

Year 12 HSC courses.

A Strategy to improve student literacy & HSC results. The verb scaffolds are handed out and are used for homework questions

7.1 Table of Objectives and Outcomes for example: Biology

Step 1: Identify PFA & skills to be addressed:

	Objectives	Preliminary Course Outcomes	HSC Course Outcomes
Prescribed Focus Area	<i>Students will develop knowledge and understanding of:</i>	<i>A student:</i>	<i>A student:</i>
	1 the history of biology	P1 outlines the historical development of major biological principles, concepts and ideas	H1 evaluates how major advances in scientific understanding and technology have changed the direction or nature of scientific thinking
	2 the nature and practice of biology	P2 applies the processes that are used to test and validate models, theories and laws of science, with particular emphasis on first-hand investigations in biology	H2 analyses the ways in which models, theories and laws in biology have been tested and validated
	3 applications and uses of biology	P3 assesses the impact of particular technological advances on understanding in biology	H3 assesses the impact of particular advances in biology on the development of technologies
	4 implications of biology for society and the environment	P4 describes applications of biology which affect society or the environment	H4 assesses the impacts of applications of biology on society and the environment
	5 current issues, research and developments in biology	P5 describes the scientific principles employed in particular areas of biological research	H5 identifies possible future directions of biological research
Domain: Knowledge	6 cell ultrastructure and processes	P6 explains how cell ultrastructure and the coordinated activities of cells, tissues and organs contribute to macroscopic processes in organisms	H6 explains why the biochemical processes that occur in cells are related to macroscopic changes in the organism
	7 biological diversity	P7 describes the range of organisms in terms of specialisation for a habitat	H7 analyses the impact of natural and human processes on biodiversity
	8 environmental interactions	P8 analyses the interrelationships of organisms within the ecosystem	H8 evaluates the impact of human activity on the interactions of organisms and their environment
	9 mechanisms of inheritance	P9 explains how processes of reproduction ensure continuity of species	H9 describes the mechanisms of inheritance in molecular terms
	10 biological evolution	P10 identifies and describes the evidence for evolution	H10 describes the mechanisms of evolution and assesses the impact of human activity on evolution

Step 2: Identify skills that link topics or concepts together. Skills that may be unfamiliar for the students as they would not expect these to be questions they would be required to answer.

9 Content: Biology Stage 6 HSC Course

9.1 Biology Skills

During the HSC course, it is expected that students will further develop skills in planning and conducting investigations, communicating information and understanding, scientific thinking and problem-solving and working individually and in teams. Each module specifies content through which skill outcomes can be achieved. Teachers should develop activities based on that content to provide students with opportunities to develop the full range of skills.

HSC Course Outcomes	Content
<p><i>A student:</i></p> <p>H11 justifies the appropriateness of a particular investigation plan</p>	<p><i>Students will learn to:</i></p> <p>11.1 identify data sources to:</p> <ul style="list-style-type: none"> a) analyse complex problems to determine appropriate ways in which each aspect may be researched b) determine the type of data that needs to be collected and explain the qualitative or quantitative analysis that will be required for this data to be useful c) identify the orders of magnitude that will be appropriate and uncertainty that may be present in the measurement of data d) identify and use correct units for data that will be collected e) recommend the use of an appropriate technology or strategy for data collection or gathering information that will assist efficient future analysis <p>11.2 plan first-hand investigations to:</p> <ul style="list-style-type: none"> a) demonstrate the use of the terms 'dependent' and 'independent' to describe variables involved in the investigation b) identify variables that need to be kept constant, develop strategies to ensure that these variables are kept constant and demonstrate the use of a control c) design investigations that allow valid and reliable data and information to be collected d) design and trial procedures to undertake investigations and explain why a procedure, a sequence of procedures or repetition of procedures is appropriate e) predict possible issues that may arise during the course of an investigation and identify strategies to address these issues if necessary <p>11.3 choose equipment or resources by:</p> <ul style="list-style-type: none"> a) identifying and/or setting up the most appropriate equipment or combination of equipment needed to undertake the investigation b) carrying out a risk assessment of intended experimental procedures and identifying and addressing potential hazards c) identifying technology that could be used during investigations and determining its suitability and effectiveness for its potential role in the procedure or investigations d) recognising the difference between destructive and non-destructive testing of material and analysing potentially different results of these two procedures

<p>H12 evaluates ways in which accuracy and reliability could be improved in investigations</p>	<p>12.1 perform first-hand investigations by:</p> <ul style="list-style-type: none"> a) carrying out the planned procedure, recognising where and when modifications are needed and analysing the effect of these adjustments b) efficiently undertaking the planned procedure to minimise hazards and wastage of resources c) disposing carefully and safely of any waste materials produced during the investigation d) identifying and using safe work practices during investigations <p>12.2 gather first-hand information by:</p> <ul style="list-style-type: none"> a) using appropriate data collection techniques, employing appropriate technologies, including data loggers and sensors b) measuring, observing and recording results in accessible and recognisable forms, carrying out repeat trials as appropriate <p>12.3 gather information from secondary sources by:</p> <ul style="list-style-type: none"> a) accessing information from a range of resources, including popular scientific journals, digital technologies and the Internet b) practising efficient data collection techniques to identify useful information in secondary sources c) extracting information from numerical data in graphs and tables as well as from written and spoken material in all its forms d) summarising and collating information from a range of resources e) identifying practising male and female Australian scientists, the areas in which they are currently working and information about their research <p>12.4 process information to:</p> <ul style="list-style-type: none"> a) assess the accuracy of any measurements and calculations and the relative importance of the data and information gathered b) identify and apply appropriate mathematical formulae and concepts c) best illustrate trends and patterns by selecting and using appropriate methods, including computer-assisted analysis d) evaluate the relevance of first-hand and secondary information and data in relation to the area of investigation e) assess the reliability of first-hand and secondary information and data by considering information from various sources f) assess the accuracy of scientific information presented in mass media by comparison with similar information presented in scientific journals
<p>H13 uses terminology and reporting styles appropriately and successfully to communicate information and understanding</p>	<p>13.1 present information by:</p> <ul style="list-style-type: none"> a) selecting and using appropriate text types or combinations thereof, for oral and written presentations b) selecting and using appropriate media to present data and information c) selecting and using appropriate methods to acknowledge sources of information d) using symbols and formulae to express relationships and using appropriate units for physical quantities e) using a variety of pictorial representations to show relationships and present information clearly and succinctly f) selecting and drawing appropriate graphs to convey information and relationships clearly and accurately g) identifying situations where use of a curve of best fit is appropriate to present graphical information

<p>H14 assesses the validity of conclusions from gathered data and information</p>	<p>14.1 analyse information to:</p> <ul style="list-style-type: none"> a) identify trends, patterns and relationships as well as contradictions in data and information b) justify inferences and conclusions c) identify and explain how data supports or refutes an hypothesis, a prediction or a proposed solution to a problem d) predict outcomes and generate plausible explanations related to the observations e) make and justify generalisations f) use models, including mathematical ones, to explain phenomena and/or make predictions g) use cause and effect relationships to explain phenomena h) identify examples of the interconnectedness of ideas or scientific principles <p>14.2 solve problems by:</p> <ul style="list-style-type: none"> a) identifying and explaining the nature of a problem b) describing and selecting from different strategies those which could be used to solve a problem c) using identified strategies to develop a range of possible solutions to a particular problem d) evaluating the appropriateness of different strategies for solving an identified problem <p>14.3 use available evidence to:</p> <ul style="list-style-type: none"> a) design and produce creative solutions to problems b) propose ideas that demonstrate coherence and logical progression and include correct use of scientific principles and ideas . <p>VERY IMPORTANT!!!!!!!!!!!!</p> <ul style="list-style-type: none"> c) apply critical thinking in the consideration of predictions, hypotheses and the results of investigations d) formulate cause and effect relationships
<p>H15 explains why an investigation is best undertaken individually or by a team</p>	<p>The HSC course builds on the Preliminary course and further increases the students' skills in working individually and in teams. Refer to the content overview on page 14.</p>

Important:

Students receive HSC verb scaffold at beginning of Year 11.

Glossary of Key Words

Syllabus outcomes, objectives, performance bands and examination questions have key words that state what students are expected to be able to do. A glossary of key words has been developed to help provide a common language and consistent meaning in the Higher School Certificate documents. Using the glossary will help teachers and students understand what is expected in response to examinations and assessment tasks.

Account	Account for: state reasons for, report on. Give an account of: narrate a series of events or transactions	Distinguish	Recognise or note/indicate as being distinct or different from; to note differences between
Analyse	Identify components and the relationship between them; draw out and relate implications	Evaluate	Make a judgement based on criteria; determine the value of: Examine: Inquire into...
Apply	Use, utilise, employ in a particular situation	Explain	Relate cause and effect; make the relationships between things evident; provide why and/or how
Appreciate	Make a judgement about the value of	Extract	Choose relevant and/or appropriate details
Assess	Make a judgement of value, quality, outcomes, results or size	Extrapolate	Infer from what is known
Calculate	Ascertain/determine from given facts, figures or information	Identify	Recognise and name
Clarify	Make clear or plain	Interpret	Draw meaning from
Classify	Arrange or include in classes/categories	Investigate	Plan, inquire into and draw conclusions about
Compare	Show how things are similar or different	Justify	Support an argument or conclusion
Construct	Make; build; put together items or arguments	Outline	Sketch in general terms; indicate the main features of
Contrast	Show how things are different or opposite	Predict	Suggest what may happen based on available information
Critically (analyse/evaluate)	Add a degree or level of accuracy (depth, knowledge and understanding, logic, questioning, reflection and quality to analysis/evaluation)	Propose	Put forward (for example a point of view, idea, argument, suggestion) for consideration or action
Deduce	Draw conclusions	Recall	Present remembered ideas, facts or experiences
Define	State meaning and identify essential qualities	Recommend	Provide reasons in favour
Demonstrate	Show by example	Recount	Retell a series of events
Describe	Provide characteristics and features	Summarise	Express, concisely, the relevant details
Discuss	Identify issues and provide points for and/or against	Synthesise	Put together various elements to make a whole

Step 3: Complete the key word list

Account		Distinguish	
Analyse		Evaluate	
Apply		Explain	
Appreciate		Extract	
Assess		Extrapolate	
Calculate		Identify	
Clarify		Interpret	
Classify		Investigate	
Compare		Justify	
Construct		Outline	
Contrast		Predict	
Critically analyze/evaluate		Propose	
Deduce		Recall	
Define		Recommend	
Demonstrate		Recount	
Describe		Summarize	
Discuss		Synthesize	

Step 4: Test yourself!

Account		Distinguish	
	Identify components and the relationship between them; draw out and relate implications		Make a judgment based on criteria; determine the value of, examine, inquire into
Apply		Explain	
Appreciate			Choose relevant or appropriate details
	Make a judgment of value, quality, outcomes, results or size	Extrapolate	Infer what is known
Calculate		Identify	
	Make clear or plain		Draw meaning of
Classify	Arrange or include in classes/categories	Investigate	Plan, draw conclusions
Compare		Justify	
Construct		Outline	
Contrast	Make, build, put together items or arguments		Suggest what may happen based on available information
Critically analyze/evaluate		Propose	
Deduce		Recall	
Define		Recommend	Provide reasons in favour
	Show by example	Recount	
Describe		Summarize	
	Identify issues and provide points for and or against	Synthesize	

Step 5: List Biology topics and the key concepts you have studied this year using the syllabus dot points:

Maintaining a Balance

Enzyme activity
Homeostasis

The Blueprint of Life

Evolution

Evidence for evolution

Natural selection

The Search for Better Health

Gene expression and health
Infectious and non infectious disease
Cleanliness and water treatment
Louis Pasteur

Communication

Role of receptors, stimulus pathway, senses
Structure and function of the eye

***Step 6: Organise all topic concepts under the “Prescribe Focus Area”
H1-H5 headings:***

You will need to organize key points from each topic into each the prescribed focus areas (PFA: H1, H2, H3, H4, H5)

For example:

H3 assesses the impact of particular advances in biology on the development of technologies:

Maintaining a Balance:

Blueprint of Life:

The Search for Better Health:

Option1. Communication:

Step 7: Identify links and relationships from the four topic area concepts and start thinking about the “big picture” and common thread of biological principles.

For example: H3 assesses the impact of particular advances in biology on the development of technologies

Think about:

- The variety, roles and use of technology in the topic concepts above
- Relationships between each technology and how it has improved our understanding of biological processes
- Provide specific examples
- Explain the direct impacts on society and the environment using examples
- Identify and discuss the need for continued research in the future in reference to your specific examples
- Think about limitations such as cost, equality, morals and ethics
- Use the BOS verbs carefully!
- Verbs to use include: identify, discuss, describe, compare, explain, evaluate, assess and analyse
- Always include a judgment based on specific evidence or examples you have included i.e assess or analyse

Step 8:

Create a “concept statement” paragraph or question that links as many concepts or ideas from each of the topics and remember to address the verbs in your answer. This will be anywhere from a 6 mark to an 8 mark question. 100% guarantee you will have an extended response question.

All HSC exams test concepts not straight recall!

FOR EXAMPLE:

H3 assesses the impact of particular advances in biology on the development of technologies

We can link concepts and create a statement/question such as:

“The Development of new technologies has lead to major advances in our understanding of biological processes.

Assess the impact on our society and the environment”?

This question now addresses:

H1 evaluates how major advances in scientific understanding and technology have changed the direction or nature of scientific thinking

H3 assesses the impact of particular advances in biology on the development of technologies

H4 assesses the impacts of applications of biology on society and the environment

H5 identifies possible future directions of biological research

Example 1. My marking criteria you can use for the question above:

Criteria	Marks
<ul style="list-style-type: none"> • Demonstrates thorough knowledge of the technologies studied • Clearly states the relationship between each technology and how it has improved our understanding of biological processes • Links appropriate technologies to the possible impacts on society and the environment • Relates using these technologies to discuss the need for continued research in the future 	8
<ul style="list-style-type: none"> • Provides some information about the technologies studied • Clearly states the relationship between each technology and how it has improved our understanding of biological processes • Outlines an impact on society and the environment • Relates this technology to possible future research 	6-7
<ul style="list-style-type: none"> • Provides some information about the use of technologies in biology • States a relationship between technology and our understanding And • Outlines the possible impacts on society and the environment OR • Identifies the need for continued research in the future 	4-5
<ul style="list-style-type: none"> • Provides some information about technology OR • Shows a relationship between technology and our understanding OR • Outlines an impact on society or the environment technology OR • Identifies possible areas for future research 	2-3
<ul style="list-style-type: none"> • Provides some relevant information 	1

Step 9: Read carefully through the marking criteria to identify relationships and links between each topic and common concepts. You WILL see the pattern and realize the marking criteria are very similar for every extended response question!

Write your answer using the marking criteria as a guide then check your answer with the sample answer!!! This applies for physics, chemistry and Earth!!! Remember to use the verb scaffolds.

Example 2:

Question 30 (8 marks)

Explain how the contributions of Louis Pasteur, Robert Koch and MacFarlane Burnet have increased our understanding of the nature and prevention of infectious disease. 8

Criteria	Marks
<ul style="list-style-type: none"> Communicates succinctly, logically and sequentially using precise biological terms Provides a detailed knowledge and understanding of biological methodology and concepts and is able to adequately link these to the nature and prevention of disease Identifies biological research relationships between the named scientists Provides a clear understanding of the historical development of biological concepts and their applications and implications for society and the environment. Provides an understanding of valid experimental processes or appropriate technologies for developing biological ideas and their application to society 	7-8
<ul style="list-style-type: none"> Communicates effectively using biological terms Provides some knowledge and understanding of biological methodology and concepts and is able to adequately link some of these to the nature and prevention of disease Provides an understanding of some historical developments of biological concepts and their applications and implications for society and the environment AND Identifies biological research relationships between the named scientists OR links experimental processes and appropriate technologies to their application to society as related to the topic. 	5-6
<ul style="list-style-type: none"> Communicates using clear written expression Provides knowledge and understanding of some biological methodology and concepts and is able to show some linkage between them Provides some understanding of historical developments of biological concepts AND Identifies biological relationships between the named scientists OR identifies a named scientist and shows how their findings have assisted our understanding of the nature and prevention of disease OR links experimental processes and appropriate technologies to their application to society as related to the topic 	3-4
<ul style="list-style-type: none"> Provides a limited understanding and knowledge of the topic areas 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

[illegible]

In your responses, highlight the specific Prescribed Focus Areas you have addressed. Eg H1, H2, H3 H4, H5

Example 3:

Explain how our knowledge of chromosome structure has led to reproductive technologies that have the potential to alter the path of evolution. 8 marks

Criteria	Marks
<ul style="list-style-type: none"> • Demonstrates thorough knowledge of the structure of chromosomes • Clearly states the relationship between chromosome structure and inheritance • Links appropriate reproduction technologies to the nature of inheritance and chromosome • Relates using these technologies to possible impacts on evolution 	8
<ul style="list-style-type: none"> • Provides some information about chromosome structure • Clearly states the relationship between chromosome structure and inheritance • Outlines a reproductive technology • Relates this technology to possible impact on evolution 	6-7
<ul style="list-style-type: none"> • Provides some information about chromosomes • States a relationship between chromosomes and inheritance AND • Outlines a reproductive technology OR links chromosomes to evolution 	4-5
<ul style="list-style-type: none"> • Provides some information about chromosome structure OR • Shows a relationship between chromosomes and inheritance • OR • Outlines a reproductive technology OR • Relates chromosomes to evolution 	2-3
<ul style="list-style-type: none"> • Provides some information about chromosomes or evolution OR • Identifies a reproductive technology 	1

Your Answer:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Example 4: (7 marks)

Fungi are a natural source of antibiotics. A scientist developed a new antibiotic by exposing a fungus to radiation. Information relevant to this antibiotic:

- It stops the activity of an enzyme in pathogenic bacteria.
- It has no effect on a similar enzyme in humans.
- The chemical composition of the enzyme in humans differs from the enzyme in the pathogenic bacteria by two amino acids.
- It is used to treat humans infected with the pathogenic bacteria.

Using this example and other relevant knowledge, describe how advances in our understanding of biology have implications for society.

Criteria	Marks
<ul style="list-style-type: none">• Demonstrates a thorough knowledge and understanding of advances in our understanding of biology and their implications for society• Gives a thorough description of major advances in biology that have allowed the development and use of antibiotics• Relates the implications of the development of antibiotics to society• Demonstrates coherence and logical progression and includes correct use of biological terms	6-7
<ul style="list-style-type: none">• Demonstrates a sound understanding of advances in our understanding of biology and their implications for society• Gives a description of TWO major advances in biology that have allowed the development and use of antibiotics• Outlines the implications of the development of antibiotics to society• Communicates some scientific principles and ideas in a clear manner	4-5
<ul style="list-style-type: none">• Demonstrates some understanding of advances in our understanding of biology and their implications for society• Gives a description of ONE major advance in our understanding that has allowed the development and use of antibiotics• Outlines an implication of the development of antibiotics to society• Communicates ideas in a basic form using some general scientific terms	2-3
<ul style="list-style-type: none">• Provides a relevant statement about a major advance in our understanding of biology that could be linked to the development of antibiotics OR• Outlines an implication of the development of antibiotics to society	1-2

Your Answer:

[illegible]

Step 10: Use the answer in bold to write a suitable question for each multiple-choice questions below:

Question 1

- (A) Nitrogenous waste
- (B) Carbon dioxide
- (C) Lipid**
- (D) Salt

Question 2

- (A) Sugar, phosphate and bases
- (B) Lipids, DNA and protein
- (C) DNA and protein**
- (D) Genes and DNA

Question 3

- (A) Cilia, sweat, saliva**
- (B) T cells, B cells, antibodies
- (C) Inflammation, skin, phagocytosis
- (D) Stomach acid, mucus, lymph system

Question 4

- (A) He determined that mosquitoes transmit malaria.
- (B) He disproved the theory of spontaneous generation.
- (C) He developed a method for establishing that a particular microbe causes a disease.
- (D) He discovered how the body distinguishes between its own tissues and foreign cells.**

Short answer style questions:

Step 11: This time use the sample answer to write an appropriate question. You will need to think about the general area the answer is identifying and then use your glossary of key words (verb list) to create a possible question.

REMEMBER: *HSC questions are testing the concept and your ability to apply biological principles; not simple or straight out recall!*

Question 1 (5 marks)

Watson, Crick, Franklin and Wilkins were the scientists who determined the structure of DNA. Watson and Crick had a good relationship and worked closely together. Franklin and Wilkins did not work well together and there was some level of competition between them. Some of Franklin's images and results were shown to Watson and Crick by Wilkins. Franklin kept her results secret, which may have caused her to not publish them in time for her discovery to be acknowledged. The close collaboration between Watson and Crick, with the aid of Wilkins, enabled them to determine and publish their DNA model first.

Question 2 (5 marks)

Mutations can occur when nuclei divide (DNA replicates). In asexual reproduction this can mean that daughter cells are different from the parent. In sexual reproduction, if this occurs in the gametes, the offspring can be different in a particular characteristic than both parents. If this change gives a survival advantage then they are likely to reproduce and their offspring (daughter cells) will have the new characteristic. The frequency of this characteristic will increase in the population over time – this is evolution.

Question 3 (8 marks)

Eyesight and hearing are essential for normal communication between humans and impairment diminishes the quality of life of individuals. In terms of sight, cloudiness of the lens caused by aging or pathways associated with glucose metabolism prevents light getting to the retina. This can be treated simply by removing the lens and using spectacles to correct the focal distance, or replacing of the cloudy lens with a synthetic plastic one. Changes to the shape of the cornea or the length of the eyeball lead to hyperopia, myopia or astigmatism. These can be corrected with external lenses (spectacles or contact lenses) or by reshaping the cornea, eg LASIK. At this stage retina or optic nerve damage cannot be repaired but there is research being done with bionic eyes where charge coupled devices (CCDs) are being connected to nerves and emulate vision at low resolution. With hearing, hearing aids are used to amplify sound when the ability in the ossicles in the middle ear to respond to vibration decreases with age or abuse (loud sounds). These simply amplify the sound, but can be tuned to certain frequencies, which aids in isolating background noise. Bionic ears are used for people who are profoundly deaf due to damage to the hair cells in the cochlea but still have auditory nerve function. Essentially sound is sent by a receiver to the auditory nerves via wires implanted in the cochlea. The quality of sound is limited. With auditory nerve damage, an auditory brainstem implant can help. This is similar to the cochlear damage implant but connects directly to the auditory centre.