

Colour, complexes and catalysis in the d-block

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test checks electron configurations, complex ions, colour, ligand exchange, titration and catalysis. Answer all questions in full, show working and units. You have 45 minutes and 20 marks are available.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** A Level 3.2.5

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

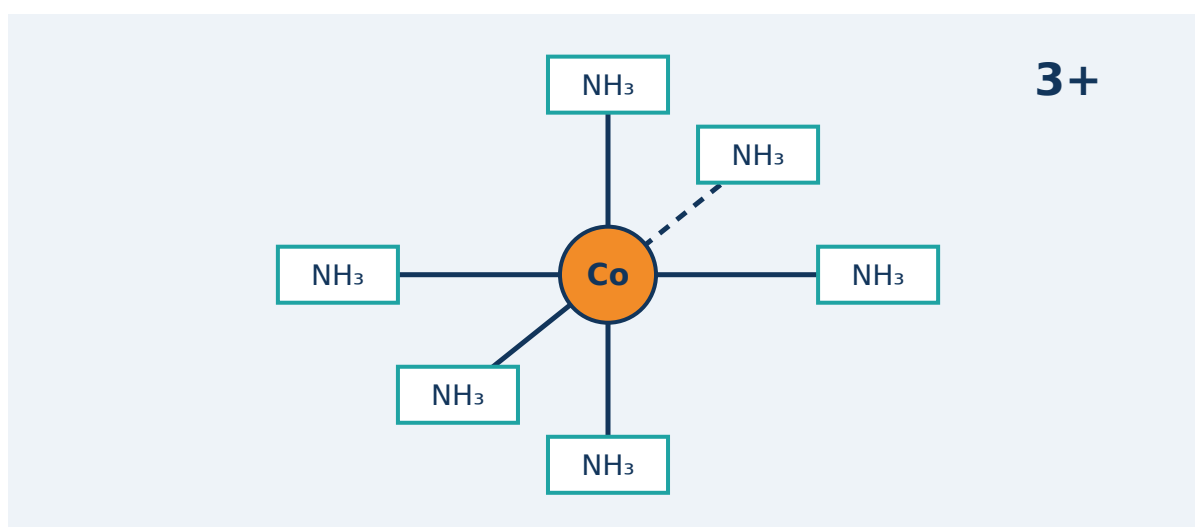
Question 1 Electron configurations (2 marks)

- Write the electron configuration of a chromium atom. (1 mark)
- Write the electron configuration of Cu^+ . (1 mark)

Question 2 Definition (3 marks)

- Define a transition element. (1 mark)
- Explain why zinc is not a transition element. (2 marks)

Question 3 Read the complex (2 marks)



A cobalt complex ion.

- State the coordination number and shape of the complex. (1 mark)
- The overall charge is 3+. State the oxidation state of cobalt. (1 mark)

Question 4 Colour of a complex (3 marks)

- a. Explain why $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ is blue. (3 marks)

Question 5 Ligand substitution (2 marks)

- a. Write the equation for copper(II) ions reacting with excess ammonia and state the colour of the product. (2 marks)

Question 6 Titration with manganate(VII) (4 marks)

- a. 25.0 cm³ of iron(II) solution needs 20.00 cm³ of 0.0200 mol dm⁻³ KMnO₄ in acid: $\text{MnO}_4^- + 8\text{H}^+ + 5\text{Fe}^{2+} \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} + 5\text{Fe}^{3+}$. Calculate $n(\text{MnO}_4^-)$. (1 mark)
- b. Calculate $n(\text{Fe}^{2+})$. (1 mark)
- c. Calculate the concentration of the iron(II) solution. (2 marks)

Question 7 Catalysts (2 marks)

- a. Explain why transition metals and their compounds are good catalysts. (2 marks)

Question 8 Cisplatin (2 marks)

- a. State the shape of $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$. (1 mark)
- b. Name the type of isomerism it shows. (1 mark)