CHAPTER 23 TRANSITION METALS

	Transition metals and their complexes have characteristic properties.
(a)	Give the electron configuration of the Zn^{2+} ion. Use your answer to explain why the Zn^{2+} ion is not classified as a transition metal ion.
	Electron configuration
	Explanation
	(2 marks)
(b)	In terms of bonding, explain the meaning of the term <i>complex</i> .
	(2 marks)
(c)	Identify one species from the following list that does not act as a ligand. Explain your answer.
	H_2 O^{2-} O_2 CO
	Not a ligand
	Explanation
	(2 marks)
(d)	The element palladium is in the d block of the Periodic Table. Consider the following palladium compound which contains the sulfate ion.
	$[Pd(NH_3)_4]SO_4$
(i)	Give the oxidation state of palladium in this compound.
	(1 mark)
(ii)	Give the names of two possible shapes for the complex palladium ion in this compound.
	Shape 1
	Shape 2
	(2 marks)

2	This question is about copper chemistry.
(a)	Aqueous copper(II) ions [Cu(H ₂ O) ₆] ²⁺ (aq) are blue.
(i)	With reference to electrons, explain why aqueous copper(II) ions are blue.
	(3 marks)
(ii)	By reference to aqueous copper(II) ions, state the meaning of each of the three terms in the equation $\Delta E = hv$.
	(3 marks)
(iii)	Write an equation for the reaction, in aqueous solution, between $[Cu(H_2O)_6]^{2^+}$ and an excess of chloride ions. State the shape of the complex produced and explain why the shape differs from that of the $[Cu(H_2O)_6]^{2^+}$ ion.
	(3 marks)

(b)	Draw the structure of the ethanedioate ion $(C_2O_4^{\ 2-})$. Explain how this ion is able to act as a ligand.
	(2 marks)
(c)	When a dilute aqueous solution containing ethanedioate ions is added to a solution containing aqueous copper(II) ions, a substitution reaction occurs. In this reaction four water molecules are replaced and a new complex is formed.
(i)	Write an ionic equation for the reaction. Give the co-ordination number of the complex formed and name its shape.
	(4 marks
(ii)	In the complex formed, the two water molecules are opposite each other. Draw a diagram to show how the ethanedicate ions are bonded to a copper ion and

give a value for one of the O-Cu-O bond angles. You are **not** required to show the water molecules.

5		metal	hedral and tetrahedral complex ions are produced by the reaction of transition lions with ligands which form co-ordinate bonds with the transition metal ion. he the term <i>ligand</i> and explain what is meant by the term <i>co-ordinate bond</i> .
			(3 marks)
	(b)	(i)	Some complex ions can undergo a ligand substitution reaction in which both the co-ordination number of the metal and the colour change in the reaction. Write an equation for one such reaction and state the colours of the complex ions involved.
			(4 marks)
		(ii)	Bidentate ligands replace unidentate ligands in a metal complex by a ligand substitution reaction. Write an equation for such a reaction and explain why this reaction occurs.

(4 marks)