



# Contents

Introduction	viii
Core topics	
1: Statistical analysis	1
Introduction	1
1.1 Statistics	1
Practice questions	10
2: Cells	12
Introduction	12
2.1 Cell theory	12
2.2 Prokaryotic cells	16
2.3 Eukaryotic cells	19
2.4 Membranes	29
2.5 Cell division	38
Practice questions	43
3: The chemistry of life	46
Introduction	46
3.1 Chemical elements and water	46
3.2 Carbohydrates, lipids and proteins	49
3.3 DNA structure	55
3.4 DNA replication	58
3.5 Transcription and translation	60
3.6 Enzymes	66
3.7 Cell respiration	69
3.8 Photosynthesis	74
Practice questions	79
4: Genetics 1	81
Introduction	81
4.1 Chromosomes, genes, alleles and mutations	81
4.2 Meiosis	84
4.3 Theoretical genetics	90
4.4 Genetic engineering and biotechnology	100
Practice questions	110

5: Ecology and evolution	112
Introduction	112
5.1 Communities and ecosystems	112
5.2 The greenhouse effect	122
5.3 Populations	130
5.4 Evolution	134
5.5 Classification	142
Practice questions	150
6: Human health and physiology 1	151
Introduction	151
6.1 Digestion	151
6.2 The transport system	157
6.3 Defence against infectious disease	162
6.4 Gas exchange	168
6.5 Nerves, hormones and homeostasis	173
6.6 Reproduction	185
Practice questions	191
HL topics	
7: Nucleic acids and proteins	193
Introduction	193
7.1 DNA structure	193
7.2 DNA replication	197
7.3 Transcription	201
7.4 Translation	203
7.5 Proteins	206
7.6 Enzymes	210
Practice questions	214
8: Cell respiration and photosynthesis	217
Introduction	217
8.1 Cell respiration	217
8.2 Photosynthesis	227
Practice questions	237
9: Plant science	238
Introduction	238
9.1 Plant structure and growth	238
9.2 Transport in Angiospermophytes	246
9.3 Reproduction in Angiospermophytes	256
Practice questions	262

10: Genetics 2	265
Introduction	265
10.1 Meiosis	265
10.2 Dihybrid crosses and gene linkage	272
10.3 Polygenic inheritance	278
Practice questions	282
11: Human health and physiology 2	283
Introduction	283
11.1 Defence against infectious disease	283
11.2 Muscles and movement	290
11.3 The kidney	299
11.4 Reproduction	306
Practice questions	317
Options for SL	
12 (Option A): Human nutrition and health	320
Introduction	320
A.1 Components of the human diet	321
A.2 Energy in human diets	332
A.3 Special issues in human nutrition	342
Practice questions	349
13 (Option B): Physiology of exercise	350
Introduction	350
B.1 Muscles and movement	350
B.2 Training and the pulmonary system	359
B.3 Training and the cardiovascular system	362
B.4 Exercise and respiration	367
B.5 Fitness and training	372
B.6 Injuries	377
Practice questions	379
14 (Option C): Cells and energy	382
Introduction	382
C.1 Proteins	382
C.2 Enzymes	386
C.3 Cell respiration	390
C.4 Photosynthesis	400
Practice questions	410

Options for SL and HL	
15 (Option D): Evolution	414
<i>Core (SL and HL)</i>	
Introduction	414
D.1 Origin of life on Earth	415
D.2 Species and speciation	422
D.3 Human evolution	432
<i>Extension (HL only)</i>	
D.4 The Hardy–Weinberg principle	444
D.5 Phylogeny and systematics	448
Practice questions	458
16 (Option E): Neurobiology and behaviour	461
<i>Core (SL and HL)</i>	
Introduction	461
E.1 Stimulus and response	461
E.2 Perception of stimuli	465
E.3 Innate and learned behaviour	471
E.4 Neurotransmitters and synapses	481
<i>Extension (HL only)</i>	
E.5 The human brain	489
E.6 Further studies of behaviour	499
Practice questions	505
17 (Option F): Microbes and Biotechnology	510
<i>Core (SL and HL)</i>	
Introduction	510
F.1 Diversity of microbes	511
F.2 Microbes and the environment	519
F.3 Microbes and biotechnology	525
F.4 Microbes and food production	529
<i>Extension (HL only)</i>	
F.5 Metabolism of microbes	534
F.6 Microbes and disease	538
Practice questions	548
18 (Option G): Ecology and conservation	552
<i>Core (SL and HL)</i>	
Introduction	552

G.1 Community ecology	553
G.2 Ecosystems and biomes	562
G.3 Impact of humans on ecosystems	572
<i>Extension (HL only)</i>	
G.4 Conservation of biodiversity	582
G.5 Population ecology	589
Practice questions	595
Option for HL	
19 (Option H): Further human physiology	601
Introduction	601
H.1 Hormonal control	601
H.2 Digestion	605
H.3 Absorption of digested foods	611
H.4 Functions of the liver	614
H.5 The transport system	618
H.6 Gas exchange	627
Practice questions	635
20 Theory of knowledge	636
Advice for IB biology students on internal assessment	648
Advice for IB students on extended essays in biology	650
Advice for IB biology students on examination strategies	652
Answers to exercises and practice questions	655
Index	703