Pearson Edexcel

International GCSE Science

Understanding Assessment and Improving Delivery in International GCSE Biology

4BI1-25IF1

Pearson Edexcel

Aims and objectives

- Introduce the two different types of assessment routes
- Introduce the concept of assessment objectives: what are they and why they are used when writing examination papers
- Analyse recent question papers and learn which types of questions match the different assessment objectives
- Investigate different assessment objectives, considering how questions have been answered by looking at feedback from the previous exam series
- Discuss strategies for teaching to help students access questions targeting different assessment objectives
- Review the support Pearson offers for teaching the qualification
- Network, discuss best practice and share ideas with other teachers

Agenda

- Welcome
- Specification Design and key documentation
- The assessment
- The content
- Question styles
- Command Words
- Assessment Objectives
- AO1
- AO2
- AO3
- Support

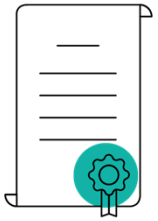
Welcome to Pearson

Welcome to Pearson Edexcel

- We are the world's leading learning company and as the **UK's largest awarding organisation**, best placed to provide qualifications aligned to the British educational system.
- Our international **heritage stretches back over 150 years**.
- Today, we partner with schools, universities and employers worldwide, offering world-class, globally-recognised qualifications to over **3.5 million students a year**.

Pearson Edexcel

Trusted and recognized qualifications partner to **6,500** schools, colleges and employers globally



We mark over **10 million** exam scripts on behalf of the UK Department for Education each year

We operate in **70 countries** worldwide

Specification Design and key documentation

The Specification

- The Specification contains all the key information required for teaching the course.
- It can be downloaded directly from the Pearson website.
- Many other useful materials can also be downloaded from the website.

What does the specification contain?

- Assessment model – mark allocations, topics, styles of questions on both papers
- Content – arranged by topics
- Assessment objectives – the skills that we test on the papers AND the proportions of marks allocated to each skill
- Taxonomy – all the command words used in questions
- Mathematical skills – the skills that may be tested in the exams
- Practical skills – the core practicals that students should do and the skills expected
- Transferable skills – other skills that can be taught through International GCSE Biology

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International GCSEs and Edexcel Certificates

Biology (2017)

Pearson | Edexcel

Specification | Course materials | Published resources | News

Specification

DOWNLOAD

PDF | 1.2 MB

First teaching: **September 2017**
First external assessment: **2019**

Our Pearson Edexcel International GCSE (9-1) Biology specification and support materials have been developed with the help of teachers, higher education representatives and subject expert groups.

The qualification supports progression to further study, with up-to-date content reflecting the latest thinking in the subject. It is comparable to the UK reformed GCSEs in terms of the level of demand and assessment standards.

Register your interest

Find out more about Pearson Edexcel International qualifications and sign up to receive the latest news.

Let us know

Course materials

- Specification and sample assessments (3)
- Exam materials (13)
- Teaching and learning materials (20)

The Assessment

The assessment model

This tells us how we assess candidates.

Key features:

- The choice of Linear or Modular examinations
- No separate practical exam – practical skills are assessed on the papers
- Papers have similar question styles but paper 2 has additional content
- No tiering of papers – both papers grade from 9–1

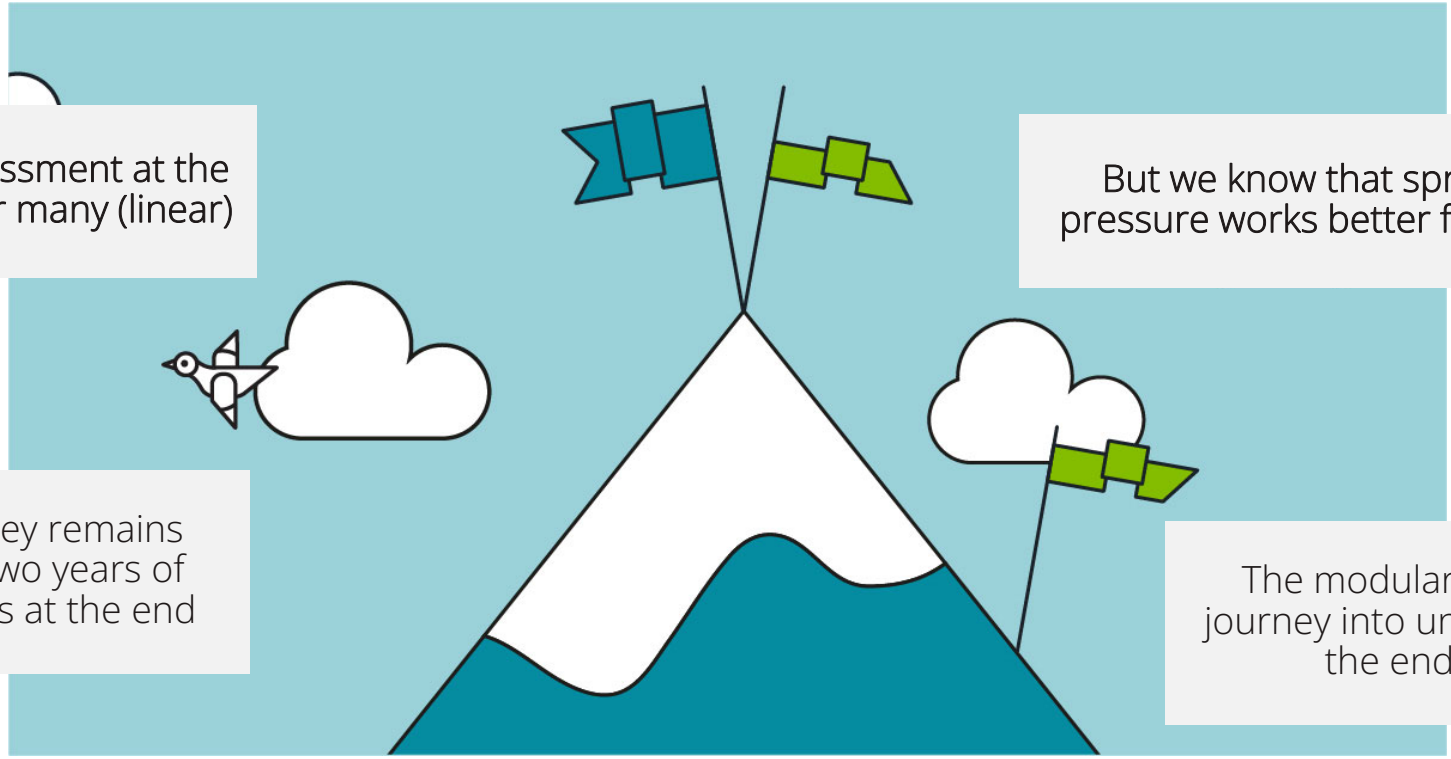
Modular Overview

Why a choice of linear or modular assessment?

The secret of International GCSE success is different for every student.

Doing all the assessment at the end works well for many (linear)

But we know that spreading the exam pressure works better for others (modular)



The linear journey remains exactly as it is, two years of study with exams at the end

The modular route breaks the journey into units, with an exam at the end of each unit

Whichever route you choose, the exams take the same amount of time, teachers spend the same amount of time teaching, and everyone has the best chance of success at international GCSE.

IG Science Modular Key Changes

Modular route

Unit assessments can be taken over multiple exam series (no tier)

Grades are calculated on raw marks which are then converted to a UMS (Uniform Mark Scale).

Students can re-sit individual units in any exam series.

Once a student has all their unit results, they can 'cash in' these results for their grade.

A modular route is only offered by Pearson Edexcel at International GCSE

Linear route

Assessments for all units are taken together in one exam series (no tier).

Grades are calculated on raw marks only.

Students can re-sit assessments for all units together in one exam series.

The grade students receive are calculated at the end of the exam series in which they sat their assessments.

Everything else remains the same, including content and level of demand in assessments

What's changed?

- Assessment

"understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms"		
	Linear	**Modular**
Topic number	2	3
Topic description	Structure and function in living organisms	Structure and function in living organism: Part 2
Sub-topic	h	h
Sub-topic description	Transport	Transport
Specification number	2.64B	3.14B

Biology: a closer look, Paper 1

The modular and linear approach contact the same content, but the modular approach breaks the journey into two units with an exam at the end of each unit.

Paper 1	
Linear	**Modular**
2-hour written examination.	1-hour-40-minute written examination.
The total number of marks is 110, 61.1% of the total International GCSE.	The total number of marks if 90, 50% of the total International GCSE.
Content summary Assesses core content that is **NOT** in bold and does not have a 'C' prefix. Questions may come from any topic area across the specification. **Topic 1. The nature and variety of living organisms** **Topic 2. Structures and functions in living organisms** **Topic 3. Reproduction and inheritance** **Topic 4. Ecology and the environment** **Topic 5. Use of biological resources**	Content summary **Topic 1: The nature and variety of living organisms** a. Characteristics of living organisms b. Variety of living organisms **Topic 2: Structures and functions in living organisms** a. Level or organisation b. Cell structure c. Biological molecules d. Movement of substances into and out of cells e. Nutrition f. Respiration g. Gas exchange

Biology: a closer look, Paper 2

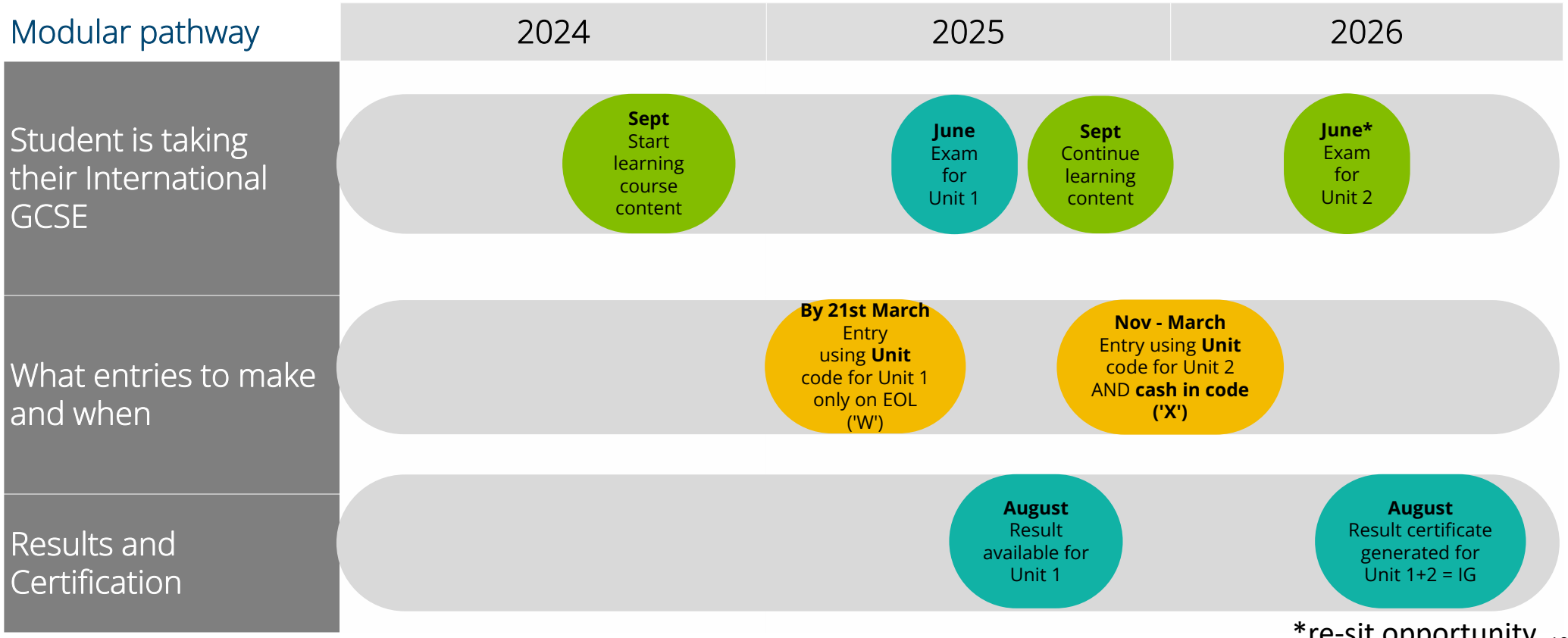
The modular and linear approach contact the same content, but the modular approach breaks the journey into two units with an exam at the end of each unit.

<table>
<tr><th colspan="3">Paper 2</th></tr>
<tr><th>Linear</th><th colspan="2">Modular</th></tr>
<tr><td>1-hour-15-minute written examination.</td><td colspan="2">1-hour-40-minute written examination.</td></tr>
<tr><td>The total number of marks is 70, 38.9% of the total International GCSE.</td><td colspan="2">The total number of marks if 90, 50% of the total International GCSE.</td></tr>
<tr><td>Content summary
Assesses all the content including content that is in bold and has a ‘C’ prefix.

Questions may come from any topic area across the specification. Bold statements cover some sub-topics in greater depth.</td><td>Content summary
Topic 1: Structures and functions in living organisms
h. Transport
i. Excretion
j. Co-ordination and response
Topic 2: Reproduction and inheritance
a. Reproduction
b. Inheritance</td><td>Topic 4: Ecology and the environment
a. The organism in the environment
b. Feeding relationships
c. Cycles within ecosystems
d. Human influences on the environment
Topic 5: Use of biological resource
a. Food production
b. Selective breeding
c. Genetic modifications (genetic engineering)
d. Cloning</td></tr>
</table>

Humans	
2.59	describe the composition of the blood: red blood cells, white blood cells, platelets and plasma
2.60	understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy
2.61	understand how adaptations of red blood cells make them suitable for the transport of oxygen, including shape, the absence of a nucleus and the presence of haemoglobin
2.62	understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen
2.63B	**understand how vaccination results in the manufacture of memory cells, which enable future antibody production to the pathogen to occur sooner, faster and in greater quantity**
2.64B	**understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms**
2.65	describe the structure of the heart and how it functions
2.66	explain how the heart rate changes during exercise and under the influence of adrenaline
2.67	understand how factors may increase the risk of developing coronary heart disease
2.68	understand how the structure of arteries, veins and capillaries relate to their function
2.69	understand the general structure of the circulation system, including the blood vessels to and from the heart and lungs, liver and kidneys

A student's IG Science modular journey



*re-sit opportunity

The benefits of a modular approach

Students

- ✓ Reduces students' **mental load** and **stress** by allowing them to focus on one year of curriculum at a time and spreads out their exams over 2 years.
- ✓ Provides more **opportunities** to demonstrate their skills and abilities and optimise feedback to improve their performance.
- ✓ Allows them to take exams when they're ready, like they do with other tests, and take advantage of multiple **re-sit** opportunities.

Educators & Parents

- ✓ Provides teachers with rich mid-cycle data on learner **performance** via post-exam analysis support tools such as Results Plus.
- ✓ **Eases the pressures** faced by exam officers as it allows international schools to spread the exam admin burden.
- ✓ Where parents pay exam fees, it helps with **budgeting** by enabling families to spread their child's exam fees over two years.

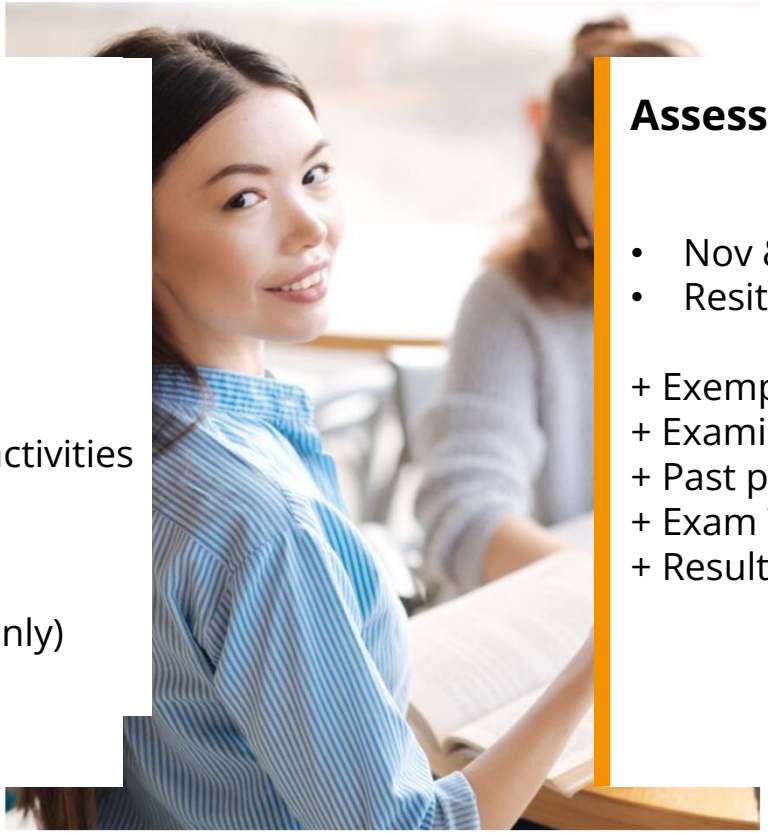
IG Biology Modular Overview

Teaching and Learning

120 GLH for Biology

- Specification
- Getting Started Guides
- Teacher Course planners
- Scheme of Work
- Lesson Plans suggested activities

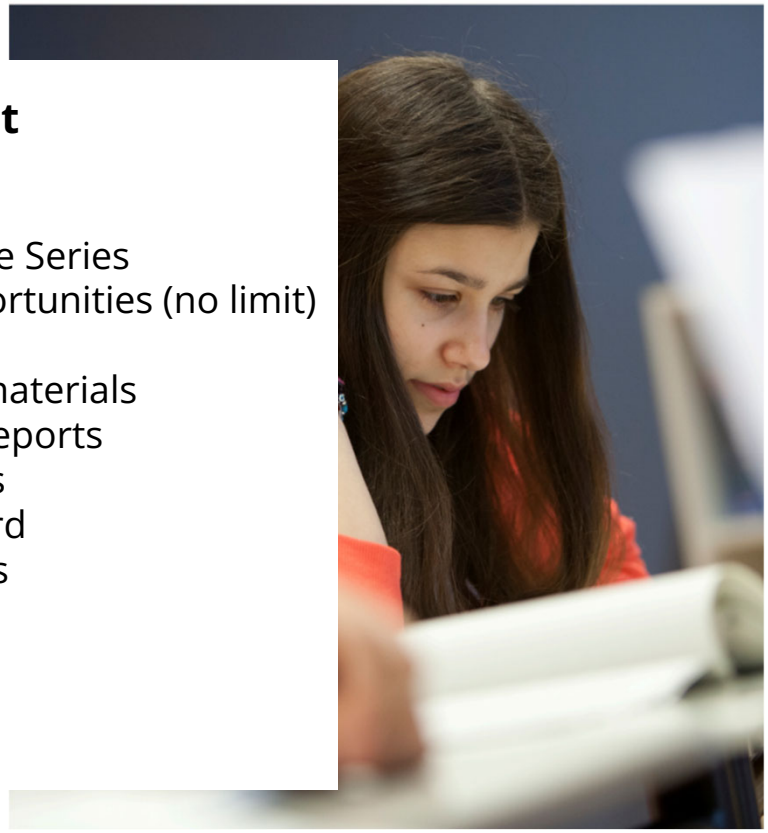
+ Student Books
+ Student lab books
+ Teaching Hubs (separate only)



Assessment

- Nov & June Series
- Resit opportunities (no limit)

+ Exemplar materials
+ Examiner reports
+ Past papers
+ Exam Wizard
+ Results Plus



A Question for you

How do you see the Modular assessment pathway supporting your students?

Three possible suggestions

- Students may find it easier to break down the content into two separate exam sessions
- The expectation is that Paper 1 will be taken at the end of the first year of teaching, allowing students to monitor their progress
- Resits of Paper 1 and 2 do not have to be taken in the same exam series

Teaching in a Modular Way

You may want to change the way you teach the International GCSE Biology Specification Content if you take the Modular route for assessment.

- To support your planning and teaching of the course, we are producing course planners, editable schemes of work and Getting Started Guide. These are available on the website to download.

- First teaching for International GCSE Biology (Modular) is September 2024
- First assessment of International GCSE Biology (Modular) is May/June 2025

Planning to teach modular International GCSE

Suggest 3 things that need to be taken into account when changing to a modular approach

Possible suggestions

- Although the total content is the same, topics have to be taught in a certain order
- Topics 1 and 2 are examined in Paper 1 of the modular route
- Topics 3 4 and 5 are examined in Paper 2
- Topics in bold are examined in Paper 1 and Paper 2

Re-sits for Modular International GCSE

- Learners can re-sit any unit irrespective of whether the qualification is to be cashed in.
- If a learner 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.
- Results of units will be held in Pearson Edexcel's unit bank for as many years as this specification remains available.
- Once International GCSE in Chemistry (Modular) has been certificated, all unit results are deemed to be used up at that level. These results cannot be used again towards a further award of the same qualification at the same level.

The Content

Supporting progression

Builds on prior knowledge from iP & iLS

Provides the foundational knowledge for IAS and IAL

7.3	know that the circulatory system comprises the heart and blood vessels that contain blood	iPrimary
6.2	know the main components of the circulatory system and their functions	iLower Secondary
IG	3.15 describe the structure of the heart and how it 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 are not needed at IAS.*	IAS
7.12	(i) know the myogenic nature of cardiac muscle (ii) understand how the normal electrical activity of the heart coordinates the heartbeat, including the roles of the sinoatrial node (SAN), the atrioventricular node (AVN), the bundle of His and the Purkyne fibres (iii) understand how the use of electrocardiograms (ECGs) can aid in the diagnosis of abnormal heart rhythms	IAL

Linear

Biology qualification content summary

There are five topic areas in the specification:

Nature and variety of living organisms

- Characteristics of living organisms
- Variety of living organisms

Structures and functions in living organisms

- Organisation
- Cell structure
- Bio molecules
- Movement in & out of cells
- Nutrition
- Respiration
- Gas exchange
- Transport
- Excretion
- Coordination & response

Reproduction and inheritance

- Reproduction
- Inheritance

Ecology and the environment

- Organisms in environment
- Feeding relationships
- Cycles within ecosystems
- Human influences on environment

Use of biological resources

- Food production
- Selective breeding
- Genetic modification
- Cloning

Topic 1: The nature and variety of living organisms

- Subdivided into two areas:
  - (a) Characteristics of living organisms
  - (b) Variety of living organisms
- Focus on classification of organisms
- Key features of living organisms and viruses are given
- Students often find Fungi and Protoctista difficult – key vocabulary is given. They should be familiar with key terms such as mycelium, hyphae, chitin, eukaryote and prokaryote, pathogen.
- Example organisms and viruses are given, e.g. Pneumococcus, HIV
- Only account for about 5% of marks over the papers.

Topic 2: Structure and functions in living organisms

- Large section of specification
- Biological molecules, cell biology and physiology of living organisms
- What many pupils think of as being biology
- Both animals and plants are considered

Topic 3: Reproduction and inheritance

- Two sub-topics:
  - (a) Reproduction
  - (b) Inheritance
- Plant and animal reproduction are both considered
- Inheritance covers both classical genetics and molecular genetics (DNA structure, transcription, translation, mutations), natural selection and mutation.

Topic 4: Ecology and the environment

- Four sub-topics:
  (a) The organism in the environment
  (b) Feeding relationships
  (c) Cycles within ecosystems
  (d) Human influences on the environment
- Many students find nitrogen cycle challenging
- Water vapour, carbon dioxide, nitrous oxide, methane and CFCs are listed as greenhouse gases.

Topic 5: Use of biological resources

- Four sub-topics:
  (a) Food production
  (b) Selective breeding
  (c) Genetic modification (genetic engineering)
  (d) Cloning
- This topic has several different themes
- Lots of detail in terms of methods of cloning, use of fermenters and genetic engineering

Modular

How is the Biology content split?

Unit 1 (Unit 1 for Double Award)	Unit 2 (Unit 2 for Double Award)
1. The nature and variety of living organisms a. Characteristics of living organisms b. Variety of living organisms 2. Structure and function of living organisms: Part 1 a. Level of organization b. Cell structure c. Biological molecules d. Movement of substances into and out of cells e. Nutrition f. Respiration g. Gas exchange	3. Structure and functions in living organisms: Part 2 h. Transport i. Excretion j. Co-ordination and response 4. Reproduction and inheritance a. Reproduction b. Inheritance 5. Ecology and the environment a. The organism in the environment b. Feeding relationships c. Cycles within ecosystems d. Human influences on the environment 6. Use of biological resources a. Food production b. Selective breeding c. Genetic modification (genetic engineering) d. Cloning*

* = separate biology content only

Teaching considerations & supporting student progress

- Same considerations that you would have with a linear course e.g. sequencing, threshold concepts, development of disciplinary and substantive knowledge, interleaving etc.
- June & November series - First assessment June 2025
- Multiple combinations of papers e.g.

Example 1	Example 2	Example 3
• Unit 1 end of Y10 (June) • Unit 2 end of Y11 (June)	• Unit 1 Y10 (June) • Unit 1 re-sit Y11 (Nov) • Unit 2 end of Y11 (June)	• Unit 1 & Unit 2 Y11 (Nov) • Unit 2 re-sit Y11 (June)

Schemes of Work

Biology Scheme of work

- Pearson publish an editable scheme of work
- It has an order which is the same as the specification
- The topics can be taught in any order, and this will depend on individual circumstances
- It has suggested activities for all topics.
- The order and timings will depend if the course is taught over one, two or three years.

Modular

3	**Topic 2: Structures and functions in living organisms: Part 1** *a) Levels of organisation* *b) Cell structure* **Lesson title:** Cell differentiation and stem cells	**Students will be able to:** 2.1 describe the levels of organisation in organisms: organelles, cells, tissues, organs and systems. **2.5B explain the importance of cell differentiation in the development of specialised cells** **2.6B understand the advantages and disadvantages of using stem cells in Medicine.**	Activities: • Match different levels of organisation to the correct system. • Class debate on the ethics of stem cell use. • Make an information leaflet for a doctor's surgery informing patients on the uses of stem cells. Demonstrations: • Model of human body to explore different systems and the organs in them.	Pearson Edexcel International GCSE (9–1) Biology Student Book**: pp. 18–21** Pearson Edexcel International GCSE (9-1) Biology Teaching Hub / Term 1 / Lesson 6: Cell differentiation and stem cells	Personal and social responsibility Adaptability Problem solving Reasoning Interpretation Adaptive learning Adaptability Creativity	Personal and social responsibility Adaptability Intellectual interest and curiosity Perseverance Communication Collaboration Teamwork Ethics Cooperation Interpersonal skills Leadership Responsibility Assertive communication

Linear

Week	Content coverage	Learning outcomes	Exemplar activities	Exemplar resources	Which transferable skills are explicitly assessed through examination	Which transferable skills could also be acquired through teaching and delivery
4	**Section 2: Structures and functions in living organisms** a) Levels of organisation b) Cell structure	Students will be assessed on their ability to: **2.5B explain the importance of cell differentiation in the development of specialised cells** **2.6B understand the advantages and disadvantages of using stem cells in Medicine.**	**Activities:** • View abpi poster of stem cells. • Carry out interactive web exercise on stem cells (http://www.abpischools.org.uk/page/resource/age.cfm). • Class debate on the ethics of stem cell use. • Make an information leaflet for a doctor's surgery informing patients on the uses of stem cells.	**Websites:** • Association of the British Pharmaceutical Industry (ABPI) website provides posters, information and interactive exercises on stems cells (http://www.abpischools.org.uk/page/about.cfm) **Video clips:** • BBC DVD about stem cells and uses in medicine – Fix Me – Horizon	Personal and social responsibility Adaptability Problem solving Reasoning Interpretation Adaptive learning Adaptability Creativity	Personal and social responsibility Adaptability Intellectual interest and curiosity Perseverance Communication Collaboration Teamwork Ethics Cooperation Interpersonal skills Leadership Responsibility Assertive communication Self- presentation
5	**Section 2: Structures and functions in living organisms** **c)** Biological molecules	Students will be assessed on their ability to: **2.7** identify the chemical elements present in carbohydrates, proteins and lipids (fats and oils) **2.8** describe the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units: starch and glycogen from simple sugar; protein from amino acids; lipid from fatty	**Activities:** • View models of the biological molecules to ascertain common elements. • Make paper models of large molecules from simple basic units. • Build a Carbohydrate interactive game. **Animation:** • Virtual laboratory – starch test	Edexcel International GCSE Biology Student Book: Pages 37–43 Experiment 6 – Student Book: Page 43 and pdf on ActiveBook Page 42 Edexcel International GCSE Biology Revision Guide: Page 15	Critical thinking Problem solving Analysis Reasoning Interpretation Decision making Adaptive learning Creativity Innovation Adaptability	Intellectual interest and curiosity Reasoning Interpretation Decision making Adaptive learning Initiative Self-direction Self regulation (metacognition, forethought, reflection) Communication Collaboration

Activity 1-1: What order should we teach the topics in?

- Suggest **three topics** that you think should be covered at the **start of the course, for both linear and modular**.
- Suggest **two topics** that you think should be taught at the **end of the course, for both linear and modular**.
- Suggest **one topic** that is '**synoptic**' – this means that it links to many other areas of the specification, for both linear and modular.

- Discuss **why** you made these suggestions.

There is no one correct order of teaching topics!

- You can change the order to suit schools / classes / teaching styles.
- Seasonal availability for example, plants for practicals
- ‘Underpinning topics’ need covering early – cells, transport across membranes, enzymes
- Some topics are often found to be more difficult – transcription / translation and so may be better placed at the end of the course BUT there can be a risk that they are then rushed
- Some topics require knowledge from other areas of the course – gas exchange requires a knowledge of diffusion
- Use topics to revisit themes – helps pupil understanding and ‘deepen learning.’
- Some topics draw everything together (synoptic)– fish farming involves pollution, respiration, digestion, nitrogen cycle, energy flow…

Activity 1-2: What other areas of the specification link to these topics?

Linear

Humans	
2.46	describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes
2.47	understand the role of the intercostal muscles and the diaphragm in ventilation
2.48	explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries
2.49	understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease
2.50	*practical: investigate breathing in humans, including the release of carbon dioxide and the effect of exercise*

Modular

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2.50	*practical: investigate breathing in humans, including the release of carbon dioxide and the effect of exercise*

Activity 1-2: ‘alveoli adaptations’ and breathing / ventilation, require this knowledge

Linear

(d)	Movement of substances into and out of cells
Students should:	
2.15	understand the processes of diffusion, osmosis and active transport by which substances move into and out of cells
2.16	understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient
2.17	*practical: investigate diffusion and osmosis using living and non-living systems*

(f)	Respiration
Students should:	
2.34	understand how the process of respiration produces ATP in living organisms
2.35	know that ATP provides energy for cells
2.36	describe the differences between aerobic and anaerobic respiration
2.37	know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms
2.38	know the word equation for anaerobic respiration in plants and in animals
2.39	*practical: investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms*

Modular

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Learners should:	
2.15	understand the processes of diffusion, osmosis and active transport by which substances move into and out of cells
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1-2 There are links to these spec points

Linear

(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
2.67	understand how factors may increase the risk of developing coronary heart disease

(g) Gas exchange	
Students should:	
Flowering plants	
2.40B	**understand the role of diffusion in gas exchange**
2.41B	**understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis**
2.42B	**understand how the structure of the leaf is adapted for gas exchange**
2.43B	**describe the role of stomata in gas exchange**
2.44B	**understand how respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light**
2.45B	***practical: investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator***

Modular

(h) Transport	
Learners should:	
3.1	understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell
3.2	understand the need for a transport system in multicellular organisms

(g) Gas exchange	
Learners should:	
Flowering plants	
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2.45B	*practical: investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator*

How can we help students with content?

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

Example of a topic checklist with emoji

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)			

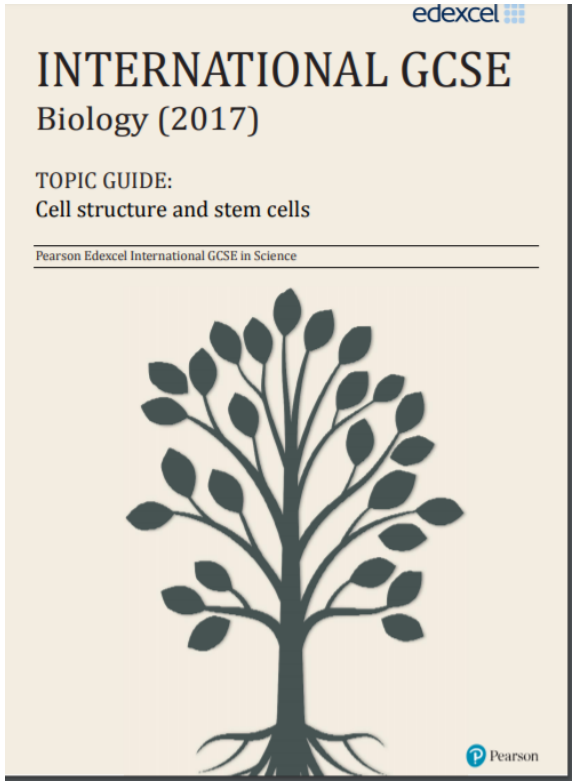
Test grids can be used after tests / exams

- 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 can also be shown to help students self-identify where they lost marks

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

Guide booklets (download)



LINK

[Edexcel International GCSE Biology (2017) | Pearson qualifications]

Topic support

PDF Topic Guide: Cell structure and stem cells
| PDF 738.5 KB | 21 June 2018

PDF Topic Guide: Genetic modification and cloning
| PDF 515.7 KB | 30 April 2018

PDF Topic Guide: Protein synthesis - transcription and translation
| PDF 618.4 KB | 30 April 2018

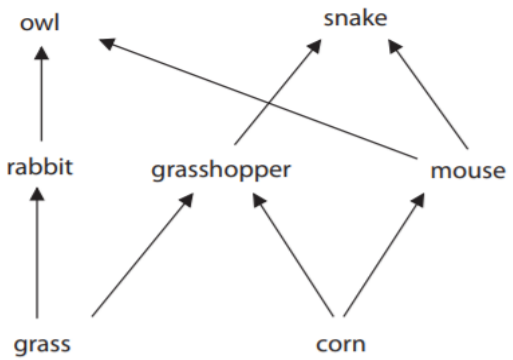
Question Styles

Question Styles

- Multiple choice – can be AO1, AO2 or A03
- Short answer – one, two or three marks. Typically describe, suggest, explain
- Longer answer/mini-essay – can be four, five or six marks. May be describe, explain, evaluate, discuss or plan.
- Maths questions – calculations/graph plotting
- Experimental planning – CORMS questions
- Comprehension – ‘sets’ the scene for synoptic questions

Multiple Choice Questions

1 The diagram shows a food web.



(a) Which of these organisms is a secondary consumer in this food web?

(1)

☒ **A** corn

☒ **B** grasshopper

☒ **C** mouse

☒ **D** owl

(ii) Which of these organisms will be hunted more often by predators when the corn is infected by a fungus?

(1)

☒ **A** grass

☒ **B** owl

☒ **C** rabbit

☒ **D** snake

Short answer questions

(ii) Describe the role of enzymes in genetic modification.

(2)

Longer Answer Questions / Mini-Essays

- Mark Schemes are 'points – based' not level based.
- Candidates should look at the mark allocations rather than number of lines.
- Candidates should focus on precise, accurate language.
- Bullet points are acceptable.
- Spelling – phonetic unless a word can be mistaken for another word. For example, fotosynthesis is okay, but meitosis is not okay.

(c) If the mineral ions are not absorbed, they are egested in the faeces.

The faeces of genetically modified (GM) farm animals contain less phosphate than the faeces of normal farm animals.

(i) Some people catch fish from rivers near farm land.

Discuss why these people might support the genetic modification of farm animals.

(4)

Activity 2-1: Making a mark scheme and marking candidate answers

- Make a points-based mark scheme for this question.
- Suggest five marking points – they should be clear, not overlap and be easy to apply correctly by many markers.

10 A balanced diet should include the correct proportions of each component.

(a) Two of these components are vitamins and minerals.

Describe the functions of the **other** components of a balanced diet.

(5)

Activity 2-1: Now mark the two answers (A and B) provided, using this MS.

Question Number	Answer	Additional guidance	Mark
10(a)	A description that makes reference to the following points: • carbohydrate for energy / respiration (1) • lipid / fat for energy / storage / insulation / myelin / hormones / protecting organs (1) • protein for growth / repair / (named) enzyme / hormones / antibodies / neurotransmitter (1) • water as solvent / transport / reactions / temperature regulation / prevent constipation / help egestion (1) • fibre / roughage for peristalsis / move food / prevent constipation / help egestion (1)	Allow correct named hormone for Mp2 and Mp3 Mp3 Ignore skin / nails / hair / bones Ignore prevents cancer	**5**

Activity 2-1: How many marks?

A:

Humans need carbohydrates, proteins, water and fibre. They also need plenty of lipids for energy. Iron is important for haemoglobin and vitamin A helps vision. Vitamin C is also important for stopping scurvy and vitamin D and calcium are needed to stop rickets.

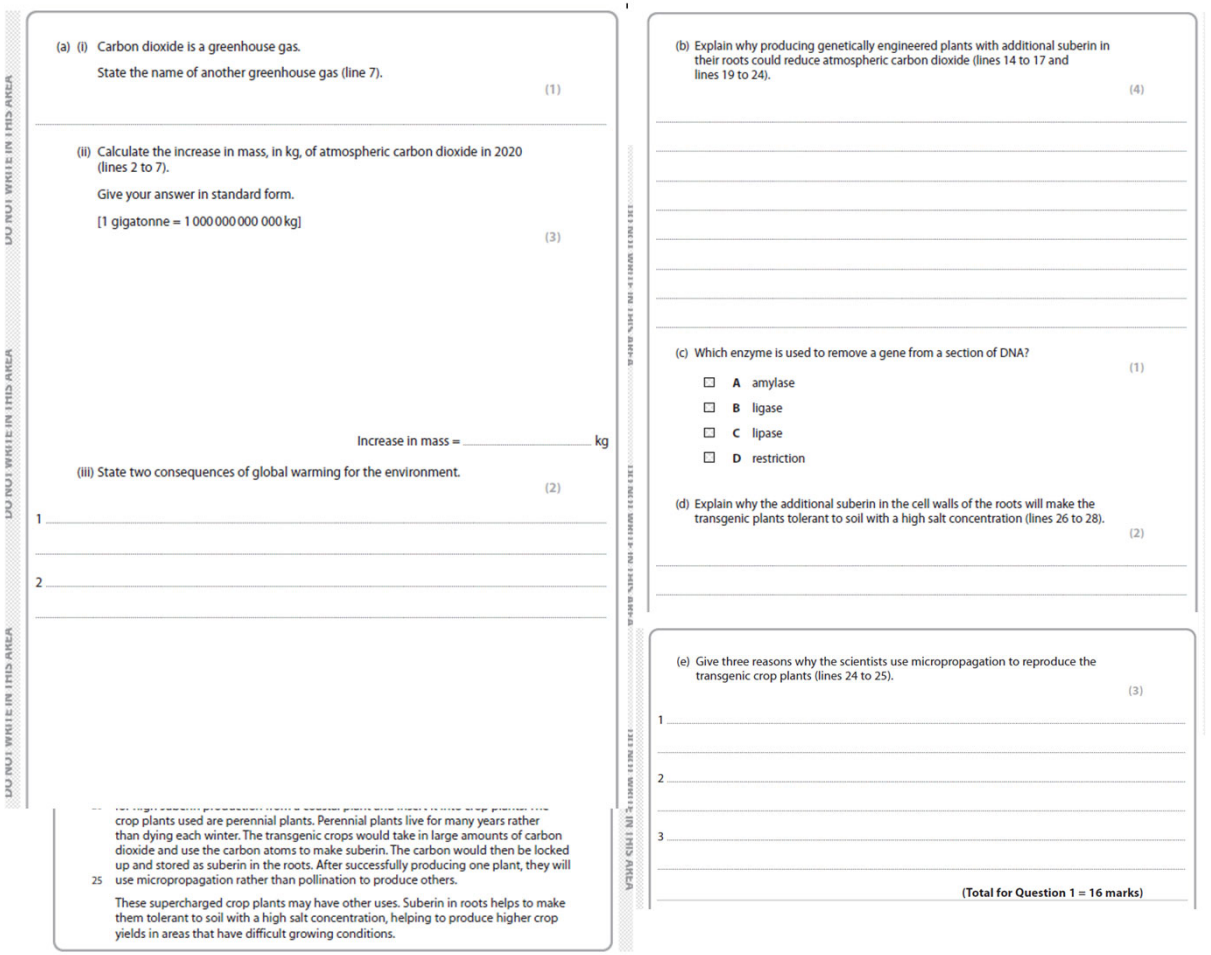
B:

Starch and fats are important for energy. Too much sugar though will cause obesity. Proteins and amino acids are used for growth and repair of tissues. Fresh fruit and vegetables are important for peristalsis of the gut (they prevent constipation.)

(June 2022) Comprehension Question

This is often stimulus material to ‘set the scene’.

Questions may be synoptic and draw from several areas of the specification.



(a) (i) Carbon dioxide is a greenhouse gas.

State the name of another greenhouse gas (line 7).

(1)

(ii) Calculate the increase in mass, in kg, of atmospheric carbon dioxide in 2020 (lines 2 to 7).

Give your answer in standard form.

[1 gigatonne = 1 000 000 000 000 kg]

(3)

Increase in mass = ... kg

(iii) State two consequences of global warming for the environment.

(2)

1 .....

2 .....

crop plants used are perennial plants. Perennial plants live for many years rather than dying each winter. The transgenic crops would take in large amounts of carbon dioxide and use the carbon atoms to make suberin. The carbon would then be locked up and stored as suberin in the roots. After successfully producing one plant, they will use micropropagation rather than pollination to produce others.

These supercharged crop plants may have other uses. Suberin in roots helps to make them tolerant to soil with a high salt concentration, helping to produce higher crop yields in areas that have difficult growing conditions.

(b) Explain why producing genetically engineered plants with additional suberin in their roots could reduce atmospheric carbon dioxide (lines 14 to 17 and lines 19 to 24).

(4)

(c) Which enzyme is used to remove a gene from a section of DNA?

(1)

- ☐ **A** amylase
- ☐ **B** ligase
- ☐ **C** lipase
- ☐ **D** restriction

(d) Explain why the additional suberin in the cell walls of the roots will make the transgenic plants tolerant to soil with a high salt concentration (lines 26 to 28).

(2)

(e) Give three reasons why the scientists use micropropagation to reproduce the transgenic crop plants (lines 24 to 25).

(3)

1 .....

2 .....

3 .....

(Total for Question 1 = 16 marks)

Taxonomy (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.
- All our qualifications in International GCSE sciences now use a common taxonomy for command words.
- These can be found in Appendix 5 at the back of the specification.
- Students can expect a range of command words across the demand range of the exam paper.

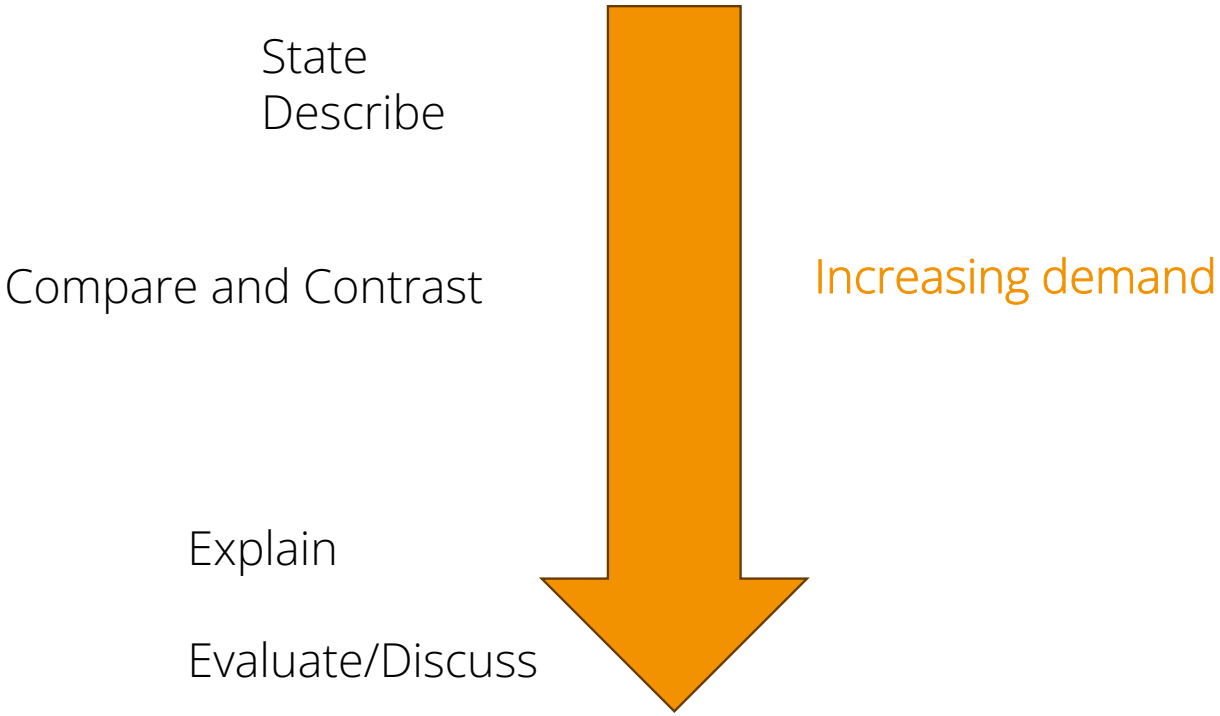
Appendix 5: Command word taxonomy

The following table lists the command words used in the external assessments.

Command word	Definition
Add/Label	Requires the addition or labelling of a stimulus material given in the question, for example labelling a diagram or adding units to a table.
Calculate	Obtain a numerical answer, showing relevant working.
Comment on	Requires the synthesis of a number of variables from data/information to form a judgement.
Complete	Requires the completion of a table/diagram.
Deduce	Draw/reach conclusion(s) from the information provided.
Describe	To give an account of something. Statements in the response need to be developed, as they are often linked but **do not** need to include a justification or reason.
Determine	The answer must have an element that is quantitative from the stimulus provided, or must show how the answer can be reached quantitatively. To gain maximum marks, there must be a quantitative element to the answer.
Design	Plan or invent a procedure from existing principles/ideas.
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.
Draw	Produce a diagram either using a ruler or freehand.
Estimate	Find an approximate value, number or quantity from a diagram/given data or through a calculation.
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.
Explain	An explanation requires a justification/exemplification of a point. The answer must contain some element of reasoning/justification – this can include mathematical explanations.
Give/State/Name	All of these command words are really synonyms. They generally all require recall of one or more pieces of information.
Give a reason/reasons	When a statement has been made and the requirement is only to give the reason(s) why.
Identify	Usually requires some key information to be selected from a given stimulus/resource.
Justify	Give evidence to support (either the statement given in the question or an earlier answer).
Plot	Produce a graph by marking points accurately on a grid from data that is provided and then draw a line of best fit through these points. A suitable scale and appropriately labelled axes must be included if these are not provided in the question.
Predict	Give an expected result.
Show that	Verify the statement given in the question.
Sketch	Produce a freehand drawing. For a graph, this would need a line and labelled axes with important features indicated. The axes are not scaled.
State what is meant by	When the meaning of a term is expected but there are different ways for how these can be described.
Suggest	Use your knowledge to propose a solution to a problem in a novel context.
Verb preceding a command word	
Analyse the data/graph to explain	Examine the data/graph in detail to provide an explanation.
Multiple choice questions	
What, Why, Which	Direct command words used for multiple-choice questions.

Cognitive demand of command words

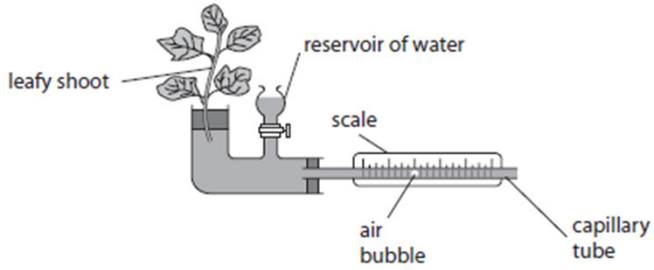
Some command words have different cognitive demands:



Command words -Describe and Explain

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)

Command word: Comment on

Note this is Paper 1 2b, -2a set context with question on gas exchange / fish gills

(b) Seawater is warmed if hot water from power stations is released into the sea.

A scientist investigates the effect of water temperature on the concentration of oxygen dissolved in water.

He also investigates the effect of water temperature on the oxygen used by a fish.

The table shows his results.

Water temperature in °C	Dissolved oxygen in arbitrary units	Oxygen used in cm^3 per hour
5	7.8	10
10	6.8	15
15	6.0	40
20	5.6	100
25	5.2	150
30	5.0	200
35	4.6	220

(i) The scientist concludes that hot water pollution affects the population of fish living near a power station.

Comment on this conclusion.

(5)

Mark scheme (2bi)

Question Number	Answer	Mark
2(b)(i)	An answer that makes reference to five of the following points: • reduce population (1) • increase in oxygen consumption / demand (1) • reduction in available oxygen (1) • respiration affected (1) • bacteria grow (1) • death of fish (1) • migration (1) • only one fish used so results not reliable (1)	**5**

Command word: Suggest

'Use your knowledge to propose a solution to a problem in a novel context.'

(ii) Suggest how woodlice benefit from the bacteria in their digestive system.

(2)

.....

.....

.....

.....

(iii) Suggest how the bacteria benefit from living in the gut of the woodlice.

(1)

.....

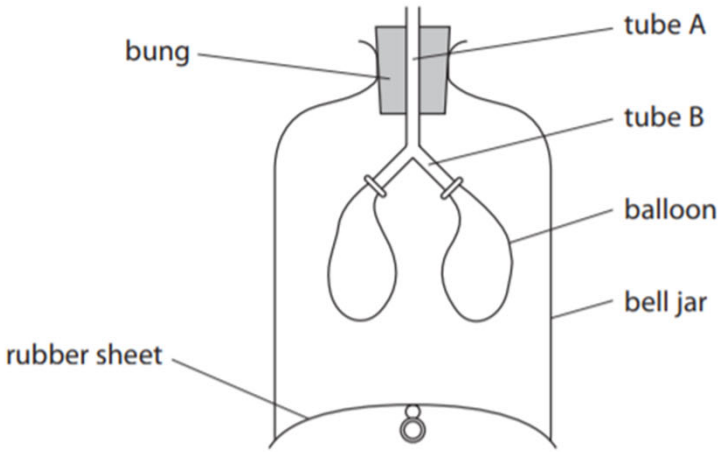
.....

Command word: 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.'

Paper 1 - 8a, asked about how the teacher would use the apparatus to demonstrate breathing

8 A teacher uses this bell jar model of the thorax to show the process of ventilation.



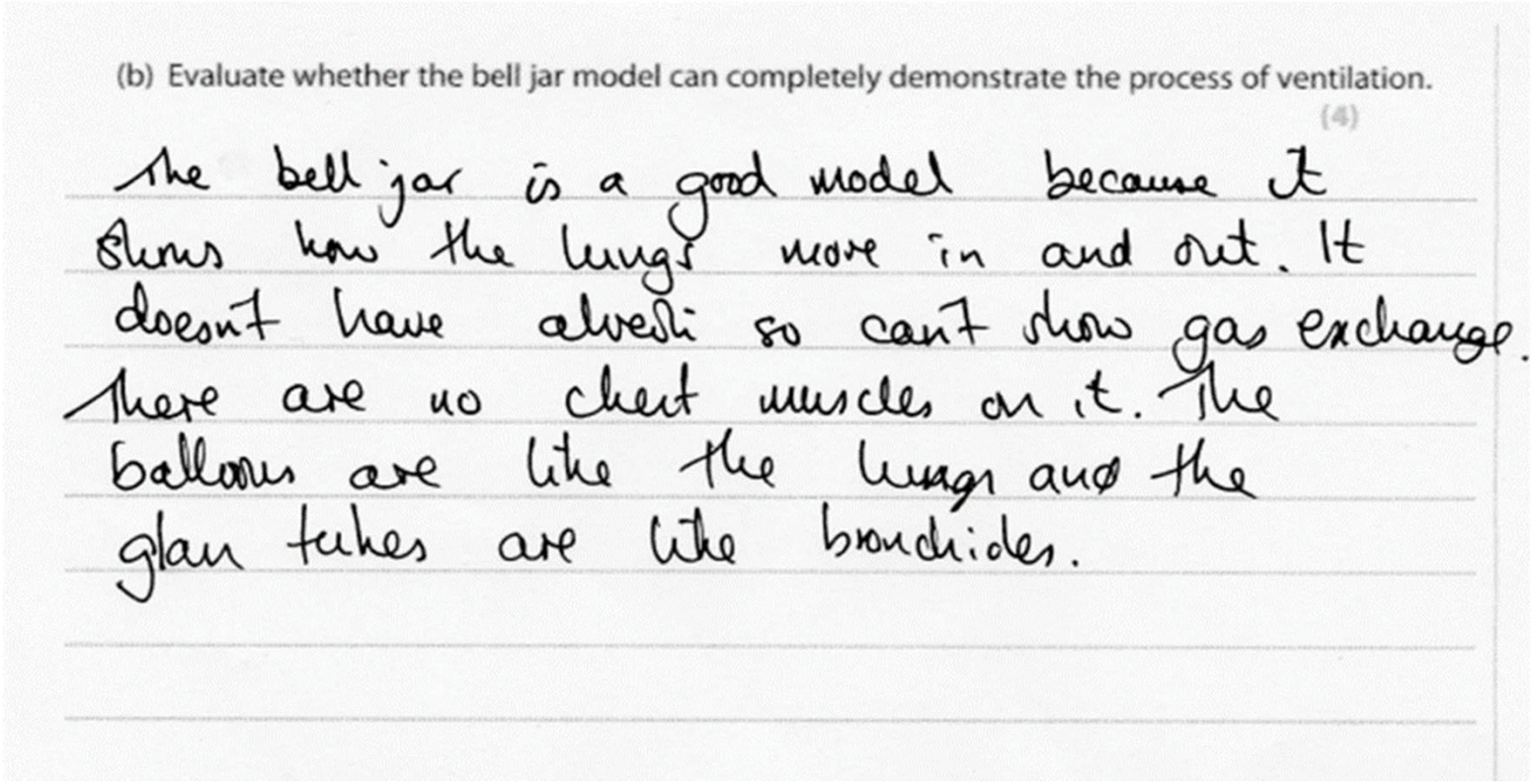
(b) Evaluate whether the bell jar model can completely demonstrate the process of ventilation.

(4)

Mark scheme (Paper1)

Question Number	Answer	Mark
8(b)	An answer that makes reference to four of the following points: • reference to diaphragm (1) • balloons represent lungs (1) • reference to trachea / windpipe / bronchus (1) • reference to ribs / ribcage / movement of chest / ribcage / bell jar does not move (1) • reference to intercostal muscles (1)	**4**

Activity 2-2. (answer A)
How many marks would this answer score?

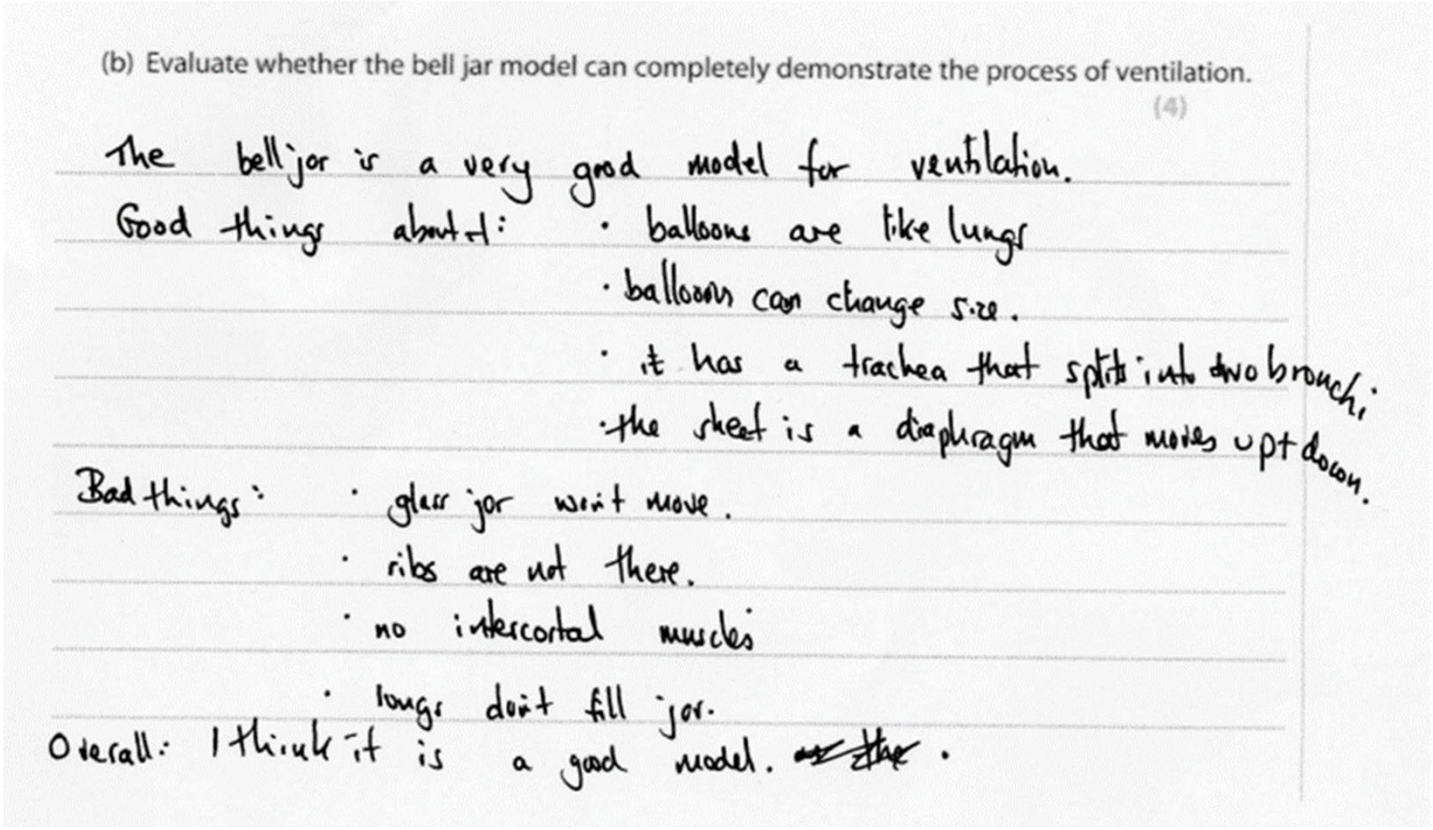


(b) Evaluate whether the bell jar model can completely demonstrate the process of ventilation.

(4)

the bell jar is a good model because it shows how the lungs move in and out. It doesn't have alveoli so can't show gas exchange. There are no chest muscles on it. The ballons are like the lungs and the glass tubes are like bronchioles.

Activity 2-2: (answer B): How many marks would this answer score?



(b) Evaluate whether the bell jar model can completely demonstrate the process of ventilation.

(4)

The bell jar is a very good model for ventilation.

Good things about it:
- balloons are like lungs
- balloons can change size.
- it has a trachea that splits into two bronchi.
- the sheet is a diaphragm that moves up + down.

Bad things:
- glass jar won't move.
- ribs are not there.
- no intercostal muscles
- lungs don't fill jar.

Overall: I think it is a good model. ~~the~~.

Command word: 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.'

(Paper 1 - 2a,2b,2ci asked about (salmon) protein in the diet)

(c) A student investigates the effect of genetic modification on the growth of salmon.

The student measures the mass and length of one normal salmon and one genetically modified salmon when both salmon are 18 months old.

The table shows the student's results.

Type of salmon	Mass in g	Length in cm
normal	1250	33
genetically modified	3000	61

(ii) The student concludes that his results show that genetically modified (GM) salmon are useful in providing a balanced diet.

Discuss the student's conclusion.

(6)

Mark Scheme (Paper1)

Question Number	Answer	Mark
2(c)(ii)	An answer that makes reference to six of the following points: • GM salmon grow more / heavier / longer / larger / more mass / grow faster / eq (1) • (more) protein provided (1) • only need protein in correct amount / only need sufficient protein / only need 50g / too much protein / excess protein / eq (1) • balanced diet also needs vitamins / carbohydrate / lipid / minerals / fibre / no idea of other **named** component in salmon (1) • one salmon used / not repeated/ should use several fish (1) • (data) not reliable / result may be anomalous (1) • no information on food supply to salmon / temperature / oxygen / pollution (1) • protein need depends on age / sex / activity / eq (1)	**6** **Mp1 Allow converse**

Activity 2-3: Marking scripts

Paper 1. 4a,b on role of mineral ion nitrate in growth of crops

2.

(c) If the mineral ions are not absorbed, they are egested in the faeces.

The faeces of genetically modified (GM) farm animals contain less phosphate than the faeces of normal farm animals.

(i) Some people catch fish from rivers near farm land.

Discuss why these people might support the genetic modification of farm animals.

(4)

Question Number	Answer	Additional guidance	Mark
4(c)(i)	An answer that makes reference to the following points: • fewer plants / fewer algae / less eutrophication (1) • (more) light **and** (more) photosynthesis (1) • (less) <u>decomposition</u> / <u>decomposed</u> / <u>decomposers</u> (1) • (more) oxygen / not anoxic / less BOD (1) • respiration (ONCE) (1) • (catch) more fish / fewer fish killed / better catch / fish survive / fish do not suffocate / eq (1)	Allow converse for all Mps	**4**

Activity 2-3 A: How many marks would this answer score?

(c) If the mineral ions are not absorbed, they are egested in the faeces.

The faeces of genetically modified (GM) farm animals contain less phosphate than the faeces of normal farm animals.

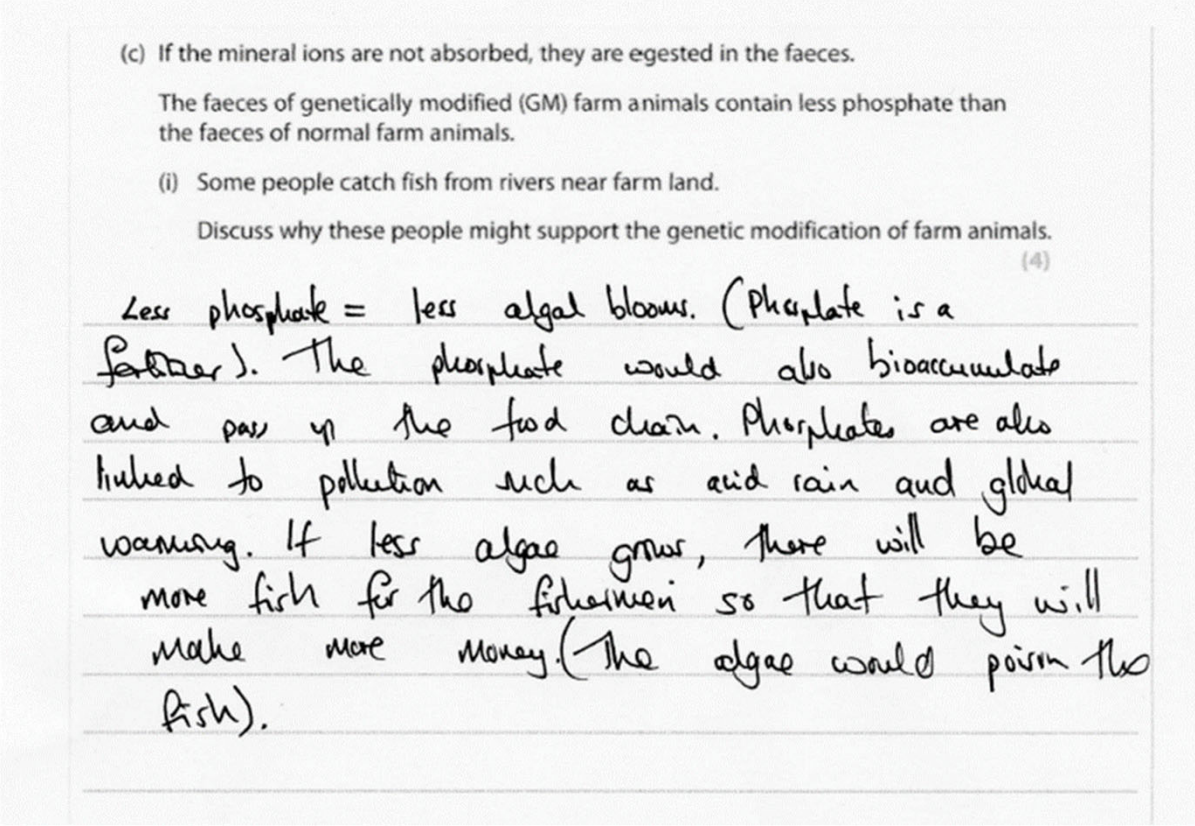
(i) Some people catch fish from rivers near farm land.

Discuss why these people might support the genetic modification of farm animals.

(4)

If there is less phosphate passing into the river, there will be less eutrification. This means less algae will grow. Algae would block light and so many algae would die - this would give decomposer bacteria food. The decomposer bacteria would respire and use up Oxygen. This means there would be less oxygen for fish which would die. This means that less phosphate = more fish = more money!

Activity 2-3: B. How many marks would this answer score?



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The faeces of genetically modified (GM) farm animals contain less phosphate than the faeces of normal farm animals.

(i) Some people catch fish from rivers near farm land.

Discuss why these people might support the genetic modification of farm animals.

(4)

Less phosphate = less algal blooms. (Phosphate is a fertiliser). The phosphate would also bioaccumulate and pass up the food chain. Phosphates are also linked to pollution such as acid rain and global warming. If less algae grow, there will be more fish for the fishermen so that they will make more money. (The algae would poison the fish).

Maths skills

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 4 of the 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

Appendix 4 (same skills for Biology, Chemistry and Physics)

		B	C	P
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	C	P
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	✓		✓

Maths Question

(ii) The population of the United Kingdom is 65 million, of which half are male.

Calculate the number of males with heart disease in the age range 18 to 44.

(2)

number of males = ...

Maths Question

(c) The table shows the number of deaths in 2014 caused by bacteria that are resistant to antibiotics.

The table also shows the predicted number of deaths in 2050 caused by resistant bacteria.

Year	Number of deaths $\times 10^6$
2014	0.7
2050	10.0

(i) Calculate the percentage increase in the predicted number of deaths in 2050 compared with the number of deaths in 2014.

(2)

percentage increase = ...

Maths Question - Graph

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

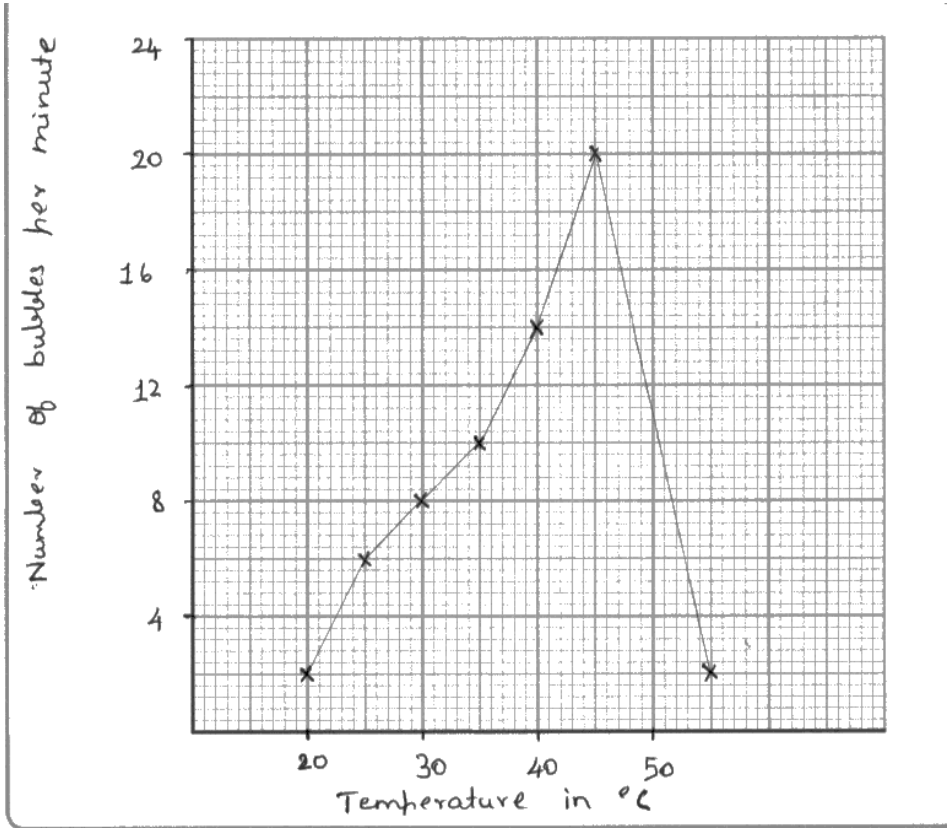
Temperature in °C	Number of bubbles per minute
20	2
25	6
30	8
35	10
40	14
45	20
50	no data
55	2

(i) Plot a graph to show these results.

Join the points with straight lines.

(5)

How many marks



Mark Scheme

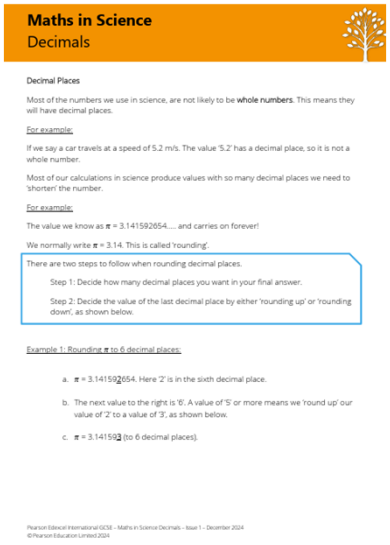
Question Number	Answer	additional guidance	Mark
5(b)(i)	An answer that makes reference to the following points: S scale linear and half the axes (1) L lines straight and through each point (1) A1 axes correct way (1) A2 axes labelled temperature in ^{0}C **and** bubbles per min(ute) (1) P points plotted accurately (1)	 bar charts / extrapolations: no L mark no P mark if data plotted for 50	**5** **exp**

Plotting graphs –typical Mark Scheme includes

Often marked as SLAAP, SLAPU or SLAPUK:

S	scale linear and half of each axis
L	lines straight, between points, and neat (or neat bars)
A	axis correct way round
A	axes labelled
P	points (or bars) plotted correctly
U	units correct on each axis
K	key if two or more lines (bars).

Guide Booklets (download)



Maths in Science
Decimals

Decimal Places

Most of the numbers we use in science, are not likely to be **whole numbers**. This means they will have decimal places.

For example:

If we say a car travels at a speed of 5.2 m/s. The value '5.2' has a decimal place, so it is not a whole number.

Most of our calculations in science produce values with so many decimal places we need to 'shorten' the number.

For example:

The value we know as π = 3.141592654.... and carries on forever!

We normally write π = 3.14. This is called 'rounding'.

There are two steps to follow when rounding decimal places.

Step 1: Decide how many decimal places you want in your final answer.

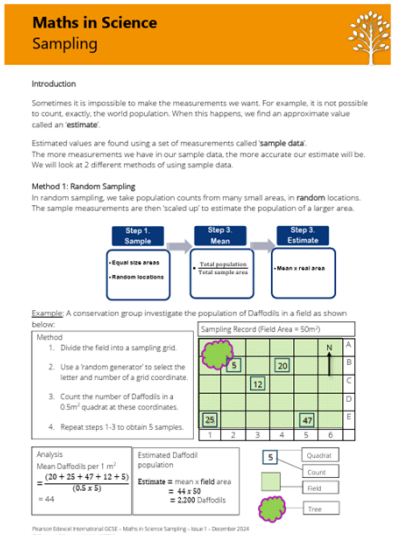
Step 2: Decide the value of the last decimal place by either 'rounding up' or 'rounding down', as shown below.

Example 1: Rounding π to 6 decimal places:

a. π = 3.141592654. Here '2' is in the sixth decimal place.

b. The next value to the right is '6'. A value of '5' or more means we 'round up' our value of '2' to a value of '3', as shown below.

c. π = 3.141593 (to 6 decimal places).



Maths in Science
Sampling

Introduction

Sometimes it is impossible to make the measurements we want. For example, it is not possible to count, exactly, the world population. When this happens, we find an approximate value called an '**estimate**'.

Estimated values are found using a set of measurements called '**sample data**'.
The more measurements we have in our sample data, the more accurate our estimate will be.
We will look at 2 different methods of using sample data.

Method 1: Random Sampling
In random sampling, we take population counts from many small areas, in **random** locations.
The sample measurements are then 'scaled up' to estimate the population of a larger area.

Step 1. Sample
•Equal size areas
•Random locations

Step 2. Mean
Total population / Total sample area

Step 3. Estimate
•Mean x real area

Example: A conservation group investigate the population of Daffodils in a field as shown below:

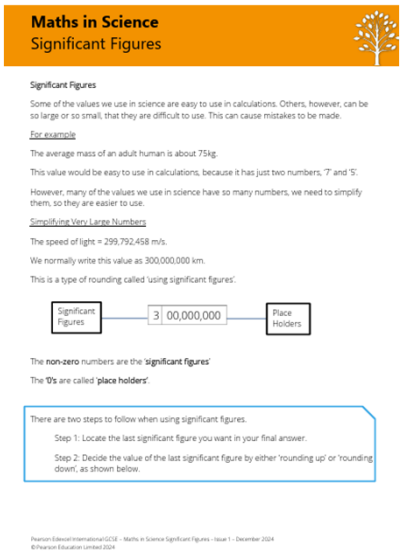
Sampling Record (Field Area = 50m²)

Method
1. Divide the field into a sampling grid.
2. Use a 'random generator' to select the letter and number of a grid coordinate.
3. Count the number of Daffodils in a 0.5m² quadrat at these coordinates.
4. Repeat steps 1-3 to obtain 5 samples.

Analysis
Mean Daffodils per 1 m² = (20 + 25 + 47 + 12 + 5) / (0.5 x 5) = 44

Estimated Daffodil population
Estimate = mean x field area = 44 x 50 = 2,200 Daffodils

5 Quadrat
Count
Field
Tree



Maths in Science
Significant Figures

Significant Figures

Some of the values we use in science are easy to use in calculations. Others, however, can be so large or so small, that they are difficult to use. This can cause mistakes to be made.

For example

The average mass of an adult human is about 75kg.

This value would be easy to use in calculations, because it has just two numbers, '7' and '5'.

However, many of the values we use in science have so many numbers, we need to simplify them, so they are easier to use.

Simplifying Very Large Numbers

The speed of light = 299,792,458 m/s.

We normally write this value as 300,000,000 km.

This is a type of rounding called 'using significant figures'.

Significant Figures — 3 00,000,000 — Place Holders

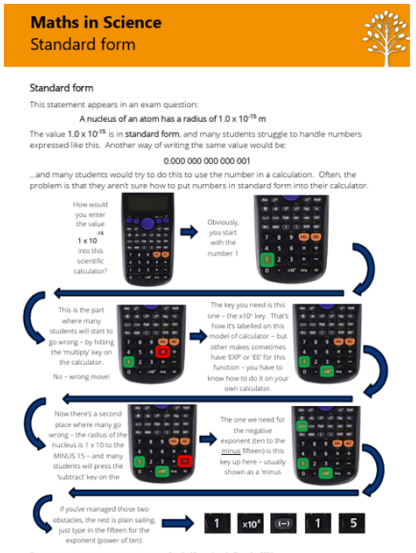
The **non-zero** numbers are the '**significant figures**'

The '**0's** are called '**place holders**'.

There are two steps to follow when using significant figures.

Step 1: Locate the last significant figure you want in your final answer.

Step 2: Decide the value of the last significant figure by either 'rounding up' or 'rounding down', as shown below.



Maths in Science
Standard form

Standard form

This statement appears in an exam question:

A nucleus of an atom has a radius of 1.0 x 10^{-15} m

The value **1.0 x 10^{-15}** is in **standard form**, and many students struggle to handle numbers expressed like this. Another way of writing the same value would be:

0.000 000 000 000 001

...and many students would try to do this to use the number in a calculation. Often, the problem is that they aren't sure how to put numbers in standard form into their calculator.

How would you enter the value 1 x 10⁻¹⁵ into this scientific calculator?

Obviously, you start with the number 1

This is the part where many students will start to go wrong – by hitting the 'multiply' key on the calculator.

No – wrong move!

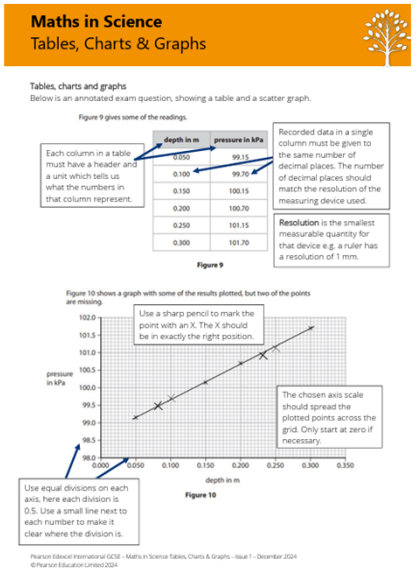
The key you need is this one – the x10ˣ key. That's how it's labelled on this model of calculator – but other makes sometimes have 'EXP' or 'EE' for this function – you have to know how to do it on your own calculator.

Now there's a second place where many go wrong – the radius of the nucleus is 1 x 10 to the MINUS 15 – and many students will press the 'subtract' key on the

The one we need for the negative exponent (ten to the minus fifteen) is this key up here – usually shown as a 'minus

If you've managed those two obstacles, the rest is plain sailing, just type in the fifteen for the exponent (power of ten).

1 x10ˣ (-) 1 5



Maths in Science
Tables, Charts & Graphs

Tables, charts and graphs

Below is an annotated exam question, showing a table and a scatter graph.

Figure 9 gives some of the readings.

Each column in a table must have a header and a unit which tells us what the numbers in that column represent.

depth in m	pressure in kPa
0.050	99.15
0.100	99.70
0.150	100.15
0.200	100.70
0.250	101.15
0.300	101.70

Recorded data in a single column must be given to the same number of decimal places. The number of decimal places should match the resolution of the measuring device used.

Resolution is the smallest measurable quantity for that device e.g. a ruler has a resolution of 1 mm.

Figure 9

Figure 10 shows a graph with some of the results plotted, but two of the points are missing.

Use a sharp pencil to mark the point with an X. The X should be in exactly the right position.

pressure in kPa: 102.0, 101.5, 101.0, 100.5, 100.0, 99.5, 99.0, 98.5, 98.0

depth in m: 0.000, 0.050, 0.100, 0.150, 0.200, 0.250, 0.300, 0.350

The chosen axis scale should spread the plotted points across the grid. Only start at zero if necessary.

Use equal divisions on each axis, here each division is 0.5. Use a small line next to each number to make it clear where the division is.

Figure 10

Assessment Objectives

Assessment objectives

- There are three assessment objectives: AO1, AO2 and AO3
- Questions on the exam papers will focus on all three objectives.
- Very important that pupils are aware of how they will be assessed.
- Many pupils (and teachers!) only focus on content.

Assessment objectives and weightings

- The balance of the assessment objectives is the same on Paper 1 and Paper 2/Unit 1 & Unit 2.

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

AO1

Assessment objective 1 (AO1)

AO1 Knowledge and understanding of biology / science

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

Typical AO1 Questions (Modular SAMs)

(b) Describe how a mammal is cloned.

(6)

Assessment Objective

- This is AO1
- The command word is describe
- It is factual information from the specification

Mark Scheme

Question Number	Answer	Additional guidance	Mark
7(b)	An answer that makes reference to six of the following points: • use enucleated egg/ empty egg/ remove nucleus from egg/ eq (1) • nucleus from body cell/ diploid nucleus (placed into empty egg)/ fuse adult cell with empty egg (1) • use of electricity/ shock (1) • cell division/ mitosis (1) • embryo (1) • uterus/ womb (1) • surrogate mother (1)	Ignore DNA	**6**

Typical AO1 Questions (Modular SAMs)

6 Plants use their leaves during photosynthesis.

(a) Explain how the structure of a leaf is adapted for gas exchange.

(4)

Typical AO1 Questions (Modular SAMs)

- This is AO1. It is factual knowledge direct from the specification.
- Write a mark scheme for this question.

Mark Scheme

Question Number	Answer	Mark
6(a)	An explanation that makes reference to four of the following points: • waxy cuticle to prevent evaporation of water / eq (1) • air spaces / spongy cells / gaps/eq (1) • to allow diffusion of CO_2 / eq (1) • stomata (1) • allow entry of CO_2 / exit of O_2 / eq (1) • moist to allow gases to dissolve/ eq (1)	**4**

Typical AO1 Questions (Linear)

1 Organs in the human body have different functions.

(a) Name the organ that produces bile.

(1)

.....

(b) Which organ releases progesterone?

(1)

☒ **A** the brain

☒ **B** the ovary

☒ **C** the pituitary

☒ **D** the testis

(c) Which row of the table correctly shows whether the kidneys and skin are involved in excretion?

(1)

	kidneys	skin
☒ **A**	no	no
☒ **B**	no	yes
☒ **C**	yes	no
☒ **D**	yes	yes

Assessment Objective 1
Activity 3-1

Looking at student responses to an AO1 item

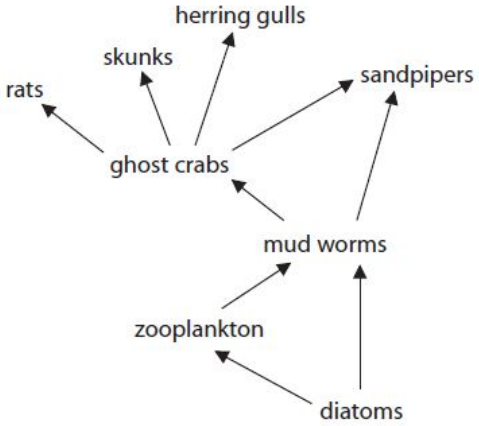
Question 3b. (from this Assessment grid shown)

1. Without reference to published mark scheme, rank order samples A–D.
2. Then use the published mark scheme to mark samples A–D.
3. Compare your marks to your first order.

Activity 3-1

We are only looking at answers to 3b

3 The diagram shows a food web.



(a) Use information from the food web to complete the table.

The first one has been done for you.

(3)

number of organisms	8
number of producers	
number of primary consumers	
number of food chains	

(b) Explain why the energy in the mud worms is not all transferred to the organisms that eat them.

(4)

Activity 3 -1 (A)

(b) Explain why the energy in the mud worms is not all transferred to the organisms that eat them.

(4)

Some energy is lost in heat as the organisms may heat up their surrounding some energy is used in kinetic energy as the energy used to eat the organisms is being lost also

Activity 3 -1 (B)

(b) Explain why the energy in the mud worms is not all transferred to the organisms that eat them.

(4)

There are several reasons, firstly, some of the energy is used for respiration, some is lost through excretion and mostly, egestion, meaning the energy is not being used, finally, some is used in the body for life processes such as growth. Moreover, some of the energy is used lost in egestion and excretion because the body cannot convert it and growth and movement require energy to happen.

Activity 3 -1 (C)

(b) Explain why the energy in the mud worms is not all transferred to the organisms that eat them.

(4)

As they may not eat all of the mudworm, they also may egest some of it in their faeces. Also they may use some of the energy ~~to respire~~ ~~to~~ to move around, or lose it keeping themselves warm. Finally they may also use the energy for metabolic processes such as digestion.

Activity 3 -1 (D)

(b) Explain why the energy in the mud worms is not all transferred to the organisms that eat them.

(4)

they loose energy through respiration, they egest and excrete a lot of what they eat. the organisms eating them may not eat all of them therefore not getting as much energy from them and they will not be able to obtain all the energy they can whilst digesting the mud worm. Because of this only about 10% of the energy will be transfered to the next trophic level.

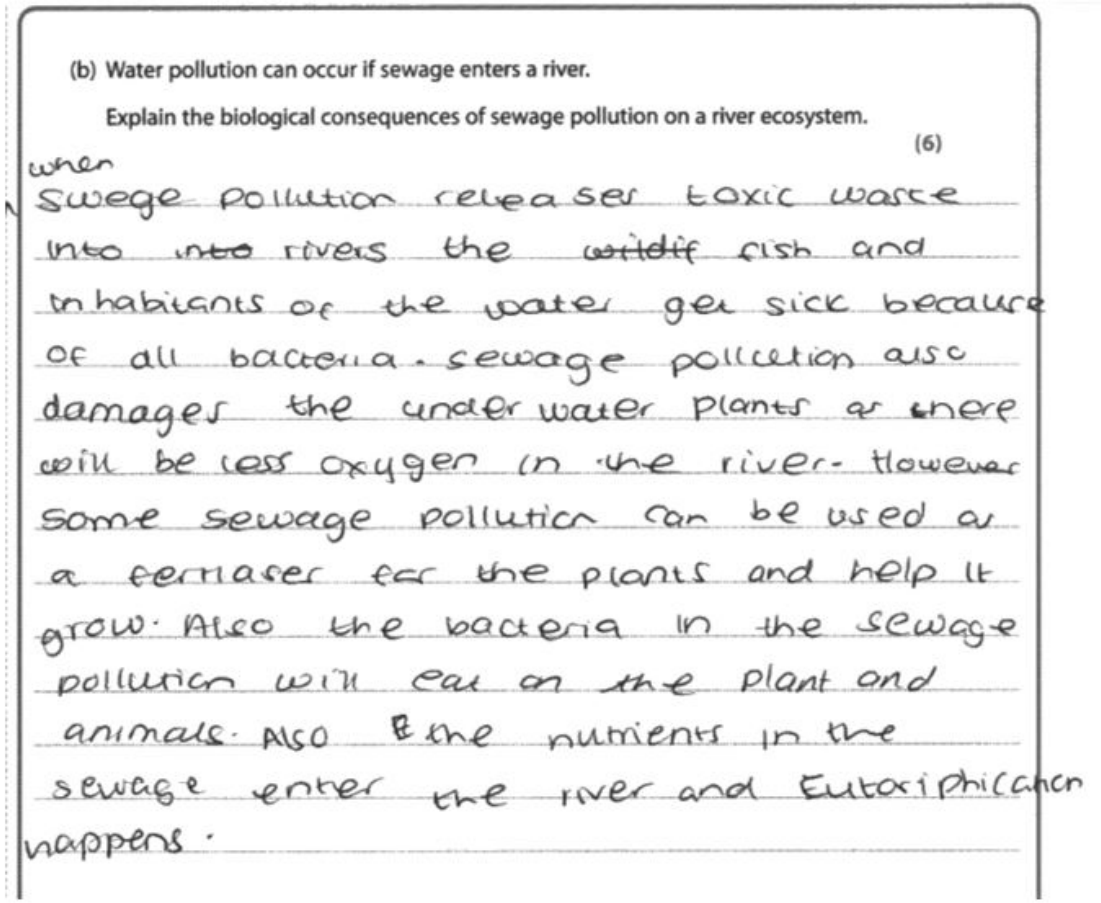
Activity 3-1 Mark Scheme

Question Number	Answer	Additional guidance	Mark
3(b)	An explanation that makes reference to the following points: • respiration / movement / heat loss (1) • egested / undigested / faeces / not absorbed / not assimilated (1) • excreted / urine / urea (1) • uneaten (1) • death / <u>decomposition</u> (1)	Mp1 Ignore exercise / metabolism Mp3 excreted from the digestive system = 0	**4**

Assessment Objective 1
Activity 3-2

1. Look at another AO1 question (9b)
2. Without reference to the published mark scheme, rank order samples A–C.
3. Now, use the published mark scheme to mark samples A–C.
4. Compare your marks to your first order.

Activity 3 -2 (A)



(b) Water pollution can occur if sewage enters a river.

Explain the biological consequences of sewage pollution on a river ecosystem.

(6)

when swege pollution release toxic waste into ~~into~~ rivers the ~~wildlif~~ fish and inhabitants of the water get sick because of all bacteria. sewage pollution also damages the under water plants as there will be less oxygen in the river. however some sewage pollution can be used as a fertiliser for the plants and help it grow. Also the bacteria in the sewage pollution will eat on the plant and animals. Also the nutrients in the sewage enter the river and Eutorophication happens.

Activity 3 -2 (B)

(b) Water pollution can occur if sewage enters a river.

Explain the biological consequences of sewage pollution on a river ecosystem.

(6)

A river being contaminated by sewage can lead to eutrophication and problems throughout a river ecosystem. Sewage contains human waste such as faeces and urine. These contain bacteria and can lead to disease affecting organisms in a rivers ecosystem. The sewage could kill organisms by them eating it an getting ill (animals) or by the sewage blocking ~~sunlight~~ the sunlight from the river meaning that the plants can't photosynthesis and die as they can't survive without food (glucose). This would also mean that fish could die as all of the oxygen has been used by the plants so theres none left for the animals to use in respiration. However the sewage may also contain nutrients which could be used by algae (for example) to grow again leading to it to block out the sun resulting in the death of organisms and an unbalanced food chain.

(Total for Question 9 = 9 marks)

Activity 3 -2 (C)

(b) Water pollution can occur if sewage enters a river.

Explain the biological consequences of sewage pollution on a river ecosystem.

(6)

- Sewage pollution on a river causes eutrophication.
- The sewage carries excess phosphates and nitrates into the water, increasing the number of bacteria.
- This increases algae growth.
- Algal bloom forms, which reduces the light penetration for other larger plants, meaning they can't photosynthesise so they die.
- The death of these plants increases the build up of detritus, as well as removing food sources for fish.
- The detritus build up causes an increase in the number of aerobic bacteria.
- These bacteria reduce the oxygen availability for other organisms, meaning the organisms can't respire, therefore killing them.
- Eventually, the water becomes anoxic, and no other organisms can live there, so species diversity decreases.

Mark Scheme 9b

Question Number	Answer	Mark
9(b)	An explanation that makes reference to six of the following points: • pathogenic bacteria / cause disease (1) • urea / urine / nitrogenous waste / nitrate / phosphate (1) • decomposition / decomposed / decomposers (ONCE) (1) • eutrophication / plant growth / algae growth (1) • (plants) block light / prevents photosynthesis (1) • respiration (ONCE) (1) • (less) oxygen (1) • death of organisms (ONCE) / reduce biodiversity / eq (1)	**6**

How can we improve student responses on AO1?

What strategies do you use in your centres to ensure that students are well prepared for AO1 items?

How do we check the students' knowledge and understanding of each topic?

What strategies work particularly well?

How is it best to check on learning?

How can we ensure language is precise and the depth of understanding adequate for IGCSE?

How can we improve student responses on AO1?

Within the classroom	Teaching strategies	Use the specification	Use past papers
Use textbook	Use tests	Use the published mark schemes	Use examiner reports

Developing AO1 skills

- 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 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.

AO2

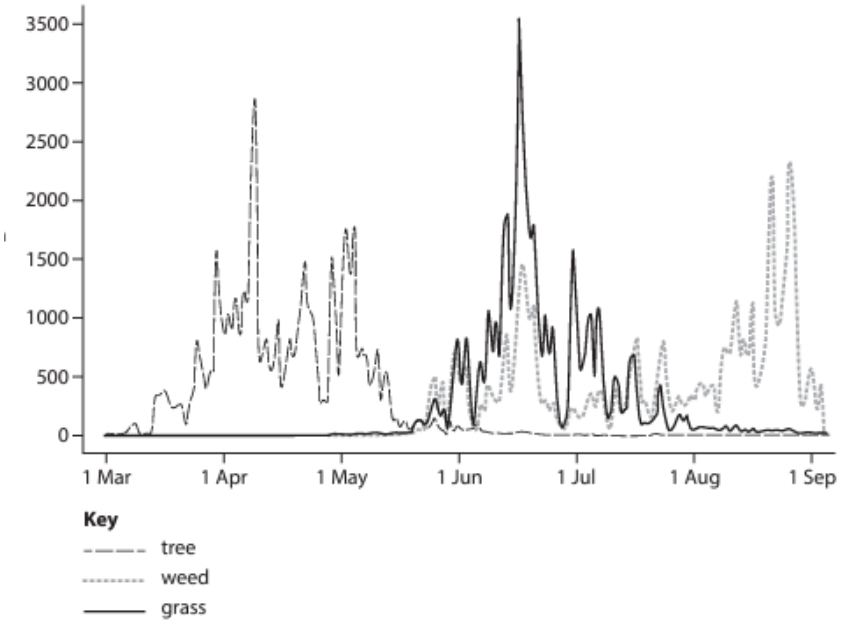
Assessment objective 2 (AO2)

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

- 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*, *discuss*
- Can be challenging for less confident students: 'You never taught us about birds in the winter!'
- Can be 'suggest' questions as this implies an unfamiliar context

Typical AO2 Question (Modular)

The graph shows the changes in total pollen count for three different plant types from March to September during one year in the United Kingdom.



Person	Months with severe symptoms	Months with mild symptoms	Months with no symptoms
A	April and May	March and June	July to September
B	June and July	March to May, August	none
C	April to September	March	none
D	none	none	all
E	June to September	March to May	none

Typical AO2 Question (Modular)

Using the data in the table and the information from the graph, discuss the likely causes of the allergic responses in each person.

(5)

Assessment Objective

- This is AO2
- It requires application of knowledge to an unfamiliar situation
- Candidates have to apply knowledge to interpret data they are given.

Mark scheme

Question Number	Answer	additional guidance	Mark
5(b)	An answer that makes reference to five the following: • link between pollen number and symptoms /eq (1) • Person A allergic to tree pollen (only) / eq (1) • Person B allergic to (mainly) grass pollen / eq (1) • • Person B some / mild allergy to tree and weed / eq (1) • Person C allergic to all pollen / tree and grass and weed/eq (1) • Person D no pollen allergy / eq (1) • Person E allergic to (mainly) grass and weed/ eq (1) • Person E some / mild allergy to tree / eq (1) • no species level data / eq (1) • only one year / eq (1)	allow hay fever/ allergic response/ for allergy	**5**

Typical AO2 Question (Linear)

(b) Heart disease is a major risk to health in the United Kingdom.

In a study, the number of people with heart disease was recorded.

The table shows the results of the study.

Age range in years	Number of people with heart disease per 1000 in population	
	males	females
18 to 44	5	3
45 to 64	138	118
65 to 74	305	220
over 75	422	358

(i) Give two conclusions that can be made from this study.

(2)

1 .....

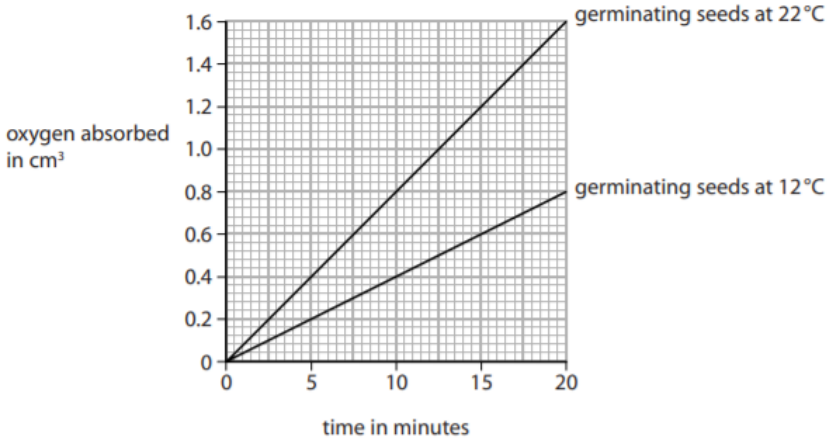
.....

2 .....

.....

Typical AO2 question (Linear - maths)

(c) The graph shows the results of the student's investigation.



(i) Calculate the percentage increase in the rate of oxygen absorption at 22 °C compared to the rate of oxygen absorption at 12 °C.

(2)

percentage = ...

(ii) Suggest why the rate of oxygen absorption is greater at 22 °C than at 12 °C.

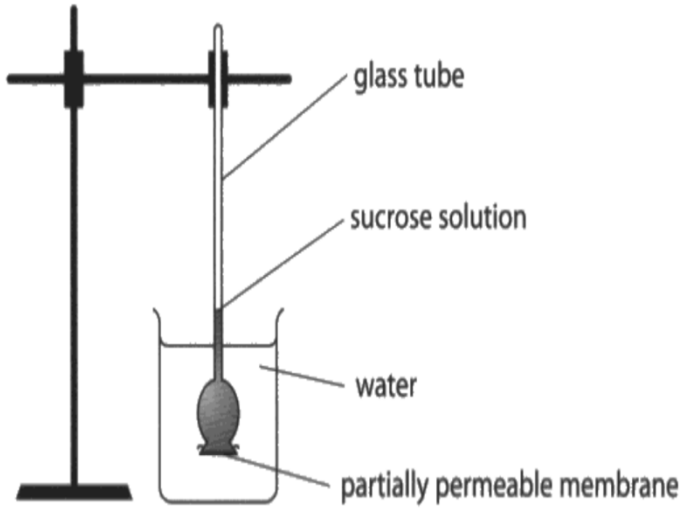
(2)

Activity 4-1

Look	Look at Question 4a.
Reference	Without reference to the published mark scheme, rank order samples A–D.
Use	Now, use the published mark scheme to mark samples A–D.

4-1: A

4 This apparatus can be used to show osmosis.



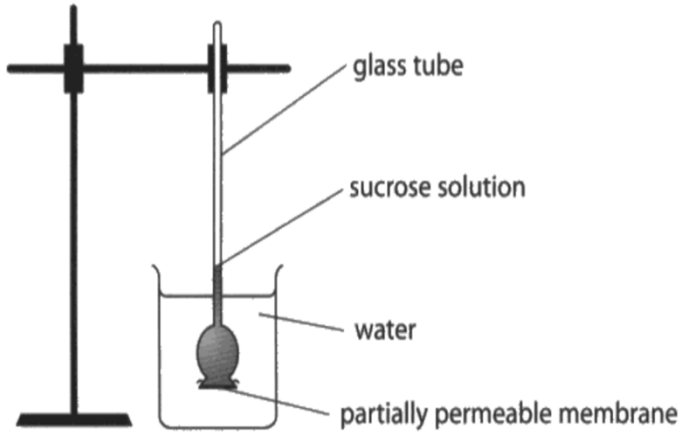
(a) Explain what happens to the level of the sucrose solution in the glass tube.

(3)

The sucrose solution will pass through the partially permeable membrane and disperse into the water of lower concentration through osmosis.

4-1: B

4 This apparatus can be used to show osmosis.



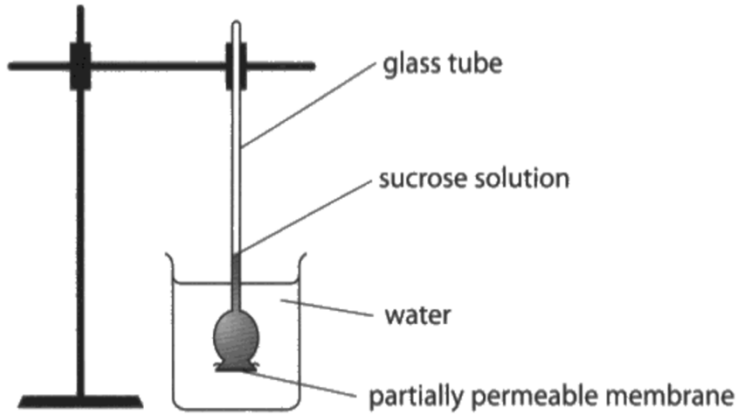
(a) Explain what happens to the level of the sucrose solution in the glass tube.

(3)

As the water has a higher water potential than the sucrose solution the water would move (through the partially permeable membrane) down the water potential gradient by osmosis into the ~~sa~~ sucrose solution. The level of the solution would actually increase as although the amount of sucrose is the same there would be more water and so a larger volume inside the glass tube

4-1: C

4 This apparatus can be used to show osmosis.



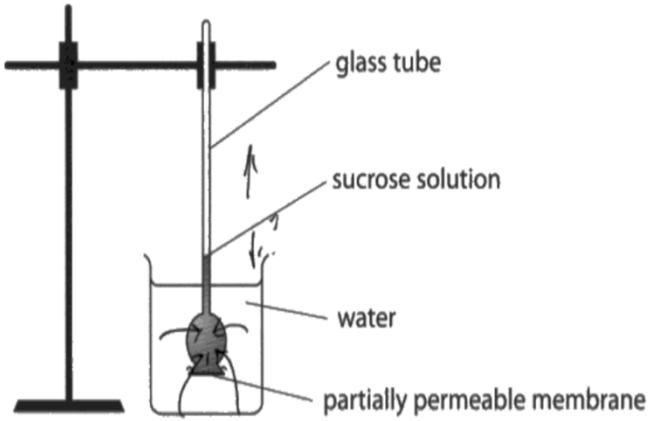
(a) Explain what happens to the level of the sucrose solution in the glass tube.

(3)

The level of the sucrose solution in the glass tube will decrease because the sucrose solution has a higher water potential than the water. Osmosis is the movement of water molecules from an area of higher water potential to an area of lower water potential across a partially permeable membrane. The ~~sucrose~~ solutions will have the same water potential after the water and sucrose solution have mixed. The sucrose molecules will move across the partially permeable membrane into the water.

4-1: D

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)

It will rise. This is because the sucrose solution has a lower water potential (wp) than the surrounding water in the beaker. The water goes into the solution via osmosis and so increases the volume of the solution, making the level rise.

4-1 Mark scheme

An explanation that makes references to the following points:

- moves up / increases (1)
- because water enters / water passes through membrane (1)
- sucrose is a concentrated solution / sucrose has a low(er) water potential / high water potential to low water potential / down a water potential gradient / dilute to concentrated (1)

Total 3

Activity 4-2

Look at Question 5b(iii).

Design a mark scheme and use it to mark A-D

4-2: A

(iii) The student measures the distance moved by the coloured liquid and converts this to volume of oxygen absorbed.

The volume of oxygen absorbed can be calculated using the formula

volume = $\pi \times \text{radius}^2 \times \text{distance}$

Calculate the volume of oxygen absorbed when the coloured liquid moves a distance of 6.0 mm.

0.6 cm

[diameter of tube = 1.0 mm]

0.1 cm

(3)

$\pi \times 0.5^2 \times$

$\pi \times 0.05^2 \times 0.6 =$

volume = 4.71×10^{-3} cm³

4-2: B

(iii) The student measures the distance moved by the coloured liquid and converts this to volume of oxygen absorbed.

The volume of oxygen absorbed can be calculated using the formula

volume = $\pi \times \text{radius}^2 \times \text{distance}$

Calculate the volume of oxygen absorbed when the coloured liquid moves a distance of 6.0 mm.

[diameter of tube = 1.0 mm]

(3)

$\pi \times 0.5^2 \times 6.0$

$= \frac{3}{2}\pi$

$= 4.71$ (7.5.8:)

$= 0.471$

(cm → dm)

0.00471

0.471

4.71

volume = ... cm^3

$\pi \times 0.05^2 \times 0.6$

$= 4.71 \times 10^{-3}$

$= 0.00471$

4-2: C

(iii) The student measures the distance moved by the coloured liquid and converts this to volume of oxygen absorbed.

The volume of oxygen absorbed can be calculated using the formula

volume = $\pi \times \text{radius}^2 \times \text{distance}$

Calculate the volume of oxygen absorbed when the coloured liquid moves a distance of 6.0 mm.

[diameter of tube = 1.0 mm]

(3)

$\pi \times 0.5\,\text{mm} \times 6\,\text{mm}$

or

$0.05\,\text{cm} \times 0.6\,\text{cm}$

$\pi \times 0.05^2 \times 0.6$

(3y)

volume = 4.71×10^{-3} cm^3

4-2: D

(iii) The student measures the distance moved by the coloured liquid and converts this to volume of oxygen absorbed.

The volume of oxygen absorbed can be calculated using the formula

volume = $\pi \times \text{radius}^2 \times \text{distance}$

Calculate the volume of oxygen absorbed when the coloured liquid moves a distance of 6.0 mm.

[diameter of tube = 1.0 mm]

(3)

$\pi \times 0.5^2 \times 6$

(3 s.f.)

volume = 4.71 cm^3

4-2 Mark Scheme

MS

- multiply by distance (1)
- determine volume
- correct answer with unit conversion

3.142 x 0.05 x 0.05 =
0.007855
× 0.6
= 0.0047 / 4.7 × 10 -3

Allow one mark for
× 6.0 / × 0.6 in working
Allow two marks for
4.7 / 47 / 0.47 in working
Allow three marks for
4.7 $\underline{mm^3}$

Developing AO2 skills

- 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.

AO3

Assessment objective 3 (AO3)

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

- AO3 is about experimental skills.
- Can include core practicals (but this could be classed as AO1)
- Can include general practical themes, variables, accuracy, reliability, valid planning, evaluating practical methods and data.
- Questions can use command words that require higher cognitive skills, such as *evaluate* and *discuss*

AO3 Typical Question (Modular)

(b) A student observes that the leaves on different ivy plants seem to be different sizes depending on the amount of sunlight the plants receive.

Design an investigation to test whether the amount of sunlight received by ivy plants affects the size of their leaves.

Include experimental details in your answer and write in full sentences.

(6)

Assessment Objective

- This is AO3
- It is Experimental Design
- It is not merely a repeat of a core practical

- Is there a particular acronym you could use to support students answering these questions?

Mark Scheme

Question Number	Answer	Additional Guidance	Mark
6(b)	An answer that makes reference to six of the following: • C – (plant ivy in) shaded and unshaded area / different exposure to light / eq (1) • O – same species / type / age / starting size of leaf / same plant / eq (1) • R – repeat with multiple leaves / repeat / eq (1) • M1 – measure length / width / height / surface area / eq (of leaves) (1) • M2 – grow ivy for same stated time (1) • S1 - temperature / pests / humidity / plant density / carbon dioxide / weather / time of year / wind / eq (1) • S2 – same water / minerals / soil /nutrients / fertiliser / pH / eq (1)	**Allow** different light intensities / distances of lamp **Allow** groups **Ignore** size of leaves **Allow** measure size with a ruler / in mm / eq **Allow** volume Minimum time of one day	**6**

Typical AO3 Question (bii) (Linear)

(b) The table shows the results the student obtained from her investigation.

Colour of light	Number of gas bubbles released in one minute			
	trial 1	trial 2	trial 3	average
Red	23	26	25	
Blue	19	18	21	19
Green	12	16	6	14

(i) Complete the table by calculating the average rate of photosynthesis for red light.

(1)

(ii) Explain whether the results for each colour are reliable.

(2)

Typical AO3 Planning question (Linear)

(c) Plant growth substances stimulate root growth from a cut stem.

Describe an investigation to find the best concentration of plant growth substance to stimulate root growth.

You should include experimental details in your answer and write in full sentences.

(6)

Core practicals and 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 GCSE Biology core practicals

2.9 Investigate food samples for the presence of glucose, starch, protein and fat
2.12 Investigate how enzyme activity can be affected by changes in temperature
2.14B Investigate how enzyme activity can be affected by changes in pH
2.17 Investigate diffusion and osmosis using living and non-living systems
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
2.33B Investigate the energy content in a food sample
2.39 Investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms
2.45B Investigate the effect of light on net gas exchange from a leaf, using hydrogen carbonate indicator
2.50 Practical: investigate breathing in humans, including the release of carbon dioxide and the effect of exercise
2.58B Investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot in humans, including the release of carbon dioxide and the effect of exercise
3.5 Investigate the conditions needed for seed germination
4.2 Investigate the population size of an organism in two different areas using quadrats
4.4B Investigate the distribution of organisms in their habitats and measure biodiversity using quadrat
5.6 Investigate the role of anaerobic respiration by yeast in different conditions

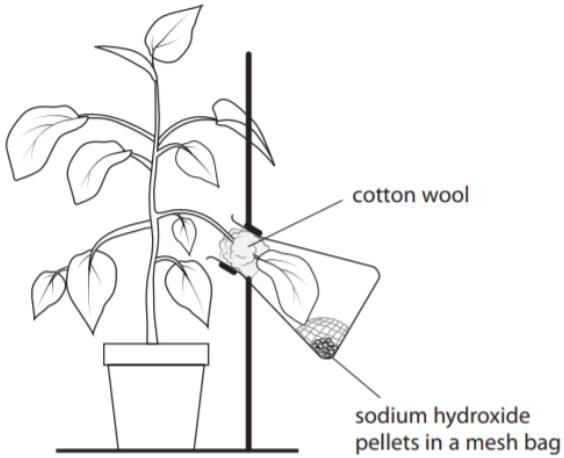
Practical skills in examinations

Students may be tested on their ability to:

- Describe and plan experiments
- Draw conclusions which are consistent with the evidence, using scientific knowledge and understanding
- Describe safe and appropriate practical techniques
- Communicate findings from experimental activities using appropriate vocabulary, calculations and graphs
- Analyse and interpret data from experimental activities
- Evaluate data and methods

Typical AO3 question (core practical 2.23)

(b) A student uses this apparatus to investigate the need for carbon dioxide in photosynthesis.



(i) Explain how the student could use this apparatus to show that carbon dioxide is needed for photosynthesis.

(4)

(ii) The student is told that, after keeping the leaf in the flask for a day, he should cut the leaf into small shapes for testing.

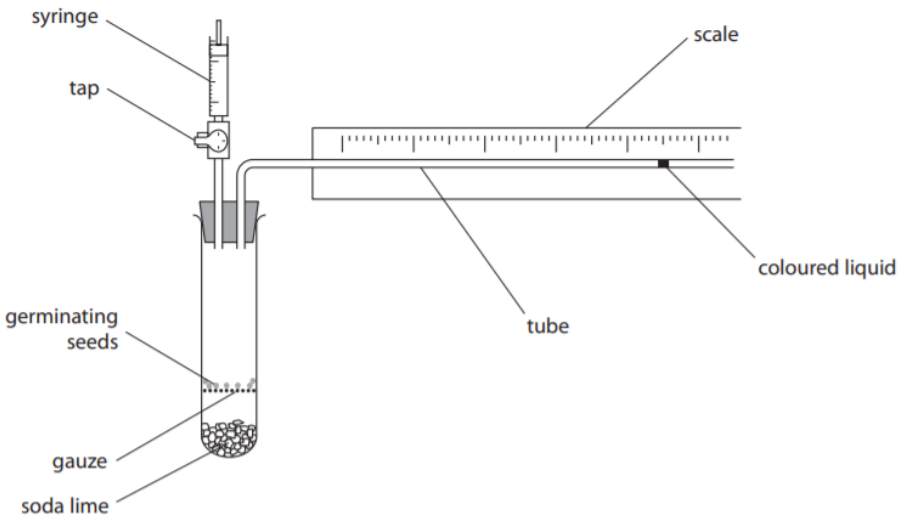
Suggest why this is a good idea.

(2)

Spec. 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

Experimental skills

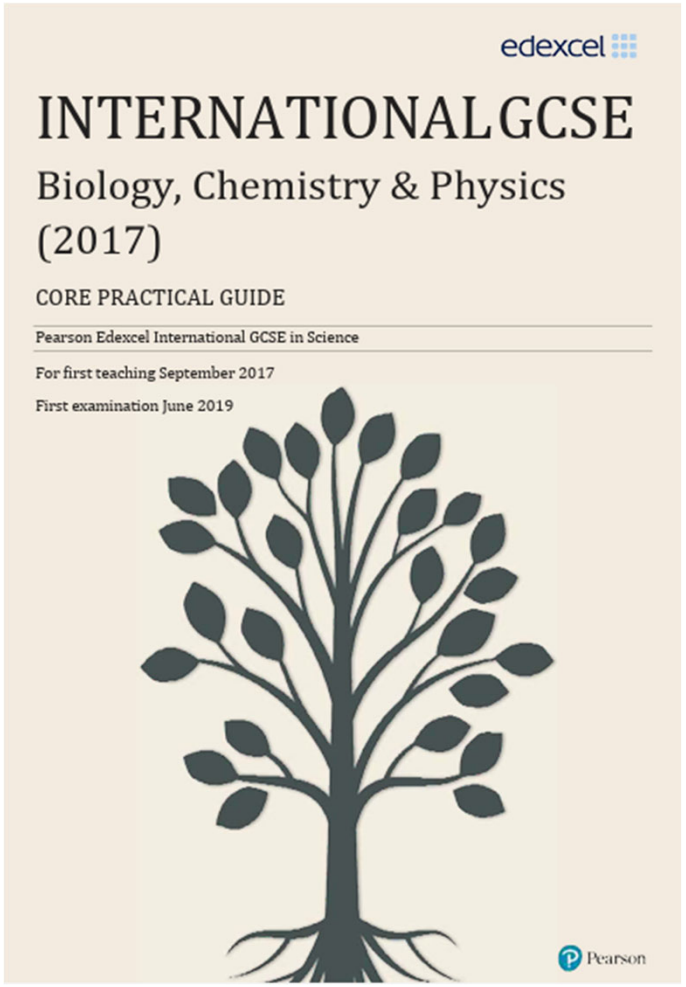
The best way to develop experimental skills is to embed practical investigations in teaching or theory. The development of knowledge and experimental skills can then happen together, leading to secure acquisition of both knowledge and skills.

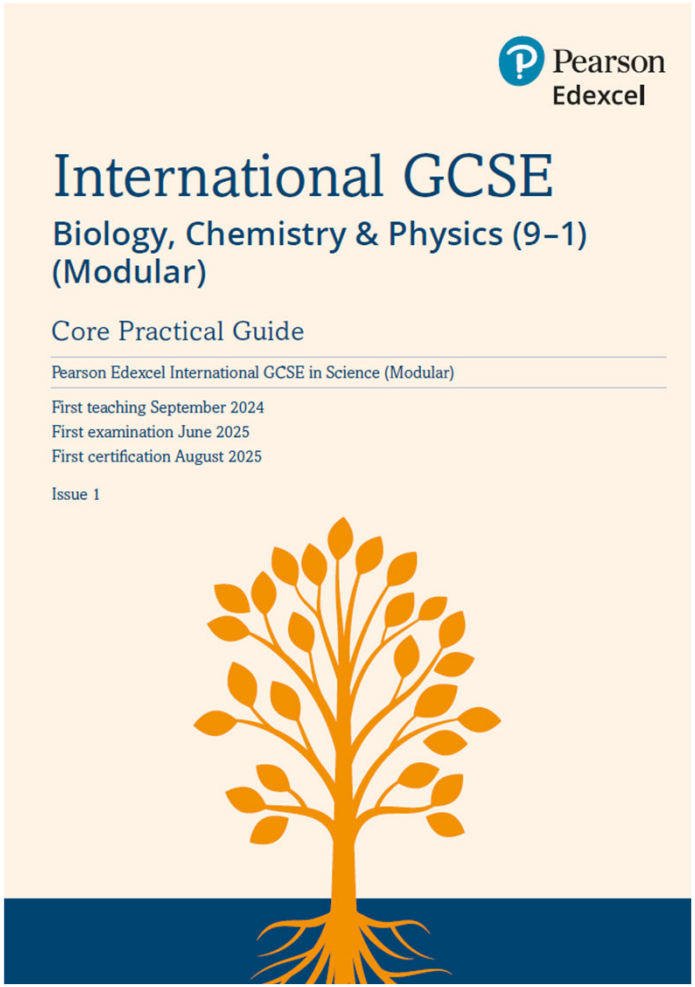
Our practical investigations are embedded within *2: Biology content* as specification points in italics. The skills developed through these and other practicals will be assessed through written examinations.

In the assessment of experimental skills, students may be tested on their ability to:

- solve problems set in a practical context
- apply scientific knowledge and understanding in questions with a practical context
- devise and plan investigations, using scientific knowledge and understanding when selecting appropriate techniques
- demonstrate or describe appropriate experimental and investigative methods, including safe and skilful practical techniques
- make observations and measurements with appropriate precision, record these methodically and present them in appropriate ways
- identify independent, dependent and control variables
- use scientific knowledge and understanding to analyse and interpret data to draw conclusions from experimental activities that are consistent with the evidence
- communicate the findings from experimental activities, using appropriate technical language, relevant calculations and graphs
- assess the reliability of an experimental activity
- evaluate data and methods taking into account factors that affect accuracy and validity.

Guide Booklets





Experimental planning (CORMS)

- These are AO3 planning questions.
- Allocated six marks.
- Candidates have to plan a valid experiment in an unfamiliar context.
- They are not focused on core practicals.
- Plan using 'CORMS' but write the plan in an experimental context using continuous prose (although bullet points can be used).

Change (control)	=	+ and - / range of values; Independent variable
Organism (biotic)	=	species / size / age / sex / eq; Controlled variable
Repeat (reliable)	=	more than one reading / eq;
Measure (precise/accurate)	=	mass / length / units / time / eq; Dependent variable (could be 2 marks)
Same (abiotic)	=	temp. / LI / water / eq; Controlled variable (could be 2 marks)

CORMS clarification

C – change:

- be clear what is being set up

O – organism:

- stated factors, not just “same animal”
- Avoid vague terms like “size”. Refer to mass / length etc.

R – repeats:

- for reliability must be at each value not at additional values
- idea of making it possible to take means

M - measure:

- usually, two marks
- usually for a change / before and after
- measurable quantities (length, mass) not just growth / size / amount.
- usually, a rate so specify a sensible time (appropriate);

S - same:

- usually, two variables that are relevant and would affect the results;

Activity 5-1 Write a CORMS mark scheme for (c)

(c) Plant growth substances stimulate root growth from a cut stem.

Describe an investigation to find the best concentration of plant growth substance to stimulate root growth.

You should include experimental details in your answer and write in full sentences.

(6)

Activity 5-1: Use this mark scheme to mark the student answers A, B, C.

Question Number	Answer	Additional guidance	Mark
10(c)	A description that makes reference to six of the following points: • C change / different concentrations of growth substances (1) • O same species / same plant / same type of plant/ named plant / same age / same size / eq (1) • R repeat (1) • M1 count number of roots / length of roots / measure roots with ruler / eq (1) • M2 stated time period of one day plus (1) • S1 same (control) temperature / oxygen / light / carbon dioxide (1) • S2 same compost / water / humidity / soil / mineral ions / named mineral ion / same <u>volume</u> of plant growth substance (1)	Auxin and no auxin = 0 M1 Ignore mass S2 Ignore nutrients	**6**

5-1 Answer A

I will take several oat seedlings. I will grow them so that their roots begin to develop. I will then add a range of different auxin concentrations to each of the roots. I will repeat each concentration with three plants to make it reliable. I will put the plants into soil and see how much they grow over a constant time period. I will keep everything the same, such as the amount of nutrients in the soil.

5-1 Answer B

I will make a range of concentrations of auxin. I will then take plants of the same species (and same age) and place the different concentrations of auxin on the roots of each one. I will repeat this two more times so that there are three for each concentration. I will measure the lengths of the roots for all the plants. I will put the plants into soil with the same compost (same mineral ion concentrations.) I will measure the lengths of the roots one week later to see how much they have grown. I will keep the oxygen and carbon dioxide concentrations the same.

5-1 Answer C.

Take two plants of the same species. Place the roots of one in plant hormones but not the other. The plant hormones should make the roots grow longer than the one without the hormones. This is because the plant hormones affect the speed which roots and shoots grow. The hormones used could include auxin which also affects phototropism and geotropism. I will repeat the experiment.

Planning practicals –helping lower grades

* When planning practicals, give lots of guidance

“The independent variable is _____”
“Two variables I need to control are _____”

* Give 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 - helping higher grades

* 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."

Developing AO3 skills

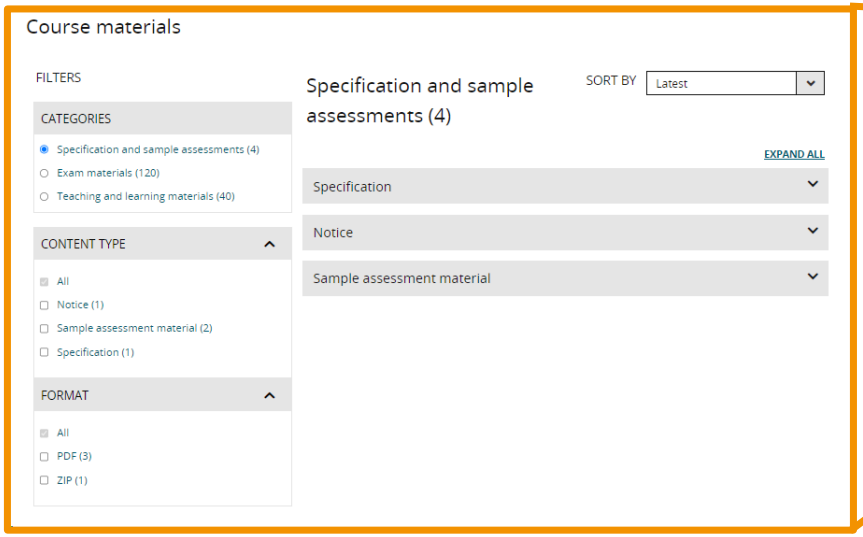
- Do lots of practical work – you do not need to restrict students to the core practicals. A significant proportion of marks is about practical skills and understanding – it needs teaching as much as factual content.
- Start early: pupils can begin to plan practicals from a very early age and become 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 students 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.

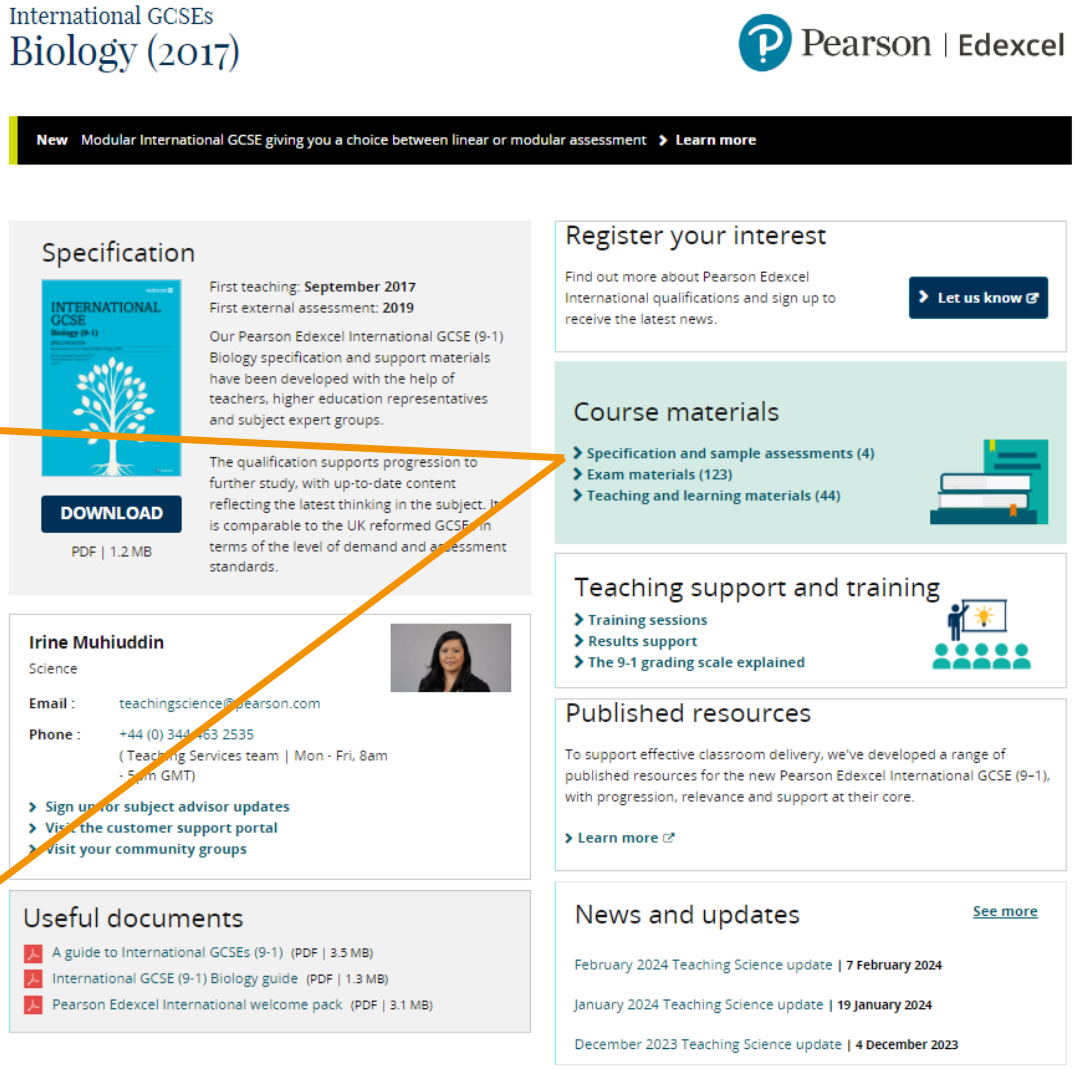
Support

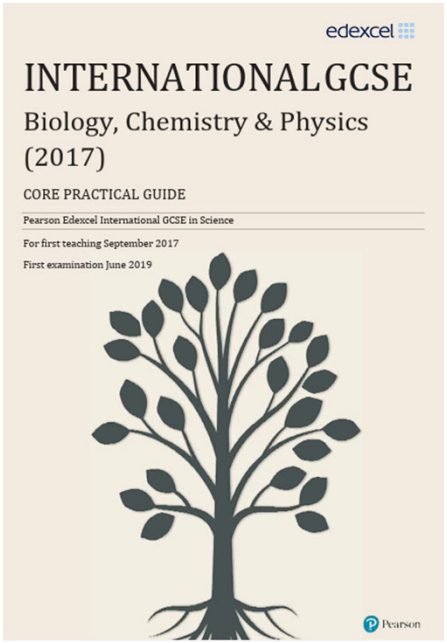
Support for you at every stage

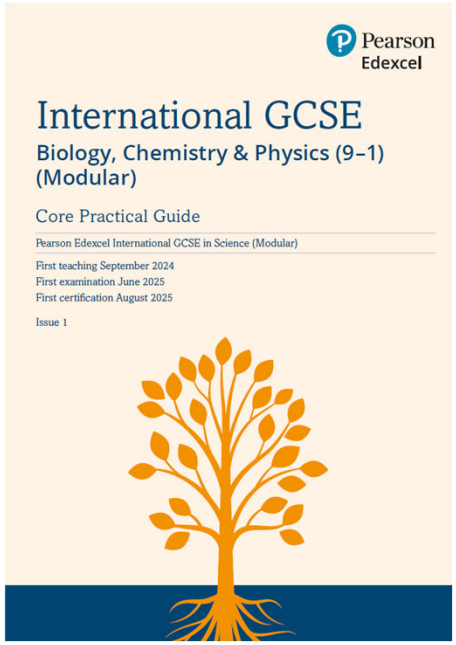
Free Resources and support	Planning, teaching and learning	Exam preparation and assessment	Results support
Getting Started Guide	✓		
Training Events (Face-to-Face & Online)	✓		
Subject Advisor Support	✓	✓	✓
Community Forums	✓	✓	✓
Schemes of Work	✓		
Skills Mapping	✓		
Sample Assessment Materials	✓	✓	
Examiner Reports	✓	✓	✓
Exemplar Marked Responses		✓	
Past Papers		✓	
examWizard		✓	
Mark Schemes		✓	
ResultsPlus Mock Exam Analysis		✓	
Results Plus		✓	✓
Access to Scripts Service (ATS)			✓

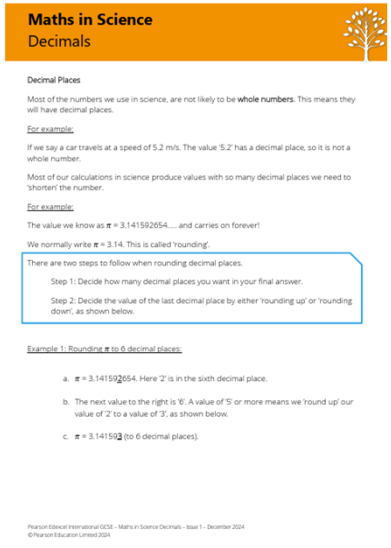
Teaching and Learning Materials online

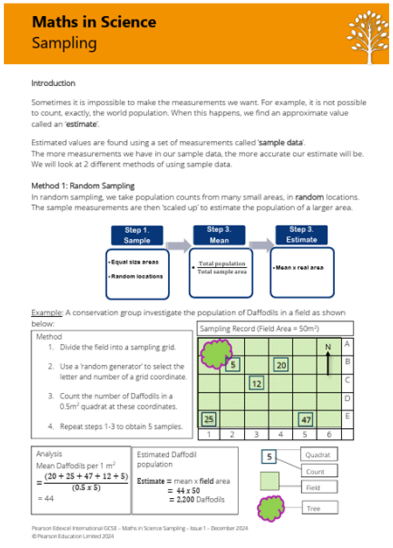


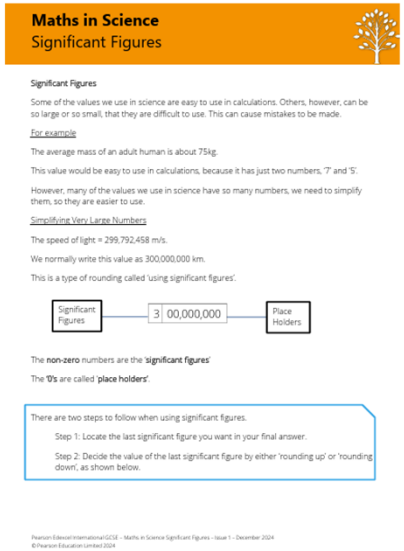


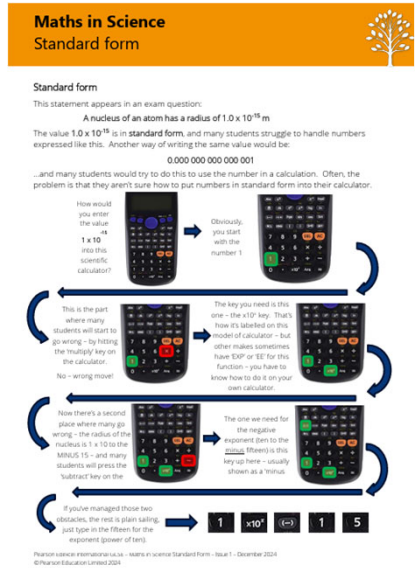


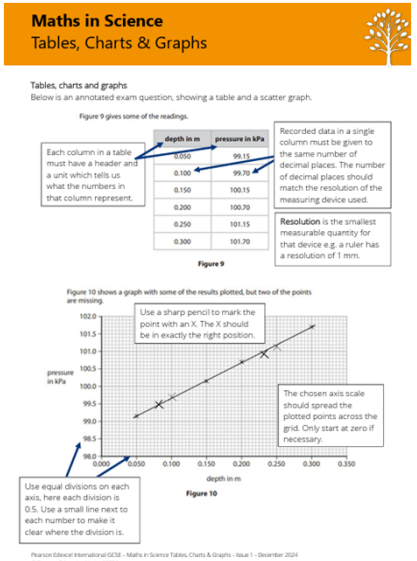












Support for Exam preparation and post results

ResultsPlus

- Free online results analysis tool for teachers.
- Provides a detailed breakdown of student performance in Pearson Edexcel exams.
- Identify topics and questions where the student could benefit from further learning and inform teaching strategies and approaches.
- Benchmark your school's performance against other Pearson Edexcel schools in your country.
- Not just a post-results tool: Mock exam results can also be fed into the system to produce analysis.
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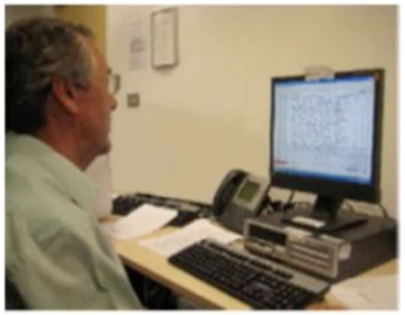
- ResultsPlus Direct gives your students access to their final grades and performance breakdown, wherever they are.
- Schools can sign up for free ResultsPlus account in just a few quick and easy steps: https://qualifications.pearson.com/en/support/Services/ResultsPlus.html

ResultsPlus

1.
Student takes exam on paper

2.
Exam papers scanned



3.
Examiners mark papers online

4.
Performance reports shared

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.

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.

Additional Paid Resource

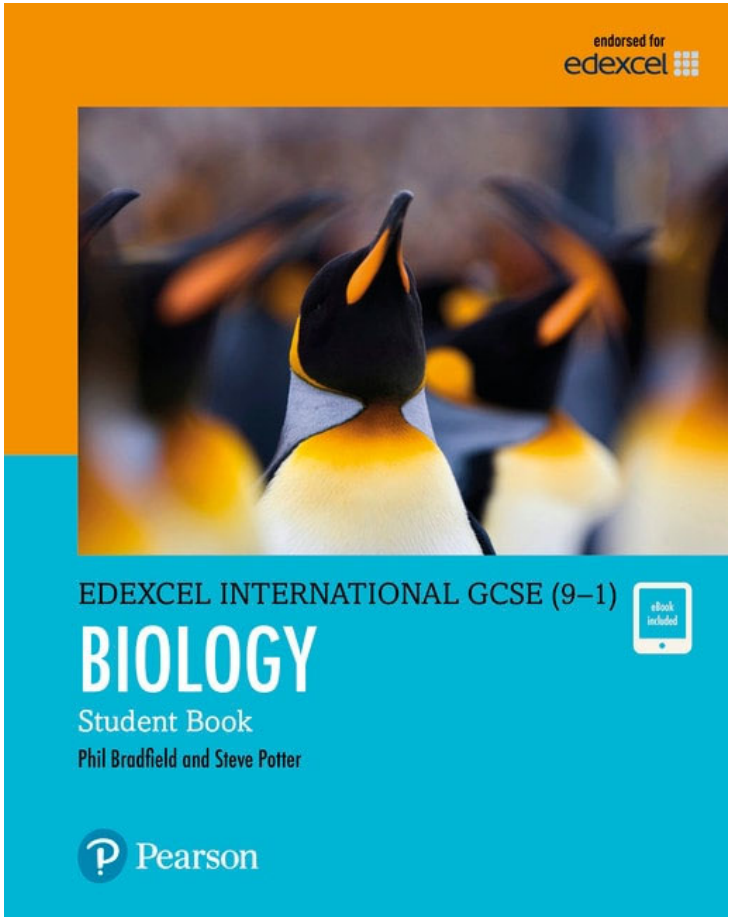
Resource	Planning, teaching and learning	Exam preparation and assessment	Results support
Curriculum-matched Student Books with ActiveBooks	✓	✓	
Teaching Hubs	✓	✓	

Pearson published resources

Student Book
Edexcel International GCSE (9-1): Biology Student Book
ISBN: 9780435185084

For more information and access to samples visit:

www.pearson.com/international-schools



International GCSE (9–1)

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