



Answer all the questions below as fully as you can then check your answers

1. What is the bond angle between ligands in a square planar complex?
A. 60° B. 90° C. 120° D. 180°
2. Which type of ligands are arranged adjacent to each other in the cis-isomer of a square planar complex?
A. Monodentate ligands B. Ligands of the same type
C. Bidentate ligands D. Ligands of different types
3. The trans-isomer of $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$ has:
A. Ammonia ligands adjacent to each other
B. Chloride ligands at an angle of 90°
C. Chloride ligands opposite each other
D. Ammonia and chloride ligands adjacent to each other
4. Which of the following types of complexes is most likely to show geometric isomerism?
A. Tetrahedral complexes
B. Square planar complexes of type MA_2B_2
C. Linear complexes
D. Octahedral complexes of type MA_6

5. Explain the key difference between cis- and trans-isomers in square planar complexes.
6. Draw the cis and trans geometric isomers of $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$.
7. Describe why geometric isomerism cannot occur in a tetrahedral complex.
- b. Identify whether the following complexes can exhibit geometric isomerism. Justify your answers:
- $[\text{Ni}(\text{CN})_4]^{2-}$
 - $[\text{Pt}(\text{NH}_3)_2(\text{H}_2\text{O})_2]$
8. The complex ion $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ exists as cis and trans isomers.
- Explain how the geometric isomers differ in terms of their ligand arrangement.
 - Discuss how these isomers might differ in their chemical or biological properties.
9. Transition metals such as platinum can form square planar complexes that exhibit geometric isomerism.
- Provide a detailed description of how cisplatin (cis- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$) works as an anti-cancer drug.
 - Why is the trans-isomer of this complex ineffective as an anti-cancer agent?

Answers:

1. What is the bond angle between ligands in a square planar complex?

- A. 60° B. 90° C. 120° D. 180°

Answer B. 90°

2. Which type of ligands are arranged adjacent to each other in the cis-isomer of a square planar complex?

- A. Monodentate ligands B. Ligands of the same type
C. Bidentate ligands D. Ligands of different types

Answer B. Ligands of the same type

3. The trans-isomer of $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$ has:

- A. Ammonia ligands adjacent to each other
B. Chloride ligands at an angle of 90°
C. Chloride ligands opposite each other
D. Ammonia and chloride ligands adjacent to each other

Answer: C. Chloride ligands opposite each other

4. Which of the following types of complexes is most likely to show geometric isomerism?

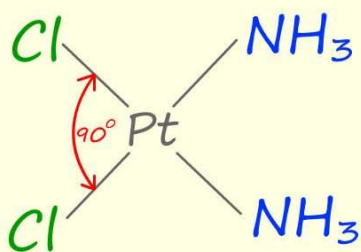
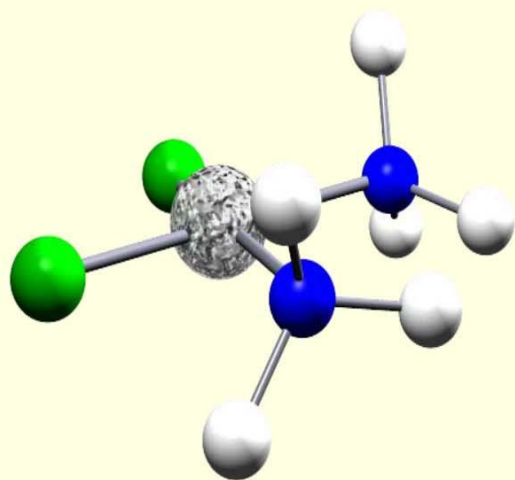
- A. Tetrahedral complexes
B. Square planar complexes of type MA_2B_2
C. Linear complexes
D. Octahedral complexes of type MA_6

Answer B. Square planar complexes of type MA_2B_2

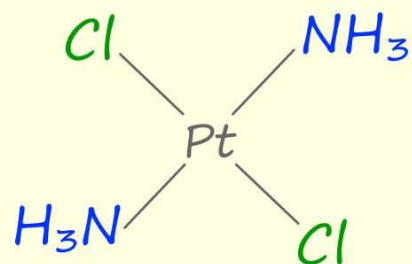
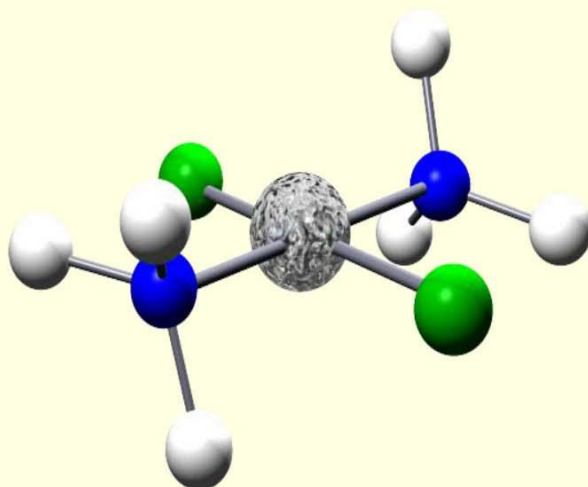
5. Explain the key difference between cis- and trans-isomers in square planar complexes.

Answer: In cis-isomers, ligands of the same type are adjacent to each other (90° apart). In trans-isomers, ligands of the same type are opposite each other (180° apart).

6. Draw the cis and trans geometric isomers of $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$.



cisplatin



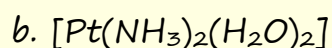
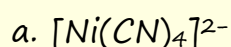
transplatin

7. Describe why geometric isomerism cannot occur in a tetrahedral complex.

Answer: Geometric isomerism cannot occur in tetrahedral complexes because all bond angles are 109.5° , and there are no adjacent or opposite positions to distinguish between cis and trans arrangements. All the positions in a tetrahedral structure are equivalent.

b. Identify whether the following complexes can exhibit geometric isomerism.

Justify your answers:



Answer: a – No geometric isomerism, as it is a square planar complex with identical ligands.

Answer: b – Yes, it can exhibit cis and trans isomers.

8. The complex ion $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ exists as cis and trans isomers.

a. Explain how the geometric isomers differ in terms of their ligand arrangement.

b. Discuss how these isomers might differ in their chemical or biological properties.

Answer:

a. In the cis-isomer, the two chloride ligands are adjacent (90°), while in the trans-isomer, they are opposite (180°).

b. Geometric isomers can differ in properties like solubility and reactivity due to the spatial arrangement of ligands.

9. Transition metals such as platinum can form square planar complexes that exhibit geometric isomerism.

a. Provide a detailed description of how cisplatin (cis- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$) works as an anti-cancer drug.

b. Why is the trans-isomer of this complex ineffective as an anti-cancer agent?

Answer:

a. Cisplatin binds to DNA, causing cross-linking that prevents DNA replication, leading to cancer cell death.

b. The trans-isomer is ineffective because it cannot form the necessary cross-links with DNA to disrupt its function.