Edexcel International AS/A Level Biology

Bridging the gap between International GCSE and IAL

Event code: 4BI1-20IO1

First teaching in 2018, first assessment 2019

Pearson Edexcel

Session agenda

8.00	Welcome & introductions, aims and objectives
8.15	Qualification structures
8.35	Assessment information
8.50	Command words, mathematical skills
9.15	Practical skills, assessment of practical skills
9.45	Resources
10.00	Finish

Aims and objectives

- Discuss the differences between International GCSE and Advanced Level study, including level of difficulty, accessibility, learning styles and methods of assessment.
- Be introduced to a range of activities to both enthuse and enable students who have just completed International GCSE assessments to make and sustain the necessary step up to the level of understanding and methods of working, including independent learning, required to succeed at International A Level.
- Discuss and look at ways to address some of the common pitfalls experienced by students in taking this challenging step.

Welcome and Introductions

Delegate exercise 1

What is the name of a large town/city close to where you live/work?

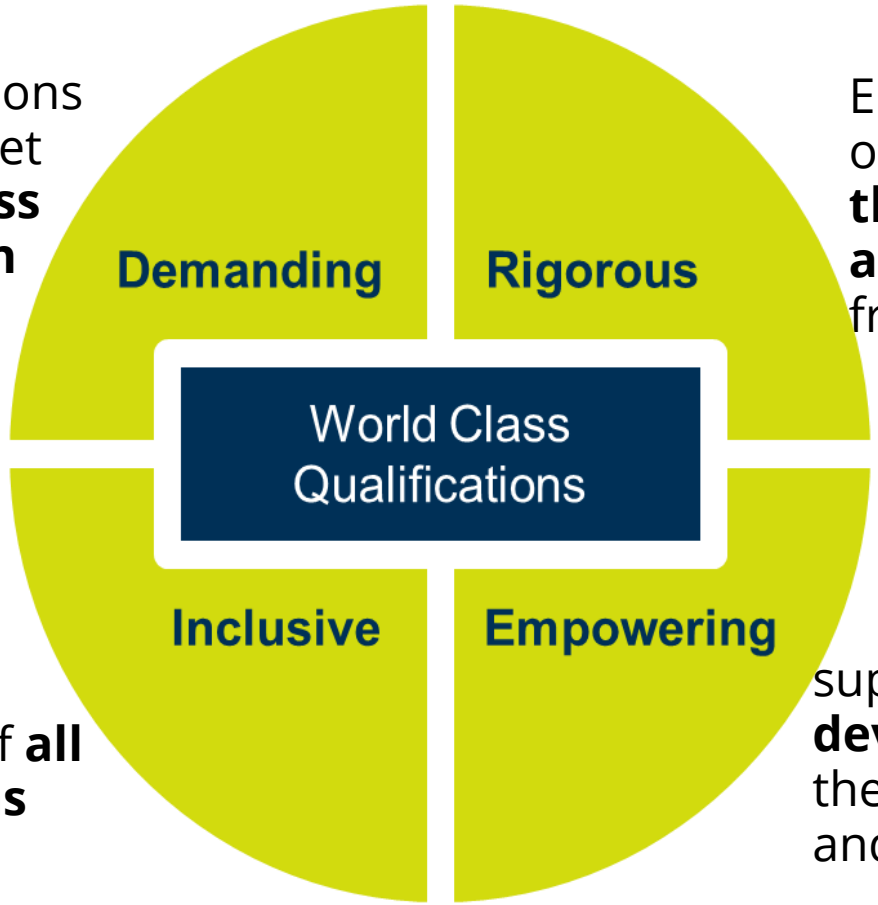
About Pearson Edexcel

- As the UK's largest awarding organisation, we are best placed to provide qualifications that are most closely aligned to the British educational system.
- We are the most reliable awarding organisation in the UK, recognised and trusted by educators, learners and employers to provide high quality qualifications.
- By helping you to realise student potential, you can prepare and empower all your students to progress to further education, university and employment.
- Our technology capability allows us to provide you with more advanced support services, tools and resources to make life easier for school leaders, teachers and students.
- Pearson Edexcel are leading the way, challenging thinking and creating new ideas so you can be confident our qualifications will always be world-class.

Pearson
Edexcel

World-class Qualifications

All Edexcel qualifications are developed to meet Pearson's **World Class Qualification design principles**



Endorsement of educational **thought-leaders and assessment experts** from across the globe

Developed using an understanding and benchmarking of **all educational systems**

Qualifications that support young people to **develop the capabilities** they need to **progress** and prosper in their lives

Pearson Edexcel

Supporting transferable skills

- Our transferable skills framework underpins the design of all Pearson Edexcel international qualifications and their supporting resources across IPLS, International GCSE and International A Level.
- Ensures our assessments target the skills students need for successful progression.
- Increases our support where these skills **naturally** occur through the teaching, learning and assessment.
- Pearson materials and mapping will support you in identifying and developing the acquisition of these skills in students across the full curriculum.
- https://qualifications.pearson.com/content/dam/pdf/International%20GCSE/General/Transferable-Skills-Information-Pack.pdf

Pearson Edexcel

Structure of qualifications and assessment: linear and modular

International GCSE

International GCSE Biology exams are linear: all examinations are taken in the same examination series at the end of the course.

Examinations are available in January and May / June.

If there is more than one paper, all papers must be taken in the same examination series.

International Advanced Subsidiary (IAS) and International Advanced Level (IAL)

These are unit-based, modular courses. Students have the choice to sit examinations at the end of each unit or at the end of the course.

IAS Biology consists of 3 units (1, 2 & 3)

IAL Biology consists of 6 units – the IAS units (1,2,3) plus 3 A2 units 4, 5 & 6

Examinations are available in January, June and October.

Pearson Edexcel

International AS and A Level: resitting individual units

Students can resit any unit irrespective of whether the qualification is to be cashed in.

If a student resits a unit more than once, only the better of the two most recent attempts of that unit will be available for aggregation to a qualification grade.

Specifications – what do they tell us?

Specifications show us many things:

- Content – the topics that must be covered
- The structure of the papers – content that is covered by each paper
- Assessment requirement: objectives – how we test candidates and how much emphasis we put on each assessment objective
- Maths skills – all exams have 10% maths content
- Command words – the words used to ask questions
- What grades mean
- Transferable skills
- Practical skills that need to be covered, and the core practicals that candidates need to know
- Other things, e.g. prior learning, how candidates can use the course, administration.

Content

The specifications show us all the content that candidates need to cover. They also show us what content is assessed on each paper. All specifications are organised in the same way.

International GCSE Biology:

Paper 1 only assesses content not in bold.

Paper 2 assesses all content, including emboldened topics.

International AS & A Level:

Each paper has different content assessed:

Paper 3 tests practical skills using content from all parts of AS

Paper 6 tests practical skills using content from all parts of the AL.

Pearson Edexcel

International GCSE Biology

Content for paper 1 is not in bold.

All content is tested on paper 2.

(h)	Transport
Students should:	
2.51	understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell
2.52	understand the need for a transport system in multicellular organisms
Flowering plants	
2.53	describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant
2.54	describe the role of xylem in transporting water and mineral ions from the roots to other parts of the plant
2.55B	**understand how water is absorbed by root hair cells**
2.56B	**understand that transpiration is the evaporation of water from the surface of a plant**
2.57B	**understand how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity**
2.58B	***practical: investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot***

Pearson Edexcel

International AS and A Level content

Each Topic lists content that is assessed.

Core practicals are in bold.

Topic 1 – Molecules, Transport and Health

Students will be assessed on their ability to:

1.1	understand the importance of water as a solvent in transport, including its dipole nature
1.2	(i) know the difference between monosaccharides, disaccharides and polysaccharides, including glycogen and starch (amylose and amylopectin) (ii) be able to relate the structures of monosaccharides, disaccharides and polysaccharides to their roles in providing and storing energy *β-glucose and cellulose are not required in this topic.*
1.3	**CORE PRACTICAL 1** **Use a semi-quantitative method with Benedict's reagent to estimate the concentrations of reducing sugars and with iodine solution to estimate the concentrations of starch, using colour standards.**
1.4	know how monosaccharides (glucose, fructose and galactose) join together to form disaccharides (maltose, sucrose and lactose) and polysaccharides (glycogen, amylose and amylopectin) through condensation reactions forming glycosidic bonds, and how these can be split through hydrolysis reactions
1.5	(i) know how a triglyceride is synthesised by the formation of ester bonds during condensation reactions between glycerol and three fatty acids (ii) know the differences between saturated and unsaturated lipids
1.6	understand why many animals have a heart and circulation (mass transport to overcome the limitations of diffusion in meeting the requirements of organisms)
1.7	understand how the structures of blood vessels (capillaries, arteries and veins) relate to their functions
1.8	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 *Details of myogenic stimulation not needed at IAS.*

Pearson Edexcel

How can we help students with content?

- Give clear checklists for them each time we teach a topic.
- Encourage ‘metacognition’ by getting them to evaluate their own knowledge and learning of a topic.
- After tests and exams, get them to assess their ‘weaker’ topic areas by giving them a grid to write in their marks.

Checklist for topics

Code	Topic	☺	😐	☹
7.1	know that the process of respiration releases energy in living organisms			
7.2	practical: investigate the difference between inspired and expired air for carbon dioxide concentration			
7.3	know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms			
7.4	know the word equation for anaerobic respiration			
7.5	explain the differences between aerobic and anaerobic respiration			
7.6	understand the role of ATP in energy transfer (addition and removal of a phosphate group and associated energy requirement and release)			

Test grids

- Students fill in a test grid after getting their paper back.
- The grid gives the specification references so they can check any weaker areas.
- Assessment objectives are also shown to help them self-identify where they lose marks – we will look at this later!

Test Grid

Question	Spec Ref	Max Mark	My Score	AO1	AO2	AO3
1ai	2.54	3				
1aii	2.54	2				
1b	2.57B	3				
1ci	2.57B	1				
1cii	2.60	1				
1d	2.60	3				
1e	2.58B	6				
Total		19	/ 19	/ 5	/ 5	/ 9

Pearson Edexcel

Assessment Information

Assessment information in the specification

- It tells us how candidates are assessed.
- It tells us how much we weight each assessment objective.
- It is often ignored by students (and teachers!) – most focus only on the content of the specification.
- It is very important to know how we assess.

Assessment objectives: what are they and why are they important?

- They tell us the skills that we are assessing AND the proportion of marks that each is allocated to each.
- There are three assessment objectives (AOs) for International GCSE Biology and four assessment objectives for International AS and A Level Biology.

Assessment objective 1 (AO1)

International GCSE Biology:

AO1 Knowledge and understanding of biology/science.

International AS and A Level Biology:

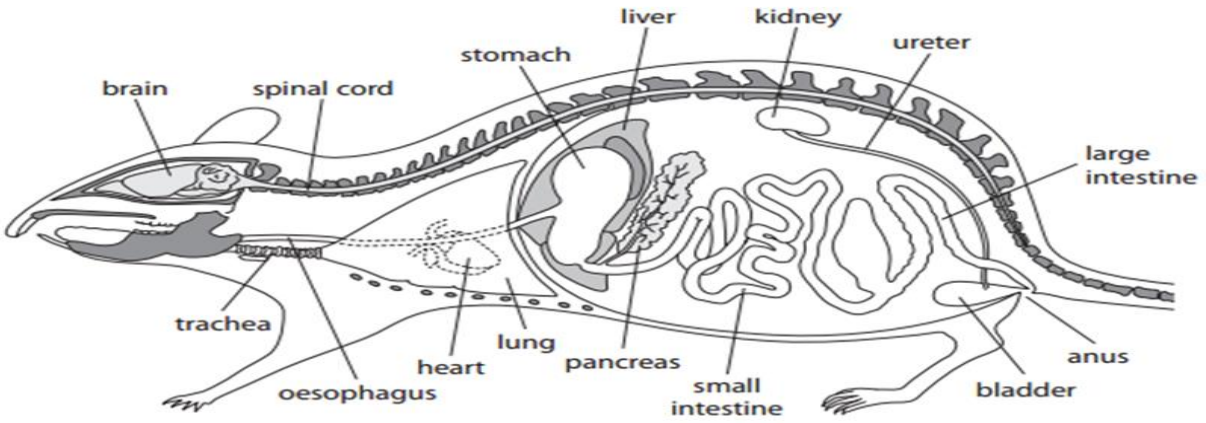
AO1 Demonstrate knowledge and understanding of science.

These are obviously very similar!

- AO1 is about understanding content.
- Conscientious students like AO1 – they feel confident in learning detail and depth.
- Easy to revise – repetitions, mind maps, testing with flash cards and questions.

Typical AO1 question

2 The diagram shows a section through a rat. Some of the rat's organs have been labelled.



(a) (i) What is meant by the term **organ**?

(1)

(ii) Name the organ labelled in the diagram that is part of the circulation system.

(1)

(iii) Name three other systems shown in the diagram.

(3)

1 .....

2 .....

3 .....

Pearson Edexcel

Assessment objective 2 (AO2)

International GCSE Biology:

AO2 Application of knowledge and understanding, analysis and evaluation of biology.

International AS and A Level:

AO2 (a) Application of knowledge and understanding of science in familiar and unfamiliar contexts.
(b) Analysis and evaluation of scientific information to make judgements and reach conclusions

AO2 is split into two sections but the same theme is present.

- AO2 is about **application** of knowledge to familiar and unfamiliar contexts.
- Can require quantitative (calculations, graphs, analysis of tables with data) or qualitative analysis
- Can require higher cognitive levels – evaluate, assess, discuss.
- Can be challenging for less confident students. 'You never taught us about birds in the winter!'

Typical AO2 question

11 Farmers in Asia add fertiliser to their crops to increase the yield.

Fertilisers usually contain nitrate, phosphate and potassium.

The table shows the farmers' crop yield when the crops are given a fertiliser lacking one of these three minerals.

A figure of 100% is the maximum yield with all three minerals given.

	Yield (%)			
Crop	**No nitrate**	**No phosphate**	**No potassium**	**All three minerals added**
lowland rice	73	97	99	100
barley	52	66	72	100
rye	44	70	68	100
wheat	46	69	72	100
upland rice	46	66	90	100
potato	47	47	70	100

(a) (i) State the mineral that has the greatest effect on crop yield.

(1)

(ii) Explain why this mineral has the greatest effect on crop yield.

(2)

(b) Which crop is most affected by the lack of potassium?

(1)

Pearson Edexcel

Assessment objective 3 (AO3)

International GCSE Biology:

AO3 Experimental skills, analysis and evaluation of data and methods in biology

International AS and A Level Biology:

AO3 Experimental skills in science, including analysis and evaluation of data and methods

These are very similar!

- AO3 is about experimental skills.
- Can include core practicals (but this could be classed as AO1).
- Can include general practical themes, variables, accuracy, repeatability, valid planning, evaluating practical methods and data.
- AS and A Level requires a higher level compared to International GCSE.

Pearson Edexcel

Typical AO3 question

2 An investigation was carried out to determine the relative concentration of reducing sugars in a range of foods.

In each case, some food was ground up with distilled water. The resulting liquid was filtered to give an extract.

This extract was then tested for the presence of reducing sugars using a reagent.

(a) (i) Describe how a test for reducing sugars is carried out.

(2)

(ii) Explain how this investigation should be carried out to give a semi-quantitative estimate of the concentration of the reducing sugars by comparing the colour of the precipitate with a colour chart.

(3)

Pearson Edexcel

Weighting of assessment objectives

		International GCSE
AO1	Knowledge and understanding of science	38–42%
AO2	Application of knowledge and understanding, analysis and evaluation of science	38–42%
AO3	Experimental skills, analysis and evaluation of data and methods in science	19–21%
		100%

Pearson Edexcel

International AS and A Level

Similar to GCSE in terms of weightings.
AS and A Level are similar to each other.
Different papers have different weightings.
AO3: ONLY Units 3 and 6
AO1: Units 4 and 5 have less than Units 1 and 2
AO2: Units 4 and 5 have more AO2b than Units 1 and 2 – more evaluation (higher order thinking)

Relationship of assessment objectives to units for the International Advanced Subsidiary qualification

Unit number	Assessment objective (%)			
	AO1	AO2a	AO2b	AO3
Unit 1	17–18	17–18	4.5–5.5	0
Unit 2	17–18	17–18	4.5–5.5	0
Unit 3	2–3	0	0	17–18
Total for International Advanced Subsidiary	36–39	34–36	9–11	17–18

Relationship of assessment objectives to units for the International Advanced Level qualification

Unit number	Assessment objective (%)			
	AO1	AO2a	AO2b	AO3
Unit 1	8.5–9.0	8.5–9.0	2.2–2.8	0
Unit 2	8.5–9.0	8.5–9.0	2.2–2.8	0
Unit 3	1–1.5	0	0	8.8–9.2
Unit 4	7.3–7.8	8.4–8.9	3.6–4.0	0
Unit 5	7.3–7.8	8.4–8.9	3.6–4.0	0
Unit 6	1–1.5	0	0	8.8–9.2
Total for International Advanced Level	34–37	33–36	11–14	17–18

Pearson Edexcel

Delegate exercise 2

Guess the assessment objectives!

- Look at the questions in the packs and identify the assessment objectives being tested.
- The first two questions are International AS Level questions.
- The third question is an International GCSE Human Biology question.

How to identify areas that students need to develop

Tests – use examWizard to focus on topics or AOs.

Get students to self-identify areas for development.

ResultsPlus – identify areas for development by cohort or class.

Access to Scripts – candidates/centres have free access to scripts.

How to develop skills for each AO

AO1 :

- Factual knowledge tests
- Revision notes/mind maps/lists
- Blank page revision – students start with a blank page and write down what they know about a particular topic. Missing facts are then looked up.
- Students teaching each other – a good way to learn is to teach someone else!

Vocabulary – ALWAYS use key vocabulary (photosynthesis, digestion, emulsification, hydrolysis etc.). The more students use it, the more they become confident with using it. Less confident students are often 'too scared' to use scientific vocabulary; 'I can't use that because I am not a real science student.' Make key vocabulary lists at the start of topics and keep referring to them when teaching.

NEVER assume that students know all vocabulary – ALWAYS reintroduce words when teaching each topic.

When teaching complex concepts, gradually build up a picture rather than doing everything in one go.

How to develop skills for each AO

AO2:

- Give students regular data analysis questions.
- Encourage them to think about contexts that are not on the specifications.
- Start developing graph skills, numerical skills and analytical skills from a young age – Year 7 ideally.
- Confidence is key to student performance.
- When evaluating encourage them to see both sides – look for data that supports and does not support.
- When writing up practicals, use scaffolding for conclusions:

  'Describe the patterns show by the graph, then explain the patterns using the words respiration, oxygen, carbon dioxide production, anaerobic, aerobic.'

- Give out data exercises as quick starter activities – these can be differentiated for different ability groups/age groups.

Differentiated data analysis

'Shrews are small warm blooded mammals. Here is some data to show the rate of oxygen use by different species of shrew.'

'Discuss the rates of oxygen use by the different species of shrew.'

OR

1. Describe how the masses of the shrews changes going down the table.
2. Describe how rate of oxygen use of the shrews changes going down the table.
3. Identify the relationship between body mass and rate of oxygen use.
4. Explain how the mass of shrews will affect the surface area to volume ratio.
5. What will happen to the speed that the shrews will lose heat if their surface area to volume ratio is higher?
6. Explain the data in terms of body mass, heat loss, surface area to volume ratio and respiration rate.

Type of shrew	Body mass of shrew in g	Oxygen used in cm^3 per g per hour
Masked	2.5	10.8
Wandering	4.5	8.6
Monterey	6.5	7.2
Sonoma	11.5	5.2
Short-tailed	20.0	4.0

How to develop skills for each AO

AO3:

- Do LOTS of practical work – you do not need to restrict students to the core practicals. A significant proportion of marks is about practical skills and understanding – it needs teaching as much as factual content.
- Start early: students can begin to plan practicals from a very early age and become familiar with key vocabulary such as accurate, variable, repeatability.
- There is no such thing as bad data. Even if experiments don't work, students can learn from it – 'discuss why the results didn't seem to show what was expected.'
- Put together class data to compare data. This means that students can identify anomalies, investigate ranges of results and discuss how reliable the results are.
- Don't assume that they have the maths skills from maths lessons!
- Even if you can't do a particular practical – students can still plan it or analyse data about it.

Planning practicals

When planning practicals, give lots of guidance for weaker or younger students.

"The independent variable is _____"
"Two variables I need to control are _____"
Give them the hypothesis as a gap fill.

"As the light intensity _____, the rate of oxygen production by the pond weed will _____"

"Circle any anomalous values"
"Two sources of error are _____"
"To make the investigation more reliable I need to _____"

Planning practicals

For stronger students and students who are familiar with planning, gradually reduce the scaffolding:

> "Plan an investigation into ___. Explain how you will ensure that the results are reliable and enable you to make a valid conclusion."

> "Evaluate your results and the strength of your conclusion."

If they have progressed through the years, by the time they reach International AS and A Level, they will understand how to plan, carry out and analyse.

Delegate exercise 3: What would this student need to focus on?

Test Grid

Question	Spec Ref	Max Mark	My Score	AO1	AO2	AO3
1ai	2.54	3	*3*	*3*		
1aii	2.54	2	*0*		*0*	
1b	2.57B	3	*2*			*2*
1ci	2.57B	1	*1*	*1*		
1cii	2.60	1	*1*	*1*		
1d	2.60	3	*1*		*1*	
1e	2.58B	6	*2*			*2*
Total		19	*10* / 19	*5* / 5	*1* / 5	*4* / 9

Pearson Edexcel

AO1: Seems fine – has learnt content well.

AO2: Only one mark out of five – application needs development.

AO3: Four out of nine – suggests some development of practical skills required.

Content – no clear weaker topic area although 2.58B could need development.

Test Grid

Question	Spec Ref	Max Mark	My Score	AO1	AO2	AO3
1ai	2.54	3	3	3		
1aii	2.54	2	0		0	
1b	2.57B	3	2			2
1ci	2.57B	1	1	1		
1cii	2.60	1	1	1		
1d	2.60	3	1		1	
1e	2.58B	6	2			2
Total		19	10 / 19	5 / 5	1 / 5	4 / 9

General strategies for all assessment objectives

- Get students to spot assessment objectives on past papers.
- Get students to write their own questions and mark schemes.

The Language of Assessment – Command Words

Command words – what they are and why they are important

- Every question should have a command word.
- It is an instruction to candidates, telling them what we want them to write.
- It is critical that candidates know what each command word means so that they can answer the question effectively.
- Many candidates do not fully understand what each command word means – describe and explain are often confused with each other.

Where do we find out about command words?

1. Specifications – all Pearson specifications give a glossary of command words.
2. Sample assessment material (SAMS) – these contain examples of all command words.
3. Past papers and mark schemes – these will show the command words; the mark schemes illustrate how answers should be written for each command word.

Are command words the same for all papers?

International GCSE:

All science specifications have a common glossary.

International AS and A Level:

All science specifications have a common glossary. Many command words are the same as, or very similar to, International GCSE command words.

Command words in International GCSE, AS and A Level

Most command words are the same, or very similar between International GCSE and IAL.

The following are ONLY found in IAS and IAL:

- Assess
- Compare and contrast
- Criticise
- Derive
- Devise
- Write.

Cognitive demand of command words

Some command words have different cognitive demands:

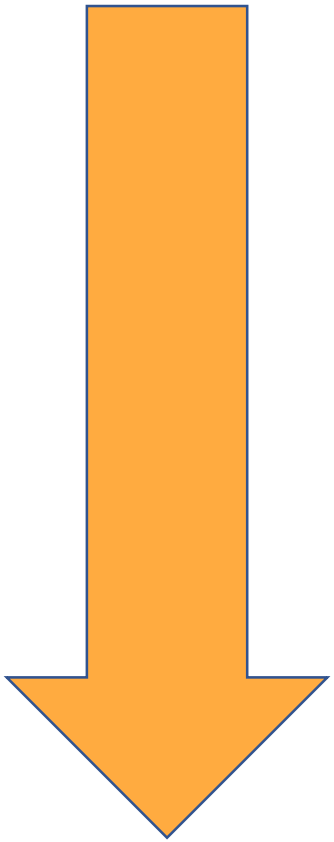
State

Describe

Compare and contrast

Explain

Assess/Evaluate/Discuss



Increasing demand

Pearson Edexcel

Familiarising students with command words

How do you teach candidates about command words?

- Give them a list of definitions.
- Practise past papers with mark schemes.
- Underline command words.
- Get them to mark exemplar answers.
- Get them to write their own questions and mark schemes.

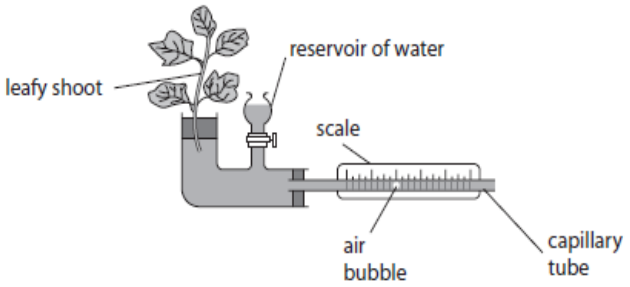
Describe and explain

- Describe and explain are often confused by candidates.
- Describe requires a descriptive account.
- Explain requires some level of reasoning or justification.
- Explain answers should be:
  'It is this **BECAUSE OF** this....'

What would the difference between describe and explain be for this question?

4 A student investigates the effect of wind on the rate of transpiration of a leafy shoot using a potometer.

The diagram shows her apparatus.



(b) The table shows the student's results.

Experiment	Rate of transpiration in mm per minute	
	still air	wind
1	0	3
2	1	4
3	1	3

Explain the difference in the rate of transpiration in wind and in still air.

(2)

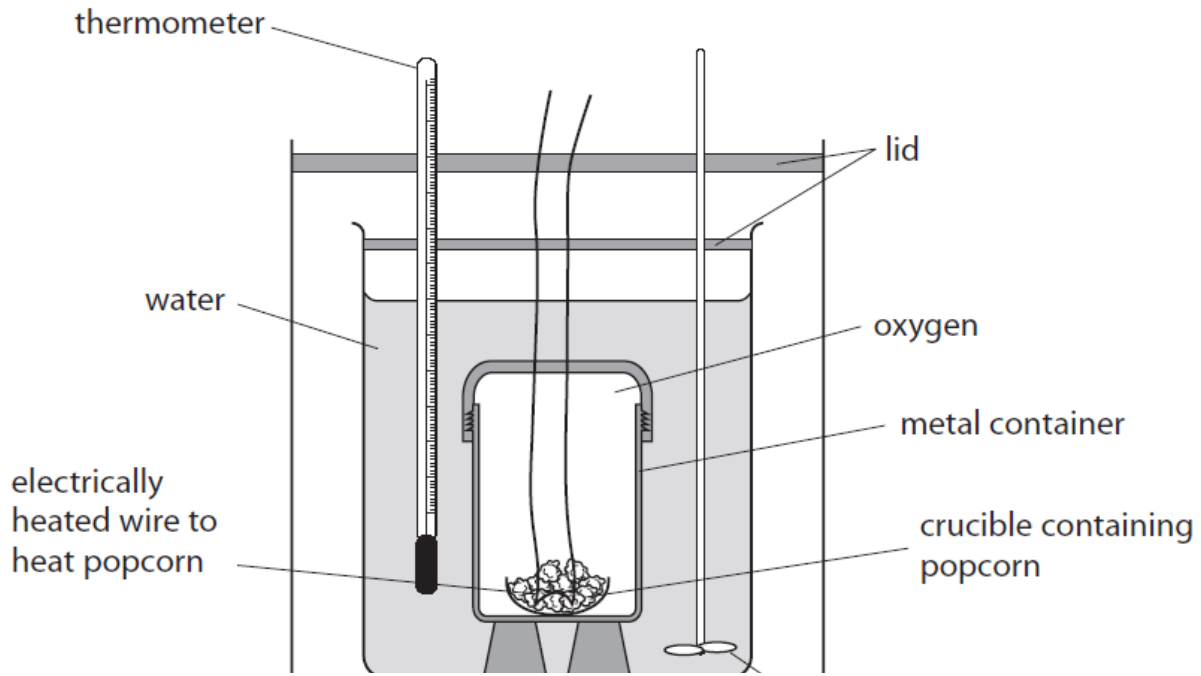
Justify

'Give evidence to support (either the statement given in the question or an earlier answer).'

Often used with practical questions.

(b) The result the student calculates for the energy content of the popcorn was much lower than the value given on the popcorn packet.

His teacher suggests that if he repeats his investigation using this calorimeter his result will be more accurate.



Justify how using this calorimeter will produce a more accurate result.

(6)

Mark scheme

An answer that makes reference to six of the following points:

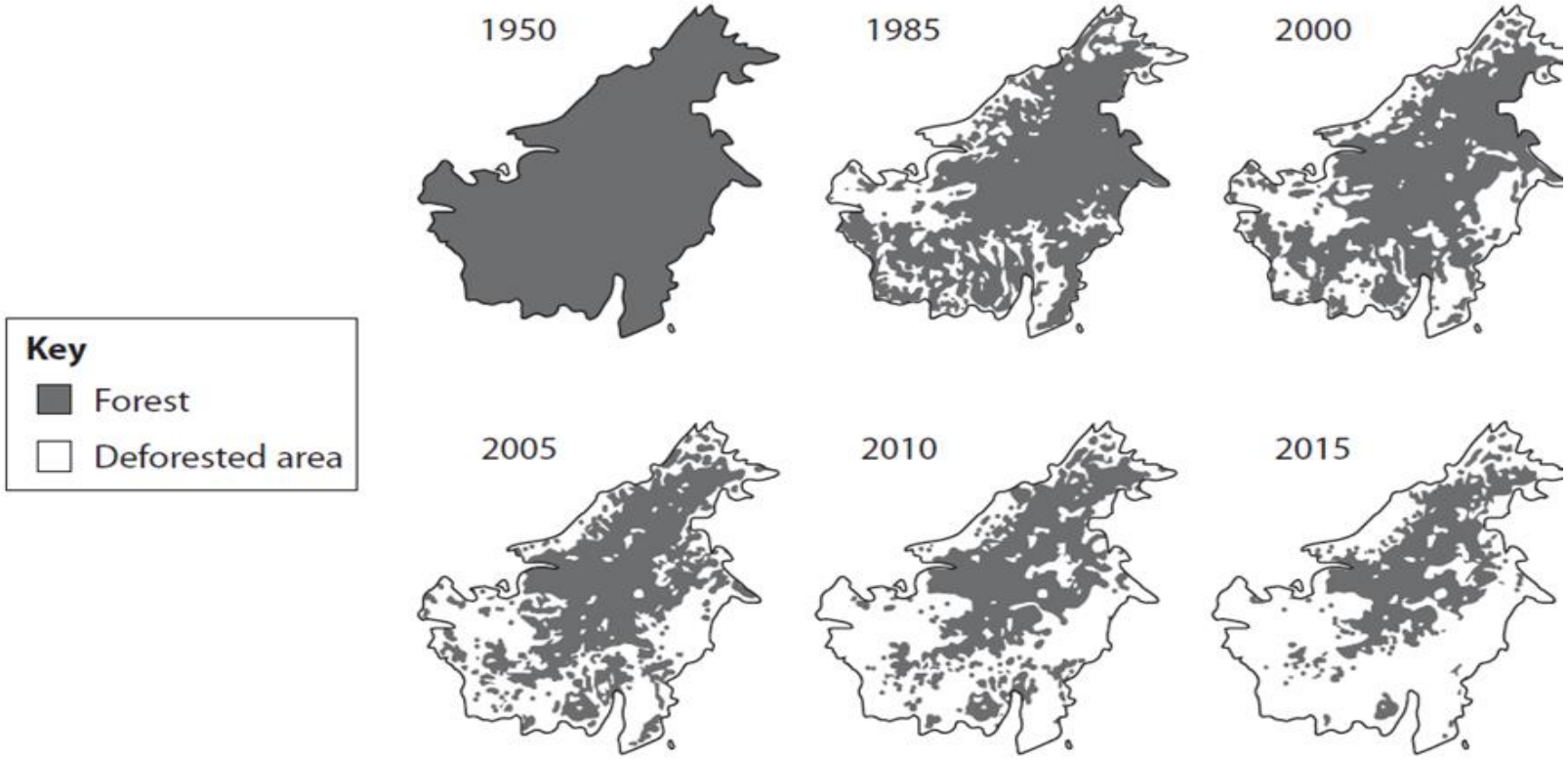
- lid reduces heat loss/provides insulation (1)
- use of oxygen means complete combustion (1)
- using wire means no energy loss in transfer (1)
- surrounding with water means more energy transferred to water (1)
- use of stirrer means even temperature of water (1)
- use of air means less heat loss/provides insulation (1)
- metal container allows heat transfer to water (1)
- thermometer has a precise scale (1)

Discuss

- *'Identify the issue/situation/problem/argument that is being assessed within the question.*
- *Explore all aspects of an issue/situation/problem/argument.*
- *Investigate the issue/situation etc. by reasoning or argument.'*

3 Borneo is an island in Asia that used to be covered by rainforest.

The diagram shows the loss of this rainforest by deforestation since 1950.



(a) A conservationist states that all deforestation should be stopped.

Discuss this statement.

(6)

Mark scheme

The mark scheme shows that all aspects of the question are discussed.

3(a)	An answer that makes reference to six of the following points: Three from: • wood for building construction (1) • wood for manufacture of paper / furniture (1) • road construction (1) • farming crops / cattle (1) • grow other crops to produce useful products (1) • economic benefit (1) Three from: • global warming / greenhouse effect (1) • loss of trees increases carbon dioxide (1) • cattle release methane (1) • soil erosion (1) • flooding (1) • loss of species / extinction (1)	**6**

Pearson Edexcel

Evaluate

'Review information (e.g. data, methods) then bring it together to form a conclusion, drawing on evidence including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement of a subject's quality and relate it to its context.'

Evaluate

The scientists concluded that letrozole is a safe and effective treatment for male infertility.

Factors measured	Group 1 (letrozole)		Group 2 (no treatment)	
	Start	After 6 months	Start	After 6 months
Sperm concentration/number per cm^3	450	1.4×10^6	475	450
Percentage of moving sperm	2	18	2	2
Blood testosterone level/arbitrary units	249	1198	266	266
Blood oestrogen level/arbitrary units	44	0	44	48
Number of men with side effects	0	8	0	0

Mark scheme

Question number	Answer	Additional guidance	Mark
8	An evaluation that makes reference to the following points: • letrozole does improve male fertility (1) • sperm concentration increases/sperm motility increases (1) • letrozole increases testosterone levels/ decreases oestrogen levels (1) • letrozole causes side effects/equivalent (1) • need to know group size (1) • matched groups (1) • need to know other factors controlled (1)	e.g. age, diet, smoking, drugs	**6**

Assess

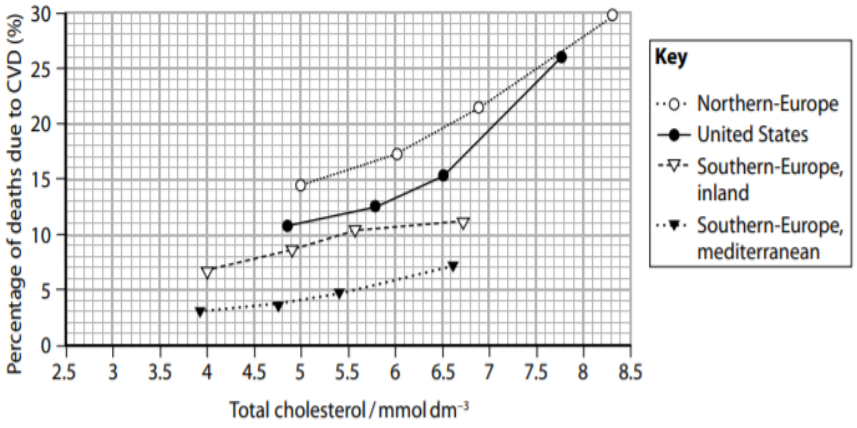
'Give careful consideration to all the factors or events that apply and identify which are the most important or relevant. Make a judgement on the importance of something, and come to a conclusion where needed.'

Assess

*(c) Cholesterol is transported in the blood as lipoproteins LDL and HDL.

In one study, the relationship between total blood cholesterol and the risk of death from CVD was investigated.

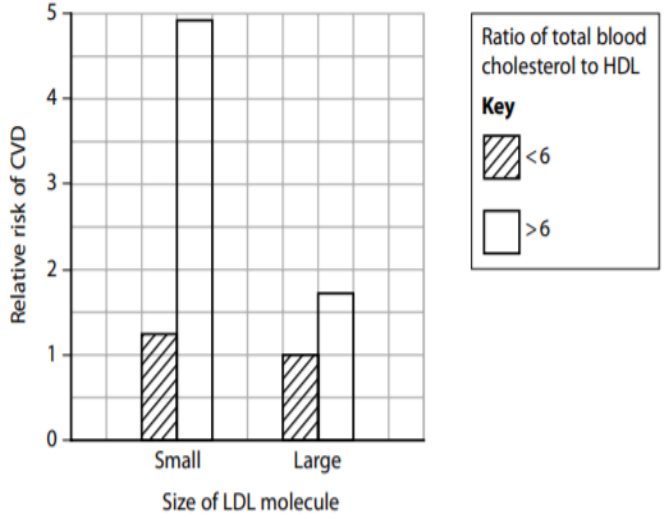
The results are shown in the graph.



Graph 1

In another study, the effect of the size of LDL and the ratio of total blood cholesterol to HDL on the relative risk of CVD was investigated.

The results are shown in the graph.



Graph 2

Pearson Edexcel

Mark scheme

A generic mark scheme is given that shows what is required to attain each level.

Level	Marks	Descriptor
	0	No awardable content.
1	1-2	A scientific assessment is made of a factor, supported by the application of limited relevant evidence from the scientific information provided. No conclusion is attempted.
2	3-4	A scientific assessment is made of some of the factors, supported by the application of some relevant evidence from the analysis and with some interpretation of the scientific information. A conclusion, where needed, is made, demonstrating linkages to elements of biological knowledge and understanding, with some evidence to support the assessment being made.
3	5-6	A scientific assessment is made of the factors, supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion, where needed, is made, demonstrating sustained linkages to biological knowledge and understanding, with sufficient evidence to support the assessment being made.

Mark scheme

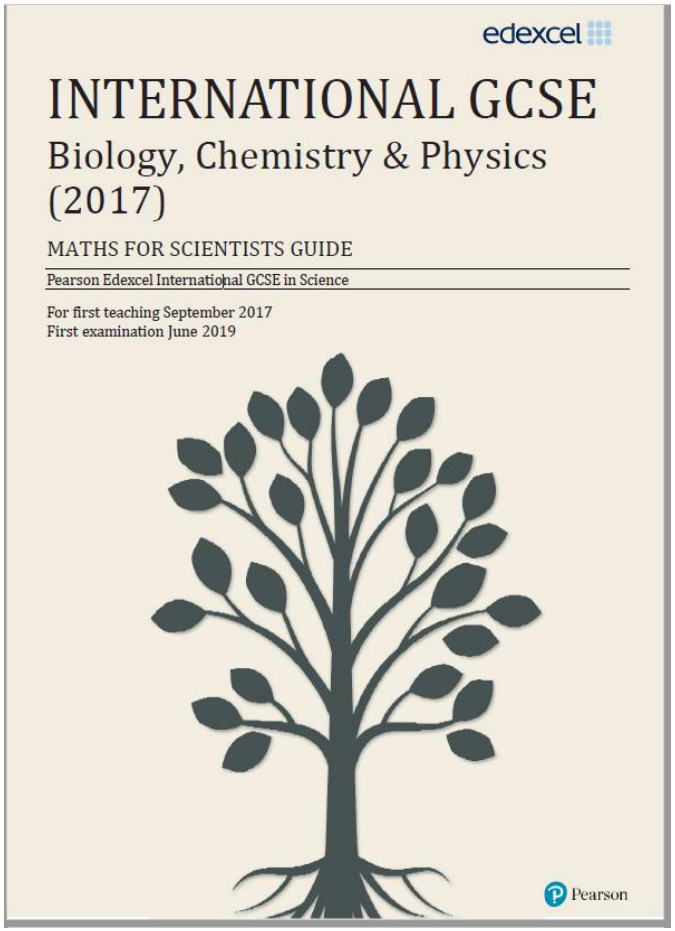
This is an example of a ‘6 mark’ level-based mark scheme.

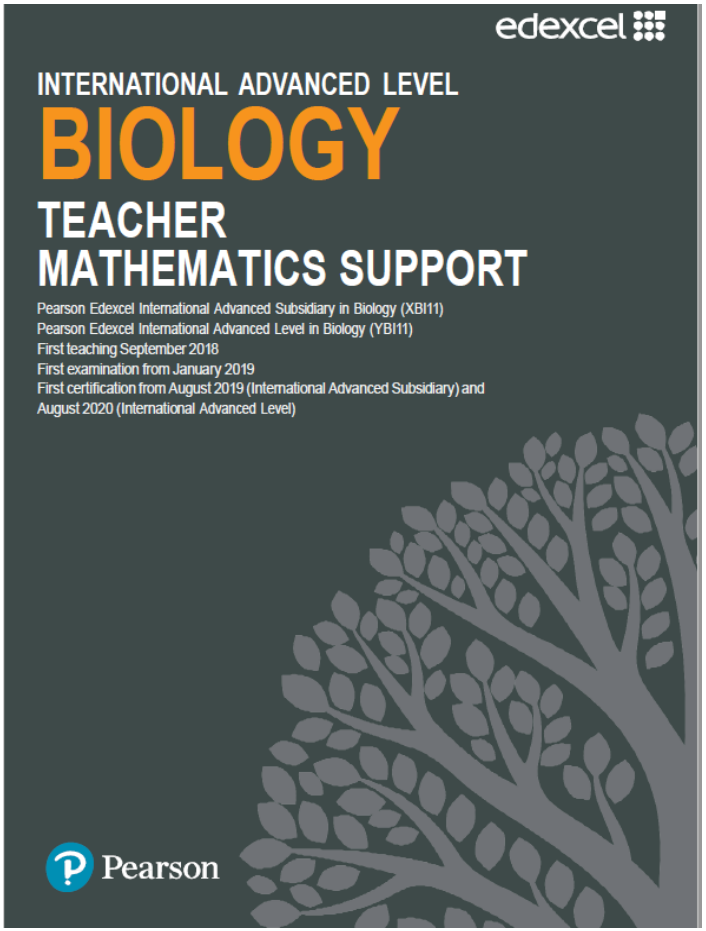
Indicative content is given – these are correct statements that candidates may give but candidates may give additional relevant comments and are not required to give every statement in the indicative content.

Question number	Answer	Additional guidance	Mark
8(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** • increased cholesterol increases chance of dying from CVD • cholesterol concentrations are different in different countries • same cholesterol level does not confer same risk in different countries • greater the cholesterol to HDL ratio, the greater the risk of CVD • the smaller the diameter the LDL, the greater the risk of CVD • individuals at greatest risk of CVD are those with a large cholesterol to HDL ratio and small LDL diameter and a high cholesterol concentration • not possible to say if different risks for a particular cholesterol concentration in the first study are due to differences in cholesterol to HDL ratio / diameter of LDL	Allow differences in the first study may be due to differences in cholesterol to HDL ratio / diameter of LDL	(6)

Cone of Learning

After 2 weeks we tend to remember		Nature of Involvement
90% of what we say and do	Doing the Real Thing	Active
	Simulating the Real Experience	
	Doing a Dramatic Presentation	
70% of what we say	Giving a Talk	
	Participating in a Discussion	
50% of what we hear and see	Seeing it Done on Location	Passive
	Watching a Demonstration	
	Looking at an Exhibit Watching a Demonstration	
	Watching a Movie	
30% of what we see	Looking at Pictures	
20% of what we hear	Hearing Words	
10% of what we read	Reading	





Pearson
Edexcel

Mathematical skills

- The development and use of relevant mathematical skills is key to progress in science subjects.
- A list of mathematical skills which should be developed appears in the Appendix for each specification.
- These skills will be tested in exam papers within the context of the science
- Assessment of mathematical skills will account for 10% of marks in Biology.

		B
1	**Arithmetic and numerical computation**	
A	Recognise and use numbers in decimal form	✓
B	Recognise and use numbers in standard form	✓
C	Use ratios, fractions, percentages, powers and roots	✓
D	Make estimates of the results of simple calculations, without using a calculator	✓
E	Use calculators to handle sin x and $\sin^{-1} x$, where x is expressed in degrees	
2	**Handling data**	
A	Use an appropriate number of significant figures	✓
B	Understand and find the arithmetic mean (average)	✓
C	Construct and interpret bar charts	✓
D	Construct and interpret frequency tables, diagrams and histograms	✓
E	Understand the principles of sampling as applied to scientific data	✓
F	Understand simple probability	✓
G	Understand the terms mode and median	✓
H	Use a scatter diagram to identify a pattern or trend between two variables	✓
I	Make order of magnitude calculations	✓
3	**Algebra**	
A	Understand and use the symbols <, >, ∝, ~	
B	Change the subject of an equation	✓
C	Substitute numerical values into algebraic equations using appropriate units for physical quantities	✓
D	Solve simple algebraic equations	✓
4	**Graphs**	
A	Translate information between graphical and numerical form	✓
B	Understand that $y = mx + c$ represents a linear relationship	
C	Plot two variables (discrete and continuous) from experimental or other data	✓
D	Determine the slope and intercept of a linear graph	✓
E	Understand, draw and use the slope of a tangent to a curve as a measure of rate of change	
F	Understand the physical significance of area between a curve and the x-axis, and measure it by counting squares as appropriate	

		B
5	**Geometry and trigonometry**	
A	Use angular measures in degrees	
B	Visualise and represent 2D and 3D objects, including two dimensional representations of 3D objects	
C	Calculate areas of triangles and rectangles, surface areas and volumes of cubes	✓

Core practicals & general practical skills

Core practicals

- All courses have a series of core practicals that candidates should complete.
- Candidates may be tested on their knowledge of these practicals.
- Questions about modified versions of the core practicals can be set.
- Core practical methods may be used in other contexts, e.g. indicator solutions, iodine test for starch.

Practical skills and understanding of the scientific method

- Students should be familiar with typical school laboratory equipment at the appropriate levels.
- Students should understand how to plan experiments that will generate valid data.
- Students should understand how to analyse and evaluate the quality of data at an appropriate level.

International AS & A Level core practicals

1. Use a semi-quantitative method with Benedict's reagent to estimate the concentrations of reducing sugars and with iodine solution to estimate the concentrations of starch, using colour standards.
2. Investigate the vitamin C content of food and drink.
3. Investigate membrane properties including the effect of alcohol and temperature on membrane permeability.
4. Investigate the effect of temperature, pH, enzyme concentration and substrate concentration on the initial rate of enzyme-catalysed reactions.
5. (i) use a light microscope to make observations and labelled drawings of suitable animal cells (ii) use a graticule with a microscope to make measurements and understand the concept of scale
6. Prepare and stain a root tip squash to observe the stages of mitosis.
7. Use a light microscope to: (i) make observations, draw and label plan diagrams of transverse sections of roots, stems and leaves (ii) make observations, draw and label cells of plant tissues (iii) identify sclerenchyma fibres, phloem, sieve tubes and xylem vessels and their location. None
8. Determine the tensile strength of plant fibres.
9. Investigate the antimicrobial properties of plants, including aseptic techniques for the safe handling of bacteria

International AS & A Level core practicals

10. Investigate the effects of light intensity, light wavelength, temperature and availability of carbon dioxide on the rate of photosynthesis using a suitable aquatic plant.
11. Carry out a study on the ecology of a habitat, such as using quadrats and transects to determine the distribution and abundance of organisms, and measuring abiotic factors appropriate to the habitat.
12. Investigate the effects of temperature on the development of organism (such as seedling growth rate, brine shrimp hatch rates)
13. Investigate the rate of growth of microorganisms in a liquid culture, taking into account the safe and ethical use of organisms.
14. Investigate the effect of different antibiotics on bacteria
15. Use an artificial hydrogen carrier (redox indicator) to investigate respiration in yeast.
16. Use a simple respirometer to determine the rate of respiration and RQ of a suitable material (such as germinating seeds or small invertebrates).
17. Investigate the effects of exercise on tidal volume, breathing rate, respiratory minute ventilation and oxygen consumption using data from spirometer traces.
18. Investigate the production of amylase in germinating cereal grains.

Using core practicals to develop general practical skills

- Core practicals are a useful opportunity to practise general practical skills.
- They can enable students to develop planning skills, analytical skills and evaluation of practical techniques.
- Some skills can be assessed on the papers in a different context, for example:
    - the use of bicarbonate indicator
    - the use of colorimeters
    - using soda lime to remove carbon dioxide
    - using a method to ensure random placements of quadrats.

Experimental skills and assessment objective 3 (AO3)

- General practical skills and understanding of the 'scientific method' are also assessed on the exam papers.
- This area is covered by **assessment objective 3 (AO3)**.
- At GCSE: 'Experimental skills, analysis and evaluation of data and methods in biology.'
- At AS and A Level: 'Experimental skills in science, including analysis and evaluation of data and methods.'

Summary of practical assessment areas

There are three broad areas of practical assessment:

- Planning experimental work
- Implementation of experimental work
- Analysis and evaluation of data and methods.

Planning skills

- Students are expected to be able to plan investigations that will produce valid data, at both International GCSE level and International AS and A Level.
- The basic ideas behind a valid plan are similar at all levels.
- Identification of independent, dependent and control variables.
- Use of repeat readings.
- International AS and A Level planning requires more detail, explanation and precision than GCSE.

International GCSE planning

At International GCSE Level, use CORMS to get students to plan practicals.

Change (control)	=	+ and - **or** a range of values (1) Independent variable
Organism (biotic)	=	same species / size / age / sex / eq (1) Controlled variable
Repeat	=	more than one reading / eq (1)
Measure (1)	=	mass / length - something that can be measured, not 'amount' over a **stated** time period e.g. one hour (1) Dependent variable
Same (2)	=	two controlled abiotic variables e.g. temp./LI/water (abiotic) etc Controlled variable

Pearson Edexcel

International AS and A Level planning

At AS and A Level, more detail is required for planning. This could include:

- **Independent variable:** identify, give a number of values, range of values and possible method for making them, e.g. dilutions.
- **Dependent variable:** identify, give a detailed method for collecting data and any precautions that must be made to ensure accuracy and precision.
- **Equipment:** identify appropriate equipment and at A Level, explain equipment accuracy e.g. 50 cm^3 measuring cylinder to measure volumes of liquid.
- **Control variables:** identify, give methods for how they are controlled.
- **Safety and ethics**: assess any risks, give precautions, state how any living organisms should be treated ethically.
- **Errors:** List potential errors and uncertainty when using equipment.
- **Analysis:** Explain how data will be used, e.g. graphs plotted, how to calculate rates, means. At A Level, may have to give a null hypothesis and suggest stats tests.

Implementing practicals

Difficult to assess on paper!

International GCSE:

- Drawing appropriate results tables
- Stating appropriate (basic) equipment that could be used
- Describing what the results of experimental tests such as starch and sugar tests
- Basic health and safety.

International AS and A Level:

- Drawing appropriate results tables
- Drawing biological diagrams – pencil, no shading, no broken lines etc.
- Selecting equipment that could be used, how it is set up and precautions that should be made, e.g. setting up a potometer or respirometer
- Suggesting alternative methods that could generate more accurate data or explaining how a method should be modified
- Calculations to correct number of significant figures (to least accurate apparatus)
- Comment on numbers of repeats, appropriateness of ranges etc.
- At A Level, identify or correct the units
- Health and safety.

Analysis and evaluation of data and methods

International GCSE:

- Processing data: Explain, discuss and evaluate data from experiments
- Analysis of quantitative and qualitative data. Graph plotting. Recognising trends. Calculations (rates, means, percentages)
- Evaluating data strength: Use trend lines, identify and account for outliers/ anomalies. Assess reliability (repeats) and validity (controls)
- Evaluating method: Does the apparatus generate accurate data? (close to true values) Suggesting improvements and justifying them.

International AS and A Level:

- Processing data: Calculations. Appropriate graph plotting – students to determine the correct graph to plot, e.g. bar chart or line of best fit. Explain, discuss and evaluate data to draw conclusions. Analysis of quantitative and qualitative. Data is more complex than GCSE
- Evaluating data strength: Use trend lines, identify correlations and account for outliers / anomalies. Understand standard deviations. Assess reproducibility/ repeatability and validity. At A Level, statistical analysis may be assessed
- Evaluating methods: Determining error and uncertainty. Suggesting improvements to methods and justify them.

How is practical work assessed in science qualifications?

International GCSEs

- No separate practical assessments
- No separate written practical exam
- No coursework or teacher assessment
- Practical skills are assessed on the exam papers as part of AO3
- Core practicals – it is expected candidates will have experience of these.

International AS and A Level

- Unit 3 and Unit 6 assess practical skills
- No coursework or teacher assessment
- Core practicals – it is expected candidates will have experienced every one of them.

Pearson Edexcel

Key vocabulary – delegate exercise 4

- There is a lot of practical specific vocabulary!
- Give definitions for the following terms:

	Term
1	Accurate
2	Controlled Variable
3	Dependent Variable
4	Independent variable
5	Precision
6	Random error (AS and AL)
7	Systematic error (AS and AL)
8	Reliable (GCSE)
9	Valid
10	Uncertainty (AS and AL)
11	Reproducible (AS and AL)
12	Repeatable (AS and AL)
13	True value

	Definition
A	A measure of the closeness of repeated measurements.
B	A measure of the range of values within which the true value lies.
C	A value that is close to the true value
D	An error that arises due to inconsistency in the experiment. Often causes anomalies.
E	An error that is repeated when each measurement is taken, for example if a balance always reads 0.1 g above the true value.
F	An investigation where all variables have been controlled and the results are reliable.
G	Factors that would affect the experiment and so need to be maintained constant
H	Results that have been repeated and show similar patterns
I	Similar results from different methods and / or equipment.
J	Similar results from the same method.
K	The value that would be obtained under ideal conditions.
L	The variable that is under investigation and is changed by the experimenter
M	Variable that is measured as a result of changing another

Term	Definition
Accurate	A value that is close to the true value
Controlled Variable	Factors that would affect the experiment and so need to be maintained constant
Dependent Variable	Variable that is measured as a result of changing another
Independent variable	The variable that is under investigation and is changed by the experimenter
Precision	A measure of the closeness of repeated measurements.
Random error (AS and AL)	An error that arises due to inconsistency in the experiment. Often causes anomalies.
Systematic error (AS and AL)	An error that is repeated when each measurement is taken, for example if a balance always reads 0.1 g above the true value.
Reliable (GCSE)	Results that have been repeated and show similar patterns
Valid	An investigation where all variables have been controlled and the results are reliable.
Uncertainty (AS and AL)	A measure of the range of values within which the true value lies.
Reproducible (AS and AL)	Similar results from the same method.
Repeatable (AS and AL)	Similar results from different methods and / or equipment.
True value	The value that would be obtained under ideal conditions.

Developing student understanding of experimental work

- Practise practical planning and experimental analysis from a young age.
- Introduce CORMS from a young age – scaffold it to help, e.g. you should include in your answer…
- Credit precise language.
- Think up one planning exercise per topic – quick, easy homework task.
- Evaluate class data and always consider accuracy of methods.
- Scaffold 'conclusions' at first, e.g. 'describe the results your graph shows, then explain the trend using the words…'
- Encourage confident independent exploration by letting students 'have a go.'
- Practice, practice, practice…

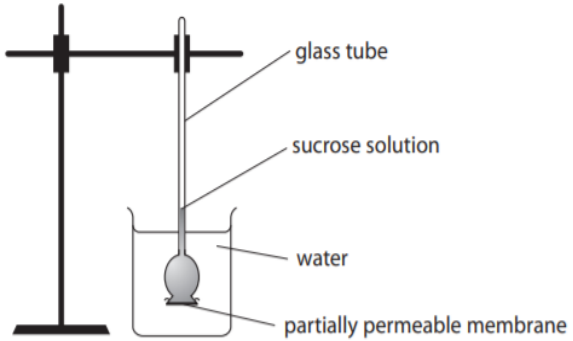
How are core practicals assessed?

This is an example of a core practical from:

- 2.17Investigate diffusion and **osmosis** using living and **non-living systems**

It also tests general practical skills in part (b).

4 This apparatus can be used to show osmosis.



(a) Explain what happens to the level of the sucrose solution in the glass tube.

(3)

(b) Describe how this apparatus could be modified to measure the rate of osmosis at different temperatures.

(3)

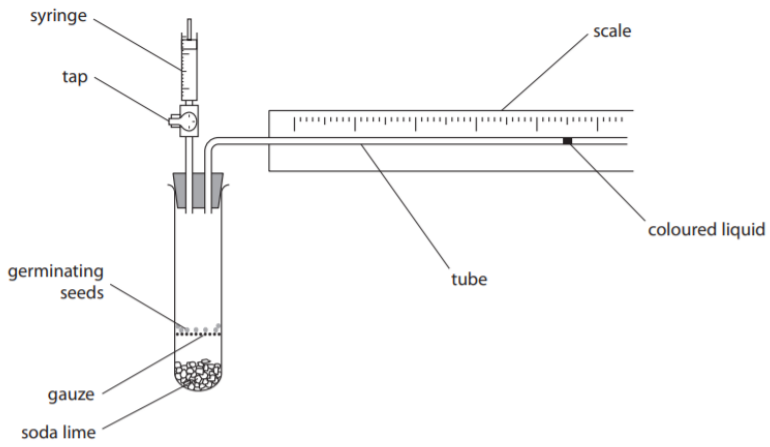
Pearson Edexcel

This has aspects of two core practicals in an unfamiliar context:

- 2.23 Investigate photosynthesis, showing the evolution of oxygen from a water plant, the production of starch and the requirements of light, carbon dioxide and chlorophyll.
- 2.39 Investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms.

(b) A student investigates the oxygen absorbed by germinating seeds at different temperatures.

The diagram shows some of the student's apparatus.



(i) Suggest why the student opens the tap after obtaining one set of results.

(2)

(ii) What is the function of the soda lime?

(1)

- A it absorbs carbon dioxide
- B it absorbs oxygen
- C it releases carbon dioxide
- D it releases oxygen

Resources

We offer a range of free and paid for resources for **International A Level in Biology**. They have been designed to support teachers to improve learner outcomes.

Pearson
Edexcel

Support Overview for both International GCSE and IAL

Free Support

Getting Started Guide & Scheme of Work	Getting Ready to Teach Events	Subject interpretation of transferable skills
Subject Advisor	**ResultsPlus**	Regional Support Manager

Additional support for selected subjects

Curriculum Matched Publishing	Lesson plans	Exemplar Marked Responses
Topic booklets & Subject guides	Additional SAMs	**examWizard**

Pearson Edexcel

Resources

Textbooks from various publishers are available to support the International GCSE course.

A textbook is also available to support the IAL course.

Pearson published resources

Edexcel International Advanced Level Biology Student Book and ActiveBook 2
Publisher: Pearson
Author: Ann Fullick
Book and CD
ISBN: 9781292244846

£28.99

VIEW SAMPLE PAGES AND ORDER

Edexcel International Advanced Level Biology Student Book and ActiveBook 1
Publisher: Pearson
Author: Ann Fullick
Book and CD
ISBN: 9781292244709

£28.99

VIEW SAMPLE PAGES AND ORDER

Pearson
Edexcel

ResultsPlus

ResultsPlus is the free online results analysis tool for teachers - it provides analysis features that other similar solutions don't.

- Provides a detailed breakdown of student performance in Edexcel exams.
- Helps identify topics where the student can benefit from further learning and allows this knowledge to inform teaching strategies and approaches.
- Provides a comparison of student performance at regional level.
- Allows you to view your school's performance against other Pearson Edexcel schools in your country. You can also find student results analysis from their previous Pearson Edexcel school.
- Mock exams results can also be fed into the system to produce an analysis.
- **ResultsPlus Direct** gives your students access to their final grades and performance breakdown, wherever they are.
- Sign up for a free ResultsPlus account in just a few quick and easy steps **here**.
- Access additional video guides here:

ResultsPlus - Individual Student Analysis
ResultsPlus - Cohort Analysis
ResultsPlus - Mock Analysis
ResultsPlus - Global Analysis

Pearson Edexcel

examWizard

- A free tool for teachers which helps you make quick homework assignments, topic tests and mock exams.
- Questions tagged against unit, topic and assessment objective or simply choose a whole past paper.
- Use existing mark schemes for accurate marking.
- Use examiner report for insight.
- Most recent exam content available sooner.
- Use the results to understand where students need more support, informing teaching strategies.

Pearson Edexcel

New Access to Script (ATS) Online Portal

Access to Scripts (ATS) is a free online portal which allows teachers to immediately access electronically marked exam papers.

Provides enhanced transparency and

- offers transparent approach to marking process
- provides better understanding of marking before requests for enquiries about results are made
- provides excellent aid for teaching and preparing other cohorts for examinations by helping you to evaluate a student's performance on particular questions in relation to what they have been taught.

Available instantly from results day for all our examination series, for a defined window, you can view and download scripts which have been marked online free of charge from our Self-Service Portal.

For more information on ATS, and the post results windows, visit our post-results pages.

Pearson Edexcel

Pearson International Schools Community

Connect with international teachers around the world

- Connect with other teachers working in international schools and join groups who have shared interests, subjects or location
- Read topical news and articles and share yours
- Advertise jobs at your school or find job opportunities
- Download free resources
- Sign up for events.

Sign up today at:

pearson.com/internationalschools/blog

Pearson
Edexcel

Your dedicated Subject Advisor

Your Science Subject Advisor is Irine Muhiuddin
Email: TeachingScience@pearson.com
Phone: **+44 (0)344 463 2934**
Twitter: **@PearsonSciences**

Science community – Join the community for a place to chat, share resources and ideas, ask questions and start your own discussions.

Pearson
Edexcel

Useful websites

https://www.pearsonschoolsandfecolleges.co.uk/secondary/Science/16Biology/SaltersNuffieldASandAlevelBiologySNAB/Salters-NuffieldAdvancedBiologySNAB.aspx

https://www.nuffieldfoundation.org/practical-biology

https://www.field-studies-council.org/pubs/maths-skills-for-biologists.aspx

Other useful links

1 Grade boundaries

This page shows the minimum marks needed to achieve a certain grade for all UK and international examinations. Also refer to the examiners' report which is available for download with other documents.

2 Examination results statistics

Results statistics summarise the overall grade outcomes of candidates sitting Pearson Edexcel examinations.

3 Progress to university

Here you can find information and guidance about how to progress to universities worldwide with Pearson Edexcel qualifications.

4 Access to Scripts

Make an informed enquiry about results (EARs) using our free access to scripts portal.

Any questions?

Pearson
Edexcel

Please fill in your evaluation forms.

We value your feedback!

ALWAYS LEARNING