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JEE Main 2023 (Memory based)

24 January 2023 - Shift 1

Answer & Solutions

CHEMISTRY

1. Statement 1: Noradrenaline is one of the neurotransmitters

Statement 2: Deficiency of noradrenaline causes depression.

A. Statement 1 and 2 both are correct
B. Statement 1 is correct but statement 2 is incorrect
C. Statement 1 is incorrect but statement 2 is correct
D. Statement 1 and 2 both are incorrect.

Answer (A)

Sol.

Noradrenaline is one of the neurotransmitters that plays a role in mood changes. If the level of noradrenaline is low for some reason, then the signal-sending activity becomes low, and the person suffers from depression. So, statement 1 and 2 both are correct.

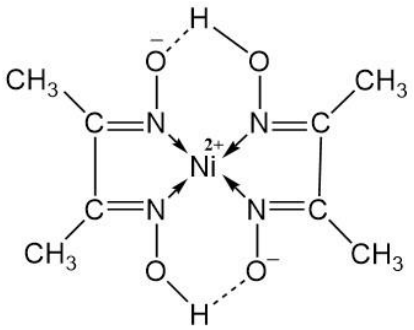
2. The cation gives bright red color with dimethyl glyoxime. Which is that cation?

A. Cu^{2+}
B. Ni^{2+}
C. Zn^{2+}
D. Co^{2+}

Answer (B)

Sol.

Ni^{2+} gives bright red color with dimethylglyoxime in an alkaline medium.



3. A 25 mL buffer solution is prepared by mixing CH_3COOH of concentration 0.1 M and CH_3COONa of concentration 0.01 M. If the P^H of the solution is 5, then calculate the pK_a of CH_3COOH

A. 4
B. 5
C. 6
D. 7

Answer (C)

Sol.

$[CH_3COOH] = 0.1$

$[CH_3COONa] = 0.01$

$$p^H = pK_a + log\ \frac{[CH_3COONa]}{[CH_3COOH]}$$

$$= p^H - log\frac{[0.01]}{[0.1]}$$

$$= p^H - \log[10^{-1}] = p^H + log10$$

$$pK_a = 5 + 1 = 6$$

4. The number of unpaired electrons on cobalt in the complex ion $[CoCl_4]^{2-}$ is

A. 2
B. 3
C. 4
D. 5

Answer (B)

Sol.

$[\boldsymbol{CoCl_4}]^{\boldsymbol{2-}} = \boldsymbol{Co^{2+}(Td) = e^4t_2^3}$

Hence number of unpaired electrons is 3

5. Magnetic moment of a metal ion is 3.87 B.M. Identify the metal ion?

A. V^{3+}
B. Cr^{3+}
C. Mn^{2+}
D. Ti^{2+}

Answer (B)

Sol.

Magnetic moment (μ) = $\sqrt{\boldsymbol{n(n+2)}}$

n – number of unpaired electrons

The given Magnetic moment is 3.87 B.M.
This magnetic moment corresponds to 3 unpaired electrons.
V^{3+} , Cr^{3+} , Mn^{2+}, Ti^{2+}, has 2, 3, 5, 2 unpaired electrons respectively.

Hence Option B is the correct answer.

6. The Correct statement about freons is

A. They are used as a cancer medicine
B. They are chlorofluorocarbon compounds
C. These are toxic organic compounds
D. These are flammable compounds

Answer (B)

Sol.

The chlorofluorocarbons (CFC'S) are known as Freons. These are non-reactive, non-flammable, non-toxic organic molecules.

7. Statement 1: Freezing point of a solution decreases with decrease in the amount of non-volatile solute.

Statement 2: Freezing point of the solution is less than that of solvent.

A. Statement 1 and 2 both are correct.
B. State 1 is correct but statement 2 is incorrect
C. Statement 1 is incorrect but statement 2 is correct
D. Statement 1 and 2 both are incorrect

Answer (3)

Sol.

Freezing point of a solution decreases with increase in the amount of non-volatile solute.

Freezing point of the solution is less than that of solvent, in case of non-volatile solvent

8. Consider the following reaction given below $\boldsymbol{BeO + HF + NH_3 \rightarrow A \xrightarrow{\Delta} BeF_2 + (NH_4)F}$

Identify the missing compound A

A. $\boldsymbol{Be(OH)_2}$
B. $\boldsymbol{(NH_4)_2(BeF_4)}$
C. $\boldsymbol{(NH_4)_2(BeF_3)}$
D. D. $\boldsymbol{(NH_4)_2(BeF_6)}$

Answer (B)

Sol.

$$BeO + HF + NH_3 \rightarrow \underset{\textbf{(A)}}{(NH_4)_2(BeF_4)} \xrightarrow{\Delta} BeF_2 + NH_4F$$

Option (2) is the correct answer.

9.

List - I	List - II
A. Soda Ash	P. NaF
B. Chlorophyll	Q. $Ca(OH)_2$
C. White washing	R. Na_2CO_3
D. Tooth paste	S. Mg^{2+} ions

Match the compounds given in List – II with the compounds which are present in List – I

A. A – P, B – Q, C – R, D – S.
B. A – R, B – S, C – Q, D – P.
C. A – R, B – S, C – P, D – Q.
D. A – P, B – Q, C – S, D – R.

Answer (B)

Sol.

Soda Ash - Na_2CO_3

Chlorophyll - Mg^{2+} ions

White washing - $Ca(OH)_2$

Tooth paste - NaF

10. Calculate the percentage of Fe^{2+} ions in $Fe_{0.93}O$

A. 15 %
B. 85 %
C. 65 %
D. 35 %

Answer (B)

Sol.

Iron exists as Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$

Let's take $Fe^{2+} = x$ and $Fe^{3+} = y$

Thus, $x+y = 0.93$ -----(1)

Applying the concept of charge balancing

$2x+3y = 2$ --------(2)

Upon solving (1) and (2)

$y = 0.14$

Percentage of $Fe^{3+} = \frac{0.14}{0.93} \times 100 = 15\%$

Percentage of $Fe^{2+} = 100 - 15 = 85\%$

11. Following Reactions are given

A. $\Delta n = -25\ kJ/mol\ ;\ \Delta s = +30\ J/mol\ ;T = 300K$
B. $\Delta n = +30\ kJ/mol\ ;\ \Delta s = -50\ J/mol\ ;T = 300K$
C. $\Delta n = +30\ kJ/mol\ ;\ \Delta s = +500\ J/mol\ ;T = 300K$
D. $\Delta n = -30\ kJ/mol\ ;\ \Delta s = -1500\ J/mol\ ;T = 300K$

How many of the above reactions are non-Spontaneous under given conditions

Answer (2)

Sol.

Reaction (B)

Enthalpy change $(\Delta n) = +30000\ J/mol$

Entropy Change $(\Delta s) = -50\frac{J}{mol}/K$

$\Delta G = \Delta n - T\Delta S$

For non- spontaneous reaction $\Delta G > 0$

$30000 + 15000 > 0$ (Non-Spontaneous)

Reaction (D)

Enthalpy change $(\Delta n) = -30000\ J/mol$

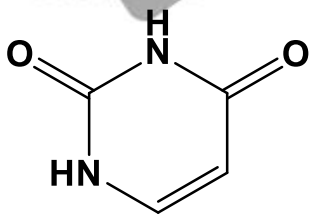
Entropy Change $(\Delta s) = -1500\frac{J}{mol}/K$

$\Delta G = \Delta n - T\Delta S$

$= -30000 - (300)(-1500)$

$= (-30000 + 45000) > 0$ (Non-Spontaneous)

12. The percentage of nitrogen in uracil is :



uracil

Answer (25)

Sol.

Molecular weight of uracil = 112 g

Weight of nitrogen = 28 g

% of Nitrogen = $\frac{28}{112}\ X\ 100 = 25\%$

13. Which of the following oxoacids can reduce $AgNO_3$?

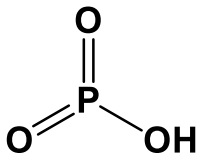
A. (HPO3)n
B. H4P2O7
C. H4P2O5
D. H3PO4

Answer (C)

Sol.

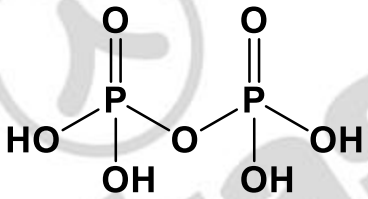
To reduce $AgNO_3$, oxoacid should behave as a reducing agent. Central atom with maximum oxidation state can act only as an oxidizing agent and in oxidation state less than the maximum can act as reducing agent.
The Maximum oxidation state of P is +5, thus

a. $(HPO_3)n$ – Metaphosphoric acid ; P is in +5 oxidation state. Thus, it behaves only as an oxidizing agent.



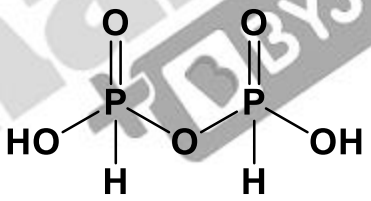
metaphosphoric acid

b. $H_4P_2O_7$ – Pyrophosphoric acid; P is in +5 oxidation state. Thus, it behaves only as an oxidizing agent.



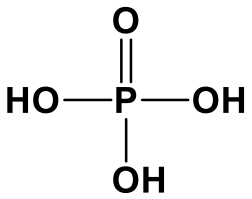
Pyrophosphoric acid

c. $H_4P_2O_5$ – Pyro phosphorous acid; P is in +3 oxidation state. $H_4P_2O_5$ can act as reducing agent due to the presence of P-H bond.



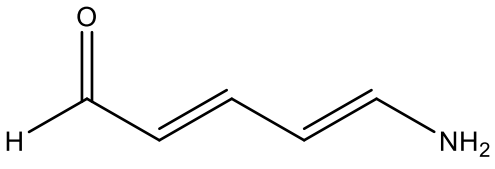
pyrophosphorous acid

d. H_3PO_4 – Orthophosphoric acid; P is in + 5 oxidation state. Thus, it behaves only as an oxidizing agent.



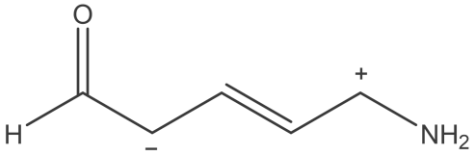
ortho phosphoric acid

14. The correct stability order of the resonating structure of

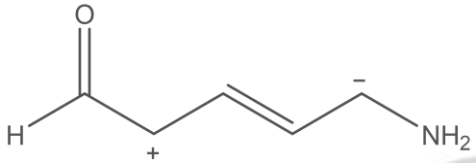


is ?

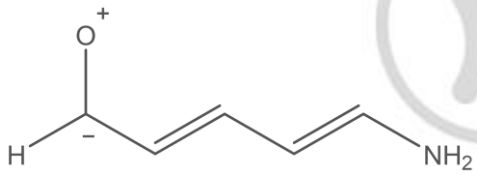
A)



B)



C)



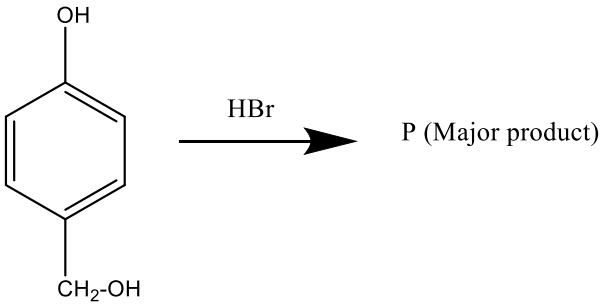
A. A > B > C
B. B > A > C
C. C > A > B
D. B > C > A

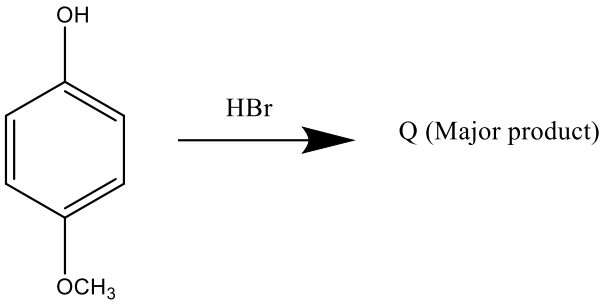
Answer (A)

Sol.

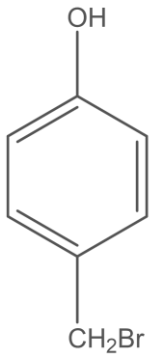
Positive charge on more electropositive atom and negative charge on electronegative atom is more stable. Thus, structure (A) and (B) are more stable than structure (C) because of the positive charge on oxygen which is more electronegative. Comparing (A) and (B) , in (B) lone pair of electron on -NH_2 and negative charge on carbon creates repulsion which makes less stable than (A).

15. Consider the following reactions.

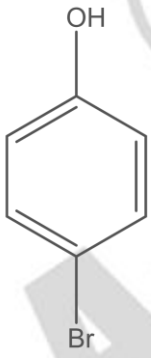




The products P & Q are respectively,

A. 

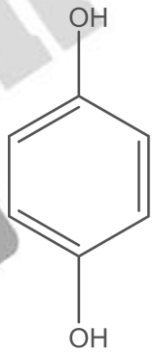
P



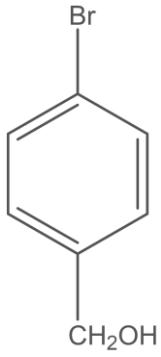
Q

B. P 

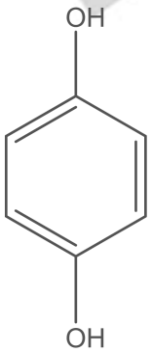
P



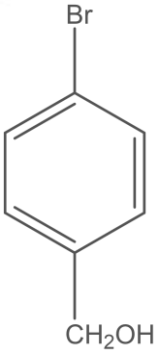
Q

C. 

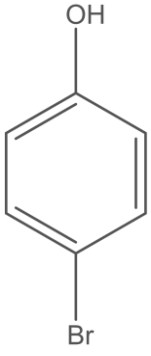
P



Q

D 

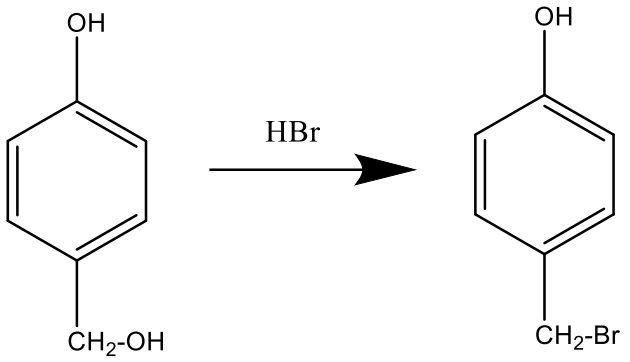
P

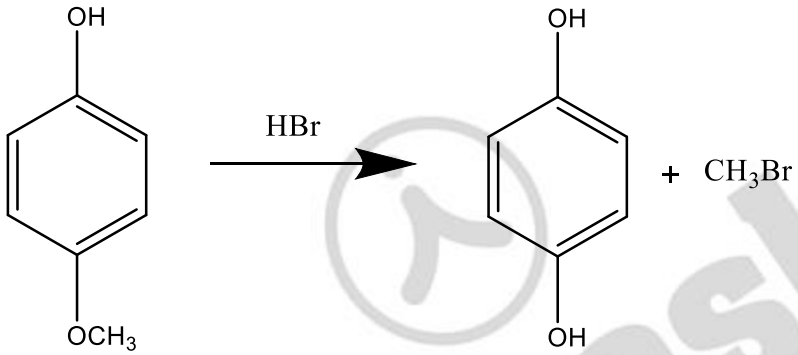


Q

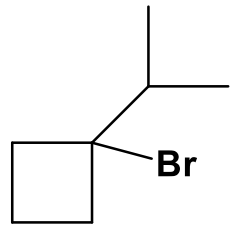
Answer (B)

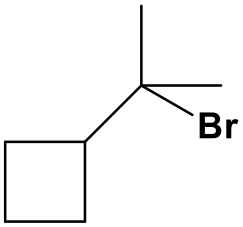
Sol.

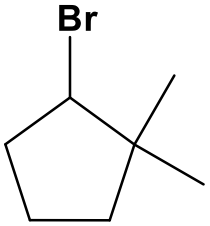


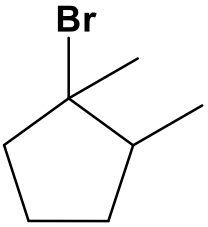


16. The correct product of the following reaction is :

A. 

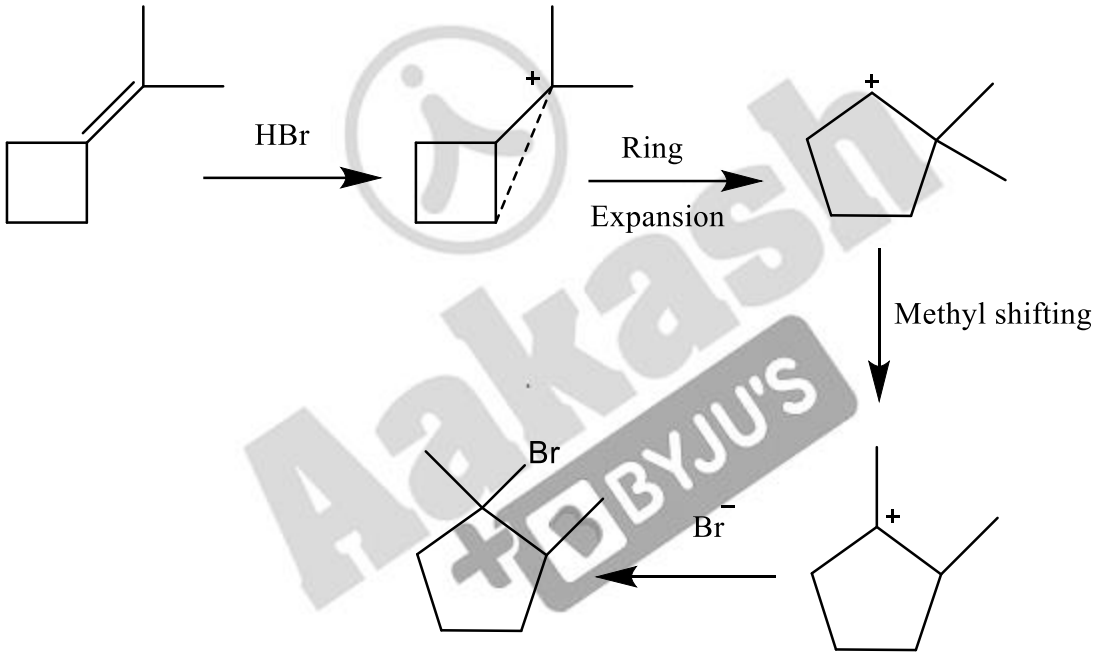
B. 

C. 

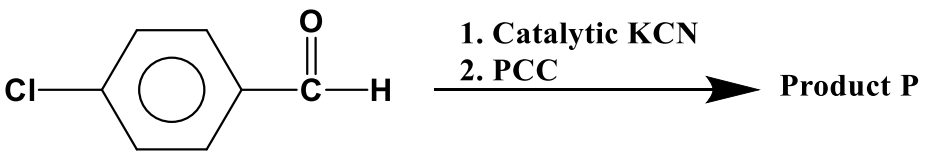
D. 

Answer (D)

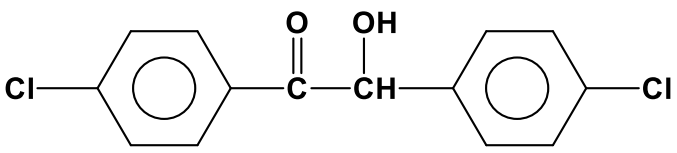
Sol.

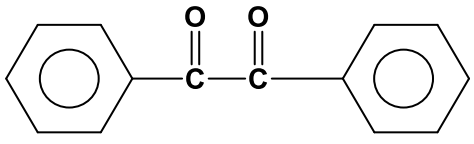


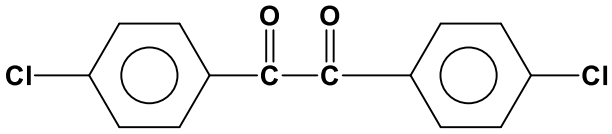
17. Consider the following sequence of reaction?

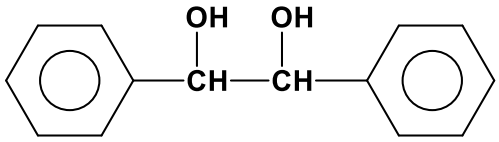


The correct structure of P is :

A. 

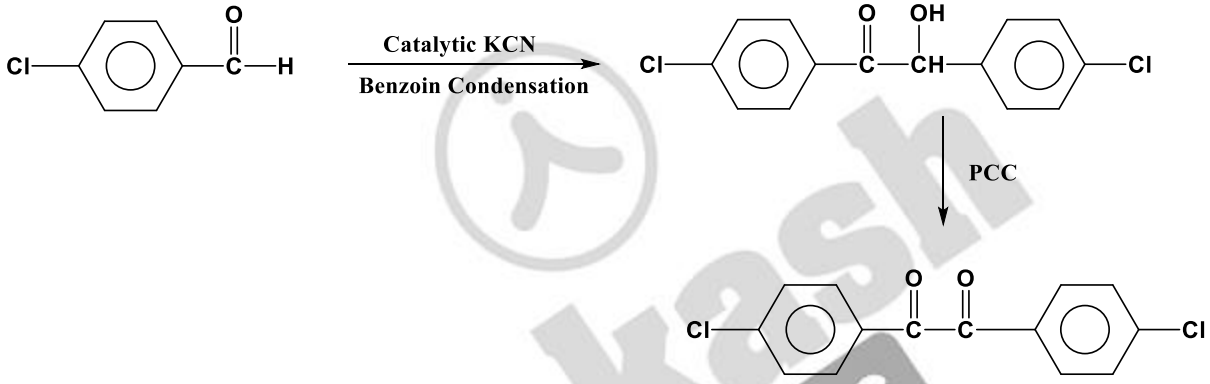
B. 

C. 

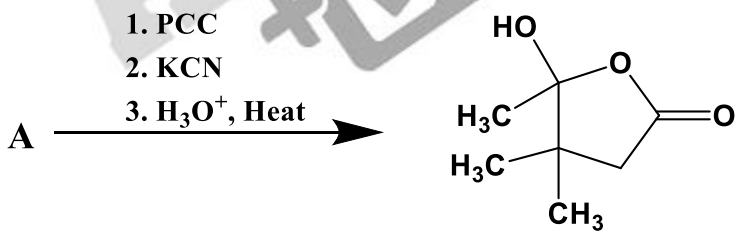
D. 

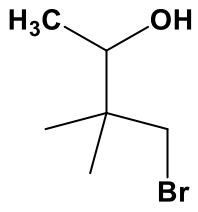
Answer (C)

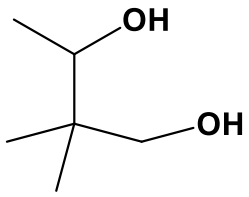
Sol.

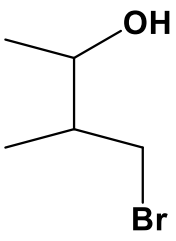


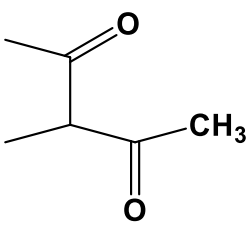
18. The correct structure of A is :



A. 

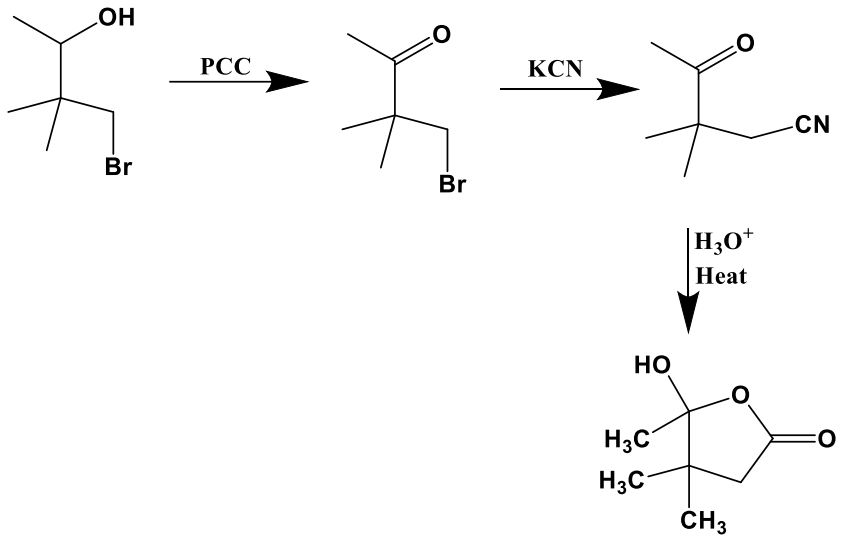
B. 

C. 

D. 

Answer (A)

Sol.



19. Match the following :

Column I	Column II
(A). Aluminium	1. Electrolysis
(B). Iron	2. Reverberatory Furnace
(C). Silicon	3. Blast furnace
(D). Copper	4. Zone refining

A. (A – 1) ; (B – 3) ; (C – 4) ; (D – 2)
B. (A – 2) ; (B – 3) ; (C – 4) ; (D – 1)
C. (A – 3) ; (B – 2) ; (C – 1) ; (D – 4)
D. (A – 2) ; (D – 4) ; (C – 1) ; (D – 3)

Answer (A)

Sol.

Aluminum is extracted by electrolysis of bauxite (Al_2O_3)
Iron is extracted in blast furnace
Silicon is extracted using zone refining
Copper is extracted in reverberatory furnace

20. 5.0 g of NaOH is dissolved in water to get 450 mL solution. What volume of the solution is required to prepare 500 Ml of 0.1 M NaOH solution ?

Answer (180)

Sol.

Molarity of NaOH solution prepared = $\frac{5\ x\ 1000}{40\ x\ 450} = \frac{5}{18} M$
Let V mL of the solution is required to prepare 500 mL of 0.1 M NaOH
Hence, V x $\frac{5}{18} = 500\ \text{X}\ 0.1$
V = 180 mL

21. If the primary valency of central metal ion in the complex$[Co(NH_3)_5Cl]Cl_2$ is n and its secondary valency is y, then find the value if x + y.

Answer (9)

Sol.

Primary valency(oxidation number) of Co ion in the given complex is 3 and its secondary valency (coordination number) is 6. Hence, x = 3 and y = 6

Thus x + y = 3 + 6 = 9