



Learner Guide

Cambridge O Level Biology 5090

For examination from 2023



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About this guide

This guide explains what you need to know about your Cambridge O Level Biology course and examinations.

It will help you to:

- ✓ understand what skills you should develop by taking this Cambridge O Level course
- ✓ understand how you will be assessed
- ✓ understand what we are looking for in the answers you write
- ✓ plan your revision programme
- ✓ revise, by providing revision tips and an interactive revision checklist (Section 4).

The aims of this syllabus are to enable you to:

- acquire scientific knowledge and understanding of scientific theories and practice
- develop a range of experimental skills, including handling variables and working safely
- use scientific data and evidence to solve problems and discuss the limitations of scientific methods
- communicate effectively and clearly, using scientific terminology, notation and conventions
- understand that the application of scientific knowledge can benefit people and the environment
- enjoy science and develop an informed interest in scientific matters which support further study.

Section 1: Syllabus content - what you need to know about

This section gives you an outline of the syllabus content for this course. Ask your teacher for more detail about each topic. You can also find more detail in the Revision checklists of this guide.

There are 19 main units in this syllabus which you will study:

1. Cells
2. Classification
3. Movement into and out of cells
4. Biological molecules
5. Enzymes
6. Plant nutrition
7. Transport in flowering plants
8. Human nutrition
9. Human gas exchange
10. Respiration
11. Transport in humans
12. Disease and immunity
13. Excretion
14. Coordination and control
15. Coordination and response in plants
16. Development of organisms and continuity of life
17. Inheritance
18. Biotechnology and genetic modification
19. Relationships of organisms with one another and with the environment

Make sure you always check the latest syllabus, which is available at www.cambridgeinternational.org

Section 2: How you will be assessed

You will be assessed at the end of the course using three components:

- Paper 1: Multiple Choice
- Paper 2: Theory
- Paper 3: Practical Test or Paper 4: Alternative to Practical.

Find out from your teacher which components you will be taking, and when you will be taking them.

Components at a glance

This table summarises the key information about each examination paper. You can find details and advice on how to approach each component in the 'About each paper' sub-section.

Component	Time and marks	Details	Percentage of qualification
Paper 1 Multiple Choice	1 hour 40 marks	40 four-choice multiple-choice questions. Questions will be based on the full subject content. Tests assessment objectives AO1 and AO2. Externally assessed.	30%
Paper 2 Theory	1 hour 45 minutes 80 marks	Short-answer and structured questions. Questions will be based on the full subject content. Tests assessment objectives AO1 and AO2. Externally assessed.	50%
Paper 3 Practical Test	1 hour 30 minutes 40 marks	Questions will be based on the experimental skills listed in the syllabus. Tests assessment objective AO3 in a practical context. Externally assessed.	20%
Paper 4 Alternative to Practical	1 hour 40 marks	Questions will be based on the experimental skills listed in the syllabus. Tests assessment objective AO3 in a written paper. Externally assessed.	20%

About each paper

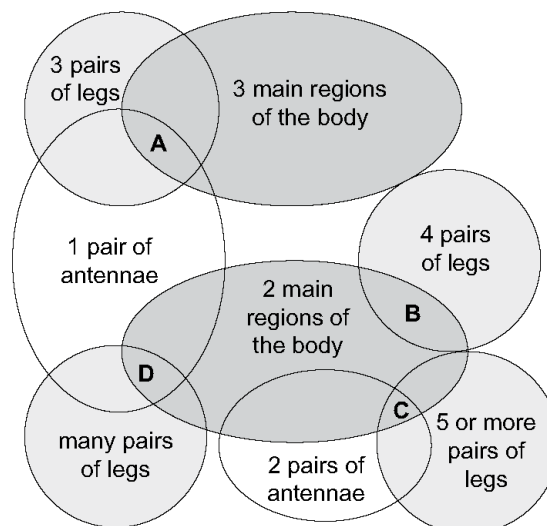
Paper 1: Multiple Choice

Each of the 40 multiple choice questions you will answer has four choices.

3

- 3 The diagram shows some of the features used to classify animals in the phylum arthropods.

In the diagram, which letter, A, B, C or D, could represent insects?



- 4 Which processes can **only** occur through a membrane?

	active transport	diffusion	osmosis
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✓

key:
✓ = yes
✗ = no

- 5 A student cuts four cylinders from a potato.
Each cylinder is 30 mm long. The cylinders are all of the same diameter.

The potato cylinders are placed in sugar solutions of different concentrations. After one hour, the lengths of the cylinders are measured again. The results are shown in the table.

Which sugar solution has a water potential closest to that of the potato cells?

	concentration of sugar/g per dm ³	starting length/mm	length after one hour/mm
A	35	30	33
B	105	30	31
C	135	30	27
D	170	30	26

Paper 2: Theory

For Paper 2, all questions are compulsory and there are no separate sections.

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(d) Fig. 7.1 shows a sample of human blood as seen under a microscope.

In Fig. 7.1 one cell is labelled X. Cells of this type produce antibodies.

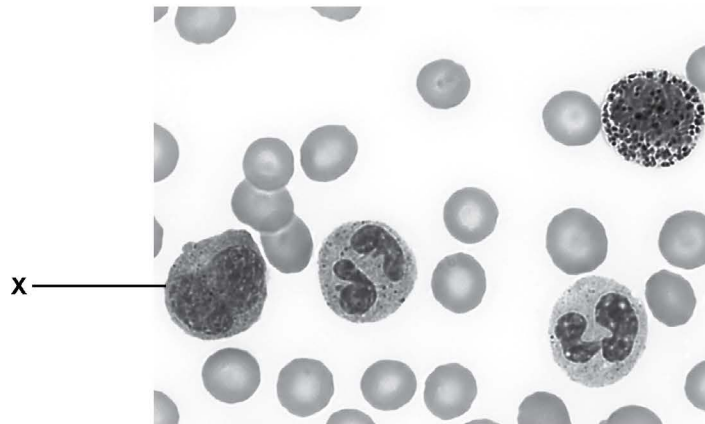


Fig. 7.1

(i) Outline how the type of cell labelled X defends the body against infection by a pathogen.

.....
.....
.....
.....
.....
..... [4]

(ii) Infection causes the type of cell labelled X to produce antibodies.

State **one** other cause of antibody production.

..... [1]

[Total: 11]

Section 3: What skills will be assessed

The areas of knowledge, understanding and skills that you will be assessed on are called **assessment objectives** (AO).

The examiners take account of the following skills areas (assessment objectives) in the question papers:

- Knowledge with understanding
- Handling information and problem solving
- Experimental skills and investigations

It is important that you know the different weightings (%) of the assessment objectives, as this affects how the examiner will assess your work. For example, assessment objective 1 (AO1 Knowledge with understanding) is worth 63% of the total marks in Paper 1 and Paper 2, and AO2 Handling information and problem solving covers the remaining 37%. However, in Paper 3 and Paper 4, only AO3 Experimental skills and investigations is assessed.

Assessment objectives (AO)	What does the AO mean?	What do you need to be able to do?
AO1 Knowledge with understanding	Remembering facts and applying these facts to new situations	You should be able to demonstrate knowledge and understanding of: <ul style="list-style-type: none"> • scientific phenomena, facts, laws, definitions, concepts and theories • scientific vocabulary, terminology and conventions (including symbols, quantities and units) • scientific instruments and apparatus, including techniques of operation and aspects of safety • scientific and technological applications with their social, economic and environmental implications.
AO2 Handling information and problem solving	How you extract information and rearrange it in a sensible pattern, and how you carry out calculations and make predictions	You should be able, in words or using other written forms of presentation (i.e. symbolic, graphical and numerical) to: <ul style="list-style-type: none"> • locate, select, organise and present information from a variety of sources • translate information from one form to another • manipulate numerical and other data • use information to identify patterns, report trends and form conclusions • present reasoned explanations for phenomena, patterns and relationships • make predictions based on relationships and patterns • solve problems, including some of a quantitative nature.
AO3 Experimental skills and investigations	Planning and carrying out experiments and recording and analysing information	You should be able to: <ul style="list-style-type: none"> • demonstrate knowledge of how to select and safely use techniques, apparatus and materials (including following a sequence of instructions where appropriate) • plan experiments and investigations • make and record observations, measurements and estimates • interpret and evaluate experimental observations and data • evaluate methods suggest possible improvements.

Section 4: Revision

This advice will help you revise and prepare for the examinations. It is divided into general advice for all papers and more specific advice for Paper 1, Paper 2, Paper 3 and Paper 4.

Use the tick boxes to keep a record of what you have done, what you plan to do or what you understand.

General advice

Before the examination

Find out when the examinations are and plan your revision so you have time to revise. Create a revision timetable and divide it into sections to cover each topic.

Find out how long each paper is, how many questions you have to answer, how many marks there are for each question, and work out how long you have for each question.

Find out the choices you have on each paper, make sure you know how many sections there are and which sections you should answer from.

Know the meaning of the command words used in questions and how to apply them to the information given. Look at past examination papers and highlight the command words and check what they mean.

Make revision notes. Try different styles of notes.

Work for short periods then have a break. Revise small sections of the syllabus at a time.

Test yourself by writing out key points, redrawing diagrams, etc.

Make sure you define, scientific terms accurately.

Definitions must not reuse the words to be defined.

Make your own dictionary or draw up a glossary of key terms for each section of the syllabus.

Practise drawing clear, simple, neat, fully-labelled diagrams

Learn to spell scientific terms correctly.

Have a look at past questions so that you are clear of what to expect in an examination.

Look at mark schemes to help you to understand how the marks are awarded for each question.

In the examination

Read the instructions carefully and answer the right number of questions from the right sections.

Do not answer more questions than are needed, as this will not gain you more marks in the examination.

Plan your time according to the marks for each question. For example, a question worth three marks requires less time and a shorter answer than one worth 10 marks. If a question has several parts, then the parts with more marks will need more time and more developed answers.

Do not leave out questions or parts of questions. Remember, no answer means no mark.

Look for details that indicate how to answer or the depth of answer required.

Read each question very carefully.

- Identify the command words – you could underline or highlight them.
- Identify the other key words and perhaps underline them too.
- Try to put the question into your own words to understand what it is really asking.

Read all parts of a question before starting your answer. Think carefully about what is needed for each part. You will not need to repeat material.

Look very carefully at the resource material you are given.

- Read the title, key, axes of graphs, etc. to find out exactly what it is showing you.
- Look for dates, scale, and location.
- Try using coloured pencils or pens to pick out anything that the question asks you about.

Answer the question. This is very important!

Use your knowledge and understanding.

Do not just write all you know, only write what is needed to answer the question.

Plan your answers. Clear, concise, well-ordered, well-argued, well-supported answers get more marks than long, rambling, muddled, repetitious answers. Quality is better than quantity.

Use scientific terms in your answers as much as possible.

Use the resource material given in the question to support your answer.

Make sure you have all the equipment you will need for the exam. You need two pens, pencils (preferably HB or B), a clean eraser, a ruler (which measures in mm), a pencil sharpener and a calculator.

Make sure your writing is clear and easy to read. It is no good writing a brilliant answer if the examiner cannot read it!

Paper 1 advice

Work through the paper with care. Do not miss out a question for any reason – you may then start placing your answers in the wrong places.

Do not attempt to look for any pattern, or any lack of pattern in the answers. In other words, do not worry about how many questions have been answered A, B, C or D and do not worry about the distribution of As, Bs, Cs and Ds.

You will likely make fewer mistakes if you write down your working than if you try to work out the answers in your head.

Practise multiple-choice questions and get someone else to mark them. Look for:

- errors
- questions you didn't read carefully
- topics you don't know or understand.

Paper 2 advice

The number of marks for each question or question part often gives you a clue about how many separate points you need to make in your answer.

Structured questions contain many parts. Often later parts can depend on the answer to earlier parts.

Answer the question being asked. For example, if the question asks you to name 'three other cell structures', do not write down the cell structures which are given in the question.

Know the biological terms used in the questions.

Keep an eye on the time. Make sure you have time to answer all the questions and return at the end to check your answers.

Paper 3 advice

Paper 3 assesses experimental skills and investigations. You take the exam in a laboratory under teacher supervision; you will have your own working space and set of apparatus. It is important that you learn and practise experimental skills during your course.

This paper will not test specific topic content from the syllabus content. It only tests experimental skills and investigations (AO3). Any information required to answer the questions in this paper is contained within the paper itself or should be known from the experimental context, and skills listed in the Revision checklist.

Each question includes the instructions for the experiments you must carry out, space for you to record observations and data, and space for you to then interpret or process your results. You need to answer all questions.

The number of marks for each question or question part often gives you a clue about how many separate points you need to make in your answer.

Paper 4 advice

Paper 4 assesses experimental skills and investigations. It is a written paper about practical work, so make sure that you study all the experiments you have done in the classroom and seen demonstrated. You will take this examination under the same conditions as other written papers. It is important that you learn and practise experimental skills during your course.

This paper will not test specific topic content from the syllabus content, it tests experimental skills and investigations. This is AO3. Any information required to answer the questions in this paper is contained within the paper itself or should be known from the experimental context, and skills listed in the Revision checklist.

The number of marks for each question or question part often gives you a clue about how many separate points you need to make in your answer.

Tests to identify ions and gases (known as Notes for use in qualitative analysis) are included in the exam paper to help you identify ions and gases.

Record readings using suitable accuracy, for example:

- volume to the nearest 0.1 cm^3
- thermometer readings usually to the nearest 0.5°C
- time to the nearest second.

Record observations in the order the steps are carried out.

Write notes before writing the plan. Clearly state:

- details of apparatus
- quantities of substances to be used
- practical procedures you think should be carried out
- a conclusion.

Make sure any diagrams fill the space given on the paper and are fully labelled.

Revision checklists

In the next part of this guide we have provided some revision checklists. These include information from the syllabus that you should revise. They don't contain all the detailed knowledge you need to know, just an overview. For more detail see the syllabus and talk to your teacher.

The table headings are explained below:

Topic	You should be able to	R	A	G	Comments
These are the core topics you need to know	Content in the syllabus you need to cover	<p>You can use the tick boxes to show when you have revised an item and how confident you feel about it.</p> <p>R = RED means you are really unsure and lack confidence; you might want to focus your revision here and possibly talk to your teacher for help.</p> <p>A = AMBER means you are reasonably confident but need some extra practice.</p> <p>G = GREEN means you are very confident.</p> <p>As your revision progresses, you can concentrate on the RED and AMBER items in order to turn them into GREEN items. You might find it helpful to highlight each topic in red, orange or green to help you prioritise.</p>			<p>You can:</p> <ul style="list-style-type: none"> • Add further information of your own. • add learning aids, such as rhymes, poems or word play • pinpoint areas of difficulty you need to check further with your teacher or textbooks • include reference to a useful resource

Note: the tables below cannot contain absolutely everything you need to know, but it does use examples wherever it can.

1 Cells

Topic	You should be able to	R	A	G	Comments
1.1 Cell structure and function					
1	Examine under the microscope, animal cells and plant cells from any suitable locally available material, using an appropriate temporary staining technique, such as methylene blue or iodine solution				
2	Draw diagrams to represent observations of the animal and plant cells examined above				
3	Identify on diagrams, photomicrographs or electron micrographs, the ribosomes, mitochondria, nucleus, cytoplasm and cell membrane in an animal cell				
4	Identify on diagrams, photomicrographs or electron micrographs, the ribosomes, mitochondria, chloroplasts, nucleus, sap vacuole, cytoplasm, cell membrane and cellulose cell wall in a plant cell				
5	Describe the structure of a bacterial cell, limited to: ribosomes, circular deoxyribonucleic acid (DNA) and plasmids, cytoplasm, cell membrane and cell wall				
6	Describe the functions of the above structures in animal, plant and bacterial cells				
1.2 Specialised cells, tissues and organs					
1	Understand that cells can become specialised and that their structures are related to their specific functions, as illustrated by examples covered in the syllabus				
2	Understand the terms cell, tissue, organ, organ system and organism as illustrated by examples covered in the syllabus				
3	State and use the formula magnification = image size/actual size				

2 Classification

Topic	You should be able to	R	A	G	Comments
2.1 Concept and use of a classification system					
1	Understand that organisms can be classified into groups by the features that they share				
2	Describe a species as a group of organisms that can reproduce to produce fertile offspring				

Topic	You should be able to	R	A	G	Comments
3	Describe the binomial system of naming species as an internationally agreed system in which the scientific name of an organism is made up of two parts showing the genus and species				
4	Construct and use dichotomous keys based on identifiable features				
2.2 Features of organisms					
1	State the main features used to place all organisms into one of the five kingdoms: Animal, Plant, Fungus, Prokaryote, Protocist				
2	State the main features used to place organisms into groups within the animal kingdom, limited to: a. the main groups of vertebrates: mammals, birds, reptiles, amphibians, fish b. the main groups of arthropods: myriapods, insects, arachnids, crustaceans				
3	State the main features used to place organisms into groups within the plant kingdom, limited to ferns and flowering plants (dicotyledons and monocotyledons)				
4	Classify organisms using the features identified in 2.2.1, 2.2.2 and 2.2.3				
5	State the main features of viruses, limited to protein coat and genetic material				
6	Understand that viruses can only reproduce in living cells				

3 Movement into and out of cells

Topic	You should be able to	R	A	G	Comments
3.1 Diffusion and osmosis					
1	Describe the role of water as a solvent in organisms with reference to digestion, excretion and transport				
2	Understand that the energy for diffusion and osmosis comes from the kinetic energy of random movement of molecules and ions				
3	Understand diffusion as the net movement of molecules or ions from a region of their higher concentration to a region of their lower concentration (i.e. down a concentration gradient) as a result of their random movement				
4	Investigate the factors that influence diffusion, limited to: surface area, temperature, concentration gradient and distance				

Topic	You should be able to	R	A	G	Comments
5	Understand osmosis as the net movement of water molecules from a region of higher water potential to a region of lower water potential, through a partially permeable membrane				
6	Understand that plants are supported by the pressure of water inside the cells pressing outwards on the cell wall				
7	Describe the effects of osmosis on plant and animal tissues and explain the importance of water potential gradient and osmosis in the uptake and loss of water				
8	Investigate and explain the effects on plant tissues of immersing them in solutions of different concentrations, using the terms turgid, turgor, plasmolysis and flaccid				
9	Investigate osmosis using materials such as dialysis tubing				

3.2 Active transport

1	Understand active transport as the movement of molecules or ions into or out of a cell through the cell membrane, from a region of their lower concentration to a region of their higher concentration (i.e. against a concentration gradient), using energy released during respiration				
2	Explain the importance of active transport in ion uptake by root hair cells				

4 Biological molecules

Topic	You should be able to	R	A	G	Comments
4.1 Biological molecules					
1	List the chemical elements that make up: <ol style="list-style-type: none"> carbohydrates lipids (fats and oils) proteins DNA 				
2	State that large molecules are made from smaller molecules, limited to: starch, cellulose and glycogen from glucose; proteins from amino acids; lipids from fatty acids and glycerol; DNA from nucleotides				

Topic	You should be able to	R	A	G	Comments
3	Describe and be able to do chemical tests for: a. starch (iodine solution) b. glucose and maltose (Benedict's solution) c. protein (biuret test) d. lipids (ethanol emulsion test)				

5 Enzymes

Topic	You should be able to	R	A	G	Comments
5.1 Enzyme action					
	Describe a catalyst as a substance that increases the rate of a chemical reaction and is not changed by the reaction				
	Describe enzymes as proteins that function as biological catalysts and are involved in all metabolic reactions				
	Explain enzyme action with reference to the substrate, active site, enzyme-substrate complex, and product				
	Explain the specificity of enzymes in terms of the complementary shape and fit of the active site with the substrate ('lock and key' hypothesis)				
5.2 Effects of temperature and pH					
	Understand that the progress of enzyme-catalysed reactions can be followed by measuring the concentrations of reactants and products				
	Investigate and describe the effects of temperature and pH on enzyme activity				
	Explain the effect of changes in temperature and pH on enzyme activity in terms of kinetic energy, shape and fit, denaturation and the frequency of effective collisions				

6 Plant nutrition

Topic	You should be able to	R	A	G	Comments
6.1 Photosynthesis					
1	Understand that photosynthesis is the process by which plants make carbohydrates from raw materials using energy from light				
2	State that chlorophyll is a green pigment that is found in chloroplasts				
3	State that chlorophyll transfers light energy into chemical energy in carbohydrates				
4	Outline the subsequent use and storage of the carbohydrates made in photosynthesis, limited to: <ol style="list-style-type: none"> starch as an energy store cellulose to build cell walls glucose used in respiration to provide energy sucrose for transport through the plant 				
5	State the word equation and balanced chemical equation for photosynthesis				
6	Investigate the need for chlorophyll, light and carbon dioxide for photosynthesis, using appropriate controls				
7	Describe and explain the effect of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis				
8	Investigate the effect of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis using submerged aquatic plants and hydrogencarbonate indicator solution				
9	Identify and explain the limiting factors of photosynthesis in different environmental conditions				

Topic	You should be able to	R	A	G	Comments
6.2 Leaf structure					
1	State that most leaves have a large surface area and are thin, and explain how these features are adaptations for photosynthesis				
2	Identify and label the cuticle, cellular and tissue structures of a dicotyledonous leaf, as seen in diagrams or photomicrographs under the microscope, and explain how these structures are adaptations for photosynthesis and gas exchange, limited to: <ol style="list-style-type: none"> stomata and guard cells spongy and palisade mesophyll cells air spaces vascular bundles (xylem and phloem) distribution of chloroplasts upper and lower epidermis 				
6.3 Mineral nutrition					
1	Explain the importance of nitrate ions for making amino acids, required for the production of proteins				
2	Explain the importance of magnesium ions for making chlorophyll				

7 Transport in flowering plants

Topic	You should be able to	R	A	G	Comments
7.1 Uptake and transport of water and ions					
1	Relate the structure of root hair cells to their function of water and ion uptake				
2	Outline the pathway taken by water through the root, stem and leaf, limited to: root hair cells, root cortex cells, xylem and mesophyll cells				
3	Investigate, using a suitable stain, the pathway of water in a cut stem				
7.2 Transpiration and translocation					
1	Describe transpiration as the loss of water vapour from leaves				
2	Understand that water evaporates from the surfaces of the mesophyll cells into air spaces and then diffuses out of the leaves through the stomata as water vapour				

Topic	You should be able to	R	A	G	Comments
3	Explain: a. the effects of wind speed, and the variation of temperature, humidity and light intensity on transpiration rate b. how wilting occurs				
4	Investigate the effects of wind speed, light intensity and temperature variation on transpiration rate				
5	Explain the mechanism by which water moves upwards in the xylem in terms of a transpiration pull that draws up a column of water molecules, held together by forces of attraction between water molecules				
6	Describe translocation as the movement of sucrose and amino acids in the phloem from parts of plants that produce or release them (sources) to parts of plants that use or store them (sinks)				
7	Identify the positions of tissues as seen in transverse sections of non-woody dicotyledonous roots and stems, limited to: xylem, phloem and cortex				
8	State the functions of xylem as transport of water and mineral ions, and support				
9	Relate the structure of xylem vessels to their function, limited to: a. thick walls with lignin (details of lignification not required) b. no cell contents c. cells joined end-to-end with no cross walls to form a long continuous tube				

8 Human nutrition

Topic	You should be able to	R	A	G	Comments
8.1 Diet					
1	List the principal sources of, and describe the dietary importance of carbohydrates, lipids, proteins, vitamins (C and D only), mineral salts (calcium and iron only), fibre (roughage) and water				
2	Name the diseases and describe the symptoms resulting from deficiencies of vitamin C (scurvy), vitamin D (rickets), calcium (rickets) and iron (anaemia)				
3	Understand the concept of a balanced diet				

Topic	You should be able to	R	A	G	Comments
8.2 Human digestive system					
1	Identify the main regions of the digestive system: mouth, salivary glands, oesophagus, stomach, small intestine (duodenum and ileum), pancreas, liver, gall bladder and large intestine (colon, rectum and anus)				
2	Explain why most foods must be digested before they can be absorbed				
3	Describe physical digestion as the breakdown of food into smaller pieces without chemical change to the food molecules				
4	Describe chemical digestion as the breakdown of large molecules into small molecules				
5	State that physical digestion increases the surface area of food for the action of enzymes in chemical digestion				
6	Identify the types of human teeth (incisors, canines, premolars and molars)				
7	Describe the structure of human teeth, limited to: enamel, dentine, pulp, nerves and cement, and understand that teeth are embedded in the gum				
8	Describe the functions of the types of human teeth in physical digestion of food				
9	Describe the functions of the main regions of the digestive system, limited to: a. mouth – ingestion, physical digestion, chemical digestion of starch by amylase b. salivary glands – secretion of saliva containing amylase c. stomach – physical digestion, chemical digestion of protein by protease, presence of hydrochloric acid in gastric secretions d. duodenum – chemical digestion of starch by amylase, maltose by maltase, protein by protease and lipids by lipase e. liver – production of bile and storage of glycogen f. gall bladder – storage of bile g. pancreas – alkaline secretion containing amylase, maltase, protease and lipase h. ileum and colon – absorption i. rectum and anus – egestion				

Topic	You should be able to	R	A	G	Comments
10	Describe the functions of amylase, protease and lipase, listing the substrates and end-products, limited to: a. amylase breaks down starch to maltose b. maltase breaks down maltose to glucose c. protease (pepsin and trypsin) breaks down protein to amino acids d. lipase breaks down lipids to fatty acids and glycerol				
11	Describe the function of hydrochloric acid in the stomach as killing ingested bacteria				
12	Understand that the different proteases present in the stomach and the duodenum work best at different pH levels				
13	Outline the role of bile in emulsifying fats to increase the surface area for the chemical digestion of fat to fatty acids and glycerol by lipase				
14	Describe peristalsis as waves of contractions of longitudinal and circular muscles which move food through the digestive system				
8.3 Absorption and assimilation					
1	State that the small intestine is the region where nutrients are absorbed				
2	Understand that absorption (by diffusion, osmosis and active transport) is the movement of nutrients from the intestines into cells lining the digestive system and then into the blood				
3	Understand that assimilation is the uptake and use of nutrients by cells from the blood				
4	Describe the structure of a villus and the roles of capillaries and lacteals				
5	Explain the significance of villi and microvilli in increasing the internal surface area of the ileum				
6	Understand that water is absorbed from the lumen of the small intestine and the colon, but that most absorption of water happens in the small intestine				
7	State the function of the hepatic portal vein as the route taken to the liver by most of the molecules and ions absorbed from the ileum				

9 Human gas exchange

Topic	You should be able to	R	A	G	Comments
9.1 Human gas exchange					
1	Describe the features of gas exchange surfaces in humans, limited to: large surface area, thin surface, good blood and air supply				
2	State the percentages of the gases in atmospheric air				
3	Investigate and explain the differences between inspired and expired air				
4	Identify, on diagrams and images, the larynx, trachea, lungs, bronchi, bronchioles, alveoli and associated capillaries				
5	State the characteristics of, and describe the role of, the exchange surface of the alveoli in gas exchange				
6	Identify, on diagrams and images, the ribs, internal and external intercostal muscles and the diaphragm				
7	Explain the role of the ribs, the internal and external intercostal muscles and the diaphragm in producing volume and pressure changes in the thorax, causing the movement of air into and out of the lungs (breathing)				
8	Investigate and explain the effect of physical activity on rate and depth of breathing				
9	Explain the role of goblet cells, ciliated cells and mucus in protecting the gas exchange system from pathogens and particles				

10 Respiration

Topic	You should be able to	R	A	G	Comments
10.1 Respiration					
1	Describe respiration as the chemical reactions in all living cells that release energy from glucose				
2	State the uses of energy in living organisms including muscle contraction, protein synthesis, cell division, active transport, growth, the passage of nerve impulses and the maintenance of a constant body temperature				
3	Investigate and describe the effect of temperature on respiration in yeast				

Topic	You should be able to	R	A	G	Comments
10.2 Aerobic respiration					
1	Describe aerobic respiration as the release of a relatively large amount of energy by the breakdown of glucose in the presence of oxygen				
2	State the word equation and balanced chemical equation for aerobic respiration				
10.3 Anaerobic respiration					
1	Describe anaerobic respiration as the release of a relatively small amount of energy by the breakdown of glucose without using oxygen				
2	State the word equation for anaerobic respiration in humans				
3	State the word equation for anaerobic respiration in yeast				
4	Explain why lactic acid builds up in muscles and blood during vigorous exercise causing Excess Post-exercise Oxygen Consumption (EPOC) or an 'oxygen debt'				
5	Outline how the oxygen debt is removed after exercise, limited to: a. continuation of fast heart rate to transport lactic acid in blood from muscles to the liver b. continuation of deeper and faster breathing to supply oxygen for the breakdown of lactic acid in the liver				

11 Transport in humans

Topic	You should be able to	R	A	G	Comments
11.1 Circulatory system					
1	Describe the circulatory system as a system of blood vessels with a pump and valves to ensure one-way flow of blood				
2	Describe a double circulation as a system in which blood passes through the heart twice for each complete circuit				
3	Understand that a double circulation provides a low pressure circulation to the lungs and a high pressure circulation to the body tissues				

Topic	You should be able to	R	A	G	Comments
11.2 Heart					
1	Identify the structures of the mammalian heart, limited to: the muscular wall, the septum, the left and right ventricles and atria, atrioventricular and semilunar valves and coronary arteries				
2	Explain the relative thickness: a. of the muscle walls of the left and right ventricles b. of the muscle walls of the atria compared to those of the ventricles				
3	Describe the functioning of the heart in terms of the contraction of muscles of the atria and ventricles and the action of the valves in a heartbeat				
4	State that blood is pumped away from the heart in arteries and returns to the heart in veins				
5	State that the activity of the heart may be monitored by electrocardiogram (ECG), pulse rate and listening to sounds of valves closing				
6	Investigate and explain the effect of physical activity on heart rate				
7	Describe coronary heart disease in terms of the blockage of coronary arteries and state the possible risk factors including diet, sedentary lifestyle, stress, smoking, genetic predisposition, age and gender				
8	Discuss the role of diet and exercise in reducing the risk of coronary heart disease				
11.3 Blood vessels					
1	Name the main blood vessels that carry blood to and from the heart, lungs, liver and kidneys, limited to: aorta, vena cava, pulmonary artery, pulmonary vein, hepatic artery, hepatic vein, hepatic portal vein, renal artery and renal vein				
2	Describe the structure of arteries, veins and capillaries, limited to: a. relative thickness of wall b. composition of wall (muscle and elastic tissue) c. diameter of lumen d. presence of valves				
3	Explain how the structure of arteries, veins and capillaries is related to the pressure of the blood that they transport				

Topic	You should be able to	R	A	G	Comments
11.4 Blood					
1	Identify red and white blood cells (lymphocytes and phagocytes) as seen under the light microscope on prepared slides, and in diagrams and photomicrographs				
2	List the components of blood as red blood cells, white blood cells, platelets and plasma				
3	State the functions of the components of blood: a. red blood cells – oxygen transport b. white blood cells – antibody production by lymphocytes and engulfing pathogens by phagocytes c. platelets – clotting by converting soluble fibrinogen to insoluble fibrin to prevent blood loss and the entry of pathogens d. plasma – transport, limited to: blood cells, ions, glucose, amino acids, hormones, carbon dioxide, urea, vitamins and plasma proteins				
4	Describe the transfer of substances between blood in capillaries, tissue fluid and body cells				

12 Disease and immunity

Topic	You should be able to	R	A	G	Comments
12.1 Disease					
1	Describe a pathogen as a disease-causing organism				
2	Describe a transmissible disease as a disease in which the pathogen can be passed from one host to another				
3	Understand that a pathogen may be transmitted: a. through direct contact, including through blood or other body fluids b. indirectly, including from contaminated surfaces or food, from animals, or from the air				
4	Describe the human body's barriers to the entry of pathogens, limited to: skin, hairs in the nose, mucus, stomach acid				
5	Understand the role of the mosquito as a vector of disease				
6	Describe the malarial pathogen as an example of a parasite and explain how it is transmitted				

Topic	You should be able to	R	A	G	Comments
7	Describe the control of the mosquito that transmits malaria with reference to its life cycle				
8	Explain that human immunodeficiency virus (HIV) is a viral pathogen				
9	Describe how HIV is transmitted				
10	Understand that HIV infection may lead to Acquired Immune Deficiency Syndrome (AIDS)				
11	Discuss the spread of HIV and methods by which it may be controlled				
12	Describe cholera as a disease caused by a bacterium, which is transmitted in contaminated water				
13	Explain the importance of a clean water supply, hygienic food preparation, good personal hygiene, waste disposal and sewage treatment in controlling the spread of cholera (details of the stages of sewage treatment are not required)				
14	Explain that the cholera bacterium produces a toxin that causes secretion of chloride ions into the small intestine, causing osmotic movement of water into the gut, resulting in diarrhoea, dehydration and loss of ions from the blood				
15	Describe the effects of excessive consumption of alcohol: reduced self-control, depressant, effect on reaction times, damage to liver and social implications				
16	Describe the effects of tobacco smoke and its major toxic components (nicotine, tar and carbon monoxide): strong association with bronchitis, emphysema, lung cancer, heart disease, and the association between smoking during pregnancy and reduced birth weight of the baby				
12.2 Antibiotics					
1	Describe a drug as any substance taken into the body that modifies or affects chemical reactions in the body				
2	Describe the use of antibiotics for the treatment of bacterial infection				
3	State that antibiotics kill bacteria but do not affect viruses				
4	Explain how development of antibiotic-resistant bacteria, including MRSA, can be minimised by using antibiotics only when essential				

2Topic	You should be able to	R	A	G	Comments
12.3 Immunity					
1	Describe active immunity as defence against a pathogen by antibody production in the body				
2	State that each pathogen has its own antigens, which have specific shapes				
3	Describe antibodies as proteins that bind to antigens leading to direct destruction of pathogens, or marking of pathogens for destruction by phagocytes				
4	State that specific antibodies have complementary shapes which fit specific antigens				
5	Explain that active immunity is gained after an infection by a pathogen, or by vaccination				
6	Outline the process of vaccination: <ul style="list-style-type: none"> a. weakened pathogens or their antigens are given b. the antigens stimulate an immune response by lymphocytes which produce antibodies c. memory cells are produced that give long-term immunity 				
7	Explain the role of vaccination in controlling the spread of transmissible diseases				
8	Explain that passive immunity is a short-term defence against a pathogen by antibodies acquired from another individual, limited to: across the placenta and in breast milk				
9	Explain the importance of breast-feeding for the development of passive immunity in infants				
10	State that memory cells are not produced in passive immunity				
11	Outline how HIV affects the immune system, limited to: decreased lymphocyte numbers and reduced ability to produce antibodies, which weakens the immune system				

13 Excretion

Topic	You should be able to	R	A	G	Comments
13.1 Excretion					
1	Describe excretion as the removal of toxic materials and the waste products of metabolism from organisms				
2	State that carbon dioxide is a waste product of respiration, which is excreted through the lungs				
3	State that urea is a toxic waste product produced in the liver from the breakdown of excess amino acids				
13.2 Urinary system					
1	Identify, on diagrams, the kidneys, ureters, bladder and urethra and state the function of each (the function of the kidney should be described simply as removing urea and excess salts and water from the blood as urine)				
2	Explain the need for excretion, limited to toxicity of urea				
3	Outline the structure of a nephron and its associated blood vessels, limited to: Bowman's capsule, glomerulus, tubules, loop of Henle and collecting duct				
4	Outline the function of a nephron and its associated blood vessels, limited to: <ol style="list-style-type: none"> the role of the glomerulus in the filtration from the blood of water, glucose, urea and ions the role of the nephron in the reabsorption of all of the glucose, some of the ions and most of the water back into the blood the formation of urine containing urea, excess water and excess ions (details of these processes are not required) 				
5	Describe the role of the liver in the assimilation of amino acids by converting them to proteins				
6	Describe deamination as the removal of the nitrogen-containing part of amino acids, resulting in the formation of urea.				

14 Coordination and control

Topic	You should be able to	R	A	G	Comments
14.1 Mammalian nervous system					
1	State that the nervous system (brain, spinal cord and nerves) coordinates and regulates body functions				

Topic	You should be able to	R	A	G	Comments
2	Describe the mammalian nervous system in terms of: a. the central nervous system (CNS) consisting of the brain and the spinal cord b. the peripheral nervous system (PNS) consisting of the nerves outside the brain and spinal cord				
3	Identify, on diagrams, sensory, relay and motor neurones				
4	State that electrical impulses travel along neurones				
5	Describe simple reflex arcs in terms of receptor, sensory neurone, relay neurone, motor neurone and effector (muscles and glands)				
6	Describe a reflex action as a rapid and automatic response to a stimulus				
7	Describe a synapse as a junction between two neurones				
8	Describe the structure of a synapse, including the presence of vesicles containing neurotransmitter molecules, the synaptic gap and receptor proteins				
9	Describe the events at a synapse: a. an impulse stimulates the release of neurotransmitter molecules from vesicles into the synaptic gap b. the neurotransmitter molecules diffuse across the gap and bind with receptor proteins c. an impulse is stimulated in the next neurone				
10	State that synapses ensure that impulses travel in one direction only				
14.2 Mammalian sense organs					
1	Describe sense organs as groups of receptor cells responding to specific stimuli: light, sound, touch, temperature and chemicals				
2	Identify, on a diagram, the structures of the eye, limited to: cornea, iris, pupil, lens, ciliary muscles, suspensory ligaments, retina, fovea, optic nerve, and blind spot				

Topic	You should be able to	R	A	G	Comments
3	Describe the function of each part of the eye, limited to: a. cornea – refracts light b. iris – controls how much light enters the pupil c. lens – focuses light onto the retina d. ciliary muscles and suspensory ligaments – control the shape of the lens e. retina – contains light receptors, some sensitive to light of different colours f. fovea – contains the greatest density of light receptors g. optic nerve – carries impulses to the brain				
4	Explain the pupil reflex in terms of light intensity and antagonistic action of circular and radial muscles in the iris				
5	Explain accommodation to view near and distant objects in terms of the contraction and relaxation of the ciliary muscles, tension in the suspensory ligaments, shape of the lens and refraction of light				
14.3 Mammalian hormones					
1	Describe a hormone as a chemical substance, produced by a gland and carried by the blood, which alters the activity of one or more specific target organs				
2	Identify, on a diagram, endocrine glands that produce hormones and state the hormones they produce, limited to: a. the adrenal glands – produce adrenaline b. the pancreas – produces insulin and glucagon c. the pituitary gland – produces follicle-stimulating hormone (FSH) and luteinising hormone (LH) d. the testes – produce testosterone e. the ovaries – produce oestrogen and progesterone				
3	Understand the role of the hormone adrenaline, produced by the adrenal glands, in increasing the blood glucose concentration and heart rate and give examples of situations in which these may occur				
4	Compare nervous and hormonal control, limited to speed of action and duration of effect				

Topic	You should be able to	R	A	G	Comments
14.4 Homeostasis					
1	Describe homeostasis as the maintenance of a constant internal environment				
2	Explain the concept of control by negative feedback with reference to a set point				
14.5 Temperature control					
1	Identify, on a diagram of the skin: hairs, hair erector muscles, sweat glands, receptors, sensory neurones, blood vessels and fatty tissue				
2	Describe the role of insulation in maintaining a constant internal body temperature in mammals				
3	Describe the roles of the hypothalamus and of temperature receptors in the skin in maintaining a constant internal body temperature in mammals				
4	Explain how each of the following processes contributes to the maintenance of constant internal body temperature in mammals: a. sweating b. shivering c. contraction of hair erector muscles d. vasodilation and vasoconstriction of arterioles supplying skin surface capillaries				
14.6 Blood glucose control					
1	Explain the need to control blood glucose concentration				
2	Describe the control of blood glucose concentration by the liver and pancreas and the roles of insulin and glucagon				
3	Describe the signs of Type 1 diabetes (limited to increased blood glucose concentration and glucose in urine) and its treatment (administration of insulin)				

15 Coordination and response in plants

Topic	You should be able to	R	A	G	Comments
15.1 Coordination and response in plants					
1	Describe gravitropism as a response in which parts of a plant grow towards or away from gravity				

Topic	You should be able to	R	A	G	Comments
2	Describe phototropism as a response in which parts of a plant grow towards or away from light				
3	Explain the role of auxin in controlling shoot growth, limited to: a. auxin is made in the shoot tip b. auxin spreads through the plant from the shoot tip c. auxin is unequally distributed in response to light and gravity d. auxin stimulates cell elongation				
4	Investigate gravitropism and phototropism in shoots and roots				

16 Development of organisms and continuity of life

Topic	You should be able to	R	A	G	Comments
16.1 Nuclear division					
1	Understand that chromosomes contain DNA, which carries genetic information in the form of genes				
2	Describe a haploid nucleus as a nucleus containing a single set of chromosomes				
3	Describe a diploid nucleus as a nucleus containing two sets of chromosomes				
4	State that in a diploid cell there is a pair of each type of chromosome and in a human diploid cell there are 23 pairs				
5	Describe mitosis as nuclear division giving rise to genetically identical cells in which the chromosome number is maintained (details of stages are not required)				
6	Outline the role of mitosis in growth, repair of damaged tissues, replacement of worn out cells and asexual reproduction				
7	Describe stem cells as unspecialised cells that divide by mitosis to produce daughter cells that can become specialised for specific functions				
8	State that meiosis is involved in the production of gametes				
9	Describe meiosis as a reduction division in which the chromosome number is halved from diploid to haploid resulting in genetically different cells (details of stages are not required)				

Topic	You should be able to	R	A	G	Comments
10	Understand that cancers form as a result of uncontrolled cell division				
16.2 Asexual and sexual reproduction					
1	Describe asexual reproduction as a process resulting in the production of genetically identical offspring from one parent				
2	Identify examples of asexual reproduction				
3	Describe sexual reproduction as the process involving the fusion of haploid nuclei (fertilisation) to form a diploid zygote and the production of genetically different offspring				
4	Discuss the advantages and disadvantages of asexual reproduction and sexual reproduction				
16.3 Sexual reproduction in plants					
1	Identify and draw the sepals, petals, stamens (anthers and filaments) and carpels (stigmas, styles, ovaries and ovules) of an insect-pollinated flower				
2	Identify and draw the anthers and stigmas of a wind-pollinated flower				
3	Relate the structure of the parts of flowers to their functions, limited to the parts listed in 16.3.1				
4	Compare the flower structure and the pollen from insect-pollinated and wind-pollinated flowers				
5	Outline the process of pollination and distinguish between self-pollination and cross-pollination				
6	Discuss the potential effects of self-pollination and cross-pollination on a population, in terms of variation, capacity to respond to changes in the environment and reliance on pollinators				
7	Describe the growth of the pollen tube and its entry into the ovule followed by fertilisation (production of endosperm and details of development are not required)				
8	Understand that after fertilisation the ovules develop into seeds and the ovary develops into a fruit				
9	Investigate and describe the structure of a seed, limited to embryo (radicle, plumule and cotyledons) and testa				

Topic	You should be able to	R	A	G	Comments
10	Understand that seed and fruit dispersal by wind and by animals is a means of colonising new areas and of reducing competition				
11	Relate the features of wind-dispersed fruits and animal-dispersed fruits to their functions				
12	Investigate and state the environmental conditions that affect germination of seeds, limited to: suitable temperature, water and oxygen				
13	Describe the process of germination, including the role of enzymes in the process				
16.4 Sexual reproduction in humans					
1	Identify, on diagrams of the male reproductive system: the testes, scrotum, sperm ducts, pros-tate gland, urethra and penis, and describe their functions				
2	Identify, on diagrams of the female reproductive system: the ovaries, oviducts, uterus, cervix and vagina, and describe their functions				
3	Explain how the structure of a sperm cell is related to its function, limited to: flagellum, mito-chondria and enzymes in the acrosome				
4	Explain how the structure of an egg cell is related to its function, limited to energy stores and the jelly coat that changes at fertilisation				
5	Compare male and female gametes in terms of size, structure, numbers and motility				
6	Describe the roles of testosterone and oestrogen in the development and regulation of secondary sexual characteristics during puberty				
7	Describe the menstrual cycle in terms of development and release of an egg and changes in the lining of the uterus				
8	Explain the roles of follicle stimulating hormone (FSH), luteinising hormone (LH), oestrogen and progesterone in controlling the menstrual cycle				
9	Describe the early development of the zygote, limited to the formation of a ball of cells (embryo) that becomes implanted in the lining of the uterus				
10	State the functions of the amniotic sac and the amniotic fluid				

Topic	You should be able to	R	A	G	Comments
11	Identify, on diagrams, the placenta and umbilical cord and describe their functions in relation to the exchange of dissolved nutrients, gases and excretory products between the blood of the mother and the blood of the fetus (structural details are not required)				
12	State that some viruses can pass across the placenta and affect the fetus				

17 Inheritance

Topic	You should be able to	R	A	G	Comments
17.1 Variation					
1	Describe variation as differences between individuals of the same species				
2	Understand that continuous variation results in a range of phenotypes between two extremes, including body length and body mass				
3	Understand that discontinuous variation results in a limited number of phenotypes with no intermediates, including ABO blood groups, seed shape and seed colour in peas				
4	Understand that discontinuous variation is usually caused by genes only and continuous variation is caused by genes and the environment				
5	Investigate and describe examples of continuous and discontinuous variation				
17.2 DNA					
1	Describe the structure of a DNA molecule: a. two strands coiled together to form a double helix b. each strand is made up of a chain of nucleotides c. each nucleotide contains a base (A, T, C, G; full names are not required) d. bonds between pairs of bases hold the strands together e. the bases always pair up in the same way: A with T, and C with G				
2	Define a gene as a length of DNA that codes for a protein				
3	Explain that DNA controls cell function by controlling the production of proteins, including enzymes				

Topic	You should be able to	R	A	G	Comments
4	State that the sequence of bases in a gene determines the sequence of amino acids needed to make a specific protein (knowledge of the details of nucleotide structure is not required)				
5	Understand that different sequences of amino acids give different shapes to protein molecules				
17.3 Inheritance					
1	Describe inheritance as the transmission of genetic information from generation to generation				
2	Define an allele as an alternative form of a gene				
3	Understand and use the terms: dominant, recessive, phenotype, genotype, homozygous and het-erozygous				
4	Use genetic diagrams, including Punnett squares, to predict the results of monohybrid crosses and calculate phenotypic ratios, limited to 1:1 and 3:1 ratios				
5	Explain why observed ratios often differ from expected ratios, especially when there are small numbers of offspring				
6	State that two identical homozygous individuals that breed together will be pure-breeding				
7	Explain codominance by reference to the inheritance of the ABO blood groups (phenotypes A, B, AB, O, gene alleles I ^A , I ^B and I ^O)				
8	Describe the determination of sex in humans (XX and XY chromosomes)				
9	Describe a gene mutation as a random change in the base sequence of DNA, using sickle cell anaemia as an example				
10	Describe a chromosome mutation as a change in the chromosome number or structure, using Down's syndrome as an example (47 chromosomes instead of 46)				
11	State that mutation, meiosis, random mating and random fertilisation are sources of genetic variation in populations				
12	Understand that ionising radiation and some chemicals increase the rate of mutation				

Topic	You should be able to	R	A	G	Comments
17.4 Selection					
1	Describe natural selection with reference to: a. variation within populations b. production of many offspring c. struggle for survival, including competition for resources d. reproduction by individuals that are better adapted to the environment than others e. passing on of their alleles to the next generation				
2	Describe how the inherited features of a population can evolve over time as a result of natural selection				
3	Describe the development of strains of antibiotic-resistant bacteria, including MRSA, as an example of natural selection				
4	Describe artificial selection (selective breeding) with reference to: a. selection by humans of animals or plants with desirable features b. crossing these to produce the next generation c. selection of offspring showing the desirable features d. repetition over many generations				
5	Describe the role of artificial selection in the production of economically important plants and animals				

18 Biotechnology and genetic modification

Topic	You should be able to	R	A	G	Comments
18.1 Biotechnology					
1	Explain the role of yeast in the production of bread and ethanol				
2	Understand that bacteria are useful in biotechnology and genetic modification due to their rapid reproduction rate and their ability to make complex molecules				
3	Discuss why bacteria are useful in biotechnology and genetic modification, limited to: a. no ethical concerns over their manipulation and growth b. presence of plasmids				

Topic	You should be able to	R	A	G	Comments
4	Describe how fermenters can be used for the large-scale production of useful products by bacteria and fungi, including the conditions that need to be controlled, limited to: temperature, pH, oxygen, nutrient supply and waste products				
5	Describe the use of: <ol style="list-style-type: none"> enzymes in biological washing powders pectinase for fruit juice production lactase for lactose-free milk 				
18.2 Genetic modification					
1	Describe genetic modification as changing the genetic material of an organism by removing, changing or inserting individual genes				
2	Understand that the gene that controls the production of human insulin has been inserted into bacterial DNA, for commercial production of insulin				
3	Outline the use of genetic modification in crop plants by inserting genes <ol style="list-style-type: none"> to confer resistance to herbicides to confer resistance to insect pests to provide additional vitamins 				
4	Discuss potential advantages and risks of genetic modification, limited to modifying crop plants and bacteria				

19 Relationships of organisms with one another and with the environment

Topic	You should be able to	R	A	G	Comments
19.1 Energy flow					
1	Understand that the Sun is the principal source of energy input to most biological systems				
2	Explain why most forms of life are completely dependent on photosynthesis				
3	Describe the flow of energy through food chains and webs including energy from light and energy in living organisms and its eventual transfer to the environment				
4	Construct and interpret simple food chains				

Topic	You should be able to	R	A	G	Comments
5	Understand the terms producer, consumer, herbivore, carnivore and decomposer				
6	Describe a food web as a network of interconnected food chains and interpret them				
7	Explain why the transfer of energy from one trophic level to another is inefficient				
8	Explain why food chains usually have fewer than five trophic levels				
9	Explain why it is more energy efficient for humans to eat crop plants than to eat livestock that have been fed on crop plants				
10	Draw, describe and interpret pyramids of numbers, biomass and energy				
19.2 Nutrient cycles					
1	Describe the carbon cycle, limited to: photosynthesis, respiration, feeding, decomposition, formation of fossil fuels and combustion				
2	Outline the nitrogen cycle in making nitrogen available for plant and animal protein, limited to: a. decomposition of plant and animal protein to ammonium ions b. nitrification c. nitrogen fixation by lightning and bacteria d. absorption of nitrate ions by plants e. production of amino acids and protein f. feeding and digestion of proteins g. denitrification h. (the names of individual bacteria are not required)				
3	Outline the role of fungi and bacteria in decomposition				

Topic	You should be able to	R	A	G	Comments
19.3 Ecosystems and biodiversity					
1	Describe a population as a group of organisms of one species, living in the same area, at the same time				
2	Describe a community as all of the populations of different species in an ecosystem				
3	Describe an ecosystem as a unit containing the community of organisms and their environment, interacting together				
4	Describe biodiversity as the number of different species that live in an area				
5	Identify and state the factors affecting the rate of population growth for a population of an organism, limited to: food supply, competition, predation and disease				
6	Understand that the growth of the human population is increasing the demand for global resources				
19.4 Effects of humans on ecosystems					
1	Outline the causes and describe the consequences of deforestation, limited to its effects on: biodiversity, extinction, loss of soil, flooding and concentration of carbon dioxide in the atmosphere				
2	Describe the impacts humans have through: a. over-harvesting of plant and animal species b. introducing a non-native species to an ecosystem				
3	Describe the harmful effects of: a. water pollution by untreated sewage and nitrogen-containing fertilisers leading to eutrophication, limited to: i. increased availability of nitrate and other ions ii. increased growth of producers iii. increased decomposition after death of producers iv. increased aerobic respiration by decomposers v. reduction in dissolved oxygen vi. death of organisms requiring dissolved oxygen in water b. air pollution by greenhouse gases (carbon dioxide and methane), contributing to global warming and its likely effects				

Topic	You should be able to	R	A	G	Comments
	c. pollution due to insecticides and herbicides d. non-biodegradable plastics in the environment, in both aquatic and terrestrial ecosystems				
19.5 Conservation					
1	Discuss reasons for conservation of species with reference to: a. maintenance of biodiversity b. reducing extinction c. protecting vulnerable environments				
2	Explain how forests can be conserved using education, protected areas, quotas and replanting				
3	Explain how fish stocks can be conserved using education, closed seasons, protected areas, controlled net types and mesh size, quotas and monitoring				
4	Describe a sustainable resource as one which is produced as rapidly as it is removed from the environment so that it does not run out				

Section 5: Useful websites

The resources listed below will help you to revise and study for your Cambridge O Level Biology course.

These resources have not been through the Cambridge quality assurance process but have been found suitable for use with various parts of the syllabus. This list includes website links providing direct access to internet resources. Cambridge is not responsible for the accuracy or content of information contained in these resources. The inclusion of a link to an external website should not be understood to be an endorsement of that website or the site's owners (or their products/services).

www.bbc.co.uk/schools/gcsebitesize/biology

A secondary revision source for GCSE exams. The site contains revision material, tests and SOS teacher. The site also gives references to other relevant websites.

www.clickbiology.com/igcse-biology-2/

A number of videos, animations and games for revision resources for IGCSE Biology.

www.skool.com/

You will need to select your location before accessing this revision site. There are numerous quizzes on topics, but like with many general revision sites, check which topics match the Cambridge IGCSE syllabus.

www.s-cool.co.uk

A revision guide that can be used to complement your learning.

revisioncentral.co.uk/gcse/biology/index.html

There are lots of Biology revision notes on this website including notes on Classification, Cells, Tissues and Organs and Transportation in Plants.

revisionlink.co.uk/biology/index.html

This site is a portal to lots of useful Biology and other educational web sites.

www.abpischools.org.uk/

The Association of the British Pharmaceutical Industry (ABPI) has a number of useful interactive revision activities and games on many of the physiology topics. Revision for human physiology.

You can find a resource list, including endorsed resources to support Cambridge O Level Biology on our public website [[here](#)]

Endorsed resources have been written to be closely aligned to the syllabus they support, and have been through a detailed quality assurance process. All textbooks endorsed by Cambridge International for this syllabus are the ideal resource to be used alongside this Learner Guide.

In addition to reading the syllabus, you should refer to the past and specimen papers.

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