

Water power!



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This pack supports an introduction for learners to an Eco-School's focus on environmental information

Grade 9

This pack contains:

Activity One: Learners find out more about energy and energy options in South Africa during this **LANGUAGES** lesson and then debate whether water as an energy option is the way forward for our country.

Activity Two: During this **TECHNOLOGY** exercise, learners investigate, design, make and evaluate their own design based on water or steam power.

Activity Three: This **ARTS AND CULTURE** lesson looks at marketing and advertising our water or steam power designs that were made in Activity Two.

Activity Four: During this **NATURAL SCIENCES** activity, learners develop a school environmental policy to improve water management.

Activity Five: Just for fun – learners make a jet-propelled steam boat and a water-powered wheel.



This pack of lesson plans is part of a series of lesson plans from Grade R to Grade 10, which focus on water and water-related issues. This resource development project has been funded by the Water Research Commission, Private Bag X 03, Gezina, Pretoria, 0031 (Website: www.wrc.org.za). This pack is available electronically on www.envirolearn.org.za



Activity	Learning Area covered in this activity	Learning Outcomes covered in this activity	Assessment Standards covered in this activity
1. Learners find out more about energy and energy options in South Africa and then debate whether water as an energy option is the way forward for our country.	Languages	Learning Outcome 2: Speaking: The learner will be able to communicate effectively in spoken language in a wide variety of situations. Learning Outcome 5: Thinking and reasoning: The learner will be able to use language to think and reason, as well as to access, process and use information for learning. Demonstrates a range of complex interaction skills by participating actively in group discussions, conversations, debates, group interviews and surveys.	• Demonstrates a range of complex interaction skills by participating actively in group discussions, conversations, debates, group interviews and surveys. • Extends sources and methods for locating relevant information (e.g. electronic and other media such as newspaper archives, documentary films, specialist libraries).
2. Learners investigate, design, make and evaluate their own design which makes use of water or steam power.	Technology	Learning Outcome 1: Technological processes and skills: The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technology.	Investigates: • Identifies and explains a problem, need or opportunity from a given real-life context, and investigates the context, the nature of the need, the environmental situation, and the people involved. • Uses a variety of available technologies and methods to locate (e.g. use library referencing system, database searches, indexes). Designs: • Writes or communicates a short and clear statement or a design brief for the development of a product. • Lists product and design specifications and constraints. Makes: • Develops plans for making that include resource lists, formal drawings and manufacturing sequence. • Chooses and uses appropriate tools and materials to make designed products with precision and control by measuring, marking, cutting or separating, shaping or forming, joining or combining and finishing a range of materials accurately and effectively. • Demonstrates knowledge and understanding of safe working practices and efficient use of materials and tools. Evaluates: • Evaluates the product or system and suggests sensible improvement or modifications that would clearly result in a more effective or higher-quality end product.
3. This lesson looks at marketing and advertising our water or steam power designs that were made in Activity Two.	Arts and Culture	Learning Outcome 4: Expressing and communicating: The learner will be able to analyse and use multiple forms of communication and expression in Arts and Culture.	Applies skills of media production, while considering target group, purpose and design elements (e.g. create an advertisement, class newsletter, poster, T-shirt, logo or jingle).
4. During this activity, learners develop an environmental policy to improve water management at their school.	Natural Sciences	Learning Outcome 3: Science, society and the environment: The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.	Understands sustainable use of the earth's resources: responds appropriately to knowledge about the use of resources and environmental impacts: • Contributes to formulating a school environmental policy, including constructive ways to deal with waste material and to improve water management.
5. Just for fun – learners make a jet-propelled steam boat and a water-powered wheel.	Technology and Natural Sciences	-	-

ACTIVITY ONE: WATER POWER – THE WAY TO GO?

Learners find out more about energy and energy options in South Africa during this LANGUAGES lesson and then debate whether water, as an energy option, is the way forward for our country.

ACTIVITY:

Ask the learners:

1. Have you seen or taken part in a debate?
2. What was it about?
3. Where did it take place?
4. Who was taking part in the debate? *Prompt: Politicians, general public, members of a group or organisation.*

Ask the learners:

1. What is a debate?
2. If you were going to define it in a dictionary, what would you write? *Suggestion: A formal argument where groups or individuals present opposing views about a particular issue according to a set of rules.*

ACTIVITY:

- Explain that a debate is based around a suggestion or motion.

An example of a motion is: The voting age should be lowered to 16.

- Explain that the people who are arguing to support the motion are called the proposers. The people arguing against the motion are the opposers. Print out copies of the worksheet on the following page which contains a muddled debating process and hand out to each learner.
- Ask learners to correctly order the stages of the debate.

See if you can un-muddle the steps in this debate...

An opposer sums up their group's main argument.

The first proposer presents the arguments for the motion.

The Speaker announces the result of the vote.

One of the proposers presents their arguments for the motion.

Everyone votes (apart from the Speaker) by leaving the debating chamber and coming back through a door marked 'aye' or 'no.'

The debate is chaired by the Speaker, who reads out the motion.

This side to side motion continues until everyone has had their say. You can only speak ONCE during the debate.

Two people, called tellers, count up the votes (bodies), as they come through each door.

A proposer sums up their group's main argument.

The first opposer presents the arguments against the motion.

An opposer presents their arguments against the motion.

The speaker re-reads the motion.

Check answers against the correct order:

1. The debate is chaired by the Speaker, who reads out the motion.
2. The first proposer presents the arguments for the motion.
3. The first opposer presents the arguments against the motion.
4. One of the proposers presents their arguments for the motion.
5. An opposer presents their arguments against the motion.
6. This side to side motion continues until everyone has had their say.
7. You can only speak ONCE during the debate.
8. An opposer sums up their group's main argument.
9. A proposer sums up their group's main argument.
10. The speaker re-reads the motion.
11. Everyone votes (apart from the Speaker) by leaving the debating chamber and coming back through a door marked 'aye' or 'no.'
12. Two people, called tellers, count up the votes (bodies), as they come through each door.
13. The Speaker announces the result of the vote.

Ask the learners:

1. Why do you think there is a rule about people only speaking once during the debate?
2. What other rules do you think you will need to make the debate run smoothly?

Here are some rules of debate that we will follow:

1. The debate is chaired by the Speaker, whose decision on all matters is final.
2. You can only speak ONCE during the debate. Your speech should be about two minutes long. If you can, develop an argument rather than making a single point.
3. But you CAN 'intervene' as many times as you like. To intervene is to ask a question about a point being made, such as ... are those statistics up-to-date?
4. You can use notes to help you with your speeches and make notes during the debate.
5. If you want to speak during the debate, you should catch the Speaker's eye by standing up as soon as someone has finished speaking. The Speaker will pick someone from those standing up.
6. If you spot someone breaking these rules you should tell the Speaker. This is called a point of order.

SO, WHAT ARE WE GOING TO DEBATE??

Read the following extract to the class:

Have you ever watched surfers riding the ocean waves at the coast? It is the power of water that moves them along.

People have used water-power for centuries. Since early days, it has been used to drive machines, and in the 18th century steam-power, a different form of water power, was invented.

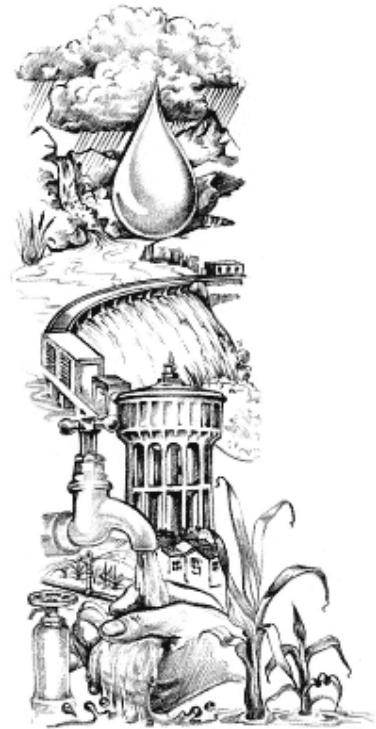
Water-power

In the past, water-mills were built on the banks of streams to grind cereal to flour. These mills had huge paddle-wheels that were turned by the flowing water. Gears connected to the water-wheel turned the grindstones inside the mill.

The power of water is still used to turn wheels, but today they are turbines that drive generators to produce electricity. Power from water is an important source of renewable energy, unlike coal and oil that cannot be replaced once they are used up.

Steam power

Another source of water-power is steam. The steam is produced by boiling water over a fire and keeping the steam under pressure so that it has the power to drive engines. The first engines were all steam-engines and coal was used to boil the water. The engines were a good substitute for human muscle-power and increased the amount of work that could be done in factories.



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CLASS ACTIVITY:

1. Divide the class into two groups.
2. Give them the following debate topic.

Water as an energy option is the way forward for our country.

3. One group needs to prepare their debate agreeing with the topic (the proposers), the other needs to argue against it (the opposers).
4. Using the two enviro facts sheets (*Energy Options* and *Energy and Environment*) as an introduction to energy options, learners need to find out as much as they can about this topic. If you have a well-resourced library (school or community), make use of it; use the Internet; search for newspaper articles or magazines, see if there are any environmental films or videos on energy and energy options as well as energy issues (if possible, take out the movie 'An Inconvenient Truth' all about global warming and watch it as a class) as well as any other sources of information that will be useful. (*Learners need to keep a record of where they found their sources and what these sources were – this will help you, the teacher, when it comes to the assessment of this lesson*). Some of the learners may have parents or relatives that work either for Eskom or for non-governmental organisations that are promoting the use of sustainable energy so they will be able to interview these people. Encourage the learners to make use of as many varied sources and methods of locating information as possible.

5. When the groups are ready and well prepared, you need to select seven learners to be:
 - Speaker. This person chairs the debate but cannot take part or vote.
 - First proposer to speak
 - First opposer to speak
 - Opposer to sum up
 - Proposer to sum up
 - Two tellers to count the votes

Hold the debate according to the formal order and rules.

Ask the learners:

1. What are the advantages of debating?
2. What are the disadvantages of debating?
3. Describe the strengths of a good debater. *Prompt: persuasive, confident, calm.*
4. Can you think of a better way to settle a difference of opinion?

Source: http://news.bbc.co.uk/cbbcnews/hi/newsid_4530000/newsid_4537100/4537177.stm

Criteria to assess learners during this languages lesson

Criteria	Exceeded requirements of the Learning Outcome	Satisfied requirements of the Learning Outcome	Partially satisfied requirements of the Learning Outcome	Not satisfied requirements of the Learning Outcome
The learner used a range of sources and methods (Internet, books, magazines, enviro facts) to prepare for the debate on water energy – <i>teacher, you may want to use the list of where and what the learners found and what sources they used</i>				
The learner took an active role in the preparation for the debate				
The learner took an active role in the debate				

Enviro Fact: Energy Options



Coal supplies most of South Africa's electrical energy. It is a finite, non-renewable resource. Burning coal to produce electricity causes serious environmental problems. Pollution from power stations contributes to global warming. In addition to the environmental challenges associated with energy supply, South Africa faces significant social challenges. Although we produce half of the electricity on the African continent, 40% of South Africans do not have access to electricity and rely instead on fuelwood and other inconvenient fuels such as coal, paraffin, gas, or candles. It is important that South Africa addresses both the environmental problems associated with energy supply, and the inequalities in access to adequate and affordable energy.

How can we provide adequate and affordable energy for all, while promoting environmental sustainability?

Many of South Africa's medium- and long-term energy needs could be addressed through regional co-operation. This could include the establishment of a regional electricity transmission grid and a Southern African Development Community (SADC) power pool, and regional energy planning. Such co-ordination would create opportunities for SADC countries to provide their people with clean and sustainable energy. Regional co-operation does however require political and economic stability.

There are also several technologies that could improve the sustainability of the regional electricity industry.

In addition to reducing pollution from coal-fired power stations, hydroelectric and solar power, natural gas, wind, tide and wave power may all help the region address its energy needs with minimum impact on the environment.

Reducing pollution from coal-fired power stations

This pollution can be reduced by using equipment which removes oxides of sulphur and nitrogen from the gases released when coal is burnt. This could result in electricity being more expensive, but this should be weighed against the benefits to the environment.

Hydro-power

Coal stocks are finite and sooner or later we shall have to rely on another source of energy. A possible medium-term alternative is to harness the huge hydro-electric potential of the sub-Saharan Africa region, estimated to be more than twice Eskom's current generating capacity. There are many other rivers in Zambia, Zimbabwe, Angola and Mozambique suitable for hydroelectricity.

Hydroelectricity is renewable and does not pollute. However, it is expensive, and requires the construction of large dams which have significant social and environmental costs. In addition, this option requires regional co-operation and political stability.

Solar energy

Solar energy can be used to produce heat. In Israel more than two-thirds of houses are fitted with solar water heaters. South Africa experiences more sunshine than most places and there is much potential for widespread use of solar water heaters, particularly in mass, low-income housing projects. However, the initial outlay for solar panels is expensive as large areas of panels are needed to collect useful amounts of energy. Solar energy could be particularly useful in remote areas far from the electricity grid, such as farms, rural clinics, and water pumping stations.

Nuclear energy

There is much debate among energy planners in South Africa as to whether nuclear energy should play a role in this country's future. Using current technology it is a costly option, with unresolved environmental problems such as the disposal and storage of waste products.

Natural gas

Although natural gas is a non-renewable energy resource, it has great potential as a future energy source for South Africa. South Africa has a limited amount of natural gas reserves, but strong regional ties would allow us to import gas from Namibia and Mozambique. Natural gas produces less pollution than other fossil fuels. In fact, latest natural-gas-burning turbines can produce electricity 50% more efficiently than those burning coal. Natural gas can also be burned cleanly in co-generation (see below). Because of its advantages over coal and oil, some analysts see natural gas as the best fuel for the transition to energy efficiency and renewable energy.

Wind power

As global energy resources become more and more scarce, wind power is becoming increasingly attractive. Wind energy is freely available and poses less of a threat to the environment than fossil and nuclear energy sources. Wind energy can provide electricity for communities not linked to the electricity grid. Telecommunications companies currently use small wind turbines to support cellular networks in the region. In addition, wind energy can be exploited on a large grid-tied scale through the development of wind farms. However, wind is not a reliable source of energy, and its use is limited to areas with steady winds. These areas are often found near coastal regions and in some arid and semi-arid areas.

Energy efficiency

South Africa uses more energy per unit of economic output (GDP or gross domestic product) than many other countries. There is much potential for energy saving. European countries and Japan have shown in recent years that industrial production can be increased while using less energy through energy-efficient manufacturing processes. Passive solar design principles and more efficient lighting and insulation contribute to energy savings in buildings. Industry is able to save energy through co-generation, advanced heat recovery systems and better control of energy usage. (Co-generation is a process which produces both electricity and heat at the same time, while advanced heat recovery systems economize on, and use the heat generated in industrial and chemical processes). Recycling waste materials can also save energy, for example aluminium produced from scrap uses 95% less energy than when it is manufactured from ore. New motor vehicles are also becoming more fuel efficient.

Planning in towns and cities should encourage the use of efficient public transport systems rather than private motor vehicles. In the long term we shall also have to find alternative fuels for transport. Hydrogen offers a clean alternative and as one of the elements in water it is plentiful. But it still requires energy to separate hydrogen from oxygen in water. Nuclear fusion (the combination of hydrogen atoms to form helium, i.e. the reaction which powers the sun) may also be a future option, but scientists do not foresee major progress in this area for many years to come.

Enviro Fact: Energy and Environment

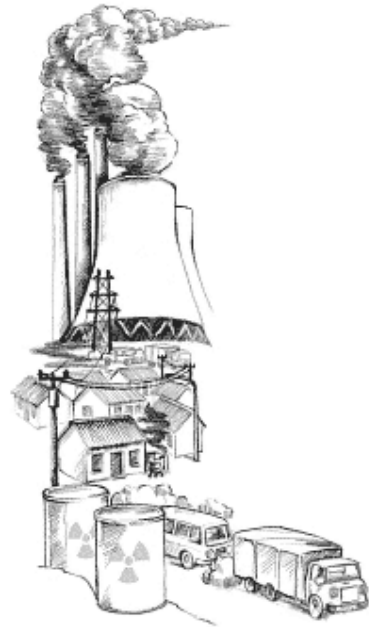
Some of South Africa's most serious environmental problems are associated with our use of energy. Coal-fired and nuclear power stations for electricity generation, coal combustion in the townships, SASOL coal-to-oil processes, petrol and diesel use in vehicles for bulk transport, and over exploitation of fuelwood resources, all result in serious, long-term environmental damage.

Pollution from burning coal

More than three-quarters of South Africa's energy comes from coal, approximately half of which is used to generate electricity, a quarter to produce synthetic liquid fuels and another quarter directly by industry and in homes. Air pollution problems from coal combustion are serious. Medical studies are revealing increased rates of respiratory disease in residents in polluted areas.

Acid rain

Most of South Africa's power stations are concentrated within a 100 km radius in Mpumalanga and this leads to pollution problems. While all of Eskom's coal-fired power stations are designed to remove dust and other particles from waste gases produced during coal combustion, none are fitted with flue-gas scrubbers (cleaning equipment) to remove oxides of sulphur and nitrogen. Tall chimney stacks in power stations assist in releasing oxides of sulphur and nitrogen into the upper atmosphere where atmospheric conditions are more favourable for their dispersal and dilution. Although this reduces ground level concentrations of these pollutants, they may combine with moist air and rain at higher levels and cause acid rain in areas far from the source of pollution.



Whilst South Africa's coal has a relatively low sulphur content there is considerable concern about the potential environmental and economic impact of acid rain. Half of South Africa's agriculturally productive land, half of its commercial forests and a quarter of its surface water run-off are in Mpumalanga.

Pollution from vehicles

Motor vehicle fumes make air pollution problems worse and are the main cause of photochemical smog in cities. Unleaded fuel has recently been introduced to South Africa and this may reduce the amount of lead in exhaust fumes. Catalytic converters fitted to exhausts would result in a significant reduction in the release of carbon dioxide, hydrocarbons, and nitrogen oxides. However, South Africa lags far behind other countries (such as Japan and Germany) in legislation to control vehicle emissions. Solutions to transport pollution and vehicle congestion require long-term planning to introduce efficient public transport systems in our cities.

Deforestation

Another environmental concern associated with energy use is the reliance by a significant number of South Africans on fuelwood, once a renewable resource, but now being used at a rate much greater than that at which it is naturally regenerated. Fuelwood is an inefficient source of energy for cooking and heating and its use can cause increased respiratory illnesses. It has been estimated that if current consumption trends continue, all natural woodland in the former "homelands" will be denuded by 2020. In addition to the environmental consequences of deforestation, diminishing supplies of wood require rural people (particularly women) to travel further and further from home to gather wood, placing a great burden on them.

Global warming

South Africa uses a great deal of energy, very much more per unit of gross domestic product (GDP) than most other countries. The combustion of coal, oil and wood results in increased carbon dioxide production. This gas acts like a greenhouse - it lets short-wave, natural light through but traps outgoing long-wave (infra-red or heat) radiation. The potentially devastating consequence is that the Earth is slowly getting warmer, causing the climate to change and sea levels to rise. Although South Africa produces only a small percentage (1,6%) of the total, global carbon dioxide emissions, it plays a disproportionately large role per person in contributing towards the greenhouse effect and global warming. As a country needing rapid economic growth in the medium-term to satisfy the country's developmental needs, South Africa's potential contribution to global warming is an area of concern.

Nuclear energy

South Africa currently has one commercial nuclear power station at Koeberg near Cape Town. It provides 1 800 MW of Eskom's installed electricity generation capacity of 37600 MW, less than 5% of the total. There is intensive debate among energy planners as to whether nuclear energy should play a role in South Africa. In addition to being a costly option, nuclear fission produces dangerous radioactive by-products. There is considerable concern about their safe containment in the case of accidents at nuclear power stations, the closing down (decommissioning) of old power stations, and the storage of highly toxic wastes. At present, low-level radioactive wastes are stored in sealed containers which are buried underground at disposal sites. No long-term solution has been agreed on for the safe storage of high-level radioactive wastes, some of which remain harmful for thousands of years.

ACTIVITY TWO: WATER POWER!

During this **TECHNOLOGY** exercise, learners investigate, design, make and evaluate their own water or steam power designs.



Coal supplies most of South Africa's electrical energy. It is a finite, non-renewable resource. Burning coal to produce electricity causes serious environmental problems. Pollution from power stations contributes to global warming. In addition to the environmental challenges associated with energy supply, South Africa faces significant social challenges. Although we produce half of the electricity on the African continent, 40% of South Africans do not have access to electricity and rely instead on fuelwood and other inconvenient fuels such as coal, paraffin, gas, or candles. It is important that South Africa addresses both the environmental problems associated with energy supply, and the inequalities in access to adequate and affordable energy.

How can we provide adequate and affordable energy for all, while promoting environmental sustainability?

What the learners need to do:

1. Investigate whether water or steam can generate electricity

The investigation phase is the research phase. Learners need to understand and explain the energy problems that South Africans are facing today; they need to locate information on existing water or steam generators by looking at pictures of water wheels and steam engines and at books and any other material that they can find on water power. They can also discuss their ideas with friends, in small groups and with you, the teacher. Let the learners write a paragraph on their "research" which should include what sources of information they used, where they found these sources, what they found out, what they think they would like to design.

2. Design

- Each learner will need paper and pencils so that they are able to write and draw their design ideas. There needs to be a short, clear statement (or design brief) for their design. The design must be on paper and learners should make rough drawings first. When they are happy with their designs, they need to make a neat drawing with a heading and labels or a colour key. The dimensions of the design must be written down and the materials that will be used must be listed. Any constraints/restrictions that the learner can see/anticipate in the future must also be noted. In addition, the learner must work out the cost of the design, how safe it will be, what the product will do.
- It is very important that you, the teacher, guide the learners through this design phase. Some of the learners' designs may be wonderfully creative but very impractical, so you need to be on hand to make sure that their designs will work.

3. Make

- The learners need to gather together the materials they will need to construct their design. They will need to develop plans for their designs which include a resource list (the materials and tools needed and their costs; formal drawings showing dimensions or quantities (such as 'exploded views [An exploded view is a representative picture or diagram that shows the components of an object slightly separated by distance, or suspended in surrounding space]; orthographic views [orthographic drawings are front, side, top, etc views of an object. An orthographic view is only one side. It takes several views to show the whole object], isometric views [a method of visually representing three-dimensional objects in two dimensions]; sequence drawings [a drawing of each stage of manufacture and includes brief notes or instructions. It normally follows a flowchart which simply lists each stage]; and the sequence (by way of a flow chart) of how the product will be built.
- Encourage the learners to use recycled objects if possible. When they have all they need, the designs need to be constructed. Remind them that they need to make sure they are precise and careful when making their design and they need to work safely with any tools they use.

4. Evaluate

- Test the designs!! Do they work, how well? After testing individual designs, learners can set up their designs at the front of the class and demonstrate them to everyone. Learners need to ask themselves if their designs could be improved on – how? There may even be some constructive comments from the rest of the class during the demonstrations.

Criteria to assess learners during this technology lesson

Criteria	Exceeded requirements of the Learning Outcome	Satisfied requirements of the Learning Outcome	Partially satisfied requirements of the Learning Outcome	Not satisfied requirements of the Learning Outcome
The learner was able to identify that energy generation is an environmental problem in South Africa (<i>teacher, the learners will have written a paragraph on this during the investigation phase</i>)				
The learner located and made use of a number of references (such as books, used the Internet, newspapers) during the investigation process				
The learner wrote a clear statement (design brief)				
The learner listed the products and design specifications				
The learner made a note of any constraints				
The learner drew formal drawings of the design				
The learner drew a flow chart of how the design would be built				
The learner worked carefully and safely				

ACTIVITY THREE: MARKETING OUR WATER POWERED DESIGNS

This ARTS AND CULTURE lesson looks at marketing and advertising our water or steam power designs that were made in Activity Two!!

The term, MARKETING, was first academically defined in 1937 when the American Marketing Association (AMA) stated that:

"Marketing consists of those activities involved in the flow of goods and services from the point of production to the point of consumption."

Although marketing is often interchangeably used with the word *advertising*, marketing can be more specifically described as the game plan by which the advertising will be carried out, as in a *marketing strategy*.

ADVERTISING is a paid form of communicating a message by the use of various media. It is persuasive, informative, and designed to influence people's purchasing behaviour or thought patterns.

DISCUSS WITH THE CLASS:

1. What are ways that a product can be advertised?
2. Are there any adverts (radio, television, in newspapers or magazines) that you remember from a long time ago?
3. Why do you think you remember them? Do you think that company that developed that advert, so many years ago and that you can still remember, had an effective marketing strategy?
4. Which ways are the most effective ways of advertising for teenagers (these will vary from learner to learner)?
5. Should one always 'tell the truth' in advertising? Why? Why not?

ACTIVITY:

You will need:

- Paper – white or coloured
- Paint
- Pastels
- Kokis
- Chalk
- Wax and / or wax crayons
- Plain T-shirts and fabric paint

WHAT TO DO:

Using your research information gathered in Activity Two, design and create a poster, T-shirt, logo or music 'jingle' to advertise your steam- or water-power design. Those creating a T-shirt, will need to do the initial design on paper and then, time and the availability of T-shirts permitting, transfer the design onto the material.

Remember to consider your target group, the purpose of your design and design elements.

Criteria to assess learners during this arts and culture lesson

Criteria	Exceeded requirements of the Learning Outcome	Satisfied requirements of the Learning Outcome	Partially satisfied requirements of the Learning Outcome	Not satisfied requirements of the Learning Outcome
The learner participated in the discussions about advertising				
The learner considered target group, purpose and design elements				
The learner created a music jingle, poster, T-shirt or logo				

ACTIVITY FOUR: DEVELOPING A SCHOOL POLICY TO IMPROVE OUR WATER MANAGEMENT

During this NATURAL SCIENCES activity, learners develop a school environmental policy to improve water management.

A school environmental policy is a statement of intentions and principles for improving a school's educational and environmental performance. The policy development process involves learners, teachers and other stakeholders and encourages schools to audit existing practices, activities and other elements of the curriculum and to select, evaluate and review environmental education goals and management plans.

A simple school environmental policy is shown below:

At all times the staff, learners and community will try to:

- *Engage with environmental issues for more meaningful learning in a healthy, happy school*
- *Manage resources more wisely*
- *Minimise wastage*
- *Minimise water and electricity use*
- *Improve our school grounds and environment*
- *Share ideas, improve co-operation throughout the school community*

From Georgenau Primary, Pietermaritzburg

One way to further develop a school policy is to develop two sub-points for each of the main points in the policy. The sub-points should describe what you will do in more detail.

At all times the staff, learners and community will try to:

- **Engage with environmental issues for more meaningful learning in a healthy, happy school:**
 - *Through developing and teaching environmental lesson plans, and*
 - *Through creating opportunities for learners to enjoy the school's natural environment in the context of lessons.*
- **Manage resources more wisely**
 - *Reduce electricity consumption in the school*
 - *Reduce water consumption in the school*
- **Minimise wastage**
 - *Reduce the number of resources used*
 - *Establish a recycling programme*
- **Improve our school grounds and environment**
 - *Plant a food garden*
 - *Reduce soil erosion by planting indigenous water-wise vegetation in bare areas*
- **Share ideas, improve co-operation throughout the school community**
 - *Involve parents in more environmental projects*
 - *Establish an environmental club for teachers and learners*

It is useful to assess the current status of our school by means of an audit. An audit can be described as a careful look at the way things are. A policy then attempts to address what has been discovered in the audit. In the following activity, we will start with an audit and this will lead to the development of a water policy for the school.

ACTIVITY:

- Divide the class into five groups. Every learner needs a copy of the water audit worksheet on the following page. All learners need to check the water meter (if your school has one) each day. Each group needs to do the audit on a different day of the week (one group of learners will do it on Monday, the next group on Tuesday etc) and report any leaking taps to the teacher.

Name: _____

Date of audit: _____

Time of audit: _____

WATER		YES	NO	
1.	Does the school have access to water-on-tap?			
2.	Is the drinking water clean and safe for consumption?			
3.	Does the school have tanks to collect rainwater?			
4.	Are teachers and learners aware of ways to save water?			
5.	Is water management recognised and promoted at your school?			
6.	Who amongst teachers, school governing body members, learners and other staff members know how to change a tap washer?			
7.	How many taps are dripping?			
8.	How many taps including baths and showers are in the school and school grounds?			
9.	How many flush toilets are in the school?			
10.	How many toilets are leaking?			
If the school has access to municipal water, find and read the water meter in the school grounds. Record the daily use in the table below:				
DAY	DATE	TIME	METER READING	LITRES USED
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Total for the school week (Monday to Friday)				

- Now that the audits are complete, learners (individually or in small groups) need to brainstorm ideas around how the water management in their school can be improved, based on what they discovered during their audits. Water management actions can include individual learner and teacher actions and whole class/grade/school actions.



- Learners then need to write down all the ideas on paper.
- Go round the class, asking individuals (or groups) for their contributions and ideas. List these on the board. As a class, decide which (between five and ten) are the most likely that your school will be able to implement. Eliminate the rest. If necessary, expand the initial idea to include two sub-points (see example on page 14).
- Once everyone is happy with the policy, write or type it up neatly and present it to the school governing body or headmaster. Your school may already have an environmental policy so your water management policy can become part of that.

Remember, we can ALL work towards managing our water resources more wisely, whether it is on an individual, group, class, grade or school level!

Criteria to assess learners during this natural sciences lesson

Criteria	Exceeded requirements of the Learning Outcome	Satisfied requirements of the Learning Outcome	Partially satisfied requirements of the Learning Outcome	Not satisfied requirements of the Learning Outcome
The learner carried out the water audit on her/his own				
The learner contributed ideas towards better water management at the school				

ACTIVITY FIVE: JUST FOR FUN – MAKE A JET-PROPELLED STEAMBOAT AND A WATER-POWERED WHEEL

These two **TECHNOLOGY** and **NATURAL SCIENCES** activities highlight water power as well as the outcome of what occurs when water changes phase. They can be done in the classroom or learners could try them out at home.

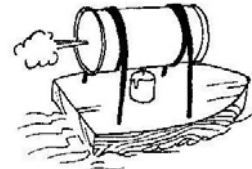
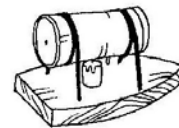
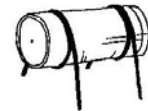
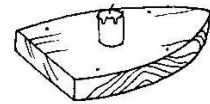
1. MAKE A JET-PROPELLED SPEEDBOAT

You will need:

- A metal tube or small tin with a tight-fitting lid
- Wood (very light wood is best)
- Stiff wire (a coat-hanger works well)
- Candles and matches
- A nail

What to do:

1. Make a hole in one end of the metal tube / tin
2. Saw a piece of wood to create the outline of a boat and make a shallow hole near each corner.
3. Using the wire, make a “cradle” for the tube – see drawing – and wind wire around the tube.
4. Place the feet into the holes in the wood.
5. Half fill the tube with water and replace lid.
6. Place the candle underneath the tube and light it.
7. Place the boat onto water.

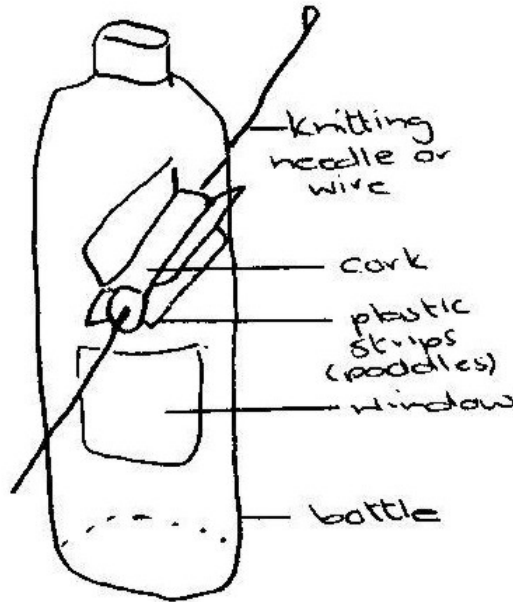


2. MAKE A WATER-POWERED WHEEL

You will need:

- A clear plastic cool-drink bottle
- Three pieces of cork
- Knitting needle

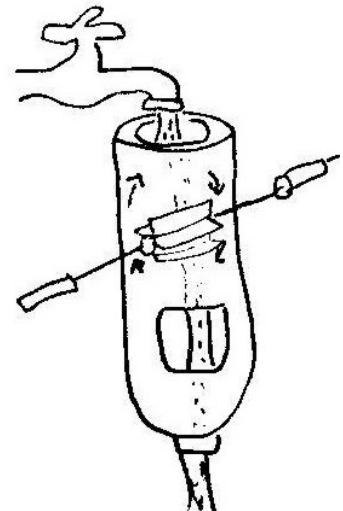
What to do:



1. Cut a window out of one side of a clear plastic cold-drink bottle. Cut the window into four equal strips.
2. Make a hole in a cork by pushing a thin knitting needle down the centre. Remove the needle. Use a sharp knife to cut four slits down the sides of the cork and push a plastic strip into each one.
3. Use the needle to pierce the small holes opposite each other below the window. Push your needle through one hole, then through the waterwheel held inside the bottle and out the hole on the other side. See that the needle spins freely. Push a piece of cork onto each end of the needle to stop it from coming out.

4. Make a hole in the base of the bottle and push it onto a tap. Gently trickle water over your water-wheel to make it turn.

- *Note how fast the water-wheel turns. What happens when you increase the water flow?*
- *See how the outer corks turn as well. This part of the water-wheel would turn a grindstone or motor.*



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