# Biology

## ABOUT THE AUTHOR

Harry Hoey has now retired from teaching after being previously involved in National Examinations since 1979 in many varied roles. The most significant was acting as principal assessor for Higher Biology from 1989 to 2002. He is also the author of two textbooks on how to pass Biology.

YOU will have already spent time studying for your school prelim exams. How you performed will be an indicator as to whether your methods and depth of study are good enough to allow you to obtain the grades that you need. There is still time available to turn things round in the areas where you are weak.

Get the right documents.

● It is essential to get the appropriate level of the Book of Past Papers (Leckie & Leckie). Not only does the book show question styles used in the exam but it includes the quality of answer that is expected in the attached marking instructions.

● It is essential to get a copy of the appropriate Arrangement Documents. The school may already have supplied this. A copy, however, can be downloaded from the SQA website – www.sqa.org.uk/dgsa

● The Knowledge and Understanding (KU) in Biology that can be tested in the national examinations are described within published Arrangements Documents. In the Standard Grade the KU is listed under the heading of "Learning Outcomes". At the other Levels – Intermediate 2, Higher and Advanced Higher – the KU is listed under "Content", together with "Notes". The Notes are used to clarify the depth of the required KU.

● The Arrangements Documents also outline the course specifications for Problem Solving (PS) and Practical Abilities (PA).

● It would be good practice to keep a record of your study. You may be fortunate, in that the school supplies you with sheets that show all the topics that have to be covered. If this is not the case then draw one up using information from the appropriate Arrangement Document. Part of a Study Plan for Unit 1 of Higher Biology is shown below.

**Problem Solving and Practical Abilities**

As part of the examination at all levels, you need to be prepared for problem solving questions and questions that test experimental situations. The most common types of problem solving situations you will meet in exams are given below:

1. Select information from:
A. Texts
B. Tables
C. Charts
D. Keys
E. Graphs
F. Diagrams

2. Present information:
A. Extended writing
B. Tables
C. Graphs
D. Written summary

3. Process information:
A. Percentages
B. Averages
C. Ratios
D. Diagrams/Graphs etc

4. Plan and Design Experimental procedures
A. Variables required / identified
B. Controls required
C. Measurements required
D. Observations required
E. Describe procedures to test a given hypothesis
F. Describe procedures to illustrate particular effects

5. Evaluation of Experimental Procedures
A. Comment on suitability/purpose of approach
B. Comment on effectiveness of procedures
C. Comment on limitations of set up
D. Comment on apparatus
E. Comment on suggested measurements/ observations
F. Comment on limitations of equipment
G. Comment on appropriateness of controls
H. Comment on sources of error
I. Comment on possibility of improvements

6. Draw valid conclusions and give explanations supported by evidence
A. Statement of the overall pattern from observations
B. Statement of the trends in the results
C. Statement of the connection between variables
D. Statement of connection between variables and control

7. Make predictions, inferences and generalisations based on evidence
A. Given results, predict what further results may be
B. Given situations, predict what the results may be
C. Given results, predict the outcome of an experiment
D. Justify any of the above

Don't be put off problem solving because you think that you are not very good at maths. The calculations are normally straightforward. Numerical answers in problem solving will usually be a whole number or worked out to, at the most, one decimal point.

If you get a complex answer to the calculation, check the numbers that you used in the calculation and check by recalculating.

The level of difficulty of problem solving increases with course level. In Standard Grade, the problem solving questions (PS) are clearly identified on the question paper. You know immediately that the answers can be found somewhere in the information presented or that they may be calculated mathematically, using the data.

At Intermediate, Higher and Advanced Higher levels, problem solving questions can only be identified by the wording and style of the question – *calculate, predict, draw a line graph, what conclusion* and so on.

## AN EXAMPLE OF A STUDY PLAN: HIGHER GRADE BIOLOGY UNIT 1

| How good am I? Scale 1-10 | Topics to be revised | Revision check | | |
|---|---|---|---|---|
| | **a) Cell structure in relation to function** | 1 | 2 | 3 |
| | Cell variety | | | |
| | Diffusion and osmosis | | | |
| | Cell wall and plasma membrane in osmosis | | | |
| | Cell wall structure | | | |
| | Plasma membrane structure | | | |
| | Active uptake | | | |
| | **b) Photosynthesis** | 1 | 2 | 3 |

### PROBLEM SOLVING TIP 1: PERCENTAGES

Percentages are another way of representing fractions, decimals and ratios that are based on hundredths. "Percent" means per hundred or "for every hundred".

To calculate percentages, create a fraction first and then convert the fraction to a percentage.

To convert a fraction to a percentage, multiply by 100%.

**Example**

*The table shows the units of penicillin produced by a fungus.*

| Sampling time (hrs) | 0 | 20 | 40 | 60 | 80 | 100 | 120 |
|---|---|---|---|---|---|---|---|
| Concentration of penicillin (units/cm$^3$) | 0 | 0 | 0.8 | 4.5 | 7 | 7.8 | 8 |

Photograph: Rex

*What percentage of the final concentration had been produced after 80 hours?*

- Step 1: Identify the top value for the fraction = 7 units
- Step 2: Identify the lower value for the fraction = 8 units
- Step 3: Write down the fraction = $\frac{7}{8}$
- Step 4: Convert the fraction to a percentage by multiplying by 100

$$= \frac{7}{8} \times 100$$

- Step 5: Calculate value = 87.5%

Examiners make questions more difficult by asking you to calculate percentage increases and decreases.

**Example**
*A cylinder of potato tissue was weighed before and one hour after being placed into a salt solution.*
*Initial mass of potato cylinder = 10 g*
*Final mass of potato cylinder = 9.4 g*
*Calculate the percentage decrease in mass of the potato cylinder.*

Remember, in calculating a percentage, first create a fraction.

- Step 1: Identify the top value of the fraction = Decrease = 10 – 9.4 = 0.6
- Step 2: Identify the lower value of the fraction = Starting mass = 10
- Step 3: Write down the fraction = $\frac{0.6}{10}$
- Step 4: Convert the fraction to a percentage by multiplying by 100

$$= \frac{0.6}{10} \times 100$$

- Step 5: Calculate value = 6%

The easiest types of percentage calculations are when you are asked to find something such as 20% of 400 invertebrates.

- Step 1: Write 20% as a fraction = $\frac{20}{100}$
- Step 2: Multiply the number of invertebrates by the fraction

$$= 400 \times \frac{20}{100}$$

- Step 3: Calculate value = 80

## PROBLEM SOLVING TIP 2: RATIOS

A ratio compares two or more quantities/values in a particular order.

**Example**
*Samples of invertebrates were collected in bushes. The sample contained 60 flies, 35 beetles and five spiders.*
*Calculate the ratio of flies to spiders in the bushes area.*
*Show your answer as a simple whole number.*

- Step 1: Value of 1st group = flies in bush area = 60
- Step 2: Value of 2nd group = spiders in bush area = 5
- Step 3: Show values in correct order = 60:5
- Step 4: Divide both by smallest number

$$\frac{60}{5} : \frac{5}{5} = 12 : 1$$

**Answer** = 12 flies : 1 spider

## PROBLEM SOLVING TIP 3: MASTERING GRAPHS

Graphs to be drawn in the national examinations show slight differences from year to year, but the basic rules that apply are the same. Graphs are usually drawn from the data that is obtained from an experimental situation. The procedures below refer to a line graph. These same rules would also apply to a bar graph.

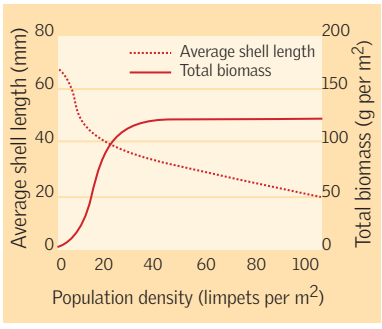
- The factor that was controlled in the experiment becomes the X-axis.
- Each axis (X and Y) is labelled by using all the details as listed in the headings in the table of results.
- If both the X and Y-axis have values that begin at 0 then you must insert a 0 at both axes.
- The scale selected must use at least half of the area available in the graph given
- The scale used must be of equal value; 0 to 5, 5 to 10, 10 to 15, etc
- If the values given do not begin at 0 then you do not have to make up a scale that starts at 0. For example, if a range of values is given from 450 to 650 units then the starting point on the axis would be 450 and not 0.
- The examiner helps candidates in the selection of a suitable scale. The number of squares available within the graph paper relates to the range of values given.
- All points must be plotted accurately. A dot on the exact spot or a thin X (not an amorphous blob).
- All points must be joined. Use a ruler. Do not have thick or wiggly lines.
- A graph to show line of best fit is not usually appropriate except at Advanced Higher Level
- Only connect the line of the graph to the origin if this data has been given.
- If you make a mistake with the graph do not panic or apply paper fluid. There is a second graph in the end pages to allow for a second attempt.

## MORE PROBLEM SOLVING TIPS

Graphs, tables and texts are the main sources of information used. The level of complexity involved in them increases as the course level increases from Standard Grade to Advanced Higher. The following procedures can be applied to line graphs:

- Identify what each axis represents.
- Identify the values that have been used for the scales in both X and Y axis.
- Identify the values for the smallest division within each axis.
- If a graph has two different Y-axes, then take care that you are reading the values from the correct axis.

**Example**
*The graph shows the effects of limpet population density on the average shell length and total biomass.*

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*Use values from the graph to describe the effect of increasing population density on the total biomass of limpets.*

Approaching the graph:

- You must identify the values as this is stated in the question
- The axis you have to use is the Y-axis to the right of the graph.
- The graph you have to follow is the one that is drawn with a solid line.
- In answers to questions like this use *increase, decrease* and *stays constant* in the description.
- Start the description from the origin of the graph.

**Answer**
As the population density increases to 40 limpets per $m^2$ the total biomass increases to 125g per $m^2$.

As population density increases further the total biomass stays constant at 125g per $m^2$.

From the list on page 8 for Problem Solving and Practical Abilities you can see that there could be a great variety of question types.

Terms that cause confusion when used within experimental situation questions, include:

- Validity of procedure
- Accuracy of readings
- Reliability of results
- Control experiments

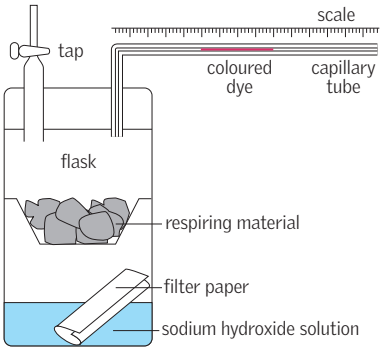
**Accuracy**
This refers to the precision or exactness of the measurements recorded during the experiment. For example, a basic thermometer will be accurate to plus or minus 1C°.

**Validity**
This is to do with the "correctness" or "fairness" of the experimental procedure. The basic idea is that one factor (variable) only should be varied within the experimental procedure and that all the other factors (variables) that may affect the results obtained should be kept the same.

**Reliability**
This is to do with the "believability" of the results obtained when the procedure used is valid and the accuracy of the results is acceptable.

**Controls**
The control is identical in every way except that the factor that causes change is removed – this can be replaced with something that does not bring about change.

**Example**
Describe a control for this experiment:




**Answer**
An identical experimental set up except that the respiring material would be removed and replaced with plasticine.

**Example**
Identify two variables that would have to be kept the same in each experiment.

**Answer**
Any two from: Same mass of material; same volume of solution; same concentration of hydroxide; same time between readings of movement of dye, etc

**Example**
*How would the reliability of the results be improved?*

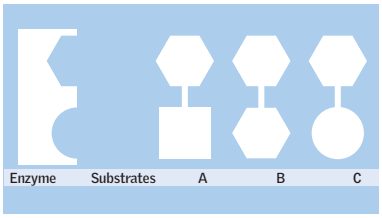
**Answer**
Repeat several times and take an average of the results.

**Reinforcement**
Now find past paper questions and identify questions that test drawing graphs. Do these and get them corrected.

Next do calculations, then selecting information and finally experimental procedures.

Build this into your revision programme.

**Master Knowledge and Understanding**
The learning outcome "Explain the term 'specific' as applied to enzymes and their substrates" is of the type that can be converted into a mind video. To do this requires imagination on your part. From your notes and resources you would have already picked up information on enzymes. Picture that the enzyme has a special shape. Picture the shape of three different substrates (Remember the substrate is the molecule that the enzyme reacts with).




Now picture that the substrate molecules are all moving about and trying to fit into the shape of the enzyme. (Feet into Cinderella's glass slipper).

Can you now picture that only substrate C will fit? It is the only shape that fits and this is because its shape matches the shape of the enzyme.

For some candidates a working model helps better in understanding. The shapes above can be drawn and cut out and then each tested against the enzyme to see if it fits.

Throughout the arrangements there are many learning outcomes that might be better understood from mind videos or working models.

Each topic within the course is made up of several learning outcomes and mastery of a topic has to begin through mastery of each of the individual learning outcomes.

The mastery technique is shown being applied to the following learning outcome:

**Example**
*Explain the term "specific" as applied to enzymes and their substrates.*

- Step 1: Identify each of the parts that make up the learning outcome.

These are: *explain – specific – enzymes – substrates.*

- Step 2: Give meaning to each of the parts identified.

*Explain*: Show by a written answer that you understand how the parts are linked.

*Specific*: particular to only one.

*Enzymes*: biological catalysts / speed up reactions.

*Substrates*: chemicals that enzymes react with.

- Step 3: You have to show in writing how the different parts are linked.

*Specific* means that each enzyme reacts with only the one particular substrate.

- Step 4: The final stage is to interlink each of the different learning outcomes within a topic to provide an overall understanding of the topic area.

Step 4 can only be attempted after completing all the learning outcomes within a topic area. A spider diagram is a good way to represent Step 4.

These are sometimes called mind maps. Try to construct a spider diagram after you have studied all the learning outcomes within a topic. The idea is to link together all the different learning outcomes associated within a single topic. As a learning technique it is equally good to work by yourself or to work with a partner.

**It is important you know about the various types of laboratory equipment and you may need to draw diagrams and explain their function**

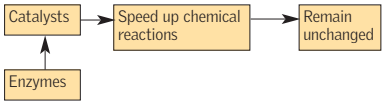
**Photograph: Rex**

Taking enzymes at Standard Grade as an example.

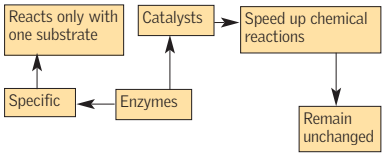
1. In the centre of a blank sheet of paper write the word enzyme into a rectangle.

2. Now start to think of all the facts associated with enzymes.

3. If you remember that enzymes are catalysts, they speed up chemical reactions, they remain unchanged, then you build this into the diagram as shown below.




4. Another piece of knowledge would be that enzymes are specific and the explanation of this is that each enzyme reacts with only the one substrate. This can now be built into the spider diagram.




5. Continue to do this for all the learning outcomes associated with enzymes. You can at times check back to see which, if any, of the outcomes have been missed out.

Try this technique after completing the study of each topic.

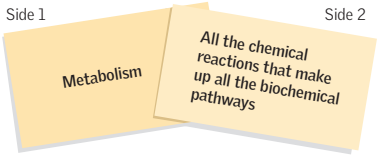
**TIPS FOR LEARNING**

The best way to take facts (pieces of knowledge) into the brain so that they are retained and can be recalled later varies from person to person and it can also vary depending on the complexity of the facts involved. Many students try to learn facts off by heart either by repetition or by re-writing them over and over again. Research into the human brain would not support either of these two as the best of methods. However, unless you have been trained in a recognised learning technique then the following could give good support in your learning.

- Set a self-paced revision programme within a realistic timetable. You have to identify the days

and times that you can set aside for study. Can you find time within the school day? This may be the best time to access videos, web sites, etc. You have to be firm with yourself but also realistic. If there is a TV soap that you normally watch, or an activity or club that you regularly attend, then you still have to have some time to yourself.

- Write out the areas of the syllabus in your order of experienced difficulty. It makes good sense to "master" first those areas that give you the greatest learning problems.
- Have copies of pupil notes, suitable textbooks, and so on available.
- If possible, have access to resources such as suitable videos, CD-ROMs and web sites. Your teacher may be able to direct you to websites such as the BBC Bitesize series. Many of these resources have animation sequences and these have been shown to be a powerful method of learning.
- Have relevant past paper questions.
- Identify key words, phrases and definitions from text books, notes and so on. Produce "Flash Cards" for the words and phrases. Written on one side of the card is a named biological process or structure and on the other is a definition of the process or a description of the function. The two sides of a typical Flash Card look like this:




Both sides are used to ask a question.

Side 1. What is the definition of metabolism?

Side 2. What term is described by "All the chemical reactions that make up all the biochemical pathways"?

Cards can be cut out from A4 paper to a rectangular size of approximately 10.5 cm x 3.0 cm. To keep the cards for a chapter together, punch a hole at a corner and keep them together in a key ring. You can study the key words for that chapter any time, anywhere.

- Use blank diagram sheets to name structures and to give their function.
- Try to draw and label your own diagrams
- Construct flow charts. This is best used when the material under study occurs in stages that have a sequence.
- Construct spider diagrams of an area under study.
- Use internal visualisation – mind videos. Many aspects of Biology allow you to form "videos" inside your brain. You have to use your imagination for this, but the benefits are worth the effort.
- Study with a group of friends. Decide the topic. Use the time to ask questions, to talk about all aspects of the topic, to share ideas, to identify learning outcomes with which you are not confident. Ask questions from flash cards.
- After study, attempt questions from past papers that test the area you have studied. Answers are now supplied with published past papers. Do not be tempted to look at the answers if you are finding the question difficult. If you look you can be kidding yourself on that you understand the work better than you really do.
- Make a note of all the areas that you identified as problem areas. Take these points to your teacher and ask for help.

## TIPS FOR EXAMINATIONS AT ALL LEVELS

- Look carefully at copies of past papers. This gives you a good idea of the lay-out of questions. As a rule the examiner starts the paper with a slightly easier question to give you time to settle into the exam.
- Students normally start at the beginning of an exam paper and gradually work their way through from page to page. There is nothing to prevent you starting wherever you like.
- The sequence of questions in the paper, particularly at Higher and Advanced Higher, often follows the order in which topics appear in the Arrangements Documents. This can help you to locate an area that you feel you understand in depth. It can be reassuring to know that you have answered a question well. This increases your confidence and helps you to relax. The more confident and relaxed that you become then the easier it gets to access the memory centre of your brain.
- It is always advisable for Intermediate 2, Higher and Advanced Higher level candidates to check the essay questions found in Section C of the paper. Your subconscious mind will be processing responses to these questions as you proceed through the paper, making choice selection easier when you reach this stage.
- The number of marks awarded for a question (1, 2 and so on) is an essential indicator of the number of points required in your answer. Remember there are no half marks in Biology so you have to give your best attempt and deliver all the facts that you consider relevant to the question. Marks are not deducted for additional information, unless it contradicts the correct answer.
- Another good indicator is given by the length and number of lines provided in the answer space. Short, single lines are provided for one or two word answers, two or three long lines for descriptions and explanations. If you run out of space, give a clear indication that the question is completed at the back of your answer book. Give the question number and identify the part of the question you are answering.

## STANDARD GRADE

There are two papers, the easier at General level, the more difficult at Credit level.

In the General paper, 100 marks are awarded, divided equally between Knowledge and Understanding (KU) and Problem Solving (PS). The time allowance is 90 minutes.

The marks are clearly identified as being awarded to one or other element of the course in the "Marks" column at the right-hand side of the exam paper.

It is always worthwhile checking to see if the mark is PS. This means that the answer may well be provided in the information or data in the question, eg in a written passage or data table. Alternatively, it may have to be calculated.

You can expect questions at General level to be straightforward. Often, when examining KU, the questions begin with "*Name, Select, State, Give, Complete, Which and What*". For example, a question may begin "*Name two abiotic factors*" or "*Give the name of one enzyme*" or "*Select the term which describes*" or "*Complete the equation*".

You may also be asked to circle or underline an answer from a list or add an arrow or label to a diagram. Ensure that you follow such instructions. You would be surprised at the number of candidates who fail to follow simple instructions.

If you've learned your facts, the exam is relatively straightforward. Strangely, there are a greater number of facts to learn at **General** level compared to **Credit** level. The difference between the two levels is in the greater complexity of some of the facts and the types of question that you are asked.

In the Credit level paper only 80 marks are awarded, split equally between KU and PS, and time to complete the exam is the same – 90 minutes. More of the questions asked are at a higher level of demand. The KU questions often begin with *Describe, Explain, Explain why, Explain how and Suggest.* Another technique used by the examiner is that you have to provide two pieces of knowledge for one mark.

*Explain how* and *Explain why* questions are best answered in two parts.

Part 1 – *It is because* ..... and Part 2 – *and.*

**Example questions**

*Explain how an increased number of capillaries in the heart muscle contributes to its efficiency.*

**Answer**

*It is because* with an increase in capillaries more blood flows to the heart *and* with more blood oxygen and glucose reach the heart muscle faster.

*Explain why a range of antibiotics is needed to treat bacterial diseases.*

**Answer**

*It is because* the one type of antibiotic does not kill all bacteria *and* by giving a range one of them should kill the bacteria that is causing disease.

*Describe the arrangement of the semi-circular canals and explain this arrangement.*

**Answer**

The semi-circular canals are arranged in three planes (not directions). This allows detection of movement in all directions.

Problem Solving questions are set at a higher level and calculations often involve decimal fractions.

## INTERMEDIATE

Intermediate 2 level coursework is designed to

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overlap with, and be a progression from, Standard Grade work. If you have a Standard Grade award, the style of the examination questions, as well as some of the knowledge and understanding, will appear familiar to you. However, there are a number of significant differences.

## INTERMEDIATE 1

This paper lasts one and a half hours. The course-work covers three topics – Health and Technology, Biotechnological Industries and Growing Plants.

The examination consists of one paper worth a total of 75 marks.

The paper is divided into two sections:

**Section A** – 25 multiple choice items, each worth one mark.

Advice for tackling multiple-choice questions is similar to that given for Higher papers.

**Section B** – a section of structured questions worth 50 marks.

KU questions are interspersed with PS, with between 9-11 of the multiple choice being PS and 20-30 marks of Section B testing PS.

## INTERMEDIATE 2

This paper last two hours. The coursework covers three topics – Living Cells, Environmental Biology and Genetics and Animal Physiology.

The examination consists of one paper for which 100 marks are awarded.

The paper is divided into three sections:

**Section A** – 25 multiple choice items, each worth one mark.

Advice for tackling multiple-choice questions is similar to that given for Higher papers.

**Section B** – a section of structured questions worth 65 marks.

**Section C** – four extended writing questions of which candidates select two, each worth 5 marks.

KU questions are interspersed with PS questions with between 9-11 of the multiple choice and 15-20 marks of the structured paper testing PS.



Skills in answering Sections A, B and C are the same as outlined for Higher Biology

## HIGHER GRADE

This exam lasts two and a half hours. The Higher Biology and Higher Human Biology papers have the same layout .

**Section A** – 30 multiple-choice questions of which 9-11 test problem solving

**Section B** – structured questions worth 80 marks in total, mainly testing KU, but with one data-handling question and one question based on an unknown experimental situation.

**Section C** – Candidates are expected to answer one out of a choice of two structured extended-response questions for 10 marks and to answer one out of a choice of two open extended-response questions for 10 marks (1 mark for relevance, 1 mark for coherence and 8 marks for knowledge and understanding).

The Marking Grid for Section A is attached to the examination paper. The Grid contains all the information about you – candidate number, name, school and so on. The reason for this is that Section A will be electronically marked.

**Section A**

Read the instructions for completing the multiple-choice paper, particularly the part on how to correct answers you decide to change.

Make sure that you answer every question and that as you answer the question you clearly mark the correct answer with a horizontal line on the grid.

The best way to treat multiple-choice questions is to see if you can answer the question without looking at the choices. If you can, then look for the option that matches your answer. If a question is giving you difficulty, try firstly to remove any of the options that you think are clearly wrong. Continue to try to remove options until you are left with one only. This has to be your answer.

There is usually a fairly equal distribution of answers A, B, C and D in the multiple-choice. It is worth checking this if you have time.

This year, Section A will be marked electronically. Answers have to be inserted in pencil.

The new grid and method of answering and changing an answer is shown below.

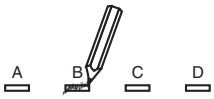
**Question**

*Which of the following foods contains a high proportion of fat?*

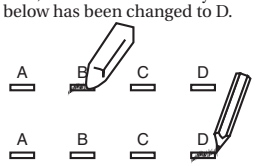
| | |
|---|---|
| A | Bread |
| B | Butter |
| C | Sugar |
| D | Apple |

The correct answer is B – Butter

The answer B has been clearly marked with a horizontal line in pencil.




If you decide to change your answer, carefully erase your first answer, using an eraser, and using your pencil, fill in the answer you want. The answer below has been changed to D.




**Section B**

The structured questions in this section test knowledge and understanding and problem solving. The presentation of questions broadly follows the sequence in which topics appear in the Arrangements Document.

Questions that begin with *Name, State, Give, Identify, What , Which*, and so on, are usually of a lower level of demand. Questions that begin with *Describe, Explain how* and so on are usually of a higher level of demand.

To gain a pass at Grade A or B you must be answering correctly as many of these kind of questions as possible. Remember to gauge the level of response required in your answer by checking marks awarded and line length.

When asked for biological terms do your best to get spelling correct. Marks are not usually deducted for misspelling except where confusion with similar biological terms occurs. Ensure that you can differentiate glycogen from glucagon, stoma from stroma and thymine from thiamine..

Abbreviations are acceptable for many terms: DNA, ATP, NAD, FSH, LH, ADH.

The data handling and experimental situation questions are set in unfamiliar contexts.

You must practise answering these types of questions from the book of past papers and after a time you should observe a pattern in the type of answer expected each question type.

- How to select information from a graph with two Y-axes.
- How to describe a control in an unknown experimental situation.
- Why apparatus should be left for a time before taking readings.
- How to make a prediction from results.
- How to draw a conclusion from results.
- How to draw a line graph, and so on.

**Section C**

To achieve a Grade A or B you must answer well in the extended-response questions.

Successful writing is critical to achieving a good grade. Decisions on which questions to do can be made easier if you have checked out the titles at the start of the exam. Your brain will have been working away in response to the titles and you should, by the time you reach Section C, be ready to make your choice. The order in which the extended-response questions are answered does not matter.

The titles must be read carefully. You can only gain full marks if you have attempted to answer every area within the question.

**Question**

*Write notes on each of the following:*
*(i) the importance of nitrogen and magnesium in plant growth and development and symptoms of their deficiency*
*(ii) the importance of vitamin D and iron in humans*

The areas you must answer to in part (i) are:

- The importance of nitrogen in plant growth and development.
- The importance of magnesium in plant growth and development.
- The symptoms of nitrogen deficiency.
- The symptoms of magnesium deficiency.

You cannot score the full marks available unless you answer all these areas.

In the structured extended-response question you are not penalised for giving information that is not relevant to the title. This is not so in the open extended-response question.

In the open extended-response question there are only 8 marks available for KU. You can only gain full marks if you have attempted to answer every area within the question.

**Question**

*Give an account of the effect of light on shoot growth and development, and on the timing of flowering in plants and breeding in animals.*

The question can be broken down into areas, all of which your answer must cover:

- The effect of light on shoot growth and development.
- The effect of light on the timing of flowering in plants.
- The effect of light on the timing of breeding in animals.

You cannot score the full marks available for KU unless you answer to all of these areas.

To gain the coherence mark your answer must match the following:

- The writing should be under sub headings or divided into paragraphs.
- Related information must be grouped together
- There must be a minimum of five relevant points in the answer with at least one point given for each area.

To answer this type of question make sure that you identify the areas within the question: write them down. Begin your answer to each of the areas by writing down a suitable sub heading.

First sub heading would be: The effect of light on shoot growth and development

A lab researcher at the Pasteur Institute holds up a petrie dish

Photograph: Rex

You now write down all the relevant knowledge that you can recall on this area.

The second sub heading would be: The effect of light on the timing of flowering

You now write down all the relevant knowledge that you can recall on this area

The third sub heading would be: The effect of light on the timing of breeding in animals

You now write down all the relevant knowledge that you can recall on this area.

To gain the relevance mark your answer must match the following:

- You must not give details of any other effects of IAA or any effects of GA
- There must be a minimum of 5 relevant points in the answer with at least 1 point given for each area.

In extended-response questions each piece of relevant knowledge can be seen to have a value of 1 mark. In the structured question the mark allocation for each area will be an indicator as to the number of pieces of relevant knowledge that is required. In the open question there is no indication of how the eight available marks are to be allocated. In this case you try to write down every last piece of relevant information that you have learned.

Check that you have presented the maximum number of points possible.

Diagrams can be used in extended-response questions and often help clarify your understanding of the facts, e.g. a diagram representing the fluid mosaic structure of the plasma membrane can help display your knowledge of the chemicals present, their molecular arrangement and indeed some of the functions, such as channel proteins. A must is that all diagrams have to be fully labelled.

Flowcharts can be used in extended-response questions. Typical questions that suit this style would be respiration and photosynthesis. The biggest danger is forgetting to show the direction of flow. The direction of flow must be shown by arrows otherwise marks are lost.

Bullet points can be used in extended-response questions. But each bullet point must contain a clearly understood and relevant statement that matches the marking instructions.

**Example 1**

- A virus injects its DNA into the host cell

This is acceptable as it is a clear statement

**Example 2**

- Viral DNA
- Enters host cell

This is not acceptable – no clear statement within each bullet point

Practise the extended-response type of questions. After studying a topic ask your teacher for a suitable title. Try to answer without looking at your notes. Slowly but surely you will start to improve and as you improve you will gain in confidence. Section C is the most difficult area within the examination. You must train for success in this area.

## ADVANCED HIGHER

The layout of the paper is similar to the Higher. The exam lasts two and a half hours

**Section A**

This section contains 25 multiple-choice questions based on the two mandatory units (Cell and Molecular Biology and Environmental Biology). Of these 8-10 test PS, the remainder test KU. One mark is allocated to each question.

Advice for tackling multiple-choice questions is similar to that given for Higher Exams.

**Section B**

This section contains structured questions, data handling questions and extended response questions based on the two mandatory units with an allocation of 55 marks. Between 13-16 marks test PS and the remainder test KU.

There is one large data-handling question that is interspersed with KU questions. The question is based on several types of complex data (graphs, pie charts and tables).

Some additional tips for answering the data handling question are:

- Read the introduction to the question carefully as it contains significant details necessary to your understanding of the questions.
- Go through this question, underlining or highlighting key information.
- Study the data provided carefully. Note, in particular, the scale being used in graphs and the multiple units in which the scale rises.
- Check to see if two 'y' axes are labelled and ensure that you relate the readings you make from the graph to the appropriate scale.
- When asked to describe trends in data, describe all significant changes in the pattern, quoting relevant figures where these changes occur.
- Where asked to summarise the data or give overall conclusions, use all sources – the introduction, tables, graphs and diagrams. Once again, focus on general trends but provide significant figures to support your answer.

Advice for the extended response question is the same as for Higher Exams and there are no coherence or relevance marks.

As with Higher Exams, check the titles of the extended response question at the start of the exam. A "brainstorm" of key facts may help you decide which title to choose.

No marks are awarded for coherence or relevance so every justified fact counts. To gain a mark you not only have to describe or name a relevant fact e.g. excessive use of fertilisers can cause algal blooms, but also expand on this by giving an explanation of the term algal bloom.

It is really important for you to use correct terminology to which you have been introduced at Advanced Higher level. Do not revert to Higher or Standard Grade language. For example, use photosynthetic autotrophs rather than green plants. Preparing a vocabulary list of key words and terms should form part of your revision. These can be written onto flash cards.

**Section C**

This section contains structured questions, data handling questions and extended response questions based on each of the optional units with an allocation of 20 marks. Candidates are expected to answer questions on one of the optional units. For each unit 4-6 marks will test problem solving and the remainder will test knowledge and understanding.

### BIOLOGY EXAM TIMETABLE

| Level/Paper | Time |
|---|---|
| **Monday May 21** | |
| Intermediate 1 | 9am-10.30am |
| Intermediate 2 | 9am-11.00am |
| General | 9am-10.30am |
| Credit | 10.50am-12.20pm |
| Higher | 1pm-3.30pm |
| Advanced Higher | 1pm-3.30pm |