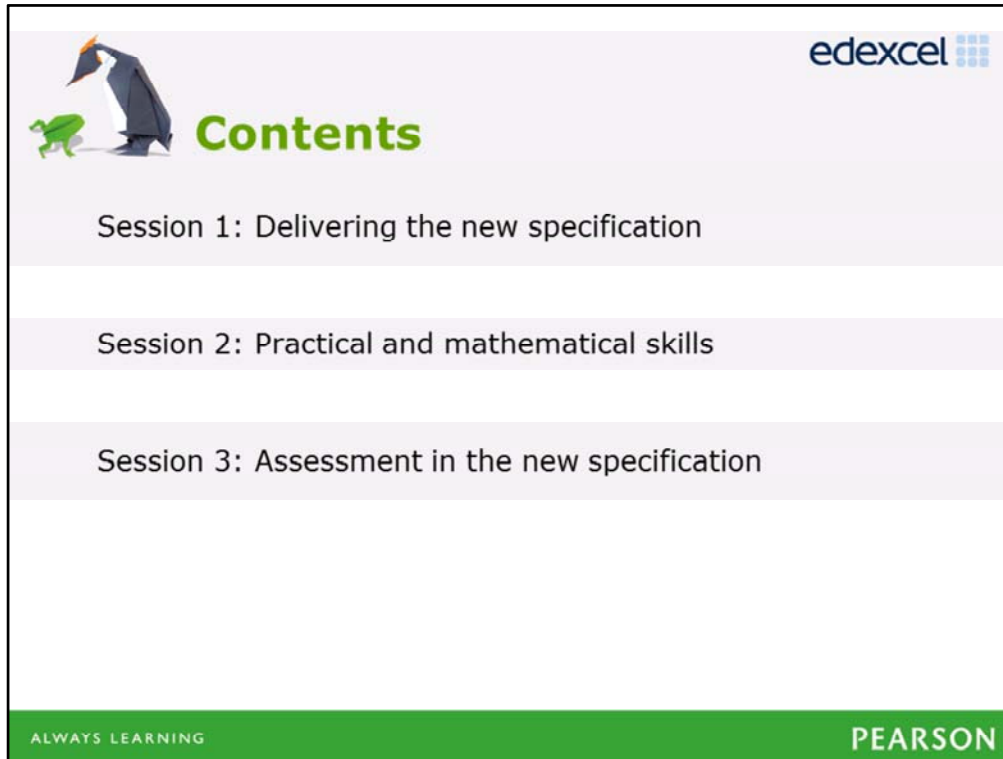






**Our Getting Ready To Teach training looks at how the new specifications can be delivered in the classroom.**

This is the presentation used in our events and there are embedded notes that will talk you through the specification content and assessment and will tell you what other documents you will need to access along the way.



The presentation will go through:

- The structure, content and assessment of the new qualifications
- The support available to guide you through the changes
- Possible teaching and delivery strategies, including co-teaching AS and A level
- New topics
- Maths requirements
- Practical assessment
- Question types

## Session 1 – Delivery

- ❖ Overview of content / topic structure
  - What's changed in the new specification?
  - Delivering new topics
- ❖ Different approaches to AS and A level
  - Co-teachability / spiral curriculum)
  - High-level course planning
  - Detailed planning for one particular topic, inc references to maths, practical and HSW skills
- ❖ From GCSE to A level – supporting student progression

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Here's an overview of what will be covered in the first session of this course.

It would be useful if, as you work through these slides, you have access to the webpage for Biology A:

<http://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-a-2015.html>

Almost all of the support documents that are referred to in these slides can be found under the tab "Course Materials" and then under "Teaching and Learning Materials". Of particular use are the following Guides:

At-a-glance Guide to Biology A:



<https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/At-a-glance-guide-to-the-new-A-level-Biology-A-Salters-Nuffield.pdf>

Qualification Guide for Biology A:

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/support/A\\_level\\_Biology\\_2015\\_Guide\\_new.pdf](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/support/A_level_Biology_2015_Guide_new.pdf)

Support Guide for Biology A:

<https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/U431%20A%20Level%20Science%20Spec%20Guide%20LORES.pdf>



## Topic outline

AS

- ❖ Topic 1: Lifestyle, Health and Risk
- ❖ Topic 2: Genes and Health
- ❖ Topic 3: Voice of the Genome
- ❖ Topic 4: Biodiversity and Natural Resources

A Level (in addition to Topics 1 – 4)

- ❖ Topic 5: On the Wild Side
- ❖ Topic 6: Immunity, Infection and Forensics
- ❖ Topic 7: Run for your Life
- ❖ Topic 8: Grey Matter

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The new specification is very much based on the existing SNAB one that has been running since 2008. You will see all 8 topics with the same names as before, and most of the core practicals too.

The content is divided up into a number of topics: 4 topics at AS; and a further 4 topics for those students who are taking the A level qualification.

This slide shows an outline of those topics, so you can see – at a glance – what is covered in AS and what is covered in the 2<sup>nd</sup> year of the A level.

You can find the final AS and A level specifications on the Biology A homepage: <http://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-a-2015.html>



## Structure of the new spec


**Familiar:**

- ❖ same 8 topics
- ❖ the Topic Titles
- ❖ the approach
- ❖ use of real life contexts (or by themes)
- ❖ most of the content

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Emphasis has been on minimal change, this slide shows a list of what will be familiar.



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## Structure of the new spec


Different:

- ❖ some new topics
  - ❖ Fick's Law; haemoglobin and collagen; electron micrograph recognition
  - ❖ Sex linkage; epigenetics; biodiversity measures; Hardy-Weinberg
  - ❖ Phloem structure & function; bacterial growth requirements
- ❖ some core practicals
  - ❖ [S] on initial rate; plant histology; Hill reaction
  - ❖ Temperature on initial rate &  $Q_{10}$ ; minute vol. and  $O_2$  use
- ❖ some re-arranged content
  - ❖ Most DNA material now in AS

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This slide shows the changes in summary.



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## What's changed?

❖ TWO mapping documents, get both!

Edexcel ?	SNAB ?
--------------	-----------

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Shown are two mapping documents which take two different approaches and both are useful.

The Edexcel document one picks out the major changes and puts them in bold.

The SNAB document, written by the team in York, takes every spec point and shows how it has changed in red italics.

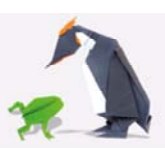
If you are moving to Biology A from another Awarding Body specification, there are also documents mapping the new Edexcel Biology A to the AQA and OCR 2008 specs.

AQA

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AQA\\_Biology\\_A\\_FINAL.pdf](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AQA_Biology_A_FINAL.pdf)

OCR

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/OCR\\_Biology\\_A\\_FINAL.pdf](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/OCR_Biology_A_FINAL.pdf)



## The Edexcel mapping document

Level	Topic	Spec. points	New content included	Content not included in the new spec.
AS	Protein synthesis	2.6 i and ii	Understand the process of protein synthesis (transcription) including the role of RNA polymerase, translation, messenger RNA, transfer RNA, ribosomes and the role of start and stop codons.  <b>Understand the roles of the DNA template (antisense) strand in transcription, codons on messenger RNA and anticodons on transfer RNA.</b>	Outline the process of protein synthesis, including the role of transcription, translation, messenger RNA, transfer RNA and the template (antisense) DNA strand ( <b>details of the mechanism of protein synthesis on ribosomes are not required at AS</b> ).
AS	Protein structure	2.9 iv	<b>Know the molecular structure of a globular protein and a fibrous protein and understand how their structures relate to their functions (including haemoglobin and collagen).</b>	
AS	Enzyme action	Core practical	<b>CORE PRACTICAL 4:</b> Investigate the effect of enzyme <b>and substrate</b> concentrations on the initial rates of reactions.	
AS	Genetics	2.13 i	Know the meaning of the terms: gene, allele, genotype, phenotype, recessive, dominant, <b>incomplete dominance</b> , homozygote and heterozygote.	
		2.13 ii	<b>Understand patterns of inheritance</b> , including the interpretation of genetic pedigree diagrams, <b>in the context of monohybrid inheritance.</b>	The interpretation of genetic pedigree diagrams, in the context of traits such as cystic fibrosis, albinism, <u>thalassaemia</u> , garden pea height and seed morphology.

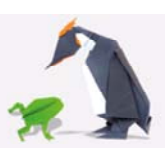
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This slide shows a small sample of the EdExcel document.

The full document can be found here:

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/Switching\\_from\\_Edexcel\\_2008\\_to\\_Edexcel\\_2015\\_specifications.pdf](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/Switching_from_Edexcel_2008_to_Edexcel_2015_specifications.pdf)





## The SNAB mapping document

<p>14 Outline the process of protein synthesis, including the role of transcription, translation, messenger RNA, transfer RNA and the template (ant sense) DNA strand (details of the mechanism of protein synthesis on ribosomes are not required at AS).</p> <p>From Topic 6 due to protein synthesis moved from A2 to AS in the core criteria so all detail now required in AS</p> <p><u>3 Explain the process of protein synthesis (transcription, translation messenger RNA, transfer RNA, ribosomes and the role of start and stop codons) and explain the roles of the template (ant sense) DNA strand in transcription, codons on messenger RNA, anticodons on transfer RNA.</u></p>	<p>2. 6 i) <i>Understand</i> the process of protein synthesis (transcription including <u>the role of RNA polymerase</u>, translation, messenger RNA, transfer RNA, <u>ribosomes and the role of start and stop codons</u>). ii) <i>Understand</i> the roles of the template (ant sense) DNA strand in transcription, <u>codons on messenger RNA, and anticodons on transfer RNA.</u></p>
<p>12 Explain the nature of the genetic code (triplet code <del>only</del>; <del>nonoverlapping</del> and degenerate <del>not required at AS</del>).</p> <p>From Topic 6 due to move of protein synthesis in the core criteria</p> <p><u>2 Explain the nature of the genetic code (triplet code, non-overlapping and degenerate).</u></p>	<p><u>2.7 Understand the nature of the genetic code (triplet code, non-overlapping and degenerate).</u></p>



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An extract from the SNAB Document.

This extract one highlights the pieces of content which have moved (From A2 to AS).

The full document can be found in the documents accompanying this presentation. It's called " 2008-2015 spec comparison".

## New command words

Some subtle changes?



Biology (2008)	Biology 'A' (2015)
8 Explain how the structures of blood vessels (capillaries, arteries and veins) relate to their functions.	1.3 <i>Understand</i> how the structures of blood vessels (capillaries, arteries and veins) relate to their functions.
12 Compare historic drug testing with contemporary drug testing protocols, eg. William Withering's digitalis soup; double blind trials; placebo; three-phased testing	4.13 <i>Understand the development of drug testing from historic to contemporary protocols</i> , including William Withering's digitalis soup, double blind trials, placebo, three-phased testing.
14 <i>Describe</i> the concept of niche and discuss examples of adaptation of organisms to their environment (behavioural, physiological and anatomical).	4.3 <i>Understand</i> the concept of niche and discuss examples of adaptation of organisms to their environment (behavioural, physiological and anatomical).

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Some apparently slight changes in wording may need to be looked at carefully to think about their implications. These can be easily tracked down through the changes documents.

The example shows the SNAB document highlighting the change in wording on the topic of drug development.



## New command words

The specification asks only for:  
**know, understand and be able to.**

Other “command words” may feature in exam papers (as we shall see later).

SNAB 2008: Compare historic drug testing with contemporary drug testing protocols, eg William Withering’s digitalis soup; double blind trials; placebo; three-phased testing

SNAB 2015: Understand the development of drug testing from historic to contemporary protocols, including William Withering’s digitalis soup, double blind trials, placebo, three-phased testing

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One feature of the new specification is that the large variety of command words in the specification have been replaced by just three:

- know, for simple recall or description statements
- understand, for statements where candidates would be expected to explain ideas
- be able to, for statements where candidates would be expected to demonstrate a skill, such as calculation or graph plotting

The reason for this change is so that these command words can feature in exam questions to address higher level cognitive skills. This slide shows an example for the command word compare.

Note that the question papers use a different set of command words – these are clearly set out in Appendix 7 of the specification.



## Delivering the specification



### Activity 1

- ❖ *Discuss how the changes and the overview of content compares with your current teaching specification.*
- ❖ *Identify any actions required before September.*

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On training days, delegates now had a few minutes to think about how the changes outlined may affect them and any actions that might be needed in view of this.

## Schemes of work - principles

- ❖ There are a number of possible 'routes'
  1. All students together, some AS only, some A Level from day 1
  2. AS separate from A level from Day 1
  3. No plan to do AS at all with any students
- ❖ Strategies for scenario 1 (co-teaching)
  - Teach the same material to both halves, differentiate by homework etc. as soon as judged feasible
  - Operate a 'spiral curriculum'

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**Schemes of Work** – we will provide two schemes of work – one based on a two year teaching route and the other for centres who wish to offer the opportunity for learners to take an AS level at the end of year 1 of the course. They will be available for each specification.

Remember that there are different routes through the specification. Although many schools use the Salters-Nuffield teaching approach, it is possible to teach the same Biology in a more topic-based way.

Schemes of work appear on the website here:

SNAB approach (AS):

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AS\\_Biology\\_A\\_\(Salters-Nuffield\)\\_Scheme\\_of\\_Work\\_\(Context-led\\_Approach\).doc](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AS_Biology_A_(Salters-Nuffield)_Scheme_of_Work_(Context-led_Approach).doc)

SNAB approach (A level):

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/A\\_level\\_\(Year\\_2\)\\_Biology\\_A\\_\(Salters-Nuffield\)\\_Scheme\\_of\\_Work\\_\(Context-led\\_Approach\).doc](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/A_level_(Year_2)_Biology_A_(Salters-Nuffield)_Scheme_of_Work_(Context-led_Approach).doc)

Concept-led (AS):



[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AS\\_Biology\\_A\\_\(Salters-Nuffield\)\\_Scheme\\_of\\_Work\\_\(Concept-led\\_Approach\).doc](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AS_Biology_A_(Salters-Nuffield)_Scheme_of_Work_(Concept-led_Approach).doc)

Concept-led (A level):

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/A\\_level\\_\(Year\\_2\)\\_Biology\\_A\\_\(Salters-Nuffield\)\\_Scheme\\_of\\_Work\\_\(Concept-led\\_Approach\).doc](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/A_level_(Year_2)_Biology_A_(Salters-Nuffield)_Scheme_of_Work_(Concept-led_Approach).doc)

**Possible routes to A and AS level.**

Course planners can help with planning for any of these routes. More information on these appears on a subsequent slide.



## Schemes of work - discussion

Consider the decoupling of AS and A Level.

- ❖ How likely are you to enter all students for the AS in biology and then for the A Level?
- ❖ What are the implications for developing schemes of work? Will you consider any alternatives to a linear route for curriculum delivery?



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At this stage, it is likely that you will have made a decision about the route you will take but it might be worth taking some time to reflect on that decision and its implications here.

Some thoughts about AS how it can be taught and its role in the new schemes:

- AS and A level students may be taught in the same class in Year 12. You will need to think about how this is best achieved.
- Some students may wish to supplement a three A level programme of study with an additional AS in Biology. This may be important to your students as it will continue to provide them with breadth of study.
- Alternatively, some students might start four A levels, knowing they will 'drop down' to three A levels in year 2. In this scenario, they may wish to postpone their decision until they have taken one or more AS qualifications and seen the results. Students who unexpectedly leave the course after the first year will have an AS qualification.
- Starting with the AS content gives a focus for Year 12 study and taking an AS qualification at the end of Year 12 could provide a useful way of tracking student progress at the end of the first year.

## Using course planners

Course planners:

- ❖ On the website.
- ❖ Tailor them to the route that you are taking through the course.

**Pearson Edexcel GCE Biology A**

**Course Planner – A Biology**

This course planner can be used alongside Biology A level Scheme of Work.

Week Number	Lesson Content
1 year 12	Unit 1
2	Topic 1: Lifestyle health and risk
3	
4	
5	
6	
7	
8	
9	Unit 1
10	Topic 2: Genes and health
11	
12	
13	
14	
15	
16	
17	
18	Unit 2
19	Topic 3: The voice of the Genome
20	
21	
22	
23	
24	Unit 4


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This shows an extract from one of our course planners found here, for AS and for A level:

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AS-and-A-level-Biology-A-Salters-Nuffield\\_Course-Planners.doc](https://qualifications.pearson.com/content/dam/pdf/A%20Level/biology-a/2015/teaching-and-learning-materials/AS-and-A-level-Biology-A-Salters-Nuffield_Course-Planners.doc)





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## Planning a topic

### Activity 2

You are provided with schemes of work for the following topics:

- ✓ Topic 1: Lifestyle, health and risk
- ✓ Topic 4: Biodiversity and Natural Resources

---



- ❖ Carry out medium term planning for one of these topics.
- ❖ Are there any implications for teaching and learning?

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On the training days delegates now did a course planning exercise on the topics shown.

You may wish to look at the same exercise, using the worksheet "Scheme of work (Topics 1 & 4)" provided as part of this pack.

As you saw on a previous slide, full Schemes of Work are available on the website.



## Progression to A level

Consider the challenges students face when they start to study AS/A Level Biology in year 12

❖ What can be done to support student progression?

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One of the big issues we have identified is the leap that many students feel they have to make from GCSE to AS.

Here you are encouraged to put yourself in student shoes and think about what these challenges might be.

Some thoughts are:

- Amount of content to learn/level of understanding required
- More independence expected in thinking and practical work/organisational skills/self-assessment)
- New A Level 2015 – 10% maths skills – there will be many more unstructured maths questions, problem solving, investigative approaches for practical skills, unfamiliar contexts for exam questions and practicals in exam questions, practical endorsement)



## Transition materials

Include:

- ❖ Mapping of KS4 Edexcel GCSE(s) to the new Edexcel A level Biology specifications
- ❖ Baseline test and mark scheme
- ❖ Sample lesson plans
- ❖ Practice exam questions

And could be used

- ❖ Induction weeks in 6<sup>th</sup> Form
- ❖ Levelling out the baseline of all students from their range of KS4 qualifications.

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To support you and your students in this, Biology **transition guides are provided.**

These will support you to develop students' skills in their first lessons, including two to three weeks OR 5 lesson scheme of work mapped to specification content including:

- classroom materials
- baseline assessments
- practice questions

This will support you as teachers to understand the level of your new students but also to allow students to better understand the jump required of them.

The guide is here:

<https://qualifications.pearson.com/content/dam/pdf/A%20Level/Biology/2015/teaching-and-learning-materials/transition-guide.pdf>

Note that there is also a password-protected version, which has answers to the exercises:

[https://qualifications.pearson.com/content/dam/secure/silver/all-uk-and-international/a-level/biology/2015/teaching-and-learning-materials/transition-guide-\(with-mark-scheme\)-updated.pdf?665903880260881](https://qualifications.pearson.com/content/dam/secure/silver/all-uk-and-international/a-level/biology/2015/teaching-and-learning-materials/transition-guide-(with-mark-scheme)-updated.pdf?665903880260881)



# The transition guide

There are 3 sections:

## CELLS

## MOLECULES



## HUMAN BIOLOGY

Topics	A level specification links	Lesson ideas	Type of resource	Description & skills developed
Section A: Cells		Microscope work on animal and plant cells. Identification of cell features from light and electron microscopy images. Measure cell length and calculate actual cell size. Root tip squash to show cells undergoing mitosis. Gram staining of bacteria. Investigating osmosis in potato chips.	Starter activity's Teacher resources Fact sheets Consolidation activities	

Section B: Molecules		Practical on the action of amylase on starch Practical on factors effecting enzyme action Modelling of lock and key hypothesis of enzyme action	Starter activity's Teacher resources Fact sheets Consolidation activities	
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Section C: Human Biology		Heart dissection Lung dissection Comparing the elasticity of arteries and veins Diffusion in agar cubes Calculation of surface area: volume ratios	Starter activity's Teacher resources Fact sheets Consolidation activities	
-----------------------------	--	--	--	--

This slide shows samples from the guide, which is divided into three sections as shown.

# Mapping to GCSE

**GCSE colour key: 2B101 (colours correspond to the Pearson textbooks)**



	1B117/H+ Core Science
	1B127/H+ Additional Science
	1B137/H+ Extension Unit or Further Additional Science

Topic 1- Lifestyle, Health and Risk	GCSE
<p>1.4 i) Know the cardiac cycle (atrial systole, ventricular systole and cardiac diastole) and relate the structure and operation of the mammalian heart, including the major blood vessels, to its function.</p> <p>ii) Know how the relationship between heart structure and function can be investigated practically.</p>	<p>3.10 Explain how the structure of the heart is related to its function, including:</p> <ul style="list-style-type: none"> <li>a the four major blood vessels associated with the heart (pulmonary artery, pulmonary vein, aorta, vena cava)</li> <li>b left atrium and ventricle to pump oxygenated blood</li> <li>c right atrium and ventricle to pump deoxygenated blood</li> <li>d valves to prevent backflow (names not required)</li> <li>e left ventricle has a thicker muscle wall than the right ventricle</li> <li>f the direction of blood flow through the heart</li> </ul>
<p><b>CORE PRACTICAL 1:</b></p> <p>Investigate the effect of caffeine on heart rate in daphnia.</p>	<p>3.2 Describe the general effects of:</p> <ul style="list-style-type: none"> <li>a painkillers that block nerve impulses, including morphine</li> <li>b hallucinogens that distort sense perception, including LSD</li> <li>c stimulants that increase the speed of reactions and neurotransmission at the synapse, including caffeine</li> <li>d depressants that slow down the activity of the brain, including alcohol</li> </ul> <p>3.3 Investigate reaction times</p>

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The Guide including full mapping to current Edexcel GCSE specs, an example is shown here.



## Topic guides

Cover new aspects of the specification, or where you might like new information – **MICROBIOLOGY & EPIGENETICS**



- ❖ written by experts and informed by teachers
- ❖ designed to refresh knowledge and give suggested teaching approaches
- ❖ cover areas of new thinking or topics which are new to our specifications
- ❖ provide approaches to teaching the specification content
- ❖ lesson ideas, including suggested class materials
- ❖ practice questions

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We have commissioned guides for two topic areas which are quite new or much expanded on the specification. These are Microbiology and Epigenetics.

The Guides are available free from the website on the support pages.





## Endorsed resources

- ❖ We are committed to helping teachers deliver our Edexcel qualifications and students to achieve their full potential.
- ❖ To do this, we aim for our qualifications to be supported by a wide range of high-quality resources, produced by a range of publishers, including ourselves.
- ❖ However, it is not necessary to purchase endorsed resources to deliver our qualifications.

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Of course, the choice of resources to support your teaching is a matter for your personal preference.



## Endorsed resources

- ❖ We are working with publishers who are looking towards getting their resources endorsed for Biology 'A':
  - **Pearson:** Year 1 and 2 textbooks, with support for "Thinking Bigger", support for practical and maths, and links to online resources.

\* Year 1 textbook has been endorsed; Year 2 has have not yet been endorsed. This information is correct as of end February 2015, but may be subject to change.

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You can find information about both the Pearson resources through this link:



<https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-a-2015.resources.html>



# BREAK TIME



Have a break!!



## Session 2 – Maths & practical



- ❖ Delivery of maths within Biology
- ❖ Core Practicals:
  - coverage of the required techniques / apparatus
  - planning to integrate into teaching
  - resourcing the activities
  - encouraging an investigative approach
- ❖ Practical competency:
  - detailed look at the CPAC criteria
  - collecting evidence
  - keeping records of student work
  - how will monitoring work

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This slides shows a general outline for Session 2.

The two really big changes to A level Biology are not in content, as we have seen, but in the role of Maths and the assessment of practical skills.



## Mathematical skills in biology

Maths appendix in the specification (p70 – 74) covers most of what you need to know!

There are 5 main areas of Maths to cover:



- ❖ A.0 - arithmetic and numerical computation (4 statements at AS plus **1 extra at A level**)
- ❖ A.1 - handling data (11 AS)
- ❖ A.2 – algebra (4 AS plus **1 A**)
- ❖ A.3 – graphs (5 AS plus **1 A**)
- ❖ A.4 - geometry and trigonometry (1 AS)

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This, and the next few slides, detail the new requirements for Maths in A level Biology.

You can find more information in Appendix 6 of the specification.

## Maths – A.0 and A.1

A.0 - arithmetic and numerical computation

units	decimal & standard form
ratios, fractions, percentages	estimates

**use calculators to find and use power, exponential and logarithmic functions**

A.1 - handling data


significant figures	mean, median and mode
simple probability	sampling
scatter diagrams	order of magnitude (mag x)
SD and range	error and uncertainty
stats tests	frequency tables, bar charts, histograms

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The items in bold are for A Level only.

Note that some basic statistical tests are now incorporated into AS.



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## Maths – A.2


A.2 – algebra


- understand and use the symbols  $=$ ,  $<$ ,  $<<$ ,  $>>$ ,  $>$ ,  $\infty$ ,  $\sim$ .
- change the subject of an equation
- substitute into an equation
- solve equations
- use logs for orders of magnitude**

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The items in bold are for A Level only.



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## Maths – A.3 and A.4

A.3 – graphs



- translate data between forms
- plot 2 variables
- understand  $y = mx + c$
- rate of change calculations, linear and non-linear graphs
- determine an intercept**

A. 4 - geometry and trigonometry

- circumference, surface area and volume

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The items in bold are for A Level only.



## What makes Maths "Level 2"?

Question papers must contain 10% of marks addressing Maths at Level 2.



- ❖ having to select data from that provided in the question
- ❖ change of unit e.g. from  $\text{cm}^3$  to  $\text{dm}^3$
- ❖ conversion to and from standard form e.g. 0.040 and  $4.0 \times 10^{-2}$
- ❖ rearrangement of an expression
- ❖ a multi-step calculation
- ❖ quoting a final answer to an appropriate number of significant figures
- ❖ absence of scaffolding

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It is a requirement of the new subject conditions for A level Biology that written examination papers must contain 10% of marks addressing Maths at Level 2.

So the question is, "What makes Maths 'Level 2 maths (L2M)'?"  
Here are some suggestions on this slide.

## Maths in question papers

### Activity 3

Consider A level Paper 1, Q 12.

- ❖ How much L2M can you see there?
- ❖ Which L2M skills are addressed?
- ❖ How would you help students prepare for such questions?

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In this exercise, two “maths-heavy” questions have been chosen to consider.

You can find these questions in the training pack: they are labelled as “Activity 3”.

There is also a very comprehensive Maths guide available on the website here for students:

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/Biology/2015/teaching-and-learning-materials/Biology\\_Maths\\_Student\\_Guide\\_-\\_FINAL.pdf](https://qualifications.pearson.com/content/dam/pdf/A%20Level/Biology/2015/teaching-and-learning-materials/Biology_Maths_Student_Guide_-_FINAL.pdf)


And here for teachers:

[https://qualifications.pearson.com/content/dam/secure/silver/all-uk-and-international/a-level/biology/2015/teaching-and-learning-materials/Biology\\_Maths\\_Teacher\\_Guide\\_-\\_FINAL.pdf?751272972906001](https://qualifications.pearson.com/content/dam/secure/silver/all-uk-and-international/a-level/biology/2015/teaching-and-learning-materials/Biology_Maths_Teacher_Guide_-_FINAL.pdf?751272972906001)

In this question:

- (a) (i) does not involve L2 maths skills
- (a) (ii) uses maths skills A.0.2 and A.4.1
- (b) (i) does not involve L2 maths skills, as it is a written description
- (b) (ii) uses a great deal of Maths including A.0.2, A.1.1, A.1.9, A.2.1, A.2.3, A.2.4
- (b) (iii) does not involve L2 maths skills, as it is a written description
- (c) Does not use L2 maths





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## "Working scientifically"

- ❖ "Working scientifically" covers aspects of practical work across the specification
- ❖ DfE say this is to be achieved through a variety of practical activities
- ❖ Students should be undertaking regular hands-on practical work
- ❖ As a **minimum**, students must undertake 12 practical activities
- ❖ There are various strands to this...

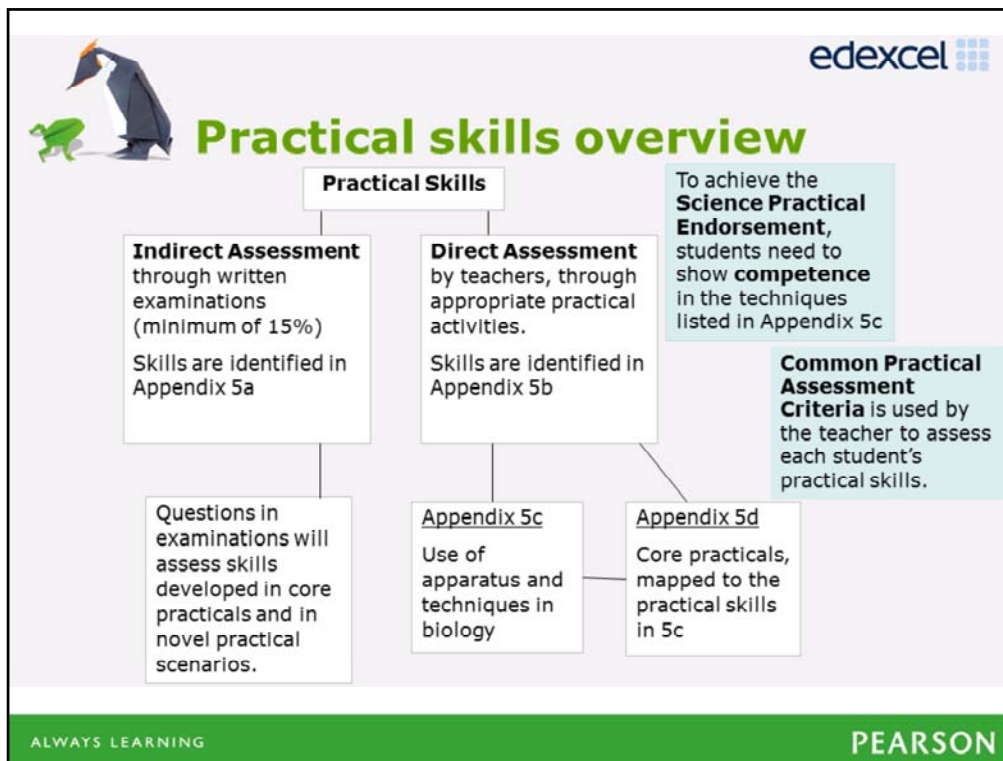
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The other big change from September is the way in which practical skills will be assessed.

The bottom line requirement is that 12 activities must be undertaken.

To give some flexibility, Biology A has incorporated 18 "core practicals" within the specification. We would strongly recommend that these practicals are done – and, ideally, supplemented with other practical work – so that students are in a position to meet the requirements for the indirect assessment of practical skills on written examination papers.




**This very useful slide shows the ‘big picture’ of practical skills assessment, both direct and indirect.**

**Indirect assessment** - Questions within written examination papers will assess knowledge and understanding that students gain within the context of the core practicals, as well as novel practical scenarios. (minimum of 15% across AS and A Level) Skills are in Appendix 5a – indirect assessment.

**Direct assessment** – Practical work carried out throughout the course will enable students to develop the skills in Appendix 5b. Appendix 5c lists the apparatus and techniques for biology. These skills are directly assessed by teachers.

The Common Practical Assessment Criteria (CPAC) will be used to assess students’ skills as they demonstrate their competencies.



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## Techniques and apparatus

The subject criteria require candidates to have experienced these techniques / apparatus:

1. use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)
2. use appropriate instrumentation to record quantitative measurements, such as a colorimeter or potometer
3. use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions
4. use of light microscope at high power and low power, including use of a graticule
5. produce scientific drawing from observation with annotations
6. use qualitative reagents to identify biological molecules


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These next two slides show the 12 practical techniques to be taught which must be developed by students during the A level.

Note that these don't correspond to the 12 minimum practicals!

Each core practical may address more than one technique. The techniques are therefore covered several times during the Core Practicals, to ensure mastery.



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## Techniques and apparatus


7. separate biological compounds using thin layer/paper chromatography or electrophoresis
8. safely and ethically use organisms to measure:
  - plant or animal responses
  - physiological functions
9. use microbiological aseptic techniques, including the use of agar plates and broth
10. safely use instruments for dissection of an animal organ, or plant organ
11. use sampling techniques in fieldwork
12. use ICT such as computer modelling, or data logger to collect data, or use software to process data.

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The second half of the list of 12 practical techniques.

Note the requirement to incorporate sampling techniques in fieldwork. There is no need for teachers to spend much time worrying about these techniques and apparatus – they are all incorporated into the Core Practicals, so the simple requirement is to do the core practicals!



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## Core practicals in Biology 'A'

### Activity 4

You are provided with:

- ✓ a list of the 18 core practical titles
- ✓ a list of the techniques and apparatus

Decide which techniques might be addressed in each core practical.



- ❖ Mark your decision on the sheet entitled: **Biology 'A' Core Practicals Skills Grid**
- ❖ Are there any issues arising e.g. are any of the 12 skills inadequately covered?
- ❖ Compare with the mapping on pages 66-67 of the spec. Do you agree with this mapping?

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This exercise, which was part of the GRTT event, is not one that we have reproduced in these materials, as the mapping of core practicals to techniques appears as Appendix 5d in the specification.

However, you can – if you wish – check that Appendix to see if you agree with the mapping of core practicals to techniques.



## Support for Core Practicals

### Practical Work- Implementing, Integrating, Resourcing, and Encouraging

- ❖ All 18 core practicals will be supported by free student worksheets and teacher and technician sheets.
- ❖ These will all help with the above skills.
- ❖ They will be available for download from the Edexcel website.
- ❖ In addition, detailed teacher and student guides to practical work are provided.

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The sheets for the 8 AS practicals, for students, teachers and technicians are on the website now:

<https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-a-2015.coursematerials.html#filterQuery=Pearson-UK:Category%2FTeaching-and-learning-materials>



The remaining sheets, for A level, will go up later in 2015.

Links to each are not given here as there 27 in total but the page above will allow you to access all of them.

There are also Teacher and Student Guides for practical skills. You can find these in the "Course materials" tab of the Biology A webpage:

<http://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-a-2015.coursematerials.html>

Click on "Teaching and learning materials" and then scroll down to the section headed "Guides". Note that the Teacher version is password protected, as it contains answers to the Student Guide questions.



## Worksheets: an example

**CORE PRACTICAL 4:**  
Investigate the effect of enzyme and substrate concentrations on the initial rates of reactions.


- This example is in your pack
- It shows an example of progression from GCSE
- This progression will be useful for learners

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As an example of the support materials that will be provided, the sheets for the first core practical can be found in the materials attached to this pack (“Sample practical worksheets”)

This is an especially useful core practical. as it shows some very clear examples of progression from this topic at GCSE to A Level.



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## Preparing for Core Practicals

### Activity 5

You are provided with:

- ✓ “Core Practical 4” in the Teachers Guide
- ✓ Student, teacher and technician worksheets

Discuss how you might implement this practical.

- ❖ Which enzyme / substrate system would you use: one of the ones suggested or something else?
- ❖ What equipment would you need?
- ❖ Which equipment, if any, do you not currently have?


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In addition to the three CP4 sheets (last slide) you should also look at the relevant page in the practical guide for teachers (page 24). This should also be available as a single page on the webpage where you found the current document.

This should also be available as a single page on the webpage where you found the current document (“Core practical 4 teachers guide”)

It is worth considering all of this material, especially in relation to ideas for implementation of the suggested ideas and/or other enzyme-substrate systems that might be useful.





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## Investigative approaches

- ❖ Some students are not comfortable with uncertainty and often just want to learn the 'right' answer!
- ❖ However, this will not serve them well as they progress in science at A level and beyond.
- ❖ So, how do we encourage an investigative approach rather than one of rote learning?
- ❖ The core practicals can be an excellent vehicle for this.
- ❖ Investigative approaches are also needed to demonstrate 'practical competency'.

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A general point about a use of Core and other practicals is made here.



## Practical competency

This is a new feature of A level.

We will look at the issues of:

- ❖ collecting evidence
- ❖ keeping records of student work
- ❖ CPAC criteria
- ❖ how will monitoring work



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For more information read the letter sent to centres. This is available at:

[http://qualifications.pearson.com/content/dam/pdf/News/A%20level%20news/Practical\\_Endorsement\\_Letter\\_June\\_2015.pdf](http://qualifications.pearson.com/content/dam/pdf/News/A%20level%20news/Practical_Endorsement_Letter_June_2015.pdf)

Do keep an eye on the website for further information.



## Practical competency

Awaiting information following the trials in schools of the assessment of practical skills

Awaiting information regarding the monitoring and recording requirements.

Click on the link to play the video regarding the assessment trial

[https://www.youtube.com/watch?v=p2\\_jncXPFqM&feature=youtu.be&utm\\_source=sciencepractical&utm\\_medium=Email&utm\\_campaign=SEC\\_GEN\\_07MAR2014\\_05eandalevel2015&mmroi=1347-2525213-575488-0](https://www.youtube.com/watch?v=p2_jncXPFqM&feature=youtu.be&utm_source=sciencepractical&utm_medium=Email&utm_campaign=SEC_GEN_07MAR2014_05eandalevel2015&mmroi=1347-2525213-575488-0)


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If you've not already seen the video, outlining the new system for practical competency, then it is worth watching.

There is also some information (slightly out-of-date, but worth looking at) in the most recent podcast on CPAC:

[https://edexcel.adobeconnect.com/\\_a49419191/p4y09fpw41n/](https://edexcel.adobeconnect.com/_a49419191/p4y09fpw41n/)



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## Principles of practical competency

This is not a whole series of assessed practicals but.....

- ❖ a series of class practicals
- ❖ a chance for students to develop skills, as the teacher supervises
- ❖ about breadth of practical experience
- ❖ it's not necessarily the idea of perfection at everything
- ❖ think driving test - they need to be competent, not perfect!

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This is key: as you engage with the CPAC, remember that it is a holistic assessment, and not a series of practicals which are passed / failed individually.



## Indirect assessment

### Activity 6

*The skills to be assessed in question papers are listed in Appendix 5a of the specification.*

- ❖ Look at A Level Paper 3, Q 3 and its mark scheme*
- ❖ How will you help students to develop their practical skills to be successful?*

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Appendix 5a in the specification shows the skills which are designated as IAPS (Indirect Assessment of Practical Skills).


As an example, you have A level Paper 3, Q 3 and its mark scheme (“Activity 6 - IAPS in exam questions”).


Take a look and think about the questions.

# BREAK



Take a break





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## Session 3 – Assessment

- ❖ What's tested where?
- ❖ The different assessment items (MCQs etc)
  - Command words and ramping of questions
  - Extended-writing question and their mark schemes
  - Looking at exemplar questions
  - Dealing with unscaffolded questions
- ❖ Specific issues in Biology 'A' (pre-release article)
- ❖ End of topic tests
- ❖ Mock examinations

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This slide lists some of the main issues that we need to think about in relation to the new assessment arrangements.



## What's tested where (AS)?

**AS paper 1 (1h 30 mins, 80 marks)**

- ❖ Topic 1: Lifestyle, Health and Risk
- ❖ Topic 2: Genes and Health

**AS paper 2 (1h 30 mins, 80 marks)**

- ❖ Topic 3: Voice of the Genome
- ❖ Topic 4: Biodiversity and Natural Resources

Both papers will include:

- questions that target mathematics at Level 2
- questions that target the conceptual and theoretical understanding of experimental methods


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This slide summarises what is assessed on each paper. Note the point about Maths at the end.

Remember that the AS results, if students take the AS, will not contribute to a final A level grade for those who go on to A level.





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## What's tested where (A level)?

**A level paper 1 (2h, 100 marks)**

- ❖ *Topic 1: Lifestyle, Health and Risk*
- ❖ *Topic 2: Genes and Health*
- ❖ *Topic 3: Voice of the Genome*
- ❖ *Topic 4: Biodiversity and Natural Resources*
- ❖ *Topic 5: On the Wild Side*
- ❖ *Topic 6: Immunity, Infection and Forensics.*


The paper will include:


- questions that target mathematics at Level 2
- questions that target the conceptual and theoretical understanding of experimental methods

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Remember that A level papers need to test across the whole course, so A level Paper 1 tests some of the second year topics, whilst drawing on the background knowledge from the first year (AS) topics.



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## What's tested where (A level)?

**A level paper 2 (2h, 100 marks)**



- ❖ *Topic 1: Lifestyle, Health and Risk*
- ❖ *Topic 2: Genes and Health*
- ❖ *Topic 3: Voice of the Genome*
- ❖ *Topic 4: Biodiversity and Natural Resources*
- ❖ *Topic 7: Run for your Life*
- ❖ *Topic 8: Grey Matter.*

The paper will include:

- questions that target mathematics at Level 2
- questions that target the conceptual and theoretical understanding of experimental methods

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Remember that A level papers need to test across the whole course, so A level Paper 2 tests some of the second year topics, whilst drawing on the background knowledge from the first year (AS) topics.



## What's tested where (A level)?

**A level paper 3 (2h, 100 marks)**

This paper will include:

- ❖ questions from Topics 1-8
- ❖ synoptic questions that may draw across different topics
- ❖ question based on a pre-release scientific article (available via the website 8 weeks before the exam)

The paper will also include:



- questions that target mathematics at Level 2
- questions that target the conceptual and theoretical understanding of experimental methods

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Finally, here's what is assessed on Paper 3 – which is, effectively, a holistic assessment over the whole A level course.

There is more information on the pre-release article on a later slide.



## The assessment items

All papers at both levels may include:

- ❖ multiple-choice
- ❖ short open
- ❖ open-response
- ❖ calculations
- ❖ extended writing questions.

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There will be a mixture of question types as shown.

These are best appreciated by looking at the SAMs, which you can find on the Biology B webpage, under the “Course materials” tab.

<http://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-a-2015.html>

There will be further sample materials available in the Autumn.



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## Command words in exams

### Activity 7

*Command words in questions are crucial to understanding exactly what the question requires.*


- ❖ Read through the command words (Appendix 7, p75)*
- ❖ In small groups, discuss the formulation of THREE questions using THREE different command words in THREE different learning objectives from the specification*


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An exercise on the crucial aspect of student understanding of what the command words in the exam are asking them to do.

The command words allowed on papers are listed in the spec. on page 75. If you are working with others you could a discussion now or try this useful exercise yourself.



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## Ramping in questions

To try and improve responses to the paper, each one is ramped so that there is an:

- ❖ increase in demand through a paper
- ❖ increase in demand within a question


Candidates should attempt all questions – instructed to do so on front cover of each paper

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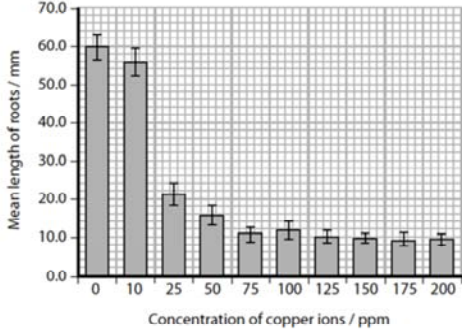
About the notion of ramping.

Remember, when you look at the SAMs, that a number of revisions take place as we go through the accreditation process; and this tends to have an effect on the ramping that was in place in the first draft of the question papers.

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## Open-ended questions





Concentration of copper ions / ppm	Mean length of roots / mm
0	60.0
10	55.0
25	20.0
50	15.0
75	10.0
100	11.0
125	9.0
150	8.0
175	9.0
200	8.0

(a) (i) Analyse the data to explain the effect of copper ions on the growth of roots. (3)

(ii) Explain how this investigation could be improved. (3)

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A very open ended question to look at, which is from AS SAMs paper 2, Q10.



## Unscaffolded questions

Present exams often have questions of this type:

(iv) Name **one** biotic factor and suggest how this factor might affect the distribution of *Pleurococcus* on the trees. (2)

Biotic factor \_\_\_\_\_

Effect \_\_\_\_\_

(b) Semilunar valves and elastic fibres are found in the aorta.  
For each of these structures, describe its location in the aorta and explain its function.

Semilunar valves (3)

Location \_\_\_\_\_


Function \_\_\_\_\_

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It was clear, throughout the accreditation process, that the new requirements for A level include one for less scaffolding on the new papers.

Some scaffolded questions from the current spec/ exam are shown. Expect few, if any, of this type in future question papers.





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## Unscaffolded questions

A DNA molecule consists of two strands of mononucleotides. Each of these strands is twisted around the other, forming a \_\_\_\_\_.

Each mononucleotide consists of a pentose sugar called \_\_\_\_\_, a base and a \_\_\_\_\_. In each strand, the mononucleotides are held together by \_\_\_\_\_ bonds.

The two strands are held together by complementary base pairing. Adenine bonds with \_\_\_\_\_ and cytosine bonds with \_\_\_\_\_.


The name of the bond that forms between these bases is a \_\_\_\_\_ bond. A DNA molecule that is composed of 34% adenine will be composed of \_\_\_\_\_% cytosine.

This type of scaffolded question is unlikely to feature in the new exams.

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A common question type now, which we are unlikely to see again: it would be replaced by an open question asking candidates to describe the structure of DNA i.e. the same level of demand, but with candidates having less structure to the question.



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## Unscaffolded questions

(ii) Another mutation reduces the quantity of CFTR protein in membranes.  
Explain the effects of having smaller quantities of CFTR protein in membranes. (5)

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This is from SAMS AS Paper 1, Q9 and is more typical of what to expect in the future.



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## Levels-based marking


These questions are marked with an asterisk.  
They are typically worth 6 or 9 marks.  
The marking rewards structure, as well as content, of the answer.

- In questions marked with an asterisk (\*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

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A feature of all the papers in future will be extended writing questions which are marked with an asterisk (\*) and will be marked using a levels-based system.



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## Levels-based marking

### Activity 8

Here is a question from Paper 1 of the SAMs:

\*(ii) The diagram shows the distribution of some of the abiotic and biotic components of a sea shore. There are three species of seaweed (*Fucus*) and one species of limpet (*Patella vulgata*). Limpets feed on seaweed.

Analyse the data to explain how the distribution patterns of *Fucus spiralis*, *Fucus vesiculosus* and *Fucus serratus* are affected by abiotic and biotic factors. (6)


- ❖ Devise a levels-based mark scheme for this question.
- ❖ What 'indicative content' would you expect to see?


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This is an exercise in which you are asked to devise a levels based mark scheme (LBMS) for a question to get a feel for how it is done. You are provided with the full question and its mark scheme and also a template for any LBMS.

It is suggested you have a go at writing something in the template ("Activity 8 - EW question") before looking at the published scheme. How far do you agree/disagree with what we have done?

When you want to look at the final mark scheme, it is from the A level SAMs, Paper 1 Q11.



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## The pre-release article

- ❖ Having an article to be read before the exam is NOT new...
- ❖ ... so, there are many past examples and lots of support from the past.
- ❖ A good idea to get the past articles and associated questions.

- ❖ The article is released at least 8 weeks before the exam
- ❖ Questions are related to the article, rather than a comprehension exercise.

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The pre-release article, as currently seen on SNAB 6BI05 will be retained. So, lots of past paper materials exist for exam practice!



## Some exemplar questions

### Activity 9

*You are provided with a series of questions from the SAMs, along with some student exemplar answers.*

*❖ Do the exemplars show you the standard that is required?*



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We arranged for students to have a go at some of the SAMs and some of their attempts are available for you to look at in relation to this exercise.

One example is focussed on practical skills (IAPS), another on extended writing type and the third a typical theory question.

Have a look at the versions with no commentary first ("Activity 9 - student exemplars") and then see how far you agree with the mark given and the comments made ("Activity 9 – commentary").



## Tracking progress

You will probably want your students to do

- ❖ End of topic tests
- ❖ 'Mock' exams

You can use

- ❖ Exam Wizard
- ❖ Results Plus – see next slide

You can find them [here](#)



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The link should take you to the “Teaching support” tab of the Biology A webpage.

Scroll down to Exam Wizard and click on Show More, when you have read this click on ‘Find out more...’

Do the same for Results Plus.

To access both these services, you will need an “Edexcel Online” login which can be obtained from your centre’s Exams Officer.




## Tracking progress

### ResultsPlus

[www.edexcel.com/resultsplus](http://www.edexcel.com/resultsplus)

- ❖ Edexcel's free online service giving instant and detailed analysis of your students' exam and mock performance
- ❖ see your students' scores for every exam question
- ❖ understand how your students' performance compares with Edexcel national averages





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ResultsPlus is Edexcel's free online service giving instant and detailed analysis of your students' exam and mock performance.

Here you can see your students' scores for every exam question and understand how your students' performance compares with Edexcel national averages.





## Support

For more information, please contact:

- ❖ subject advisors ([TeachingScience@pearson.com](mailto:TeachingScience@pearson.com))
- ❖ subjects pages/communities
- ❖ [Ask the expert](#)

The root of all assistance is the Edexcel Biology subject website:

<http://qualifications.pearson.com/en/qualifications/edexcel-a-levels/biology-b-2015.html>

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Ask the Expert is at URL

<http://qualifications.pearson.com/en/support/support-for-you/teachers/contact-us.html>

Edexcel now has two full-time science subject advisors: Stephen Nugus and Julius Edwards.

Or click the link on the page



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## Pearson is recruiting...

We have exciting opportunities for you to become an examiner for Biology and:

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- ❖ grow your career

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[www.edexcel.com/aa-recruitment](http://www.edexcel.com/aa-recruitment)

or e-mail [aaresourcing@pearson.com](mailto:aaresourcing@pearson.com)

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We are always interested in having more experienced teachers to join our dedicated team of examiners and markers.

Further information can be found on the website.



## Thank you

❖ We hope that this has been useful!