What are Coordination Compounds?

Worksheet

A coordination compound is formed when ligands (Lewis bases) bond to a central metal ion (Lewis acid) through coordinate covalent bonds. Ligands donate electron pairs to the metal, forming complex ions like [Fe(CN)] or [Cu(NH)].

Questions

1. In the complex [Cu(NH)], what is the coordination number?

A) 2
B) 4
C) 8
D) 6

2. Which of the following is a bidentate ligand?

A) Cl
B) NH
C) HO
D) ethylenediamine (en)

3. Calculate the charge on the complex [Fe(CN)] if the central Fe is Fe.

A) 2+
B) 4
C) 6
D) 8

4. What geometry is typical for coordination number 4?

A) Octahedral
B) Tetrahedral or square planar
C) Linear
D) Trigonal

5. Determine the coordination number and identify the ligands in [Ni(NH)(HO)].

6. Write the formula for a complex formed by Fe ion with 6 cyanide ligands.

7. Is [CuCl] octahedral or tetrahedral?

8. Define: What is a ligand?

9. Define: What is a coordination number?

10. Define: What are common ligands?

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Answer Key

1. B) 4 - Four ammonia ligands are bonded to Cu, so CN = 4.

2. D) ethylenediamine (en) - Ethylenediamine (en) has two donor atoms, making it bidentate.

3. B) 4 - Charge = 2+ (Fe) 6(1) (CN) = 2 6 = 4. Formula: [Fe(CN)].

4. B) Tetrahedral or square planar - CN = 4 usually gives tetrahedral or square planar geometry.

5. Count the number of ligands bonded to the central metal (Ni). Ligands: 4 NH molecules + 2 HO molecules = 6 total. Coordination number (CN) = 6. Ligands are: ammonia (NH) and water (HO).

6. Central metal: Fe Ligand: CN (cyanide, charge 1) Number of ligands: 6 Formula: [Fe(CN)] Charge on complex: 3+ 6(1) = 3 charge. Complete formula: [Fe(CN)]

7. Count the coordination number. Cl ligands: 4 Coordination number = 4. With CN = 4, the geometry is tetrahedral. [CuCl] is tetrahedral, not octahedral.

8. A molecule or anion that donates an electron pair to a central metal ion, forming a coordinate covalent bond.

9. The number of ligands bonded to the central metal atom or ion.

10. Water (HO), ammonia (NH), cyanide (CN), chloride (Cl), carbon monoxide (CO), and other polar molecules or anions.

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