

Example unit plan – science

This unit plan was developed by Ochre Education and science teacher Darcie Clarke. It outlines her approach to teaching a Year 8 unit of science on cells, organs and tissues.



[Watch a video of Darcie talking about her teaching practices](#)



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Ochre Education and the Australian Education Research Organisation (AERO) have published 15 online lessons (and supporting resources), 10 of which are covered in this document. The lessons are available [here](#) and you can watch a video of Darcie talking about her teaching practices [here](#).

This unit plan is a supplementary resource for this work. It includes guidance on how the unit was structured and sequenced and can be used while interacting with the Ochre resources. The plan also allows teachers to see an example of planning for a sequence of lessons and reflect on their own teaching and effective practice. The unit plan is annotated to explicitly show some of the decisions that are made during the planning process.

Another way to use this unit plan is as a starting point for discussions with colleagues to build collective capacity for lesson and unit planning. Teachers can also use the unit plan to reflect on their own planning for lessons and units and guide future planning. A blank unit plan teachers can use and modify as a resource for their own planning can be accessed [here](#).

All the lessons from this unit can be accessed for free on either the [AERO](#) or [Ochre Education](#) websites.

Definitions

Knowledge

Awareness of pieces of information (such as facts, people and skills).

Learning objectives

Clear and easy-to-understand statements about what students are expected to be able to know, do and/or understand by the end of a period of instruction (not to be confused with the instructional tasks), and at what level this learning is to take place.

Tasks

Activities undertaken by students as part of the learning process. Carefully designed tasks can also assist students in mastering new knowledge or skills. Scaffolds and worked examples might be used to assist students with some tasks. Teachers can monitor their students' ability to complete tasks as part of a formative assessment approach to help determine whether students have demonstrated the success criteria.

Skills

Abilities and actions students can do using their understanding and knowledge.

Success criteria

A clear statement about the measure that will be used to prove whether, and how well, a student has met the learning objectives by the end of a period of instruction.

Understanding

The awareness of connections between pieces of information (such as facts, people and skills), that draw on students' knowledge.

Subject: Science

Year level/Stage: Year 8

Length

10 lessons
3 weeks' class time

Unit Name and Australian Curriculum Links

Cells, Organs and Tissues

- AC9S8U01
- AC9S8U02
- AC9S8H01
- AC9S8I02
- AC9S8I04

These content descriptors can be accessed at V9.0 of the [Australian Curriculum website](#).

Unit objectives

Students should be able to:

- identify a given cell as plant/ animal/prokaryotic based on diagrams or organelles, providing reasons for their thinking
- identify the net direction of diffusion based on relative concentrations and provide methods of increasing diffusion rate
- relate the structural features of various cell types to factors relating to increased rates of diffusion
- identify the effects of the disfunction of certain organs in the respiratory and digestive system
- identify dependent, independent and controlled variable in an experiment, and represent experimental data appropriately
- construct responses to explain and describe observations in various settings based on learned scientific theories.

Learning sequence and mastery learning – pre-requisite units/skills*

This unit builds on understandings from the [Year 7 Particles unit](#) (AC9S7U05) regarding particle movement and Year 6 Structure unit (AC9S5U01) regarding relationships between structure and function.

Learning sequence and mastery learning – post units/skills

Year 9 units addressing AC9S9U01 and AC9S9H03 build upon ideas developed in this unit.

* A good curriculum is constructed as a continuous sequence of learning that stretches over a number of years. It is important to consider what knowledge and skills students are likely to have had access to before this unit, as the lessons in this unit can both review and build upon these ideas

In addition, there will be future units that rely on the knowledge and skills built in this unit. It is important to know what future learning relies on this unit, as it will help inform our decisions about what students need to know and be able to do as they approach future units

Unit learning objectives

The learning objectives describe what students should know and be able to do at the end of the unit of learning. This list helps make explicit what the expected outcomes of the unit are. This information is useful in sequencing the unit – it is a place to keep checking back to in order to make sure that the lessons in the unit address each of these aspects.

Understanding	Knowledge	Skills	Vocabulary
<p>Students will understand:</p> <ul style="list-style-type: none"> every living thing is made up of one or more cells the cell is the basic unit of structure and function a cell's organelles contribute to its function within a larger organism the mechanism of diffusion the role of diffusion in body systems, including the digestive and respiratory systems the causes and treatments of burns. 	<p>Students will know:</p> <ul style="list-style-type: none"> cells are the building blocks of living things a cell is made up of a variety of organelles that contribute to its function the organelles that makeup plant and animal cells that net diffusion occurs from areas of high concentration to low concentration the organs and tissues involved in the digestive and respiratory systems the compositions of inhaled and exhaled air key elements of the life and work of Dr Fiona Wood. 	<p>Students will be able to:</p> <ul style="list-style-type: none"> compare and contrast prokaryotic and eukaryotic cells. identify a cell as prokaryotic based on its features. identify plant and animal cells. identify the net direction of diffusion of particles given a diagram explain the effect of various factors on diffusion identify the differences between risks and hazards in an experiment construct a table of values to display collected data define the structure and function of the digestive and respiration systems answer questions accurately which require them to describe and explain an observation. 	<p>Unicellular, multicellular, nucleus, prokaryotic cells, eukaryotic cells, organelle, cell membrane, cytoplasm, mitochondria, ribosome, endoplasmic reticulum, Golgi apparatus, cell wall, chloroplast, chlorophyll, vacuole, photosynthesis, diffusion, passive, organ, system, digestion, absorption, adaptation, cellular respiration, breathing, gas exchange.</p>

Evidence of learning

The evidence of learning considers what tasks we might set to check that students are making progress in the unit. It describes key tasks set at intervals throughout the unit that are used to make a judgement about how well students are progressing towards the learning objectives.

What evidence will we look for to determine whether students have made progress and mastered the unit objectives?

What will understanding and skill look like?

Task 1

Students will be able to apply their knowledge of cellular organelles to identify a cell and its likely role in a multicellular organism.

Task 2

Students will be able to relate the increased rate of diffusion of a substance across a membrane of high surface area:volume ratio to the structure of stomach cells.

Task 3

Identify the effects of the disfunction of certain organs in the respiratory system.

See [Appendix](#) for tasks and sample responses.

Lesson stages

Lesson stage	Review and recap Mastery learning	New learning	Formative assessment Check for understanding
	<p>What skills and knowledge should students practice as part of their introduction?</p> <p>What skills and knowledge are required for this lesson?</p> <p>How will students retrieve this knowledge?</p>	<p>What knowledge will be introduced in this lesson?</p> <p>How will the new learning be broken down to avoid overloading students?</p> <p>How will the new learning be spaced?</p> <p>How will the new learning be broken down into smaller chunks?</p>	<p>How will we know if students have mastered the skills and content?</p> <p>How will planned future lessons in this unit be reviewed given the level of mastery displayed in the formative assessment?</p>
<p>Lesson 1 Cell theory</p>	<p>Basic aspects of cell theory – how many of the students come in with knowledge of cells, including prokaryote and eukaryote cells?*</p> <p>No recap session – recap of some ideas featured in the body of the lesson.</p>	<p>What is a cell, and cell theory explanation.</p> <p>Differences between eukaryotic and prokaryotic cells, focusing on the role of the nucleus.</p> <p>Discussion of the role of membranes and the relationship to organelles in eukaryotic cells.**</p>	<p>Students will be required to identify given cells as eukaryotic or prokaryotic based on the presence of a nucleus.</p> <p>They will also use a Venn diagram to sort features of cells between eukaryotic/prokaryotic/both.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly cell theory and definitions of cell types.</p>

* The learning objectives describe what students should know and be able to do at the end of the unit of learning. This list helps make explicit what the expected outcomes of the unit are.

This is useful in sequencing the unit – it is a place to keep checking back to in order to make sure that the lessons in the unit address each of these aspects.

** The unit plan is different to a lesson plan. The full lesson plan will describe the ways in which the lessons are structured and paced. The unit plan describes how the learning objectives are sequenced and arranged across the unit. It helps define the focus of each lesson.

Lesson stage	Review and recap Mastery learning	New learning	Formative assessment Check for understanding
	<p>What skills and knowledge should students practice as part of their introduction?</p> <p>What skills and knowledge are required for this lesson?</p> <p>How will students retrieve this knowledge?</p>	<p>What knowledge will be introduced in this lesson?</p> <p>How will the new learning be broken down to avoid overloading students?</p> <p>How will the new learning be spaced?</p> <p>How will the new learning be broken down into smaller chunks?</p>	<p>How will we know if students have mastered the skills and content?</p> <p>How will planned future lessons in this unit be reviewed given the level of mastery displayed in the formative assessment?</p>
<p>Lesson 2 Animal cells</p>	<p>Cell theory, types of cells (prokaryotic and eukaryotic cells) and concept of uni- and multicellular.</p> <p>Review cell theory and the differences between prokaryotic and eukaryotic cells.</p> <p>Students identify a cell as prokaryotic or eukaryotic.</p>	<p>Introduction to animal cells.</p> <p>Description of organelles, with specific detail provided on:</p> <ul style="list-style-type: none"> • ribosome • endoplasmic reticulum • golgi mitochondria • apparatus. <p>These are introduced 2 at a time before checks for understanding.*</p> <p>Specialised cells. Describing blood cells (red, white blood cells and platelets). Relating structure to function of the cells.</p>	<p>Multichoice questions after introducing pair of new organelles, linking the function of the organelle to its name.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly organelle function and features of specialised blood cells.</p>

* Note the sequencing of information – chunking new elements into small sections and checking for understanding.

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<p>Lesson 3</p> <p>Ordering and comparing</p>	<p>Review concept of multicellular organisms, features of eukaryotic cells and test for any pre-existing knowledge of plant cell structure</p> <p>Review cell theory and the differences between prokaryotic and eukaryotic cells.</p> <p>Review major organelles in animal cells.</p>	<p>Introduction to plant cells.</p> <p>Description of plant cell organelles, with specific detail provided on:</p> <ul style="list-style-type: none"> • vacuole (larger in plants) • chloroplast • cell wall. <p>This is introduced 2 at a time before checks for understanding.</p> <p>Specialised cells. Describing root cells, transport cells (xylem and phloem) and stomata.</p> <p>Introduce photosynthesis as part of a description of photosynthetic cells with an indication of the role of chloroplasts and chlorophyll.</p> <p>Relate the actions of the stomata to the need for gas transport in and out of plant cells.*</p>	<p>Multichoice questions after introducing pair of new organelles, linking the function of the organelle to its name.</p> <p>A challenge question where students need to consider how they might differentiate an onion cell from a celery cell by looking at organelles.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly plant cell organelle function.**</p>

* A good unit plan carefully considers the sequence of learning. In particular, the amount of new learning in each lesson needs to be moderate. It is tempting to use most of the lesson time on new information to 'get through the content'. However, setting aside time for appropriate re-teaching and practice is absolutely crucial to ensure students master the content being taught.

** Formative assessment is an important aspect of lesson design and should be included in the unit plan. Information from the formative assessment tasks can be used to adjust the lesson or planned future lessons in the unit. The adjustments made from the formative assessment information must be balanced. It is important that the intended learning is secure; however, there is also a sequence of learning in the unit that is important. Spending more time on re-teaching and rehearsal of a concept need to be balanced with the need to give students the opportunity to learn further concepts.

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<p>Lesson 4 Diffusion</p>	<p>Review of what a particle is, the definition of kinetic energy and some testing of any pre-existing knowledge of diffusion.</p> <p>Quick review of diffusion from studies in Year 8, focusing on the movement of particles from areas of high concentration to low concentration.</p>	<p>Diffusion across a membrane, with the concentration gradient. Emphasis on it being a net direction. Students are to count particles on either side of the membrane to determine net movement.</p> <p>Factors involved in the rate of diffusion, including:</p> <ul style="list-style-type: none"> • SA:V ratio • temperature • degree of concentration differential. <p>Explanation of places in the body where diffusion across membranes is important, focusing on the cornea and the nephrons in the kidney.</p>	<p>Check for understanding relating to the fact that particles will diffuse for and against the concentration gradient.</p> <p>Written answers to questions relating to diffusion in the cornea and the kidney.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly the idea of net diffusion (with particles still moving) and effects of various factors on the rate of diffusion.</p>

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<p>Lesson 5 Diffusion experiment</p>	<p>Review the idea of net diffusion (with particles still moving) and effects of various factors on the rate of diffusion, as well as safety precautions in experimentation.*</p> <p>Review of diffusion across a membrane, net movement of particles from high to low concentration.</p>	<p>Introduction to a diffusion experiment involving the diffusion of food dyes at 2 different temperatures.</p> <p>Description of independent, dependent and controlled variables. Worked example identifying variables given a method. Students then identify variables in the diffusion experiment.</p> <p>Introduction to risks and hazards, and how to differentiate them. Generation of potential risks and hazards in the diffusion experiment.</p> <p>Worked example of drawing a table using experimental data, including titles, column headings, units and data themselves.</p> <p>Students can conduct the diffusion experiment (time taken for the dye to fully diffuse through a glass of water at 10 and 50 degrees) or use provided data. Enter the data into a table, using all of the required conventions.</p>	<p>Identification of variables, risks and hazards from experiment.</p> <p>Correct table formatting and data collection.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly the identification of variables and responses to risks and hazards.</p>

* Note that the review sessions primarily focus on the knowledge and skills that the lesson builds upon. When considering what to review, start with what knowledge is required for the coming lesson, and the degree to which the students have demonstrated competence. The review also forms a key component of mastery learning, providing the opportunity to re-teach elements where required.

Lesson	Review and recap Mastery learning	New learning	Formative assessment Check for understanding
	<p>What skills and knowledge should students practice as part of their starter?</p> <p>What skills and knowledge are required for this lesson?</p> <p>How will students retrieve this knowledge?</p>	<p>What knowledge will be introduced in this lesson?</p> <p>How will the new learning be broken down to avoid overloading students?</p> <p>How will the new learning be spaced?</p> <p>How will the new learning be broken down into smaller chunks?</p>	<p>How will we know if students have mastered the skills and content?</p> <p>How will planned future lessons in this unit be reviewed given the level of mastery displayed in the formative assessment?</p>
<p>Lesson 6 Digestive system</p>	<p>Primarily questions regarding prior knowledge of the function of various organs in the digestive system.</p> <p>Review of diffusion across a membrane, net movement of particles from high to low concentration.</p>	<p>Introduction to the differences between organs and systems.</p> <p>Description of the role of digestion – why it is important to the body, and then the mechanism of how it occurs, including peristalsis.</p> <p>Then spending time on the adaptations of the digestive system, with specific references to villi and rates of diffusion.</p> <p>Work through an example of responding to a question requiring an explanation of the function of diffusion in the digestive system using. Then students work on answering similar questions taking note of this worked example.*</p>	<p>Multichoice questions linking an organ’s function with its name and vice versa.</p> <p>Short answer responses to situations involving diffusion.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly identification of the identity and function of organs in the digestive system.**</p>

* There may be some instances in the unit where there is a key task that is known to be effective, and so it can be included in a little bit of detail in the unit plan.

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Lesson	Review and recap Mastery learning	New learning	Formative assessment Check for understanding
	<p>What skills and knowledge should students practice as part of their starter?</p> <p>What skills and knowledge are required for this lesson?</p> <p>How will students retrieve this knowledge?</p>	<p>What knowledge will be introduced in this lesson?</p> <p>How will the new learning be broken down to avoid overloading students?</p> <p>How will the new learning be spaced?</p> <p>How will the new learning be broken down into smaller chunks?</p>	<p>How will we know if students have mastered the skills and content?</p> <p>How will planned future lessons in this unit be reviewed given the level of mastery displayed in the formative assessment?</p>
<p>Lesson 7 Respiratory system</p>	<p>Review systems and check on any prior knowledge of the respiration system.</p> <p>Recap the differences between organs and systems in the body.</p>	<p>Description of the role of respiration – why it is important to the body, the major organs involved and then the mechanism of how it occurs, including gas exchange at the alveoli.</p> <p>Then spending time on the adaptations of the respiration system, with specific references to alveoli thickness and presence of capillaries.</p> <p>Work through an example of responding to a question requiring an explanation of the function of location of oxygen in the system. Then students work on answering similar questions taking note of this worked example.</p>	<p>Multichoice questions linking an organ’s function with its name and vice versa.</p> <p>Short answer responses to situations involving gas exchange.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly the purpose of various organs of the respiratory system and the adaptations required at the alveoli for diffusion,</p>

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<p>Lesson 8</p> <p>Composition of air</p>	<p>Review of data representation in an experiment, along with a probe of prior knowledge on atmospheric gas composition and gas exchange.</p> <p>Recap the respiratory system – its role and the organs involved.</p>	<p>Compare the composition of inhaled and exhaled air, giving particular focus to the percentage of nitrogen (unchanged), oxygen and carbon dioxide in the samples.</p> <p>Introduce the experimental method of an air composition experiment.</p> <p>Review the construction of a table using a worked example from an experiment. Then students draw a table featuring the data from the air composition experiment.</p> <p>Review elements of gas exchange from the previous lesson. Then determine the difference between discrete and continuous data, and the types of representations that are used to represent them.</p> <p>Using a provided set of axes, students plot the continuous data from the experiment.</p>	<p>Multichoice questions probing recall of important knowledge from the lesson.</p> <p>Development of a table using appropriate title, column headings, and units.</p> <p>Short answer questions relating to data analysis and interpretation using theory developed in this lesson.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly the changes in gas composition during respiration.</p>

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<p>Lesson 9 Dr Fiona Wood</p>	<p>Review of systems and organs, diffusion across membranes and probe for prior knowledge of burns.</p> <p>Recap levels of body organisation – tissues, organs and systems.</p>	<p>Introduce the life and work of Dr Fiona Wood, including her background and current roles.</p> <p>Describe the causes of burns and compare and contrast the degrees of burns. Include a worked example where students compare first and second-degree burns.</p> <p>Introduce Dr Wood’s development of spray-on skin, including the benefits it presents over regular graft treatments.</p> <p>Worked example of answering a question involving a short answer response requiring the explanation of a key point or idea.</p>	<p>Use a Venn diagram to describe differences and similarities between first- and second-degree burns.*</p> <p>Short answer descriptions of an opinion regarding Dr Wood’s work.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly the differences between burn degrees, the benefits of spray-on skin and the work of Dr Wood.</p>

* Use a variety of representations to collect information about student progress. A Venn diagram is a handy way of quickly categorising information, particularly when comparing and contrasting two or more elements.

Lesson	Review and recap Mastery learning	New learning	Formative assessment Check for understanding
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<p>Lesson 10 Review</p>	<p>Basic question review from across the lessons so far – focus on diffusion, function of the villi and features of prokaryotic cells.</p> <p>Review of cell theory and the key differences between eukaryotes and prokaryotes. Identify prokaryotic and eukaryotic cells given cell names and diagrams.</p> <p>Review levels of organisation, then the purpose of, and organs involved in, the respiratory systems.</p>	<p>N/A</p>	<p>Multichoice questions linking an organ’s function with its name and vice versa.</p> <p>Exit quiz focus: assessing mastery of learning objectives from this lesson, particularly levels of body organisation, ways of increasing rates of diffusion, adaptations of various cells based on functions.</p>

Appendix – Sample Evidence of Learning

Task 1

Students will be able to apply their knowledge of cellular organelles to identify a cell and its likely role in a multicellular organism

Question

There are two plant specimens without labels. You have been told one is from an onion and the other is from celery. Describe at least 2 ways you could identify the specimens.

Sample response showing evidence of understanding:

1. Check the colour of the specimen. Onion specimen will be clear coloured and celery specimen will appear as green due to chlorophyll present in the chloroplasts.
2. Examine the cells under the microscope. The celery specimen will have chloroplasts because it photosynthesises. Onions grow underground and do not photosynthesise, which suggests chloroplasts will not be found.

Task 2

Students will be able to relate the increased rate of diffusion across a membrane of high surface area:volume ratio to the structure of stomach cells.

Question

The inside of the small intestine is covered in finger like projections, as opposed to being smooth and flat. Here, nutrients are absorbed from the small intestine into the bloodstream. Explain why the small intestine has this unique structure.

Sample response showing evidence of understanding:

Having these projections, as opposed to a flat surface, increases the surface area of the small intestine. The projections create more surface for nutrients to diffuse across, so the rate of diffusion of these nutrients into the bloodstream is increased.

Task 3

Identify the effects of the disfunction of certain organs in the respiratory system.

Question

Create a flow diagram showing the path oxygen takes, from entering the nose/mouth, to entering the bloodstream. For each step, include a short description and a picture to illustrate the event.



Sample response showing evidence of understanding:

