CAMBRIDGE
International Examinations

Cambridge
IGCSE

Learner Guide

Cambridge IGCSE®
Biology
0610

Cambridge Secondary 2

Contents

How to use this guide

It can be used to help you to plan your revision programme for the theory examinations and will explain what we are looking for in the answers you write. It can also be used to help you revise by using the tick boxes in Section 4, 'What you need to know?', to check what you know and which topic areas of Biology you have covered.

The guide contains the following sections:

Section 1: How you will be tested

This section will give you information about the different types of theory and practical examination Papers that are available.

Section 2: Examination tips

This section gives you advice to help you do as well as you can. Some of the tips are general advice and some are based on the common mistakes that learners make in exams.

Section 3: What will be tested

This section describes the areas of knowledge, understanding and skills that you will be tested on.

Section 4: What you need to know

This shows the syllabus content in a simple way so that you can check:

- the topics you need to know about
- how the Extended syllabus (Supplement) differs from the Core syllabus
- details about each topic in the syllabus
- how much of the syllabus you have covered

Section 5: Appendices

This section covers the other things you need to know, including:

- information about the mathematical skills you need
- information about terminology, units and symbols, and the presentation of data
- the importance of the command words the Examiners use in the examination papers

Not all the information will be relevant to you. For example, you will need to select what you need to know in Sections 1 and 3, by finding out from your teacher which examination Papers you are taking.

Section 6: Cambridge IGCSE Biology useful websites

Section 1: How you will be tested

1.1 The examinations you will take

You will be entered for **three** examination Papers, **two** theory Papers and **one** practical Paper.

You will need to ask your teacher which practical Paper you are taking. Nearer the time of the examination, you will also need to ask which theory Papers you are being entered for:

- If your teacher thinks that you should enter for the examination based on the Core syllabus, you will take Paper 1 (theory), Paper 2 (theory) and **one** of the practical Papers (4 or 5 or 6).
- If your teacher thinks that you should enter for the examination based on the Extended syllabus, you will take Paper 1 (theory), Paper 3 (theory) and **one** of the practical Papers (4 or 5 or 6).

Whether you take Paper 2 or 3 will depend on the progress your teacher thinks you have made and which Paper most suits your particular strengths. You should discuss this with your teacher.

1.2 About the theory Papers

The table gives you information about the theory Papers.

Paper number	How long and how many marks?	What's in the paper?	What's the % of the total marks?
Paper 1	45 minutes (40 marks)	40 multiple-choice questions. You choose one answer you consider correct from a choice of 4 possible answers.	30%
Paper 2	1¼ hours (80 marks)	Short-answer questions and structured questions. You should write your answers in the spaces provided. The Paper tests the Core syllabus.	50% (you do either Paper 2 or Paper 3)
Paper 3	1¼ hours (80 marks)	Short-answer questions and structured questions. You should write your answers in the spaces provided. The Paper tests topics in both the Core and Extended syllabus. The ***Extended syllabus*** consists of the ***core*** plus ***supplement***	50% (you do either Paper 2 or Paper 3)
Practical Paper	see next table	see next table	20%

Total 100%

1.3 About the practical Papers

Twenty percent of the marks for IGCSE Biology are for practical work. Practical work is based only on the Core syllabus.

You will do **one** of the practical Papers shown in the table. Your teacher will tell you which practical Paper you will do. The number of marks varies between the Papers but your final mark will be calculated so that it is worth the same percentage of the total examination as the other practical Papers.

Paper number and type	How long and what it's marked out of?	What's involved?
Paper 4 (coursework)	no fixed time (48 marks)	You design and carry out experiments, which are then marked by your teacher. You will be assessed on 4 skill areas. You need to produce 2 pieces of work for each skill area.
Paper 5 (practical test)	1¼ hours (40 marks)	You do a practical exam, which is supervised by a teacher. There are usually 2 questions testing 4 skill areas.
Paper 6 (alternative to practical)	1 hour (40 marks)	You answer a written paper about practical work. There are usually 2 or 3 questions, which test the same skill areas as Paper 5.

Here is some more detail about each of the practical Papers. If you are unsure of anything, ask your teacher.

1.3.1 Paper 4 (Coursework)

You will carry out several experiments throughout your Biology course, which will be marked by your teacher. Your teacher will mark you on **four** different skill areas (Using apparatus, Observing, Handling results, Planning and Evaluating.)

What you have to do to get a basic (B), medium (M) or high (H) mark is shown below. The differences between basic, medium and high marks are shown below in italics and underlined.

Skill C1: Using apparatus

You follow written instructions to set up and use apparatus correctly. You carry out your work safely.

B: You follow instructions correctly to do a *single* practical operation e.g. testing a sample of food to find out if it contains starch.

You use familiar apparatus with *a little help* on points of safety.

M: You follow instructions correctly to do a *series of step-by-step* practical operations e.g. testing a leaf to find out if it contains starch or investigate the digestion of starch by amylase

You use familiar apparatus *fairly well with no help* on points of safety

H: You follow instructions correctly to do a series of step-by-step practical operations, but you *may need to change one step if things don't work out as you thought* e.g. lower the concentration of amylase if the digestion of starch goes too fast.

You use familiar apparatus *very well* with no help on points of safety.

Skill C2: Observing

You make observations and measurements and write them down clearly.

B: You make suitable observations when given *some detailed instructions*. You record results correctly when given *a detailed table or some help*.

M: You make suitable observations when given *minimal instructions*. You record results correctly when given *an outline table or minimal help.*

H: You make suitable observations *without help and record results as accurately as the apparatus allows.* You record results correctly *without help.*

Skill C3: Handling results

You draw graphs and/or perform calculations from your results. You draw conclusions from your results and recognize any results, which do not fit into the pattern.

B: You draw graphs or charts (or do some calculations) from your results when given *detailed suggestions*.

You draw *simple* conclusions from your results.

M: You draw graphs or charts (or do some calculations) from your results when given *only a little help*.

You draw simple conclusions from your results and *comment on the patterns shown by the data* e.g. a high concentration of amylase causes a faster rate of reaction than a low concentration.

You *comment on results which do not fit the pattern*.

H: You draw graphs or charts (or do some calculations) from your results when given *no help*.

You draw *more general* conclusions from your results and comment on the patterns, e.g. the greater the concentration of amylase, the faster the reaction. You comment on results which do not fit the pattern and *suggest how to deal with them* e.g. ignore them.

You *suggest what errors there are in your experiment.*

Skill C4: Planning and evaluating

You plan your experiment given some basic information from your teacher. You suggest how well your plan worked and modify if necessary.

B: You write a *simple* plan for your experiment.

You modify your plan after doing *several experiments to see which works the best*.

M: You write a plan for your experiment, which has *a series of logical steps in it.*

You modify your plan *after doing trial experiments and give reasons why you need to alter your original plan*.

If there are *two variables* (things which can change e.g. concentration of amylase, concentration of starch)*, you recognise that one variable needs to be changed, while the other is kept the same*. E.g. keep the concentration of starch the same but vary the concentration of amylase.

H: You write a plan for your experiment which has a series of logical *and clearly reasoned steps*.

You modify your plan after doing trial experiments and give reasons why you need to alter your original plan and *suggest to what extent your plan works and why. You suggest how to deal with unexpected results*. If there are *more than two variables you recognise which need to be controlled (kept constant) and which needs to be changed.*

1.3.2 Paper 5 (Practical test)

You do a practical exam, which is supervised by a teacher. In the exam you are given an instruction sheet which enables you to carry out the experiments, handle the data and draw appropriate conclusions. You may be asked to:

- carefully follow a set of instructions in a particular order.
- use familiar and unfamiliar methods to record observations and make deductions from them by performing simple tests, for example tests for food substances, using hydrogen carbonate indicator, litmus and Universal Indicator paper.
- use a scalpel or razor blade, forceps, scissors and mounted needles skilfully.
- use a hand lens to observe and record information about biological specimens.
- make clear line drawings of specimens.
- perform simple arithmetical calculations. E.g. the magnification of a drawing.

1.3.3 Paper 6 (Alternative to practical)

This is a written Paper. You may be asked to:

- carefully follow a set of instructions in a particular order.
- follow familiar and unfamiliar methods to record observations and make deductions from simple tests, for example tests for food substances, using hydrogen carbonate indicator, litmus and Universal Indicator paper.
- observe and record information about biological specimens from images.
- make clear line drawings of specimens from photographs or micrographs.
- perform simple calculations, including the magnification (enlargement) of a drawing.

Section 2: Examination tips

How to use these tips

Much of this advice is given in response to the types of answers that learners have written in the past. These tips are presented under various subheadings to help you when you prepare for your examinations. Some examples of questions and answers are included to illustrate some of the tips.

- Make sure you read all the general tips. These can be important in any of the papers that you take.
- Have a copy of the syllabus to look at as you read through these tips. Note the different columns – the left hand side has all the Core topics; the right hand side has the Supplement topics.
- Make sure you know which examination papers you are taking before you look at the tips for the different papers.
    - You will take Paper 1, which is a multiple choice paper.
    - You will take EITHER Paper 2, which is set on the Core syllabus, OR Paper 3 which is set on the Core and the Supplement.
    - You will take EITHER Paper 4, which is coursework, OR Paper 5, which is the Practical Examination, OR Paper 6, which is the written paper about practical work known as the Alternative to Practical (often called the ATP).

General advice

- Use your syllabus all the time while you are revising and preparing for the examination papers.
- You must know which topics you will be tested on.
- Make sure you have all the equipment you will need for the exam in a clear, plastic container. You need two pens, pencils (preferably HB or B), a clean eraser, a ruler (which measures in mm), a pencil sharpener and a calculator.

Answering questions

- The questions are meant to let you show the biology that you have studied. When you are writing your answers remember that another person has to be able to read it.
    - Do not waste time by writing out the question before you start to answer.
    - Keep your handwriting clear and legible.
    - Keep your answers on the lines on the question paper. Do not write in the left hand side of the paper or in the column marked *For Examiner's use*. This is because papers are scanned and the Examiners mark them online. If you write in the margin your answers may not be visible.
    - If you wish to change an answer, cross out your first answer and rewrite. Do not write over what you have already written.
    - If you have to cross out something, put a line through it, do not scribble over it.
    - If you run out of space, use white space on another part of the exam paper for a continuation answer; do not try to squeeze in your answer by using very small writing.
    - If you have to use a different space for a rewritten another answer or to continue an answer, put a note to tell the Examiner where it is, e.g. 'see page 5'.

- Always try to write accurately using the correct biological terms. Learners often lose marks because they do not use the vocabulary of biology correctly.
- Do not use words like 'it', 'they', 'effect', 'affect' without any more explanation. A sentence like 'It has an effect on the body' or 'They affect the process' does not say anything.

Example 1

Question
State why magnesium ions are important for healthy plant development. [1]

Answers:
– "They are needed by the plant" is true but too vague.
– "They are needed by the leaves" is still too vague.

If these are the first answers that come into your head, ask yourself: What is it or they? What is the "need"?
– "Magnesium is needed to make chlorophyll" is a better answer and would gain the mark
– "Magnesium is part of each chlorophyll molecule" Good answer, one mark!

- If you want to use the word 'it' or 'they' – think 'what is it?' or 'what are they?' and then phrase your answer more precisely.
- If you want to use the word 'affect' or 'effect' – think 'how do they affect' or 'what is the effect that they have?'

Terms

- These are the names used in biology. Many of them are given in the syllabus. These terms will be used in questions. You will get more marks if you can use them correctly in your examination. Ask your teacher if you are unsure of the meanings of the biological terms used in the syllabus and in any textbook you are using. It is a good idea to write your own biological dictionary using the glossaries at the back of books. You will notice that many terms are defined in the syllabus, so that is a good place to start when making your own dictionary.
  - Try to use the correct spelling. The person marking your answer will try to recognise what word you mean, but if the spelling is too far out or ambiguous, then they cannot allow you a mark.
  - Some biological terms have very similar spelling. One example is 'ureter', urethra' and 'uterus'. If the answer is ureter and your mis-spelling is 'uretus', it is not clear enough as you could have thought the answer is 'uterus'. Other common examples are ovum/ova, ovary and ovule; testes and testa; sucrose and sucrase. Make sure you write clearly and always try to spell as accurately as you can.
  - Do not try to mix the spellings of two words when you are not sure which of them is the correct answer. For example, you might write 'meitosis' when you are not sure whether the answer is mitosis or meiosis, or urether, when you are not sure if the answer is ureter or urethra. In both cases you would not get the mark.
  - You need to check carefully that you have used the right word when similar terms are used in the same topic, e.g. urea and urine, ureter and urethra, semen and sperm.

Writing in your own words.

- You sometimes have to write two or more sentences to answer a question.
    - Use short sentences. If you write long sentences you can become confused and your meaning is lost. You might also write something contradictory. It is hard for the Examiner to find correct statements in a muddled answer.
    - You are often asked to write down something you have learned. Make sure you have learnt the meanings of the common terms used in biology, e.g. photosynthesis, osmosis and fermentation.
    - In the revision checklist there is a list of the terms which you should be able to define. You also need to be able to write down the meaning of more complicated ideas, e.g. levels of organisation, natural selection, artificial selection, global warming and eutrophication.

What you should look for in a question

The number of marks

- In Paper 1 there is one mark for each question.
- The number of marks is printed on the examination papers for Papers 2, 3, 5 and 6. The mark available for each part question is printed in square brackets, e.g. [2]. The number of marks helps you decide how much to write. The total number of marks for each question is printed at the end of the last question, e.g. [Total: 12].
- The number of marks is a guide to how long to spend on each question or parts of a question.
- Do not waste time and write a long answer for a question which has one or two marks. You will not get any extra marks even if your answer is full of many correct and relevant statements.
- If there are two or more marks do not write the same thing in two different ways, e.g. "The leaf is very large. The leaf has a large surface area". Notice that the second sentence is more accurate and is preferable to the first one.

The instructions

- These are called command words and tell you what to do.
- You can find all the command words in the Glossary of terms used in science papers which is at the end of your syllabus.
- If a question asks you to 'Name' or 'State' **two** things only the first two will be marked. Use the numbered lines for your answers if they are given on the question paper. If you write more than two and the first is correct, the second one is wrong, and the third one correct, you will only get one mark.
- Some questions have two commands in the question, for example 'Predict and explain'. This means you have to say what you think will happen AND then say why you think it will happen. Usually the word **and** is printed in bold type to help you. See the section below for a tip about answering questions that have two command terms and require an extended answer.
- The table on the following page has a list of terms used in biology papers to tell you what to do in an answer. Make sure you know what you should do in response to each command word.

Example 2

Question 1

Name the process by which green plants make sugars. [1]
All you need to write for your answer is 'photosynthesis'.

Question 2

Define the term *photosynthesis*. [2]
This requires a full sentence:

'The process by which green plants make carbohydrates from raw materials using energy from light'.
This is very similar to the definition given in the syllabus so would easily gain both marks.

What the question is about

- Make sure you know which part of your biology is being tested.
- Read the whole of a question including all the stimulus material and parts (a), (b), (c) (i) and (c) (ii), etc. carefully before you begin to answer. Some of the parts have similar answers so you need to work out the differences between them. If you write exactly the same thing in different parts of the same question, then only one of them might be a correct answer.
- There is often stimulus material for each question. This might be a photograph, diagram, drawing, flow chart, table of data, graph or just some text. Read all of this information carefully and study any pictures, tables or graphs that are included. All of it is relevant to the questions.
- The stimulus material is often about something you have not studied. Do not panic. There will be enough information in the question for you to work out an answer. You are being tested on your ability to **apply** your knowledge to new information.
- All the different parts of a question may be about the same topic, e.g. digestion or photosynthesis, but you should be prepared for questions that test different topics, e.g. digestion, enzymes and assimilation.
- Look for clues in the words of the question. For example, if you see the word mammal in the question, you know that the animals are warm blooded and have biological systems like ours.
- If you are only given a Latin name or a name you do not recognise, e.g. eland, look to see if you are told anything about it. If you are told that an eland is a herbivore, then you know it eats plants.
- Answer each question as far as you can. Do not spend a long time staring at a question.
- If you do not know the answer or how to work it out, then leave it and come back to it later. It is best to put a mark by the side of the question so you can find it easily. An asterisk (*) is a good idea or a large question mark against the letter of the part question. Not all part questions have answer lines so a question you may not see a question that you have left out when you turn through your script towards the end of the examination.
- Try not to leave blanks. Always check through your script towards the end of the examination. When you come back to a question you may remember what to write an answer to a question that you left out earlier in the exam.
- Do not waste time by writing about things unrelated to the question.

Example 3

It helps to highlight the main features of a question. You cannot use a highlighter pen, so the best thing to do is to underline or circle key words in the questions.

Question

Name the tissue that transports the sugars made by photosynthesis to other parts of the plant [1]

This tells you that should write a one word answer about plant transport of sugars. Underline the command word (which is not always at the start of the question) and the biological terms as you read the question.

Command words

- **You can find out more about command terms in the 'Glossary of terms used in science papers' towards the end of the syllabus. These notes should help you know how to respond to each of the command words.**

Command words	What you should do in response to each command word
Define	Give a definition – use the definitions given in the syllabus
What do you understand by the term .....?	Give a definition or a fairly brief explanation of what the term means. You can use an example to illustrate if this seems appropriate
State	Brief answer – maybe one word or a phrase
List	A number of brief answers should be given; usually you are asked for a specific number of points. You do not gain extra marks by writing more than the number stated
Describe	You may have to describe the steps in a process or describe the appearance of a biological structure You may also have to describe some data given in a table or a graph. Make sure you have the correct vocabulary for such a description. Use the words increase, decrease, constant, peak, maximum, minimum, etc.
Explain	This is **not** the same as describe. You should give an answer that has some reasons. You may have to explain why something happens or how it happens
Discuss	You may be asked to discuss advantages and disadvantages – so make sure you give some of both. Much depends on the type of question, but 'discuss' usually means you should give different sides of a story or an argument
Outline	This is not the same as describe. You should give the main important points without any detail

Command words	What you should do in response to each command word
Predict	This means you should state what you think will happen. You may be asked to justify your prediction or explain it; explanation is not required if all the question says is "predict...."
Suggest	This is often used when there is no one correct answer; you should look through the information you have been given for some clues as to what to 'suggest' in response to the question. Many problem-solving questions use this command word
Calculate	This is obvious; make sure you know how to calculate percentages, percentage changes, rates and ratios (for genetics). Always give your working even if not asked. Always make sure you use the correct units
Measure	You should use a suitable measuring instrument to take a reading. Usually this involves using a ruler to measure to the nearest mm. Make sure you write down the unit after the numerical answer
Determine	This is **not** the same as 'measure'. Either you should explain how an experiment should be set up to take measurements or how you should make a calculation from some results or data given in a table or graph
Estimate	You do not have to give an accurate answer – but your answer (which is usually numerical) should only be approximate
Sketch	This is usually used about graphs. You should put a line (straight or curved) on a pair of axes. This may be a graph that has a line on it already or it may be pair of axes printed on the exam paper without a line or curve

The style of questions

Identify features of cells, tissues, organs or other structures

- You may be expected to name some structures that are identified by letters on a diagram or drawing.
- You may have to put labels on a diagram using label lines.

Example 4

Question
Use label lines to identify the following on the drawing of a flower: petal, sepal and stamen. [3]
To answer this question:

- You have to know the structure of a flower.
- You also have to be able to find the structures on a diagram of a flower that you may never have studied.
- You then have to draw a label line to the structure and write the name next to the labelling line. If you do not draw a label line you may not get any marks even if you have found the correct structure.

Use information given in the question

- Questions may ask you to 'Use examples from...' or 'Use **only** the information in ....' or 'With reference to Fig. 6.2'. If you read instructions like these, find out what you are expected to use as examples or take information from. You will not get any marks if you use examples from somewhere else. The information can be given to you in different ways:
    - a diagram, such as a food web, a set of apparatus or a biological structure;
    - a graph, which could be a line graph, a bar chart or a histogram – always check the headings and units carefully;
    - a table – always read carefully the headings of the columns and/or rows and look for any units.

Example 5

You may have to give examples to show that you understand an idea in Biology.

Question that includes a food web as its stimulus material.

Name one example of each of the following from the food web: producer, primary consumer and tertiary consumer.

- To answer this question you have to know definitions of producers, primary consumers and tertiary consumers. Then you have to show that you understand how these terms apply to the food web shown in the diagram. If you put examples from other food webs you have learned, you will not get any marks.

Example 6

Question that includes a diagram of a cross section of a leaf.

Describe **and** explain the advantage of the distribution of chloroplasts in leaves, as shown in the diagram.

- To answer this question you have to observe the diagram and describe which cells have the most chloroplasts. Then you have to work out why this arrangement might help photosynthesis. If you only write about the functions of chloroplasts you will not get any marks.

Interpret tables and graphs

- The stimulus material may be in the form of a table, line graph, bar chart or histogram.
- Always read the introductory text very carefully before you study the table or graph. Underline key points in the information that you are given. In Paper 3, there may be quite a bit of introductory text explaining how the information was collected, e.g. from an investigation.

Tables

- Look at the column and row headings in a table and make sure you understand them. If you have read the introduction carefully, then you will.
- Find the units that have been used. Make sure you use them if you give any figures in your answer.
- Use a ruler to help read the table. Start on the left with the first column. This should be the independent variable and should increase in steps. Now put the ruler to the right of the next column and look at the figures in this second column. Look for a pattern or trend in the figures. Identify the pattern or trend first before thinking of an explanation. Move the ruler across to the right of the third column if there is one and continue in the same way. It may help to sketch a little graph on the exam paper to help you identify any pattern or trend.

Line graphs

- Look carefully at the *x*-axis which is the independent variable and make sure you understand what has been changed. Look carefully at the *y*-axis which is the dependent variable. Both variables should be described in the introduction to the question.
- Put your ruler against the *y*-axis and move it gradually across the graph from left to right. Follow the pattern or trend of the line (or each line if there is more than one). Mark on the graph where something significant happens. For example, the line might show that the dependent variable becomes constant (gives a flat horizontal line).

Bar charts and histograms

- Look carefully at the *x*-axis and the *y*-axis to see what has been plotted. Again, it is a good idea to move a ruler across the bar graph or histogram to help you concentrate on one aspect at a time. You can identify the highest and lowest figures and see if there is any pattern.
- You should make yourself some notes about the table, graph or histogram before answering the questions.
- On Papers 2 and 3, you might be asked to complete a graph, bar chart or histogram. If so, you should look carefully at the question to see what you are being asked to do. You may have to add one or more points to a line graph and then add a suitable line. There is advice about how to draw lines on line graphs in the section of general tips for Papers 5 and 6.

Do calculations

- If you are asked to do a calculation:
    - You may have to find the figures from a table or graph.
    - Write out all the working for your calculation. If you make a mistake and give the wrong answer, you may well be given marks for showing how to do the calculation.
    - Make sure that you show the units in the calculation.
    - If the units are not given on the answer line, then make sure you write them after your numerical answer.
    - Often you will be asked to carry out a calculation and add the result to a table. Always express your answer in the same way as the figures given in the table. If the other figures are 5.6 and 4.6, then your answer should be given to one decimal place, even if the answer is a whole number where you should write 7.0, not 7.
    - If you use a calculator, round up or down the figures – do not copy all the figures after the decimal point.

Show or complete equations

- If you are taking Paper 2, then you should know word equations for photosynthesis, aerobic and anaerobic respiration. If you are taking Paper 3, then you should also know the chemical equations and be able to use the chemical symbols correctly. You should know the correct formulae for the compounds involved.
- If you are asked to give either a word or a symbol equation, do not combine symbols and words in the same answer.

Example 7

Question
Write the word equation for anaerobic respiration in yeast [2]

Correct answer:

glucose → carbon dioxide + ethanol + energy

This is an incorrect answer: "glucose → CO_2 + ethanol and energy", as there is a mixture of words and symbols. It would probably get one mark out of two.

Question
Write the chemical equation for anaerobic respiration in yeast [2]

Correct answer:

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + \text{energy}$$

Note that you should use subscripts correctly when writing out the formulae of glucose, alcohol (ethanol), carbon dioxide, lactic acid and water in these equations.

Example 8

Question
State **two** ways in which arteries differ from veins. [2]

Correct answer:
1 Arteries have thicker walls than veins.
2 Veins have semi-lunar valves, but arteries do not.

Ambiguous answer:
1 They have thick walls.
2 They don't have valves.

No marks would be given to the second answer as the comparisons have not been made.

Question
Complete the table to compare the structure of arteries with the structure of veins [2]
Correct answer

Arteries	Veins
has thick wall	has thin wall
thick muscle layer	very thin muscle layer

Incorrect answers as the comparisons are not made between the same features.

Arteries	Veins
thick wall	thick elastic layer
no valves	small amount of muscle

In cases like this, it is much better to have an extra column that gives the features to be compared:

Feature	Arteries	Veins
thickness of wall	thicker	thinner
valves	absent	present

This ensures that you make direct comparisons in each row of the table. You can always add a first column if it is not included in the question.

Make comparisons

- If you are asked to compare two things make sure you make it clear which thing you are writing about.
    - The question may ask you to compare two structures or two processes that you have learnt about. Sometimes you may be expected to do this on answer lines in which case you must make clear the items that you are comparing (see example 8).
    - You may be given a table to complete. This may be blank and you have to fill it in, or it may already have some entries and you complete it.
    - If you are given lines to make the comparison, it is perfectly acceptable to draw a table for your answer.
    - A question may give a table of data and then ask you about it. Make sure you only use information from the table; for example, in a table that shows the composition of normal breast milk and colostrum, you can see which milk contains more fat, protein and sugar. Your answers should start with 'colostrum has more …….. than breast milk' or 'breast milk has more …… than colostrum'. Do not put 'It has more protein'.

- **Extended writing.** You are required to write longer answers to questions that have four or more marks. There are more of these questions in Paper 3 than in Paper 2.

Example 9

Question
Explain what happens if excess nitrogen fertiliser is washed into a stream or pond [4]

The mark scheme for a question like this will have a list of points that the Examiner will be looking for in your answer. There will be more points than there are marks, so you do not need to put them all in your answer. The points for this question could be:

– Algae and aquatic plants grow faster using the fertiliser.
– Algae cover the water surface.
– Light cannot pass to aquatic plants lower down.
– These plants die.
– Bacteria/decomposers, decay or feed on the dead plants.
– Bacteria/decomposers, increase in numbers.
– Bacteria/decomposers use aerobic respiration.
– They use up oxygen.
– There is not enough oxygen for the respiration of other organisms which live in the water.
– These organisms die.
– The process is called eutrophication.

If your answer is something like 'The fertiliser causes low oxygen and it affects animals in the water' you will not get any marks. The answer is much too short and too vague. If your answer is something like 'The animals do not have enough oxygen for their respiration and they die' you may get two marks.

- When you answer these questions always use full sentences if you can. If you find it helps to write bullet points, then make sure each bullet point is a full sentence. If you abbreviate your answer too much by writing notes, then you may not convey enough information to gain the marks.
- If you are giving a sequence of events (as in Example 9), then you should make sure they are in a logical order. If you are explaining a biological principle or making comparisons, then give the main points first.
- If you are describing something that moves from one place to another, then make sure you include the direction of movement. For example, 'water moves by osmosis' is unlikely to gain a mark unless you include the direction; 'water enters the cell by osmosis' is a much better answer.

The rest of these tips concern the individual papers

Paper 1

- You have about one minute to read and answer each question. Each question tests just one topic.
- Some questions test what you know and understand. For example: What tissue in the eye detects light?
- Some questions test if you can apply what you have learned to understand new data. These questions will often have a diagram, graph or table to use.
- Try to decide what the question is testing as you are reading it. The sequence of questions usually follows the sequence of topics in the syllabus. Therefore you can expect the early questions to ask about Section I on characteristics of life and classification and those at the end will be on Section IV about ecology and the environment.

Example 10

Question
Four blood vessels are labelled as **A**, **B**, **C** and **D** on a diagram of the human circulatory system.
This is followed by the question:
In which vessel will absorbed alcohol first be found?

You need to think about what the question is asking
- Is it about digestion?
- Is it about excretion (of alcohol)?
- Is it about the circulation?

The question is asking about something absorbed from the gut to be transported, so it is about circulation.
- Which vessel carries substances absorbed by the gut?
- Answer 'The Hepatic Portal Vein'.

So you have to decide whether the vessel is an artery or a vein, then realise that it is a vein taking blood away from the organ that absorbs alcohol.

Then choose the letter which labels the hepatic portal vein.

- Do not try to find a pattern in the order of your answers (e.g. A, B, C, D, A, B....)
  - The same letter could be the correct answer for several questions in a row.
  - Letter **A** might be the correct answers for more questions than **B**, **C** or **D**. Or there could be fewer correct answers shown by letter **D** than any of the others.
  - Do not let what you have chosen for the previous questions influence which letter you choose.

Paper 2

- Most of the questions require short answers. This means that you write mainly one word or one sentence answers worth one mark.
- Longer answers will need two or three sentences with two or three different ideas. Always look at the number of marks for each part question to help you decide how much to write.
- Look at the number of command words: ask yourself 'do you have to do one or two things?'
- Use the lines given. Stick to the point and do not write too much.
- Only give the number of answers that are asked. Use the numbered lines and give one answer per line.
- There will only be a few parts of questions that need extended writing. These will have four [4] or [5] marks. The question will often be related to some information you are given. You will need to write four or five sentences in a sequence that makes sense. You can think of it like 'telling a story with a beginning, a middle and an end'. Remember to refer to any information you are given.

Paper 3

- There is more to read in this paper than in Paper 1 and Paper 2.
- Many questions will be based on one, two or three sentence answers. Always look carefully at the number of marks for each part question.
- Look carefully at the number of command words – do you have to do one or two things, for example describe **and** explain.
- Look carefully to see if you are asked for an actual number of answers. Only give that number. Use the numbered lines and give one answer per line.
- There are questions that may start in one part of the syllabus and link to another, e.g. the information could be about the animals in a particular habitat and what they eat. The first parts of the question might be about the food chains or food webs which include these animals. A later part of the question could be about teeth or about factors in the environment.
- You are likely to be asked to interpret unfamiliar data, e.g. results from an experiment that you may not have carried out or could not be carried out in a school. Do not be put off. Follow the same advice as before. There will always be enough information in the question for you to answer it.
- You are likely to have questions about events and situations that are new to you. Do not be put off. The question will tell you all you need to know. Read the information carefully and if it is not immediately apparent, look for clues that will tell you which part of the syllabus the question is about.

Papers 5 and 6

General tips

- Read through the questions carefully, looking to see how many marks are given for each question.
- In Paper 5, you have to follow a set of instructions. Read these to the end first, before you start.
- In Paper 6, you will have to read some information about an experiment. Again, read these very carefully.
- Divide the time of your examination in proportion to the marks given.
- If you are taking Paper 6, make sure that you have done plenty of practical work so you can imagine what has happened to obtain the results that you will process, analyse and interpret in the questions.
- Make sure that you have a **sharp pencil** to use for making drawings and drawing graphs and charts. Do not draw in ink because you cannot make changes as you can when using a pencil.
- Make sure you have a good, clean eraser for rubbing out your pencil lines if necessary. Do not press too hard when using a pencil for making drawings, graphs or charts. Sometimes it is hard for an Examiner to tell which is your final line on a scanned script.

Recording your observations

In both papers you are expected to make observations and record them.

- You can record your observations:
  - as statements in writing
  - in tables
  - by using drawings
  - by constructing tally charts
- You can process your observations by:
  - carrying out calculations, e.g. percentages and percentage changes
  - plotting graphs – line graphs, bar charts and histograms.
- Use all the space available on the paper for your observations.
- Do not write an explanation until the question asks for one.
- Use a sharp HB or B pencil. It can be rubbed out easily if you need to correct a mistake. Use a good eraser as traces of pencil lead are detected when your paper is scanned.
- Do not forget headings for the columns and the rows in tables and in axes on graphs. Do not forget to include the units.
- Make drawings as big as the space allows.
- Use a ruler for labelling lines.
- Label in pencil.
- Use one clear continuous outline not an artistic drawing. Do not shade other than using very light dots.

Drawing tables

- If you are asked to draw a table:
  - Use a ruler and a pencil to draw the table. Make sure you rule lines for the columns and the rows.
  - Write headings for each column and/or row of the table.
  - Write in units if they are needed, e.g. volume of water/cm^3, mass of seed/g. The unit should be written after the oblique line (forward slash).
  - Do not put units in the table spaces where you write numbers.
- Make sure you use the same number of decimal places in each column and/or row.
  - If you are asked to draw and/or complete a tally chart for recording data:
  - Make sure that you rule up a table and use clear headings.
  - Record the numbers by using strokes and putting an oblique line to represent 5:
    /// = 3; //// = 4 and 𝍸 = 5
  - Include a column to show the total numbers.

Drawing line graphs

- If you are asked to draw a graph:
  - Choose a scale which uses most of the grid provided on the exam paper.
  - Choose a simple scale, e.g. one large square is equal to 1, 2, 5 or 10 units in the data. Do not make it difficult to plot the data by using a scale such as one large square = 3 or 6.
  - Write the name of each axis and the correct unit, e.g. rate of water loss/g per h, temperature/°C, time/s.
  - Plot the points exactly using a sharp pencil. Draw the points lightly so that you can rub them out if you need to. Make them more definite when you are sure they are right.
  - Use a cross (x) or a dot in a circle (⊙) for your plot points. Do not use a single dot as it may not be seen after you have drawn your line.
  - If you have to plot two lines on a graph, use two different symbols for the plot points. You can use a cross, a dot in a circle or a plus sign (+). Label each line carefully or use a key. Use a pencil for both lines; do **not** use a blue or black pen or different colours as these do not show up on scanned scripts.
  - Read the question carefully before you put a line in the graph. Look carefully at the points. You have to decide whether to use a straight line of best fit, a smooth curve of best fit or join the points by straight lines. Always use a **sharp** pencil.
  - Remember that lines of best fit do not have to pass through the point where the two axes meet (the origin). If you are sure that 0, 0 is a point then you can include it. For example, in an investigation of the effect of the concentration of enzyme on enzyme activity 0, 0 means that there is no enzyme present. If there is no enzyme there can be no activity, so 0, 0 could be included.
- Do not extend your line graph beyond the last plotted point.

Bar charts have separate columns that do not touch – there are gaps in between; histograms have columns that do touch each other. Bar charts are used to show data on discontinuous variables, for example blood groups, eye colour, etc.; histograms are used to show data on continuous variables, e.g. length, mass, speed, volume, etc.

Drawing bar charts

- You may have to draw a bar chart (Papers 5 or 6) or add some data to a bar chart (Papers 2 and 3). You draw a bar chart when you have different categories, such as the numbers of six different species in a habitat.
    - Choose a scale which uses most of the grid provided on the exam paper; do not make the chart too small.
    - Draw the chart in pencil.
    - Rule the columns evenly so that they are all the same width.
    - Take care to rule the top of each block in the correct place – double check with the table of data each time.
    - The spaces between the columns on the *x*-axis should be identical; they should be the same length, e.g. one large square on graph paper.
    - The *y*-axis should be properly scaled with equal intervals just as in a line graph.
    - The *y*-axis should be labelled with units.
    - The lines or blocks can be arranged in any order, but to make comparisons it helps if they are arranged in descending or ascending order of size.
    - You should identify each block by putting a label directly underneath each block. Do not shade the blocks or colour code them.

Drawing histograms

- Histograms are ways of displaying the variation in a particular feature, for example the lengths of leaves on a tree. If you measure the lengths of leaves you would have to divide the data into classes, such as 50–54 mm, 55–59 mm, 60–64 mm, etc. The numbers would be recorded in a tally table.
    - Choose a scale which uses most of the grid provided on the exam paper; do not make the histogram too small.
    - Draw the histogram in pencil. The *x*-axis represents the independent variable and is continuous. It should be properly scaled and labelled with appropriate units.
    - The blocks should be drawn touching.
    - The *area* of each block is proportional to the size of the class. It is usual to have similar-sized classes (as in the example above) so the widths of the blocks are the same.
    - The blocks should be labelled either by putting the class ranges (e.g. 60–64, 65–69 etc.) underneath each block or by putting the lowest number in each range (e.g. 60, 65, 70, etc.) under the left-hand side of the relevant block.
    - The *y*-axis represents the number or frequency and should be properly scaled with equal intervals. It should be labelled with appropriate units.

Planning investigations

Sometimes you are asked to suggest a way of carrying out an investigation or to improve the method that is in the question paper.

- When you read through an investigation try to work out three main things:
  1. What is being changed – this is called the independent variable.
  2. What is being measured – this is called the dependent variable.
  3. What is being kept the same – these are the control variables.

Example 11

In a question to investigate the effect of temperature on enzyme activity:

- the independent variable is temperature.
- the dependent variable may be the time taken for a solution of the substrate to change its appearance.
- the key control variables are the concentration of the enzyme solution, the volume of the enzyme solution, the concentration of the substrate solution and the volume of the substrate solution. These are the variables that must be kept constant if you are to find out the effect of changes in temperature.

- Some investigations need to have two parts:
  - The experimental – which measures the process being studied and contains the living organism, part of an organism (e.g. a leaf) or enzyme being tested.
  - The control – which will be exactly the same as the experimental except that the living organism will be missing or replaced by something non-living. The control shows that the results are due to the activity of the living organism and is not due to the apparatus or an environmental factor.
- All investigations should be repeated to increase the reliability of the results. If the same results are achieved (or the results are very similar) then they are reliable.
- The precision of results taking may not be very good. For example, if you are measuring using a syringe or measuring cylinder it may be difficult to measure to the nearest cm^3. You should think about ways in which the precision can be improved.
- Give quantities in appropriate terms – avoid the use of term 'amount' as this does not convey precise meaning to any specific quantity. 'Amount' could mean volume, mass or concentration. Always be precise and use these words; avoid writing the word 'amount'. For example, you can give the volume in cm^3, mass in grams and concentration in an appropriate unit such as grams per 100 cm^3.

Tips for paper 5

In paper 5 you are following instructions, using laboratory equipment, making observations, recording results and drawing conclusions.

- Start by reading the entire first question.
- Think about the apparatus that you will use for each step and imagine using it in your mind.
- Check the time to be allowed and imagine following the instructions.
- Do the same when you are ready to begin the next question.

Following the instructions

- Follow the instructions for practical methods exactly. If you make a change in the method you can alter the results.
- Do not take short cuts.
- Always label test tubes and other containers to help you remember which is which.
- If you are told to 'Wash the apparatus thoroughly after each use' make sure you do. If there is anything left in the apparatus the next stage may not work.
- If you have to measure a specimen make sure you draw a line on your drawing to show where you made your measurement.
- It is a good idea to put a tick by the side of each instruction when you have completed it. This helps you to find the right place in the instructions, so that you do not leave out a step or repeat a step when it is not required.
- Keep your exam paper on a part of the bench which you can keep dry. Do not pour liquids or use syringes or pipettes over your exam paper. If you keep our exam paper away from the 'wet' part of your bench you are unlikely to spill anything on it.

Recording your observations

- Do not forget that observations can be seen, heard, felt and smelled, e.g. colour, fizzing, warming, smell of a flower, texture (feel) of a fruit.
- You can always find something to observe, so make sure you record something for each observation.
- Write down **exactly** what you observe.
- e.g. if you add a drop of iodine solution to a drop of starch solution on a white tile, the colour changes.
    - You should write 'the colour changed from yellow to blue-black'.
    - If you write 'it turned black' you have not given all the information.
    - If you add iodine solution to a drop of water on a white tile, you should write down 'the colour stayed yellow'. If you write 'the colour stayed the same', or 'no change', you have left out important information.

Drawings

These will be from specimens or photographs.

- Read the question carefully, the drawing may have to be an accurate size e.g. twice the original.
- Make each drawing as big as the space allows.
- Use a ruler for labelling lines.
- Label in pencil.
- Use one clear continuous outline not an artistic drawing. Do not shade other than using very light dots.
- Observe details carefully, such as number of seeds in a seed case, thickness of a layer in a shell, etc. Show these accurately on your drawing.

Taking measurements

- Make your measurements as accurate as you can. Measure to the nearest unit, e.g. mm. Do not try and 'guess' 0.5 mm.
- Make sure you put units! Use the correct SI units, do not use other units; for example measure in millimetres not inches.
- Always measure in millimetres, not centimetres.
- If you have to make calculations on your measurements, use the blank pages within the paper but indicate if the answer is continued elsewhere on the blank pages. Do not write in the margins.
- Write neatly and show your working. The person marking your paper might be able to give you marks for knowing what to do if you make a mistake or do not finish the calculation.

Conclusions

- Use your own results for your conclusions.
- Before planning what to write for a conclusion, turn back to the beginning of the question and read the introduction. You may have forgotten what you were told about the investigation you have just carried out. Think about the theory and apply it to the results you have obtained.
- Sometimes you are expected to make conclusions about some other data, not the data you have collected.
- Do not write the conclusion you have learned from a class experiment or from theory.

Tips for paper 6

The topics on Paper 6 will be very similar to those on Paper 5, so the tips are very much the same as for that paper. Because you are not doing any practical work, there is usually a third question, so Paper 6 tests more of the syllabus.

In this paper you are making observations from information given in the paper, recording results and drawing conclusions. Try to imagine doing the practical which has produced the results in the questions and look very carefully at the information you are given as it will almost certainly be unfamiliar to you.

Recording observations

- Some of your observations are based on photographs or diagrams on the paper.
- Write down exactly what you see – as differences or similarities. Measurements may need to be made and magnifications calculation.
- Look carefully at photomicrographs as these will be enlarged, e.g. x 100. If you are asked to calculate a magnification follow these steps:
    - measure the structure in the photograph in millimetres (not centimetres).
    - look for the actual size of the object – you will be given this.
    - divide the length of the structure in the photograph (in mm) by the actual size (in mm).
    - the answer is the magnification; round up or down the answer from your calculator.
    - usually magnifications are given as whole numbers, so do not give the answer to one or more decimal places.

If you are asked to calculate an actual size follow these steps:

- measure the structure in the photograph in millimetres (not centimetres).
- look for the magnification – you will be given this.
- divide the length of the structure in the photograph (in mm) by the magnification.
- the answer is the actual size in millimetres; round up or down the answer from your calculator.
- actual sizes could be given as whole numbers or you could include one or two decimal places, but no more.

Section 3: What will be tested

The Examiners will take account of the following areas in your examination Papers:

- your knowledge (what you remember) and understanding (how you use what you know and apply it to unfamiliar situations).
- how you handle information and solve problems.
- your use of experimental skills.

These areas of knowledge and skills are called Assessment Objectives. The theory Papers (Papers 1 and 2 or 3) test mainly Assessment Objectives A (knowledge with understanding) and Assessment Objective B (handling information and problem solving). The purpose of the practical Paper (Paper 4 or 5 or 6) is to test Assessment Objective C (experimental skills). Your teacher will be able to give you more information about how each of these is used in the examination Papers.

The table shows you the range of skills you should try to develop:

Skill	What the skill means?	What you need to be able to do?
A: knowledge with understanding	remembering facts and applying these facts to new situations	1. use scientific ideas, facts and theories 2. know scientific definitions e.g. what is excretion? 3. know about biological apparatus and how it works 4. know about S I units, quantities (e.g. mass) and symbols (e.g. dm^3) 5. understand the importance of science in everyday life
B: 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	1. select and organize information from graphs, tables and written text 2. change information from one form to another, e.g. draw chart and graphs from data 3. arrange data and carry out calculations 4. identify patterns from information given and draw conclusions 5. explain scientific relationships, e.g. changes in heart rate in relation to activity 6. make predictions and develop scientific ideas 7. solve problems
C: experimental skills	planning and carrying out experiments and recording and analysing information	1. set up and use apparatus safely 2. make observations and measurements and record them 3. analyse experimental results and suggest how valid they are 4. plan and carry out your own experiment and describe to what extent your plan worked and suggest improvements

Section 4: What you need to know

The table describes the things you may be tested on in the examination. It is arranged in 14 topic areas. If you are studying only the Core material (Papers 1 and 2), you will need to refer **only** to the column headed Core material. If you are studying the Extended syllabus (Papers 1 and 3), you will need to refer to both the Core and Supplement material columns. Read **Section 1** (How will you be tested?) if you are unsure about which material to use.

How to use the table

You can use the table throughout your course to check the topic areas you have covered. You can also use it as a revision aid. When you think you have a good knowledge of a topic, you can tick the appropriate box in the checklist column. The main headings in the topic areas are usually followed by the details of what you should know.

Test yourself as follows:

- cover up the details with a piece of paper.
- try to remember the details.
- when you have remembered the details correctly, put a tick in the appropriate box.

If you use a pencil to tick the boxes, you can retest yourself whenever you want by simply rubbing out the ticks. If you are using the table to check the topics you have covered, you can put a tick in the topic column next to the appropriate bullet point.

The column headed 'Comments' can be used:

- to add further information about the details for each bullet point.
- to add learning aids.
- to highlight areas of difficulty/things which you need to ask your teacher about.

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**
Section I						
1. Features of living organisms	• list and describe the features of living organisms, state the meaning of the terms: ○ nutrition ○ excretion ○ respiration ○ growth ○ movement ○ reproduction ○ sensitivity					
2. Classification and diversity of living organisms						
2.1 The idea and use of a classification system	• explain the meaning of and describe the binomial (two name) system of naming species, e.g. *Felis leo* and *Felis tigris* • identify and name the five main classes of vertebrates by using visible, external features only			• know that there are other classification systems based on DNA and RNA data		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
2.2 Adaptations of organisms to their environment	• list the main, visible, external features used to identify and name the groups, also name examples: ○ Flowering plants (mono- and dicotyledons)			• list the main features used to identify and name the groups, also list their adaptation to the environment as appropriate.		
	○ arthropods (insects, arachnids, crustaceans and myriapods) ○ annelids ○ nematodes ○ molluscs			○ viruses ○ bacteria ○ fungi		
Section II						
3. Simple keys	• use simple dichotomous (forked) keys that use easily identified features					
1. Cell structure and organisation	• State that living organisms are made of cells • Recognise and describe the structure of: ○ a plant cell (palisade cell) ○ an animal cell (liver cell) • Know the differences in structure between animal and plant cells			• Know how the structures in plant and animal cells are related to their functions		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**
2. Levels of organisation	• Relate the structure of the following to their functions: ○ ciliated cells – in respiratory tract ○ root hair cells – absorption ○ xylem vessels – conduction and support ○ muscle cells – contraction ○ red blood cells – transport					
	• Define with examples: ○ tissue as a group of cells with similar structures, working together to perform a shared function ○ organ as a structure made up of a group of tissues, working together to perform specific functions ○ organ system as a group of organs with related functions, working together to perform body functions					
3. Size of specimens	Be able to calculate magnification and size of biological specimens using millimetres as units					

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
4. Movement in and out of cells	• Know the importance of diffusion of gases, solutes and water • Define *diffusion* as: the net movement of molecules from a region of their higher concentration to a region of their lower concentration down a concentration gradient, as a result of their random movement			• Define *active transport* as movement of ions in or out of a cell through the cell membrane, from a region of their lower concentration to a region of their higher concentration against a concentration gradient, using energy released during respiration		
	• Know the importance of osmosis in the uptake of water by plants, and its effects on plant and animal tissues • Define *osmosis* as the diffusion of water molecules from a region of their higher concentration (dilute solution) to a region of their lower concentration (concentrated solution), through a partially permeable membrane			• Discuss the importance of active transport e.g. ion uptake by root hairs and uptake of glucose by epithelial cells of villi • Describe and explain the importance of a water potential gradient in the uptake of water by plants		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**
5. Enzymes	• Define the term *catalyst* as a substance that speeds up a chemical reaction and is not changed by the reaction • Define *enzymes* as proteins that function as biological catalysts • Describe the effect of changes in temperature and pH on enzyme activity			• Explain the 'lock and key' model • Explain how temperature and pH effect enzyme activity • Describe what use enzymes have in: ○ seed germination ○ biological washing products ○ food industry (including pectinase and fruit juice)		
				• Describe the use of microorganisms and fermenters to make: ○ penicillin ○ enzymes for use in biological washing powders • Describe the role of the fungus Penicillium in the making antibiotic (penicillin)		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
6. Nutrition	• Define *nutrition* as taking in of nutrients which are organic substances and mineral ions, containing raw materials or energy for growth and tissue repair, absorbing and assimilating them					
6.1 Nutrients	• List the chemical elements that make up: ○ carbohydrates ○ fats ○ proteins • Describe the synthesis of large molecules from smaller basic units, i.e. ○ simple sugars to starch and glycogen ○ amino acids to proteins ○ fatty acids and glycerol to fats and oils			• Describe how microorganisms are used to make: ○ yoghurt ○ single cell protein • Describe the uses, benefits and health hazards associated with food additives, including colourings		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**

	• Describe tests for:
	  ○ starch (iodine solution)
	  ○ reducing sugars (Benedict's solution)
	  ○ protein (biuret test)
	  ○ fats (ethanol)
	• List the principal sources of, and describe the importance of:
	  ○ carbohydrates
	  ○ fats
	  ○ proteins
	  ○ vitamins (C and D only)
	  ○ mineral salts (calcium and iron only)
	  ○ fibre (roughage)
	  ○ water
	• Describe the deficiency symptoms for:
	  ○ vitamins (C and D only)
	  ○ mineral salts (calcium and iron only)					

6.2 Plant nutrition	• Define *photosynthesis* as the fundamental process by which plants manufacture carbohydrates from raw materials using energy from light • State the word equation for photosynthesis			• Know the balanced equation for photosynthesis in symbols ($6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$) • Define the term *limiting factor* as something		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

	• Know that photosynthesis needs chlorophyll, light and carbon dioxide
	• Describe how plants get carbon dioxide and water
	• Explain that chlorophyll traps light energy and converts it into chemical energy for the formation of carbohydrates
	• Be able to label a leaf with:
	  ○ cuticle
	  ○ cellular structure
	  ○ tissue structure
	• Describe the significance of these features in terms of functions:
	  ○ distribution of chloroplasts (for photosynthesis)
	  ○ stomata and mesophyll cells (gas exchange)
	  ○ vascular bundles (xylem and phloem) (for transport and support)
	• Describe the importance of:
	  ○ nitrate ions for protein synthesis
	  ○ magnesium ions for chlorophyll synthesis
	• Describe the uses, and dangers of overuse of nitrogen fertilisers
				present in the environment in such short supply that it restricts life processes
				• Explain limiting factors in photosynthesis such as
				  ○ light intensity,
				  ○ carbon dioxide concentration
				  ○ temperature
				• Explain the use of
				  ○ carbon dioxide enrichment,
				  ○ optimum light
				  ○ optimum temperatures in glasshouse systems
				• Explain the effects of
				  ○ nitrate ion
				  ○ magnesium ion deficiency on plant growth		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**
6.3 Animal nutrition	• Define *balanced diet* and describe a balanced diet related to age, sex and activity of an individual • Describe the effects of malnutrition in relation to starvation, coronary heart disease, constipation and obesity • Discuss how modern technology has resulted in increased food production (including modern agricultural machinery, chemical fertilisers, pesticides and herbicides, artificial selection) • Define *ingestion* as taking substannces (e.g. food, drink) into the body through the mouth • Define *egestion* as passing out of food that has not been digested, as faeces, through the anus • Identify the main regions and organs of the alimentary canal			• Discuss the problems of world food supplies • Discuss the problems which contribute to famine (unequal distribution of food, drought and flooding and increasing population)		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

	And including mouth, salivary glands, oesophagus, stomach, small intestine (duodenum and ileum), pancreas, liver, gall bladder, large intestine (colon) and rectum, anus
	• Describe the functions of the regions of the alimentary canal listed above, in relation to:
	  ○ ingestion
	  ○ digestion
	  ○ absorption
	  ○ assimilation
	  ○ egestion
	• Define *digestion* as the break-down of large, insoluble food molecules into small, water soluble molecules using mechanical and chemical processes
	• Know the types of human teeth and describe their structure and functions
	• State the causes of dental decay and describe the proper care of teeth
	• Describe the process of chewing
	• Describe the role of longitudinal and circular muscles in peristalsis					

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**

	• Outline the role of bile in emulsifying fats
	• State the significance of chemical digestion in the alimentary canal
	• State where amylase, protease and lipase enzymes are secreted
	• State the functions of amylase, protease and lipase
	• Define *absorption* as movement of digested food molecules through the wall of the intestine into the blood or lymph
	• Identify the small intestine as the region for the absorption of digested food
	• Describe the function of villi
	• Define *assimilation* as movement of digested food molecules into the cells of the body where they are used, becoming part of the cells
	• Describe the role of the liver in the metabolism of:
	  ○ glucose → glycogen
	  ○ amino acids → proteins
	  ○ destruction of excess amino acids
				• Describe how fluoride reduces tooth decay
				• Explain arguments on the addition of fluoride to public water supplies
				• Describe the structure of a villus (including capillaries and lacteals)
				• State the role of the hepatic portal vein in the transport of absorbed food to the liver
				• Identify the role of the small intestine and colon in absorption of water		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
	• Describe the role of fat as an energy storage substance			• Define *deamination* as removal of the nitrogen-containing part of amino acids to form urea, followed by release of energy from the remainder of the amino acid • State that the liver is the site of breakdown of alcohol and other toxins		
7. Transportation 7.1 Transport in plants	• State the functions of xylem and phloem • Know where xylem and phloem are found in dicotyledonous roots, stems and leaves • Identify root hair cells and state their functions • State the pathway taken by water through root, stem and leaf (root hair, root cortex cells, xylem, mesophyll cells)			• Relate the structure and functions of root hairs to their surface area and to water and ion uptake • Explain how water uptake happens in terms of transpiration producing a tension ('pull') from above, creating a water potential gradient in the xylem, pulling cohesive water molecules up the plant.		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**
	• Define *transpiration* as evaporation of water at the surfaces of the mesophyll cells followed by loss of water vapour from plant leaves, through stomata • Describe how water vapour loss is related to cell surfaces, air spaces and stomata • Describe how temperature, humidity and light intensity affect the transpiration rate • Describe how wilting occurs • Define *translocation* in terms of the movement of sucrose and amino acids in phloem; from regions of production to regions of storage OR to regions of utilisation in respiration or growth			• Discuss the adaptations of leaves, stems and roots to **three** contrasting environments (including a pond, garden and desert) • Describe translocation of applied chemicals (including systemic pesticides) • Compare the role of transpiration and translocation in the transport of materials from sources to sinks, at different seasons		
7.2 Transport in humans	• Describe the circulatory system as a system of tubes with a pump and valves to ensure oneway flow of blood					

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

	• Describe the double circulation in terms of
	  ○ a low pressure circulation to the lungs
	  ○ a high pressure circulation to the body tissues
	(also relate the differences to the different functions of the two pathways)
	• Describe the structure of the heart including:
	  ○ muscular wall
	  ○ septum
	  ○ chambers
	  ○ valves
	  ○ associated blood vessels
	• Describe the function of the heart in terms of:
	  ○ muscular contraction
	  ○ how the valves work
	• Explain how physical activity affects pulse rate
	• Describe coronary heart disease as the blockage of coronary arteries
	• State the possible causes (diet, stress and smoking) and preventative measures of heart disease
	• Name the main blood vessels to and from the heart, lungs, liver and kidney					

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

	• Describe the structure and functions of:
	  ○ arteries
	  ○ veins
	  ○ capillaries
	• Recognise red and white blood cells
	• List the components of blood as:
	  ○ red blood cells,
	  ○ white blood cells
	  ○ platelets
	  ○ plasma
	• State the functions of blood:
	  ○ red blood cells (haemoglobin and oxygen transport)
	  ○ white blood cells (phagocytosis and antibody formation)
	  ○ platelets (clotting (no details))
	  ○ plasma (transport of blood cells, ions, soluble nutrients, hormones, carbon dioxide, urea and plasma proteins)
				• Explain how structure and function are related in:
				  ○ arteries
				  ○ veins
				  ○ capillaries
				• Describe the transfer of materials between capillaries and tissue fluid
				• Describe the immune system in terms of:
				  ○ antibody production
				  ○ tissue rejection phagocytosis
				• Describe the function of the lymphatic system including:
				  ○ circulation of body fluids, production of lymphocytes
				• Describe the process of clotting (fibrinogen to fibrin only)		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
8. Respiration	• Define *respiration* as the chemical reactions that break down nutrient molecules in living cells to release energy • State the uses of energy in the body of humans: ○ muscle contraction ○ protein synthesis ○ cell division ○ active transport ○ growth ○ passage of nerve impulses ○ maintenance of a constant body temperature • Define *anaerobic respiration* as the release of a relatively small amount of energy by the breakdown of food substances in the absence of oxygen • State the word equation for anaerobic respiration ○ in muscles during hard exercise (glucose →lactic acid) ○ in yeast (glucose → alcohol + carbon dioxide)			• State the balanced equation for anaerobic respiration in: ○ muscles ($C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$) ○ yeast ($C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$) • Describe the effect of lactic acid in muscles during exercise (include oxygen debt in outline only)		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

	• Describe the role of anaerobic respiration in yeast during brewing and bread-making
	• Compare aerobic respiration and anaerobic respiration in terms of how much energy is released
	• List the features of gas exchange surfaces in animals
	• Know the labels for:
	  ○ larynx
	  ○ trachea
	  ○ bronchi
	  ○ bronchioles
	  ○ alveoli
	  ○ capillaries
	• State the differences in composition between inspired and expired air
	• Know the lime water test for carbon dioxide
	• Describe the effects of physical activity on rate and depth of breathing
				• Describe the role of:
				  ○ ribs
				  ○ internal intercostal muscles
				  ○ external intercostal muscles
				  ○ diaphragm
				in producing volume and pressure changes during ventilation of the lungs
				• Explain the role of mucus and cilia in protecting the gas exchange system from pathogens and particles
				• Explain the link between physical activity and rate and depth of breathing in terms of:
				  ○ changes in the rate at which tissues respire
				  ○ carbon dioxide concentration and pH in tissues and in the blood		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

9. Excretion in humans	• Define *excretion* as the removal from organisms of:
	  ○ toxic materials
	  ○ waste products of metabolism (chemical reactions in cells including respiration)
	  ○ substances in excess of requirements (including carbon dioxide, urea and salts)
	• Describe the function of the kidney in terms of:
	  ○ removal of urea and excess water
	  ○ reabsorption of glucose and some salts
	(details of kidney structure and nephron are **not** required)
	• Know the position in the body of
	  ○ ureters
	  ○ bladder
	  ○ urethra
	• Know that urea is formed in the liver from excess amino acids
	• Know that alcohol, drugs and hormones are broken down in the liver
				• Describe the structure of a kidney (cortex, medulla, and the start of the ureter) outline the structure and functioning of a kidney tubule including:
				  ○ role of renal capsule in filtration from blood of water, glucose, urea and salts
				  ○ role of tubule in reabsorption of glucose, most of the water and some salts back into the blood, leading to concentration of urea in the urine as well as loss of excess water and salts
				• Explain dialysis in terms of maintenance of glucose and protein concentration in blood and diffusion of urea from blood to dialysis fluid		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**
				• Discuss the application of dialysis in kidney machines • Compare the advantages and disadvantages of kidney transplants with dialysis		
10. Coordination and response	• Describe the human nervous system in terms of: ○ the central nervous system (brain and spinal cord as areas of coordination) ○ the peripheral nervous system which together serve to coordinate and regulate body functions • Recognise: ○ motor (effector) neurones ○ relay (connector) neurones ○ sensory neurones • Describe a simple reflex arc in terms of sensory, relay and motor neurones • Describe a reflex action as a means of automatically and rapidly integrating and coordinating stimuli with responses			• Distinguish between voluntary and involuntary Actions		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
	• Know that muscles and glands can act as effectors • Describe the action of antagonistic muscles (including the biceps and triceps at the elbow joint) • Define sense *organs* as groups of receptor cells responding to specific stimuli: light, sound, touch, temperature and chemicals • Describe the structure and function of the eye (including accommodation and pupil reflex) • Define a *hormone* as a chemical substance, produced by a gland, carried by the blood, which alters the activity of one or more specific target organs and is then destroyed by the liver • Know the role of the hormone adrenaline in chemical control of metabolic activity, including increasing the blood glucose concentration and pulse rate • Know examples of situations in which adrenaline secretion increases • Compare nervous and hormonal control systems			• Know the difference in function and distribution of rods and cones • Discuss the use of hormones in food production		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**

	• Define *geotropism* as a response in which a plant grows towards or away from gravity
	• Define *phototropism* as a response in which a plant grows towards or away from the direction from which light is coming
	• Define *homeostasis* as the maintenance of a constant internal environment
	• Know the following labels of the skin:
	  ○ hairs
	  ○ sweat glands
	  ○ temperature receptors
	  ○ blood vessels
	  ○ fatty tissue
	• Describe the maintenance of a constant body temperature in humans in terms of:
	  ○ insulation
	  ○ the role of temperature receptors in the
	  ○ skin
	  ○ sweating
	  ○ shivering
	  ○ vasodilation and vasoconstriction of arterioles supplying skin surface capillaries
	  ○ coordinating role of the brain
				• Explain the chemical control of plant growth (in terms of regulating differential growth) by auxins including:
				  ○ geotropism
				  ○ phototropism
				• Know how synthetic plant hormones are used as weedkillers		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

	• Define a drug as any substance taken into the body that modifies or affects chemical reactions in the body
	• Describe the medicinal use of antibiotics for the treatment of bacterial infection
	• Describe the effects of the abuse of heroin: a powerful depressant including:
	  ○ problems of addiction
	  ○ severe withdrawal symptoms associated problems such as crime
	  ○ infection e.g. HIV/AIDS
	• Describe the effects of excessive consumption of alcohol:
	  ○ reduced self-control depressant
	  ○ effect on reaction times damage to liver
	  ○ social implications
	• Describe the effects of tobacco smoke and its major toxic components (tar, nicotine, carbon monoxide, smoke particles) on the gas exchange system
				• Explain the concept of control by negative feedback
				• Describe the control of glucose content of the blood:
				  ○ by the liver
				  ○ by insulin and glucagon from the pancreas
				Explain why antibiotics kill bacteria but not viruses		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
Section III						
1. Reproduction						
1.1 Asexual reproduction	• understand that asexual reproduction is the production of new individuals of the same type/species by one parent describe asexual reproduction in ○ bacteria ○ spore production in fungi ○ tuber formation in potatoes			• consider the advantages and disadvantages to a species of asexual reproduction		
1.2 Sexual reproduction	• understand that sexual reproduction is the production of new individuals of the same type/species by the fusing together of gametes from two parents			• consider the advantages and disadvantages to a species of sexual reproduction		
1.2.1 Sexual reproduction in plants	describe the structure and functions of the flower of a **named** dicotyledonous plant • understand that pollination is the transfer of pollen from an anther to a stigma • name agents of pollination			• Know the differences between and consider the implications to a species of ○ self-pollination ○ cross-pollination		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

	• compare the different structural adaptations of
	  ○ insect-pollinated flowers
	  ○ wind-pollinated flowers
	describe the
	  ○ growth of the pollen tube
	  ○ process of fertilisation
	  ○ formation of seed and fruit
	  ○ structure of a non-endospermic seed
	• understand that dispersal of seeds and fruits is the carriage of these away from the parent plant describe seed and fruit dispersal by
	  ○ wind
	  ○ animals					

1.2.2 Sexual reproduction in humans	• describe the structure and functions of the reproductive system of the human
	  ○ male
	  ○ female
	• describe the female menstrual cycle
	• describe
	  ○ sexual intercourse
	  ○ fertilisation
	  ○ implantation
				• compare the size, numbers and mobility of sperm and eggs
				• Explain the functions of the menstrual hormones		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**

	• describe the development of the fetus in terms of
	  ○ placenta
	  ○ maternal and fetal blood supplies
	• exchange of materials describe ante-natal care in terms of
	  ○ dietary needs of the mother
	  ○ maintaining good health
	• describe birth
				• outline the functions of the
				  ○ amniotic sac
				  ○ amniotic fluid
				• describe the advantages of breast-feeding compared with bottle-feeding		

1.3 Sex hormones	• describe the roles, in the development and regulation of secondary sexual characteristics at puberty, of
	  ○ testosterone
	  ○ oestrogen
				• describe the sites of production and the roles of oestrogen and progesterone in
				  ○ the menstrual cycle
				  ○ pregnancy		

1.4 Methods of birth control	• name and describe the following methods of birth control
	  ○ natural
	  ○ chemical
	  ○ mechanical
	  ○ surgical
				• consider social aspects of
				  ○ artificial insemination
				  ○ the use of hormones in fertility drugs		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
1.5 Sexually transmissible diseases	• describe the signs, symptoms, effects and treatment of gonorrhoea • describe for human immunodeficiency virus (HIV) • the methods of transmission • the ways in which it can be prevented from spreading			• outline how HIV affects the immune system		
2. Growth and development	• understand that growth can be measured by the increase in dry mass of an organism • understand that development can be thought of as the increase in complexity of an organism • describe the environmental conditions that affect germination					
3. Inheritance	• understand that inheritance is the transfer of genetic information from one generation to the next, and that this leads to both continuity and variation within a species					

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**

3.1 Chromosomes	• understand the following terms
	  ○ a chromosome is a thread like structure in the nucleus of a cell that carries genes
	  ○ a gene is a unit of inherited information on a chromosome that controls an inherited feature e.g. eye colour
	  ○ alleles are forms of a gene that control different versions of a feature e.g. blue eye colour or brown eye colour
	  ○ a haploid nucleus is one that has one copy of each of the different chromosomes that exist for a species
	  ○ a diploid nucleus is one that has a pair of copies of each of the different chromosomes that exist for a species
	• describe the inheritance of sex in humans (XX and XY sex chromosomes)					

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

3.2 Mitosis	• describe mitosis simply (no details of stages needed) in terms of:
	  ○ exact duplication of chromosomes
	  ○ producing identical diploid daughter nuclei					

3.3 Meiosis	• describe the production of gametes by meiosis simply (no details of stages needed) in terms of:
	  ○ halving of chromosome number
	  ○ producing variation in the haploid daughter nuclei					

3.4 Monohybrid inheritance	• understand the terms gene and allele and additionally the following terms • genotype is the alleles an individual has • phenotype is the observable feature of an individual • homozygous is having two identical alleles for a feature • heterozygous is having two different alleles for a feature • a dominant allele is one which when present always affects the phenotype			explain • codominance • the inheritance of A, B, AB and O blood groups (IA, IB and IO) describe • sickle cell anaemia • its occurrence linked to that of malaria		

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**

	• a recessive allele is one which only affects the phenotype if it is the only type of allele present
	• calculate and predict the results of monohybrid crosses involving:
	  ○ 1 : 1 ratios
	  ○ 3 : ratios					

3.5 Variation	• describe continuous and discontinuous variation, illustrated by height and A, B, AB and O blood groups, as affected by
	  ○ the environment
	  ○ genes
	• understand that mutation is a change in the genes or chromosomes of an individual
	• describe mutation as a source of variation, e.g. Down's syndrome outline the effects, on the rate of mutation, of
	  ○ radiation
	  ○ chemicals
				• describe variation
				• understand that competition leads to differential survival of, and reproduction by, those organisms best fitted to the environment		

3.6 Selection	• describe the role of artificial selection in producing varieties of animals and plants with increased economic importance					

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
	• understand that natural selection involves the transfer of genes by the best adapted organisms to their offspring			• consider the importance of natural selection as a possible mechanism for evolution		
3.7 Genetic engineering	• understand that genetic engineering is the transfer of a gene from one species into another species			• describe the development of strains of antibiotic resistant bacteria, as an example of natural selection • explain why human insulin genes were put into bacteria • outline how this is achieved using genetic engineering		
Section IV						
1. Energy flow	• state that the Sun is the principal source of energy input to biological systems. • describe the non-cyclical nature of energy flow					

Topic	Core material			Supplement material		
	You should be able to:	**Checklist**	**Comments**	**You should be able to:**	**Checklist**	**Comments**
2. Food chains and food webs	• understand the following terms ○ a food chain shows links between a series of organisms feeding on one another ○ a food web shows a group of interlinked food chains ○ producers are green plants that produce their own food by photosynthesis ○ consumers are organisms that depend on the food produced by plants ○ herbivores (primary consumers) obtain their energy by feeding directly on producers			• understand that there is ○ increased efficiency in supplying green plants as human food ○ relative inefficiency, in terms of energy loss, in feeding crop plants to animals		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
	○ carnivores (secondary consumers) obtain their energy by feeding on herbivores or (tertiary consumers) on other carnivores ○ decomposers are microorganisms that feed on the dead remains of animals and plants • an ecosystem is an area and the organisms that live in that area • trophic level is the position an organism occupies in a food chain. Trophic level 1 is always the producers • describe ○ energy loss between trophic levels ○ the advantages of short food chains • describe and interpret pyramids of ○ biomass ○ energy ○ numbers					

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

3. Nutrient cycles	• describe the
	  ○ carbon cycle
	  ○ water cycle
				• describe the nitrogen cycle in terms of the roles of microorganisms (names of individual bacteria are not needed) and other processes
				• producing usable nitrogen containing substances by decomposition and by nitrogen fixation in roots
				• absorption of these substances by plants and their conversion into protein
				• the passage of protein through food chains
				• death and decay
				• nitrification
				• denitrification
				• return of nitrogen to the soil or atmosphere
				• consider the effects, on the balance between oxygen and carbon dioxide, of		

				○ burning fossil fuels ○ cutting down of forests		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments

4. Population size	• understand that a population is a groups of one species, living in the same area at the same time
	• state the factors affecting the rate of population growth (food supply, predation, disease)
	• describe their importance
	• identify the phases of a sigmoid curve of population growth resulting from the action of a limiting factor
	• describe the
	  ○ increase in population size in the absence of limiting factors (human population)
	  ○ social implications of current human survival rate
	  ○ interpret graphs and diagrams of human population growth
	  ○ with emphasis on examples of international importance (e.g. tropical rain forests, oceans and rivers)
				• Explain the factors that lead, in the sigmoid curve of population growth, to the
				  ○ lag phase
				  ○ exponential (log) phase
				  ○ stationary phase		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
5. Human influences on the ecosystem						
5.1 Agriculture	• consider, using suitable examples, ways in which the use of modern technology has resulted in increased food production • describe the undesirable effects of deforestation • describe the overuse of fertilisers on the land					
5.2 Pollution	• describe the undesirable effects of ○ water pollution by sewage and chemical waste ○ air pollution by sulphur dioxide ○ pollution by pesticides and herbicides ○ pollution by nuclear fallout			• consider the ○ significance of non-biodegradable plastics and other materials used in the manufacturing industry ○ causes and apparent effects of acid rain ○ measures that might be taken to reduce the incidence of acid rain		

Topic	Core material			Supplement material		
	You should be able to:	Checklist	Comments	You should be able to:	Checklist	Comments
5.3 Conservation	• describe the need for conservation of ○ species ○ their habitats ○ natural resources			describe the principle of recycling materials including sewage (water) and paper		

Section 5: Appendices

5.1 The mathematical skills you need

This is a checklist of the mathematical skills you need for your Biology examination. You should tick each box in the checklist when you know that you have learned the skill. Ask your teacher to explain any skill you are unsure about. The 'Comments' column is for extra notes and examples.

You can use a calculator for all the examination Papers. If your calculator is one that can be programmed, you should make sure that any information in it is removed before the examination.

You should be able:	Checklist	Comments
• add • subtract • multiply • divide	☐ ☐ ☐ ☐	
Use: • averages • decimals • fractions • percentages • ratios • reciprocals	 ☐ ☐ ☐ ☐ ☐ ☐	
• recognise standard notation (notation is putting symbols for numbers e.g. x = 2, y = 5, atomic mass, Z = 12) • use standard notation	☐	
• use direct proportion (stepwise increases) • use inverse proportion (inverse means turned up side down)	☐ ☐	the inverse of 4 is ¼ (= 0.25)
• use numbers to the 'power of 10' e.g. $1 \times 10^2 = 100$	☐	Your calculator will often show number to the power of 10 when you do calculations. Do not worry too much though – your calculator does the work for you.
• draw charts	☐	You will be given the data

You should be able:	Checklist	Comments
• graphs with line of best fit	☐	
interpret: • bar graphs • pie charts • line graphs	☐ ☐ ☐	
• select suitable scales and axes for graphs	☐	
• make approximations	☐	
use the formulas: • area = length × width • volume = length × width × height • use and convert metric units into one another	☐ ☐ ☐	e.g. 100cm = 1 m 1000g = 1 kg
• use mathematical and measuring instruments e.g. ruler, compasses, protractor	☐	
understand the meaning of: • radius • diameter • square • rectangle	☐ ☐ ☐ ☐	

5.2 Other important information you need for your Biology Examination

The terms used in Biology examination Papers are given in the sections that follow. It is very important that you know and understand all of them before you take your examination. You should ask your teacher to explain anything that you are unsure about.

5.2.1 Numbers

The decimal point will be placed on the line, e.g. 52.35.

Numbers from 1000 to 9999 will be printed without commas or spaces.

Numbers greater than or equal to 10 000 will be printed without commas. A space will be left between each group of three whole numbers, e.g. 4 256 789.

5.2.2 Units

The International System of units will be used (SI units). Units will be indicated in the singular not in the plural, e.g. 28 kg.

(a) SI units commonly used in Biology are listed below.

N.B. Care should be taken in the use of *mass* and *weight*. In most biological contexts, the term mass is correct, e.g. dry mass, biomass.

Quantity	Name of unit	Symbol for unit
length	kilometre metre centimetre millimetre micrometer	km m cm mm μm
mass	tonne (1000 kg) kilogram gram milligram microgram	(no symbol) kg g mg μg
time	year day hour minute second	y d h min s
amount of substance	mole	mol

(b) Derived SI units are listed below.

energy	kilojoule joule (calorie is obsolete)	kJ J

(c) Recommended units for area, volume and density are listed below.

area	hectare 10^4 m^2	ha
	square metre	m^2
	square decimetre	dm^2
	square centimetre	cm^2
	square millimetre	mm^2
volume	cubic kilometre	km^3
	cubic metre	m^3
	cubic decimetre (preferred to dm^3 litre) litre dm^3 (**not** l)	
	cubic centimetre cm^3 (**not** ml) cubic millimetre mm^3	
density	kilogram per cubic metre *or* kg m^{-3}	
	gram per cubic centimetre *or* g cm^{-3}	

(d) Use of Solidus

The solidus (/) must **not** be used for a quotient, e.g. m / s for metres per second.

5.2.3 Presentation of data

The solidus (/) is to be used for separating the quantity and the unit in tables, graphs and charts, e.g. time/s for time in seconds.

(a) Tables

(i) Each column of a table will be headed with the physical quantity **and** the appropriate unit, e.g. time / s.

There are three acceptable methods of stating units:

- metres per sec
- m per s
- m s^{-1}

(ii) The column headings of the table can be directly rewritten on to the axes of a constructed graph.

(b) Graphs

(i) The independent variable should be plotted on the *x*-axis (horizontal axis) and the dependent variable plotted on the *y*-axis (vertical axis).
(ii) Each axis will be labelled with the physical quantity and the appropriate unit, e.g. time/s.
(iii) The graph is the whole diagrammatic presentation. It may have one or several curves plotted on it.
(iv) Curves and lines joining points on the graph should be referred to as 'curves'.
(v) Points on the curve should be clearly marked as crosses (x) or encircled dots (⊙). If a further curve is included, vertical crosses (+) may be used to mark the points.

(c) Pie Charts

Use pie charts with the sectors in rank order, largest first, beginning at 12:00 and proceeding clockwise, with no more than six sectors.

(d) Bar Charts

Use bar charts when one of the variables are categories, e.g. percentage of vitamin C in different fruits. They should be made up of narrow bars of equal width with a **gap** (not touching) between each bar.

(e) Histograms

Use histograms to plot frequency graphs with continuous data, e.g., frequency of occurrence of leaves of different lengths. The blocks should be drawn in order of increasing or decreasing magnitude and they **should** be touching.

5.2.4 Taxonomy

Taxonomy is the study of how organisms are arranged into groups. There are seven levels of taxon – kingdom, phylum, class, order, family, genus and species. These are the rule you need to know:

(a) The Five Kingdoms are:

- Prokaryotes (Prokaryotae), including bacteria and blue-green bacteria
- Protoctists (Protoctista), including green, red and brown algae and protozoans
- Fungi (Fungi)
- Plants (Plantae)
- Animals (Animalia)

The viruses cannot be fitted into this classificatory system.

(b) The binomial system of naming gives each organism a two-word name. The first word is the generic name and the second word is the trivial name, e.g. *Homo sapiens*. The trivial name should never be used without the generic name as well.

(c) Generic and trivial names are distinguished from the rest of the text either by underlining (when written or typed) or by being set in italics (in print).

(d) The generic name always takes an initial capital letter. The trivial name can be left off if it is clear which organsism it is. e.g. *Plasmodium*, and in these circumstances can stand alone.

(e) The common name should not normally be written with an initial capital letter, e.g. cat and dog. The exception is Man, where it is the common name for a species where the two sexes are distinguished by the terms man and woman.

(f) A species is not easy to define but an acceptable general definition is as follows.

'A group of organisms capable of interbreeding and producing fertile offspring.'

5.2.5 Genetics

(a) The terms *gene* and *allele* do not mean the same thing.

A gene is a specific length of DNA occupying a position called a locus. A specific function can be assigned to each gene. An allele is one of two or more different forms of a gene.

(b) Use this standard form of presenting genetic crosses:

- Use P for the cross of pure-breeding (homozygous) individuals
- Use F1 for the offspring of homozygous parents
- Use F2 for the offspring produced by crossing F1 parents.

(c) The format for the course of a genetic cross should be labelled in the following order:

- Parental phenotypes
- Parental genotypes
- Gametes
- Offspring genotypes
- offspring phenotypes

(d) Chose a letter for the gene so that upper and lower case versions are ease to see the difference e.g. B and b. The upper case letter indicates the dominant allele and the lower case letter indicates the recessive allele.

(e) The symbols for gametes should be circled to indicate the discrete nature of each gamete.

(f) Use a checkerboard to show genotypes that can result from random fusion of gametes.

(g) Use the word 'codominance' if the alleles are equally dominant, e.g. the AB blood group in humans.

5.2.6 Terminology

Use English terms rather than Latin or Greek terms, e.g. red blood cell (**not** erythrocyte) unless there is none e.g. atrium, brinchi, villi.

Section 6: Cambridge IGCSE Biology useful websites

These websites are useful resources to help you study for your Biology IGCSE.

IGCSE Bitesize Biology
http://www.bbc.co.uk/schools/gcsebitesize/biology
A secondary revision source for GCSE examinations. The site contains revision material, tests and SOS teacher. The site also gives references to other relevant websites. There are two versions: 56kb and broadband.

Click4Biology
http://www.clickbiology.com/igcse-biology-2/
A number of videos, animations and games for revision resources for IGCSE Biology.

Skool Revision site
http://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 IGCSE syllabus.

S-cool! GCSE Biology Revision Guide
http://www.s-cool.co.uk
A revision guide that can be used to complement your learning.

Purchon.com
http://purchon.com/biology/revision.htm
This website has information about revising and lots of useful resources about GCSE Biology which are also are relevant to IGCSE.

Revision Central
http://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.

Revision Link
http://revisionlink.co.uk/biology/index.html
This site is a portal to lots of useful Biology and other educational web sites.

Revision for human physiology
http://www.abpischools.org.uk/
The Association of the British Pharmaceutical Industry (ABPI) has a numer of useful interactive revision activities and games on many of the physiology topics.

Apps

http://itunes.apple.com/gb/app/biology-gcse-revision/id367827149?mt=8
These are new resources which are being developed.

- Ipad:
- http://www.educationapps.co.uk/ipad/revisionguide/gcse/biology/
- Andriod:
- http://www.educationapps.co.uk/apps/android/gcse/science/biology-revision
- iphone:
- http://www.educationapps.co.uk/apps/iphone/self-assessment/gcse/biology

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