2(g) \rightarrow 2HI(g)$

Apply Arrhenius equation

$$\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{1}{600} - \frac{1}{800}\right)$$

$$\log\frac{1}{2.5\times10^{-4}} = \frac{E_a}{2.303\times8.31}\left(\frac{200}{600\times800}\right)$$

$\therefore E_a \approx 166$kJ/mol

6. The correct statements among (a) to (b) are:

(a) saline hydrides produce H_2 gas when reacted with H_2O.

(b) reaction of $LiAH_4$ with BF_3 leads to B_2H_6.

(c) PH_3 and CH_4 are electron - rich and electron-precise hydrides, respectively.

(d) HF and CH_4 are called as molecular hydrides.

(1) (c) and (d) only

(2) (a), (b) and (c) only

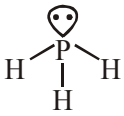
(3) (a), (b), (c) and (d)

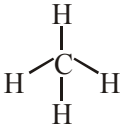
(4) (a), (c) and (d) only

Official Ans. by NTA (3)

Sol. (a) $\underset{\text{Ionic hydride/saline hydride}}{\overset{\oplus}{M}\overset{\ominus}{H}} + HOH \longrightarrow MOH + H_2$

(b) $4BF_3 + 3LiAlH_4 \longrightarrow 2B_2H_6 + 3LiF + 3AlF_3$

(c)  → phosphorous is electron rich hydride due to presence of lone pair

 → It is electron precise hydride.

(d) HF & CH_4 are molecular hydride due to they are covalent molecules.

7. The increasing order of nucleophilicity of the following nucleophiles is :

(a) $CH_3CO_2^{\ominus}$ (b) H_2O

(c) $CH_3SO_3^{\ominus}$ (d) $\overset{\ominus}{O}H$

(1) (b) < (c) < (a) < (d)

(2) (a) < (d) < (c) < (b)

(3) (d) < (a) < (c) < (b)

(4) (b) < (c) < (d) < (a)

Official Ans. by NTA (1)

Sol. $\underset{\text{Charged ion}}{\overline{O}H > CH_3-\overset{O}{\overset{\|}{C}}-O^- > CH_3-\overset{O}{\overset{\|}{S}}-O^-} > \underset{\text{neutral system}}{H_2O}$

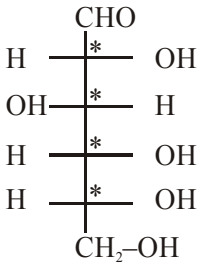
ione pair donating tendency on oxygen is reduced, nucleophilicity reduced b < c < a < d

8. Number of stereo centers present in linear and cyclic structures of glucose are respectively :

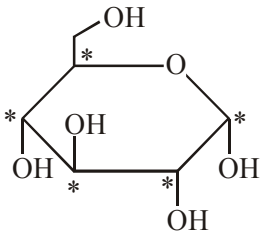
(1) 4 & 5 (2) 5 & 5 (3) 4 & 4 (4) 5 & 4

Official Ans. by NTA (1)

Sol.



D–Glucose
(Linear structure)



α-D–Glucose
(cyclic structure)

∗ :- Stereocenter

9. A hydrated solid X on heating initially gives a monohydrated compound Y. Y upon heating above 373K leads to an anhydrous white powder Z. X and Z, respectively, are:

(1) Washing soda and soda ash.

(2) Washing soda and dead burnt plaster.

(3) Baking soda and dead burnt plaster.

(4) Baking soda and soda ash.

Official Ans. by NTA (1)

Sol. $\underset{\text{washing soda (X)}}{Na_2CO_3.10H_2O(s)} \xrightarrow{\Delta} \underset{(Y)}{Na_2CO_3.H_2O} \xrightarrow{\Delta,\ T > 373k} \underset{\text{(soda ash) (Z)}}{Na_2CO_3}$

10. The number of pentagons in C_{60} and trigons (triangles) in white phosphorus, respectively, are:

(1) 12 and 3 (2) 20 and 4

(3) 12 and 4 (4) 20 and 3

Official Ans. by NTA (3)

Sol. Total No. of pentagons in C_{60} = 12

Total no. of trigons (triangles) in white phosphorus (P_4) = 4

11. The correct order of the first ionization enthalpies is:

(1) Mn < Ti < Zn < Ni

(2) Ti < Mn < Ni < Zn

(3) Zn < Ni < Mn < Ti

(4) Ti < Mn < Zn < Ni

Official Ans. by NTA (2)

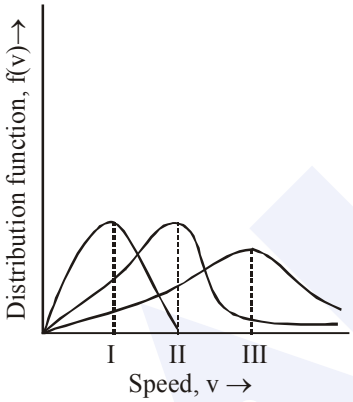
Sol. Ti → |Ar| $3d^2\ 4s^2$
Mn → |Ar| $3d^5\ 4s^2$
Ni → |Ar| $3d^8\ 4s^2$
Zn → |Ar| $3d^{10}\ 4s^2$
Correct order of I.P. is
[Ti < Mn < Ni < Zn]

12. The correct option among the following is :
(1) Colloidal particles in lyophobic sols can be precipiated by electrophoresis.
(2) Brownian motion in colloidal solution is faster the viscosity of the solution is very high.
(3) Colloidal medicines are more effective because they have small surface area.
(4) Addition of alum to water makes it unfit for drinking.

Official Ans. by NTA (1)

Sol. In electrophoresis precipitation occurs at the electrode which is oppositely charged therefore (1) is correct.

13. Points I, II and III in the following plot respectively correspond to
(V_{mp} : most probable velocity)



(1) V_{mp} of N_2 (300K); V_{mp} of H_2(300K); V_{mp} of O_2(400K)
(2) V_{mp} of H_2 (300K); V_{mp} of N_2(300K); V_{mp} of O_2(400K)
(3) V_{mp} of O_2 (400K); V_{mp} of N_2(300K); V_{mp} of H_2(300K)
(4) V_{mp} of N_2 (300K); V_{mp} of O_2(400K); V_{mp} of H_2(300K)

Official Ans. by NTA (4)

Sol. $V_{mp} = \sqrt{\frac{2RT}{M}} \Rightarrow V_{mp} \propto \sqrt{\frac{T}{M}}$

For N_2, O_2, H_2

$$\sqrt{\frac{300}{28}} < \sqrt{\frac{400}{32}} < \sqrt{\frac{300}{2}}$$

V_{mp} of N_2(300K) < V_{mp} of O_2(400K) < V_{mp} of H_2(300K)

14. The INCORRECT statement is :
(1) the spin-only magnetic moments of $[Fe(H_2O)_6]^{2+}$ and and $[Cr(H_2O)_6]^{2+}$ are nearly similar.
(2) the spin-only magnetic moment of $[Ni(NH_3)_4(H_2O)_2]^{2+}$ is 2.83BM.
(3) the gemstone, ruby, has Cr^{3+} ions occupying the octahedral sites of beryl.
(4) the color of $[CoCl(NH_3)_5]^{2+}$ is violet as it absorbs the yellow light.

Official Ans. by NTA (3)

Sol. (1) $[Fe(H_2O)_6]^{2+}$, $Fe^{2+} \rightarrow 3d^6 \rightarrow$ 4 unpaired electron
$[Cr(H_2O)_6]^{2+}$, $Cr^{2+} \rightarrow 3d^4 \rightarrow$ 4 unpaired electron
(2) $[Ni(NH_3)_4(H_2O)_2]^{2+} = Ni^{2+} \rightarrow 3d^8$
$\rightarrow$ 2 unpaired electron
μ_m = 2.83 B.M
(3) In gemstone, ruby has Cr^{3+} ion occupying the octahedral sites of aluminium oxide (Al_2O_3) normally occupied by Al^{3+} ion.
(4) Complimenry color of violet is yellow

15. For the reaction,
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$,
$\Delta H = -57.2 kJ\ mol^{-1}$ and
$K_c = 1.7 \times 10^{16}$.
Which of the following statement is INCORRECT?
(1) The equilibrium constant is large suggestive of reaction going to completion and so no catalyst is required.
(2) The equilibrium will shift in forward direction as the pressure increase.
(3) The equilibrium constant decreases as the temperature increases.
(4) The addition of inert gas at constant volume will not affect the equilibrium constant.

Official Ans. by NTA (1)

Sol. In option (2)- Δn_g is –ve therfore increase in pressure will bring reaction in forward direction.
In option (3)- as the reaction is exothermic therefore increase in temperature will decrease the equilibrium constant.
In option (4)- Equillibrium constant changes only with temperature.
Hence, option (2), (3) and (4) are correct therefore option (1) is incorrect choice.

16. The pH of a 0.02M NH_4Cl solution will be [given $K_b(NH_4OH)=10^{-5}$ and log2=0.301]

(1) 4.65 (2) 5.35

(3) 4.35 (4) 2.65

Official Ans. by NTA (2)

Sol. For the salt of strong acid and weak base

$$H^+ = \sqrt{\frac{K_w \times C}{K_b}}$$

$$\left[H^+\right] = \sqrt{\frac{10^{-14} \times 2 \times 10^{-2}}{10^{-5}}}$$

$$-\log\left[H^+\right] = 6 - \frac{1}{2}\log 20$$

$\therefore$ pH = 5.35

17. The noble gas that does NOT occur in the atmosphere is:

(1) He (2) Ra

(3) Ne (4) Kr

Official Ans. by NTA (2)

ALLEN Ans. (Bonus)

Sol. In question noble gas asked, which does not exist in the atmosphere and answer is given Ra. Ra is a alkaline earth metal not noble gas it should be Rn. It is printing error in JEE Main paper

18. 1 g of non-volatile non-electrolyte solute is dissolved in 100g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The ratio of the elevation in their boiling points, $\frac{\Delta T_b(A)}{\Delta T_b(B)}$, is :

(1) 5 : 1

(2) 10 : 1

(3) 1 : 5

(4) 1 : 0.2

Official Ans. by NTA (3)

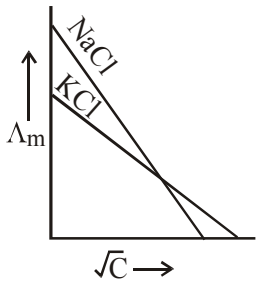
Sol. $\Delta T_b = K_b \times m$

$$\therefore \quad \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}} = \frac{K_{b(A)}}{K_{b(B)}} \text{ as } m_A = m_B$$

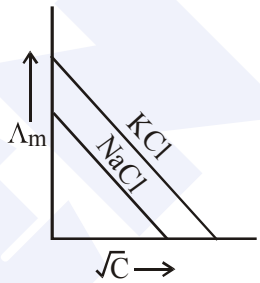
$$\therefore \quad \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}} = \frac{1}{5}$$

19. Which one of the following graphs between molar conductivity (Λ_m) versus $\sqrt{C}$ is correct?

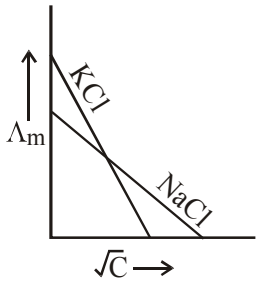
(1)



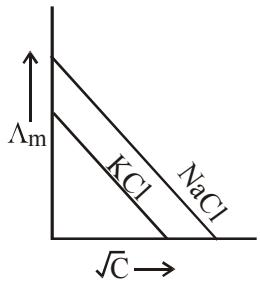
(2)



(3)



(4)



Official Ans. by NTA (2)

Sol. Both NaCl and KCl are strong electrolytes and as Na^+(aq.) has less conductance than K^+(aq.) due to more hydration therefore the graph of option (2) is correct.

20. The correct statement is :

(1) zincite is a carbonate ore

(2) aniline is a froth stabilizer

(3) zone refining process is used for the refining of titanium

(4) sodium cyanide cannot be used in the metallurgy of silver

Official Ans. by NTA (2)

Sol. (1) Zincite is ZnO

(2) Aniline is the forth stablizer.

(3) Zone refining process is not used for refining of 'Ti'

(4) Sodium cyanide is used in the metallurgy of silver

21. The minimum amount of $O_2(g)$ consumed per gram of reactant is for the reaction :

(Given atomic mass : Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1)

(1) $C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(l)$

(2) $P_4(s) + 5\ O_2(g) \rightarrow P_4O_{10}(s)$

(3) $4\ Fe(s) + 3\ O_2(g) \rightarrow 2\ FeO_3(s)$

(4) $2\ Mg(s) + O_2(g) \rightarrow 2\ MgO(s)$

Official Ans. by NTA (3)

Sol. $C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(\ell)$

Each 1g of C_3H_8 requires 3.63 g of O_2

$P_4(s) + 5O_2(g) \longrightarrow P_4O_{10}(s)$

Each 1g of P_4 requires 1.29 g of O_2

$4Fe(s) + 3O_2(g) \longrightarrow 2Fe_2O_3(s)$

Each 1g of Fe requires 0.428 g of O_2

$2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$

Each 1g of Mg requires 0.66 g of O_2

therefore least amount of O_2 is required in option (3).

22. Air pollution that occurs in sunlight is :

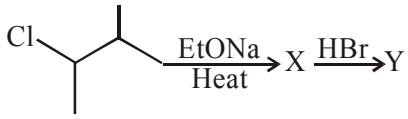
(1) oxidising smog (2) acid rain

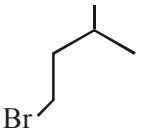
(3) reducing smog (4) fog

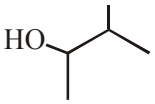
Official Ans. by NTA (1)

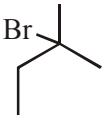
Sol. Photochemical smog occurs in warm (sunlight) and has high concentration of oxidising agent therefore it is called photochemical smog/oxidising smog.

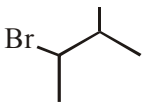
23. The major product 'Y' in the following reaction is:



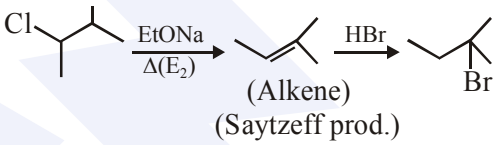
(1) 

(2) 

(3) 

(4) 

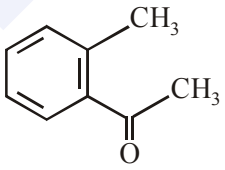
Official Ans. by NTA (3)

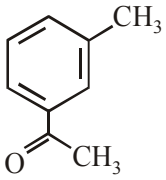
Sol. 

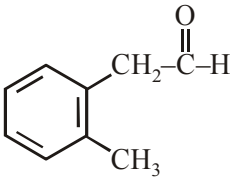
(Alkene)

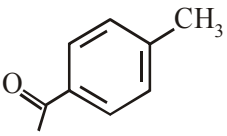
(Saytzeff prod.)

24. Compound A ($C_9H_{10}O$) shows positive iodoform test. Oxidation of A with $KMnO_4$/KOH gives acid B($C_8H_6O_4$). Anhydride of B is used for the preparation of phenolphthalein. Compound A is :-

(1) 

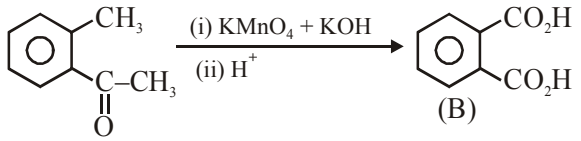
(2) 

(3) 

(4) 

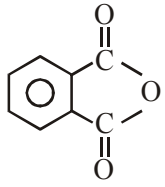
Official Ans. by NTA (1)

Sol.



+ve iodoform test

(B) ($C_8H_6O_4$) Pthleic acid



Pthleic anhydride

is used for prepareation of phenolphthalein indicator

25. The crystal fied stabilization energy (CFSE) of $[Fe(H_2O)_6]Cl_2$ and $K_2[NiCl_4]$, respectively, are :-

(1) $-0.4\Delta_O$ and $-0.8\Delta_t$

(2) $-0.4\Delta_O$ and $-1.2\Delta_t$

(3) $-2.4\Delta_O$ and $-1.2\Delta_t$

(4) $-0.6\Delta_O$ and $-0.8\Delta_t$

Official Ans. by NTA (1)

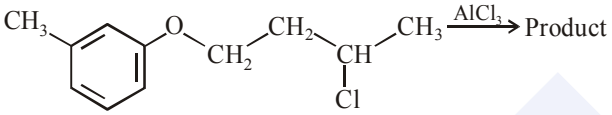
Sol. $[Fe(H_2O)_6]Cl_2$, $Fe^{2+} \rightarrow 3d^6 \rightarrow (t_{2g})^4(e_g)^2$

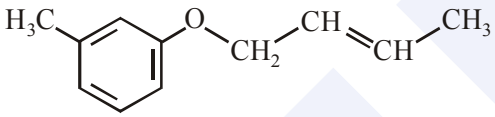
C.F.S.E. $= 4 \times(-0.4\Delta_o) + 2 \times 0.6\Delta_o = -0.4\Delta_o$

$K_2[NiCl_4]$, $Ni^{2+} \rightarrow 3d^8 \rightarrow (e)^4(t_2)^4$

C.F.S.E. $= 4\times(-0.6\Delta_t) + 4 \times (0.4\Delta_t) = -0.8\Delta_t$

26. The major product obtained in the given reaction is :-



(1)


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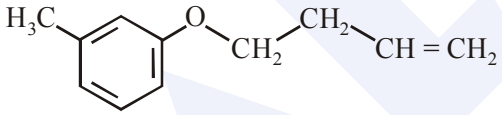

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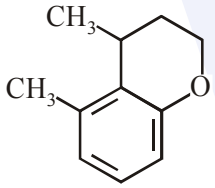
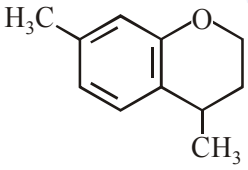
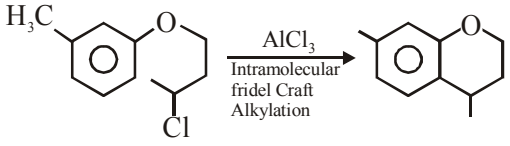


(4)


Official Ans. by NTA (4)

Sol.


27. The highest possible oxidation states of uranium and plutonium, respectively, are :-

(1) 6 and 4 (2) 7 and 6

(3) 4 and 6 (4) 6 and 7

Official Ans. by NTA (4)

Sol. The highest oxidation state of U and Pu is 6+ and 7+ respectively

28. In chromatography, which of the following statements is INCORRECT for R_f?

(1) R_f value depends on the type of chromatography.

(2) The value of R_f can not be more than one.

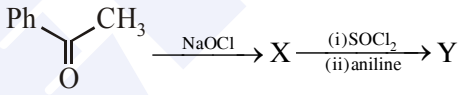
(3) Higher R_f value means higher adsorption.

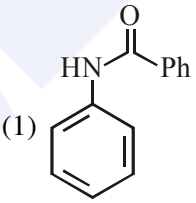
(4) R_f value is dependent on the mobile phase.

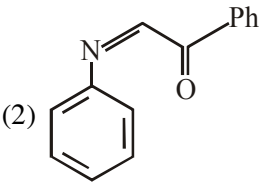
Official Ans. by NTA (3)

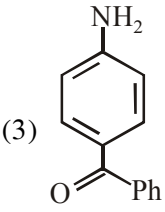
Sol. Except (3) all are correct

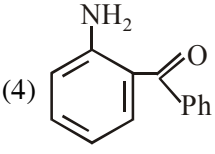
29. The major product 'Y' in the following reaction is:-



(1)


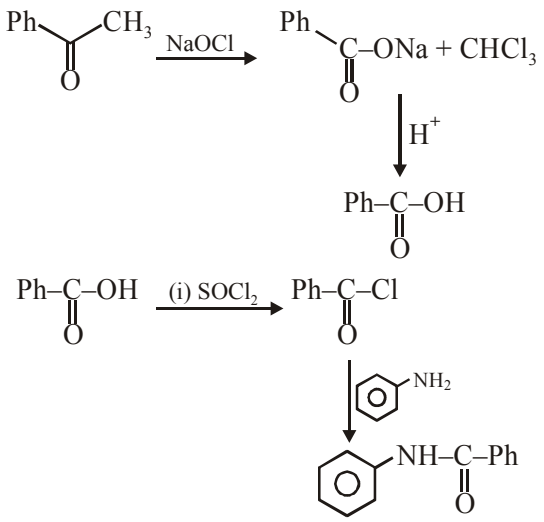
(2)


(3)


(4)


Official Ans. by NTA (1)

Sol.



30. The ratio of the shortest wavelength of two spectral series of hydrogen spectrum is found to be about 9. The spectral series are:

(1) Paschen and P fund

(2) Lyman and Paschen

(3) Brackett and Piund

(4) Balmer and Brackett

Official Ans. by NTA (2)

Sol. $$\frac{\frac{1}{\lambda_2} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)Z^2}{\frac{1}{\lambda_1} = R_H\left(\frac{1}{m_1^2} - \frac{1}{m_2^2}\right)Z^2}$$

as for shortest wavelengths both n_2 and m_2 are ∞

$$\therefore \quad \frac{\lambda_1}{\lambda_2} = \frac{9}{1} = \frac{m_1^2}{n_1^2}$$

Now if $m_1 = 3$ & $n_1 = 1$ it will justify the statement hence Lyman and Paschen (2) is correct.