

Teacher Pack

Measuring the moisture content of sediments

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Icons used in this pack:



Briefing lesson



Lab lesson: Option 1 – run the experiment



Lab lesson: Option 2 – virtual experiment



Debriefing lesson

Introduction

This pack will help you to develop your learners' practical skills as defined by assessment objective C (AOC Practical skills and investigations) in the course syllabus.

Important note

Our *Teacher Packs* have been written by **classroom teachers** to help you deliver topics and skills that can be challenging. Use these materials to supplement your teaching and engage your learners. You can also use them to help you create lesson plans for other experiments.

This content is designed to give you and your learners the chance to explore practical skills. It is not intended as specific practice for Paper 2.

This is one of a range of *Teacher Packs* and each pack is based on one investigation. The packs can be used in any order to suit your teaching sequence.

The structure is as follows:

Lab lesson (1 hour*)	
Option 1 – run the experiment (part 1)	Option 2 – virtual experiment
This lesson allows the experiment to be run with your learners, providing an opportunity to practise experimental skills.	This lesson allows your learners to complete a virtual experiment, providing an opportunity to practise some experimental skills.



Lab lesson (1 hour*)
Option 1 – run the experiment (part 2)
This lesson allows the experiment to be run with your learners, providing an opportunity to practise experimental skills.

** the timings are a guide only; you may need to adapt the lessons to suit your circumstances.*

In this pack you will find lesson plans, worksheets for learners and teacher resource sheets.

Experiment: Measuring the moisture content of sediments

This *Teacher Pack* focuses on an investigation to measure the moisture content of sediments.

This uses differences in mass to determine the percentage of water in a moist sample of sediments.

This experiment has links to the following syllabus content (see syllabus for detail):

- 5.2.5 use and describe a suitable method for measuring moisture content of sand or sediments
- 5.5.2 compare the features of sandy and muddy shores
- 5.5.3 state that environmental factors affect the distribution of organisms on a sandy shore
- 5.5.4 describe how organisms are adapted to live on a sandy shore

The experiment covers the following experimental skills, adapted from **AOC: Practical skills and investigations** (see syllabus for assessment objectives):

- using a balance to measure mass
- using values to determine percentage differences.

Going forward

The knowledge and skills gained from this experiment can be used for when you teach learners about features and environmental factors on sandy and muddy shores, and explaining adaptations of organisms on a sandy shore.

Lab lesson: Option 1 – run the experiment (part 1)





Resources


- an accurate electronic balance (capable of measuring to at least 0.1 g)
- specimen bottles or jars (with lids) containing samples of wet sediments
- evaporating dishes
- access to an oven
- Worksheet A
- Worksheet B

Learning objectives

By the end of the lesson:

- **all** learners should record the mass of sediments before drying
- **most** learners should record masses before drying for a range of different samples
- **some** learners will be able to carry out repeat measurements for the same locations to enable calculating a mean

Timings	Activity
 15 min	<p>Starter/Introduction</p> <p>Introduce the investigation and the samples of sediments obtained. You could play at least the first minute of the <i>experiment video</i>, which shows how samples might be collected on a beach. The complete video could be shared with learners as something to watch as preparation for this lesson.</p> <p>Collecting samples of sediments on a beach could be worked into this lesson as part of some prior fieldwork of course.</p> <p>Discuss how to use a balance to obtain precise and reliable results, including recording the mass of the evaporating dish before adding a sample of sediments, so that this mass can be subtracted from both the wet and dry masses of sediments.</p> <p>Discuss safety considerations and ensure all learners are familiar with the hazards and steps to reduce the risk from these hazards.</p>
 30 min	<p>Main lesson</p> <p>Safety</p> <p>Circulate the classroom at all times during the experiment so that you can make sure that your learners are safe and that the data they are collecting is accurate.</p> <p>Share Worksheet A with learners, so that they understand the method they are going to perform.</p> <p>Learners carry out the investigation by weighing out samples of sediments on evaporating dishes, labelling these and placing the samples in an oven to dry (Samples should be left for at least 24 hours to ensure they are fully dry).</p>

	<p>Note: Learners must record the mass of the evaporating dish and wet samples during this lesson.</p> <p>Give learners copies of Worksheet B to record their results (Extension – stronger learners could be asked to first design their own table of results, which they can then compare to the example in Worksheet B).</p>
 A circular icon representing a 15-minute timer. It features a ring of black dots with three green dots at the top. In the center, the text '15 min' is displayed.	<p>Plenary</p> <p>Learners review the investigation so far and consider the samples they have used – could any factors affect the results they might obtain, such as variation in the size of particles/grains in the sediments, presence of organic remains such as macro algae etc?</p> <p>The investigation will be completed in the next lesson, once the samples have been dried in the oven (move on to lesson <i>run the experiment (part 2)</i>).</p>

Teacher notes



Watch the *Measuring the moisture content of sediments* video and read these notes.

Each group will require:

- an accurate electronic balance (capable of measuring to at least 0.1 g)
- specimen bottles or jars (with lids) containing samples of wet sediments
- evaporating dishes
- spatula to transfer sediments
- access to an oven
- Worksheet A
- Worksheet B

Safety

The information in the table below is a summary of the key points you should consider before undertaking this experiment with your learners.

It is your responsibility to carry out an appropriate risk assessment for this experiment.

Hazard	Steps to reduce risk
Field work hazards if learners collect samples	Consider providing samples for the learners to investigate. If learners collect their own samples this will need a thorough fieldwork risk assessment.
Harmful pathogens or pollutants in sediment samples	Do not touch face or mouth during investigation. Wash hands after handling samples.
Burns from hot equipment	Use an oven to heat and dry samples. Use heat proof gloves to remove samples from oven.

Experiment set-up



Teacher method



This is your version of the method for this experiment that accompanies the *experiment video*.

Do not share this method with learners. Give them [Worksheet A](#).

Before you begin

Plan how you will group your learners during the experiment session.

Think about:

- the number of groups you will need (group size 2–4 learners)
- the amount of equipment/chemicals required
- whether you are testing more than one sample of sediments (e.g. from different locations on a shoreline).

Experiment

Walk around the learners during the experiment in case they encounter any difficulties.

Step	Notes
Heating samples	Use an oven for safety and reliable results – heating over a Bunsen flame will result in sediment particles getting very hot and ‘spitting’ out of the evaporating dish – this can be dangerous, and will result in loss of mass due to sediment loss as well as loss of water.
Recording masses	Learners will need to record the mass of the evaporating dish before adding the samples of sediment as they need to subtract this mass from the wet and dry samples to determine the percentage loss of water.

Clean-up

After the experiment learners should:

- clean all glassware
- tidy up their work space
- ensure any spillages have been mopped up
- return all equipment and any unused sediments to you.

Lab lesson: Option 1 – run the experiment (part 2)






Resources

- an accurate electronic balance (capable of measuring to at least 0.1 g)
- evaporating dishes with samples that have been in an oven
- Worksheet A
- Worksheet B

Learning objectives

By the end of the lesson:

- **all** learners should record the mass of sediments after drying and determine the mass of water lost from each sample
- **most** learners should be able to calculate the percentage moisture content for a range of different samples
- **some** learners will be able to calculate percentages for samples from the same location and calculate a mean for each location

Timings	Activity
 10 min	Starter/Introduction Recap on the experiment and measurements that still need to be recorded. Learners should refer back to the method on Worksheet A and their results table on Worksheet B . Discuss safety considerations and ensure all learners are familiar with the hazards and steps to reduce the risk from these hazards.
 40 min	Main lesson Safety Circulate the classroom at all times during the experiment so that you can make sure that your learners are safe and that the data they are collecting is accurate. Learners continue with the investigation by weighing the dried samples of sediments on evaporating dishes, recording their results on Worksheet B. Learners clear away equipment before calculating the mass of water lost from each sample. They then attempt to calculate the percentage mass of the water in the moist samples for each sample (and repeat where appropriate) investigated. Learners evaluate the method and their results – consider aspects such as the variation in particle size in the sample(s) tested, any the presence of any organic matter (e.g. remains of organisms such as macroalgae).
 10 min	Plenary Learners share their results and compare percentage water content with other groups to identify how similar the results are.

	Discuss the implication of moisture content for organisms that burrow in the sand or sediments, and how these organisms might have adapted to better survive these conditions.
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Lab lesson: Option 2 – virtual experiment




Resources

- *Virtual experiment video*
- Worksheet B
- Worksheet B answers

Learning objectives

By the end of the lesson:

- **all** learners should determine the mass of water lost from each sample
- **most** learners should be able to calculate the percentage moisture content for a range of different samples
- **some** learners will be able to calculate percentages for samples from the same location and calculate a mean for each location

Timings	Activity
 10 min	Starter/Introduction Introduce the investigation. Discuss how to use a balance to obtain precise and reliable results, including recording the mass of the evaporating dish before adding a sample of sediments, so that this mass can be subtracted from both the wet and dry masses of sediments. Discuss safety considerations in the investigation and ensure all learners are familiar with the hazards and steps to reduce the risk from these hazards.
 40 min	Main lesson Learners watch the <i>virtual experiment video</i> and complete the results table (Worksheet B) when prompted, by taking information provided in the video. Learners use the results to calculate the mass of water lost from each sample. They then attempt to calculate the percentage mass of the water in the moist samples for each sample investigated. Learners evaluate the method and results – consider aspects such as the variation in particle size in the sample(s) tested, any the presence of any organic matter (e.g. remains of organisms such as macroalgae).
 10 min	Plenary Share Worksheet B answers with learners so that they can check their own calculations on the results table for accuracy. Discuss the implication of moisture content for organisms that burrow in the sand or sediments, and how these organisms might have adapted to better survive these conditions.

Worksheets and answers

	Worksheets	Answers
For use in <i>Lab lesson: Option 1</i>:		
A: method	14	
B: results	15	
For use in <i>Lab lesson: Option 2</i>:		
B: results	15	16



Worksheet A: Method

1. Collect all your equipment from the front of the class.
2. Label a clean dry evaporating dish with the location of the first sample.
3. Zero (tare) an electronic balance before placing the labelled evaporating dish on the balance. Record the mass of the empty evaporating dish in a results table.
4. Add approximately 20 g of sediment to the evaporating dish. Record the exact mass of the evaporating dish and the sediments in the results table.
5. Place the evaporating dish in an oven set at around 50 °C.
6. Repeat steps 2–5 for sediments from different locations.
7. Calculate the mass of the wet sediments used for each sample by subtracting the mass of the evaporating dish (A) from the mass of the evaporating dish containing the wet sediments (B)
8. The following day, remove each of the samples from the oven (taking care not to burn yourself on the hot evaporating dishes). Allow them to cool and record the mass of each sample in the evaporating dish.
9. Calculate the mass of the water lost from each sample by subtracting the mass of the evaporating dish containing dry sediment (C) from the mass of the evaporating dish containing the wet sediments (B).
10. The moisture content of each sample can be calculated as a percentage:

$$\frac{\text{mass of water lost}}{\text{mass of wet sediments}} \times 100$$

Look over your observations and data from the experiment and start to evaluate your findings.

Worksheet B: Results



Location of sediments	Mass of evaporating dish / g	Mass of evaporating dish and wet sediments /g	Mass of evaporating dish and dry sediments /g	Mass of wet sediments /g (B-A)	Mass of water lost from sediments /g (B-C)	Moisture content / % $(\frac{E}{D} \times 100)$
A	B	C	D	E		

Worksheet B: Results (answers)

Location of sediments	Mass of evaporating dish / g	Mass of evaporating dish and wet sediments /g	Mass of evaporating dish and dry sediments /g	Mass of wet sediments /g (B-A)	Mass of water lost from sediments /g (B-C)	Moisture content / % ($\frac{E}{D} \times 100$)
	A	B	C	D	E	
High tide	61.61	81.66	77.47	20.05	4.19	20.90
2	62.05	82.15	77.93	20.10	4.22	21.00
3	61.50	81.69	77.32	20.19	4.37	21.60
4	61.73	82.01	76.95	20.28	5.06	24.95
Low tide	61.97	82.12	76.87	20.15	5.25	26.05

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