Cambridge Assessment International Education

Teacher Pack
Investigating the particle profile of sediments on a shore

Cambridge IGCSE®

Marine Science

0967

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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 *Skills 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 3.

This is one of a range of *Skills 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:

Optional fieldwork lesson (1 hour*)
This lesson allows learners to obtain their own samples to investigate. This lesson may only be possible if you have easy access to a suitable coastline and the time and facilities to transport the group.

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Lab lesson (1 hour*)	
Option 1 – run the experiment	**Option 2 – virtual experiment**
This lesson allows the experiment to be run with your learners.	This lesson allows your learners to complete a virtual experiment.

↓

Debriefing lesson (1 hour*)
This lesson consolidates and builds on the progress learners have made.

** 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: Investigating the particle profile of sediments on a shore

This *Skills Pack* focuses on an experiment where the particle sizes are measured at different points on a shore profile to compare the composition of different sized particles on the shore.

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

- 5.2.4 use and describe a suitable method for measuring particle profiles in sand or sediments

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

- demonstrate knowledge of experimental techniques, apparatus and materials and how to use them safely
- make and record observations, measurements and estimates
- interpret and evaluate experimental observations and data
- evaluate methods and suggest possible improvements.

Prior knowledge

No prior knowledge is required for this experiment.

Going forward

The knowledge and skills gained from this experiment can be used for when you teach learners about adaptations of organisms to living on a sandy shore.

Optional Fieldwork lesson: Collecting samples

Resources	• a tape measure or string, at least 20 m • specimen tubes or jars large enough to hold at least 150 g of sand. • access to an oven to dry samples • worksheet **A**: Fieldwork method
Learning objectives	By the end of the lesson: • ***all*** learners should be able to place a tape measure as a transect and collect samples from along the line. • ***most*** learners should be able to obtain at least 5 samples at regular distances along the transect. • ***some*** learners will be able to collect a second set of samples from a second transect.

Timings	Activity
15 mins	**Starter/Introduction** **Safety** Brief all learners on key safety points that all must follow while collecting their data. Ask learners if they have any questions about the safety instructions to check everyone understands.
40 mins	**Main lesson** Learners place a transect line and collect samples to take back for analysis. Circulate around groups of learners and check none are at risk from a rising tide or any other safety issues.
5 mins	**Plenary** Discuss any issues relating to the sample collection and ensure all samples are labelled with the distance on the shore and the names of learners who collected the samples, to aid returning samples to the correct groups.

Lab lesson: Option 1 – run the experiment

Resources (for each group)	• samples of at least 150 g of sediment for each of 5 locations from a shore, pre-dried ready to use AND • a balance • a collection of sieves with mesh of different sizes • callipers to measure lengths

Learning objectives	By the end of the lesson: • ***all*** learners should record measurements of particles sizes for at least one sample • ***most*** learners should record measurements of particle sizes for a range of samples from across the shore • ***some*** learners will be able to evaluate the method and the data collected

Timings	Activity
10 min	**Starter/Introduction** Discuss the aim for the investigation to measure the particle sizes at different heights on the shore. Learners should design tables to record their results in – use the skills animation video designing tables to help them with this. Alternatively use worksheet **B** (you may need to adapt the headings to match the sieve sizes you have available).
45 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 work in pairs or small groups to measure the particle sizes for each of their samples.
5 min	**Plenary** Discuss any issues relating to collecting the data – e.g. were the samples thoroughly dry, could this have affected the grading through sieves?

Teacher notes

Watch the Investigating the particle profile of sediments on a shore video (teacher version) and read these notes.

Each group will require:

- samples of at least 150 g of sediment for each of 5 locations from a shore, pre-dried ready to use

AND

- a balance
- a collection of sieves with mesh of different sizes
- callipers to measure lengths

Safety

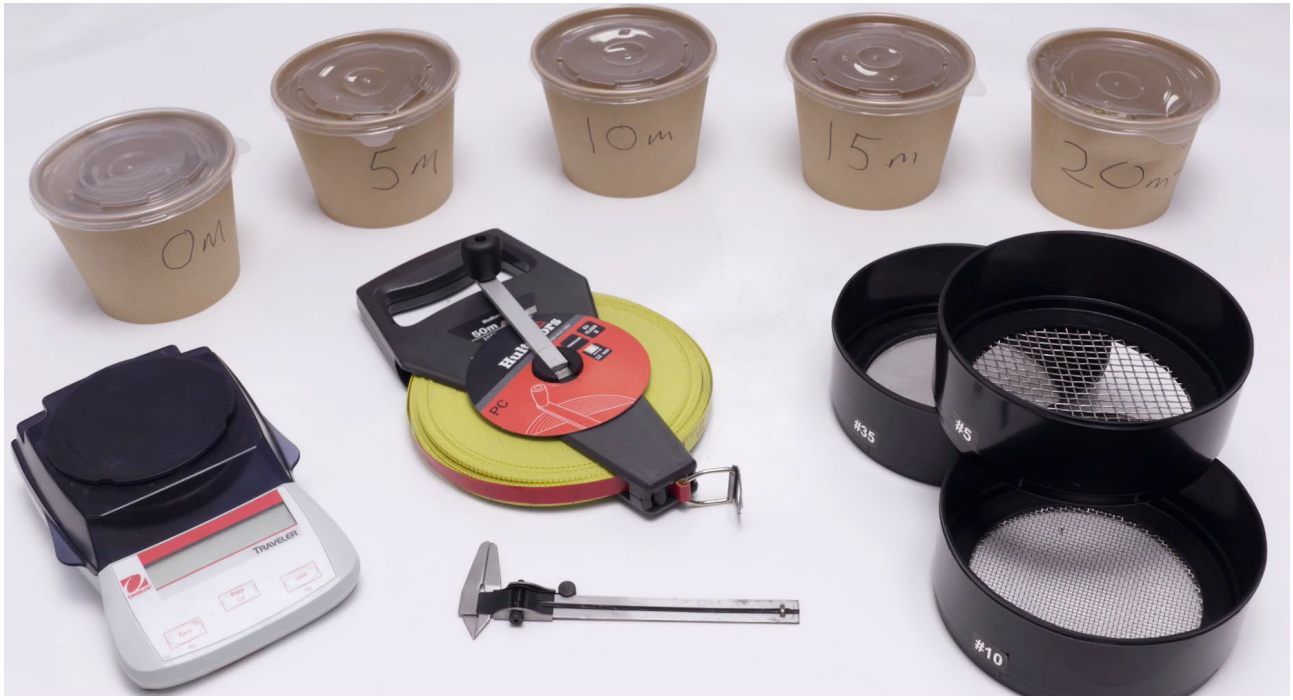
Wash hands after the practical – sediment samples may contain harmful microorganisms or pollutants.

If an oven is not available and samples are heated using a Bunsen burner wear eye protection and keep flames small to reduce the risk of particles becoming very hot and jumping out of the evaporating dish.

Follow all laboratory safety rules.

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

Experiment set-up



Teacher method

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

Do not share this method with learners. Give them **Worksheet C**.

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 required
- the number of sediment samples required

Experiment

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

Step	Notes
Using the balance	**Check learners are using the tare button (if available) or know how to record the mass of the beaker/container and subtract this from the mass of the beaker/container containing the sediments.**
Using callipers	**Check learners are using the callipers to measure larger pebbles accurately.**

Clean-up

After the experiment learners should:

- clean all glassware
- tidy up their work space
- ensure all sediments have been tidied/swept up
- return all equipment to you.

Lab lesson: Option 2 – virtual experiment

Resources	• video of investigation • results tables to complete (own or provided)
Learning objectives	By the end of the lesson: • ***all*** learners should record measurements of particles sizes for at least one sample • ***most*** learners should record measurements of particle sizes for a range of samples from across the shore • ***some*** learners will be able to evaluate the method and the data collected

Timings	Activity
10 min	**Starter/Introduction** Discuss the aim for the investigation to measure the particle sizes at different heights on the shore. Learners should design tables to record their results in – use the skills animation video designing tables to help them with this. Alternatively use worksheet **B**.
45 min	**Main lesson** Learners view the video and record the results in their results tables. Students review the video and note any comments about the method carried out to evaluate and suggest improvements to the method shown to improve the quality of the results and reliability of the investigation.
5 min	**Plenary** Discuss any issues from the video relating to collecting the data – e.g. were the samples thoroughly dry, could this have affected the grading through sieves?

Debriefing lesson: Investigating the effect of temperatur on the solubility of a solute in water

Resources	• graph paper
Learning objectives	By the end of the lesson: • ***all*** learners should plot a line graph of the data collected • ***most*** learners should be able to draw a suitable line of best fit • ***some*** learners will be able to explain their results using ideas about particles and dissolving

Timings	Activity
10 mins	**Starter/Introduction** Recall the practical and discuss the trend in the results collected and the most appropriate form of graph to show the trend (a line graph). Discuss the orientation of the axes (for this investigation we are investigating the effect of distance along the shore so this is the independent variable to be plotted on the x-axis and the dependent variable is the mass of sediments collected (for smaller sediments) or the mean diameter of sediments (for larger sediments). For smaller sediments they should separate sets of points and lines for each diameter grade the particles are separated into, using different colours or symbols for their lines. Discuss using the space available to choose an appropriate scale (try to use increments of 1, 2, 5 or 10 for ease of plotting and checking plots). If plots will all fit in less than half the scale then consider doubling the scale so the plots occupy more than half the scale.
30 mins	**Main lesson** Learners plot graphs of their data. Check the scales are appropriate as they do this and encourage learners to re-draw graphs with inappropriate scales or axes to make best use of the space available. Use this exercise as an opportunity for learners to develop and improve their graph drawing skills. Encourage learners to swap their graphs with another learner and check each others plotting and graph skills – provide feedback to each other on the accuracy of the plotting and use of space available.
20 mins	**Plenary** Discuss the implications of different sized particles for organisms living on the shore – for examplehow would the variation affect drainage of water or burrowing into the sediments?

Worksheets and answers

	Worksheets	Answers
For use in the optional *Fieldwork lesson:*		
A: Fieldwork Method	x	
For use in *Lab lesson: Option 1:*		
B: Results tables	x	
C: Method	x	
For use in *Lab lesson: Option 2:*		
B: Results tables	x	x

Worksheet A: Fieldwork Method

Use this worksheet with the optional fieldwork lesson.

Instructions

This worksheet can be used to if taking learners to a shore to collect their own samples. It can also be used as a guide to collecting samples in advance for learners to use in class if a fieldwork trip is not possible.

Different shores have different compositions of sand and sediment particles of different sizes. Some shores are composed of large pebbles, while other shores have sand or silt particles. This method will need to be adapted depending on the type of sediment present at the shore at different locations.

Large particles, such as pebbles and stones, can be measured using callipers.

Smaller particles of sand or silt must be collected, dried and then passed through mesh filters of different sizes.

Method

Place a tape measure or line with 1m intervals from the low tide mark up the shore.

Plan to collect at least 5 samples at equal intervals, for example for a 20m line you could sample every 5 m starting at 0m, 5m, 10m, 15m and 20m.

At each sample point fill a sample container with sediment, as close to the line and distance as possible. Label the container with the distance. Repeat this at each sample point along the line.

When back in the lab remove the lids from each container and place into an oven set at a low temperature to allow any moisture to evaporate over a few days.

Worksheet B: Results tables

Use this worksheet with the lab lesson.

Instructions

This worksheet can be used to support learners who have been unable to create a suitable results table.

For shores with large particles

distance up the shore / m	minimum and maximum diameter of particles / mm				
	1	**2**	**3**	**4**	**5**
0	to	to	to	to	to
5	to	to	to	to	to
10	to	to	to	to	to
15	to	to	to	to	to
20	to	to	to	to	to

For shores with small particles

distance up the shore / m	mass of sediment trapped in each sieve / g				
	> 3.8 mm	**1.8 – 3.8 mm**	**0.4 – 1.8 mm**	**0.2 – 0.4 mm**	**< 0.2 mm**
0					
5					
10					
15					
20					

Note the ranges for the grading sieves can be changed to match those used if different.

Worksheet C: Method

1. Use the balance to measure 100 g of dry sediments for one of the samples. If the particles are very large it may not be possible to obtain exactly 100 g, try to get as close to this as you can.
2. Use the grading sieves to separate the sample into different sizes.
3. Record the mass of each grade of sediments separated using the balance. Record these masses in your results table.
4. For larger sediment particles use the callipers to measure the largest and smallest diameters of each of 5 pieces chosen at random. Record these diameters in your results table.

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

Worksheet B: Results

Use this worksheet with the virtual lab lesson.

Instructions
This worksheet provides the results from the video.

For shores with small particles

distance up the shore / m	mass of sediment trapped in each sieve / g				
	> 3.8 mm	1.8 – 3.8 mm	0.4 – 1.8 mm	0.2 – 0.4 mm	< 0.2 mm
0	48.75	11.03	47.06	0.00	0.00
5	54.82	16.25	24.24	0.00	0.00
10	50.24	12.23	31.06	0.00	0.00
15	55.67	18.12	23.06	0.00	0.00
20	58.17	19.68	18.06	0.00	0.00

Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
t: +44 1223 553554
e: info@cambridgeinternational.org www.cambridgeinternational.org