

**Single correct :**

1. Select incorrect match

(A)  $[\text{Co}(\text{NO}_2)(\text{H}_2\text{O})(\text{en})_2]\text{Cl}_2$ ,  $[\text{CoCl}(\text{NO}_2)(\text{en})_2]\text{Cl} \cdot \text{H}_2\text{O}$  – Hydrate isomerism

(B\*)  $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$ ,  $[\text{CuCl}_2(\text{NH}_3)_2][\text{PtCl}_2(\text{NH}_3)_2]$  – Coordination isomerism

(C)  $[\text{Ni}(\text{CN})(\text{H}_2\text{O})(\text{NH}_3)_4]\text{Cl}$ ,  $[\text{NiCl}(\text{H}_2\text{O})(\text{NH}_3)_4]\text{CN}$  – Ionization isomerism

(D)  $[\text{Cr}(\text{NCS})(\text{NH}_3)_5][\text{ZnCl}_4]$ ,  $[\text{Cr}(\text{SCN})(\text{NH}_3)_5][\text{ZnCl}_4]$  – Linkage isomerism

1. गलत मिलान चुनिये।

(A)  $[\text{Co}(\text{NO}_2)(\text{H}_2\text{O})(\text{en})_2]\text{Cl}_2$ ,  $[\text{CoCl}(\text{NO}_2)(\text{en})_2]\text{Cl} \cdot \text{H}_2\text{O}$  – हाइड्रेट समावयवता

(B)  $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$ ,  $[\text{CuCl}_2(\text{NH}_3)_2][\text{PtCl}_2(\text{NH}_3)_2]$  – समन्वय; समावयवता

(C)  $[\text{Ni}(\text{CN})(\text{H}_2\text{O})(\text{NH}_3)_4]\text{Cl}$ ,  $[\text{NiCl}(\text{H}_2\text{O})(\text{NH}_3)_4]\text{CN}$  – आयनन समावयवता

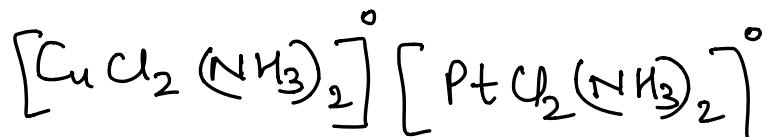
(D)  $[\text{Cr}(\text{NCS})(\text{NH}_3)_5][\text{ZnCl}_4]$ ,  $[\text{Cr}(\text{SCN})(\text{NH}_3)_5][\text{ZnCl}_4]$  – बन्धन समावयवता

**Ans. (B)**

Solution

Clearly A, C & D are correctly indicated.

In (B)



Both complexes have zero charge & this arrangement is not possible since in a salt, one cation & one anion must be present.

## Solution

The two compounds are



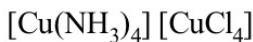
They both are different compounds, hence no isomerism.

3. Which one of the following is an example of coordination isomerism?
- (A)  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$  and  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$   
(B)  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$  and  $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$   
(C)  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  and  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$   
(D\*)  $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$  and  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$
3. निम्न में से कौनसा ,क] समन्वय; समावयवता का उदाहरण है ?
- (A)  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$  तथा  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$   
(B)  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$  तथा  $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$   
(C)  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  तथा  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$   
(D)  $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$  तथा  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$
3. **Ans. (D)**
- Sol. in coordination isomerism both cationic and anionic part must be complex which is in option (D) only .

No hydrate or ionisation isomerism is possible.

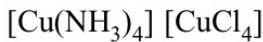
For coordination isomerism, both cation & anion must be complex.

5. The total possible co-ordination isomers for the following compounds respectively are



- (A) 4, 4, 4      (B) 2, 2, 2      (C) 2, 2, 4      (D\*) 4, 2, 4

5. निम्न दिये गये ;ैगिकों के लि, कुल सम्भव समन्व; समावयवी] क्रमशः हैं।



- (A) 4, 4, 4      (B) 2, 2, 2      (C) 2, 2, 4      (D) 4, 2, 4

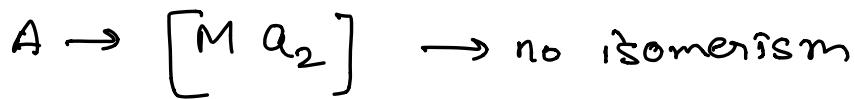
**Ans.** (D)

- Sol.**
- |  |   |
|--|---|
| (1) $[\text{Co}(\text{en})_3]^{+3}[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$                                | } |
| (2) $[\text{Co}(\text{en})_2\text{C}_2\text{O}_4]^{+1}[\text{Cr}(\text{C}_2\text{O}_4)_2(\text{en})]^{-1}$ |   |
| (3) $[\text{Cr}(\text{C}_2\text{O}_4)(\text{en})_2]^{+1}[\text{Co}(\text{C}_2\text{O}_4)_2\text{en}]^{-1}$ |   |
| (4) $[\text{Cr}(\text{en})_3]^{+3}[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$                                |   |
- 
- |   |   |
|---|---|
| (1) $[\text{Cu}(\text{NH}_3)_4]^{+3}[\text{CuCl}_4]^{-2}$                       | } |
| (2) $[\text{Cu}(\text{NH}_3)_3\text{Cl}]^{+1}[\text{CuCl}_3(\text{NH}_3)]^{-1}$ |   |
- 
- |  |   |
|--|---|
| (1) $[\text{Ni}(\text{en})_3][\text{Co}(\text{NO}_2)_6]$                           | } |
| (2) $[\text{Ni}(\text{en})_2(\text{NO}_2)][\text{Co}(\text{en})(\text{NO}_2)_4]$   |   |
| (3) $[\text{Ni}(\text{en})(\text{NO}_2)_4][\text{Co}(\text{en})_2(\text{NO}_2)_2]$ |   |
| (4) $[\text{Co}(\text{en})_3][\text{Ni}(\text{NO}_2)_6]$                           |   |

6. Of the following complex ions, one exhibits isomerism. That is:
- (A)  $[\text{Ag}(\text{NH}_3)_2]^+$       (B\*)  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{2+}$   
 (C)  $[\text{Pt}(\text{en})\text{Cl}_2]$       (D)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$
6. निम्न संकुल आयनों में समावयवता प्रदर्शित करने वाला आयन है :
- (A)  $[\text{Ag}(\text{NH}_3)_2]^+$       (B)  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{2+}$   
 (C)  $[\text{Pt}(\text{en})\text{Cl}_2]$       (D)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$

Ans. (B)

### Solution



B  $\rightarrow$  Linkage isomerism

$\leftarrow \text{NO}_2$  or  $\text{O} \text{NO} \rightarrow$

C  $\rightarrow$  No isomerism ( $M(AA)a_2$  type square planar complex)

D  $\rightarrow [M a_5 b] \rightarrow$  no isomerism.

**Ans. (B)**

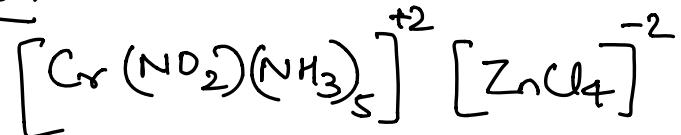
**Sol.** AgCl(white) ppt

AgBr (pale yellow) ppt

will be formed since both are ionisation isomers of each other.

8. Select correct code about complex  $[\text{Cr}(\text{NO}_2)(\text{NH}_3)_5][\text{ZnCl}_4]$  [3]  
 (I) IUPAC name of the compound is Pentaamminenitrito-N-chromium (III) tetrachloridozincate (II)  
 (II) It shows geometrical isomerism  
 (III) It shows linkage isomerism  
 (IV) It shows co-ordination isomerism  
 (A) III, IV      (B\*) I, III & IV      (C) II, III & IV      (D) I, II, III & IV
8. संकुल  $[\text{Cr}(\text{NO}_2)(\text{NH}_3)_5][\text{ZnCl}_4]$  के बारे में सही कूट चुनिये [3]  
 (I) यौगिक का IUPAC नाम पेन्टाएमीननाइट्रो -N-क्रोमियम (III) टेट्राक्लोराइडोजिंकेट (II)  
 (II) यह ज्यामिती; समावयवता प्रदर्शित करता है  
 (III) यह बन्धन समावयवता प्रदर्शित करता है  
 (IV) यह उपसहसंयोजन समावयवता प्रदर्शित करता है  
 (A) III, IV      (B\*) I, III & IV      (C) II, III & IV      (D) I, II, III & IV

Solution



Pentaamminenitrito-N-chromium (III) tetrachloridozincate (II)

$\text{Ma}_5\text{b} \rightarrow \text{cation}$  &  $\text{Ma}_4 \rightarrow \text{anion}$

They both do not show G.I.

Cation shows Linkage isomerism.



It shows coordination isomerism.

**Paragraph for question nos. 9 to 10**

Complex compounds which have same molecular formula but have different structural arrangements of ligands around central metal atom or ion are called structural isomers and phenomenon is named as structural isomerism.

[9]

संकुल ;ैगिक जिनके अणुसू= समान होते हैं लेकिन जिनके केन्द्री ; /ातु परमाणु ;। आयन के चारों ओर लिगेण्डों की अलग-अलग संरचनात्मक व्यवस्थाएँ होती हैं] संरचनात्मक समावयवी कहलाते हैं और ;ह परिघटना संरचनात्मक समावयवता कहलाती है।

[9]

9. Which of the following compounds is/are polymerisation isomer of  $[\text{Fe}(\text{NO}_2)_3(\text{NH}_3)_3]$ .

- (I)  $[\text{Fe}(\text{NO}_2)(\text{NH}_3)_5]$   $[\text{Fe}(\text{NO}_2)_5(\text{NH}_3)]$       (II)  $[\text{Fe}(\text{NO}_2)_2(\text{NH}_3)_4]_2$   $[\text{Fe}(\text{NO}_2)_5(\text{NH}_3)]$   
 (III)  $[\text{Fe}(\text{NO}_2)(\text{NH}_3)_5]$   $[\text{Fe}(\text{NO}_2)_4(\text{NH}_3)_2]_2$     (IV)  $[\text{Fe}(\text{NO}_2)_2(\text{NH}_3)_4]$   $[\text{Fe}(\text{NO}_2)_4(\text{NH}_3)_2]$

Choose the **correct** code :

- (A) II, III      (B) II, III, IV      (C) I, IV      (D\*) I, II, III, IV

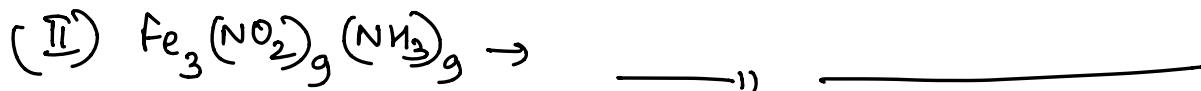
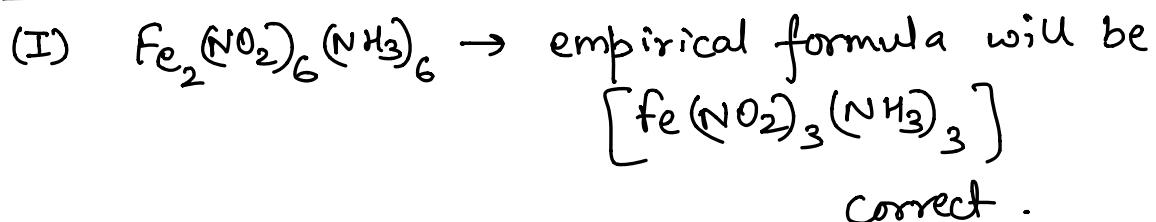
9. निम्न में से कौनसा / कौनसे ;ैगिक  $[\text{Fe}(\text{NO}_2)_3(\text{NH}_3)_3]$  के बहुलीकृत समावयवी हैं।

- (I)  $[\text{Fe}(\text{NO}_2)(\text{NH}_3)_5]$   $[\text{Fe}(\text{NO}_2)_5(\text{NH}_3)]$       (II)  $[\text{Fe}(\text{NO}_2)_2(\text{NH}_3)_4]_2$   $[\text{Fe}(\text{NO}_2)_5(\text{NH}_3)]$   
 (III)  $[\text{Fe}(\text{NO}_2)(\text{NH}_3)_5]$   $[\text{Fe}(\text{NO}_2)_4(\text{NH}_3)_2]_2$     (IV)  $[\text{Fe}(\text{NO}_2)_2(\text{NH}_3)_4]$   $[\text{Fe}(\text{NO}_2)_4(\text{NH}_3)_2]$   
 सही संकेत चुनिये :

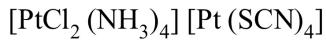
- (A) II, III      (B) II, III, IV      (C) I, IV      (D) I, II, III, IV

**Ans.** In polymerisation isomer empirical formula must be same

Solution

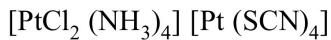


- 10.** How many more coordination isomers are possible of the following complex compound.





- 10.** निम्न संकुल ;ैगिक के कितने और समन्व; समावयवी संभव है।






**Ans. (C)**

$1^{st}$  complex

	$\text{Cl}$	$\text{Nn}_3$	$\text{SCN}$
(i)	1	4	1

## 2<sup>nd</sup> complex

$$\text{Cl} \quad \text{NH}_3 \quad \text{SCN}$$

(ii) 0 4 2

2      o      2

(iii) 2 3 1

0 1 3

(iv) 2 1 3

0 3 1

(v) 1 3 2

1            1            2

(v1) 1 1 4

1 3 0

(V11) 0 3 3

2 1 1

(VIII) 2 4 0

○ ○ 4

Solution

