

OCR Gateway: Biology A GCSE specification	Revision Guide page reference	Exam Practice Book page reference	Revision Guide and Practice Book
For GCSE exams 2018 onwards	ISBN	ISBN 9781407176871	ISBN
<b>Higher Tier in bold</b>	9781407176864		9781407176888
Paper 1 – B1-B3 and B7 (practical skills)			
Topic B1: Cell level systems			
B1.1 Cell structures			
<p>B1.1a describe how light microscopes and staining can be used to view cells.</p> <p>To include lenses, stage, lamp, use of slides and cover slips, and the use of stains to view colourless specimens or to highlight different structures/ tissues and calculation of magnification</p>	12, 15, 16	11, 13	14, 17, 18, 167, 169
<p>B1.1b explain how the main sub-cellular structures of eukaryotic cells (plants and animals) and prokaryotic cells are related to their functions.</p> <p>To include nucleus, genetic material, chromosomes, plasmids, mitochondria (contain enzymes for cellular respiration), chloroplasts (contain chlorophyll) and cell membranes (contain receptor molecules, provides a selective barrier to molecules)</p>	8, 9	8, 9	10, 11, 164, 165
<p>B1.1c explain how electron microscopy has increased our understanding of sub-cellular structures increased resolution in a transmission electron microscope.</p> <p>To include increased resolution in a transmission electron microscope</p>	8, 9, 12	11	10, 11, 14, 167
B1.2 What happens in cells (and what do cells need)?			
B1.2a describe DNA as a polymer	101, 102	67, 68	103, 104, 223, 224
B1.2b describe DNA as being made up of two strands forming a double helix	101	68	103, 224

B1.2c describe that DNA is 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.  To include the pairs of complementary bases (A-T and G-C).	102	68	104, 224
<b>B1.2d recall a simple description of protein synthesis.</b>  <b>To include the unzipping of the DNA molecule around the gene, copying to mRNA in nucleus (transcription), (translation) of the nucleotide sequence, in the cytoplasm Comparison of transcription and translation to a non-lending library. Use of kinaesthetic activities to demonstrate transcription and translation.</b>	103	68, 69	105, 224, 225
<b>B1.2e explain simply how the structure of DNA affects the proteins made in protein synthesis.</b>  <b>To include triplet code and its use to determine amino acid order in a protein</b>	103	68, 69	105, 224, 225
B1.2f describe experiments that can be used to investigate enzymatic reactions	30, 31	21, 22	32, 33, 177, 178
B1.2g explain the mechanism of enzyme action.  To include the role of enzymes in metabolism, the role of the active site, enzyme specificity (lock and key hypothesis) and factors affecting the rate of enzyme controlled reactions (pH, temperature, substrate and enzyme concentration)	30, 31, 32, 33	21, 22, 24	32, 33, 34, 35, 177, 178, 180
<b>B1.3 Respiration</b>			
B1.3a describe cellular respiration as a universal chemical process, continuously occurring that supplies ATP in all living cells	68, 69	45, 46	70, 71, 201, 202
B1.3b describe cellular respiration as an exothermic reaction	68, 69	45, 46	70, 71, 201, 202
B1.3c compare the processes of aerobic respiration and anaerobic respiration.	68, 69	46, 47	70, 71, 202, 203

To include in plants/fungi and animals the different conditions, substrates, products and relative yields of ATP			
B1.3d explain the importance of sugars in the synthesis and breakdown of carbohydrates.  To include use of the terms monomer and polymer	29, 32, 67, 71	21, 22, 23	31, 34, 69, 73, 177, 178, 179
B1.3e explain the importance of amino acids in the synthesis and breakdown of proteins.  To include use of the terms monomer and polymer	29, 32, 71	21, 22, 23	31, 34, 73, 177, 178, 179
B1.3f explain the importance of fatty acids and glycerol in the synthesis and breakdown of lipids	29, 32, 71	21, 22, 23	31, 34, 73, 177, 178, 179
<b>B1.4 Photosynthesis</b>			
B1.4a describe photosynthetic organisms as the main producers of food and therefore biomass for life on Earth Use of concept cartoons to start discussions about photosynthesis.	63	83	65, 239
B1.4b describe the process of photosynthesis.  To include reactants and products, two stage process, location of the reaction (in the chloroplasts)	63	42	65, 198
B1.4c describe photosynthesis as an endothermic reaction	63	42	65, 198
B1.4d describe experiments to investigate photosynthesis	64, 65, 66	44	66, 67, 68, 200
B1.4e explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis	64, 65, 66	43	66, 67, 68, 199
<b>B1.4f explain the interaction of these factors in limiting the rate of photosynthesis</b>	64, 65, 66	43, 44	66, 67, 68, 199, 200
Topic B2: Scaling up			
<b>B2.1 Supplying the cell</b>			
B2.1a explain how substances are transported into and out of cells through diffusion, osmosis and active transport.	21, 22, 23, 24, 25, 26	17, 18, 20	23, 24, 25, 26, 27, 28, 173, 174, 176

To include examples of substances moved, direction of movement, concentration gradients and use of the term water potential (no mathematical use of water potential required)			
B2.1b describe the process of mitosis in growth, including the cell cycle.  To include the stages of the cell cycle as DNA replication, movement of chromosomes, followed by the growth of the cell	18	15	20, 171
B2.1c explain the importance of cell differentiation.  To include the production of specialised cells allowing organisms to become more efficient and examples of specialised cells	10, 11	10	12, 13, 166
B2.1d recall that stem cells are present in embryonic and adult animals and meristems in plants	19, 20	16	21, 22, 172
B2.1e describe the functions of stem cells.  To include division to produce a range of different cell types for development, growth and repair	19, 20	16	21, 22, 172
B2.1f describe the difference between embryonic and adult stem cells in animals	19, 20	16	21, 22, 172
B2.2 The challenges of size			
B2.2a explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area: volume ratio.  To include surface area, volume and diffusion distances	10, 21, 22	17	12, 23, 24, 173
B2.2b describe some of the substances transported into and out of a range of organisms in terms of the requirements of those organisms.  To include oxygen, carbon dioxide, water, dissolved food molecules, mineral ions and urea	10, 21, 22, 37	17	12, 23, 24, 39, 173
B2.2c describe the human circulatory system.	34, 35	25, 26	36, 37, 181, 182

To include the relationship with the gaseous exchange system, the need for a double circulatory system in mammals and the arrangement of vessels			
B2.2d explain how the structure of the heart and the blood vessels are adapted to their functions.  To include the structure of the mammalian heart with reference to valves, chambers, cardiac muscle and the structure of blood vessels with reference to thickness of walls, diameter of lumen, presence of valves	34, 36	25	36, 38, 181
B2.2f explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function	10, 45	20, 31, 32	12, 47, 176, 187, 188
B2.2g describe the processes of transpiration and translocation.  To include the structure and function of the stomata	45, 46	32	47, 48, 188
B2.2h explain how the structure of the xylem and phloem are adapted to their functions in the plant	45, 46	31, 32	47, 48, 187, 188
B2.2i 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	46	32	48, 188
B2.2j describe how a simple potometer can be used to investigate factors that affect the rate of water uptake	46	32	48, 188
Topic B3: Organism level systems			
B3.1 Coordination and control – the nervous system			
B3.1a describe the structure of the nervous system.  To include Central Nervous System, sensory and motor neurones and sensory receptors Production of 3D models of neurones to illustrate their structure.	73, 74	49	75, 76, 205
B3.1b explain how the components of the nervous system can produce a coordinated response.	73, 74	49	75, 76, 205

To include it goes to all parts of the body, has many links, has different sensory receptors and is able to coordinate responses			
B3.1c explain how the structure of a reflex arc is related to its function	75, 76	49	77, 78, 205
B3.1d explain how the main structures of the eye are related to their functions.  To include cornea, iris, pupil, lens, retina, optic nerve, ciliary body, suspensory ligaments	79, 80	51	81, 82, 207
B3.1e describe common defects of the eye and explain how some of these problems may be overcome.  To include colour blindness, short-sightedness and long-sightedness	79, 80	52	81, 82, 208
B3.1f describe the structure and function of the brain.  To include cerebrum, cerebellum, medulla, hypothalamus, pituitary	78	51	80, 207
<b>B3.1g explain some of the difficulties of investigating brain function.</b>  <b>To include the difficulty in obtaining and interpreting case studies and the consideration of ethical issues</b>	78	51	80, 207
<b>B3.1h explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system.</b>  <b>To include limited ability to repair nervous tissue, irreversible damage to the surrounding tissues, difficulties with accessing parts of the nervous system</b>	78	51	80, 207
B3.2 Coordination and control – the endocrine system			
B3.2a describe the principles of hormonal coordination and control by the human endocrine system.  To include use of chemical messengers, transport in blood, endocrine glands and receptors	73, 82	54	75, 84, 210

<b>B3.2b explain the roles of thyroxine and adrenaline in the body thyroxine as an example of a negative feedback system</b>	94	62	96, 218
B3.2c describe the role of hormones in human reproduction including the control of the menstrual cycle.  To include oestrogen, progesterone, FSH and testosterone	90, 91	59	92, 93, 215
<b>B3.2d explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle</b>	90, 91	59	92, 93, 215
B3.2e explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception. To include relative effectiveness of the different forms of contraception.	92	60	94, 216
<b>B3.2f explain the use of hormones in modern reproductive technologies to treat infertility</b>	93	61	95, 217
B3.2g 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.  To include unequal distribution of auxin	95	63	97, 219
B3.2h describe some of the variety of effects of plant hormones, relating to auxins, <b>gibberellins and ethene</b> .  To include controlling growth, controlling germination, fruit ripening, flower opening and shedding of leaves	95	63	97, 219
<b>B3.2i describe some of the different ways in which people use plant hormones to control plant growth.</b>  <b>To include selective herbicides, root cuttings, seedless fruit (parthenocarpic fruit development), altering dormancy</b>	95	63	97, 219
B3.3 Maintaining internal environments			
B3.3a explain the importance of maintaining a constant internal environment in response to internal and external change.	73	48	75, 204

To include allowing metabolic reactions to proceed at appropriate rates			
B3.3b describe the function of the skin in the control of body temperature.  To include detection of external temperature, sweating, shivering, change to blood flow	81	53	83, 209
B3.3c explain how insulin controls blood sugar levels in the body	83	55	85, 211
<b>B3.3d explain how glucagon interacts with insulin to control blood sugar levels in the body</b>	83	55	85, 211
B3.3e compare type 1 and type 2 diabetes and explain how they can be treated	84	56	86, 212
B3.3f explain the effect on cells of osmotic changes in body fluids.  To include higher, lower or equal water potentials leading to lysis or shrinking (no mathematical use of water potentials required)	86	57	88, 213
B3.3g describe the function of the kidneys in maintaining the water balance of the body.  To include varying the amount and concentration of urine and hence water excreted	86, 87	57	88, 89, 213
B3.3h describe the gross structure of the kidney and the structure of the kidney tubule	86, 87	57	88, 89, 213
<b>B3.3i describe the effect of ADH on the permeability of the kidney tubules.</b>  <b>To include amount of water reabsorbed and negative feedback</b>	88	57	90, 92, 213
<b>B3.3j explain the response of the body to different temperature and osmotic challenges.</b>	81, 86, 87	57, 58	83, 88, 89, 213



<b>To include challenges to include high sweating and dehydration, excess water intake, high salt intake responses to include mechanism of kidney function, thirst</b>			
Paper 2 – B4-B6 and B7 (practical skills) with assumed knowledge from B1-3			
Topic B4: Community level systems			
B4.1 Ecosystems			
B4.1a recall that many different materials cycle through the abiotic and biotic components of an ecosystem.  To include examples of cycled materials e.g. nitrogen and carbon	127, 128, 134	80, 81, 86	129, 130, 136, 236, 237, 242
B4.1b explain the role of microorganisms in the cycling of materials through an ecosystem.  To include the role of microorganisms in decomposition	136	87	138, 243
B4.1c explain the importance of the carbon cycle and the water cycle to living organisms.  To include maintaining habitats, fresh water flow of nutrients	134, 135	86	136, 137, 242
B4.1d explain the effect of factors such as temperature, water content, and oxygen availability on rate of decomposition.  To include the terms aerobic and anaerobic	136	87, 88	138, 243, 244
B4.1e describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem	125, 126	79	127, 128, 235
B4.1f explain how abiotic and biotic factors can affect communities.  To include temperature, light intensity, moisture level, pH of soil, predators, food	127, 128	80, 81	129, 130, 236, 237
B4.1g describe the importance of interdependence and competition in a community.	126	79	128, 235

To include interdependence relating to predation, mutualism and parasitism			
B4.1h describe the differences between the trophic levels of organisms within an ecosystem.  To include use of the terms producer and consumer	130	83, 93	132, 239, 249
B4.1i describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels.  To include loss of biomass related to egestion, excretion, respiration	142, 143	93	144, 145, 249
B4.1j calculate the efficiency of biomass transfers between trophic levels and explain how this affects the number of trophic levels in a food chain	143	93	145, 249
Topic B5: Genes, inheritance and selection			
B5.1 Inheritance			
B5.1a explain the following terms: gamete, chromosome, gene, allele/variant, dominant, recessive, homozygous, heterozygous, genotype and phenotype Use of alleles to work out the phenotype of progeny.	105	70	107, 226
B5.1b describe the genome as the entire genetic material of an organism	101	72	103, 228
B5.1c describe that the genome, and its interaction with the environment, influence the development of the phenotype of an organism.  To include use of examples of discontinuous and continuous variation e.g. eye colour, weight and height	101, 105	70, 72	103, 107, 226, 228
B5.1d Recall that all variants arise from mutations, and that most have no effect on the phenotype, some influence phenotype and a very few determine phenotype	104	72	106, 228
<b>B5.1e describe how genetic variants may influence phenotype:</b> <ul style="list-style-type: none"> <li>• in coding DNA by altering the activity of a protein</li> <li>• in non-coding DNA by altering how genes are expressed.</li> </ul> <b>To include</b>	104	72	106, 228

<ul style="list-style-type: none"> <li>• in coding: DNA related to mutations affecting protein structure, including active sites of enzymes</li> <li>• in non-coding: DNA related to stopping transcription of mRNA (use of terms promoter, transcription factor not required)</li> </ul>			
<p>B5.1f explain some of the advantages and disadvantages of asexual and sexual reproduction in a range of organisms.</p> <p>To include the number of live offspring per birth, how quickly the organisms can reproduce verses the need for the introduction of variation in a population caused by environmental pressures</p>	98, 99	65	100, 101, 221
B5.1g explain the terms haploid and diploid	100	66	102, 222
<p>B5.1h explain the role of meiotic cell division in halving the chromosome number to form gametes.</p> <p>To include that this maintains diploid cells when gametes combine and is a source of genetic variation</p>	100	66	102, 222
<p>B5.1i explain single gene inheritance.</p> <p>To include the context of homozygous and heterozygous crosses involving dominant and recessive genes</p>	105, 106	70	107, 108, 226
B5.1j predict the results of single gene crosses	105, 106, 107, 108	71	107, 108, 109, 110, 227
B5.1k describe sex determination in humans using a genetic cross	109	71	111, 227
B5.1l recall that most phenotypic features are the result of multiple genes rather than single gene inheritance	107, 108	71	109, 110, 227
<p>B5.1m describe the development of our understanding of genetics.</p> <p>To include the work of Mendel</p>	119	77	121, 233
B5.2 Natural selection and evolution			
B5.2a state that there is usually extensive genetic variation within a population of a species	110	72	112, 228

B5.2b describe the impact of developments in biology on classification systems.  To include natural and artificial classification systems and use of molecular phylogenetics based on DNA sequencing	122, 123	78	124, 125, 234
B5.2c explain how evolution occurs through the natural selection of variants that have given rise to phenotypes best suited to their environment.  To include the concept of mutation	110, 111	72, 73	112, 113, 228, 229
B5.2d describe evolution as a change in the inherited characteristics of a population over time, through a process of natural selection, which may result in the formation of new species	111, 118	76	113, 120, 232
B5.2e describe the evidence for evolution.  To include fossils and antibiotic resistance in bacteria	120, 121	76	122, 123, 232
B5.2f describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection and explain the impact of these ideas on modern biology.  To include seedbanks being used as a store of biodiversity	112, 117	90	114, 119, 246
Topic B6: Global challenges			
B6.1 Monitoring and maintaining the environment			
B6.1a explain how to carry out a field investigation into the distribution and abundance of organisms in a habitat and how to determine their numbers in a given area.  To include sampling techniques (random and transects, capture-recapture), use of quadrats, pooters, nets, keys and scaling up methods	131, 132	84, 85	133, 134, 240, 241
B6.1b describe both positive and negative human interactions within ecosystems and explain their impact on biodiversity.	141	92	143, 248

To include the conservation of individual species and selected habitats and threats from land use and hunting			
B6.1c explain some of the benefits and challenges of maintaining local and global biodiversity.  To include the difficulty in gaining agreements for and the monitoring of conservation schemes along with the benefits of ecotourism	141	92	143, 248
<b>B6.1d evaluate the evidence for the impact of environmental changes on the distribution of organisms, with reference to water and atmospheric gases</b>	138	89	140, 245
<b>B6.2 Feeding the human race</b>			
B6.2a describe some of the biological factors affecting levels of food security.  To include increasing human population, changing diets in wealthier populations, new pests and pathogens, environmental change, sustainability and cost of agricultural inputs	144	94	146, 250
B6.2b describe and explain some possible agricultural solutions to the demands of the growing human population.  To include increased use of hydroponics, biological control, gene technology, fertilisers and pesticides	144, 145	94	146, 147, 250
B6.2c explain the impact of the selective breeding of food plants and domesticated animals	112	74	114, 230
B6.2d describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics	113, 114	75	115, 116, 231
<b>B6.2e describe the main steps in the process of genetic engineering.</b>  <b>To include restriction enzymes, sticky ends, vectors e.g. plasmids, ligase, host bacteria and selection using antibiotic resistance markers</b>	113, 114	75	115, 116, 231

B6.2f explain some of the possible benefits and risks of using gene technology in modern agriculture.  To include practical and ethical considerations	113	75	115, 231
B6.2g describe and explain some possible biotechnological solutions to the demands of the growing human population.  To include genetic modification	113	75, 94	115, 231, 250
B6.3 Monitoring and maintaining health			
B6.3a describe the relationship between health and disease	40, 41	29	42, 43, 185
B6.3b describe different types of diseases.  To include communicable and non-communicable diseases	40, 41, 42, 48	28, 29, 30	42, 43, 44, 50, 184, 185, 186
B6.3c describe the interactions between different types of disease.  To include HIV and tuberculosis; HPV and cervical cancer	40	29	42, 185
B6.3d explain how communicable diseases (caused by viruses, bacteria, protists and fungi) are spread in animals and plants.  To include scientific quantities, number of pathogens, number of infected cases, estimating number of cases	48, 49, 50, 51, 52	33, 34, 35	50, 51, 52, 53, 54, 189, 190, 191
B6.3e explain how the spread of communicable diseases may be reduced or prevented in animals and plants.  To include detection of the antigen, DNA testing, visual identification of the disease	53, 54, 59, 60	33, 34, 35	55, 56, 61, 62, 189, 190, 191
B6.3f describe a minimum of one common human infection, one plant disease and sexually transmitted infections in humans including HIV/AIDS.  To include plant diseases: virus tobacco mosaic virus TMV, fungal Erysiphe graminis barley powdery mildew, bacterial Agrobacterium tumefaciens crown gall disease	50, 51, 52	33, 34, 35	52, 53, 54, 189, 190, 191

B6.3g describe physical plant defence responses to disease. To include leaf cuticle, cell wall	61	41	63, 197
B6.3h describe chemical plant defence responses. To include antimicrobial substances	61	41	63, 197
<b>B6.3i describe different ways plant diseases can be detected and identified, in the lab and in the field.</b>  <b>To include the laboratory detection of the DNA or antigen from the disease causing organism. The field diagnosis by observation and microscopy</b>	59, 60	41	61, 62, 197
B6.3j explain how white blood cells and platelets are adapted to their defence functions in the blood	37, 53	27, 36	39, 55, 183, 192
B6.3k describe the non-specific defence systems of the human body against pathogens	53	36	55, 192
B6.3l explain the role of the immune system of the human body in defence against disease	53, 54	36, 37	55, 56, 192, 193
<b>B6.3m describe how monoclonal antibodies are produced</b>	57	40	59, 196
<b>B6.3n describe some of the ways in which monoclonal antibodies can be used.</b>  <b>To include their role in detecting antigens in pregnancy testing, detection of diseases (prostate cancer) and potentially treating disease (targeting cancer cells)</b>	58	40	60, 196
B6.3o explain the use of vaccines and medicines in the prevention and treatment of disease. To include antibiotics, antivirals and antiseptics	54	37	56, 193
B6.3p explain the aseptic techniques used in culturing organisms.	13, 14	12	15, 16, 168

To include use of alcohol, flaming, autoclaving of glassware and growth media, and measures used to stop contaminants falling onto/into the growth media (e.g. working around a Bunsen burner)			
B6.3q describe the processes of discovery and development of potential new medicines.  To include preclinical and clinical testing	56	39	58, 195
B6.3r recall that many non-communicable human diseases are caused by the interaction of a number of factors.  To include cardiovascular diseases, many forms of cancer, some lung (bronchitis) and liver (cirrhosis) diseases and diseases influenced by nutrition, including type 2 diabetes	42	29	44, 185
B6.3s evaluate some different treatments for cardiovascular disease.  To include lifestyle, medical and surgical	38	28	40, 184
B6.3t analyse the effect of lifestyle factors on the incidence of non-communicable diseases at local, national and global levels.  To include lifestyle factors to include exercise, diet, alcohol and smoking	42	29	44, 185
B6.3v discuss potential benefits and risks associated with the use of stem cells in medicine.  To include tissue transplantation and rejection	19, 20	16	21, 22, 172
B6.3w explain some of the possible benefits and risks of using gene technology in medicine.  To include practical and ethical considerations	145	16	147, 172
B6.3x discuss the potential importance for medicine of our increasing understanding of the human genome.	101	67	103, 223



To include the ideas of predicting the likelihood of diseases occurring and their treatment by drugs which are targeted to genomes

