Cambridge Assessment International Education

Interactive

Learner Guide

Cambridge IGCSE™ / Cambridge IGCSE (9–1) Biology 0610/0970

For examination from 2023

Version 1

Cambridge Pathway

In order to help us develop the highest quality resources, we are undertaking a continuous programme of review; not only to measure the success of our resources but also to highlight areas for improvement and to identify new development needs.

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Contents

About this guide

This guide explains what you need to know about your Cambridge IGCSE Biology course and examinations. It will help you to:

- ✓ understand what skills you should develop by taking this Cambridge IGCSE 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 5).

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 21 main units in this syllabus which you will study:

1. Characteristics and classification of living organisms
2. Organisation of the organism
3. Movement into and out of cells
4. Biological molecules
5. Enzymes
6. Plant nutrition
7. Human nutrition
8. Transport in plants
9. Transport in animals
10. Diseases and immunity
11. Gas exchange in humans
12. Respiration
13. Excretion in humans
14. Coordination and response
15. Drugs
16. Reproduction
17. Inheritance
18. Variation and selection
19. Organisms and their environment
20. Human influences on ecosystems
21. Biotechnology and genetic modification

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 (Core) or Paper 2: Multiple Choice (Extended)
- Paper 3: Theory (Core) or Paper 4: Theory (Extended)
- Paper 5: Practical Test or Paper 6: 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

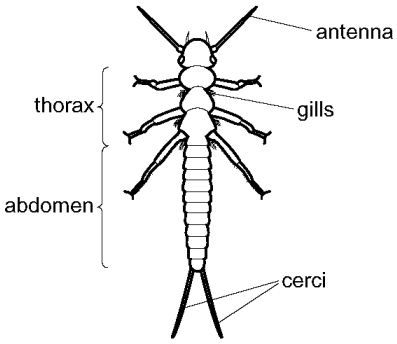
This table summarises the key information about each examination paper. You can find details and advice on how to approach each component in the 'About each paper' sub-section.

Component	Time and marks	Details	Percentage of qualification
Paper 1 Multiple Choice (Core)	45 minutes 40 marks	40 four-choice multiple-choice questions. Questions will be based on the Core subject content only. Tests assessment objectives AO1 and AO2. Externally assessed.	30%
Paper 2 Multiple Choice (Extended)	45 minutes 80 marks	40 four-choice multiple-choice questions. Questions will be based on the Core and Supplement subject content. Tests assessment objectives AO1 and AO2. Externally assessed.	30%
Paper 3 Theory (Core)	1 hour 15 minutes 40 marks	Short-answer and structured questions. Questions will be based on the Core subject content only. Tests assessment objectives AO1 and AO2. Externally assessed.	20%
Paper 4 Theory (Extended)	1 hour 15 minutes 80 marks	Short-answer and structured questions. Questions will be based on the Core and Supplement subject content. Tests assessment objectives AO1 and AO2. Externally assessed.	50%
Paper 5 Practical Test	1 hour 15 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 6 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 (Core)

3 The diagram shows a stonefly larva.



Use the key to identify the stonefly larva.

1	has two cerci at the end of the abdomen	go to 2
	has three cerci at the end of the abdomen	go to 3
2	abdomen longer than thorax	**A**
	thorax longer than abdomen	**B**
3	gills visible on the thorax	**C**
	gills not visible	**D**

4 Which part of a plant cell controls the movement of substances into and out of the cell?

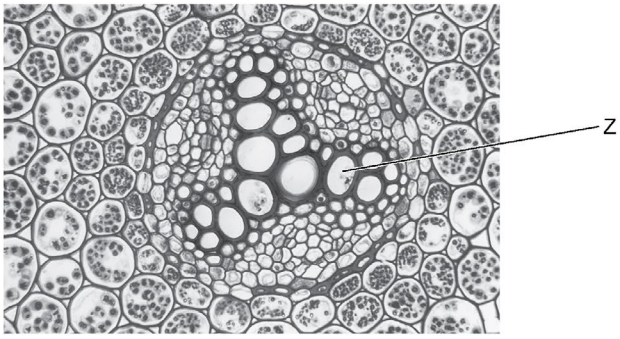
A cell membrane
B cell wall
C cytoplasm
D vacuole

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

[Turn over

Paper 2: Multiple Choice (Extended)

16 The photomicrograph shows a cross-section through the root of a buttercup plant.



What is the function of the tissue labelled Z?

A photosynthesis

B respiration

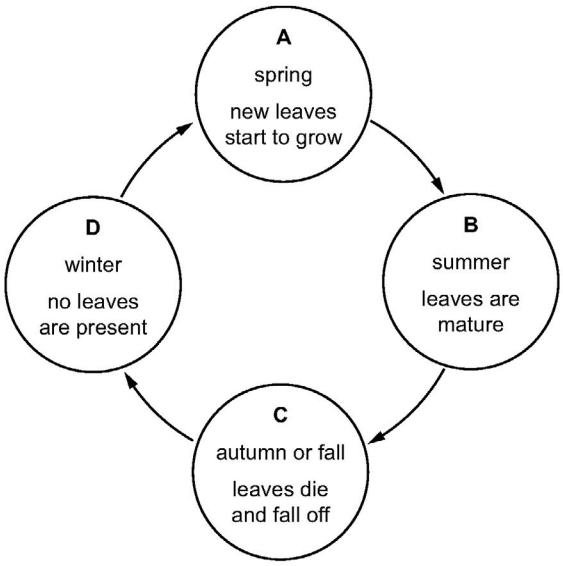
C transport of sugars

D transport of water

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

17 Roots and leaves both act as sources and sinks for sucrose and amino acids at different times during the year.

At which point in the year are the roots most active as a source?



Paper 3: Theory (Core)

4 (a) Fig. 4.1 is a diagram of a variegated leaf from a plant. The plant was exposed to sunlight so that it could photosynthesise.

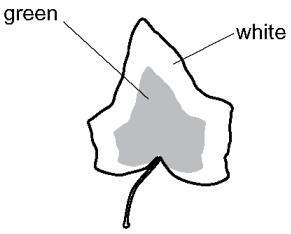


Fig. 4.1

A student tested the leaf for starch and found that:

- starch was present in the green part of the leaf
- there was **no** starch in the white part of the leaf.

Explain the results of this test.

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..... [4]

For Paper 3, all questions are compulsory and there are no separate sections.

Paper 4: Theory (Extended)

4 **(a)** Yeast can respire aerobically and anaerobically.

State the balanced chemical equation for aerobic respiration.

..... [2]

(b) When yeast respires anaerobically, ethanol is produced.

Ethanol is a type of sustainable resource that can be made from a wide range of crop plants.

It can be used as a biofuel.

Table 4.1 summarises some information about crop plants that are used to make biofuel.

Table 4.1

crop plant	biofuel produced	energy yield / GJ per ha	optimum growth temperature / °C	optimum annual rainfall range / mm
wheat	ethanol	53–84	24	800–1200
corn	ethanol	63–76	18	360–1000
sugar beet	ethanol	110–122	18	360–1000
sugarcane	ethanol	110–140	28	800–1200
oil palm	oil	150–166	28	1100–2500

A country has a mean temperature range of 12 °C to 24 °C. The country has a mean annual rainfall of 1000 mm.

Suggest **and** explain which crop plant would be the **most** suitable crop to grow to produce biofuel in the country.

Use the information in Table 4.1 to support your choice.

crop plant .....

explanation .....

.....

.....

.....

.....

..... [3]

For Paper 4, all questions are compulsory and there are no separate sections.

[Turn over

Paper 5: Practical Test and Paper 6: Alternative to Practical

(d) A student stated that:

'Catalase activity is the same in all species of plants.'

Plan an investigation to test this statement.

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..... [6]

(e) Potatoes contain starch. Starch can be broken down into reducing sugars.

Describe the tests to identify starch and reducing sugars and give the results of the positive tests.

starch .....

.....

.....

reducing sugars .....

.....

.....

.....

[5]

[Total: 21]

Both Paper 5 and Paper 6 include a planning question. It will be a 6-mark question focusing solely on the experimental skill of planning. The planning question will be identical in both papers.

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 examination 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 in Paper 3 and Paper 4, and AO2 Handling information and problem-solving covers the remaining 37% in each paper. However, in Paper 5 and Paper 6, only AO3 Experimental skills and investigations is assessed.

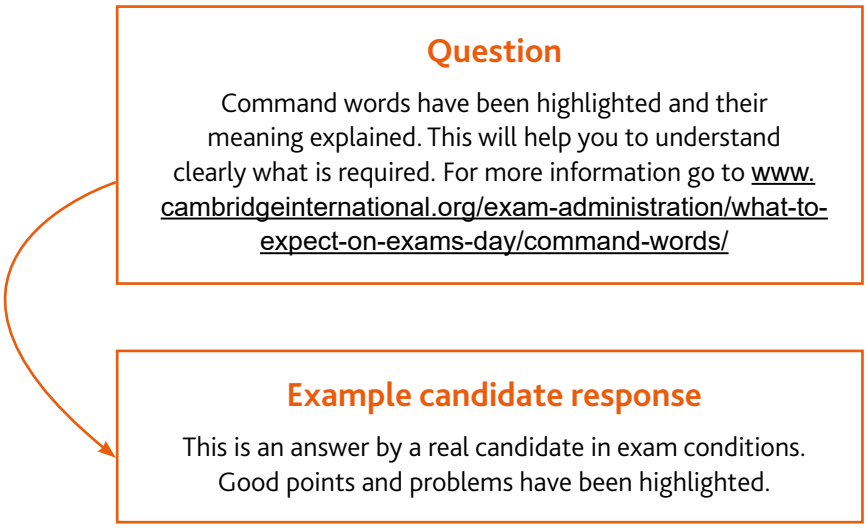
Assessment objectives (AO)	What does the AO mean?	What do you need to be able to do?
AO1 Knowledge with understanding	Remembering facts and applying these facts to new situations	You should be able to demonstrate knowledge and understanding of: • scientific phenomena, facts, laws, definitions, concepts 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: • 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: • 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: Example candidate response

This section takes you through an example question and learner response from a Cambridge IGCSE Biology specimen paper. It will help you to see how to identify command words within questions and to understand what is required in your response. A command word, is the part of the question that tells you what you need to do with your knowledge. For example, you might need to describe something, explain something, argue a point of view or list what you know.

All information and advice in this section is specific to the example question and response/ mode answer being demonstrated. It should give you an idea of how your responses might be viewed by an examiner but it is not a list of what to do in all questions. In your own examination, you will need to pay careful attention to what each question is asking you to do.

This section is separated as follows:



Question

14

4 (a) Fig. 4.1 is a diagram of a variegated leaf from a plant. The plant was exposed to sunlight so that it could photosynthesise.

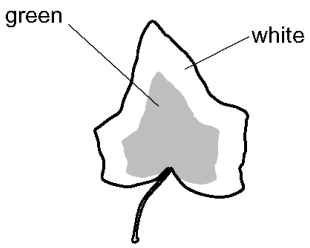


Fig. 4.1

A student tested the leaf for starch and found that:

- starch was present in the green part of the leaf
- there was **no** starch in the white part of the leaf.

Explain the results of this test.

.....

.....

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..... [4]

'Explain' requires you to 'set out purposes or reasons / make the relationships between things evident / provide why and/or how and support with relevant evidence.' Your knowledge of photosynthesis should be able to help you explain how and why starch was present in the green part of the leaf, while not found in the white part of the leaf.

There are four marks available for this question, so you should be looking to provide at least four **different** facts and explanations in your answer.

15

(b) Water is required for the process of photosynthesis.

(i) Describe where **and** how water enters a plant.

.....

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.....

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.....

.....

..... [3]

'Describe' requires you to 'state the points of a topic / give characteristics and main features', and in this question you need to ensure that you think about **both** where and how water enters a plant. Because this is a three mark question, you need to include at least three examples of where and how waters enters a plant, which you should be able to describe through your knowledge of water uptake by plants and osmosis.

(ii) Describe **one** function of water in a plant other than for photosynthesis.

..... [1]

This is a simple recall question. There are a number of potential answers and you just need to choose one.

(iii) State the name of the tissue in a plant that transports water.

..... [1]

Again, another simple recall question that should be answerable based on your knowledge of plant structures. 'State' requires you to name the structure.

(iv) State the name of the part of a leaf through which most water vapour is lost from the plant.

..... [1]

Again, another simple recall question that requires you to name the appropriate part of a leaf. There is no need to explain the process or name any other related leaf structures.

Example candidate response

14

4 (a) Fig. 4.1 is a diagram of a variegated leaf from a plant. The plant was exposed to sunlight so that it could photosynthesise.

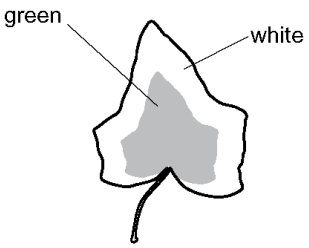

Fig. 4.1

A student tested the leaf for starch and found that:

- starch was present in the green part of the leaf
- there was **no** starch in the white part of the leaf.

Explain the results of this test.

Photosynthesis only happens in the green parts because this is where the chlorophyll is. There is no chlorophyll in the white parts, so no starch is made there.

..... [4]

The candidate gains a mark for referring to photosynthesis, another for saying that only the green part contains chlorophyll, and a third for a strong implication that chlorophyll is needed for photosynthesis.

However, there is no description of what chlorophyll does (absorbs energy from sunlight), nor reference to glucose being produced and converted to starch.

3 marks awarded

Common mistakes often include candidates repeating the same idea several times when writing longer answers, rather than thinking of several different facts or explanations.

15

(b) Water is required for the process of photosynthesis.

(i) Describe where **and** how water enters a plant.

It goes from the soil into the root hairs. It goes in by osmosis, where water diffuses through a partially permeable membrane which is the root hair cell membrane.

[3]

One mark is awarded for reference to root hairs, another for osmosis, and a third for the reference to a partially permeable membrane.

3 marks awarded

Common mistakes often include candidates failing to address both *where* and *how* water enters. Additionally, descriptions of osmosis often fail to mention a partially permeable membrane.

(ii) Describe **one** function of water in a plant other than for photosynthesis.

supporting cells

The candidate is correct.

1 mark awarded

A common mistake is candidates writing 'to stop it drying out'. Although not wrong, this does not contain enough information to gain a mark.

(iii) State the name of the tissue in a plant that transports water.

xylem

The candidate is correct.

1 mark awarded

A common mistake is the spelling of xylem which often causes difficulties, but if your attempt is clearly meant to be xylem, and cannot be confused with another term, it will be accepted.

(iv) State the name of the part of a leaf through which most water vapour is lost from the plant.

through the stomata in the epidermis [1]

The candidate is correct. Only the term 'stomata' is required for the mark.

1 mark awarded

Section 5: 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, Paper 4, Paper 5 and Paper 6.

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.
- ☐ 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.
- ☐ Look for details that indicate how to answer or the depth of answer required. For example the question 'Describe, in terms of the movement and energies of the water molecules, how evaporation takes place' is allocated two marks on a paper. This shows that you must make two valid points and you must refer to movement and energy of the molecules. So wording such as 'some molecules have more energy than others and these leave the surface' will gain both marks.
- ☐ Do not leave out questions or parts of questions. Remember, no answer means no mark.
- ☐ 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 are confident with your calculator – particularly using powers of 10.
- [ ] Always show your working in calculations so that you can gain marks for your method even if you make a mistake with the final answer.
- [ ] Always include units where appropriate.
- [ ] Avoid vague descriptions – try to write clearly and concisely using the correct physics terms.
- [ ] Use a sharp pencil for graph work, taking care to plot each point with a small, neat cross and to draw a thin best fit line.
- [ ] At the end of a calculation ask yourself 'is this answer sensible?'
- [ ] Make sure you answer the question set. You will gain no marks for merely repeating the facts given in the question.
- [ ] 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 and Paper 2 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 3 and Paper 4 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 5 advice

- [ ] Paper 5 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.
- ☐ Record readings using suitable accuracy, for example:
  - volume to the nearest 0.1 cm3
  - 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.

Paper 6 advice

- ☐ Paper 6 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.
- ☐ Record readings using suitable accuracy, for example:
  - volume to the nearest 0.1 cm3
  - 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 and Extended topics you need to know	Content in the syllabus you need to cover	You can use the tick boxes to show when you have revised an item and how confident you feel about it. 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 A = AMBER means you are reasonably confident but need some extra practice G = GREEN means you are very confident. 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.			You can: • add further information of your own, such as names of case studies needed • 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 Characteristics and classification of living organisms

You should be able to	Ways to practise skills	R	A	G	Comments
1.1 Characteristics of living organisms					
1	Describe the characteristics of living organisms by describing: a. movement as an action by an organism or part of an organism causing a change of position or place b. respiration as the chemical reactions in cells that break down nutrient molecules and release energy for metabolism c. sensitivity as the ability to detect and respond to changes in the internal or external environment d. growth as a permanent increase in size and dry mass e. reproduction as the processes that make more of the same kind of organism f. excretion as the removal of the waste products of metabolism and substances in excess of requirements g. nutrition as the taking in of materials for energy, growth and development	☐	☐	☐	
1.2 Concept and uses of classification systems					
1	State 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	☐	☐	☐	
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	☐	☐	☐	
5	Explain that classification systems aim to reflect evolutionary relationships	☐	☐	☐	
6	Explain that the sequences of bases in DNA are used as a means of classification	☐	☐	☐	
7	Explain that groups of organisms which share a more recent ancestor (are more closely related) have base sequences in DNA that are more similar than those that share only a distant ancestor	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
1.2 Concept and uses of classification systems					
1	State the main features used to place animals and plants into the appropriate kingdoms				
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	Classify organisms using the features identified in 1.3.1 and 1.3.2				
4	State the main features used to place all organisms into one of the five kingdoms: animal, plant, fungus, prokaryote, protoctist				
5	State the main features used to place organisms into groups within the plant kingdom, limited to ferns and flowering plants (dicotyledons and monocotyledons)				
6	Classify organisms using the features identified in 1.3.4 and 1.3.5				
7	State the features of viruses, limited to a protein coat and genetic material				

2 Organisation of the organism

You should be able to	Ways to practise skills	R	A	G	Comments
2.1 Cell structure					
1	Describe and compare the structure of a plant cell with an animal cell, limited to: cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, ribosomes, mitochondria, vacuoles				
2	Describe the structure of a bacterial cell, limited to: cell wall, cell membrane, cytoplasm, ribosomes, circular DNA, plasmids				
3	Identify the cell structures listed in 2.1.1 and 2.1.2 in diagrams and images of plant, animal and bacterial cells				
4	Describe the functions of the structures listed in 2.1.1 and 2.1.2 in plant, animal and bacterial cells				
5	State that new cells are produced by division of existing cells				

You should be able to	Ways to practise skills	R	A	G	Comments
6	State that specialised cells have specific functions, limited to: a. ciliated cells – movement of mucus in the trachea and bronchi b. root hair cells – absorption c. palisade mesophyll cells – photosynthesis d. neurones – conduction of electrical impulses e. red blood cells – transport of oxygen f. sperm and egg cells (gametes) – reproduction				
7	Describe the meaning of the terms: cell, tissue, organ, organ system and organism as illustrated by examples given in the syllabus				
2.2 Size of specimens					
1	State and use the formula: magnification = image size ÷ actual size				
2	Calculate magnification and size of biological specimens using millimetres as units				
3	Convert measurements between millimetres (mm) and micrometres (μm)				

3 Movement into and out of cells

You should be able to	Ways to practise skills	R	A	G	Comments
3.1 Diffusion					
1	Describe diffusion as the net movement of particles 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				
2	State that the energy for diffusion comes from the kinetic energy of random movement of molecules and ions				
3	State that some substances move into and out of cells by diffusion through the cell membrane				
4	Describe the importance of diffusion of gases and solutes in living organisms				
5	Investigate the factors that influence diffusion, limited to: surface area, temperature, concentration gradient and distance				

You should be able to	Ways to practise skills	R	A	G	Comments
3.2 Osmosis					
1	Describe the role of water as a solvent in organisms with reference to digestion, excretion and transport	☐	☐	☐	
2	State that water diffuses through partially permeable membranes by osmosis	☐	☐	☐	
3	State that water moves into and out of cells by osmosis through the cell membrane	☐	☐	☐	
4	Investigate osmosis using materials such as dialysis tubing	☐	☐	☐	
5	Investigate and describe the effects on plant tissues of immersing them in solutions of different concentrations	☐	☐	☐	
6	State that plants are supported by the pressure of water inside the cells pressing outwards on the cell wall	☐	☐	☐	
7	Describe osmosis as the net movement of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane	☐	☐	☐	
8	Explain the effects on plant cells of immersing them in solutions of different concentrations by using the terms: turgid, turgor pressure, plasmolysis, flaccid	☐	☐	☐	
9	Explain the importance of water potential and osmosis in the uptake and loss of water by organisms	☐	☐	☐	
3.3 Active transport					
1	Describe active transport as the movement of particles through a cell membrane from a region of lower concentration to a region of higher concentration (i.e. against a concentration gradient), using energy from respiration	☐	☐	☐	
2	Explain the importance of active transport as a process for movement of molecules or ions across membranes, including ion uptake by root hairs	☐	☐	☐	
3	State that protein carriers move molecules or ions across a membrane during active transport	☐	☐	☐	

4 Biological molecules

You should be able to	Ways to practise skills	R	A	G	Comments
4.1 Biological molecules					
1	List the chemical elements that make up: carbohydrates, fats and proteins				
2	State that large molecules are made from smaller molecules, limited to: a. starch, glycogen and cellulose from glucose b. proteins from amino acids c. fats and oils from fatty acids and glycerol				
3	Describe the use of: a. iodine solution test for starch b. Benedict's solution test for reducing sugars c. biuret test for proteins d. ethanol emulsion test for fats and oils e. DCPIP test for vitamin C				
4	Describe the structure of a DNA molecule: a. two strands coiled together to form a double helix b. each strand contains chemicals called bases c. bonds between pairs of bases hold the strands together d. the bases always pair up in the same way: A with T, and C with G (full names are **not** required)				

5 Enzymes

You should be able to	Ways to practise skills	R	A	G	Comments
5.1 Enzyme action					
1	Describe a catalyst as a substance that increases the rate of a chemical reaction and is not changed by the reaction				
2	Describe enzymes as proteins that are involved in all metabolic reactions, where they function as biological catalysts				
3	Describe why enzymes are important in all living organisms in terms of a reaction rate necessary to sustain life				
4	Describe enzyme action with reference to the shape of the active site of an enzyme being complementary to its substrate and the formation of products				

You should be able to	Ways to practise skills	R	A	G	Comments
5	Investigate and describe the effect of changes in temperature and pH on enzyme activity with reference to optimum temperature and denaturation	☐	☐	☐	
6	Explain enzyme action with reference to: active site, enzyme-substrate complex, substrate and product	☐	☐	☐	
7	Explain the specificity of enzymes in terms of the complementary shape and fit of the active site with the substrate	☐	☐	☐	
8	Explain the effect of changes in temperature on enzyme activity in terms of kinetic energy, shape and fit, frequency of effective collisions and denaturation	☐	☐	☐	
9	Explain the effect of changes in pH on enzyme activity in terms of shape and fit and denaturation	☐	☐	☐	

6 Plant Nutrition

You should be able to	Ways to practise skills	R	A	G	Comments
6.1 Photosynthesis					
1	Describe photosynthesis as the process by which plants synthesise carbohydrates from raw materials using energy from light	☐	☐	☐	
	State the word equation for photosynthesis as: carbon dioxide + water → glucose + oxygen in the presence of light and chlorophyll	☐	☐	☐	
3	State that chlorophyll is a green pigment that is found in chloroplasts	☐	☐	☐	
4	State that chlorophyll transfers energy from light into energy in chemicals, for the synthesis of carbohydrates	☐	☐	☐	
5	Outline the subsequent use and storage of the carbohydrates made in photosynthesis, limited to: a. starch as an energy store b. cellulose to build cell walls c. glucose used in respiration to provide energy d. sucrose for transport in the phloem e. nectar to attract insects for pollination	☐	☐	☐	
6	Explain the importance of: a. nitrate ions for making amino acids b. magnesium ions for making chlorophyll	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
7	Investigate the need for chlorophyll, light and carbon dioxide for photosynthesis, using appropriate controls				
8	Investigate and describe the effects of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis				
9	Investigate and describe the effect of light and dark conditions on gas exchange in an aquatic plant using hydrogencarbonate indicator solution				
10	State the balanced chemical equation for photosynthesis as: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$				
11	Identify and explain the limiting factors of photosynthesis in different environmental conditions				
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 in diagrams and images the following structures in the leaf of a dicotyledonous plant: chloroplasts, cuticle, guard cells and stomata, upper and lower epidermis, palisade mesophyll, spongy mesophyll, air spaces, vascular bundles, xylem and phloem				
3	Explain how the structures listed in 6.2.2 adapt leaves for photosynthesis				

7 Human nutrition

You should be able to	Ways to practise skills	R	A	G	Comments
7.1 Diet					
1	Describe what is meant by a balanced diet				
2	State the principal dietary sources and describe the importance of: a. carbohydrates b. fats and oils c. proteins d. vitamins, limited to C and D e. mineral ions, limited to calcium and iron f. fibre (roughage) g. water				

You should be able to	Ways to practise skills	R	A	G	Comments
3	State the causes of scurvy and rickets	☐	☐	☐	
7.2 Digestive system					
1	Identify in diagrams and images the main organs of the digestive system, limited to: a. alimentary canal: mouth, oesophagus, stomach, small intestine (duodenum and ileum) and large intestine (colon, rectum, anus) b. associated organs: salivary glands, pancreas, liver and gall bladder	☐	☐	☐	
2	Describe the functions of the organs of the digestive system listed in 7.2.1, in relation to: a. ingestion – the taking of substances, e.g. food and drink, into the body b. digestion – the breakdown of food c. absorption – the movement of nutrients from the intestines into the blood d. assimilation – uptake and use of nutrients by cells e. egestion – the removal of undigested food from the body as faeces	☐	☐	☐	
7.3 Physical digestion					
1	Describe physical digestion as the breakdown of food into smaller pieces without chemical change to the food molecules	☐	☐	☐	
2	State that physical digestion increases the surface area of food for the action of enzymes in chemical digestion	☐	☐	☐	
3	Identify in diagrams and images the types of human teeth: incisors, canines, premolars and molars	☐	☐	☐	
4	Describe the structure of human teeth, limited to: enamel, dentine, pulp, nerves, blood vessels and cement, and understand that teeth are embedded in bone and the gums	☐	☐	☐	
5	Describe the functions of the types of human teeth in physical digestion of food	☐	☐	☐	
6	Describe the function of the stomach in physical digestion	☐	☐	☐	
7	Outline the role of bile in emulsifying fats and oils to increase the surface area for chemical digestion	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
7.4 Chemical digestion					
1	Describe chemical digestion as the break down of large insoluble molecules into small soluble molecules	☐	☐	☐	
2	State the role of chemical digestion in producing small soluble molecules that can be absorbed	☐	☐	☐	
3	Describe the functions of enzymes as follows: a. amylase breaks down starch to simple reducing sugars b. proteases break down protein to amino acids c. lipase breaks down fats and oils to fatty acids and glycerol	☐	☐	☐	
4	State where, in the digestive system, amylase, protease and lipase are secreted and where they act	☐	☐	☐	
5	Describe the functions of hydrochloric acid in gastric juice, limited to killing harmful microorganisms in food and providing an acidic pH for optimum enzyme activity	☐	☐	☐	
6	Describe the digestion of starch in the digestive system: a. amylase breaks down starch to maltose b. maltase breaks down maltose to glucose on the membranes of the epithelium lining the small intestine	☐	☐	☐	
7	Describe the digestion of protein by proteases in the digestive system: a. pepsin breaks down protein in the acidic conditions of the stomach b. trypsin breaks down protein in the alkaline conditions of the small intestine	☐	☐	☐	
8	Explain that bile is an alkaline mixture that neutralises the acidic mixture of food and gastric juices entering the duodenum from the stomach, to provide a suitable pH for enzyme action	☐	☐	☐	
7.5 Absorption					
1	State that the small intestine is the region where nutrients are absorbed	☐	☐	☐	
2	State that most water is absorbed from the small intestine but that some is also absorbed from the colon	☐	☐	☐	
3	Explain the significance of villi and microvilli in increasing the internal surface area of the small intestine	☐	☐	☐	
4	Describe the structure of a villus	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
5	Describe the roles of capillaries and lacteals in villi				

8 Transport in plants

You should be able to	Ways to practise skills	R	A	G	Comments
8.1 Xylem and phloem					
1	State the functions of xylem and phloem: a. xylem – transport of water and mineral ions, and support b. phloem – transport of sucrose and amino acids				
2	Identify in diagrams and images the position of xylem and phloem as seen in sections of roots, stems and leaves of non-woody dicotyledonous plants				
3	Relate the structure of xylem vessels to their function, limited to: a. thick walls with lignin (details of lignification are **not** required) b. no cell contents c. cells joined end to end with no cross walls to form a long continuous tube				
8.2 Water uptake					
1	Identify in diagrams and images root hair cells and state their functions				
2	State that the large surface area of root hairs increases the uptake of water and mineral ions				
3	Outline the pathway taken by water through the root, stem and leaf as: root hair cells, root cortex cells, xylem, mesophyll cells				
4	Investigate, using a suitable stain, the pathway of water through the above-ground parts of a plant				
8.3 Transpiration					
1	Describe transpiration as the loss of water vapour from leaves				
2	State that water evaporates from the surfaces of the mesophyll cells into the air spaces and then diffuses out of the leaves through the stomata as water vapour				
3	Investigate and describe the effects of variation of temperature and wind speed on transpiration rate				
4	Explain how water vapour loss is related to: the large internal surface area provided by the interconnecting air spaces between mesophyll cells and the size and number of stomata				

You should be able to	Ways to practise skills	R	A	G	Comments
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	Explain the effects on the rate of transpiration of varying the following factors: temperature, wind speed and humidity				
7	Explain how and why wilting occurs				
8.3 Translocation					
1	Describe translocation as the movement of sucrose and amino acids in phloem from sources to sinks				
2	Describe: a. sources as the parts of plants that release sucrose or amino acids b. sinks as the parts of plants that use or store sucrose or amino acids				
3	Explain why some parts of a plant may act as a source and a sink at different times				

9 Transport in animals

You should be able to	Ways to practise skills	R	A	G	Comments
9.1 Circulatory systems					
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 the single circulation of a fish				
3	Describe the double circulation of a mammal				
4	Explain the advantages of a double circulation				
9.2 Heart					
1	Identify in diagrams and images the structures of the mammalian heart, limited to: muscular wall, septum, left and right ventricles, left and right atria, one-way valves and coronary arteries				
2	State that blood is pumped away from the heart in arteries and returns to the heart in veins				

You should be able to	Ways to practise skills	R	A	G	Comments
3	State that the activity of the heart may be monitored by: ECG, pulse rate and listening to sounds of valves closing	☐	☐	☐	
4	Investigate and describe the effect of physical activity on the heart rate	☐	☐	☐	
5	Describe coronary heart disease in terms of the blockage of coronary arteries and state the possible risk factors including: diet, lack of exercise, stress, smoking, genetic predisposition, age and sex	☐	☐	☐	
6	Discuss the roles of diet and exercise in reducing the risk of coronary heart disease	☐	☐	☐	
7	Identify in diagrams and images the atrioventricular and semilunar valves in the mammalian heart	☐	☐	☐	
8	Explain the relative thickness of: a. the muscle walls of the left and right ventricles b. the muscle walls of the atria compared to those of the ventricles	☐	☐	☐	
9	Explain the importance of the septum in separating oxygenated and deoxygenated blood	☐	☐	☐	
10	Describe the functioning of the heart in terms of the contraction of muscles of the atria and ventricles and the action of the valves	☐	☐	☐	
11	Explain the effect of physical activity on the heart rate	☐	☐	☐	
9.3 Blood vessels					
1	Describe the structure of arteries, veins and capillaries, limited to: relative thickness of wall, diameter of the lumen and the presence of valves in veins	☐	☐	☐	
2	State the functions of capillaries	☐	☐	☐	
3	Identify in diagrams and images the main blood vessels to and from the: a. heart, limited to: vena cava, aorta, pulmonary artery and pulmonary vein b. lungs, limited to: pulmonary artery and pulmonary vein c. kidney, limited to: renal artery and renal vein	☐	☐	☐	
4	Explain how the structure of arteries and veins is related to the pressure of the blood that they transport	☐	☐	☐	
5	Explain how the structure of capillaries is related to their functions	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
6	Identify, in diagrams and images, the main blood vessels to and from the liver as: hepatic artery, hepatic veins and hepatic portal vein				
9.4 Blood					
1	List the components of blood as: red blood cells, white blood cells, platelets and plasma				
2	Identify red and white blood cells in photomicrographs and diagrams				
3	State the functions of the following components of blood: a. red blood cells in transporting oxygen, including the role of haemoglobin b. white blood cells in phagocytosis and antibody production c. platelets in clotting (details are **not** required) d. plasma in the transport of blood cells, ions, nutrients, urea, hormones and carbon dioxide				
4	State the roles of blood clotting as preventing blood loss and the entry of pathogens				
5	Identify lymphocytes and phagocytes in photomicrographs and diagrams				
6	State the functions of: a. lymphocytes – antibody production b. phagocytes – engulfing pathogens by phagocytosis				
7	Describe the process of clotting as the conversion of fibrinogen to fibrin to form a mesh				

10 Diseases and immunity

You should be able to	Ways to practise skills	R	A	G	Comments
10.1 Diseases and immunity					
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	State that a pathogen is transmitted: c. by direct contact, including through blood and other body fluids d. indirectly, including from contaminated surfaces, food, animals and air				

You should be able to	Ways to practise skills	R	A	G	Comments
4	Describe the body defences, limited to: skin, hairs in the nose, mucus, stomach acid and white blood cells	☐	☐	☐	
5	Explain the importance of the following in controlling the spread of disease: a. a clean water supply b. hygienic food preparation c. good personal hygiene d. waste disposal e. sewage treatment (details of the stages of sewage treatment are **not** required)	☐	☐	☐	
6	Describe active immunity as defence against a pathogen by antibody production in the body	☐	☐	☐	
7	State that each pathogen has its own antigens, which have specific shapes	☐	☐	☐	
8	Describe antibodies as proteins that bind to antigens leading to direct destruction of pathogens or marking of pathogens for destruction by phagocytes	☐	☐	☐	
9	State that specific antibodies have complementary shapes which fit specific antigens	☐	☐	☐	
10	Explain that active immunity is gained after an infection by a pathogen or by vaccination	☐	☐	☐	
11	Outline the process of vaccination: a. weakened pathogens or their antigens are put into the body b. the antigens stimulate an immune response by lymphocytes which produce antibodies c. memory cells are produced that give long-term immunity	☐	☐	☐	
12	Explain the role of vaccination in controlling the spread of diseases	☐	☐	☐	
13	Explain that passive immunity is a short-term defence against a pathogen by antibodies acquired from another individual, including across the placenta and in breast milk	☐	☐	☐	
14	Explain the importance of breast-feeding for the development of passive immunity in infants	☐	☐	☐	
15	State that memory cells are not produced in passive immunity	☐	☐	☐	
16	Describe cholera as a disease caused by a bacterium which is transmitted in contaminated water	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
17	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, causing diarrhoea, dehydration and loss of ions from the blood				

11 Gas exchange in humans

You should be able to	Ways to practise skills	R	A	G	Comments
11.1 Gas exchange in humans					
1	Describe the features of gas exchange surfaces in humans, limited to: large surface area, thin surface, good blood supply and good ventilation with air				
2	Identify in diagrams and images the following parts of the breathing system: lungs, diaphragm, ribs, intercostal muscles, larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries				
3	Investigate the differences in composition between inspired and expired air using limewater as a test for carbon dioxide				
4	Describe the differences in composition between inspired and expired air, limited to: oxygen, carbon dioxide and water vapour				
5	Investigate and describe the effects of physical activity on the rate and depth of breathing				
6	Identify in diagrams and images the internal and external intercostal muscles				
7	State the function of cartilage in the trachea				
8	Explain the role of the ribs, the internal and external intercostal muscles and the diaphragm in producing volume and pressure changes in the thorax leading to the ventilation of the lungs				
9	Explain the differences in composition between inspired and expired air				
10	Explain the link between physical activity and the rate and depth of breathing in terms of: an increased carbon dioxide concentration in the blood, which is detected by the brain, leading to an increased rate and greater depth of breathing				
11	Explain the role of goblet cells, mucus and ciliated cells in protecting the breathing system from pathogens and particles				

12 Respiration

You should be able to	Ways to practise skills	R	A	G	Comments
12.1 Respiration					
1	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	☐	☐	☐	
2	Investigate and describe the effect of temperature on respiration in yeast	☐	☐	☐	
12.2 Aerobic respiration					
1	Describe aerobic respiration as the chemical reactions in cells that use oxygen to break down nutrient molecules to release energy	☐	☐	☐	
2	State the word equation for aerobic respiration as: glucose + oxygen → carbon dioxide + water	☐	☐	☐	
3	State the balanced chemical equation for aerobic respiration as: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$	☐	☐	☐	
12.3 Anaerobic respiration					
1	Describe anaerobic respiration as the chemical reactions in cells that break down nutrient molecules to release energy without using oxygen	☐	☐	☐	
2	State that anaerobic respiration releases much less energy per glucose molecule than aerobic respiration	☐	☐	☐	
3	State the word equation for anaerobic respiration in yeast as: glucose → alcohol + carbon dioxide	☐	☐	☐	
4	State the word equation for anaerobic respiration in muscles during vigorous exercise as: glucose → lactic acid	☐	☐	☐	
5	State the balanced chemical equation for anaerobic respiration in yeast as: $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$	☐	☐	☐	
6	State that lactic acid builds up in muscles and blood during vigorous exercise causing an oxygen debt	☐	☐	☐	
7	Outline how the oxygen debt is removed after exercise, limited to: a. continuation of fast heart rate to transport lactic acid in the blood from the muscles to the liver b. continuation of deeper and faster breathing to supply oxygen for aerobic respiration of lactic acid c. aerobic respiration of lactic acid in the liver	☐	☐	☐	

13 Excretion in humans

You should be able to	Ways to practise skills	R	A	G	Comments
13.1 Excretion in humans					
1	State that carbon dioxide is excreted through the lungs				
2	State that the kidneys excrete urea and excess water and ions				
3	Identify in diagrams and images the kidneys, ureters, bladder and urethra				
4	Identify in diagrams and images the structure of the kidney, limited to the cortex and medulla				
5	Outline the structure and function of a nephron and its associated blood vessels, limited to: a. the role of the glomerulus in the filtration from the blood of water, glucose, urea and ions b. 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 c. the formation of urine containing urea, excess water and excess ions				
6	Describe the role of the liver in the assimilation of amino acids by converting them to proteins				
7	State that urea is formed in the liver from excess amino acids				
8	Describe deamination as the removal of the nitrogen-containing part of amino acids to form urea				
9	Explain the importance of excretion, limited to toxicity of urea				

14 Coordination and response

You should be able to	Ways to practise skills	R	A	G	Comments
14.1 Coordination and response					
1	State that electrical impulses travel along neurones				
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 of the brain and spinal cord				

You should be able to	Ways to practise skills	R	A	G	Comments
3	Describe the role of the nervous system as coordination and regulation of body functions				
4	Identify in diagrams and images sensory, relay and motor neurones				
5	Describe a simple reflex arc in terms of: receptor, sensory neurone, relay neurone, motor neurone and effector				
6	Describe a reflex action as a means of automatically and rapidly integrating and coordinating stimuli with the responses of effectors (muscles and glands)				
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 as: a. an impulse stimulates the release of neurotransmitter molecules from vesicles into the synaptic gap b. the neurotransmitter molecules diffuse across the gap c. neurotransmitter molecules bind with receptor proteins on the next neurone d. an impulse is then stimulated in the next neurone				
10	State that synapses ensure that impulses travel in one direction only				
14.2 Sense organs					
1	Describe sense organs as groups of receptor cells responding to specific stimuli: light, sound, touch, temperature and chemicals				
2	Identify in diagrams and images the structures of the eye, limited to: cornea, iris, pupil, lens, retina, optic nerve and blind spot				
3	Describe the function of each part of the eye, limited to: e. cornea – refracts light f. iris – controls how much light enters the pupil g. lens – focuses light on to the retina h. retina – contains light receptors, some sensitive to light of different colours i. optic nerve – carries impulses to the brain				
4	Explain the pupil reflex, limited to changes in light intensity and pupil diameter				

You should be able to	Ways to practise skills	R	A	G	Comments
5	Explain the pupil reflex in terms of the antagonistic action of circular and radial muscles in the iris	☐	☐	☐	
6	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	☐	☐	☐	
7	Describe the distribution of rods and cones in the retina of a human	☐	☐	☐	
8	Outline the function of rods and cones, limited to: a. greater sensitivity of rods for night vision b. three different kinds of cones, absorbing light of different colours, for colour vision	☐	☐	☐	
9	Identify in diagrams and images the position of the fovea and state its function	☐	☐	☐	
14.3 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 in diagrams and images specific endocrine glands and state the hormones they secrete, limited to: a. adrenal glands and adrenaline b. pancreas and insulin c. testes and testosterone d. ovaries and oestrogen	☐	☐	☐	
3	Describe adrenaline as the hormone secreted in 'fight or flight' situations and its effects, limited to: a. increased breathing rate b. increased heart rate c. increased pupil diameter	☐	☐	☐	
4	Compare nervous and hormonal control, limited to speed of action and duration of effect	☐	☐	☐	
5	State that glucagon is secreted by the pancreas	☐	☐	☐	
6	Describe the role of adrenaline in the control of metabolic activity, limited to: a. increasing the blood glucose concentration b. increasing heart rate	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
14.4 Homeostasis					
1	Describe homeostasis as the maintenance of a constant internal environment	☐	☐	☐	
2	State that insulin decreases blood glucose concentration	☐	☐	☐	
3	Explain the concept of homeostatic control by negative feedback with reference to a set point	☐	☐	☐	
4	Describe the control of blood glucose concentration by the liver and the roles of insulin and glucagon	☐	☐	☐	
5	Outline the treatment of Type 1 diabetes	☐	☐	☐	
6	Identify in diagrams and images of the skin: hairs, hair erector muscles, sweat glands, receptors, sensory neurones, blood vessels and fatty tissue	☐	☐	☐	
7	Describe the maintenance of a constant internal body temperature in mammals in terms of: insulation, sweating, shivering and the role of the brain	☐	☐	☐	
8	Describe the maintenance of a constant internal body temperature in mammals in terms of vasodilation and vasoconstriction of arterioles supplying skin surface capillaries	☐	☐	☐	
14.5 Tropic responses					
1	Describe gravitropism as a response in which parts of a plant grow towards or away from gravity	☐	☐	☐	
2	Describe phototropism as a response in which parts of a plant grow towards or away from the direction of the light source	☐	☐	☐	
3	Investigate and describe gravitropism and phototropism in shoots and roots	☐	☐	☐	
4	Explain phototropism and gravitropism of a shoot as examples of the chemical control of plant growth	☐	☐	☐	
5	Explain the role of auxin in controlling shoot growth, limited to: a. auxin is made in the shoot tip b. auxin diffuses through the plant from the shoot tip c. auxin is unequally distributed in response to light and gravity d. auxin stimulates cell elongation	☐	☐	☐	

15 Drugs

You should be able to	Ways to practise skills	R	A	G	Comments
15.1 drugs					
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 infections				
3	State that some bacteria are resistant to antibiotics which reduces the effectiveness of antibiotics				
4	State that antibiotics kill bacteria but do not affect viruses				
5	Explain how using antibiotics only when essential can limit the development of resistant bacteria such as MRSA				

16 Reproduction

You should be able to	Ways to practise skills	R	A	G	Comments
16.1 Asexual 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 in diagrams, images and information provided				
3	Discuss the advantages and disadvantages of asexual reproduction: a. to a population of a species in the wild b. to crop production				
16.2 Sexual reproduction					
1	Describe sexual reproduction as a process involving the fusion of the nuclei of two gametes to form a zygote and the production of offspring that are genetically different from each other				
2	Describe fertilisation as the fusion of the nuclei of gametes				
3	State that nuclei of gametes are haploid and that the nucleus of a zygote is diploid				
4	Discuss the advantages and disadvantages of sexual reproduction: a. to a population of a species in the wild b. to crop production				

You should be able to	Ways to practise skills	R	A	G	Comments
16.3 Sexual reproduction in plants					
1	Identify in diagrams and images and draw the following parts of an insect-pollinated flower: sepals, petals, stamens, filaments, anthers, carpels, style, stigma, ovary and ovules	☐	☐	☐	
2	State the functions of the structures listed in 16.3.1	☐	☐	☐	
3	Identify in diagrams and images and describe the anthers and stigmas of a wind-pollinated flower	☐	☐	☐	
4	Distinguish between the pollen grains of insect-pollinated and wind-pollinated flowers	☐	☐	☐	
5	Describe pollination as the transfer of pollen grains from an anther to a stigma	☐	☐	☐	
6	State that fertilisation occurs when a pollen nucleus fuses with a nucleus in an ovule	☐	☐	☐	
7	Describe the structural adaptations of insect-pollinated and wind-pollinated flowers	☐	☐	☐	
8	Investigate and describe the environmental conditions that affect germination of seeds, limited to the requirement for: water, oxygen and a suitable temperature	☐	☐	☐	
9	Describe self-pollination as the transfer of pollen grains from the anther of a flower to the stigma of the same flower or a different flower on the same plant	☐	☐	☐	
10	Describe cross-pollination as the transfer of pollen grains from the anther of a flower to the stigma of a flower on a different plant of the same species	☐	☐	☐	
11	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	☐	☐	☐	
12	Describe the growth of the pollen tube and its entry into the ovule followed by fertilisation (details of production of endosperm and development are not required)	☐	☐	☐	
16.4 Sexual reproduction in humans					
1	Identify on diagrams and state the functions of the following parts of the male reproductive system: testes, scrotum, sperm ducts, prostate gland, urethra and penis	☐	☐	☐	
2	Identify on diagrams and state the functions of the following parts of the female reproductive system: ovaries, oviducts, uterus, cervix and vagina	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
3	Describe fertilisation as the fusion of the nuclei from a male gamete (sperm) and a female gamete (egg cell)				
4	Explain the adaptive features of sperm, limited to: flagellum, mitochondria and enzymes in the acrosome				
5	Explain the adaptive features of egg cells, limited to: energy stores and the jelly coat that changes at fertilisation				
6	Compare male and female gametes in terms of: size, structure, motility and numbers				
7	State that in early development, the zygote forms an embryo which is a ball of cells that implants into the lining of the uterus				
8	Identify on diagrams and state the functions of the following in the development of the fetus: umbilical cord, placenta, amniotic sac and amniotic fluid				
9	Describe the function of the placenta and umbilical cord in relation to the exchange of dissolved nutrients, gases and excretory products between the blood of the mother and the blood of the fetus				
10	State that some pathogens and toxins can pass across the placenta and affect the fetus				
16.5 Sexual hormones in humans					
1	Describe the roles of testosterone and oestrogen in the development and regulation of secondary sexual characteristics during puberty				
2	Describe the menstrual cycle in terms of changes in the ovaries and in the lining of the uterus				
3	Describe the sites of production of oestrogen and progesterone in the menstrual cycle and in pregnancy				
4	Explain the role of hormones in controlling the menstrual cycle and pregnancy, limited to FSH, LH, progesterone and oestrogen				
16.6 Sexually transmitted infections					
1	Describe a sexually transmitted infection (STI) as an infection that is transmitted through sexual contact				
2	State that human immunodeficiency virus (HIV) is a pathogen that causes an STI				
3	State that HIV infection may lead to AIDS				

You should be able to	Ways to practise skills	R	A	G	Comments
4	Describe the methods of transmission of HIV				
5	Explain how the spread of STIs is controlled				

17 Inheritance

You should be able to	Ways to practise skills	R	A	G	Comments
17.1 Chromosomes, genes and proteins					
1	State that chromosomes are made of DNA, which contains genetic information in the form of genes				
2	Define a gene as a length of DNA that codes for a protein				
3	Define an allele as an alternative form of a gene				
4	Describe the inheritance of sex in humans with reference to X and Y chromosomes				
5	State that the sequence of bases in a gene determines the sequence of amino acids used to make a specific protein (knowledge of the details of nucleotide structure is **not** required)				
6	Explain that different sequences of amino acids give different shapes to protein molecules				
7	Explain that DNA controls cell function by controlling the production of proteins, including enzymes, membrane carriers and receptors for neurotransmitters				
8	Explain how a protein is made, limited to: • the gene coding for the protein remains in the nucleus • messenger RNA (mRNA) is a copy of a gene • mRNA molecules are made in the nucleus and move to the cytoplasm • the mRNA passes through ribosomes • the ribosome assembles amino acids into protein molecules • the specific sequence of amino acids is determined by the sequence of bases in the mRNA (knowledge of the details of transcription or translation is **not** required)				
9	Explain that most body cells in an organism contain the same genes, but many genes in a particular cell are not expressed because the cell only makes the specific proteins it needs				

You should be able to	Ways to practise skills	R	A	G	Comments
10	Describe a haploid nucleus as a nucleus containing a single set of chromosomes				
11	Describe a diploid nucleus as a nucleus containing two sets of chromosomes				
12	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				
17.2 Mitosis					
1	Describe mitosis as nuclear division giving rise to genetically identical cells (details of the stages of mitosis are **not** required)				
2	State the role of mitosis in growth, repair of damaged tissues, replacement of cells and asexual reproduction				
3	State that the exact replication of chromosomes occurs before mitosis				
4	State that during mitosis, the copies of chromosomes separate, maintaining the chromosome number in each daughter cell				
5	Describe stem cells as unspecialised cells that divide by mitosis to produce daughter cells that can become specialised for specific functions				
17.3 Meiosis					
1	State that meiosis is involved in the production of gametes				
2	Describe meiosis as a reduction division in which the chromosome number is halved from diploid to haploid resulting in genetically different cells (details of the stages of meiosis are **not** required)				
17.4 Monohybrid inheritance					
1	Describe inheritance as the transmission of genetic information from generation to generation				
2	Describe genotype as the genetic make-up of an organism and in terms of the alleles present				
3	Describe phenotype as the observable features of an organism				
4	Describe homozygous as having two identical alleles of a particular gene				
5	State that two identical homozygous individuals that breed together will be pure-breeding				

You should be able to	Ways to practise skills	R	A	G	Comments
6	Describe heterozygous as having two different alleles of a particular gene				
7	State that a heterozygous individual will not be pure-breeding				
8	Describe a dominant allele as an allele that is expressed if it is present in the genotype				
9	Describe a recessive allele as an allele that is only expressed when there is no dominant allele of the gene present in the genotype				
10	Interpret pedigree diagrams for the inheritance of a given characteristic				
11	Use genetic diagrams to predict the results of monohybrid crosses and calculate phenotypic ratios, limited to 1 : 1 and 3 : 1 ratios				
12	Use Punnett squares in crosses which result in more than one genotype to work out and show the possible different genotypes				
13	Explain how to use a test cross to identify an unknown genotype				
14	Describe codominance as a situation in which both alleles in heterozygous organisms contribute to the phenotype				
15	Explain the inheritance of ABO blood groups: phenotypes are A, B, AB and O blood groups and alleles are A, B and O				
16	Describe a sex-linked characteristic as a feature in which the gene responsible is located on				
17	a sex chromosome and that this makes the characteristic more common in one sex than in the other				
18	Describe red-green colour blindness as an example of sex linkage				

18 Variation and selection

You should be able to	Ways to practise skills	R	A	G	Comments
18.1 Variation					
1	Describe variation as differences between individuals of the same species				
2	State that continuous variation results in a range of phenotypes between two extremes; examples include body length and body mass				

You should be able to	Ways to practise skills	R	A	G	Comments
3	State that discontinuous variation results in a limited number of phenotypes with no	☐	☐	☐	
4	intermediates; examples include ABO blood groups, seed shape in peas and seed colour in peas	☐	☐	☐	
5	State that discontinuous variation is usually caused by genes only and continuous variation is caused by both genes and the environment	☐	☐	☐	
6	Investigate and describe examples of continuous and discontinuous variation	☐	☐	☐	
7	State that mutation is the way in which new alleles are formed	☐	☐	☐	
8	State that ionising radiation and some chemicals increase the rate of mutation	☐	☐	☐	
9	Describe gene mutation as a random change in the base sequence of DNA	☐	☐	☐	
10	State that mutation, meiosis, random mating and random fertilisation are sources of genetic variation in populations	☐	☐	☐	
18.2 Adaptive features					
1	Describe an adaptive feature as an inherited feature that helps an organism to survive and reproduce in its environment	☐	☐	☐	
2	Interpret images or other information about a species to describe its adaptive features	☐	☐	☐	
3	Explain the adaptive features of hydrophytes and xerophytes to their environments	☐	☐	☐	
18.3 Selection					
1	Describe natural selection with reference to: a. genetic variation within populations b. production of many offspring c. struggle for survival, including competition for resources d. a greater chance of reproduction by individuals that are better adapted to the environment than others e. these individuals pass on their alleles to the next generation	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
2	Describe selective breeding with reference to: a. selection by humans of individuals with desirable features b. crossing these individuals to produce the next generation c. selection of offspring showing the desirable features				
3	Outline how selective breeding by artificial selection is carried out over many generations to improve crop plants and domesticated animals and apply this to given contexts				
4	Describe adaptation as the process, resulting from natural selection, by which populations become more suited to their environment over many generations				
5	Describe the development of strains of antibiotic resistant bacteria as an example of natural selection				
6	Outline the differences between natural and artificial selection				

19 Organisms and their environment

You should be able to	Ways to practise skills	R	A	G	Comments
19.1 Energy flow					
1	State that the Sun is the principal source of energy input to biological systems				
2	Describe the flow of energy through living organisms, including light energy from the Sun and chemical energy in organisms, and its eventual transfer to the environment				
19.2 Food chains and food webs					
1	Describe a food chain as showing the transfer of energy from one organism to the next, beginning with a producer				
2	Construct and interpret simple food chains				
3	Describe a food web as a network of interconnected food chains and interpret food webs				
4	Describe a producer as an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis				
5	Describe a consumer as an organism that gets its energy by feeding on other organisms				

You should be able to	Ways to practise skills	R	A	G	Comments
6	State that consumers may be classed as primary, secondary, tertiary and quaternary according to their position in a food chain	☐	☐	☐	
7	Describe a herbivore as an animal that gets its energy by eating plants	☐	☐	☐	
8	Describe a carnivore as an animal that gets its energy by eating other animals	☐	☐	☐	
9	Describe a decomposer as an organism that gets its energy from dead or waste organic material	☐	☐	☐	
10	Use food chains and food webs to describe the impact humans have through overharvesting of food species and through introducing foreign species to a habitat	☐	☐	☐	
11	Draw, describe and interpret pyramids of numbers and pyramids of biomass	☐	☐	☐	
12	Discuss the advantages of using a pyramid of biomass rather than a pyramid of numbers to represent a food chain	☐	☐	☐	
13	Describe a trophic level as the position of an organism in a food chain, food web or ecological pyramid	☐	☐	☐	
14	Identify the following as the trophic levels in food webs, food chains and ecological pyramids: producers, primary consumers, secondary consumers, tertiary consumers and quaternary consumers	☐	☐	☐	
15	Draw, describe and interpret pyramids of energy	☐	☐	☐	
16	Discuss the advantages of using a pyramid of energy rather than pyramids of numbers or biomass to represent a food chain	☐	☐	☐	
17	Explain why the transfer of energy from one trophic level to another is often not efficient	☐	☐	☐	
18	Explain, in terms of energy loss, why food chains usually have fewer than five trophic levels	☐	☐	☐	
19	Explain why it is more energy efficient for humans to eat crop plants than to eat livestock that have been fed on crop plants	☐	☐	☐	
19.3 Nutrient cycles					
1	Describe the carbon cycle, limited to: photosynthesis, respiration, feeding, decomposition, formation of fossil fuels and combustion	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
2	Describe the nitrogen cycle with reference to: • decomposition of plant and animal protein to ammonium ions • nitrification • nitrogen fixation by lightning and bacteria • absorption of nitrate ions by plants • production of amino acids and proteins • feeding and digestion of proteins • deamination • denitrification	☐	☐	☐	
3	State the roles of microorganisms in the nitrogen cycle, limited to: decomposition, nitrification, nitrogen fixation and denitrification (generic names of individual bacteria, e.g. Rhizobium, are not required)	☐	☐	☐	
19.4 Populations					
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	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	☐	☐	☐	
5	Identify the lag, exponential (log), stationary and death phases in the sigmoid curve of population growth for a population growing in an environment with limited resources	☐	☐	☐	
6	Interpret graphs and diagrams of population growth	☐	☐	☐	
7	Explain the factors that lead to each phase in the sigmoid curve of population growth, making reference, where appropriate, to the role of limiting factors	☐	☐	☐	

20 Human influences on ecosystems

You should be able to	Ways to practise skills	R	A	G	Comments
20.1 Food supply					
1	Describe how humans have increased food production, limited to: a. agricultural machinery to use larger areas of land and improve efficiency b. chemical fertilisers to improve yields c. insecticides to improve quality and yield d. herbicides to reduce competition with weeds e. selective breeding to improve production by crop plants and livestock	☐	☐	☐	
2	Describe the advantages and disadvantages of large-scale monocultures of crop plants	☐	☐	☐	
3	Describe the advantages and disadvantages of intensive livestock production	☐	☐	☐	
20.2 Habitat destruction					
1	Describe biodiversity as the number of different species that live in an area	☐	☐	☐	
2	Describe the reasons for habitat destruction, including: a. increased area for housing, crop plant production and livestock production b. extraction of natural resources c. freshwater and marine pollution	☐	☐	☐	
3	State that through altering food webs and food chains, humans can have a negative impact on habitats	☐	☐	☐	
4	Explain the undesirable effects of deforestation as an example of habitat destruction, to include: reducing biodiversity, extinction, loss of soil, flooding and increase of carbon dioxide in the atmosphere	☐	☐	☐	
20.3 Pollution					
1	Describe the effects of untreated sewage and excess fertiliser on aquatic ecosystems	☐	☐	☐	
2	Describe the effects of non-biodegradable plastics, in both aquatic and terrestrial ecosystems	☐	☐	☐	
3	Describe the sources and effects of pollution of the air by methane and carbon dioxide, limited to: the enhanced greenhouse effect and climate change	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
4	Explain the process of eutrophication of water, limited to: • increased availability of nitrate and other ions • increased growth of producers • increased decomposition after death of producers • increased aerobic respiration by decomposers • reduction in dissolved oxygen • death of organisms requiring dissolved oxygen in water				
20.4 Conservation					
1	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				
2	State that some resources can be conserved and managed sustainably, limited to forests and fish stocks				
3	Explain why organisms become endangered or extinct, including: climate change, habitat destruction, hunting, overharvesting, pollution and introduced species				
4	Describe how endangered species can be conserved, limited to: a. monitoring and protecting species and habitats b. education c. captive breeding programmes d. seed banks				
5	Explain how forests can be conserved using: education, protected areas, quotas and replanting				
6	Explain how fish stocks can be conserved using: education, closed seasons, protected areas, controlled net types and mesh size, quotas and monitoring				
7	Describe the reasons for conservation programmes, limited to: a. maintaining or increasing biodiversity b. reducing extinction c. protecting vulnerable ecosystems d. maintaining ecosystem functions, limited to nutrient cycling and resource provision, including food, drugs, fuel and genes				
8	Describe the use of artificial insemination (AI) and in vitro fertilisation (IVF) in captive breeding programmes				
9	Explain the risks to a species if its population size decreases, reducing genetic variation (knowledge of genetic drift is **not** required)				

21 Biotechnology and genetic modification

You should be able to	Ways to practise skills	R	A	G	Comments
21.1 Biotechnology and genetic modification					
1	State that bacteria are useful in biotechnology and genetic modification due to their rapid reproduction rate and their ability to make complex molecules	☐	☐	☐	
2	Discuss why bacteria are useful in biotechnology and genetic modification, limited to: a. few ethical concerns over their manipulation and growth b. the presence of plasmids	☐	☐	☐	
21.2 Biotechnology					
1	Describe the role of anaerobic respiration in yeast during the production of ethanol for biofuels	☐	☐	☐	
2	Describe the role of anaerobic respiration in yeast during bread-making	☐	☐	☐	
3	Describe the use of pectinase in fruit juice production	☐	☐	☐	
4	Investigate and describe the use of biological washing powders that contain enzymes	☐	☐	☐	
5	Explain the use of lactase to produce lactose-free milk	☐	☐	☐	
6	Describe how fermenters can be used for the large-scale production of useful products by bacteria and fungi, including insulin, penicillin and mycoprotein	☐	☐	☐	
7	Describe and explain the conditions that need to be controlled in a fermenter, including: temperature, pH, oxygen, nutrient supply and waste products	☐	☐	☐	
21.3 Genetic modification					
1	Describe genetic modification as changing the genetic material of an organism by removing, changing or inserting individual genes	☐	☐	☐	
2	Outline examples of genetic modification: a. the insertion of human genes into bacteria to produce human proteins b. the insertion of genes into crop plants to confer resistance to herbicides c. the insertion of genes into crop plants to confer resistance to insect pests d. the insertion of genes into crop plants to improve nutritional qualities	☐	☐	☐	

You should be able to	Ways to practise skills	R	A	G	Comments
3	Outline the process of genetic modification using bacterial production of a human protein as an example, limited to: a. isolation of the DNA making up a human gene using restriction enzymes, forming sticky ends b. cutting of bacterial plasmid DNA with the same restriction enzymes, forming complementary sticky ends c. insertion of human DNA into bacterial plasmid DNA using DNA ligase to form a recombinant plasmid d. insertion of recombinant plasmids into bacteria (specific details are **not** required) e. multiplication of bacteria containing recombinant plasmids f. expression in bacteria of the human gene to make the human protein	☐	☐	☐	
4	Discuss the advantages and disadvantages of genetically modifying crops, including soya, maize and rice	☐	☐	☐	

Section 6: Useful websites

The resources listed below will help you to revise and study for your Cambridge IGCSE 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.skoool.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 IGCSE 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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