AA ligands, 92–93, 100–102
AA substituted pentacyanoferrate(II)
complexes, 93–94
AA substituted pentacyanoferrate(II) ions,
infrared spectroscopic analysis
and, 92–94
Acetylacetonate ligand, 216–217
Acid–base chemistry, 16–18
   hard–soft–acid–base theory, 16–18
Acid–base titrations, 40–43
Acid hydrolysis constants, 17
Acid listings, hard–soft–acid–base
theory and, 17
Amino acid complexes, cadmium and,
178–185
Amino acid derivatives of
   Aquapentacyanoferrate(II) ion, 90–92
Amino acids, aquapentacyanoferrate(II) ion
and, 86–110
   formation $k_F$, 103–107
   stopped flow method, 105–106
   substitution kinetics II, 107–110
Aquadcapentacyanoferrate(II) complex, synthesis
of, 87–89
Aquadcapentacyanoferrate(II) ion, amino acids,
86–110
   derivatives, 90–92
   formation $k_F$, 103–107
   stopped flow method, 105–106
   substitution kinetics II, 107–110
Aquadcapentacyanoferrate(II) ion, cyclic
voltammetric analysis, 94–99
Aquadcapentacyanoferrate(II) ion, infrared
spectroscopic analysis, 92–94
Aquadcapentacyanoferrate(II) ion, substituted
pentacyanoferrate(II) complexes, semi
empirical calculations, 99–102
Aquadcapentacyanoferrate(II) ion, UV
spectroscopic analysis, 90–92
Aquad Co(II) ion: [$Co(H_2O)_6]^{2+}$,
measurement of, 38–39
Aqueous monodentate ligand complexed
inorganic ions, 8
Aqueous solution, metal ion complexes,
substitution properties, 87–88
Atomic absorption spectroscopy, 186–188
Base listings, hard–soft–acid–base theory and,
17
Beer’s Law, 34–36
Benesi–Hildebrand method. See Double
reciprocal method, 77–81
Biosynthesis, phytochelatins and
   atomic absorption spectroscopy, 186–188
   fission yeast, 186–191
Brown and green products
calibration constant determination, 61
Hartree–Fock calculations and structure
predictions, 68–72
infrared analysis (IR), 65–68
isolation of, 53–57
magnetic moments, 61
   magnetic susceptibility measurements,
   57–62
   thermal analysis, 62–65
Cadmium, 161–191
   amino acid complexes, 178–185
   qualitative UV spectroscope study,
   175–178
   phytochelatins, 175–178
Calibration constant determination, 61
Calorimetry, differential scanning, 62–63
Cancer treatments, 140–159
INDEX

Catalytic chemistry, Vanadyl-bis(2,4-pentanedione) and, 226–228
Cation exchange column, 47–49
CF splitting and magnetism, 71
CFSE. See Crystal field stabilization energy
CFT. See Crystal field theory
Chemistry, writing skills, 252–259
Chinese hamster ovary (CHO) cell culture, 244–248
Chiral discrimination, 210–211
CHO (Chinese hamster ovary), 244–248
Chromatography, ion exchange, 125–131
cis-Diamminedichloroplatinum(II), 140
synthesis of, 141–144
cis-Platin cytotoxicity assay, determination of, 155–159
cis-Platin oligonucleotide, molecular modeling, 150–155
cis-Platin, 140–159
DNA, 147–150
NMR spectroscopy, 148–150
trans-Platin
DMSO substitution kinetics, 146–147
reaction between, 144–147
CN⁻ ligands, 92–93
Co²⁺(aq) standard solutions, 37
Cobalt (II), cobalt(III) reduced to, 37–38
Cobalt amine complexes, 23
coordination compound synthesis, 28–34
cobalt complex I, 29–30
cobalt complex II, 30–31
cobalt complex III, 31–33
visible spectroscopy, 49–51
Cobalt ammine
Beer’s Law, 34–36
synthesis and analysis, 22–51
visible spectroscopy, 34–36
Cobalt complex I, 29–30
Cobalt complex II, 30–31
Cobalt complex III, 31–33
Cobalt coordination compound solution cobalt(III) reduced to cobalt(II), 37–38
decomposition and reduction, 37–38
Cobalt coordination compounds
II–acid–base titrimetric determination of ammonia, 40–43
acid–base titrations, 40–43
Cobalt coordination compounds IV
cation exchange column, 47–49
equivalent weight by ion exchange chromatography, 46–49
Cobalt(III), cobalt (II) reduced from, 37–38
Colors, 2
aqueous monodentate ligand complexed inorganic ions, 8
monodentate ligand complexed inorganic ions, 8
names assigned by Fremy, 3
origin, transition metal coordination complexes and, 8–9
Complex ions, 2–4
coordinate bonding, 4
coordination complexes, 4
number, 4
counterions, 3
group, 4
ligand number, 4
metal complexes, 3
coordination complex, 2
robust complexes, 4
stability constants, 4
Compounds, 2
Concentration polarization, 237–238
Conventional kinetic measurements, Tris(bidentate chelate) cobalt(II/III) complexes and, 131–136
Coordinate bond–bonding models, 5–8
crystal field theory, 5–7
coordinate bond–bonding models, ligand field theory (LFT), 8
molecular orbital theory (MOT), 8
valence bond theory, 5
Coordinate bonding, 4
Coordination complex reactivity, 9–12
electron transfer reactions, 11–12
substitution reactions, 9–11
Coordination complexes, 4
applications of, 13–14
Coordination compound synthesis, cobalt ammine, 28–34
Coordination number, 4
Coordination theory, Werner’s, 24–26
Counterions, 3
Crystal field stabilization energy (CFSE), 6
Crystal field theory (CFT), 5–7, 70
spectrum stabilization energy (CFSE), 6
spectrochemical series, 7
Cyclic voltammetric analysis, 94–99
ferricyanide study, 96–97
substituted pentacyanoferrate(II) complexes, 97–99
Cyclic voltammetric analyzer, 238–241
Cyclic voltammetry, 121–125, 236–241
Nernst equation, 235
Nernstian conditions, 237–238
Decomposition of cobalt coordination compound solution, 37–38
Diamagnetic susceptibilities, 59
Differential scanning calorimetry, 62–63
DMSO substitution kinetics, 146–147
temperature dependence study, 146–147
DNA, cis-Platin and, 147–150
Double reciprocal method, 77–81
Electrochemistry investigation, cyclic voltammetry, 121–125
Electrolytic theory of dissociation, 27
Electromagnetic regions of infrared spectroscopy, 65
Electron transfer quenching kinetics of, 204–205
Stern–Volmer equation, 205–207
thermodynamics of, 202–204
Electron transfer reactions, 11–12
self exchange, 11
stoichiometry determination of, 125–131
tris(bidentate chelate) cobalt(II/III) complexes and, 111–139
Electron transfer, 202
Electronic spectra of metal complexes, 73–74, 117–120
Encapsulation, Vanadyl-bis(2,4-pentanedione) and, 226
Energy absorption, nucleus and, 230–231
Environment, metals impact on, 161–191
cadmium, 161–191
solid phase peptide synthesis, 170–175
trace metal ions, 162–170
Epoxidation reactions, 222–223
geraniol, 223–225
Equilibrium dialysis study, 210–213
Excited states, 164–165, 243
Experimental inorganic chemistry, 1–20
Epoxidation reactions, geranyl acetate, 225–226
Far IR spectroscopy, 67
Ferricyanide study, 96–97
Fission yeast, 186–191
Fluorescence detection in aqueous solution luminescence, 164–167
trace metal ions and, 162–170
Fluorescence spectrum, 167–168
Fluorimetric reagent, 168–170
Formation constant $k_F$, 103–107
determination of, 106–107
Fourier transform NMR spectroscopy, 233
Fremy, Edmond, 3
Frequencies, mid infrared transitions, 66
Geometric isomerism, 4
Geometries of Ni(II) coordination complexes, 54
Geraniol, 223–225
Geranyl acetate, 225–226
Green products
infrared analysis (IR), 65–68
isolation of, 53–57
magnetic moments, 61
thermal analysis, 62–65
Ground states, 242–243
$^1$H NMR spectra, 82–83
Hard–soft–acid–base theory, 16–18
acid, base examples and, 17
acid hydrolysis constants, 17
Hartree–Fock approximation, 68–70
calculations and structure predictions, 68–72
CF splitting and magnetism, 71
crystal field theory, 70
preferred triplet structure, 70–71
single point UHF calculations, 70–71
Hexaaquacobalt(II) ion, 36–37
HQS. See Hydroxyquinoline-5-sulfonic acid
Hydroxyquinoline(HQ), 162–163 (replace “8” after sorted)
8-hydroxyquinoline-5-sulfonic acid (HQS), 162–163
fluorescence spectrum, 167–168
fluorimetric reagent, 168–170
Impurities, 19–20
Inert atmosphere, 133–136
Infrared analysis (IR), 65–68
brown and green forms, 67–68
far IR spectroscopy, 67
infrared spectroscopy, 65–67
Infrared spectroscopic analysis
AA ligands, 92–93
AA substituted
pentacyanoferate(II) complexes, 93–94
pentacyanoferate(II) ions and, 92–94
aquapentacyanoferate(II) ion and, 92–94
CN$^-$ ligands, 92–93
Infrared spectroscopy
  electromagnetic, 65
  far, 67
  metal carbonyls, 221
  mid transitions and frequencies, 66
  transition metal complexes, 65–67
Infrared studies, vanadyl-bis(2,4-pentanediode), 221–222
Inorganic chemistry
  complex ions, 2–4
  compounds and colors, 2
  coordinate bond–bonding models, 5–8
  coordination
    complex reactivity, 9–12
    complexes, 13–14
  experimental, 1–20
  inorganic synthesis, governing factors, 14–20
  transition metal coordination complexes, 8–9
  writing skills, 252–259
Inorganic synthesis
  acid–base chemistry, 16–18
  governing factors, 14–20
  precipitation, 18–20
  stoichiometry, 18
  thermodynamics vs. kinetics, 14–16
Ion exchange chromatography, 46–49, 125–131
Ions, trace metal, 162–170
IR. See Infrared analysis, 65–68
Jørgensen’s chain theory, 23–24
  Tassaert’s cobalt amine
    complexes, 23
  Job’s method, 72–77
Kinetic measurements
  outer sphere rate constant, 136–139
  tris(bidentate chelate) cobalt(II/III)
    complexes and, 131–136
  rate law, 131–133
  inert atmosphere, 133–136
Kinetics, thermodynamics vs., inorganic
  synthesis, 14–16
LFT. See Ligand field theory
Ligand
  field theory (LFT), 8
  number, 4
  Ligand pKₐ values, 179–182
  potentiometric titrations, 179–182
  Ligands,
    AA, 92–93, 100–102
    CN⁻, 92–93
Luminescence 164–167
  excited states, 164–165
  quantum efficiency, 165
  quenching
    steady state, 208
    time resolved, 209
  sensing, 165–166
  spectroscopy, 166–167
  spectrum, 207–208
  studies, 207
Magnetic
  moments, 61
  properties, transition metal complexes
    and, 57–62
  susceptibility measurements, 57–62
  diamagnetic susceptibilities, 59
  Magnetism, CF splitting and, 71
  Marcus Theory, 136–139
  Measuring, weighing by difference, 36
Medicine
  cancer treatments, 140–159
  cis-Diamminedichloroplatinum(II), 140
  metals and, 140–159
Metal carbonyls, 221
  Metal complex DNA binding, 210–211
  chiral discrimination, 210–211
  Metal complex formation, 77–78
  Metal complex structure, 23
    Jørgensen’s chain theory, 23–24
    Werner’s coordination theory, 24–26
  Metal complexes, 3
    electronic spectra of, 73–74, 117–120
    octahedral, 103–105
    photochemistry of, 202
    phytochelatins and, 175–178
    pulsed NMR spectroscopy, 230–234
    square planar, substitution
      in, 144–147
  Metal coordination complex, 2
    optical isomers, 196
  Metal ion complexes, aqueous solution and, 87–88
  Metal ligand stability constants, 179–182
  Metal complexes, aqueous solution and, 87–88
  Metal ion complexes, aqueous solution and,
    substitution properties, 87–88
  Metals in the environment, 161–191
    cadmium, 161–191
    phytochelatins, biosynthesis of, 186–191
Metals, medicine, 140–159
cancer treatments, 140–159
cis-Diaminedichloroplatinum(II), 140
cis-Platin, 140–159
molecular biology and, 193–213
trans-Platin, 140–159
Mid-infrared transitions and frequencies, 66
M–L bonds, stretches and bends, 67
Molecular biology, metals and, 193–213
Molecular biology, Tris(1,10-phenanthroline) chromium(III) hexafluorophosphate, 193–213
Molecular geometry and stability, solid and solution phase analysis, 52–83
Molecular mechanics calculations, 150–155
Molecular modeling
cis-Platin oligonucleotide and, 150–155
molecular mechanics calculations, 150–155
Molecular orbital theory (MOT), 8
Monodentate ligand complexed inorganic ions, 8
MOT. See Molecular orbital theory

N,N'-disalicylaldehyde-1,3-propanediimine nickel(II), [Ni(salpd)],
brown and green products isolation of, 53–57
magnetic susceptibility measurements, 57–62
calibration constant determination, 61
magnetic moments, 61
thermal analysis, 62–65
infrared analysis, 65–68
Hartree–Fock calculations and structure predictions, 68–72
coordination complexes, geometries of, 54, 72–73
NMR spectroscopic analysis, 81–83
1H NMR spectra, 82–83
pyridine binding, 72–77
results summary, 57
Schiff bases, 53–54
solid and solution phase analysis, 52–53
synthesis of, 55
Nernst equation, 235
Nernstian conditions, concentration polarization, 237–238
Ni(II) coordination complexes, geometries of, 54
[Ni(salpd)], 75
Nickel(II) coordination complexes, 72–73
NMR spectroscopic analysis, 81–83
1H NMR spectra, 82–83
paramagnetic, 81
NMR spectroscopy
cis-Platin, DNA and, 148–150
Fourier transform, 233
pulsed, 230–234
Nucleic acids, photo-oxidation effects on, Tris(1,10-phenanthroline) chromium(III) hexafluorophosphate, 202–210
Nucleus, energy absorption, 230–231
Octahedral metal complexes, 103–105
One-dimensional pulse experiments, 233–234
Optical isomer resolution, tartrate salts, 196–197
Optical isomers, 196
Outer sphere rate constant, 136–139
Marcus Theory, 136–139
Oxidation state, 25
Paramagnetic NMR spectroscopic analysis, 81
Particle sizes, precipitates and, 19
Pentacyanoferrate(II) complexes, cyclic voltammetric analysis and, 97–99
Pentacyanoglycylferrate(II) ion, UV spectroscopic analysis, 90–92
Pentacyanomethionylferrate(II) ion, UV spectroscopic analysis of, 90–92
Peptide synthesis, 170–175
Photo-induced electron transfer, 202
Photochemistry, metal complexes and, 202
Phytochelatins, 170–171
biosynthesis, fission yeast, 186–191
metal complexes of, 175–178
Polyelectronic systems excited states, 243
ground states, 242–243
term symbols, 242–243
Potentiometric titrations ligand pKa values and, 179–182
metal ligand stability constants and, 179–182
Precipitates impurities, 19–20
product isolation, 19
properties of, 18–20
particle sizes, 19
product solubility, 18–19
purification by recrystallization, 20
Preferred triplet structure, 70–71
Product isolation, precipitates and, 19
Product solubility, precipitates and, 18–19
Pulsed NMR spectroscopy, 230–234
eperiments, 233–234
Purification by recrystallization, 20
Pyridine binding
double reciprocal method, 77–81
Job’s method, 72–77
\(N,N\)-disalicylaldehyde-1,3-propanediimine nickel(II) and, 72–77
visible spectroscopic analysis, 72–77
Qualitative analysis, 162–163
Qualitative UV spectroscopic study, 175–178
Quantitative analysis, 163
Quantum efficiency, 165
Rate law, 131–133
Reactivity I, substitution reactions, aquapentacyanoferate(II) ion, 86–110
Recrystallization, purification and, 20
Reduction of cobalt coordination compound solution, 37–38
Resolution, Tris(1,10-phenanthroline) chromium(III) hexafluorophosphate and, 196–198
Robust complexes, 4
Schiff bases, 53–54
Self-exchange reactions, 11
Semi-empirical calculations
AA ligands, 100–102
substituted pentacyanoferate(II) complexes and, 99–100
Semi-empirical method, 99–100
Sensing, luminescence, 165–166
Single point UHF calculations, 70
Single point UHF calculations, 71
Sodium amminepentacyanoferate(II) from sodium nitroprusside, substitution reaction of, 89
Sodium nitroprusside, sodium amminepentacyanoferate(II) from, substitution reaction of, 89
Solid and solution phase analysis
molecular geometry and stability and, 52–53
\(N,N\)-disalicylaldehyde-1,3-propanediimine nickel(II), 52–53
Solid phase peptide synthesis, 170–175
phytochelatins, 170–171
Solubility, precipitates and, 18–19
Solution phase analysis, molecular geometry and stability and, 52–53
Solvatochromatic properties
Vanadyl-bis(2,4-pentanediione), 219–220
visible spectroscopy, 219–220
Spectrochemical series, 7
Spectroscopy, luminescence, 166–167
Square planar metal complexes, substitution in, 144–147
Stability constants, 4
Steady state luminescence quenching, 208
Stereochemical binding to DNA equilibrium dialysis study, 210–213
Tris(1,10-phenanthroline) chromium(III) and, 210–213
Stern–Volmer equation, 205–207
Stoichiometry, 18
determination, ion exchange chromatography, 125–131
Stopped-flow method, 105–106
Substituted pentacyanoferate(II) complexes cyclic voltammetric analysis and, 97–99
semi empirical calculations, 99–102
Substitution kinetics II, aquapentacyanoferate(II) ion and, 107–110
Substitution kinetics
DMSO, 146–147
trans-Platin and, 144–147
Substitution reactions, 9–11
aquapentacyanoferate(II) ion, amino acids, 86–110
aqueous solution and metal ion complexes, 87–88
sodium amminepentacyanoferate(II) from sodium nitroprusside, 89
Synthesis
aquapentacyanoferate(II) complex, 87–89
cis-Diaminedichloroplatinum(II), 141–144
\(N,N\)-disalicylaldehyde-1,3-propanediimine, 55
\(N,N\)-disalicylaldehyde-1,3-propanediiminenickel(II), 55
tris(1,10-phenanthroline) chromium(III) hexafluorophosphate and, 194–195
vanadyl-bis(2,4-pentanediione), 216–219
Tassaert’s cobalt amine complexes, 23
Tartrate salts, 196–197
Temperature dependence study, 146–147
Term symbols, 242–243
Thermal analysis, 62–65
Thermodynamics, electron transfer quenching, 202–204 kinetics vs., inorganic synthesis, 14–16
Time-resolved luminescence quenching, 209
Trace metal ions, 162–170 fluorescence detection in aqueous solution, 162–170
8-hydroxyquinoline (HQ), 162–163 qualitative analysis, 162–163
Transition metal complexes infrared spectroscopy and, 65–67 magnetic properties, 57–62
Transition metal coordination complexes, origin of color, 8–9
trans-Platin, 140–159
cis-Platin and DMSO substitution kinetics, 146–147 reaction between, 144–147 substitution kinetics, 144–147
UV spectroscopic study of cadmium, 175–178 phytochelatins, 175–178 UV spectroscopic analysis aquapentacyanoferrate(II) ion, 90–92 pentacyanomethionylferrate(II) ion, 90–92
UV-visible spectroscopic analysis, 75
Valence bond theory, 5
Vanadium catalyst, 215–228
vanadyl-bis(2,4-pentanedione), 215–228
Visible spectroscopic analysis pyridine binding and, 72–77 UV-visible, [Ni(salpd)], 75
Visible spectroscopy, 34–36
Weighing by difference, 36
Writing skills, 252–259
Yeast culture, 249–251