JAMES COOK UNIVERSITY OF NORTH QUEENSLAND

School of Pharmacy and Molecular Sciences

Department of Chemistry

COURSE TITLE: CH3041 NATURAL CHEMISTRY SECTION

LECTURER: Dr Mike Liddell

RECOMMENDED TEXT:

"*Environmental Chemistry*" 3rd Edition
C. Baird, M. Cann (Freeman, New York, 2005)

ADDITIONAL TEXTS (in reserve):

"*Introduction to Environmental Chemistry*", (Blackwell Science Oxford, 2004)
J. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss, B.J. Reid
"*Environmental Chemistry*" Seventh Edition, (Lewis, Boca Raton, 2000)
S.E. Manahan
"*Environmental Chemistry: a global perspective*."
Van Loon, G.W. and S.J. Duffy (OUP, 2000).
"*Environmental Chemistry*" 2nd Edition, N. Bunce (Wuerz, Winnipeg, 1994)
"*Air Composition and Chemistry'*"
P. Brimblecombe (CUP, Cambridge, 1986)
"*Aquatic Chemistry'*" 3rd e "
W. Stumm, J.J. Morgan (Wiley, N.Y., 1996)
Principles and Application of Aquatic Chemistry'"
F.M.M. Morel, J.G. Hering (Wiley, N.Y, 1993)
"*Aqueous Environmental Geochemistry*."
Langmuir, D. (Prentice Hall, 1997).
"*Principles and Practice of Soils Science'*" 3rd Edition
R.E. White (Blackwell Science, Oxford, 1997)
"*Environmental Chemistry of Soils'*" M.B. McBride (OUP, Oxford, 1994)
"*The Chemistry of Soils'*" G. Sposito (OUP, Oxford, 1989)
"*Soil Chemistry and Applications'*"
M.Cresser, K. Killham, T. Edwards (Cambridge, Cambridge, 1993)
"*Chemistry - The Molecular Nature of Matter and Change*",
M. Silberberg (McGraw-Hill, St. Louis, 1996)
"*Chemistry.*", S. Zumdahl (D.C. Heath, 1998)
"*The elements on earth : inorganic chemistry in the environment*."
Cox, P. A. (OUP, 1995).
"*Principles and applications of geochemistry : a comprehensive textbook for geology students*" Faure,G. (Prentice Hall, 1998).

Library: 1 copy of each in reserve

SUPPLEMENTARY READINGS FROM

ENVIRONMENTAL CHEMISTRY - BAIRD

1. **Atmospheric Chemistry**
   - The chemistry of the troposphere — P139 - 61
   - gas concentrations — P9, 67 – 69
   - CFCs and the ozone layer — P3 – 58
   - Aerosols — P106 - 116
2. **Aqueous Chemistry**
   - Freshwater chemistry DO, BOD, DOC — P425 - 29
   - Carbonate equilibria, hardness, Al^{3+}, BOD, pE, alk. — P433 - 57
3. **Terrestrial Chemistry**
   - Soils CEC, salinity — P591 - 8
   - Mineral types, general introduction, binding metals — P530 - 538

ENVIRONMENTAL CHEMISTRY: A GLOBAL … - VAN LOON, DUFFY

1. **Atmospheric Chemistry**
   - The chemistry of the troposphere and stratosphere — P24 – 28
   - rain drop chemistry — P90 – 95
   - CFCs and the ozone layer — P42 – 48, 50 - 60
   - Aerosols — P115 - 125
2. **Aqueous Chemistry**
   - Hydrosphere — P187 – 195
   - PE — P208, 219
   - Dissolved Organic Matter (DOM) — P239 – 250
   - Metals — P 266 - 268
3. **Terrestrial Chemistry**
   - Soil formation — P370 – 378
   - Soil properties — P380 – 383
   - CEC, soil pH — P386 – 390
4. Interface chemistry, K_F, K_D — P301 – 303
5. Microbiology classifications — P319- 24, 332- 34
6. **Geochemical cycles**
   - P cycle — P295 – 298
   - N cycle — P337 – 344
   - S cycle — P344 - 347

INTRODUCTION TO ENVIRONMENTAL CHEMISTRY - ANDREWS *et al.*

- General Introduction — P1 - 11

1. **Atmospheric Chemistry**
   - The chemistry of the troposphere and stratosphere — P31 - 45
   - CFCs and ozone — P58 - 64
2. **Aqueous Chemistry**
   - (a) Freshwater chemistry — P88 -109
   - (b) Marine chemistry — P114 - 59
3. **Terrestrial Chemistry**
   - Mineral types, weathering, soils & clays, structure — P66– 94, 104- 18
   - Element Cycles — P262 - 74

ENVIRONMENTAL CHEMISTRY - MANAHAN

- General Introduction — P1 - 11

1. **Atmospheric Chemistry**
   - The chemistry of the troposphere and stratosphere — P265 - 302

	aerosol particles	P307 - 15
	CFCs and ozone	P417 - 20
2.	**Aqueous Chemistry**	
	Freshwater chemistry	P55 - 80, P91 - 3
	phase interactions	P121 – 2, 135 – 9
	redox chemistry	P98– 106, 110 - 3
	microbial chemistry (quite a bit of)	P148 - 63
3.	**Terrestrial Chemistry**	
	Mineral types, soils and clay minerals	P433 - 50
	Soil chemistry	P476- 93
	Element cycles	P11 - 19

ENVIRONMENTAL CHEMISTRY - BUNCE

1.	**Atmospheric Chemistry**	
	The chemistry of the troposphere	P67 - 74
	residence times, sources / sinks	P1 - 7
	temperature profile	P10 - 4
	CFCs and the ozone layer	P19, P33 - 55
2.	**Aqueous Chemistry**	
	Freshwater chemistry	
	DO, COD, BOD, hardness, ionic strength	P131 - 52

AIR COMPOSITION & CHEMISTRY - BRIMBLECOMBE

1.	**Atmospheric Chemistry**	
	The chemistry of the troposphere and stratosphere	P1 - 13
	sources / sinks	P20 - 36
	hydroxyl radical	P51 - 53
	aerosol particles	P55 - 69
	clouds	P82 - 84
	ozone layer and formation of ozone holes	P190 - 202

AQUEOUS ENVIRONMENTAL GEOCHEMISTRY - LANGMUIR

2.	**Aqueous Chemistry**	
	Hydrosphere	P267 – 269
	K_F, K_D, $K_{OW,}$ BCF	P353 – 360
	Humic and fulvic acids	P161 – 162
	E_H vs pH, Redox ladders	P408 - 421
3.	**Terrestrial Chemistry**	
	Chemical weathering	P231 – 234
	Soil classifications	P236 – 237

AQUATIC CHEMISTRY - STUMM & MORGAN

2.	**Aqueous Chemistry**	
	Freshwater chemistry	P 47 - 66, P80 - 2
	ANC, BNC, humic & fulvic acids	P 138 - 43, P163
	carbonate equilibria	P148 - 51
	water-gas interface	P241 - 3
	trace metals	P252 - 58
	redox chemistry	P 426 - 35
	pE - pH diagrams	P 455 - 61
	microbial redox chemistry	P 464 - 83
	solid-solution interface	P516– 25,P903- 8

Redfield stoichiometry	P 886 - 7
Marine chemistry	P 895 - 903

PRINCIPLES ... OF AQUATIC CHEMISTRY - MOREL & HERING

2. **Aqueous Chemistry**

Freshwater chemistry	
alkalinity,	P 158 - 74
weathering	P 277
water-gas interface	P 218 - 22
redox chemistry	P 421 - 36
pE - pH diagrams	P 466
microbial redox chemistry	P 206-7, P439 -45
solid-solution interface	P 519 - 22
Redfield stoichiometry	P 203 - 6
Marine chemistry	
fluxes	P 290 - 2
organic complexation - humic, fulvic acids	P358 - 64, P370-9
trace metals	P 405 - 8

PRINCIPLES AND APPLICTIONS OF GEOCHEMISTRY - FAURE

3. **Terrestrial Chemistry**

Composition of the Earth	P 43 - 57
Ion activities	P 113, 139- 40
Weathering of feldspar	P149 - 50
Clay mineral structures	P201 - 3
CEC	P217 - 220
E_H - pH diagrams	P235 - 242
Soil formation	P354 - 357
Water composition	P370 - 373
Water quality parameters	P392 - 395
Geochemical cycles C, N, S	P425 - 446

CHEMISTRY - SILBERBERG

Geochemical cycles	P 1015 – 24

THE ELEMENTS ON EARTH - COX

Geochemical cycles	P141 C, P208 N, P258 S, P231 P

PRINCIPLES AND PRACTICE OF SOIL SCIENCE - WHITE

3. **Terrestrial Chemistry**

General introduction to soils	P3 - 15
Mineral structures	P18 - 30
Clays	P23 - 28
Humic matter	P49 - 50
CEC	P132- 136
Buffering and Acidity	P135 - 6
Weathering mechanisms	P80 - 90
Saline & Sodic soils, clay swelling, SAR, ESP	P141-44, 287-293
Surface Adsorption	P139 – 140
N, P, S element cycles	P195 – 206

ENVIRONMENTAL CHEMISTRY OF SOILS - McBRIDE

3. **Terrestrial Chemistry**

Mineral structures	P31 - 55
Clays	P46 - 84
Humic matter	P56 - 57
CEC	P63- 65, P107- 11
Buffering	P182 - 88
Acidity	P188 - 96
Weathering mechanisms	P207 - 27
Redox chemistry	P245 - 64
Saline & Sodic soils, clay swelling	P279 - 93, P304
Surface Adsorption	P343 - 4, P373 - 6

CHEMISTRY OF SOILS **- SPOSITO**

3. **Terrestrial Chemistry**

Soil composition	P13 - 16
Mineral structures	P26 - 37
Humic matter	P48 - 53
CEC	P170 - 1
Acidity	P213 - 4
Weathering mechanisms	P86 - 90
Redox chemistry	P106 - 13
Saline & Sodic soils	P226 - 30
Surface Adsorption	P127 - 133

SOIL CHEMISTRY AND APPLICATIONS **- CRESSER *et al.***

3. **Terrestrial Chemistry**

Mineral structures	P10 - 27
Humic matter	P42 - 45
CEC	P58 - 61
Acidity	P65 - 67
Saline & Sodic soils	P79 - 83

COURSE TITLE: CH3041 ANALYTICAL CHEMISTRY SECTION

RECOMMENDED TEXT:

"*Environmental Chemistry*" 3rd Edition
C. Baird, M. Cann (Freeman, New York, 2005)

ADDITIONAL TEXTS (in reserve):

"*Principles of Instrumental Analysis.*", 5th Ed. - Best for this section.
D.A. Skoog (Saunders, 1998)
"*Environmental Chemistry*" 6th Edition,
S.E. Manahan (Lewis, Boca Raton, 2000)
"*Environmental Analysis*"
R.N. Reeve (J. Wiley, Chichester, 1994)
"*Environmental Analytical Chemistry*"
F.W. Fifield, P.J. Haines (Blackie, London, 2000) 2nd Ed
"*Quantitative Chemical Analysis.*", 4th Ed.
D.C. Harris (Saunders, 1995)
Library: 1 copy of each in reserve

SUPPLEMENTARY READINGS FROM

ENVIRONMENTAL CHEMISTRY	**- BAIRD**
Gas Chromatography	P302 - 4
ICP-MS	P564
Ion Chromatography	P565 - 7
ENVIRONMENTAL CHEMISTRY	**- MANAHAN**
Sampling, storage & extraction	P766-8,778– 83,790- 801
Analyte method selection	P771 - 3
Wet methods	P754 - 6
UV/Vis, Chemiluminescence, IR	P756 - 7, P795 - 6
AA, AES	P756 - 9
GC &HPLC	P761 - 4
Electrochemical Sensors, ISE	P759 - 61
ENVIRONMENTAL ANALYTICAL CHEMISTRY	**- FIFIELD & HAINES**
The analytical method, errors	P3 – 7, 14 - 31
Transport of pollutants, site selection	P412 - 5
Sampling, storage & extraction	P7- 11, 91- 4, 377- 84 P427 - 8, 431 - 6
Wet methods	P76- 90
Liquid Chromatography	P96 – 100, 106 - 8
GC, HPLC & Ion Chromatography	P100 – 12, P438 - 49
UV/Vis	P161 - 6
AA, AES	P135 - 40, 151 - 9
Electrochemical Sensors, ISE	P228 – 32, 245 - 6
ENVIRONMENTAL ANALYSIS	**- REEVE**
Transport of pollutants	P15 - 32
Sampling, storage & extraction	P33, P49 - 51, P95 - 96, P144 - 162, P176 - 185, P196, P212 - 215
Wet methods	P54 - 68

Liquid Chromatography, Ion Chromatography	P77 - 91, P104 - 7, P128
UV/Vis	P124, 222
Continuous-flow analysis	P73 - 74
AA, AES	P76, P118 - 24
GC	P97 - 113, P195 - 99
HPLC	P110 - 113
Electrochemical Sensors, ISE	P192, P82-83

PRINCIPLES OF INSTRUMENTAL ANALYSIS."	**- SKOOG**
Method Selection	P11 - 14, 99
Calibration	P15 - 18
ND-IR	P400, 415 - 18
UV/Vis	P300 - 3, 312 - 6
Fluorescence	P355 - 7, 365 - 8
Chemiluminesence	P374 - 6
AA, ICP-AES	P206 – 17, 230 - 4, 242
Flow injection	P831 - 4
Chromatography	P674 - 683
GC	P703 - 19, 498 - 504
HPLC, IC	P725 – 36, 750 - 5
Electroanalytical	P588, 591, 596 - 608

QUANTITATIVE CHEMICAL ANALYSIS	**- HARRIS**
Amperometry	P510 - 11
FET Electrodes	P406 - 9

COURSE TITLE: CH3041 POLLUTION CHEMISTRY SECTION

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C. Baird, M. Cann (Freeman, New York, 2005)

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J. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss, B.J. Reid
(Blackwell Science Oxford, 2004)
"*Environmental Chemistry: a global perspective*."
Van Loon, G.W. and S.J. Duffy (OUP, 2000).
"*Environmental Chemistry*" Seventh Edition,
S.E. Manahan (Lewis, Boca Raton, 2000)
"*Chemical Principles of Environmental Pollution*" 2nd Edition.
Alloway, B.J. and D.C. Ayres (Blackie, 1997).
"*Environmental Chemistry*" Second Edition,
N. Bunce (Wuerz, Winnipeg, 1994)
"*Chemistry - The Molecular Nature of Matter and Change*",
M. Silberberg (McGraw-Hill, St. Louis, 1996)
"*Chemistry.*", S. Zumdahl (D.C. Heath, 1998)
"*Environmental Analytical Chemistry*"
F.W. Fifield, P.J. Haines (Blackie, London, 2000) 2nd Ed
"*Principles and Practice of Soils Science'*" 3rd Edition
R.E. White (Blackwell Science, Oxford, 1997)
"*Acid Sulphate Soils Manual.*", (NSW-ASSMAC, 1998)

333.910099436 NAT V.2 C.A Natural Resources of the Barron River Catchment 2. Water Quality, Land Use & Land Management Interactions. A.L. Cogle, (2000) Queensland Government – this will be found in the special reserve collection upstairs. Ask the librarian.

SUPPLEMENTARY READINGS FROM

ENVIRONMENTAL CHEMISTRY	**- BAIRD**
Greenhouse effect	P166 – 215, 236 - 248
Smog	P70-91, 116-27
Indoor air pollution	P127 - 35
Pesticides, Insecticides, Herbicides	P307 - 327, 337 - 54
Toxicology	P327 – 34, 412
PCBs, PAHs, dioxins	P358 - 402
Heavy Metals	P516 – 42
Acid mine drainage	P438 - 40
Sewage treatment	P494 – 504
Groundwater pollution	P478 - 93
Nuclear energy	P626 – 50
Energy sources fossil, fuel cells , biofuels	P226 – 236, 252 – 295
Soil, sediment remediation	P599 – 614
Hazardous wastes and disposal	P614 - 21
Wastes, disposal, recycling	P504 – 11, 571 - 91

INTRODUCTION TO ENVIRONMENTAL CHEMISTRY - ANDREWS *et al.*

Greenhouse effect, global warming	P240 - 51, 257 - 62
Smog	P45 - 57
Acid Rain	P265 - 271
PCBs	P274 – 279
Remediation of toxic organics, K_{ow}	P119 – 137
Acid mine drainage	P156
Water pollution (Hg, LUSTs, nutrients)	P170 – 7, 161 - 69

ENVIRONMENTAL CHEMISTRY: A GLOBAL… - VAN LOON & DUFFY

K_{OW}, BCF	P305 – 308
Eutrophication	P335 – 336
Mine wastes	P413 – 5
Fossil fuels	P172 - 17
Greenhouse effect	P154 – 169
Smog	P64 – 72
Air pollution control	P129 – 131
Indoor atmospheres	P134 –137, 142 – 151
Pesticide mobility	P455 – 461
Water treatment	P353 - 363
Landfill, incineration	P427 – 433

ENVIRONMENTAL CHEMISTRY - MANAHAN

Toxicology	P695 - 714
Greenhouse effect	P405 - 413
Smog	P379 - 400, 420 - 423
Pesticides, Insecticides, Herbicides	P208 - 214
Dioxins, PCBs	P215 – 219
Eutrophication, Detergents	P198 – 6
Sewage treatment	P231 - 6
Heavy Metals	P191 – 3
Aerosol, SO_2 removal	P322 – 25, 335 - 8
Hazardous wastes	P595 - 620
Waste minimization, treatment	P628 - 662

CHEM. PRIN. OF ENVIRONMENTAL POLLUTION - ALLOWAY

Environmental monitoring & sampling	P139 - 151
Trigger Levels	P77 – 79
Detergents	P279 - 281
Contamination of aquifers	P42 – 44
Organochlorine insecticides	P282 – 289
PCBs	P293 – 295
PAH	P267 – 271
Heavy metals Pb, Hg	P190 – 207, 214, 215

CHEMISTRY - SILBERBERG

Nuclear chemistry	P 932 – 961

CHEMISTRY - ZUMDAHL

Nuclear chemistry	P 995 – 1026

ENVIRONMENTAL CHEMISTRY - BUNCE

Greenhouse effect	P14 - 24
Smog	P74 - 95
Indoor air pollution	P107 - 125

Acid Rain	P159 - 187
Pesticides, Insecticides, Herbicides	P296 - 299
PCBs, PAHs, dioxins	P300 - 323
Heavy Metals	P335 - 353
Acid mine drainage	P354
Water treatment	P201 - 16
Waste disposal	P231 – 276

ENVIRONMENTAL ANALYTICAL CHEMISTRY - FIFIELD & HAINES

Ecotoxicology	P452 - 62
Nuclear power	P394 - 406
Radiogenic dating	P407 - 9
Measurement of radiation	P201 - 13

PRINCIPLES AND PRACTICE OF SOIL SCIENCE - WHITE

Pesticides in Soils	P273 – 279

ACID SULPHATE SOILS MANUAL - NSW-ASSMAC