

CONTENTS

1	INTRODUCTION	1
1.1	What do d orbitals look like?	2
2	CRYSTAL-FIELD THEORY	5
2.1	Octahedral complexes	5
2.2	Ionic radii	9
2.3	Crystal-field stabilisation energy	11
3	ELECTRONIC SPECTRA OF OCTAHEDRAL COMPLEXES	14
4	SUBSTITUTED AND DISTORTED OCTAHEDRAL COMPLEXES, AND SQUARE-PLANAR COMPLEXES	21
5	TETRAHEDRAL COMPLEXES	28
5.1	The occurrence of tetrahedral and square-planar four-coordinate complexes	31
6	MAGNETISM AND THE MAGNETIC PROPERTIES OF TRANSITION-METAL COMPLEXES	33
7	SUMMARY OF CRYSTAL-FIELD THEORY	40
8	MOLECULAR ORBITAL THEORY OF TRANSITION-METAL COMPLEXES	41
9	BONDING IN OCTAHEDRAL COMPLEXES	44
9.1	σ -bonding	44
9.2	π -bonding in strong-field complexes	47
9.3	π -bonding in weak-field complexes	52
9.4	Summary of Section 9	56
10	BONDING IN COMPLEXES OF D_{4h} SYMMETRY	57
10.1	Symmetry elements and symmetry point groups	57
10.2	Bonding in distorted octahedral complexes	60
10.2.1	Weak-field complexes	60
10.2.2	Strong-field complexes	63
10.3	Bonding in square-planar complexes	64
10.4	Summary of Section 10	65

11 BONDING IN TETRAHEDRAL COMPLEXES	66
11.1 Summary of Section 11	69
12 COMPLEXES OF OTHER SYMMETRY	70
13 COMPLEXES WITH TWO METAL ATOMS	71
13.1 Summary of Section 13	74
14 CHARGE-TRANSFER BANDS IN THE ELECTRONIC SPECTRA OF TRANSITION-METAL COMPLEXES	75
14.1 Ligand-to-metal charge-transfer bands	76
14.2 Metal-to-ligand charge-transfer bands	80
14.2 Metal-to-metal charge-transfer bands	81
14.4 Summary of Section 14	82
15 REVISION EXERCISE: COMPLEXES OF COBALT(II) AND COBALT(III)	83
APPENDIX FLOW CHART FOR DETERMINING THE SYMMETRY POINT GROUP OF AN OBJECT	84
LEARNING OUTCOMES	85
ANSWERS TO QUESTIONS	87
ANSWERS TO REVISION EXERCISE QUESTIONS	93
ACKNOWLEDGEMENTS	96
INDEX	97