AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES
SCHOOLS ENRICHMENT CENTRE (AIMSSEC)
AIMING HIGH

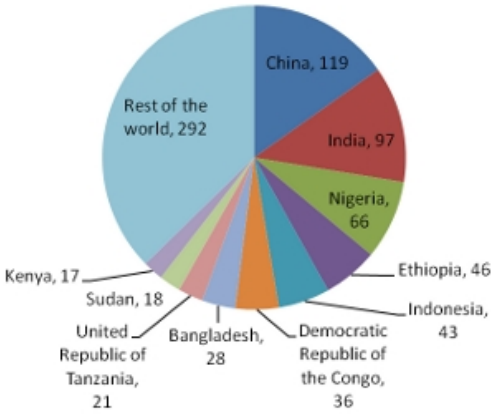
This INCLUSION AND HOME LEARNING GUIDE
suggests related learning activities for all ages from 4 to 18
on the theme of WATER

Just choose whatever seems suitable for your group of learners

The original DRINKING WATER learning activity was designed for Years 6 to 10

DRINKING WATER

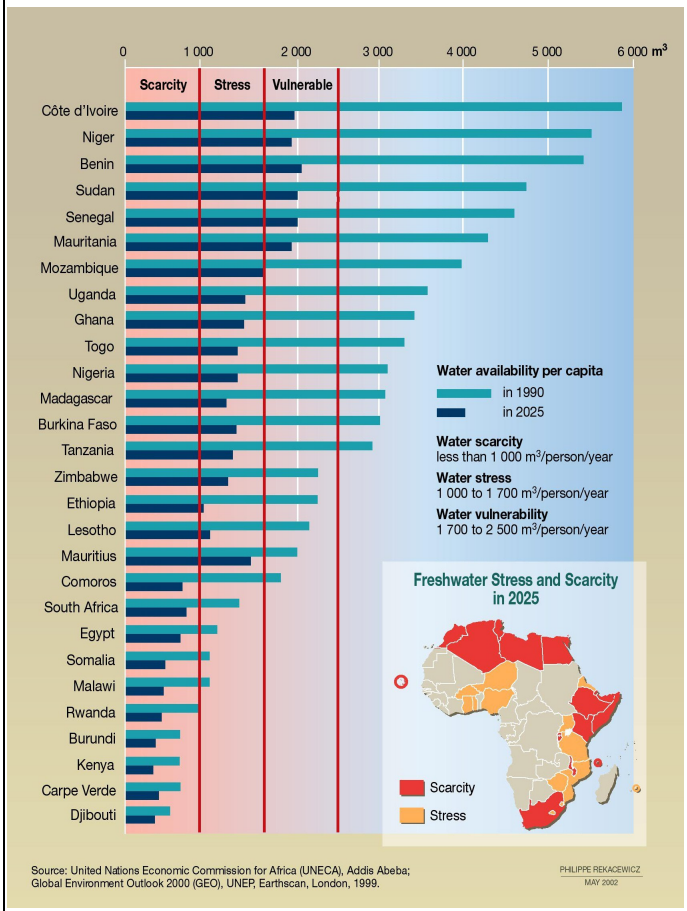
This United Nations Children's Fund pie chart shows the global locations of 783 million people who do not have safe drinking water.



The total world population in 2017 is 7.5 billion (7,500,000,000). What percentage of the world population is without safe drinking water?

The world population is forecast to rise to 8.2 billion by 2025. What percentage increase is this from 2017 to 2025?

The angle in the pie chart for China is 55°. How would you work this out? Calculate the angle in the pie chart for Nigeria.



The second chart compares water availability per person across Africa in 1990 with the expected availability in 2025.

Study this chart. What does it tell you?

Which countries will be vulnerable in 2025, having just enough water, that is more than 1700 cubic metres of water per person per year, but being at risk of shortages.

Use the red lines in the chart to find how many countries had plenty of water in 1990, how many were vulnerable, how many were stressed and how many had water scarcity?

What are the corresponding numbers expected for 2025?

Why do you think that the problem of water shortage is getting worse?

Write a short report on this problem.

You might find out more from these websites:
UNICEF https://www.unicef.org/wash/

Lifewater https://lifewater.org/

The Water Project https://thewaterproject.org/

Charity Water https://www.charitywater.org/

UNITED NATIONS http://www.unwater.org/water-facts/scarcity/

UNICEF https://www.unicef.org.uk/what-we-do/water-and-sanitation/

Evidence Action https://www.evidenceaction.org/

Water Aid http://www.wateraid.org/uk/what-we-do/statistics

Wikipedia https://en.wikipedia.org/wiki/Water_scarcity_in_Africa

HELP

Work out 783 million as a percentage of 7.5 billion

Work out the angle in the pie chart for China taking the number 119 as a fraction of 783 and multiplying by 360.

Work out the angle in the pie chart for Nigeria.

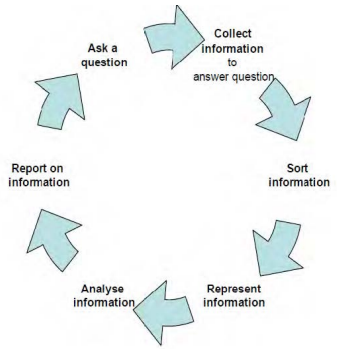
The countries that will be vulnerable in 2025 are Cote d'Ivoire, Niger, Benin, Sudan, Senegal, Mauritius and Mozambique.

Using the graphs as your source of data, fill in this table.

The numbers of African countries experiencing water shortages in 1990 compared to expectation for 2025				
	Plenty of water	Vulnerable	Stressed	Scarcity
1990	14		5	
2025				

NEXT

Carry out an individual or group project based on collecting data about water consumption in your own homes. Go through the complete data cycle as shown in the diagram and discuss your findings with your family or your class at school.



See Chapter 19 in the AIMSSEC Mathematical Thinking in the Lower Secondary Classroom book
https://aiminghigh.aimssec.ac.za/organising-workshops-for-teachers/

INCLUSION AND HOME LEARNING GUIDE

THEME: WATER

Early Years and Years 1 and 2

Water play, where you are lucky enough to have plenty of water, provides good early learning experiences for young children. Containers from the supermarket, that would otherwise be thrown away, are excellent toys for this play. The children should have the opportunity for free play. The play-learning can be enriched by play with sand and water, either at the beach or in a play area

For this activity choose about 8 containers of different sizes. Ask the children to think about how much water they will contain, and then ask them to arrange the containers in order from the one that contains least to the one that contains most. The pictures show 8 bottles and 8 cups but it's best to start with 3 or 4 and gradually build up the numbers you ask the children to arrange in order.

They can test to see if they were right about the order.

You could then ask the children to compare the capacity of these containers with the capacity of their own favourite drinking cup or mug.

For Year 2 children you can look at the labels on packs and bottles that say how many millilitres they contain.

Key questions

- Why do you think that container is the largest? (Or why is it the smallest?)
- Tell me about your ideas.
- Why do you think that?
- How will you test out your ideas?
- Why have you chosen that one as the smallest container?
- How many of cup 1 (or cup 4) will fill cup 8?
- How did you decide on that estimate?
- Tell me about your thinking.

Years 3 – 5 WATER CRISIS

In 2018, Cape Town was in danger of running out of water. The City of Cape Town rationed everyone to 87 litres per person a day and published this poster. Talk about the poster. Ask the children to say what they think the pictograph shows.

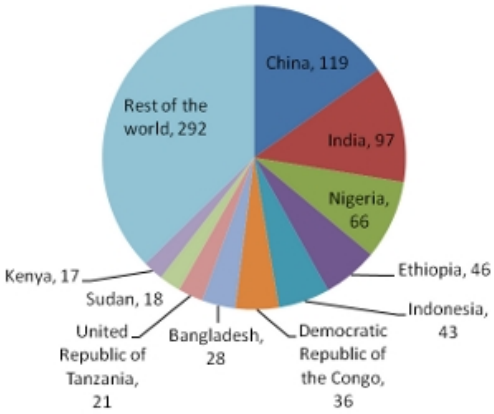
A few weeks later the City reduced the ration to 50 litres per person per day.

If you lived in Cape Town at that time, where do you think you could have saved 37 litres from the 87 litre allocation?

https://aiminghigh.aimssec.ac.za/years-4-8-water-crisis-1/

Years 6 – 10 DRINKING WATER

Give the learners copies of page 1 and talk briefly about how water shortage is a problem that affects many people in countries around the world.



If you have several learners at home, ask them to discuss the two graphs in pairs. Then lead a preliminary discussion based on what the learners say about the graphs.

Then review, with the learners, how to work out percentages. Give them some practice in calculating some of the angles for the pie chart (the method is given in the SOLUTION section).

Then ask the learners to study the second graph and answer the questions. You could ask the learners to find out more information and make posters about water shortage.

You may like to raise the question about the increasing population and how this contributes to the water shortage problem.

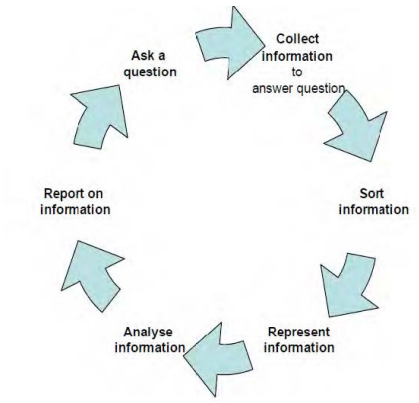
You may also want to relate this lesson to learning about volume and capacity and to introduce the facts that:
1 litre = 1000 cubic centimetres and 1 cubic metre = 1000 litres.
The class might estimate how much water they use per day using these guidelines:

Type of use	Estimated number of litres
Using water from a tap	5.5 litres per minute
Shower	9.5 litres per minute
Bath	190 litres
Toilet Low-flow toilet	13 litres per flush 6 litres per flush
Clothes washing machine	110 – 130 litres per cycle
Dishwasher	95 litres per cycle

Key questions

- Look at the pie chart. What information does it show?
- What is the significance of the figure 783 million?
- Can you explain how to work out the angles in a pie chart?
- Look at the bar chart. What do the blue horizontal bars show you?
- Look at the bar chart. What do you think the red vertical lines show you.
- What do you think the words SCARCITY, STRESS & VULNERABLE mean in relation to access to a supply of safe drinking water?
- Why do you think that, despite the huge investments made each year to provide safe drinking water for communities, more people than ever before are at risk of experiencing water scarcity in the next few years?

Why do this activity?



Part of the **DRINKING WATER** question can be given to 11 or 12 year olds. Learners could collect data about water consumption in their own households for a mathematics project involving the complete data cycle.

The class can then share a discussion and begin to think about problems that they see on TV that are far from their own experience, or perhaps about problems closer to home. The activity can be re-visited by older learners.

Learners are asked to analyse and interpret graphs relating to environmental and socio-economic issues, to discuss the graphs, ask their own questions and to write about the issues. References are given so that learners can find out what is being done to provide water for people and to improve this situation.

Many school curricula aim to educate learners in citizenship by making them aware of social, economic and environmental issues. This activity gives an opportunity for critical analysis, and the development of ideas of social issues such as population and living conditions for people around the world.

Learning objectives

In doing this activity students will have an opportunity to:

- revise the calculation of percentages;
- development their ability to interpret data;
- development critical analysis of data;

Generic competences

In doing this activity students will have an opportunity to:

- develop awareness of environmental issues;
- develop the ability of critical thinking in relation to statistics that the see on the media.

Upper Secondary – Years 10 – 13

This is a question for discussion. Do you think that the information for the different learning activities in this Inclusion and Home Learning Guide is represented clearly to make it easy for people to understand? Why or why not?

What can we learn from these statistics?

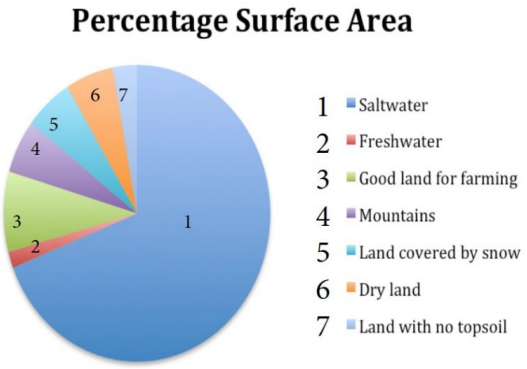
DRINKING WATER

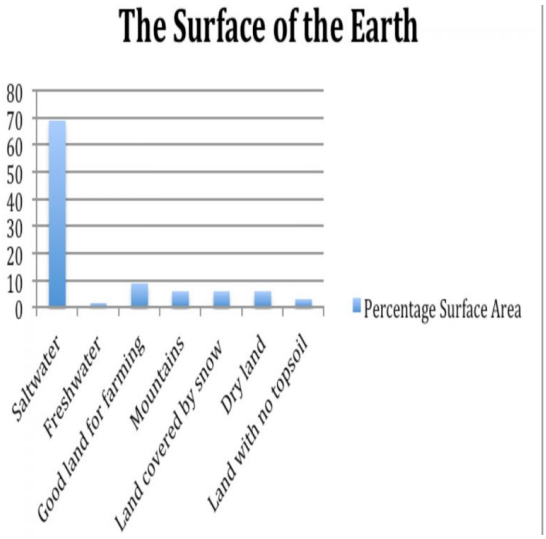
First do the question on page 1 about Drinking Water. You will have met pie chats before but the bar chart (with horizontal bars) is more unusual. It conveys a lot of information in one diagram.

LAND AND SEA STATISTICS

The table below gives data on the land and sea covering the Earth's surface, represented in a pie chart and a frequency bar chart . Which of the charts gives the best representation of the information in the table? Why?

The surface of the Earth	Surface area km²	Percentage Surface Area
Saltwater	352,103,700	69.03
Freshwater	9,028,300	1.77
Good land for farming	44,682,307	8.76
Mountains	29,788,205	5.84
Land covered by snow	29,788,205	5.84
Dry land	29,788,205	5.84
Land with no topsoil	14,894,102	2.92





For more information see: Land and Sea Statistics
https://aiminghigh.aimssec.ac.za/years-10-12-land-and-sea-statistics/

SOLUTION – DRINKING WATER

783 million as a percentage of 7.5 billion = (783,000,000 ÷ 7,500,000,000) × 100

= 10.44%

To work out the angle in the pie chart for China take the number 119 as a fraction of 783 and multiply by 360 to get (119 ÷ 783) × 360 = 54.7° or 55° to the nearest degree.

The angle in the pie chart for Nigeria is (66 ÷ 783) × 100 = 30.3° or 30° to the nearest degree.

The countries that will be vulnerable in 2025 are Cote d'Ivoire, Niger, Benin, Sudan, Senegal, Mauritius and Mozambique.

The numbers of African countries experiencing water shortages in 1990 compared to expectation for 2025

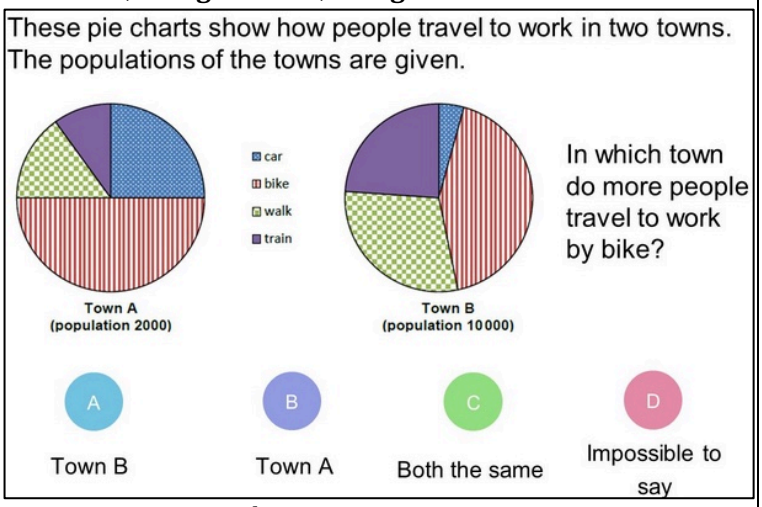
	Plenty of water	Vulnerable	Stressed	Scarcity
1990	14	5	5	4
2025	0	7	11	10

DIAGNOSTIC ASSESSMENT

This can be done before or after the lesson and as a group as described below, or the question can be answered individually.

Show this question and say:

"Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 for D".



1. Notice how the learners respond. Ask them to explain why they gave their answer and DO NOT say whether it is right or wrong, simply thank the learner for the answer.
2. It is important for learners to explain the reason for their answer so that, by putting their thinking into words, they develop communication skills and gain a better understanding.
3. With a group, make sure that other learners listen to these reasons and try to decide if their own answer was right or wrong.
4. Ask the learners to vote again for the right answer by putting up 1, 2, 3 or 4 fingers. Look for a change and who gave right and wrong answers.

The correct answer is: **A.**

The number is 1000 in Town A and between 4000 and 5000 in Town B.

Common Misconceptions

B. Learners have chosen the larger piece of the pie chart and not thought about the population represented.

C. The numbers shown are not the same. No understanding of pie charts.

D. Again a poor understanding of pie charts.

https://diagnosticquestions.com

Follow up

Bottles and Capacity https://aiminghigh.aimssec.ac.za/years-4-7-bottles-and-capacity/
Cups and Capacity https://aiminghigh.aimssec.ac.za/years-5-7-cups-and-capacity/
Water Crisis 1 https://aiminghigh.aimssec.ac.za/years-4-8-water-crisis-1/
Water Crisis 2 https://aiminghigh.aimssec.ac.za/years-6-8-water-crisis-2/
Land and Sea Statistics
https://aiminghigh.aimssec.ac.za/years-10-12-land-and-sea-statistics/

Go to the **AIMSSEC AIMING HIGH** website for lesson ideas, solutions and curriculum links: http://aiminghigh.aimssec.ac.za
Subscribe to the **MATHS TOYS YouTube Channel**
https://www.youtube.com/c/mathstoys
Download the whole AIMSSEC collection of resources to use offline with the AIMSSEC App see https://aimssec.app Find the App on Google Play.

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and school years up to Secondary 5 in East Africa.
New material will be added for Secondary 6.
For resources for teaching A level mathematics (Years 12 and 13) see https://nrich.maths.org/12339
Mathematics taught in Year 13 (UK) & Secondary 6 (East Africa) is beyond the SA CAPS curriculum for Grade 12

	Lower Primary Approx. Age 5 to 8	Upper Primary Age 8 to 11	Lower Secondary Age 11 to 15	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13