BIOLOGY Introduction

Biological activity

David Bourke, who has been teaching biology at the Institute for over 40 years, emphasises the importance of lab work

Introduction

The day the Leaving Cert results came out this year, Dick Ahlstrom and Peter McGuire wrote in *The Irish Times*: "Biology is one of the most difficult subjects for students to achieve an honours in, with just 69.6 per cent getting an A, B or C grade". This might surprise many candidates who may have been under the impression that biology was an "easy" science subject.

The student of biology faces three main difficulties. Firstly, the present syllabus is based largely on practical work and is best understood by carrying out the specified mandatory practicals. If students do not have access to a laboratory or do not have proper facilities they are at a severe disadvantage.

Secondly, the language of biology may be a barrier for some students as it is largely based on Latin and Greek. While students are not required to know the origin of words it is extremely important to understand the exact meaning of words and definitions as used in science.

Finally, the biology course covers a wide variety of topics, from genetics to ecology to human biology. Some students find it difficult to cover every section of the course and to cross-link information from various topics in answering questions. This applies to the higher level questions in particular.

Addressing the difficulties

The following articles address these difficulties by providing clear and interesting tasks for students. Examine the suggestions listed below. Some may work for you; others may not suit your style of study. Any system of study must hold your interest and build your confidence. The only way to find out which methods suit you is to try them. Remember the essential feature of all revision is to be active.

These articles cover both the higher and ordinary level courses. Where specific differences occur in the syllabus these will be indicated with "O" for ordinary level material and "H" for higher level.

At a glance - the exam paper

Both the Higher and the Ordinary level papers follow the same format.

Note the allocation of marks:

- Section A: Five questions x 20 marks each=100 marks
- Section B: Two questions x 30 marks each=60 marks
- Section C: Four questions x 60 marks each=240 marks

Section A: (Questions 1–6)

This covers short definitions and word meanings from all parts of the course, including the mandatory practicals. The instructions say answer five questions. Do all six. The best five will be added up.

Section B: (Questions 7, 8, 9)

These questions deal with the mandatory practicals only. Choose your two questions carefully. You must be able to answer all parts of the question.

Section C: (Questions 10–15)

The "long" questions are asked here. All parts of the course will be examined, including the mandatory practicals. You must select four out of six questions. Questions 10, 11, 12 and 13 are each divided into parts (a), (b) and (c). Make sure you can attempt all parts of the question if you select one of these. Questions 14 and 15 have internal choices. You have to answer two of (a), (b) or (c). Because of this choice these questions deserve careful attention.

Mandatoty practical: Molly Corbet runnning an experiment at the Institute of Education
Photograph: Brendan Duffy

BIOLOGY

Mandatory practicals

The appliance of science

The mandatory practicals part one: the importance of doing all the experiments. Familiarity with over 20 experiments is needed to prevail, writes **David Bourke**

The introduction of a set number of mandatory experiments into the biology syllabus has been a most welcome development. There are 22 mandatory practicals for ordinary level, with one extra for higher level (the effect of heat denaturation on enzyme activity).

Section B of the exam paper deals specifically with these experiments. While you are required to answer two questions out of a selection of three, this does not mean that you will only require information about two experiments as some of the questions may require information from multiple experiments.

TASK 1
Look at the following questions from past papers.

Higher level 2011 question 8
(a) State a use for each of the following in the biology laboratory:
(i) Buffer solution
(ii) Biuret test
(6 marks)
(b) (i) In the course of your practical studies you used a solution of iodine in different investigations. State **two** different uses of the iodine solution.
(ii) State **two** different uses of a water bath in biological investigations.
(iii) In the course of your practical studies you found that heart rate and breathing rate increase with exercise. Explain why this is the case.
(iv) In the course of your practical work you prepared a transverse section (TS) of a dicot stem for microscopic examination. How did you prepare the TS?
(24 marks)

Comment
This question requires information from eight experiments.

The detailed nature of some of the questions makes it essential that you have carried out the experiments and written them up yourself. Examine the following question:

Ordinary level 2011 question 7(b)
Answer the following questions in relation to your investigation into the growth of leaf yeast.
(i) From what plant did you obtain the yeast?
(ii) Name the nutrient medium on which you grew the yeast.
(iii) Outline the steps you followed to get the yeast cells onto the nutrient medium.
(iv) How long did it take for the yeast to become visible on the nutrient medium?
(v) How did you recognise the yeast?
(vi) Describe **one** aseptic technique you carried out during this investigation.

Comment
It would be very difficult for a student to answer this question without having done the practical work. No student could "learn off" the answer before the exam. You may have done the experiments as a group but you need to keep your own records of methods, results and conclusions.

The questions may provide you with scientific information to test you on general laboratory procedures and the scientific method. Examine the following question:

Higher level 2011 question 7(b)
Scientists investigated the effect of a certain mineral on the growth of wheat.

Cross-section of a plant stem

Use your knowledge of biology and laboratory procedures to answer the following questions.
(i) Suggest a reason why the seeds used were all taken from one parent plant.
(ii) The compost in which the wheat plants were grown was sterilised at the start of the investigation.
1. Suggest a way in which the scientists may have sterilised the compost.
2. State **one** reason why it was important to sterilise the compost.
(iii) Why did the scientists divide the young wheat plants into two equal groups?
(iv) During the investigation the scientists kept the two groups of plants under identical conditions. Why was this?
(v) Name **two** conditions you think the scientists would have kept constant during the investigation.
(vi) Why did the scientists repeat the investigation several times before publishing their results in a scientific journal?
(24 marks)

Comment
This question is not one of the mandatory investigations, but requires you to "use your head" to answer questions on laboratory techniques and the scientific method.

Questions on the mandatory experiments may also be asked in sections A and C of the exam paper. The best preparation is to do all the practicals and write them up fully in a separate book.

TASK 2
The following is a list of all the mandatory investigations. Mark off the ones you have completed in class and check that you have them written up fully.

"Keep your own records of methods, results and conclusions

1. Learn how to use the microscope.
2. Prepare and examine one type of plant cell (stained and unstained) with light microscope.
3. Prepare and examine one type of animal cell (stained and unstained).
4. Carry out any experiment to demonstrate osmosis.
5. Prepare and examine a transverse section of a dicotyledonous stem.
6. Investigate the effect of water, oxygen and temperature on seed germination.
7. Investigate the digestive activity in seeds during germination.
8. Conduct a qualitative test for reducing sugar, starch, protein and fat.
9. Investigate the effect of pH on the rate of an enzyme's activity.
10. (a) Investigate the effect of temperature on the rate of enzyme's activity.
(b) Look at the effect of heat denaturation on the activity of one enzyme (H).
11. Prepare one enzyme or yeast immobilization and examine its application.
12. Dissect and identify the parts of a sheep's heart.
13. Investigate the effect of exercise on breathing rate **or** pulse rate of a human.
14. Examine the effect of light intensity **or** carbon dioxide on the rate of photosynthesis.
15. Prepare and show the production of alcohol by yeast.
16. Investigate the effect of IAA growth regulator on plant tissue.
17. Separate DNA from a plant tissue extract.
18. Identify and use apparatus for sample collection in an ecological study.
19. Use keys to identify five flora and five fauna.
20. Conduct a quantitative survey of a sample area of a selected ecosystem.
21. Investigate three abiotic factors in the ecosystem.
22. Investigate the growth of leaf yeasts using agar plates.

Top five tips for the exam

1. When answering section C questions quickly read over the six questions, marking those that look familiar. Now choose your best question and give it your full attention. This will give a large boost to your confidence.
2. Make plenty of use of simple, clear, labelled diagrams. It is very useful to begin an answer with a suitable diagram. You can then refer the examiner to the diagram in the course of your answer.
3. Refer to examples as often as possible, especially examples drawn from the course.
4. List key points of information on filing cards for rapid revision the night before the exam.
5. Bring your calculator with you. Have spare pens, ruler, pencil and eraser.

Biology – Mandatory practicals

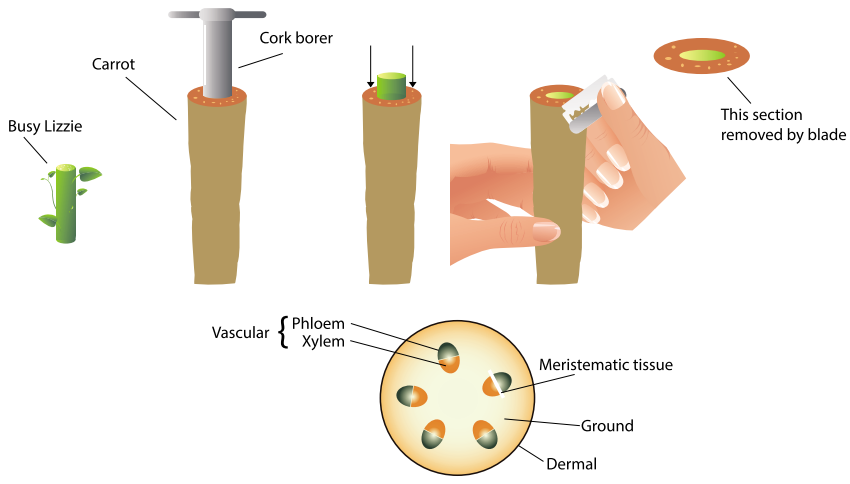


Diagram 1: Transverse section (TS) of a dicot stem

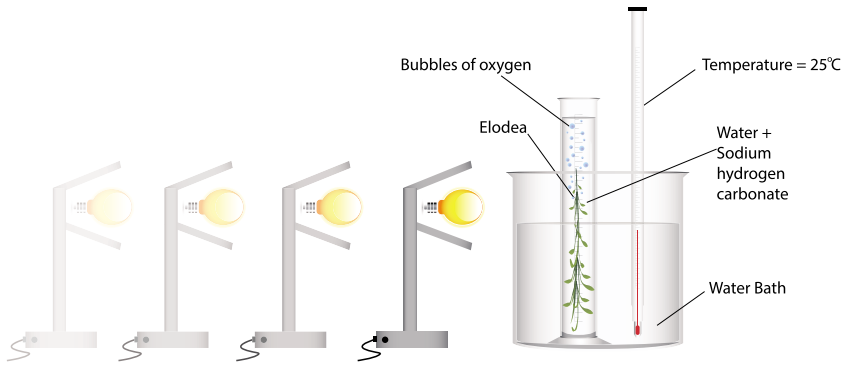


Diagram 2: Light intensity versus rate of photosynthesis

Prepare to reason

The mandatory practicals part two: the reasons for particular procedures. Remember to write notes on the experiment steps you did not personally perform

You must understand the reasons for certain steps in the course of an experiment. This type of question can be difficult to answer, especially if you have not carried out the experiment fully by yourself. In the classroom, many experiments are carried out in groups of three or four. Certain steps may be unfamiliar to you. This is why it is important to write up the experiment fully by yourself after the experimental work has been completed. Under "Materials and Methods" you need to highlight the reason for following a particular instruction.

Here are some examples:

Experiment: To prepare and examine a transverse section (TS) of a dicot stem (Diagram 1)

Why did you use an internode section of stem?
Answer: To keep the vascular bundles intact.
Why did you embed the length of Busy Lizzie stem in carrot or wax?
Answer: In order to make a thin shaving of the stem and for safety reasons.
Why did you transfer the sections to a dish of water?
Answer: To make it easy to find the thinnest section.

Experiment: To examine the effect of increasing light intensity on the rate of photosynthesis (Diagram 2)

Why did you place the graduated cylinder and plant in the beaker of water?
Answer: To keep the temperature constant.
Why did you gradually move the bulb closer to the plant?
Answer: To increase the light intensity.
Why did you delay counting the bubbles of oxygen after moving the bulb closer to the plant?
Answer: To allow the plant time to adjust to the new light intensity.
Why did you add sodium hydrogen carbonate to the graduated cylinder?
Answer: To act as a source of carbon dioxide for the synthesis of glucose.

Experiment: To investigate the growth of leaf yeasts using agar plates. (Diagram 3)

Why did you add malt extract to the agar?
Answer: To provide nutrients for the yeast cells.
Why did you place the malt agar in the autoclave (pressure cooker)?
Answer: To make sure the initial medium was sterile.
Why did you invert the dishes after 24 hours?
Answer: To prevent too many yeast cells growing on the plate and to make it easy to count the individual colonies of yeast cells.
Why did you use leaves from different areas?
Answer: Because yeast cells are sensitive to atmospheric pollution and to compare the air quality from different areas.

EXAM TIMES ONLINE

For more Irish Times/Institute of Education Exam Times, see

irishtimes.com/examtimes

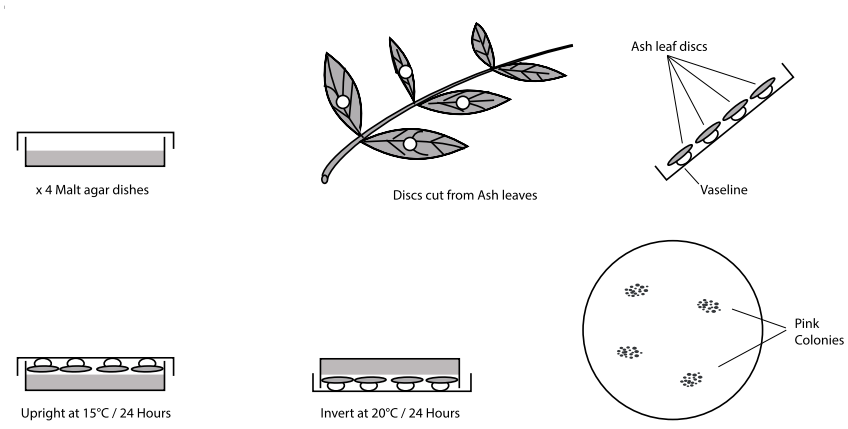


Diagram 3: Leaf yeasts

SAMPLE QUESTIONS

Ordinary level 2011 question 8(b)

For what purpose did you use each of the following in the course of your practical activities?

(i) Fehling's solution **or** Benedict's solution.
(ii) Anaerobic jar.
(iii) Cover slip.
(iv) Buffer solution.
(v) Methylene blue.
(vi) Sodium alginate.
(vii) IAA.
(viii) Freezer-cold alcohol.

Answer: Marks=2(6)+6(2)

(i) To test for glucose / reducing sugar
(ii) To remove oxygen / see if oxygen is necessary for some process.
(iii) To protect the objective lens / stop evaporation.
(iv) To keep the pH constant.
(v) To stain cells / nucleic acids.
(vi) To immobilise enzymes / make beads.
(vii) To examine growth regulators / stimulate (or inhibit) growth / to produce seedless fruit.
(viii) Bring DNA out of solution / isolate DNA.

Higher level 2011 question 9(b)

Answer the following questions by referring to the procedures that you used to isolate DNA from a plant tissue.

(i) Having obtained a plant tissue,eg onion,
1. What was the first procedure that you followed?
2. What was the reason for that procedure?
(ii) Washing-up liquid is then used in the isolation. Give a reason for its use.
(iii) Salt (sodium chloride) is also used in the isolation. Give a reason for its use.
(iv) 1. What is a protease?
2. Why is a protease necessary when isolating DNA?
(v) The final stage of the isolation involves the use of freezer-cold ethanol.
1. Describe how it is used.
2. For what purpose is it used?

Answer: Marks=8(3)

(i) 1. Chop.
2. To disrupt cell walls / to increase surface area.
(ii) To break down membranes.
(iii) To clump the DNA / to protect the DNA from other positive ions.
(iv) 1. An enzyme that digests proteins.
2. Because DNA is bound to proteins.
(v) 1. Added slowly down the side of the test tube.
2. To bring the DNA out of solution / isolate the DNA.

BIOLOGY

Mandatory practicals

Finding the solution

The mandatory practicals part three: chemicals and reagents used in experiments. This can be a tricky section for those not taking chemistry

Biology students not familiar with chemistry may feel uncomfortable with the names and uses of chemicals in the course of practical investigations. Generally words and word equations can be used for chemicals and chemical equations. These are very few chemicals for which the formula must be known. Most students are familiar with the following formulae:

Water: H_2O
Carbon dioxide: CO_2
Glucose: $C_6H_{12}O_6$
Oxygen molecule: O_2
Nitrogen molecule: N_2
Nitrate: NO_3

Remember, a reagent is a chemical used to test for the presence of another chemical.

TASK 1

Copy out and complete the chart of chemicals and their functions. Leave extra rows for further chemicals as you revise.

Chemical	Function
Iodine	Staining onion cells
Methylene blue	Staining cheek cells
Behedict's or Fehling's solution	To test for glucose (reducing sugar)
Biuret reagent	.....
Buffer tablets	.....
Malt extract	.....
Agar	.....
(Add your own)	.....

TASK 2

You can reverse this exercise, placing the function in the first column and then choosing the correct chemical in the second column. The first three have been completed as examples. Leave extra rows for further functions as you revise.

Function	Chemical
To add carbon dioxide to water	Sodium hydrogen carbonate
To test for starch	Iodine
To immobilise enzymes	Sodium alginate beads
Growth regulator involved in phototropism	.....
To test for the presence of alcohol	.....
(Add your own)	.....

SAMPLE QUESTIONS

Various ordinary level papers

Name a stain for plant cells.
Answer: Iodine (3 marks)

Name a chemical to test for a reducing sugar (eg glucose).
Answer: Benedict's or Fehling's solution (3 marks)

Name one substance found in the walls of xylem but not found in the walls of phloem.
Answer: Lignin (3 marks)

Name a test or the solution(s) that is (are) used to detect protein in a food source.
Answer: Biuret test (sodium hydroxide plus copper sulphate) (3 marks)

What type of agar did you use to investigate digestive activity during germination?
Answer: Starch agar (5 marks)

How did you show that alcohol had been produced by yeast?
Answer: Dichromate test – mix sample with potassium dichromate and sulphuric acid. A green colour indicates alcohol
(1 mark)
or
Iodoform test – mix sample with potassium iodide and sodium hypochlorite. Yellow crystals indicate alcohol
(1 mark)

Name the chemical used to show the presence of starch.
Answer: Iodine solution (5 marks)

How did you keep a constant pH during the investigation?
Answer: Use buffer tablets of a particular pH value (3 marks)

What reagent or chemicals did you use to test for protein?
Answer: Biuret or Sodium hydroxide + copper sulphate (6 marks)

Higher level 2006 question 7

(a) State a use of each of the following in the biology laboratory.
(i) Biuret test (copper sulphate and sodium hydroxide solutions).
(ii) Benedict's (or Fehling's) test.
(6 marks)
(b) In the case of each of the following state:
1. An investigation in which you used it.
2. The precise purpose for its use in the investigation that you have indicated.
(i) IAA.
(ii) Starch of skimmed milk agar plates.
(iii) Cold alcohol (ethanol).
(iv) Alkaline pyrogallol or anaerobic jar.
(24 marks)

Answer

(a) (i) To test for the presence of protein. (3 marks)
(ii)To test for the presence of a reducing sugar (glucose). (3 marks)
(b) (i)1. To investigate its effect on plant growth or cell elongation. (3 marks)
2. To see if different concentrations of IAA have different effects. (3 marks)
(ii)1.To examine digestive activity of enzymes. (3 marks)
2.To act as a substrate for the enzyme . (3 marks)
(iii)1. The extraction of DNA. (3 marks)
2.To separate DNA from the filtrate. (3 marks)
(iv)1. To examine the conditions necessary for germination.
2.To remove oxygen. (3 marks)

Chemical chameleons

The mandatory practicals part four: initial and final colours of reagents (test solutions)

In the course of many experiments a reagent may change colour to indicate the presence of the substance under investigation. The change in colour gives a "positive result". If the reagent does not change colour you get a "negative result". You need to know the starting colour of the mixture and the final "positive" colour of the mixture. You also need to know if the mixture has been heated or not. See the table at right for examples.

SAMPLE QUESTIONS

Ordinary level 2009 question 7(b)
The composition of a **colourless** sports drink is to be investigated. Use your knowledge of food testing to answer the following:
1. (i) Name the test **or** name the chemical used to test a sports drink for the presence of glucose (reducing sugar).
(ii) If glucose is present in the drink, what colour change would you expect to see? In your answer give the initial **and** final colour of the test solution. (iii) Is heat necessary for this test?
2. (i) Name the test **or** give the chemicals used to test the sports drink for the presence of protein.
(ii) If protein is present in the drink, what colour change would you expect to see? In your answer give the initial **and** final colour of the test solution.
(iii) Is heat necessary for this test?

Answer: Marks = 2(9) + 6(1)
1. (i) Benedict's or Fehling's solution.
(ii) Initial colour is blue. Final colour is brick-red.
(iii) Yes. Heat in a water bath.
2. (i) Biuret test (sodium hydroxide plus copper sulphate).
(ii) Initial colour is light blue. Final colour is violet / purple.
(iii) No.

Ordinary level 2012 Question 9(b)
Answer the following questions in relation to food tests that you carried out as part of your practical work.
(i) What chemical did you use to test the food for starch?
(ii) Was heat necessary for this test?
(iii) How did you know that starch was present?
(iv) What control did you use in this test?
(v) Another food was tested for the presence of protein. What solution was used to test for protein?
(vi) What was the initial colour of the protein-testing solution before you put in the food?
(vii) Was heat necessary for this test?
(viii) What colour indicated that protein was present in the food?

Answer: Marks = 2(6) + 6(2)
(i) Iodine (solution).
(ii) No.
(iii) Blue/Black colour.
(iv) Used water instead of starch.
(v) Biuret (solution) or named chemical, ie: $NaOH + CuSO_4$
(vi) Blue.
(vii) No.
(viii) Purple / violet / pink.

Higher level 2009 question 1(e)(f)
(e) Name a test or give the chemicals used to demonstrate the presence of a reducing sugar.
(f) In relation to the test referred to which of the following is correct?
1. No heat needed.
2. Heat but do not boil.
3. Boil.

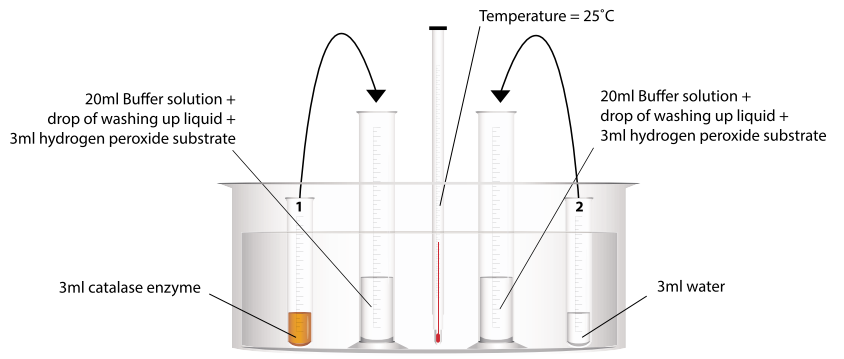
Answer: Marks = 2(4)
(e) Clinistix or Benedict' or Fehling's or Copper sulphate.
(f) Number 2 is correct, heat but do not boil.

> "The change in colour gives a 'positive result'"

Test (plus reagent)	Initial colour	Heat	Final positive colour
Glucose (Benedict's or Fehling's)	Blue	Yes	Brick-red
Protein (Biuret)	Light blue	No	Violet
Starch (iodine solution)	Colour-less	No	Blue-black
CO_2 (Lime water)	Colour-less	No	Milky
Alcohol (iodoform test)	Light brown	Yes	Yellow crystals
Alcohol (dichromate test)	Orange	Yes	Green
Lignin, eg xylem (aniline sulphate)	Colour-less	No	Yellow

Enzyme experiments

There is a series of set questions that are asked regularly on the effects of pH levels



Effect of pH on catalase activity

For the enzyme experiments it is extremely important to be able to answer set questions, eg:
1. How did you start the experiment?
2. What was the variable factor in the experiment? How did you vary this factor?
3. What was kept constant during the experiment? How was this done?
4. How did you monitor the progress of the experiment?
5. What control was used in the experiment?
6. What were the results of the experiment?
7. What conclusion did you draw from the results?
8. If the experiment involved enzymes:
(i) What substrate did you use?
(ii) What enzyme did you use?
(iii) What product was formed?

Ordinary and higher level example
Answer the above questions in relation to the effect of changing pH on enzyme activity, eg catalase activity, on hydrogen peroxide.

Answer
1. By mixing the enzyme (catalase) and substrate (hydrogen peroxide) together.
2. pH. By using different buffer tablets.
3. Temperature. By using a water bath.
4. By measuring the volume of foam in the graduated cylinder.
5. Equal volume of hydrogen peroxide with distilled water instead of enzyme.
6. The enzyme was most active at pH 9. Above and below this pH the enzyme activity was reduced.

See diagram above.

Marking scheme

Scientific questions look for specific pieces of information. If this information is not in the answer, no marks will be given. Quality, not quantity is the secret for good answers. The marking scheme contains key words or phrases for which the student may be awarded marks. Other words or phrases which mean the same thing will be accepted provided they are scientifically accurate and used in the correct context.

If you cancel an answer and make no other attempt to answer the question, the cancelled answer will be accepted if it is correct. In section A, surplus wrong answers will cancel the marks for a correct answer.

Example
Question: The walls of xylem vessels are reinforced with...?

Marking scheme: Lignin (Four marks).

Sample answer: Chitin , Lignin.
(No marks. The surplus wrong answer cancels the right one.)

Sample answer: Lignin [struck-through]
(Four marks. The cancelled answer is correct.)

Sample answer: Chitin [struck-through], Lignin.
(4 marks. The wrong answer has been cancelled.)

Past papers
It is a very useful exercise to attempt to correct questions using the official marking scheme. Marking schemes for past papers can be downloaded from examinations.ie

BIOLOGY

The language of biology

Learning the language of life

Strange words can be used to convey simple ideas in biology but discovering their meanings can bring them to life

Use the biology dictionary

As you make your way through the course make sure you understand the language of biology. Many strange words are used to describe simple ideas. Behind every word is a story. If the story is explained then the word jumps to life and many other connections are made. Some words are used repeatedly in biology. By discovering the meaning of basic words the language of biology is unlocked. Here are some examples:

– *autos* = self(autotrophic, autoclave)
– *bios* = life (biology, biomass, biosphere)
– *chloro* = green (chlorophyll, chlorosis, chloroplast)
– *mitos* = thread (mitosis, mitochondria)
– *trophein* = to feed (autotrophic, heterotrophic, trophic levels)
– *trope* = to bend (tropism, phototropism)

TASK
Look up the following words in the new syllabus *Biology Dictionary* (Folens).
– Micropyle
– Allele
– Embryo
– Sphincter
– Parasite
– Achilles tendon
– Haploid
– Telophase

Continue to add to this list. Every time you meet a strange word, look up its meaning. You do not have to remember the explanation. You will not be asked to explain words in the exam, but they add interest and depth to your knowledge.

Alternative names

Alternative names to items you have learned can cause great confusion. You may be able to draw and label "the kidney tubule" (H) and not realise this is the same as "the nephron". The structure of the "cell membrane" may be well known to you, but you may never have heard of the "plasma membrane"

Clockwise from main: Orla Peelo, biology teacher David Bourke and Deirdre Healy at the Institute of Education; Onion bulbs; Sweet potato tubers; Graphical representation of chromosomes
Photographs: Brendan Duffy, Getty

TASK
Make a list of alternative terms. Begin with the following and leave space for others that you come across as you revise.

List of alternatives
– Neuron = nerve cell
– Cell membrane = plasmalemma
– Semi-permeable = differentially permeable
– Nephron = kidney tubule
– *Rhizopus stolonifer* = Bread mould fungus
– Passive transport = osmosis
– Active transport = active absorption (H)
– Dark phase = Calvin cycle (H)
– Hydrogen transport chain = electron transport chain (H)

Similar sounding words

It is very easy to confuse a student when similar sounding words are brought together for explanation, eg stroma and stoma; pharynx and larynx.

Students are sometimes asked to distinguish between pairs of terms in order to find out if both are understood. This may appear to be an easy question but your answer has to be exact. When you are explaining these types of words give the location and function of each if appropriate, especially if your definition is not clear.

TASK
Distinguish between the members of the following pairs of words by making a brief comment on each. Keep these words on a separate page and add to it as you meet new pairs of words.
– Photosynthesis and phototropism.
– Tendon and ligament.
– Centromere and centriole.
– Homologous and homozygous.
– Stroma and stoma
– Nephron and neuron (H)
– Lag phase and Log phase of growth curve (H)

Again, continue to add to the list yourself.

The language of biology

How to get those extra marks

- Answer the paper in the order it is presented, ie section A first, then section B and finally section C.
- Re-read your section A answers at the very end of the exam. You may find one or two silly mistakes due to anxiety at the start of the exam.
- If you are asked for a definition of some word / idea, always give an example after your explanation.
- When answering section C questions, leave some space at the end of each question.
- Leave a few lines also between the various sections of each question.
- Underline the items required when reading a question. Stick to these in your answer.
- Clear handwriting always works to your advantage.

Common errors

- Changing the numbering system in your answer from that of the question.

Example: Q 14(a) (i),(ii),(iii). Do not change this to Q 14(a) (1),(2),(3).

- Address the question asked. Irrelevant answers gain no marks and waste your time.

Example: If you are asked to explain the light phase of photosynthesis there is no point in describing the total process of photosynthesis.

- Adding more answers than requested in section A. A wrong answer cancels a correct answer.
- Using unclear lettering in genetics.

Example: A_A instead of Aa or B_B instead of Bb.

- Confusing results with conclusions.

– Results are measurements and observations made during an experiment to test a hypothesis.

– Conclusions are deductions made from the results.

– Conclusions should confirm or deny the initial hypothesis.

Sample questions

HIGHER LEVEL 2006 QUESTION 6

Distinguish between the members of each of the following pairs by making a brief comment on each.
(a) Tuber and bulb.
(b) Ureter and urethra.
(c) Hypha and mycelium
(d) Thigmotropism and chemotropism.
(e) Antigen and antibody.
(20 marks)

Answer

(a) A tuber is a modified stem or root. A bulb is a modified leaf or bud. (2+2)
(b) The ureter is a tube which carries urine from the kidney to the bladder. The urethra is the tube which empties the bladder to the outside. (2+2)
(c) A hypha is a fungal filament or thread. The mycelium is a mass of hyphae. (2+2)
(d) Thigmotropism is a growth response to touch. Chemotropism is a growth response to chemicals. (2+2)
(e) Antigen is foreign material in to blood which induces the production of antibodies. Antibodies are proteins produced to destroy antigens. (2+2)

HIGHER LEVEL 2010 QUESTION 10(C)

Distinguish between the terms in the following pairs by writing **one** sentence about **each** member of **each** pair.
(i) Haploid and diploid.
(ii) Homozygous and heterozygous.
(iii) Genotype and phenotype.
(iv) Segregation and independent assortment.
(24 marks)

Answer

(i) Haploid refers to a nucleus having one set of chromosomes (3 marks).
Diploid refers to a nucleus with two sets of chromosomes (3 marks).
(ii) Homozygous describes an identical pair of alleles (3 marks).
Heterozygous is used when the alleles of a pair are different from each other (3 marks).
(iii) Genotype refers to the genetic make-up or the genes present (3 marks).
Phenotype refers to the expression of the genotype (and environment) or the physical make-up of an organism (3 marks).
(iv) Segregation occurs when only one member of a pair of alleles enters a gamete (3 marks).
Independent assortment means either member of a pair of alleles can combine with either member of another pair of alleles during gamete formation (3 marks).

True or false questions

In this type of question a list of statements is given and you have to indicate whether each is true or false. This type of question is very frequent on the ordinary level paper, having appeared in 2004 and every year from 2007-2013.

It is not as frequent on the higher level, 2005 was the last year it was asked. It is very easy to make a mistake in this type of question, especially if the statement contains a negative.

Examples

DNA is not found in ribosomes – The statement is true.
RNA is not found in ribosomes – The statement is false.
Meiosis is never involved in gamete formation – The statement is false.
Meiosis is involved in gamete formation – The statement is true.

This type of question is very useful for rapid revision. Here are some examples.

Statement	True or False
All cells have nuclei	False
All cells that have nuclei are eukaryotic	True
Osmosis is a special case of diffusion	True
Hormones are never produced by endocrine glands	False

TASK

Continue with the list of statements and ask a partner to if they are true or false.

ORDINARY LEVEL 2013 QUESTION 3

Indicate whether the following statements are true (T) or false (F) by drawing a circle around T or F in each case.

Example: The liver produces bile. (T) F
(a) Metabolism is the sum of all the chemical reactions in the body. T F
(b) Anabolism is the breaking down of large molecules. T F
(c) Nutrition is the way living organisms get rid of waste. T F
(d) The term abiotic refers to the living factors in an ecosystem. T F
(e) In science, a hypothesis is an educated guess based on observations. T F
(f) In experiments the factor that is changed is called the variable. T F
(g) Grazing food chains begin with animals. T F

Answers: Marks = 2(1) + 3(2) + 2(6)
(a)(T), (b)(F), (c)(F), (d)(F), (e)(T), (f)(T), (g)(F).

ORDINARY LEVEL 2007 QUESTION 3

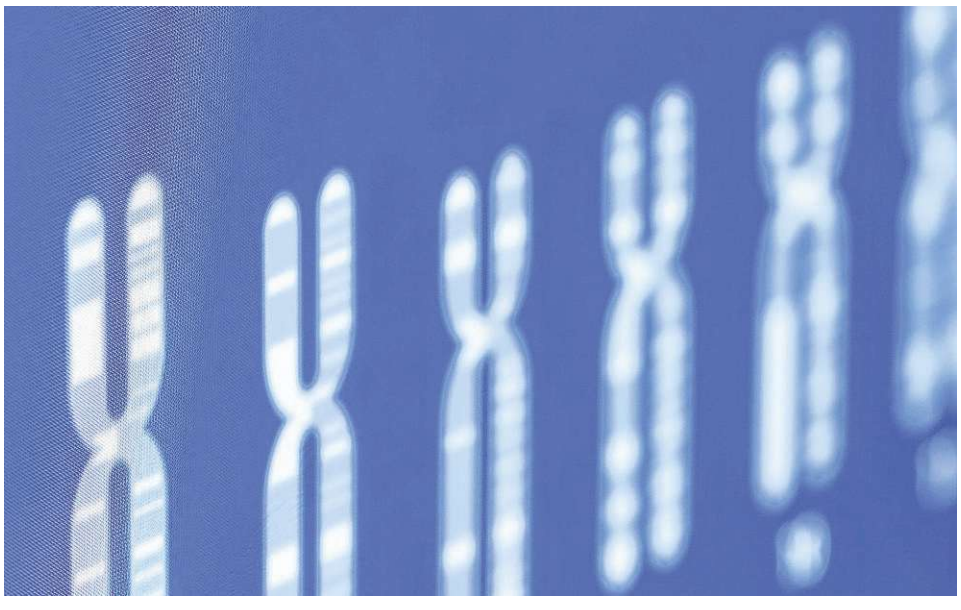
Indicate whether the following are true T or false F by drawing a circle around T or F.
Example: The pulmonary artery carries blood to the lungs. (T) F
(a) If the eyepiece lens of a microscope is marked X10 and the objective lens is marked X4, the total magnification is X14. T F
(b) Plant cells have chloroplasts, animal cells do not have chloroplasts. T F
(c) Humans receive oxygen from the air they inhale. T F
(d) Cell membranes let only some molecules pass through. T F
(e) Human chromosomes are found in the nucleus. T F

Answers: Marks = 5(4)
(a) (F), (b) (T), (c) (T), (d) (T), (e) (T).

HIGHER LEVEL 2005 QUESTION 3

Indicate whether the following are true T or false F by drawing a circle around T or F.
(a) Urea is formed in the kidneys. T F
(b) Motor neurons conduct impulses towards the central nervous system. T F
(c) Endocrine glands secrete hormones. T F
(d) Tendons join muscles to bone. T F
(e) The sino-atrial node (pacemaker) is located on the right side of the heart. T F
(f) A nucleus is absent from human red blood cells. T F
(g) Light is essential for the germination of seeds. T F
(h) Lenticels serve the same function as stomata. T F
(i) Parallel leaf veins are characteristic of monocotyledonous plants. T F
(j) Endosperm is a food reserve in some seeds. T F

Answers: Marks = 5(1) + 5(3)
(a) (F), (b) (F), (c) (T), (d) (T), (e) (T), (f) (T), (g) (F), (h) (T), (i) (T), (j) (T)



EXAM TIMES ONLINE

For more Irish Times/Institute of Education Exam Times, see

irishtimes.com/examtimes

Timing is key

It is essential to attempt all parts of each question selected.

Spending extra time on section A of the paper, which carries 100 marks, may leave you short of time for four questions in section C, which carries 240 marks. Problems may arise if you "get stuck" in a question, eg genetic crosses. It is critical to move on and complete the paper, returning to problem areas at the end if time is available.

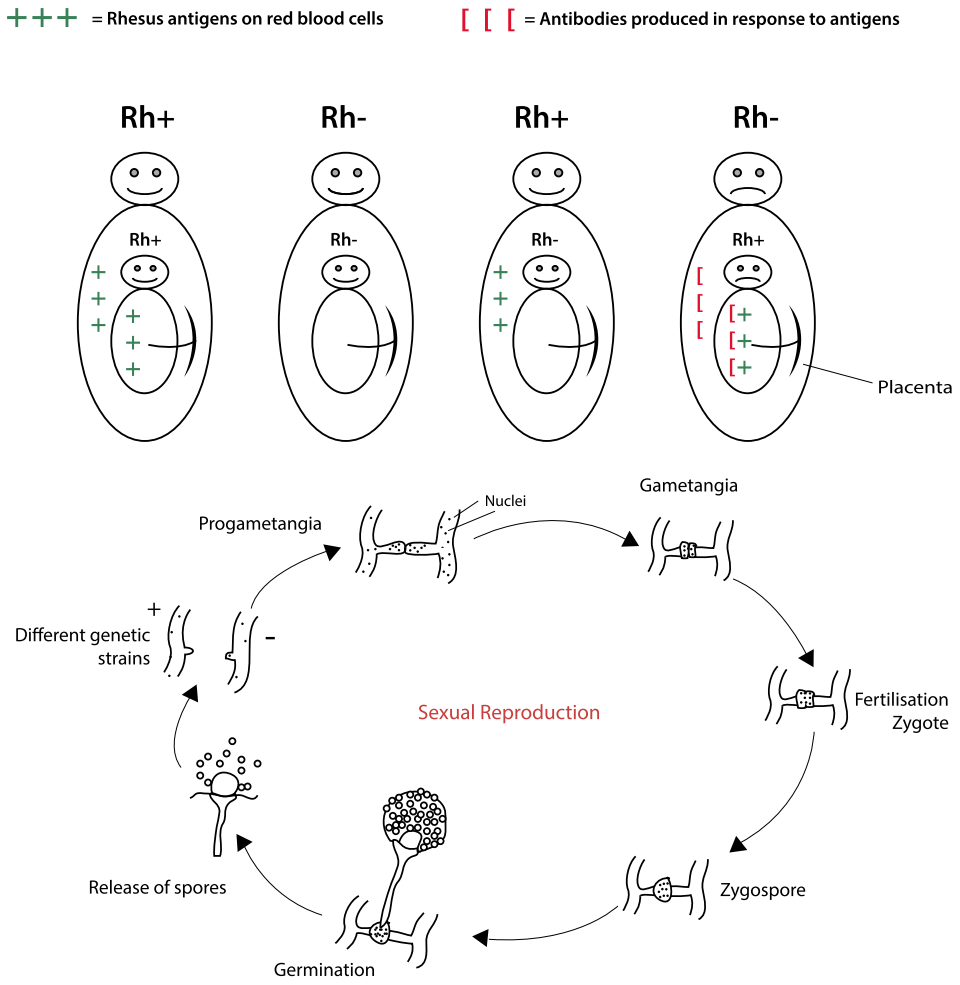
Do not exceed the following times for each section. Ideally you should aim to have ten minutes to spare at the end for a quick review of your work.

- Section A: 30 minutes.
- Section B: 15 minutes on each of two questions, ie a total of 30 minutes.
- Section C: 30 minutes on each of four questions, ie a total of 120 minutes.
- For questions 10, 11, 12, and 13, time allocation should be proportional to the marks of each part (a), (b) and (c), ie approximately four, 13 and 12 minutes respectively.
- For questions 14 and 15 you have a choice of two parts from (a), (b) and (c). Spend no more than 15 minutes on each part, ie 30 minutes for the question.

BIOLOGY

Overview of the syllabus

Topics under investigation



The variety of topics in biology is intimidating but the whole course must be studied

An overview of the syllabus

Not only does the biology syllabus cover a wide range of topics but also you may have several sources of information and notes. Some students find it difficult to marshal this vast array of information and focus on the key ideas.

The course can be condensed into twenty major headings which you can then study one by one.

TASK

Copy out the following list of topics and mark them off as you revise them.

1. Cell organelles (include microscope).
2. Osmosis.
3. Cell division (include tissues).
4. The scientific method.
5. Plant structure and reproduction.
6. Germination.
7. Food and nutrition (include enzymes).
8. Heart, blood, circulation (include immunity).
9. Photosynthesis.
10. Water transport.
11. Respiration.
12. Excretion (include skin).
13. Nervous system (include eye, ear).
14. Hormones (include plant growth regulators).
15. RNA, DNA.
16. Genetics.
17. Evolution.
18. Ecology.
19. Microbiology (bacteria, fungi, viruses).
20. Skeleton (include joints, bone).

Covering the entire course

TASK

Look at last year's papers, both LCH and LCO.

Each paper covered most of the syllabus. Only three topics were **not** covered on the higher level paper (water transport, nervous system, skeleton). Four topic were **not** covered on the ordinary level paper (scientific method, germination, evolution, microbiology). The conclusion is obvious. You must cover the entire course.

If you find a topic too difficult, at least learn the basic words and definitions relating to that topic. For example, you might decide that genetics is "beyond you". You can learn the meaning of chromosome, chromatid, gene, allele, homozygous, heterozygous, dominant, recessive, phenpotype, genotype. You can also learn how to perform simple crosses to the F1 and F2 generations, for example BB x bb.

Have an approach for each topic

FILING CARDS

Use filing cards to record the critical words and ideas for each topic. Reduce your notes to single words or short phrases. Keep this list to a minimum, eg 10 words per topic. Use separate cards for each topic. Here are two examples:

Example 1: The cell

– Compound microscope.
– How to calculate magnification.
– Iris diaphragm.
– How to use microscope.
– Plasmalemma.
– Functions of nucleus.
– Mitochondrion.
– Chloroplast.
– Stains for onion cell + cheek cell.
– Plant v animal cell.

Example 2: Diffusion

– Semi-permeable v fully permeable.
– Visking or dialysis tubing.
– Solute = ?
– Diffusion = ?
– Examples of diffusion.
– Osmosis = ?
– How to demonstrate osmosis.
– Isotonic.
– Turgor pressure = ?
– Food preservation.

TASK

Start today and compose two or three word-summary cards on topics you have studied recently.

CONVERT YOUR NOTES INTO DRAWINGS

One picture is better than a thousand words. The information needed concerning the problem of the Rhesus factor can be summarised in diagram 1 belowand the information required to show the sexual reproduction of *Rhizopus stolonifer* can be illustrated in diagram 2.

TASK

Make out summary diagrams covering the following topics:

– How to demonstrate osmosis.
– The alimentary canal.
– Blood circulatory system.
– A dissected view of the heart.
– The stages of prophase, metaphase, anaphase, telophase (H).
– Reabsorption in the nephron (H).

The importance of constant revision

There's not much point in learning something if you are then going to forget it. Study a small amount of material in a study session. Condense your notes. Check out past questions and examine the marking schemes. Learn off any definitions related to that topic. Before you begin your next study session, revise the previous topic.

Before answering a homework question revise the topic in question then close the notes or text book and answer the question as if you were in the exam hall. When you get your corrected homework returned make sure you know where you lost marks.

Main image: Micrograph featuring a mitochondrion; Top: Diagram 1 – rhesus factor; above: Diagram 2 – Sexual reproduction of *Rhizopus*

Finally...

Be consistent with your study. Most students who perform well in exams work very hard. Your teacher knows your ability best of all. Talk to him/her at appropriate times about your progress and the level you should aim for. A simple "thank you" can transform a working relationship. The fact that you have read this article does not change anything: you must now attempt some of the suggested exercises.

Do not discuss the paper in detail after the exam. Nothing can be changed that will add to your marks. You have another subject to revise.

When you get your results, thank those who helped you, starting with yourself. And, of course, don't forget your parents/guardians.

How to get your A1

BIOLOGY

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I sat the Leaving Cert in June 2013, achieving 6 As, one of which was an A1 in biology. I loved biology. It was so interesting, particularly human biology. However, it is a difficult subject, with plenty of learning involved and it does require a lot of study time.

In order to achieve a high grade, you must space out your learning. My advice is to learn the topic well as you cover it in class. Write plenty of notes on it and draw labeled diagrams. Then, every weekend, pick a certain topic to revise as well. That way, you'll stay on top of the workload.

Buy a biology revision book. It condenses the material down, highlights the important points and makes difficult topics, like respiration, easier to understand.

After learning a topic, use your exam papers to check how well you know it. Complete exam questions based on the topic and mark yourself based on the marking schemes. These will be the types of questions asked in June. Numerous questions are constantly repeated, you will notice this while doing the exam papers. Focus on these questions, hopefully you'll be asked them in the exam too.

The exam itself is three hours long and divided into three sections. Section 1 is short questions, (answer five/six), section 2 is experiment-based questions (answer two/three) and section 3 is long questions (answer four/six).

Each section offers some form of choice. My advice here would be to answer as many questions as you can, while also leaving time at the end of the exam to re-read your answers. The examiner will mark all of your questions and use your best ones to calculate your overall grade. That way, you increase your chances of receiving a higher grade.