For school teachers

Lesson plan – Year 8 science

Unit 1, Lesson 9: To review how particles diffuse

This lesson plan was developed by Ochre Education and science teacher Darcie Clarke. It outlines her approach to teaching a Year 8 science lesson on reviewing how particles diffuse.

- Watch the lesson video
- Watch a video of Darcie talking about her teaching practices
- View the science unit plan example
- Download sample lesson plan template
- View all other online lessons and supporting resources

This lesson is part of a unit on cells, tissues and organs. Ochre Education and the Australian Education Research Organisation (AERO) have published 15 online lessons (and supporting resources) that make up this unit. This is the first of the lessons in the unit – you can watch the lesson video here and you can watch a video of Darcie talking about her practice here.

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

Another way to use this lesson plan is as a starting point for discussions with colleagues to build collective capacity for lesson and unit planning. Teachers can also use the lesson plan to reflect on their own planning for lessons and units and guide future planning. A blank lesson 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

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.

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. Success criteria are observable actions that a student can perform to demonstrate their understanding of the learning objectives. It is important that these elements are observable – avoid using phrases like 'students will understand that...' as we can't observe understanding. Instead, the criteria could be 'students will write, say, make or do something that indicates understanding'.

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.

Subject Science: Cells, tissues and organs

Year level/Stage 8

Lesson background

This is the ninth lesson in the cells, tissues and organs unit, which is the first unit undertaken in Year 8. It builds upon the understanding of particles and particle movement developed in Year 7, as well as the understanding of living vs. non-living things.

This lesson background shows how the lesson is sequenced and positioned within the unit.

Learning objectives

In this lesson, students will learn to:

- understand the mechanisms of, and factors affecting, the diffusion of particles
- understand the role of diffusion in body systems.

Success criteria

By the end of this lesson, students will be able to:

- evaluate a diagram to determine the net direction of diffusion of particles
- explain the effect of various factors on diffusion
- apply the principles of diffusion to explain real-life examples in the body.

The success criteria are a series of clear statements that will be used to prove whether, and how well, a student has met the learning objectives at the end of a period of instruction.

Misconceptions

- Some students may believe that particle movement only occurs when a concentration gradient exists, and when concentration in a solution is even, particles are stationary.
- Another misconception is that when objects appear static, the particles within them possess no kinetic energy.

Misconceptions are incorrect knowledges and understandings that students have prior to the lesson, or may obtain during the lesson. Outlining these during planning can help with monitoring student learning, and recognising when corrective feedback is needed.

* In this column, you will find prompting questions to guide your planning for each lesson stage.

** In this column you will find prompting questions to consider when monitoring learning at each stage of the lesson.

Lesson stage*	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning**
Review of previous learning		
How will you ensure that students have the prerequisite skills and knowledge to progress their learning in this lesson? How will you activate prior knowledge/help students retrieve relevant learning from previous lessons?	Run a quick introductory quiz to assess prior knowledge about diffusion and its role in the body. Focus is on activation of prior knowledge around what a particle is, as well as misconceptions surrounding the movement of particles.*** 1. Overview of keywords: a. Particle b. Diffusion c. Kinetic energy	How will you gather evidence that shows you where your students are at in their learning?

*** This quiz acts as formative assessment to ascertain what students know and can do already.

It can be done online, as a paper test or using mini whiteboards.

The questions in this quiz will highlight key words to students (the first of repeat exposures) and will expose common misconceptions, such as particle movement stopping upon equilibrium in diffusion.

The level of success of students in this quiz will also inform the pace of the lesson, and whether detailed review of prior understanding is needed.

Lesson stage*	Tasks What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning**
(continued) How will you ensure that students have the prerequisite skills and knowledge to progress their learning in this lesson? How will you activate prior knowledge/help students retrieve relevant learning from previous lessons?	2. Opening questions and ideas:**** a. The definition of a particle. b. The movement of particles, including misconceptions around the static nature of particles if movement cannot be 'seen'. c. The presence of kinetic energy, and the misconception that it is only present in whole moving objects rather than particles themselves. d. The concept of diffusion and the misconception that particle movement will stop when equilibrium has been achieved.	(continued) How will you gather evidence that shows you where your students are at in their learning?

**** The ideas included in the quiz are either key concepts of prior knowledge, or common misconceptions. As this is the first unit covered in Year 8, I am assuming a low level of prior knowledge.

Students must have an understanding of particles, as well as kinetic energy in order to understand diffusion. Without understanding what a particle is, students will find it challenging to explain their movement in the phenomenon of diffusion.

Some common misconceptions here are that particles are static, and that static objects do not possess any kinetic energy of particles. Both of these are assessed in the starter quiz so they can be addressed, in order to correctly integrate new information into student understanding.

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Explicit teaching of new learning ('I do') – the process of diffusion		
How will you communicate the learning objectives to students? How will you break down your content into sequential steps to avoid overloading your students' working memory? How will you model the learning to support student understanding?	**Whole class:** 1. Read the learning objectives and success criteria to students, referencing back to them as they are encountered throughout the lesson. 2. Read lesson structure and keywords, so students can identify the next steps in learning and important concepts throughout the lesson.* 3. Explicit instruction of the concept of diffusion, including links to commonly encountered examples for students to contextualise new learning within an existing schema.**	How will you help students retrieve information learned in previous lessons, units? How will you check for understanding and correct any errors or misconceptions before moving onto guided practice?

* Students need to have an understanding of the scope and sequence of a lesson. This helps them to visualise the next steps for their learning, and to link work produced to achieving the success criteria.

It is also important in supporting the development of metacognitive skills around assessing their own understanding and abilities, recognising when support is needed, and knowing how to access it.

** Students will come into this lesson with a preconceived idea of concepts covered based on prior understanding and life experiences.

This can be challenging when this pre-existing schema contains misconceptions, but is also a tool for learning.

Being able to connect unfamiliar concepts to an existing schema will mean students can learn more readily. They will also form a deeper understanding of the new concepts and their connections to other ideas.

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
(continued) How will you communicate the learning objectives to students? How will you break down your content into sequential steps to avoid overloading your students' working memory? How will you model the learning to support student understanding?	4. Once this is established, introduce the definition of diffusion. A focus is on the key ideas of diffusion as passive, and net movement.*** 5. Work through two checks for understanding that target these common misconceptions. If students do not have a high level of success, have a verbal discussion explaining the incorrect answers.****	(continued) How will you help students retrieve information learned in previous lessons, units? How will you check for understanding and correct any errors or misconceptions before moving onto guided practice?

*** If the starter quiz has revealed a common misconception around the concept of continuous net motion, extra time can be spent unpacking this idea.

**** The checks for understanding are an important level of formative assessment.

These questions are quick and answers can be collected through online polls, holding up fingers, or mini whiteboards.

This prevents misconceptions from being integrated into student understanding as they can be identified here, and allows the opportunity for further explanation if required.

I will only move on when a high level of success is achieved as this tells me that students are ready to learn the next concept.

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Guided practice ('We do') – analysing and labelling diagrams showing diffusion		
What worked examples will you provide students? What scaffolds and instructional supports will you introduce, and how will students use these? How will students work together to progress their skills and understanding?	**Whole class:** 1. Show students a diagram of two different diffusion scenarios. Model the thought process around how to determine the net direction of diffusion.* a. Is there an equal concentration of particles on each side? b. Will there be an overall net direction of movement? If so, in which direction? c. How can we show this with arrows? 2. Students who can follow the first example easily can attempt the second example without the scaffolded steps. This gradual release of responsibility allows for differentiation in the amount of support needed during practice.** 3. Encouragement to complete the independent practice task that follows in the 'You do' phase. Emphasise the presence of the 'challenge' question.	How will you check for understanding and correct any errors or misconceptions before allowing students to independently practice?

* Modelling your thought process provides students with a step-by-step process for answering similar types of questions.

Breaking up thinking into small steps in this way reduces cognitive load. This means students can focus on one step at a time, and mental space is freed up to apply the complex concept of particle movement as influenced by concentration gradient.

** Not every student will need the same level of modelling before they are ready to attempt independent practice.

This allows students with a higher level of understanding to gain more independent practice, which is important for mastery of a concept.

In the classroom, I would allow students to work ahead independently while continuing at a slower pace to model the example for the majority of the class. The students who attempted independently can use the model to check their work.

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Independent practice ('You do') – analysing and labelling diagrams showing diffusion		
How will students display that they have mastered the skills and content? How will you work with students to provide support and to gain insight into their learning?	**Individual:** All students are encouraged to complete worksheet task 1 independently. Students who grasped the worked example easily can complete the 'challenge' task which requires a higher order of thinking around the same concept. The 'challenge' task also allows extra practice for students who complete worksheet task 1 and require repeated attempts to consolidate understanding. **Small groups:** For students who need more guided practice, gather them in a small group and work through one more example before they have the opportunity to work independently.* **Whole class:** Explain the answers to the independent tasks. Highlight common errors that may have been present, and explain choices made to achieve the correct answer.	What formative assessment will you gather to provide feedback to your students?

* Providing multiple scaffolds before independent practice means every student can demonstrate they understand the concept and the procedure before attempting it on their own.

This is a key step in ensuring mastery of a concept, as you can make sure students have the knowledge and skills needed before completing the independent task.

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Explicit teaching of new learning ('I do') – factors affecting diffusion		
	Whole class: 1. Explain the 3 key factors affecting the rate of diffusion. 2. Refer to diagrams to present examples of each scenario. Ask questions relating to modifications of the diagrams to encourage and scaffold students to connect changes in the factors with the effect on rate of diffusion. 3. Surface area is a more challenging concept. Further explicit instruction occurs here, outlining what surface area:volume ratio is. a. A question at a pause point here allows students to connect the concept of surface area:volume ratio with the key theme: its significance for human body function. b. It also promotes higher-order thinking (moving from what is happening to why it is happening). 4. As above, kinetic energy is a concept in which common misconceptions lie, and can be more challenging, so further explicit instruction is present here. 5. A check for understanding is completed. In the classroom, this can be done using fingers held up or mini whiteboards to gather data on whether students have understood the key concepts of the new learning. a. Move to 'we do' if most answers are correct. Spend time explaining incorrect responses if there is not a high success rate for this question.	

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Guided practice ('We do') – factors affecting diffusion		
	Whole class: 1. Model using a worked example, referring to a commonly experienced scenario, that has 2 parts. a. Model identification of key command and content words and explain how to apply each. b. Model answer to part a, first. as a simpler skill of 'describe'. Then follow with part b, as a more complex skill of 'explaining'. 2. Students who find part a easy may wish to attempt part b, then watch the modelled response to check their answer. 3. Encourage students who were able to answer one or both parts of the modelled answer without significant support to attempt the 'challenge' question for worksheet task 3.	
Independent practice ('You do') – explain factors affecting diffusion in the body		
	Independent: Encourage all students to work on their independent practice. Students who need extension can attempt worksheet task 3 and the 'challenge' task, or, to remove further scaffolding, only the 'challenge' task. **Small groups:** For students who need more guided practice, gather them in a small group and work through one more example before they have the opportunity to work independently. **Whole class:** Explain the answers to the independent tasks. Highlight common errors that may have been present, and explain choices made to achieve the correct answer.	

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Explicit teaching of new learning ('I do') – diffusion in the body		
	Whole class: 1. The final step in explicit instruction is to apply the concepts learned in the previous two cycles (diffusion, and factors affecting the rate of diffusion) to examples in the human body. 2. Provide an overview of the role of diffusion in the body, before focusing on two specific examples. This allows students to form a broader understanding of the significance and position their learning in context. 3. Explanation of diffusion in the eye.* a. A check for understanding here allows data to be gathered on whether students have understood this concept. This can be done using fingers held up or mini whiteboards. b. If a high level of success is achieved, move on. If not, the concept can be explained further, using student answers to guide. 4. Explanation of diffusion in the kidneys a. As the structure of the kidneys is a more unfamiliar example, spend time explaining the overarching structure before focusing on the tubule. b. To challenge students and highlight the why of kidney structure, questions can be asked to connect the structure of the tubule to surface area, and to the example of villi.** c. A check for understanding here allows data to be gathered on whether students have understood this concept. This can be done using fingers held up or mini whiteboards. d. If a high level of success is achieved, move on. If not, the concept can be explained further using student answers to guide.	

* As these examples discuss different body systems and focus on a different factor affecting diffusion, a check for understanding is important for each before moving on.

** This is an opportunity for students to link ideas discussed in the lesson. In this case, the factor of surface area with diffusion in a body system.

Highlighting the role of surface area here also helps to strengthen student understanding of this idea by presenting it in multiple contexts, and through providing repeat exposures to discuss this idea before they need to apply it in independent practice.

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Guided practice ('We do') – diffusion in the body		
	Whole class: Students have had guided and independent practice of the skills required through the previous two learning cycles. Encourage students to attempt worksheet task 3 independently. **Small groups:** For students who need more guided practice, gather them in a small group and work through one question as an example, then encourage them to complete the other available question independently.	
Independent practice ('You do') – diffusion in the body		
	Whole class: All students are encouraged to complete the worksheet task 3 questions. • 2 options are provided here to allow for differentiation of content, allowing for student strengths and interests. • Students who require challenge are encouraged to complete both questions. **Small groups:** For students who need more guided practice, gather them in a small group and work through one question as an example, then encourage them to complete the other question independently. **Whole class:** Explain the answers to the independent tasks. Highlight common errors that may have been present, and explain choices made to achieve the correct answer.	

Lesson stage	Instructional activities What are the specific classroom or instructional activities that you and your students will use in each stage?	Monitoring student learning
Lesson summary		
How will you show students how far they have come in the lesson? How will you review their learning? How will you help students reflect on, or summarise the most important parts of their learning?	1. Review the success criteria from the lesson, pointing to specific skills demonstrated by the students.* 2. Use the exit quiz to get a sense of what students know and are able to do as a result of the lesson.**	What evidence will you gather from your students to understand what you may need to review next lesson?

* This is an important step. It promotes the critical skill for students of reviewing and regulating their own learning- did I complete all the learning tasks? Did I achieve the success criteria for today? Is there anything I need to review before the next lesson?

** The exit quiz is a formative assessment of whether students can demonstrate skills and understanding relating to the success criteria.

It can be done in a range of ways: online, as a paper test, or using mini whiteboards.

The quiz allows students to test their understanding of the concepts and also provides me with data as to what they have understood. I will use this to inform retrieval practice and revision throughout the unit, and what the next steps in learning will be in the subsequent lessons.