

Contents

Note to the Student & Acknowledgments	iii
Using This Workbook	1
BIOZONE's Online Resources	2

CORE TOPICS

Topic 1: Cell Biology

<i>Understandings, Applications, and Skills</i>	3
<input type="checkbox"/> 1 Cell Theory	5
<input type="checkbox"/> 2 Unicellular Eukaryotes	6
<input type="checkbox"/> 3 Surface Area and Volume	7
<input type="checkbox"/> 4 Cell Sizes	9
<input type="checkbox"/> 5 Calculating Linear Magnification	10
<input type="checkbox"/> 6 Multicellularity	11
<input type="checkbox"/> 7 Stem Cells and Differentiation	12
<input type="checkbox"/> 8 Types of Stem Cells	13
<input type="checkbox"/> 9 Using Stem Cells to Treat Disease	15
<input type="checkbox"/> 10 Comparing Prokaryotic and Eukaryotic Cells	16
<input type="checkbox"/> 11 History of Microscopy	17
<input type="checkbox"/> 12 Prokaryotic Cell Structure	18
<input type="checkbox"/> 13 Binary Fission in Prokaryotes	19
<input type="checkbox"/> 14 Plant Cells	20
<input type="checkbox"/> 15 Animal Cells	22
<input type="checkbox"/> 16 Identifying Structures in an Animal Cell	24
<input type="checkbox"/> 17 Identifying Structures in a Plant Cell	25
<input type="checkbox"/> 18 The Structure of Membranes	26
<input type="checkbox"/> 19 How Do We Know? Membrane Structure	28
<input type="checkbox"/> 20 Diffusion	29
<input type="checkbox"/> 21 Osmosis	30
<input type="checkbox"/> 22 Estimating Osmolarity	31
<input type="checkbox"/> 23 Active Transport	32
<input type="checkbox"/> 24 Ion Pumps	33
<input type="checkbox"/> 25 Exocytosis and Endocytosis	34
<input type="checkbox"/> 26 Active and Passive Transport Summary	35
<input type="checkbox"/> 27 Investigating the Origin of Life	36
<input type="checkbox"/> 28 The First Cells	37
<input type="checkbox"/> 29 Origin of the Eukaryotes	38
<input type="checkbox"/> 30 The Common Ancestry of Life	39
<input type="checkbox"/> 31 Why Cells Need to Divide	40
<input type="checkbox"/> 32 Mitosis and the Cell Cycle	41
<input type="checkbox"/> 33 Recognizing Stages in Mitosis	43
<input type="checkbox"/> 34 Regulation of the Cell Cycle	44
<input type="checkbox"/> 35 Cancer: Cells Out of Control	45
<input type="checkbox"/> 36 Chapter Review	46
<input type="checkbox"/> 37 KEY TERMS: Did You Get It?	48

Topic 2: Molecular Biology

<i>Understandings, Applications, and Skills</i>	49
<input type="checkbox"/> 38 Organic Molecules	51
<input type="checkbox"/> 39 Water	52
<input type="checkbox"/> 40 The Properties of Water	53
<input type="checkbox"/> 41 Sugars	54
<input type="checkbox"/> 42 Condensation and Hydrolysis of Sugars	55
<input type="checkbox"/> 43 Polysaccharides	56
<input type="checkbox"/> 44 Starch and Cellulose	57
<input type="checkbox"/> 45 Lipids	58
<input type="checkbox"/> 46 Lipids and Health	60
<input type="checkbox"/> 47 Amino Acids	61
<input type="checkbox"/> 48 Proteins	62
<input type="checkbox"/> 49 The Role of Proteins	63
<input type="checkbox"/> 50 Enzymes	64
<input type="checkbox"/> 51 Enzyme Reaction Rates	65

<input type="checkbox"/> 52 Investigating Catalase Activity	66
<input type="checkbox"/> 53 Applications of Enzymes	68
<input type="checkbox"/> 54 Nucleotides and Nucleic Acids	69
<input type="checkbox"/> 55 Creating a DNA Model	71
<input type="checkbox"/> 56 DNA Replication	75
<input type="checkbox"/> 57 Meselson and Stahl's Experiment	77
<input type="checkbox"/> 58 Genes to Proteins	78
<input type="checkbox"/> 59 The Genetic Code	79
<input type="checkbox"/> 60 Transcription and Translation	80
<input type="checkbox"/> 61 The Role of ATP in Cells	81
<input type="checkbox"/> 62 Cell Respiration	83
<input type="checkbox"/> 63 Measuring Respiration	84
<input type="checkbox"/> 64 Anaerobic Metabolism	85
<input type="checkbox"/> 65 Investigating Alcoholic Fermentation in Yeast	86
<input type="checkbox"/> 66 Photosynthesis	88
<input type="checkbox"/> 67 Pigments and Light Absorption	89
<input type="checkbox"/> 68 Separation of Pigments by Chromatography	90
<input type="checkbox"/> 69 Factors Affecting Photosynthetic Rate	91
<input type="checkbox"/> 70 Chapter Review	92
<input type="checkbox"/> 71 KEY TERMS: Did You Get It?	94

Topic 3: Genetics

<i>Understandings, Applications, and Skills</i>	95
<input type="checkbox"/> 72 Alleles	97
<input type="checkbox"/> 73 Changes to the DNA Sequence	98
<input type="checkbox"/> 74 Mutagens and Variation	99
<input type="checkbox"/> 75 Gene Mutations and Genetic Diseases	100
<input type="checkbox"/> 76 The Sickle Cell Mutation	101
<input type="checkbox"/> 77 Genomes	102
<input type="checkbox"/> 78 Prokaryotic Chromosome Structure	103
<input type="checkbox"/> 79 Eukaryotic Chromosome Structure	104
<input type="checkbox"/> 80 Stages in Meiosis	105
<input type="checkbox"/> 81 Modelling Meiosis	106
<input type="checkbox"/> 82 Non-disjunction in Meiosis	108
<input type="checkbox"/> 83 Karyotypes	109
<input type="checkbox"/> 84 Human Karyotype Exercise	111
<input type="checkbox"/> 85 The Human Genome Project	114
<input type="checkbox"/> 86 Mendel's Pea Plant Experiments	115
<input type="checkbox"/> 87 Mendel's Laws of Inheritance	116
<input type="checkbox"/> 88 Basic Genetic Crosses	117
<input type="checkbox"/> 89 The Test Cross	118
<input type="checkbox"/> 90 Monohybrid Cross	119
<input type="checkbox"/> 91 Codominance of Alleles	120
<input type="checkbox"/> 92 Codominance in Multiple Allele Systems	121
<input type="checkbox"/> 93 Sex Linkage	123
<input type="checkbox"/> 94 Inheritance Patterns	125
<input type="checkbox"/> 95 Problems Involving Monohybrid Inheritance	126
<input type="checkbox"/> 96 Pedigree Analysis	127
<input type="checkbox"/> 97 Amazing Organisms, Amazing Enzymes	129
<input type="checkbox"/> 98 Polymerase Chain Reaction	130
<input type="checkbox"/> 99 Gel Electrophoresis	132
<input type="checkbox"/> 100 DNA Profiling Using PCR	133
<input type="checkbox"/> 101 Forensic Applications of DNA Profiling	135
<input type="checkbox"/> 102 What is Genetic Modification?	136
<input type="checkbox"/> 103 Making Recombinant DNA	137
<input type="checkbox"/> 104 Applications of GMOs	139
<input type="checkbox"/> 105 <i>In Vivo</i> Gene Cloning	140
<input type="checkbox"/> 106 Using Recombinant Bacteria	142
<input type="checkbox"/> 107 Golden Rice	144
<input type="checkbox"/> 108 Production of Insulin	146
<input type="checkbox"/> 109 Food for the Masses	148

Contents

<input type="checkbox"/>	110	The Ethics of GMO Technology	150
<input type="checkbox"/>	111	Natural Clones	152
<input type="checkbox"/>	112	Cloning by Embryo Splitting	153
<input type="checkbox"/>	113	Cloning by Somatic Cell Nuclear Transfer	154
<input type="checkbox"/>	114	Chapter Review	156
<input type="checkbox"/>	115	KEY TERMS: Mix and Match	158

Topic 4: Ecology

Understandings, Applications, and Skills 159

<input type="checkbox"/>	116	Components of an Ecosystem	160
<input type="checkbox"/>	117	The Stability of Ecosystems	162
<input type="checkbox"/>	118	Quadrats	163
<input type="checkbox"/>	119	Sampling a Rocky Shore Community	164
<input type="checkbox"/>	120	Using the Chi Squared Test in Ecology	166
<input type="checkbox"/>	121	Chi Squared Exercise in Ecology	167
<input type="checkbox"/>	122	Food Chains	168
<input type="checkbox"/>	123	Food Webs	169
<input type="checkbox"/>	124	Constructing a Food Web	170
<input type="checkbox"/>	125	Energy Flow in an Ecosystem	172
<input type="checkbox"/>	126	Ecological Pyramids	174
<input type="checkbox"/>	127	Nutrient Cycles.....	175
<input type="checkbox"/>	128	The Carbon Cycle	176
<input type="checkbox"/>	129	The Greenhouse Effect.....	178
<input type="checkbox"/>	130	Global Warming	179
<input type="checkbox"/>	131	Global Warming and Effects on Biodiversity	181
<input type="checkbox"/>	132	Global Warming and Effects on the Arctic	183
<input type="checkbox"/>	133	Ocean Acidification	184
<input type="checkbox"/>	134	Applying the Precautionary Principle	185
<input type="checkbox"/>	135	Chapter Review	186
<input type="checkbox"/>	136	KEY TERMS: Did You Get It?	188

Topic 5: Evolution and Biodiversity

Understandings, Applications, and Skills 189

<input type="checkbox"/>	137	Genes, Inheritance and Selection	190
<input type="checkbox"/>	138	The Fossil Record	192
<input type="checkbox"/>	139	Selection and Population Change	193
<input type="checkbox"/>	140	Homologous Structures	194
<input type="checkbox"/>	141	Divergence and Evolution	195
<input type="checkbox"/>	142	Mechanism of Natural Selection	196
<input type="checkbox"/>	143	Adaptation	198
<input type="checkbox"/>	144	Melanism in Insects	199
<input type="checkbox"/>	145	Selection for Beak Size in Darwin's Finches	200
<input type="checkbox"/>	146	The Evolution of Antibiotic Resistance.....	201
<input type="checkbox"/>	147	Investigating Evolution	202
<input type="checkbox"/>	148	The Evolution of Insecticide Resistance	203
<input type="checkbox"/>	149	The New Tree of Life	204
<input type="checkbox"/>	150	Classification System.....	205
<input type="checkbox"/>	151	Features of Taxonomic Groups	207
<input type="checkbox"/>	152	Features of Plants	212
<input type="checkbox"/>	153	Features of Animal Taxa.....	213
<input type="checkbox"/>	154	Classification Keys	215
<input type="checkbox"/>	155	Keying out Plant Species	217
<input type="checkbox"/>	156	Cladograms and Phylogenetic Trees.....	218
<input type="checkbox"/>	157	Cladistics.....	220
<input type="checkbox"/>	158	Chapter Review.....	222
<input type="checkbox"/>	159	KEY TERMS: Did You Get It?	224

Topic 6: Human Physiology

Understandings, Applications, and Skills 225

<input type="checkbox"/>	160	The Role of the Digestive System.....	227
<input type="checkbox"/>	161	Moving Food Through the Gut.....	228
<input type="checkbox"/>	162	The Stomach.....	229
<input type="checkbox"/>	163	The Small Intestine	230

<input type="checkbox"/>	164	Large Intestine, Rectum, and Anus	231
<input type="checkbox"/>	165	Digestion, Absorption and Transport	232
<input type="checkbox"/>	166	The Digestive Role of the Liver.....	234
<input type="checkbox"/>	167	Summary of the Human Digestive Tract	235
<input type="checkbox"/>	168	The Circulatory System	236
<input type="checkbox"/>	169	Blood Vessels	237
<input type="checkbox"/>	170	Capillary Networks	239
<input type="checkbox"/>	171	The Heart	240
<input type="checkbox"/>	172	Control of Heart Activity.....	242
<input type="checkbox"/>	173	The Cardiac Cycle	243
<input type="checkbox"/>	174	Review of the Heart.....	244
<input type="checkbox"/>	175	Dissecting a Mammalian Heart	245
<input type="checkbox"/>	176	Coronary Occlusions	247
<input type="checkbox"/>	177	The Body's Defences.....	248
<input type="checkbox"/>	178	Blood Clotting and Defence.....	250
<input type="checkbox"/>	179	The Action of Phagocytes	251
<input type="checkbox"/>	180	Inflammation.....	252
<input type="checkbox"/>	181	Antibiotics	253
<input type="checkbox"/>	182	Viral Diseases.....	255
<input type="checkbox"/>	183	HIV and AIDS	256
<input type="checkbox"/>	184	Introduction to Gas Exchange	258
<input type="checkbox"/>	185	The Gas Exchange System	259
<input type="checkbox"/>	186	Breathing	261
<input type="checkbox"/>	187	Measuring Lung Function.....	262
<input type="checkbox"/>	188	Exercise and Breathing	264
<input type="checkbox"/>	189	Smoking and Lung Cancer.....	265
<input type="checkbox"/>	190	Emphysema.....	266
<input type="checkbox"/>	191	Nervous Regulatory Systems	267
<input type="checkbox"/>	192	Neuron Structure and Function	268
<input type="checkbox"/>	193	The Nerve Impulse	269
<input type="checkbox"/>	194	Neurotransmitters	271
<input type="checkbox"/>	195	Chemical Synapses	272
<input type="checkbox"/>	196	Chemical Imbalances in the Brain.....	273
<input type="checkbox"/>	197	Hormonal Regulatory Systems	274
<input type="checkbox"/>	198	Principles of Homeostasis	275
<input type="checkbox"/>	199	The Endocrine System	276
<input type="checkbox"/>	200	Control of Blood Glucose	278
<input type="checkbox"/>	201	Diabetes Mellitus	279
<input type="checkbox"/>	202	The Male Reproductive System	280
<input type="checkbox"/>	203	The Female Reproductive System	281
<input type="checkbox"/>	204	The Menstrual Cycle	282
<input type="checkbox"/>	205	Using Hormones to Treat Infertility	283
<input type="checkbox"/>	206	Chapter Review	284
<input type="checkbox"/>	207	KEY TERMS: Did You Get It?	286

ADDITIONAL HIGHER LEVEL TOPICS

Topic 7: Nucleic Acids

Understandings, Applications, and Skills 287

<input type="checkbox"/>	208	Packaging DNA in the Nucleus	288
<input type="checkbox"/>	209	DNA Molecules	290
<input type="checkbox"/>	210	DNA Carries the Code	291
<input type="checkbox"/>	211	Enzyme Control of DNA Replication	292
<input type="checkbox"/>	212	Transcription	294
<input type="checkbox"/>	213	Post Transcriptional Modification	295
<input type="checkbox"/>	214	Controlling Gene Expression	296
<input type="checkbox"/>	215	Gene Environment Interactions	297
<input type="checkbox"/>	216	DNA Methylation	299
<input type="checkbox"/>	217	Translation	300
<input type="checkbox"/>	218	Protein Synthesis Summary	301
<input type="checkbox"/>	219	Protein Structure	302
<input type="checkbox"/>	220	Chapter Review	303
<input type="checkbox"/>	221	KEY TERMS: Did You Get It?	304

Contents

Topic 8: Cellular Metabolism

Understandings, Applications, and Skills 305

<input type="checkbox"/>	222	Metabolic Pathways	306
<input type="checkbox"/>	223	How Enzymes Work	307
<input type="checkbox"/>	224	Enzyme Inhibition	309
<input type="checkbox"/>	225	Control of Metabolic Pathways	310
<input type="checkbox"/>	226	The Biochemistry of Respiration	311
<input type="checkbox"/>	227	Chemiosmosis	313
<input type="checkbox"/>	228	Chloroplasts	314
<input type="checkbox"/>	229	Light Dependent Reactions	315
<input type="checkbox"/>	230	Light Independent Reactions	317
<input type="checkbox"/>	231	Experimental Investigation of Photosynthesis	318
<input type="checkbox"/>	232	Chapter Review	319
<input type="checkbox"/>	233	KEY TERMS: Did You Get It?	320

Topic 9: Plant Biology

Understandings, Applications, and Skills 321

<input type="checkbox"/>	234	The General Structure of Plants	323
<input type="checkbox"/>	235	Uptake at the Root	324
<input type="checkbox"/>	236	Transpiration	325
<input type="checkbox"/>	237	Xylem	327
<input type="checkbox"/>	238	Investigating Plant Transpiration	328
<input type="checkbox"/>	239	Adaptations for Water Conservation	330
<input type="checkbox"/>	240	Translocation	332
<input type="checkbox"/>	241	Phloem	334
<input type="checkbox"/>	242	Identifying Xylem and Phloem	335
<input type="checkbox"/>	243	Plant Meristems	336
<input type="checkbox"/>	244	Auxins and Shoot Growth	337
<input type="checkbox"/>	245	Micropropagation of Plant Tissue	338
<input type="checkbox"/>	246	Insect Pollinated Flowers	340
<input type="checkbox"/>	247	Flowering	341
<input type="checkbox"/>	248	Control of Flowering	342
<input type="checkbox"/>	249	Pollination Relationships	343
<input type="checkbox"/>	250	Pollination and Fertilization	344
<input type="checkbox"/>	251	Seed Dispersal	345
<input type="checkbox"/>	252	A Most Accomplished Traveller	346
<input type="checkbox"/>	253	Seed Structure and Germination	347
<input type="checkbox"/>	254	Investigating Germination	348
<input type="checkbox"/>	255	Chapter Review	349
<input type="checkbox"/>	256	KEY TERMS: Did You Get It?	350

Topic 10: Genetics and Evolution

Understandings, Applications, and Skills 351

<input type="checkbox"/>	257	Meiosis and Variation	352
<input type="checkbox"/>	258	Crossing Over	353
<input type="checkbox"/>	259	Crossing Over Problems	354
<input type="checkbox"/>	260	Variation	355
<input type="checkbox"/>	261	Dihybrid Cross	357
<input type="checkbox"/>	262	Inheritance of Linked Genes	358
<input type="checkbox"/>	263	Recombination and Dihybrid Inheritance	360
<input type="checkbox"/>	264	Detecting Linkage in Dihybrid Crosses	362
<input type="checkbox"/>	265	Problems Involving Dihybrid Inheritance	363
<input type="checkbox"/>	266	Using the Chi Squared Test in Genetics	365
<input type="checkbox"/>	267	Chi Squared Exercise in Genetics	366
<input type="checkbox"/>	268	Polygenes and Continuous Variation	367
<input type="checkbox"/>	269	Gene Pools and Evolution	369
<input type="checkbox"/>	270	Changes in a Gene Pool	370
<input type="checkbox"/>	271	Natural Selection	371
<input type="checkbox"/>	272	Selection for Human Birth Weight	372
<input type="checkbox"/>	273	Selection for Skin Colour in Humans	373
<input type="checkbox"/>	274	Disruptive Selection in Darwin's Finches	375

<input type="checkbox"/>	275	How Species Form	376
<input type="checkbox"/>	276	Reproductive Isolation	377
<input type="checkbox"/>	277	Comparing Isolated Populations	379
<input type="checkbox"/>	278	Rate of Evolutionary Change	381
<input type="checkbox"/>	279	Polyploidy and Evolution	382
<input type="checkbox"/>	280	Chapter Review	383
<input type="checkbox"/>	281	KEY TERMS: Did You Get It?	384

Topic 11: Animal Physiology

Understandings, Applications, and Skills 385

<input type="checkbox"/>	282	Targets For Defence	387
<input type="checkbox"/>	283	The Immune System	388
<input type="checkbox"/>	284	Clonal Selection	389
<input type="checkbox"/>	285	Antibodies	390
<input type="checkbox"/>	286	Blood Group Antigens	391
<input type="checkbox"/>	287	Allergies and Hypersensitivity	392
<input type="checkbox"/>	288	Acquired Immunity	393
<input type="checkbox"/>	289	Vaccines and Vaccination	395
<input type="checkbox"/>	290	Epidemiology	397
<input type="checkbox"/>	291	Monoclonal Antibodies	398
<input type="checkbox"/>	292	Skeletons and Movement	400
<input type="checkbox"/>	293	Movement About Joints	401
<input type="checkbox"/>	294	Antagonistic Muscles	403
<input type="checkbox"/>	295	Skeletal Muscle Structure and Function	405
<input type="checkbox"/>	296	The Sliding Filament Theory	407
<input type="checkbox"/>	297	Osmoregulation and Excretion	408
<input type="checkbox"/>	298	Water Budget in Humans	409
<input type="checkbox"/>	299	Nitrogenous Wastes in Animals	410
<input type="checkbox"/>	300	Excretory Systems	411
<input type="checkbox"/>	301	Kidney Structure	412
<input type="checkbox"/>	302	Kidney Function	413
<input type="checkbox"/>	303	The Kidney's Role in Water Conservation	415
<input type="checkbox"/>	304	Control of Urine Output	417
<input type="checkbox"/>	305	Diagnostic Urinalysis	418
<input type="checkbox"/>	306	Kidney Dialysis	419
<input type="checkbox"/>	307	Kidney Transplants	420
<input type="checkbox"/>	308	Animal Sexual Reproduction	421
<input type="checkbox"/>	309	Gametes	422
<input type="checkbox"/>	310	Spermatogenesis	423
<input type="checkbox"/>	311	Oogenesis	424
<input type="checkbox"/>	312	Fertilization and Early Growth	425
<input type="checkbox"/>	313	The Placenta	427
<input type="checkbox"/>	314	The Hormones of Pregnancy	428
<input type="checkbox"/>	315	Gestation and Animal Size	429
<input type="checkbox"/>	316	Chapter Review	430
<input type="checkbox"/>	317	KEY TERMS: Did You Get It?	432

Data Handling and Analysis

Understandings, Applications, and Skills 433

<input type="checkbox"/>	318	The Scientific Method	434
<input type="checkbox"/>	319	Variables and Data	436
<input type="checkbox"/>	320	Manipulating Raw Data	437
<input type="checkbox"/>	321	Planning a Quantitative Investigation	438
<input type="checkbox"/>	322	Constructing Graphs	440
<input type="checkbox"/>	323	Descriptive Statistics	441
<input type="checkbox"/>	324	Interpreting Sample Variability	443
<input type="checkbox"/>	325	The Student's <i>t</i> Test	445
<input type="checkbox"/>	326	Student's <i>t</i> Test Exercise	446

INDEX	448
Command Terms	450
Credits	450