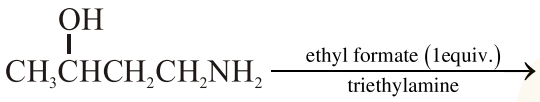
FINAL JEE–MAIN EXAMINATION – APRIL,2019

(Held On Wednesday 10th APRIL, 2019) TIME : 9 : 30 AM To 12 : 30 PM

CHEMISTRY

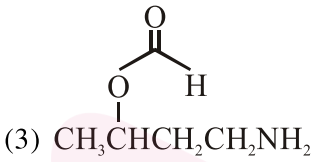
TEST PAPER WITH ANSWER & SOLUTION

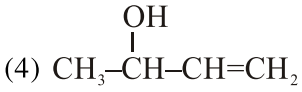
1. The major product of the following reaction is :



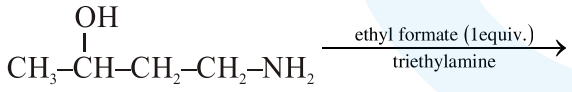
(1) 

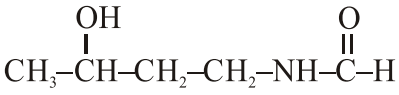
(2) $CH_3CH=CH-CH_2NH_2$

(3) 

(4) 

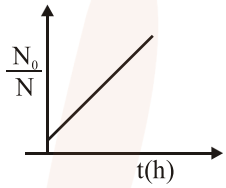
Official Ans. by NTA (1)

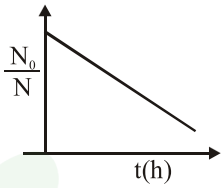
Sol. 

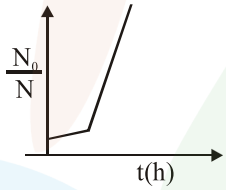


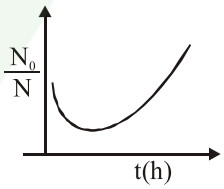
as NH_2 is a better nucleophile than OH.

2. A bacterial infection in an internal wound grows as $N'(t) = N_0 \exp(t)$, where the time t is in hours. A dose of antibiotic, taken orally, needs 1 hour to reach the wound. Once it reaches there, the bacterial population goes down as $\frac{dN}{dt} = -5N^2$. What will be the plot of $\frac{N_0}{N}$ vs. t after 1 hour ?

(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (1)

Sol. From 0 to 1 hour, $N' = N_0 e^t$

From 1 hour onwards $\frac{dN}{dt} = -5N^2$

So at t = 1 hour, $N' = eN_0$

$$\frac{dN}{dt} = -5N^2$$

$$\int_{eN_0}^{N} N^{-2}\,dN = -5\int_{1}^{t} dt$$

$$\frac{1}{N} - \frac{1}{eN_0} = 5(t-1)$$

$$\frac{N_0}{N} - \frac{1}{e} = 5N_0(t-1)$$

$$\frac{N_0}{N} = 5N_0(t-1) + \frac{1}{e}$$

$$\frac{N_0}{N} = 5N_0t + \left(\frac{1}{e} - 5N_0\right)$$

which is following y = mx + C

3. The correct order of catenation is :

(1) C > Si > Ge ≈ Sn (2) C > Sn > Si ≈ Ge

(3) Ge > Sn > Si > C (4) Si > Sn > C > Ge

Official Ans. by NTA (1)

Sol. As we move down the group, bond strength decreases, thereby decreasing the catenation tendency.

Hence the order is as expected

C > Si > Ge ≈ Sn

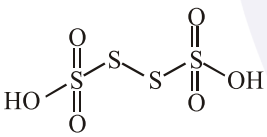
4. The oxoacid of sulphur that does not contain bond between sulphur atoms is :

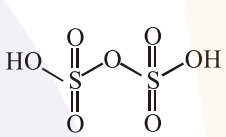
(1) $H_2S_4O_6$ (2) $H_2S_2O_7$

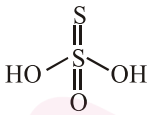
(3) $H_2S_2O_3$ (4) $H_2S_2O_4$

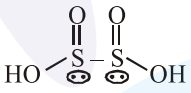
Official Ans. by NTA (2)

Sol.

$H_2S_4O_6$ 

$H_2S_4O_7$ 

$H_2S_2O_3$ 

$H_2S_2O_4$ 

$H_2S_2O_7$ does not contain bond between sulphur atoms.

5. Consider the statements S1 and S2 :

S1 : Conductivity always increases with decrease in the concentration of electrolyte.

S2 : Molar conductivity always incrteases with decrease in the concentration of electrolyte.

The correct option among the following is :

(1) Both S1 and S2 are correct

(2) S1 is wrong and S2 is correct

(3) S1 is correct and S2 is wrong

(4) Both S1 and S2 are wrong

Official Ans. by NTA (2)

Sol. On dilution, no. of ions per ml decreases so conductivity decreases hence S1 is wrong.

$$\wedge_M = \frac{1000 \times \kappa}{C}$$

On dilution C and κ both decreases but effect of C is more dominating so $\wedge_M$ increases hence S2 is right.

6. Which of the following is a condensation polymer ?

(1) Buna - S (2) Nylon 6, 6

(3) Teflon (4) Neoprene

Official Ans. by NTA (2)

Sol. Nylon-6,6 is a condensation polymer of hexamethylene diamine and adipic acid.

Buna-S, Teflon and Neoprene are addition polymer.

7. At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of O_2 for complete combustion and 40 mL of CO_2 is formed. The formula of the hydrocarbon is :

(1) C_4H_8 (2) C_4H_7Cl

(3) C_4H_{10} (4) C_4H_6

Official Ans. by NTA (4)

Sol. $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

$10 \quad 10\left(x + \frac{y}{4}\right) \quad 10x$

By given data, $10\left(x + \frac{y}{4}\right) = 55$ .... (1)

$10x = 40$ .... (2)

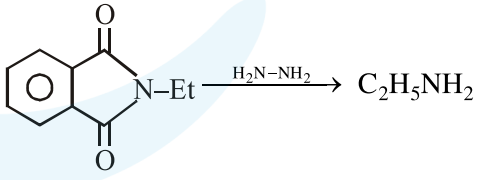
$\therefore x = 4, y = 6 \Rightarrow C_4H_6$

8. Ethylamine ($C_2H_5NH_2$) can be obtained from N-ethylphthalimide on treatment with :

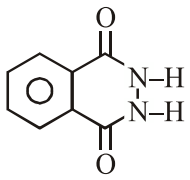
(1) $NaBH_4$ (2) CaH_2

(3) H_2O (4) NH_2NH_2

Official Ans. by NTA (4)

Sol. 

reagent is NH_2–NH_2 byproduct will be



9. The isoelectronic set of ions is :

(1) N^{3-}, Li^{+}, Mg^{2+} and O^{2-}

(2) Li^{+}, Na^{+}, O^{2-} and F^{-}

(3) F^{-}, Li^{+}, Na^{+} and Mg^{2+}

(4) N^{3-}, O^{2-}, F^{-} and Na^{+}

Official Ans. by NTA (4)

Sol. $N^{-3} \rightarrow 1s^2\ 2s^2\ 2p^6$

$Li^{+} \rightarrow 1s^2$

$Mg^{+2} \rightarrow 1s^2\ 2s^2\ 2p^6$

$O^{-2} \rightarrow 1s^2\ 2s^2\ 2p^6$

$F^{-} \rightarrow 1s^2\ 2s^2\ 2p^6$

$Na^{+} \rightarrow 1s^2\ 2s^2\ 2p^6$

N^{-3}, O^{-2}, F^{-} and Na^{+} are isoelectronic

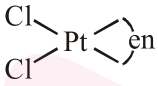
10. The species that can have a trans-isomer is :

(en = ethane-1, 2-diamine, ox = oxalate)

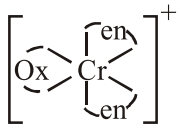
(1) $[Pt(en)Cl_2]$ (2) $[Cr(en)_2(ox)]^{+}$

(3) $[Zn(en)Cl_2]$ (4) $[Pt(en)_2Cl_2]^{2+}$

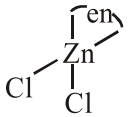
Official Ans. by NTA (4)

Sol. (1) 

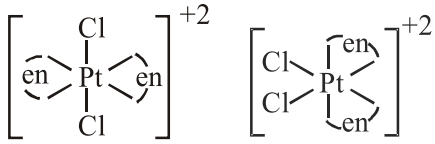
no trans isomer possible because bidentate ligand will be co-ordinating only at 90° angle in square planar complex

(2) 

no trans isomer possible

(3) 

sp^3 hybridized so no trans possible

(4) 

trans and cis both are possible

11. Match the refining methods (Column I) with metals (Column II).

Column I (Refining methods)	Column II (Metals)
(I) Liquation	(a) Zr
(II) Zone Refining	(b) Ni
(III) Mond Process	(c) Sn
(IV) Van Arkel Method	(d) Ga

(1) (I) – (b); (II) – (c); (III) – (d); (IV) – (a)

(2) (I) – (b); (II) – (d); (III) – (a); (IV) – (c)

(3) (I) – (c); (II) – (a); (III) – (b); (IV) – (d)

(4) (I) – (c); (II) – (d); (III) – (b); (IV) – (a)

Official Ans. by NTA (4)

Sol. Liquation is used for Sn.

Zone refining is used for Ga.

Mond's process is used for Ni.

Van arkel process is used for Zr.

12. Consider the following statements

(a) The pH of a mixture containing 400 mL of 0.1 M H_2SO_4 and 400 mL of 0.1 M NaOH will be approximately 1.3.

(b) Ionic product of water is temperature dependent.

(c) A monobasic acid with $K_a = 10^{-5}$ has a pH = 5. The degree of dissociation of this acid is 50%.

(d) The Le Chatelier's principle is not applicable to common-ion effect.

the correct statement are :

(1) (a), (b) and (d) (2) (a), (b) and (c)

(3) (a) and (b) (4) (b) and (c)

Official Ans. by NTA (2)

Sol. (a) $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$

$400\times.1=40$ $400\times.1=40$

20 0

$$\therefore [H^+] = \frac{20\times 2}{800} = \frac{1}{20} \Rightarrow pH = -\log\left(\frac{1}{20}\right)$$

$\therefore$ pH = 1.3 so (a) is correct

(b) $$\log\left(\frac{Kw_2}{Kw_1}\right) = \frac{\Delta H}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

so ionic product of water is temp. dependent hence (b) is correct.

(c) $K_a = 10^{-5}$, pH = 5 $\Rightarrow [H^+] = 10^{-5}$

$$K_a = \frac{c\alpha^2}{(1-\alpha)} \Rightarrow K_a = \frac{[H^+].\alpha}{(1-\alpha)}$$

$$\therefore 10^{-5} = \frac{10^{-5}.\alpha}{(1-\alpha)} \Rightarrow 1-\alpha=\alpha \Rightarrow \alpha = \frac{1}{2} = 50\%$$

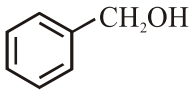
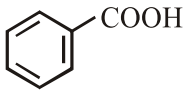
so (c) is correct.

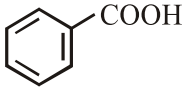
(d) Le-chatelier's principle is applicable to common –Ion effect so option (d) is wrong

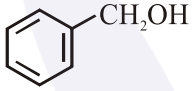
$\therefore$ correct answer (2)

13. Major products of the following reaction are :

(1) CH_3OH and HCO_2H

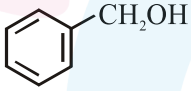
(2)  and 

(3) CH_3OH and 

(4) HCOOH and 

Official Ans. by NTA (4)

Sol. 

This is cross cannizaro reaction so more reactive carbonyl compound is oxidized and less reactive is reduced so answer is  $+ HCO_2H$

14. The principle of column chromatography is :

(1) Capillary action.

(2) Gravitational force.

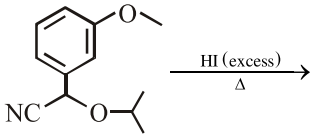
(3) Differential adsorption of the substances on the solid phase.

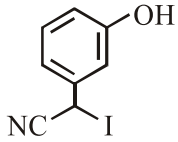
(4) Differential absorption of the substances on the solid phase.

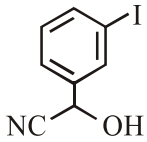
Official Ans. by NTA (3)

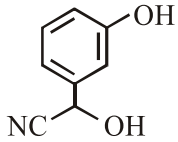
Sol. Main principle of column chromatography is differential adsorption of the substance on the solid phase.

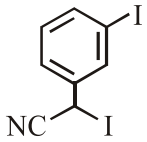
15. The major product of the following reaction is :



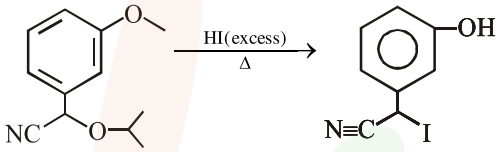
(1) 

(2) 

(3) 

(4) 

Official Ans. by NTA (3)
ALLEN Ans. (1)

Sol. 

Phenolic –OH does not react with HI and benzylic –O– having –CN attached will react with HI by S_N2 mechanism.

16. Amylopectin is composed of :
(1) α-D-glucose, C_1–C_4 and C_1–C_6 linkages
(2) α-D-glucose, C_1–C_4 and C_2–C_6 linkages
(3) β-D-glucose, C_1–C_4 and C_2–C_6 linkages
(4) β-D-Glucose, C_1–C_4 and C_1–C_6 linkages

Official Ans. by NTA (1)

Sol. Amylopetcin is a homopolymer of α-D-glucose where C_1–C_4 linkage and C_1 – C_6 linkage are present.

17. Consider the hydrates ions of Ti^{2+}, V^{2+}, Ti^{3+} and Sc^{3+}. The correct order of their spin-only magnetic moments is :
(1) $Sc^{3+} < Ti^{3+} < Ti^{2+} < V^{2+}$
(2) $Ti^{3+} < Ti^{2+} < Sc^{3+} < V^{2+}$
(3) $Sc^{3+} < Ti^{3+} < V^{2+} < Ti^{2+}$
(4) $V^{2+} < Ti^{2+} < Ti^{3+} < Sc^{3+}$

Official Ans. by NTA (1)

Sol. $Ti^{+2} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2$
unpaired electrons = 2.
spin only magnetic moment $(\mu) = \sqrt{2(2+2)}$
$= \sqrt{8}$ B.M
$Ti^{+3} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1$
unpaired electrons = 1
$\mu = \sqrt{1(1+2)} = \sqrt{3}$ B.M
$V^{+2} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$
$\mu = \sqrt{3(3+2)} = \sqrt{15}$ B.M
$Sc^{+3} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
$\mu = 0$

18. A gas undergoes physical adsorption on a surface and follows the given Freundlich adsorption isotherm equation

$$\frac{x}{m} = kp^{0.5}$$

Adsorption of the gas increases with :

(1) Decrease in p and decrease in T

(2) Increase in p and increase in T

(3) Increase in p and decrease in T

(4) Decrease in p and increase in T

Official Ans. by NTA (3)

Sol. Freundlich adsorption isotherm $\frac{x}{m} = Kp^{0.5}$

so on increasing pressure, $\frac{x}{m}$ increases

physical adsorption decreases with increase in temperature so option (3) is correct.

19. Three complexes,

$[CoCl(NH_3)_5]^{2+}$ (I),

$[Co(NH_3)_5H_2O]^{3+}$ (II) and

$[Co(NH_3)_6]^{3+}$ (III)

absorb light in the visible region. The correct order of the wavelength of light absorbed by them is :

(1) (III) > (I) > (II) (2) (I) > (II) > (III)

(3) (II) > (I) > (III) (4) (III) > (II) > (I)

Official Ans. by NTA (2)

Sol. A complex having strong field ligand has tendency to absorb light of highest energy.

Among the three complexes.

$[Co(NH_3)_6]^{+3}$ will absorb radiation of highest energy and least wavelength.

$[Co(NH_3)_5H_2O]^{+3}$ has field weaker than the above compound and therefore absorb radiation of lesser energy and more wavelength.

$[CoCl(NH_3)_5]^{+2}$ has the weakest field and therefore will absorb light of least energy and highest wavelength.

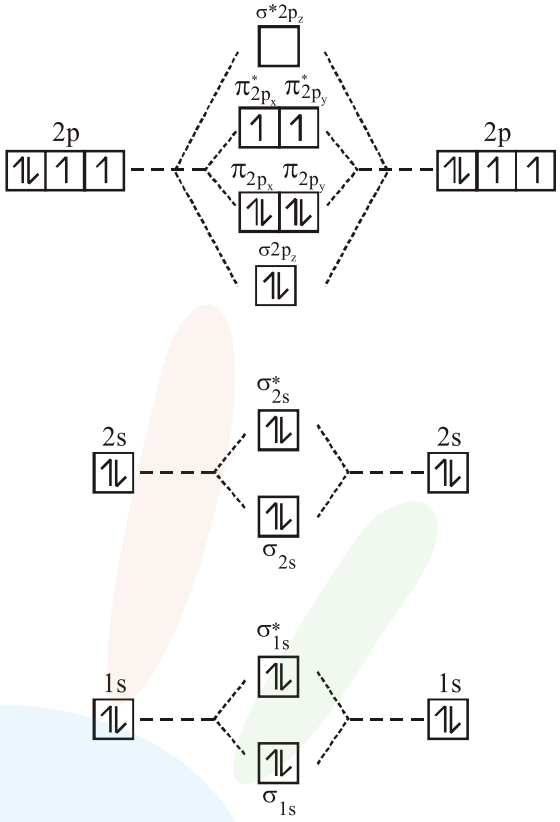
Strength of ligand $NH_3 > H_2O > Cl$.

20. During the change of O_2 to O_2^-, the incoming electron goes to the orbital :

(1) $\sigma^*\ {}^2P_z$ (2) $\pi\ {}^2P_y$ (3) $\pi^*\ {}^2P_x$ (4) $\pi\ {}^2P_x$

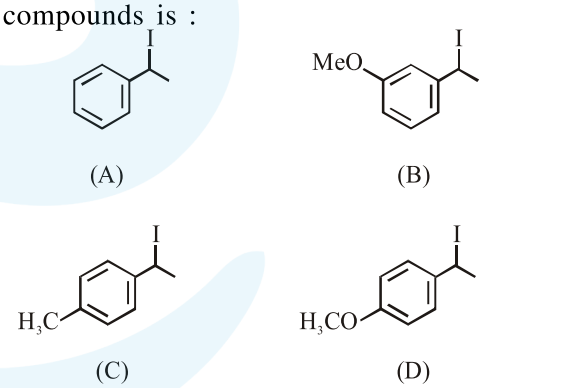
Official Ans. by NTA (3)

Sol. Molecular orbital diagram of O_2 is



An incoming electron will go in $\pi^*_{2p_x}$ orbital.

21. Increasing rate of S_N1 reaction in the following compounds is :



(1) (A) < (B) < (C) < (D)

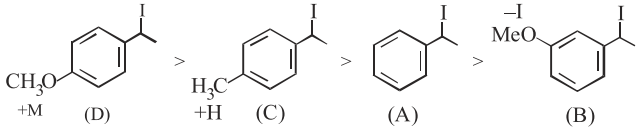
(2) (B) < (A) < (D) < (C)

(3) (B) < (A) < (C) < (D)

(4) (A) < (B) < (D) < (C)

Official Ans. by NTA (3)

Sol. Rate of $S_{N'}$ is directly proposional to stability of first formed carbocation so answer is



22. Consider the following table :

Gas	a/(k Pa dm^6 mol^{-1})	b/(dm^3 mol^{-1})
A	642.32	0.05196
B	155.21	0.04136
C	431.91	0.05196
D	155.21	0.4382

a and b are vander waals constant. The correct statement about the gases is :

(1) Gas C will occupy lesser volume than gas A; gas B will be lesser compressible than gas D

(2) Gas C will occupy more volume than gas A; gas B will be lesser compressible than gas D

(3) Gas C will occupy more volume than gas A; gas B will be more compressible than gas D

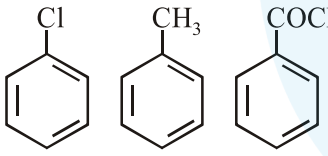
(4) Gas C will occupy lesser volume than gas A; gas B will be more compressible than gas D

Official Ans. by NTA (3)

Sol.
- Gas A and C have same value of 'b' but different value of 'a' so gas having higher value of 'a' have more force of attraction so molecules will be more closer hence occupy less volume.
- Gas B and D have same value of 'a' but different value of 'b' so gas having lesser value of 'b' will be more compressible.

so option (3) is correct.

23. The increasing order of the reactivity of the following compounds towards electrophilic aromatic substitution reactions is :-



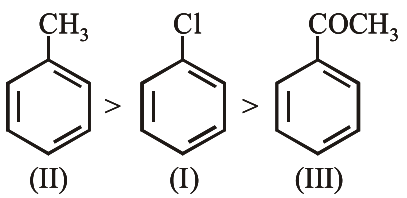
(I) (II) (III)

(1) I < III < II (2) II < I < III

(3) III < I < II (4) III < II < I

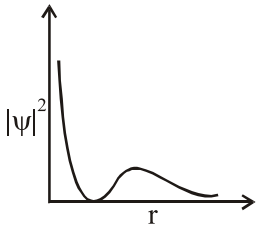
Official Ans. by NTA (3)

Sol. Rate of aromatic electophilic substitution is



(II) (I) (III)

24. The graph betweeen $|\psi|^2$ and r(radial distance) is shown below. This represents :-



(1) 3s orbital (2) 1s orbital

(3) 2p orbital (4) 2s orbital

Official Ans. by NTA (4)

Sol. Graph of $|\psi^2|$ v/s r, touches r axis at 1 point so it has one radial node and since at r = 0, it has some value so it should be for 's' orbital.

$\therefore$ $n - \ell - 1 = 1$ where $\ell = 0 \Rightarrow n - 1 = 1$

$\therefore$ $n = 2 \Rightarrow$ '2s' orbital

25. At room temperature, a dilute soluton of urea is prepared by dissolving 0.60 g of urea in 360 g of water. If the vapour pressure of pure water at this temperature is 35 mmHg, lowering of vapour pressure will be (molar mass of urea = 60 g mol^{-1}):-

(1) 0.027 mmHg (2) 0.028 mmHg

(3) 0.017 mmHg (4) 0.031 mmHg

Official Ans. by NTA (3)

Sol. Lowering of vapour pressure = $p^0 - p = p^0.x_{solute}$

$$\therefore \Delta p = 35 \times \frac{0.6/60}{\frac{0.6}{60}+\frac{360}{18}}$$

$$= 35 \times \frac{.01}{.01+20} = 35 \times \frac{.01}{20.01}$$

$$= .017 \text{ mm Hg}$$

26. The synonym for water gas when used in the production of methanol is :-

(1) natural gas (2) laughing gas

(3) syn gas (4) fuel gas

Official Ans. by NTA (3)

Sol. water gas = $CO + H_2$

is also called syn gas because it is used for synthesis of methanol.

27. A process will be spontaneous at all temperatures if :-

(1) $\Delta H > 0$ and $\Delta S < 0$

(2) $\Delta H < 0$ and $\Delta S > 0$

(3) $\Delta H > 0$ and $\Delta S > 0$

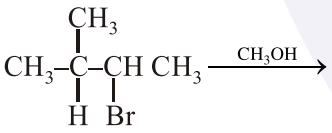
(4) $\Delta H < 0$ and $\Delta S < 0$

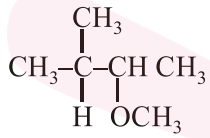
Official Ans. by NTA (2)

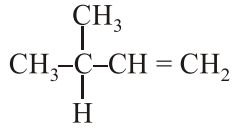
Sol. $\Delta G = \Delta H - T\Delta S$

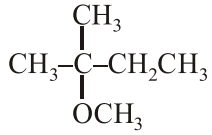
for spontaneous process at all temp. $\Delta G < 0$ and it is possible when $\Delta H < 0$ and $\Delta S > 0$.

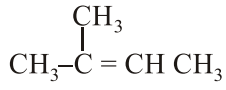
28. The major product of the following reaction is :-



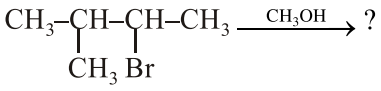
(1) 

(2) 

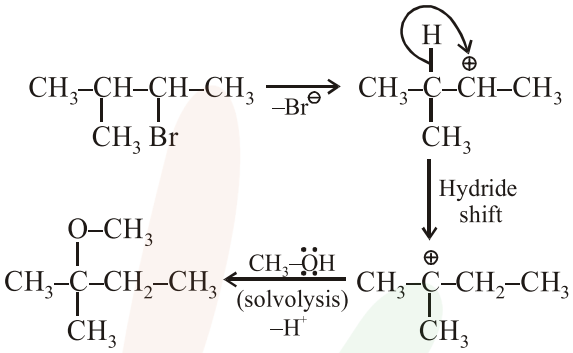
(3) 

(4) 

Official Ans. by NTA (3)

Sol. 

In polar protic solvent S_{N^1} mechanism is favourable hence reaction complete via S_{N^1} mechanism



29. The regions of the atmosphere, where clouds form and where we line respectively, are :-

(1) Stratosphere and Troposphere

(2) Troposphere and Stratosphere

(3) Troposphere and Troposphere

(4) Stratosphere and Stratosphere

Official Ans. by NTA (3)

Sol. Troposphere is the lowest region of atmosphere bounded by Earth beneath and the stratosphere above where most of the clouds form and where life form exists.

30. The alloy used in the construction of aircrafts is :-

(1) Mg – Sn (2) Mg – Mn

(3) Mg – Al (4) Mg – Zn

Official Ans. by NTA (3)

Sol. Mg – Al alloy is used for construction of aircrafts.