

A LEVEL

Transition Guide

BIOLOGY A AND B (ADVANCING BIOLOGY)

H420, H422

For first teaching in 2015

KS4–KS5 Focus

Transport across membranes

Version 3

A LEVEL **BIOLOGY A AND B (ADVANCING BIOLOGY)**

Key Stage 4 to 5 Transition guides focus on how a particular topic is covered at the different key stages and provide information on:

- Differences in the demand and approach at the different levels;
- Useful ways to think about the content at Key Stage 4 which will help prepare students for progression to Key Stage 5;
- Common student misconceptions in this topic.

Transition guides also contain links to a range of teaching activities that can be used to deliver the content at Key Stage 4 and 5 and are designed to be of use to teachers of both key stages. Central to the transition guide is a Checkpoint task which is specifically designed to help teachers determine whether students have developed deep conceptual understanding of the topic at Key Stage 4 and assess their 'readiness for progression' to Key Stage 5 content on this topic. This checkpoint task can be used as a summative assessment at the end of Key Stage 4 teaching of the topic or by Key Stage 5 teachers to establish their students' conceptual starting point.

Key Stage 4 to 5 Transition Guides are written by experts with experience of teaching at both key stages.

Mapping KS4 to KS5	Page 3
Possible Teaching Activities (KS4 focus)	Page 5
Checkpoint tasks (KS4 focus)	Page 6
Possible Teaching Activities (KS5 focus)	Page 7
Possible Extension Activities (KS5 focus)	Page 8
Resources, links and support	Page 9

Key Stage 4 Content

GCSE content

- Explain the net movement of particles across partially permeable membranes by diffusion and osmosis, as a consequence of random movement of particles and in terms of concentration gradient.
- Investigate factors affecting the rate of diffusion and osmosis.
- Describe the consequences of osmosis in plant and animal cells.
- Explain the process of active transport in terms of moving particles across a membrane against their concentration gradient, using energy from respiration.



Key Stage 5 Content

A Level Content

- The movement of molecules across plasma membranes, to include: diffusion and facilitated diffusion as passive methods of transport across membranes, and active transport, endocytosis and exocytosis as processes requiring ATP as an immediate source of energy.
- Practical investigation(s) into factors affecting diffusion rates in model cells.

Comment

At GCSE movement of particles across membranes is restricted to simple diffusion, osmosis and active transport. Limited knowledge of the structure of the plasma membrane is required, other than that it is partially permeable and has the ability to pump ions across it using energy from respiration. Additionally, the process of osmosis is usually only considered in terms of relative concentrations of water particles. The progression to A-level demands that students have a detailed understanding of the structure of the plasma membrane, and how this relates to its function in the transport of molecules and ions across it. The concept of water potential, as opposed to water concentration, is usually introduced at this stage and the additional processes of facilitated diffusion, endocytosis and exocytosis are met for the first time.

At GCSE misconceptions are common. Students often have difficulty understanding the terms 'net' movement and 'concentration gradient', they struggle to differentiate between 'passive' and 'active' processes; and they frequently confuse concentration of 'particles' with concentration of 'solution'. Additionally, many students will also answer osmosis questions in terms of sugars diffusing across membranes rather than recognising that osmosis of water particles will occur instead. An awareness of these issues is essential to your teaching approach, and it may be helpful to consider the introduction of water potential at this key stage to avoid the inevitable confusion over the term 'concentration'.

The difficulties that students encounter at GCSE are often carried over to their A-level studies, and it is therefore preferable that any misconceptions are ironed out at the GCSE stage. Additionally, as facilitated diffusion involves membrane proteins, many A-level students believe that the process requires energy. Focusing on concentration gradient may be helpful when teaching this aspect of transport. Students are often quite adept at A-level in describing the structure of the plasma membrane, but struggle to relate this directly to the different transport functions it performs, and therefore an emphasis on explanation rather than description is helpful.

Activities

1. Ideas for Practical Work

Ideas for Practical Work - These are a series of experiments on 'Exchange of Materials' provided by the Nuffield Foundation in association with the Society of Biology.

<https://practicalbiology.org/exchange-of-materials>

The experiments include:

- the effect of size on uptake by diffusion using agar cubes
- observing osmosis, plasmolysis and turgor in plant cells
- investigating osmosis in chicken eggs
- investigating the effect of different concentration of blackcurrant squash on osmosis in chipped potatoes
- tracking active uptake of minerals by plant roots.

Each experiment comes with a teacher and technician guide and associated downloads.

2. Diffusion Computer Simulation

The diffusion simulation shows how the mass of particles, radius and temperature are related to how quickly different particles travel over an area. The interactive simulation allows you to collect and analyse data by changing different variables.

The online simulation is provided by PhET interactive simulations.

<https://phet.colorado.edu/en/simulation/diffusion>

3. Osmosis and water potential video

A YouTube video created by 'Amoeba sisters' which explores the process of osmosis. The video highlights real life examples of osmosis and introduces the concept of water potential. Students are able to observe the effects of water potential on animal and plant cells when placed in hypotonic and hypertonic solutions.

<https://www.youtube.com/watch?v=L-osEc07vMs>

4. 'Leaking Bag' investigation

In this activity a mystery is used to introduce the concepts of osmosis and diffusion. The resource can be downloaded from STEM learning.

For the activity two beakers are displayed at the front of the room. Both beakers look identical in that they both contain a plastic zip-lock bag with a starch solution inside. The zip-lock bags are both sitting in a clear solution. What the students don't know is that while the solution in one beaker is just water, the second also contains iodine. In beaker two, the colour of the solution inside the zip-lock bag will change. Students need to figure out why this is happening.

<https://www.stem.org.uk/resources/elibrary/resource/36707/leaking-bag>

5. Osmosis and Diffusion online lesson

Khan Academy has developed a series of videos and notes on diffusion and osmosis. You can use this resource as an example of flipped learning or revision. There is also a practice test at the end of the course.

<https://www.khanacademy.org/science/ap-biology/cell-structure-and-function/mechanisms-of-transport-tonicity-and-osmoregulation/v/diffusion-and-osmosis>

Checkpoint Task

This is a modelling task designed to assess student understanding of the concepts of diffusion, osmosis and active transport at GCSE level. It could be used as a summary assessment task at the end of teaching at GCSE, or as a starter activity when embarking on the teaching of membrane transport at A Level.

Students are given templates of oxygen, water, glucose and vitamin molecules, some membrane templates, and membrane protein pieces, along with some key word labels (if using). They should be challenged to complete three A4 summary diagrams using these, one for diffusion, one for osmosis and one for active transport.

Depending on the ability level of your students, they could complete this individually, or in small groups, and you may choose whether to furnish them with the key word labels or add challenge by leaving these out.

The task requires the students to think carefully about each of the processes before they start making their summaries, as there are a limited number of template pieces and they will need to decide which pieces they are going to use for each of their explanations.

You can encourage students to add their own annotations as well as using the pre-provided templates. Assessment of the summary sheets should give you a clear idea of student understanding of the key concepts, and allow you to add formative comments to their work.

Teacher Instructions:

<https://www.ocr.org.uk/Images/169854-transport-across-membranes-checkpoint-task-instructions.pdf>

Learner Activity:

<https://www.ocr.org.uk/Images/169855-transport-across-membranes-checkpoint-task.docx>

Activities

1. Build a Membrane

This is a paper model building exercise that helps students to visualise the structural components of a cell membrane, and is provided by the University of Utah.

<https://teach.genetics.utah.edu/content/cells/files/build-a-membrane.pdf>

2. Transport Mechanism Animations

A series of animations on passive and active transport; taught in context of homeostasis. They can be found by scrolling to the bottom of the page.

<https://www.abpschools.org.uk/topic/homeostasis-kidneys/3>

3. Practical Work Ideas

The Nuffield Foundation produce excellent practical activities, including teacher and technician guides, and student sheets with questions and answers. They have produced two experiments in association with the Society of Biology that are particularly relevant to the teaching of this part of the course, as follows:

Investigating the Effect of Temperature on Plant Cell Membranes

<http://www.nuffieldfoundation.org/practical-biology/investigating-effect-temperature-plant-cell-membranes>

Observing Osmosis, Plasmolysis and Turgor in Plant Cells

<http://www.nuffieldfoundation.org/practical-biology/observing-osmosis-plasmolysis-and-turgor-plant-cells>

Mapping KS4 to KS5

Possible Teaching
Activities (KS4 focus)

Checkpoint task

Possible Teaching
Activities (KS5 focus)Possible Extension
Activities (KS5 focus)Resources, links
and support

Activity

Comprehension and Summarising Activity

The chapter on 'Membrane transport' from the book 'An introduction to Biological membranes', gives detailed notes on diffusion and transport across cell membranes; with particular reference to the mechanisms of drug transport. This could be used as a précis activity where students are tasked to read the resource and then summarise the ways in which drugs and other substances are transported in and out of cells, up to a maximum of 2 A4 pages.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7182109/>

Mapping KS4 to KS5

Possible Teaching
Activities (KS4 focus)

Checkpoint task

Possible Teaching
Activities (KS5 focus)Possible Extension
Activities (KS5 focus)Resources, links
and support

Resources, links and support

Find resources and qualification information through our science page: <https://www.ocr.org.uk/subjects/science/>

Contact the team: science@ocr.org.uk

Follow us on Twitter, [@ocr_science](https://twitter.com/ocr_science)

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our Customer Support Centre.

Call us on
01223 553998

Alternatively, you can email us on
support@ocr.org.uk

For more information visit

 **ocr.org.uk/i-want-to/find-resources/**

 **ocr.org.uk**

 **/ocrexams**

 **/ocrexams**

 **/company/ocr**

 **/ocrexams**



OCR is part of Cambridge Assessment, a department of the University of Cambridge.

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored. © OCR 2021 Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number 3484466. OCR is an exempt charity.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please [contact us](#). You can copy and distribute this resource freely if you keep the OCR logo and this small print intact and you acknowledge OCR as the originator of the resource.

OCR acknowledges the use of the following content: N/A

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our [Expression of Interest form](#).

Please [get in touch](#) if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.

We really value your feedback

Click to send us an autogenerated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email address will not be used or shared for any marketing purposes.

