OCR 21st Century Science: Biology B GCSE specification For GCSE exams 2018 onwards **Higher Tier in bold**	**Revision Guide page reference** **ISBN 9781407176864**	**Exam Practice Book page reference** **ISBN 9781407176871**	**Revision Guide and Practice Book** **ISBN 9781407176888**
B1: You and your genes			
B1.1 What is the genome and what does it do?			
1a) Explain how the nucleus and genetic material of eukaryotic cells (plants and animals) and the genetic material, including plasmids, of prokaryotic cells are related to cell functions	8, 9	8, 9	10, 11, 164, 165
b) Describe how to use a light microscope to observe a variety of plant and animal cells	12	13	14, 169
2. Describe the genome as the entire genetic material of an organism	101	67	103, 223
3. Describe DNA as a polymer made up of nucleotides, forming two strands in a double helix	101, 102	68	103, 104, 224
4. Describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism, including the idea that most characteristics depend on instructions in the genome and are modified by interaction of the organism with its environment *Learners are not expected to describe epigenetic effects*	110	68, 69, 70	112, 224, 225, 226
5. Explain the terms chromosome, gene, allele, variant, genotype and phenotype	105	70	107, 226

6. Explain the importance of amino acids in the synthesis of proteins, including the genome as instructions for the polymerisation of amino acids to make proteins	103, 104	69	105, 106, 225
7. Describe DNA as a polymer made from four different nucleotides, each nucleotide consisting of a common sugar and phosphate group with one of four different bases attached to the sugar *(separate science only)*	102, 103, 104	68,69	104, 105, 106, 224, 225
8. explain simply how the sequence of bases in DNA codes for the proteins made in protein synthesis, including the idea that each set of three nucleotides is the code for an amino acid *(separate science only)*	102, 103, 104	69	104, 105, 106, 225
9. recall a simple description of protein synthesis, in which: • **a copy of a gene is made from messenger RNA (mRNA)** • **the mRNA travels to a ribosome in the cytoplasm** • **the ribosome joins amino acids together in an order determined by the mRNA Learners are not expected to recall details of transcription and translation** *(separate science only)*	103, 104	69	105, 106, 225
10. recall that all genetic variants arise from mutations *(separate science only)*	104	69	106, 225
11. describe how genetic variants in coding DNA may influence phenotype by altering the activity of a protein (separate science only)	104	69	106, 225

12. describe how genetic variants in non-coding DNA may influence phenotype by altering how genes are expressed *(separate science only)*	104	69	106, 225
B1.2 How is genetic information inherited?			
1. Explain the terms gamete, homozygous, heterozygous, dominant and recessive	105	70	107, 226
2. Explain single gene inheritance, including dominant and recessive alleles and use of genetic diagrams	105, 106	70	107, 108, 226
3. Predict the results of single gene crosses	107, 108	70, 71	109, 110, 226, 227
4. Use direct proportions and simple ratios in genetic crosses	107, 108	70,71	109, 110, 226, 227
5. Use the concept of probability in predicting the outcome of genetic crosses	107, 108	70, 71	109, 110, 226, 227
6. Recall that most phenotypic features are the result of multiple genes rather than single gene inheritance *Learners are not expected to describe epistasis and its effects*	107, 108	71	109, 110, 227
7. Describe the development of our understanding of genetics including the work of Mendel **and the modern day use of genome sequencing** *(separate science only)*	119	77	121, 233
8. Describe sex determination in humans	109	70	111, 226
B1.3 How can and should gene technology be used?			

1. Discuss the potential importance for medicine of our increasing understanding of the human genome, including the discovery of alleles associated with diseases and the genetic testing of individuals to inform family planning and healthcare	110	67	112, 223
2. Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics	113, 114	75	115, 116, 231
3. Describe the main steps in the process of genetic engineering including: • **isolating and replicating the required gene(s)** • **putting the gene(s) into a vector (e.g. a plasmid)** • **using the vector to insert the gene(s) into cells** • **selecting modified cells**	113, 114	75	115, 116, 231
4. Explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology in modern agriculture and medicine	113	75	115, 231
B2: Keeping healthy			
B2.1 What are the causes of disease?			
1. Describe the relationship between health and disease	40, 41	29	42, 43, 185
2. Describe different types of diseases (including communicable and non-communicable diseases)	40	28, 29, 30, 33, 34, 35	42, 184, 185, 186, 189, 190, 191
3. Explain how communicable diseases (caused by viruses, bacteria, protists and fungi) are spread in animals and plants	48, 49	33, 34, 35	50, 51 189, 190, 191

4. Describe common human infections including influenza (viral), Salmonella (bacterial), Athlete's foot (fungal) and malaria (protist) and sexually transmitted infections in humans including HIV/AIDS (viral)	48, 49, 50, 51, 52	33, 34, 35	50, 51, 52, 53, 54, 189, 190, 191
5. Describe plant diseases including tobacco mosaic virus (viral), ash dieback (fungal) and crown gall disease (bacterial)	50, 52, 59	33, 34, 35	52, 54, 61, 189, 190, 191
B2.2 How do organisms protect themselves against pathogens?			
1. Describe non-specific defence systems of the human body against pathogens, including examples of physical, chemical and microbial defences	53	36	55, 192
2. Explain how platelets are adapted to their function in the blood	37	27	39, 183
3. Describe physical plant defences, including leaf cuticle and cell wall *(separate science only)*	61	41	63, 197
4. Explain the role of the immune system of the human body in defence against disease	53	36	55, 192
5. Explain how white blood cells are adapted to their functions in the blood, including what they do and how it helps protect against disease	37, 53	27, 36	39, 55, 183, 192
6. Describe chemical plant defence responses, including antimicrobial substances *(separate science only)*	61	41	63, 197
B2.3 How can we prevent the spread of infections?			
1. Explain how the spread of communicable diseases may be reduced or prevented in animals and plants, to include a minimum of one common	48, 49, 50, 51, 52	33, 41	50, 51, 52, 53, 54, 189, 197

human infection, one plant disease and sexually transmitted infections in humans including HIV/AIDS			
2. Explain the use of vaccines in the prevention of disease, including the use of safe forms of pathogens and the need to vaccinate a large proportion of the population	54	37	56, 193
B2.4 How can we identify the cause of an infection? *(separate science only)*			
1. a) Describe ways in which diseases, including plant diseases, can be detected and identified, in the lab and in the field	58, 59, 60	41	60, 61, 62, 197
1. b) Describe how to use a light microscope to observe microorganisms	12, 13	11, 13	14, 115, 167, 169
2. Describe and explain the aseptic techniques used in culturing organisms	13, 14	12	115, 116, 168
3. Calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr^2	14	14	116, 170
4. Describe how monoclonal antibodies are produced including the following steps: • **antigen injected into an animal** • **antibody-producing cells taken from animal cells** • **producing the correct antibody selected then cultured**	57, 58	40	59, 60, 196
5. Describe some of the ways in which monoclonal antibodies can be used in diagnostic tests	58	40	60, 196
B2.5 How can lifestyle, genes and the environment affect health?			

1. a) Describe how the interaction of genetic and lifestyle factors can increase or decrease the risk of developing non-communicable human diseases, including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition, including type 2 diabetes	42, 84	29	44, 86, 185
b) Describe how to practically investigate the effect of exercise on pulse rate and recovery rate	70	47	72, 203
2. Use given data to explain the incidence of non-communicable diseases at local, national and global levels with reference to lifestyle factors, including exercise, diet, alcohol and smoking	42, 43, 48	29	44, 45, 50, 185
3. In the context of data related to the causes, spread, effects and treatment of disease:			
a) Translate information between graphical and numerical forms	40, 41	29, 33, 35	42, 43, 185, 189, 191
b) Construct and interpret frequency tables and diagrams, bar charts and histograms	40, 41	29, 33, 35	42, 43, 185, 189, 191
c) Understand the principles of sampling as applied to scientific data	40, 41	29, 33, 35	42, 43, 185, 189, 191
d) Use a scatter diagram to identify a correlation between two variables	40, 41	29, 33, 35	42, 43, 185, 189, 191
4. Describe interactions between different types of disease	40	29	42, 185
B2.6 How can we treat disease?			
1. Explain the use of medicines, including antibiotics, in the treatment of disease	55	34, 38	57, 190, 194
2. Calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using $\pi r2$	13, 14, 17	14	15, 16, 19, 170

3. Evaluate some different treatments for cardiovascular disease, including lifestyle changes, medicines and surgery	38, 39	28	40, 41, 184
4. Describe the process of discovery and development of potential new medicines including preclinical and clinical testing	56	39	58, 195
5. Describe how monoclonal antibodies can be used to treat cancer including: • **produce monoclonal antibodies specific to a cancer cell antigen** • **inject the antibodies into the blood** • **the antibodies bind to cancer cells, tagging them for attack by white blood cells** • **the antibodies can also be attached to a radioactive or toxic substance to deliver it to cancer cells** ***(separate science only)***	58	40	60, 196
Chapter B3: Living together – food and ecosystems			
B3.1 What happens during photosynthesis?			
1. a) Describe the process of photosynthesis, including the inputs and outputs of the two mains stages and the requirement of light in the first stage, and describe photosynthesis as an endothermic process	63	42	65, 198
b) Describe practical investigations into the requirements and products of photosynthesis	63, 65	43, 44	65, 67, 199, 200
2. Explain how chloroplasts in plant cells are related to photosynthesis	63	9, 42	65, 165, 198
3. a) Explain the mechanism of enzyme action including the active site, enzyme specificity and factors affecting the rate of enzyme-catalysed reactions, including substrate concentration, temperature and pH	30, 31	21, 22	32, 33, 177, 178

b) Describe practical investigations into the effect of substrate concentration, temperature and pH on the rate of enzyme controlled reactions	30, 31, 33	21, 22, 24	32, 33, 35, 177, 178, 180
4. a) Explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis	64, 65	44	66, 67, 200
b) Describe practical investigations into the effect of environmental factors on the rate of photosynthesis	66	44	68, 200
5. Use the inverse square law to explain changes in the rate of photosynthesis with distance from a light source	65	44	67, 200
6. Explain the interaction of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis, and use graphs depicting the effects	64	44	66, 200
7. In the context of the rate of photosynthesis:			
a) Understand and use simple compound measures such as the rate of a reaction	64, 65	43	66, 67, 199
b) Translate information between graphical and numerical form	64, 65, 66	43, 44	66, 67, 68, 199, 200
c) Plot and draw appropriate graphs selecting appropriate scales for axes	66	44	68, 200
d) Extract and interpret information from graphs, charts and tables	66	43,44	68, 199, 200
B3.2 How do producers get the substances they need?			
1. Describe some of the substances transported into and out of photosynthetic organisms in terms of the requirements of those organisms, including oxygen, carbon dioxide, water and mineral ions	63	17	65, 173

2. a) Explain how substances are transported into and out of cells through diffusion, osmosis and active transport	21, 22, 23, 24, 26	17, 18, 20	23, 24, 25, 26, 28, 173, 174, 176
b) Describe practical investigations into the processes of diffusion and osmosis Learners are not expected to explain osmosis in terms of water potential	21, 24, 25	17, 18, 19	23, 26, 27, 173, 174, 175
3. Explain how the partially-permeable cell membranes of plant cells and prokaryotic cells are related to diffusion, osmosis and active transport	22, 23, 26	17, 18, 20	24, 25, 28, 173, 174, 176
4. Explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function	10, 22, 26	20, 32	12, 24, 28, 176, 188
5. a) Explain how the structure of the xylem and phloem are adapted to their functions in the plant	10, 44	31	12, 46, 187
b) Describe how to use a light microscope to observe the structure of the xylem and phloem	44	10, 13, 31	46, 166, 169, 187
6. a) Describe the processes of transpiration and translocation, including the structure and function of the stomata	45	32	47, 188
b) Describe how to use a light microscope to observe the structure of stomata	45	13	47, 169
c) Describe how to use a simple potometer Learners are not expected to describe transpiration in terms of tension or pressure, and are not expected to describe translocation in terms of water potential or hydrostatic pressure	46	32	48, 188
7. a) Explain the effect of a variety of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement, and temperature	45, 46	32	47, 48, 188

b) Describe practical investigations into the effect of environmental factors on the rate of water uptake by a plant	45, 46	32	47, 48, 188
8. In the context of water uptake by plants:			
a) Use simple compound measures such as rate	46	32	48, 188
b) Carry out rate calculations	46	32	48, 188
c) Plot, draw and interpret appropriate graphs	-	-	-
d) Calculate percentage gain and loss of mass	-	-	-
B3.3 How are organisms in an ecosystem interdependent?			
1. a) Explain the importance of sugars, fatty acids and glycerol, and amino acids in the synthesis and breakdown of carbohydrates, lipids and proteins	28, 29, 30, 31	21, 22, 23	30, 31, 32, 33, 177, 178, 179
b) Describe the use of qualitative tests for biological molecules	32	23	34, 179
2. Describe photosynthetic organisms as the main producers of food and therefore biomass for life on Earth	130	83, 93	132, 239, 249
3. Describe some of the substances transported into organisms in terms of the requirements of those organisms, including dissolved food molecules	134, 136	21, 22	136, 138, 177, 178
4. Describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem	125, 126	79, 83	127, 128, 235, 239
5. Explain the importance of interdependence and competition in a community	126	79	128, 235

6. Describe the differences between the trophic levels of organisms within an ecosystem *(separate science only)*	142	83, 93	144, 239, 249
7. Describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels *(separate science only)*	143	93	145, 249
8. Calculate the efficiency of biomass transfers between trophic levels and explain how this affects the number of organisms at each trophic level *(separate science only)*	143	83, 93	145, 239, 249
9. Recall that many different substances cycle through the abiotic and biotic components of an ecosystem, including carbon and water	127, 128, 134, 135	80, 81	129, 130, 136, 137, 236, 237
10. Explain the importance of the carbon cycle and the water cycle to living organisms	134, 135	86	136, 137, 242
11. Explain the role of microorganisms in the cycling of substances through an ecosystem	134, 135, 136	86	136, 137, 138, 242
12. Calculate the percentage of mass, in the context of the use and cycling of substances in ecosystems	136	86	138, 242
13. Explain the effect of factors such as temperature and water content on rate of decomposition in aerobic and anaerobic environments *(separate science only)*	136	87	138, 243
14. Calculate rate changes in the decay of biological material *(separate science only)*	136	88	138, 244

B3.4 How are populations affected by conditions in an ecosystem?			
1. Explain how some abiotic and biotic factors affect communities, including environmental conditions, toxic chemicals, availability of food and other resources, and the presence of predators and pathogens	127, 128	80, 81	129, 130, 236, 237
2. Describe how to carry out a field investigation into the distribution and abundance of organisms in an ecosystem and explain how to determine their numbers in a given area	131, 132	84, 85	133, 134 240, 241
3. In the context of data related to organisms within a population:			
a) Calculate arithmetic means	133	84	135, 240
b) Use fractions and percentages	128	84	130, 240
c) Plot and draw appropriate graphs selecting appropriate scales for the axes	-	-	-
d) Extract and interpret information from charts, graphs and tables	-	-	-
B4: Using food and controlling growth			
B4.1 What happens during cellular respiration?			
1. Compare the processes of aerobic and anaerobic respiration, including conditions under which they occur, the inputs and outputs, and comparative yields of ATP	68, 69	46	70, 71, 202
2. Explain why cellular respiration occurs continuously in all living cells	68, 69	46	70, 71, 202
3. Explain how mitochondria in eukaryotic cells (plants and animals) are related to cellular respiration	68	8, 46	70, 164, 202
4. Describe cellular respiration as an exothermic process	68	46	70, 202

5. a) Describe practical investigations into the effect of different substrates on the rate of respiration in yeast	68	46	70, 202
b) Carry out rate calculations for chemical reactions in the context of cellular respiration	68, 69	46	70, 71, 202
B4.2 How do we know about mitochondria and other cell structures?			
1. Explain how electron microscopy has increased our understanding of sub-cellular structures	9, 12	10, 11, 20	11, 14, 166, 167, 176
2. In the context of cells and sub-cellular structures:			
a) Demonstrate an understanding of number, size and scale and the quantitative relationship between units	8, 12	8	10, 14, 164
b) Use estimations and explain when they should be used	131, 133	84	133, 135, 240
c) Calculate with numbers written in standard form	12	12	14, 168
B4.3 How do organisms grow and develop?			
1. a) Describe the role of the cell cycle in growth, including interphase and mitosis	18	15	20, 171
b) Describe how to use a light microscope to observe stages of mitosis Learners are not expected to recall intermediate phases	12, 18	13	14, 20, 169
2. Describe cancer as the result of changes in cells that lead to uncontrolled growth and division	18, 43	30	20, 45, 186
3. Explain the role of meiotic cell division in halving the chromosome number to form gametes, including the stages of interphase and two meiotic divisions Learners are not expected to recall intermediate phases	98, 99, 100	66	100, 101, 102, 222

4. Describe the function of stem cells in embryonic and adult animals and meristems in plants	11, 19, 20	16	13, 21, 22, 172
5. Explain the importance of cell differentiation, in which cells become specialised by switching genes off and on to form tissues with particular functions	11	10	13, 166
B4.4 How is plant growth controlled? *(separate science only)*			
1. a) Explain how plant hormones are important in the control and coordination of plant growth and development, with reference to the role of auxins in phototropisms and gravitropisms	95	63	97, 219
b) Describe practical investigations into the role of auxin in phototropism	96	63, 64	98, 219, 220
2. Describe some of the variety of effects of plant hormones, relating to gibberellins and ethene	95	63, 64	97, 219, 220
3. Describe some of the different ways in which people use plant hormones to control plant growth	95	63, 64	97, 219, 220
B4.5 Should we use stem cells to treat damage and disease?			
1. Discuss potential benefits, risks and ethical issues associated with the use of stem cells in medicine	19, 20	16	21, 22, 172
B5: The human body – staying alive			
B5.1 How do substances get into, out of and around our bodies?			

1. Describe some of the substances transported into and out of the human body in terms of the requirements of cells, including oxygen, carbon dioxide, water, dissolved food molecules and urea	21, 22, 23, 24, 25, 26	17, 18, 20, 21, 22, 26, 57	23, 24, 25, 26, 27, 28, 173, 174, 176, 177, 178, 182, 213
2. Explain how the partially-permeable cell membranes of animal cells are related to diffusion, osmosis and active transport	21, 22, 23, 24, 25, 26	17, 18, 20	23, 24, 25, 26, 27, 28, 173, 174, 176
3. Describe the human circulatory system, including its relationships with the gaseous exchange system, the digestive system and the excretory system	34, 35, 36, 37	25, 26, 27	36, 37, 38, 39, 181, 182, 183
4. Explain how the structure of the heart is adapted to its function, including cardiac muscle, chambers and valves	34	25	36, 181
5. Explain how the structures of arteries, veins and capillaries are adapted to their functions, including differences in the vessel walls and the presence of valves	36	27	38, 183
6. Explain how red blood cells and plasma are adapted to their functions in the blood	37	27	39, 183
7. Explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area:volume ratio	35	17	37, 173
8. Calculate surface area:volume ratios	21, 22	17	23, 24, 173
B5.2 How does the nervous system help us respond to changes?			
1. Explain how the components of the nervous system work together to enable it to function, including sensory receptors, sensory neurons, the CNS, motor neurons and effectors	73, 74	49	75, 76, 205

2. Explain how the structures of nerve cells and synapses relate to their functions Learners are not expected to explain nerve impulse transmission in terms of membrane potentials	74, 75	49	76, 77, 205
3. a) Explain how the structure of a reflex arc, including the relay neuron, is related to its function	75, 76	49	77, 78, 205
b) Describe practical investigations into reflex actions	77	50	79, 206
4. Describe the structure and function of the brain and roles of the cerebral cortex (intelligence, memory, language and consciousness), cerebellum (conscious movement) and brain stem (regulation of heart and breathing rate) *(separate science only)*	78	51	80, 207
5. Explain some of the difficulties of investigating brain function ***(separate science only)***	78	51	80, 207
B5.3 How do hormones control responses in the human body?			
1. Describe the principles of hormonal coordination and control by the human endocrine system	73, 82	48, 54	75, 84 204, 210
2. Explain the roles of thyroxine and adrenaline in the body, including thyroxine as an example of a negative feedback system	94	62	96, 218
B5.4 Why do we need to maintain a constant internal environment?			
1. Explain the importance of maintaining a constant internal environment in response to internal and external change	73	48	75, 204

2. a) Describe the function of the skin in the control of body temperature, including changes to sweating, hair erection and blood flow	81	53	83, 209
b) Describe practical investigations into temperature control of the body *(separate science only)*	81	53	83, 209
3. Explain the response of the body to different temperature challenges, including receptors, processing, responses and negative feedback ***(separate science only)***	81	62	83, 218
4. Explain the effect on cells of osmotic changes in body fluids Learners are not expected to discuss water potential *(separate science only)*	86, 87	57	88, 89, 213
5. Describe the function of the kidneys in maintaining the water balance of the body, including filtering water and urea from the blood into kidney tubules then reabsorbing as much water as required *(separate science only)*	86, 87	57	88, 89, 213
6. Describe the effect of ADH on the permeability of the kidney tubules ***(separate science only)***	88	57	90, 213
7. Explain the response of the body to different osmotic challenges, including receptors, processing, response, and negative feedback ***(separate science only)***	86, 87, 88	57	88, 89, 90, 213
8. In the context of maintaining a constant internal environment:			

a) Extract and interpret data from graphs, charts and tables	85, 87	53, 54, 57	87, 89, 209, 210, 213
b) Translate information between numerical and graphical forms	87	53, 54, 57	89, 209, 210, 213
B5.5 What role do hormones play in human reproduction?			
1. Describe the role of hormones in human reproduction, including the control of the menstrual cycle	90, 91	59	92, 93, 215
2. Explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle	90, 91	59	92, 93, 215
3. Explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception	92	60	94, 216
4. Explain the use of hormones in modern reproductive technologies to treat infertility	93	61	95, 217
B5.6 What can happen when organs and control systems stop working?			
1. Explain how insulin controls the blood sugar level in the body	83	55	85, 211
2. Explain how glucagon and insulin work together to control the blood sugar level in the body	83	55	85, 211
3. Compare type 1 and type 2 diabetes and explain how they can be treated	84, 85	56	86, 87, 212
4. a) Explain how the main structures of the eye are related to their functions, including the cornea, iris, lens, ciliary muscle and retina and to include the use of ray diagrams	79, 80	51	81, 82, 207
b) Describe practical investigations into the response of the pupil in different light conditions	79, 80	51, 52	81, 82, 207, 208

5. Describe common defects of the eye, including short- of light using lenses sightedness, long-sightedness and cataracts, and explain how these problems may be overcome, including using ray diagrams to illustrate the effect of lenses *(separate science only)*	80	52	82, 208
6. Explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system ***(separate science only)***	78	51	80, 207
B6: Life on Earth – past, present and future			
B6.1 How was the theory of evolution developed?			
1. State that there is usually extensive genetic variation within a population of a species	110	66, 72	112, 222, 228
2. Recall that genetic variants arise from mutations, and that most have no effect on the phenotype, some influence phenotype and a very few determine phenotype	110	72	112, 228
3. Explain how evolution occurs through natural selection of variants that give rise to phenotypes better suited to their environment	110, 111	73, 76	112, 113, 229, 232
4. Explain the importance of competition in a community, with regard to natural selection	125, 126	79	127, 128, 235
5. Describe evolution as a change in the inherited characteristics of a population over a number of generations through a process of natural selection which may result in the formation of new species	111	76	113, 232
6. Explain the impact of the selective breeding of food plants and domesticated animals	112	74	114, 230

7. Describe how fossils provide evidence for evolution	117, 120, 121	76	119, 122, 123, 232
8. Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection *(separate science only)*	117	76	119, 232
9. Describe modern examples of evidence for evolution including antibiotic resistance in bacteria	120, 121	76	122, 123, 232
10. Explain the impact of these ideas on modern biology and society *(separate science only)*	120	76	122, 232
B6.2 How do sexual and asexual reproduction affect evolution? *(separate science only)*	99	65	101, 221
1. Explain some of the advantages and disadvantages of asexual and sexual reproduction in a range of organisms	98, 99	65	100, 101, 221
B6.3 How does our understanding of biology help us classify the diversity of organisms on Earth?	122, 123	78	124, 125, 234
1. Describe the impact of developments in biology on classification systems, including the use of DNA analysis to classify organisms	122, 123	67, 78	124, 125, 223, 234
B6.4 How is biodiversity threatened and how can we protect it?			
1. Describe both positive and negative human interactions within ecosystems and explain their impact on biodiversity	139	89	141, 245
2. Evaluate evidence for the impact of environmental changes on the distribution of organisms, with reference to water and atmospheric gases	138, 141	89, 91	140, 143, 245, 247

(separate science only)			
3. Describe some of the biological factors affecting levels of food security including increasing human population, changing diets in wealthier populations, new pests and pathogens, environmental change, sustainability and cost of agricultural inputs *(separate science only)*	144	94	146, 250
4. Explain some of the benefits and challenges of maintaining local and global biodiversity	141	90, 92	143, 246, 248
5. Extract and interpret information related to biodiversity from charts, graphs and tables	141	90, 92	143, 246, 248
6. Describe and explain some possible biotechnological and agricultural solutions, including genetic modification, to the demands of the growing human population *(separate science only)*	144	75	146, 229