

HELPFUL INFORMATION 1.6 to support the 2007 Biology AS and A level syllabus (revisions since version 1.5 shown with vertical lines in margin)

Some entry options have disappeared and others have appeared. What does this mean?

The standard arrangement of options A, B, C, D and S which is common to most CIE A/AS level syllabuses continues, the difference being that options A, D and S are divided into AX and AY, DX and DY, and SX and SY respectively.

The difference between the X and Y versions of entry options A, D and S is in the practical paper. There are two parallel practical papers, called papers 31 and 32. The options with an X include Paper 31 and the entry options with a Y include Paper 32. These papers contain different questions but are identical in style, format, difficulty and in the skills that they assess, so it will not matter which paper a candidate is entered for. The two papers are timetabled on different days.

The intention is as follows.

- If a school has limited laboratory space and consequently has difficulty conducting an examination for all their candidates on the same day, then they can divide their entries between the X entry options and the Y entry options, so that their laboratories only have to accommodate half of the candidates on any one day. This will avoid the need to sequester candidates for long periods of time.
- If a school has ample laboratory space and can accommodate all of the candidates without difficulty, then all of the candidates could be entered for the X entry options or all of them for the Y options. It does not matter which so choose the date most convenient for your Centre. This will avoid the need to prepare the laboratory on two different days.

So, to sum up:

Options B and C continue to be available for staged route A Level candidates.

Options A and D continue to be available for linear route A level candidates but there are now two options, AX and AY, DX and DY. AX is for linear route candidates where the Centre chooses to have the Advanced Practical Skills exam 31 (where 31 has the most convenient date for the practical exam). AY is for where centres choose Advanced Practical Skills exam 32. DX and DY are for linear route candidates who are also going to carry forward their AS components, DX where the practical exam will be Advanced Practical Skills exam 31, DY for component 32.

Option S continues to be available for AS candidates and those taking the AS part of a staged route A Level programme. There are two options, SX and SY. SX is for AS candidates where the Centre chooses to have the Advanced Practical Skills exam 31 (where 31 has the most convenient date for the

practical exam). AY is for where centres choose Advanced Practical Skills exam 32.

Options E and F are withdrawn – their last availability was November 2006.

My staged-route students did their AS in 2006, using the 2006 syllabus. Which syllabus should they use for their A2 papers in 2007?

The simple rule is – for CIE qualifications, always use the syllabus for the year in which the candidates sit the examination. This means that, for the A2 components sat in 2007, the students should use the 2007 syllabus, including the applications material rather than the old options material, which is no longer available. The entries should be made using entry options B or C.

My linear-route students are not doing any of their components in 2006, but will do all AS and A2 components in 2007. Which syllabus should they use for their AS and A2?

The simple rule is – for CIE qualifications, always use the syllabus for the year in which the candidates sit the examination. This means that these candidates should use the 2007 syllabus for all of the components that they are sitting in 2007. The entries should be made using entry option AX or AY.

My staged-route candidates did their AS in 2006, using the 2006 syllabus. They are planning to resit their AS components in 2007. Which syllabus should they use for the resit in 2007?

The simple rule is – for CIE qualifications, always use the syllabus for the year in which the candidates sit the examination. This means that for the resit these candidates must use the 2007 syllabus. If the Centre wishes the original AS to be included, the entry option should be DX or DY. If the Centre does not want the original AS to count, the entry option should be AX or AY.

My candidates have previously been able to carry forward their AS practical exam mark. What should these students do in 2007 where this option does not appear to be available?

This entry option is no longer available. It was withdrawn to bring A level sciences into line with all other CIE AS and A Levels and CIE's regulations which state 'it is not possible ... to carry forward a result in an individual (AS) component'. Very few candidates took up this entry option. Candidates should either carry forward their entire AS (entry option AX or AY) or resit all of the AS components (entry option B or C) or both (entry option DX or DY).

Paper 31 and 32

Will candidates need to do both paper 32 and 31?

Centres choose to enter candidates for either paper 31 or paper 32. In some centres it would be sensible to select only one of these papers, either 31 or

32. For centres with large entries, where it is convenient to divide the candidates into two groups, one group may enter paper 31, the other group may enter paper 32. Paper 31 and 32 will be of comparable standard and will be marked using a detailed and specific mark scheme that is, like the one on the specimen paper, a detailed version of the mark scheme in the syllabus.

Why is there only one specimen paper when there are two new papers?

The two new papers are exactly comparable. The specimen paper is typical of the style and type of the new papers. Centres can confidently use this as a specimen paper which can be used for examination preparation. In preparing for this examination, it is much more important to practice the skills in laboratory experiments and investigations than it is to do lots of past papers. For this reason CIE has published the booklet Teaching AS Biology Practical Skills available from:

- CIE publications (PSAS97000105),
- on the CD Science Support resources for Teachers, sent to all Centres in Summer 2006
- separated into parts on the CIE Teacher Support Site (available to subscribers)
- on the October 2006 syllabus and support materials CD.

Centres should encourage their candidates to practice the skills they will need in the examination by doing as many as possible of the practicals in the booklet at appropriate points during their course. If further practice or mock examination papers are required Centres would be advised to adapt old 9700/03 examination papers using the specimen paper 9700/31 and the information in the syllabus to show the style of questions and mark scheme required. The experience of doing this will help the Centre to understand the requirements of this new style of practical paper.

What activities will commonly be found in paper 31/32?

The syllabus defines the skills that CIE is expecting that candidates will acquire and on which they will be assessed. The Specimen paper gives Centres and candidates a clear idea of the range of activities that candidates are expected to encounter in the examination. The table on the next page gives information about the activities that it can be assumed will always be present in the examination and those activities that will sometimes be part of the examination.

Activities in all, or almost all, 31 and 32 papers
A laboratory practical
Make decisions about the number of treatments to use e.g. concentrations or measurements
Prepare a space for results e.g. a table
Modifying or improving method
Identify anomalies in results
Suggest a control
Calculate derived value e.g. magnification, rate of reaction, percentage increase etc.
Plot a graph – could be a line graph or other graph e.g. bar chart or histogram
Discuss a hypothesis in relation to the results obtained
Investigations involving a prepared microscope slide
Measure the size of a specimen using an eyepiece graticule or ruler
Draw a diagram of a specimen
Prepare a space for comparison of specimens or photomicrographs

Activities that will sometimes be part of 31 and 32 papers
Serial dilution or concentration calculations to make solutions
Practicals involving enzymes
A method to describe
State relationships between variables
Explain results
Draw conclusions
Identify sources of error
Estimate uncertainty
Explain the causes of errors
Investigations involving a photomicrograph
Use a stage micrometer (a scale on a microscope slide)

Paper 4

Why are there no option papers?

CIE, having consulted with Centres, decided that the advantages of having a syllabus that is common for all students now outweigh the advantages of having optional material. All students will complete the 2007 syllabus having covered the same material and will be assessed on the same examination. Paper 4 has been extended from 60 marks to 100 by including some questions which contain partly or entirely applications material. Other questions will contain A2 core material. Of course some questions will make use of knowledge and understanding acquired during the AS.

Do students have to study all the sections of the applications syllabus?

Yes, all students have to study all sections of the applications syllabus in order to give a broad and balanced perspective of the applications of biology. Paper four will cover some of the applications material in each session and CIE will ensure that all areas of the applications syllabus are regularly examined.

Why does my specimen paper contain questions that do not appear to be on the syllabus?

This means that you have an out of date version of the specimen paper. The paper now available from CIE publications, on the CIE teacher support website and www.cie.org.uk does not have material which is off the syllabus. Please throw away any out of date versions of this specimen paper and replace them with the correct version. It is easy to detect – if Question 4 is about an orchid called *Masdevallia* and if question 8 is about male hormones then dispose of your paper – if Question 4 features a table about the 5 Kingdoms and question 8 features female hormones then you have the correct version.

What is the paper duration?

As it says in the syllabus, this paper will be 2 hours long. The current version of the specimen paper has the correct duration on the front cover.

Why can't I have more than one specimen paper?

The specimen paper is typical of the style and type of the new papers. Centres can confidently use this as a specimen paper which can be used for examination preparation. In addition CIE has published the A-level Biology Applications Support booklet available from:

- CIE publications (SA97000105),
- on the CD Science Support resources for Teachers, sent to all Centres in Summer 2006
- separated into parts on the CIE Teacher Support Site (available to subscribers)
- on the October 2006 syllabus and support materials CD.

Centres should encourage their candidates to learn the knowledge, understanding and skills required for success in the applications examination through spending the appropriate proportion of the A2 year teaching material from the applications syllabus. If further practice or mock examination papers are required Centres would be advised to adapt old 9700/04 examination papers using the specimen paper 9700/04 and the information in the syllabus to show the style of questions and mark scheme required. Questions on the applications material should be adapted from old 9700/06 papers in addition using information from the syllabus support booklet, scheme of work or from the internet. The experience of doing this will help the Centre to understand the requirements of this new style of A2 paper. Therefore you can have as many specimen papers as you feel that you need since you will be producing

them yourself. Centres that make several such practice papers will be the ones with the best understanding of the syllabus and its requirements and thus the centres with the best prepared candidates.

How can I teach this when is no text book for this section of the syllabus?

The A Level Biology Application Support Booklet, SA97000105 from CIE publications, or from the CIE October 2006 syllabus and support materials CD, or, separated into chapters, from the CIE Teacher Support Website (for subscribers) or on the CD Science Support resources for Teachers, sent to all Centres in Summer 2006, provides a source of information for teachers and students. It contains a number of useful web addresses so that you can access further resources online. In addition, there is an excellent Scheme of Work on the Teacher Support Website (Unit 9: A2 Unit 4 Applications of Biology) which, in addition to a great deal of information about how to teach the course and appropriate learning activities, has a number very useful website addresses (live links so click on the words in the scheme of work pdf) that will add considerably to the information that is available to support learners.

I need to use a genetic dictionary. Which one should I use?

There are 64 different codons, coding for 20 amino acids plus stop codes. A genetic dictionary based on mRNA codons has no ambiguity – all published mRNA dictionaries have the same codons for the same amino acids. It is when we get to DNA that there is an issue. The problem is that DNA is double stranded and this leads to all sorts of ambiguity in trying to specify which strand is going to be used. From 2010 the syllabus will contain a genetic dictionary and some relevant definitions. To give an example, some sources describe as **antisense** the DNA strand that is complementary to the mRNA, whilst for other sources describe the **same** DNA stand as **sense** since this DNA strand that carries the genetic code. For this reason, you will find some genetic dictionaries that give the stop codons as UAA, UAG and UGA (mRNA codons) (e.g. Taylor, Green, Stout and Soper), others as ATT, ATC and ACT (DNA triplets complementary to mRNA) (e.g. Jones and Jones) and still others as TAA, TAG and TGA (e.g. CIE's Applications booklet and most American sources such as Georgia State University's website, <http://asterix.cs.gsu.edu/~weber/code.gif>). The genetic code is correct in all of these examples. We shall ensure that, for examination questions in 2007-9, it will either be clear which genetic dictionary is being used, or that mark schemes permit either DNA code.

Paper 5

This is a very different paper 5 from the old paper 5, so how will I know what to teach?

Your students need a lot of experience of doing practical investigations in order to succeed with this new paper. The paper tests skills that all build on laboratory practical work and so this is the most suitable context in which to develop the skills. For this reason CIE has published the booklet Teaching A2 Biology Practical Skills available from:

- CIE publications (PSA297000105),
- on the CD Science Support resources for Teachers, sent to all Centres in Summer 2006
- separated into parts on the CIE Teacher Support Site (available to subscribers)
- on the October 2006 syllabus and support materials CD.

This includes a practical course of 30 practicals which Centres could use throughout the A2 year of the course. 10 of these are fully detailed and ready for centres to use. The other 20 are presented in outline for Centres to develop for themselves. This process of practical development will greatly enhance the quality of the A2 practical teaching of Centres.

There is only one specimen paper for this examination, so how am I supposed to have a mock examination and also present my students with appropriate exam practice?

It is normal practice for exam boards to produce only one specimen paper, even where papers are a considerable departure from previous practice. This is, in part, because it encourages Centres to think about the specimen paper and syllabus requirements carefully. Centres will follow this up by making up their own specimen questions following the format of the specimen paper, the guidance below and the information in the syllabus and Teaching A2 Biology Practical Skills booklet. These questions will often feature data, much of which will derive from laboratory practicals – teachers can record samples of data during such practicals, or during the marking of them, for use in future exam-style questions.

Some of the data will be practical data that is more complex than will normally be available from laboratory practicals. For example, Centres will often be able to demonstrate the principles of gel electrophoresis of DNA fragments, perhaps using the protocols and materials available from NCBE, <http://www.ncbe.reading.ac.uk/>, or using home-made battery powered electrophoresis units. Centres are unlikely to be able to carry out the complex electrophoresis required for the data in question 3 on the specimen paper that CIE have published. Such data is readily available on the internet, in textbooks and in all sorts of past examination questions. Students need to have had practice in interpreting such data. So here is another type of exam-

style question, examples of which, Centres should prepare for their candidates.

It has always been true that such contexts have been used in practical and other examinations, and there are examples from 9700 past papers (e.g. Nov 03 9700/05 question 3 [planning], June 03, 9700/05 question 3 [potometer], June 02, 9700/05 question 2 [rate of photosynthesis], as well as from older CIE past papers e.g. Nov 2000 9266/03 question 3a [ecosystem productivity] and question 4 [enzyme reactions]. These are whole questions that could be adapted, but in addition, multiple choice and other questions contain data on which different questions could be based (e.g. June 06 9700/05 Fig 1.2 [respirometer], June 05 9700/01 question 22 [bases in DNA], question 36 [immune system], June 05 9700/02 Fig. 3.1 [haemoglobin dissociation curve], Fig. 5.1 [Energy flow in food web], June 05 9700/05 question 2 [chi squared in genetics], June 05 9700/06 Option 2 question 2 [thermostable enzyme], June 2003 9700/01 question 23 [cardiovascular pressures].

The original specimen question paper was generally characteristic of the style of question paper that will be set, although in order to avoid repetitious calculations we would avoid setting questions such as 1 (b) (i), which requires candidates to calculate two entire standard errors. We would be more likely to give a partially completed calculation and ask for candidates to work out a few values. The answers given in the specimen mark scheme should be

A, (mean = 56) standard deviation = 2.36, standard error = 0.75;;

B, (mean = 123.3) standard deviation = 2.31, standard error = 0.73;;

Because the statistics question in the original paper was not really representative of the kind of statistics question that will be used in the live examinations, an additional specimen paper has been prepared. This has replaced the original paper on CIE Online and the CIE Teacher Support Website (available for subscribers). It will be supplied as a pdf only. This is the only additional specimen paper that will be available.

There seems to be a lot written in the syllabus and a whole lot of new learning outcomes. How am I going to teach more material if I only have the same time available to teach?

Actually, this material has always been present in the syllabus, and the chances are, if you are at a well organised Centre, that you are already teaching all or almost all of what is described. What we have done is to make the existing intentions much clearer so that teachers can see precisely which skills we intend that students studying 9700 biology should acquire. Much of the preparation for this examination will come from the practical work and data response work which is a feature of all successful A2 teaching programmes.

If your A2 teaching programme consists mainly of the teacher giving notes from the front of the class, plus going through past examination papers, then your students will be no better prepared for the new examinations than they have been for the old ones. A good, effective, A2 teaching programme should

feature a mosaic of varied learning experiences which challenge the students to do the learning, giving them clear explanations followed by lots of data with questions to answer about that data, plus focussed practical work, some of which is investigatory, from planning to concluding, and some of which is to generate data for processing, statistics and analyses. For some schools and colleges a change in teaching style is an essential precursor to building success in the new syllabus, just as it was in the old syllabus.

To help you with these changes in teaching style and to give you ideas to promote effective learning, CIE runs many excellent training courses, including face-to-face training around the world and online training as well as providing a range of resources – more details of these are at <http://www.cie.org.uk/>

Will there always be an open ended planning question of 8-10 marks?

Not necessarily. Sometimes there will be such an open ended planning question. Sometimes the planning marks will come within a series of structured questions based on a scenario which may be familiar or unfamiliar. Students should be given examples of both types of planning during their course. Students need to be taught how to plan investigations, so it would be appropriate if the first examples of planning that they undertook were structured so that they learn how to do it before attempting unstructured planning exercises.

Will there always be statistics?

Yes. Statistics is fundamental to the way that working biologists establish the probability that events will occur in a particular way, and so it is right that they should be fundamental to the way that this examination works. The syllabus lays out the kind of statistics that will be included. The examinations will be written so that students do not spend long periods in doing repetitive calculations, and so that the student who is unable to do the statistical question will be penalised fairly.

Will statistics questions occur in more than one question?

No, only one of the three questions will feature statistical calculations on any one 9700/05 exam paper. There may, of course, be other kinds of calculations in other questions, for example rate of reaction, percentage change, magnification calculations or ratios – a full list of the mathematical skills that it is expected that candidates will possess is listed in the syllabus. Candidates will need to have been given the opportunity to practice such calculations throughout their course in biological contexts.

Will candidates be expected to know formulae?

Formulae will always be provided in the question. The point is to test if candidates can apply the formula and carry out the necessary calculations and interpretations, **not** to test if candidates can remember the formula. Candidates will have to learn how to carry out such statistical tests, which have always been part of the syllabus, and have been very well taught by some Centres. As in previous examinations where chi squared tests have featured, candidates will not be asked to calculate long and repetitive calculations, but will be asked to show that they can calculate particular steps in the calculation. The specimen paper does not illustrate this well.

Will candidates be expected to plot graphs?

Not necessarily, although many of these question papers will involve plotting graphs. In this A2 paper, plotting of processed data is more likely than raw data. In other words, candidates will be given some data, asked to process it in some way, for example calculating the mean from replicate readings, or calculating rate of reaction given mass of products at various times, and then to plot their processed values.

Will candidates be expected to be familiar with a range of graph types and their use?

Yes – candidates may be expected to interpret patterns, identify trends or comment on the suitability of the graph for the data plotted. The kinds of graphs that might be expected include those specified in the syllabus including: frequency diagrams, pie charts, histograms, bar charts, scatter diagrams, line graphs – curves and straight lines. Such presentations of data are, of course, central to understanding of biological science, and thus are already likely to feature as a central part of the courses that Centres run. For Centres where this is not so, graphical work should feature in every week of the course, whether based on student plotted graphs or printed graphs.

Will candidates be expected to use microscope skills?

No microscope will be required – this examination does **not** require the use of a laboratory. While there will not be a requirement to physically use a microscope, candidates may be given a photomicrograph or electronmicrograph to use as a context for interpretation and comparison, as well as for working out magnifications or calculating actual size of objects. Like the other skills, this will need to be practiced as part of the student's course as we know that it already is at most Centres.

Will there always be a question that asks candidates explain how to set up and use a piece of complex apparatus e.g. respirometer, audus apparatus, potometer?

Unfamiliar apparatus will often be presented in diagrammatic form. Candidates who have considerable experience of handling a variety of practical apparatus will be able to work out how to use even unfamiliar apparatus, and it is this skill that is being tested in such questions. It is not expected that candidates will have used many of the pieces of apparatus that will feature in such examination questions. Unfamiliar apparatus will not necessarily be a feature of every paper.

Another way that unfamiliar apparatus may be used is that candidates may be given results to interpret, as in question 3 of the original specimen paper, based on results from a type of electrophoresis apparatus that candidates are not expected to have used. Candidates who have had many experiences of interpreting results from a variety of different apparatus throughout the course will be well prepared to handle this kind of question.

Will there be questions using techniques that may not have been possible for all candidates to have used?

Such questions will often be a feature of this examination – as has already been explained, questions may be set in the context of techniques in the applications part of the syllabus, such as biotechnology and gene technology. Often it will not be possible for Centres to have given direct experience of these techniques. A combination of lots of practice at interpreting results from a wide variety of apparatus, both familiar and unfamiliar, plus lots of data response experience based on secondary data from textbooks and from the internet, will prepare candidates effectively for this kind of question. This approach is already widely used by many Centres.

Will there be questions using AS as well as A2 contexts?

Yes, almost every paper will feature synoptic questions, that is, questions requiring an overview of the whole subject. These synoptic questions assume knowledge, understanding and skills from the AS Biology syllabus. For example, explaining the reasons for the shape of a graph showing the effect of temperature on rate of respiration (an A2 topic) requires understanding of both the biochemistry of the process of respiration (an A2 topic) and the effect of temperature on enzymes and the reasons for this in terms of collisions between enzyme and substrate molecules as well as complementary shape and fit of active site and substrate (an AS topic). Again, we know that many Centres already offer students many learning opportunities that feature such synoptic work, for example homework question sheets based on data set in A2 contexts but requiring a firm grasp of AS concepts to answer effectively.