

The value of our electricity

Intermediate Phase (Grade 4, 5 & 6)

Educator Guide

Mathematics



How to save energy

Electricity is produced from fuel such as coal, water, diesel and uranium which are limited resources. An alternative to building new power stations to supply the increase in demand for electricity is to use what we have more efficiently (i.e. without wasting), one of the ways is to change the way we use electricity. Eskom's Integrated Demand Management (IDM) Energy Education programme motivates people to change the way they use electricity. Eskom has taken the approach of integrating energy education within the school curriculum.

The energy education programme is being introduced in the Intermediate Phase so that learners can see energy-saving as integral to their lives and put into practice as they grow. The activities are simple and can be adapted by the educator. The activities are within the context of the Curriculum and Assessment Policy Statement (CAPS) of the Department of Basic Education (DBE).

The subjects in the Intermediate Phase (Grades 4,5 and 6) are:

- Home Language
- First Additional Language
- Mathematics
- Life Skills
- Natural Science and Technology
- Social Science

Note: The Eskom guides are in English. The educator will need to translate them into the Home Language.

Educators need to consult the Department of Education's CAPS policy guides for details of the skills, content and assessment within the relevant phase and grade.

Mathematics (DBE, 2011)

One of the **Specific Aims** in teaching and learning Mathematics is to:

- Develop critical awareness of how much mathematical relationships are used in social, environmental, cultural and economic relations.

The **specific skills** in Mathematics include learning:

- To investigate, analyse, represent and interpret information
- To pose and solve problems
- To build an awareness of the important role Mathematics plays in real life situations including the personal development of the learner.

Data handling is one of the five content areas in Mathematics (Intermediate Phase).

For the educator to take note:

- The energy-wise message is integral to all the activities.
- You may use the activities as they are.
- You can adapt or change the activities.
- You can use other resources where you see appropriate.
- Adapt the activities to suit the grade you teach.
- Adapt the activities according to the level of the learners (consider language or any other barriers).
- Share and discuss the activities with other educators in the same phase and grade.
- You can design your own activities that best suit the level of learners and grade you are teaching.
- Practice the energy-saving behaviour so you become an example of what is expected.
- Share your knowledge and practice on energy-wise education with everyone at school, at home and in the community.
- Saving energy means we don't have to produce so much, using our limited natural resources and limiting the amount of pollution we create, thus taking better care of our environment.

Thank you for taking care of our earth

Mathematics

Activity 1: Comparing energy use

Comparing light bulbs

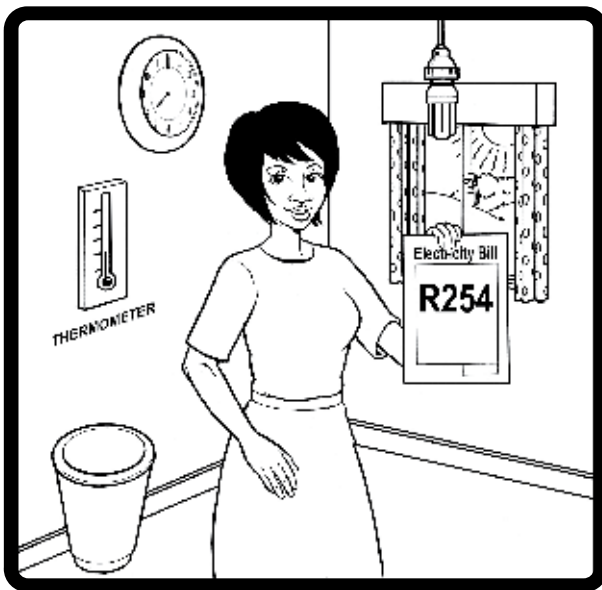
Incandescents are the old type of bulb that homeowners used often in days gone by. Nowadays people are encouraged to use CFLs (energy savers). The older bulb uses most of its energy producing heat and a small amount producing light. This makes them much warmer and using them causes us to waste valuable, scarce electricity. Energy savers cost you more to buy initially, but they last much longer than the older bulb. This means that you will buy many more older lamps before the new ones have reached the end of their life span. Buying more lamps more frequently wastes money. Buying fewer lamps that use less energy saves you money. Opening your curtains and using the natural light the sun provides us during the day, is of course the best way to save money on lighting costs.

Caution: Energy savers use mercury vapour whereas incandescents use a filament. When an energy saver has reached the end of its lifespan, most of the mercury vapour is used up. Even though the mercury vapour is used, it is still advised that spent (used) energy savers are disposed of correctly. Wherever possible they should not be put in the normal rubbish but should be disposed of using the collection points offered by municipalities and retailers. If they cannot be handed in for collection at these points, as a last resort, they can be wrapped in newspaper and placed in a sealed bag and disposed of in the rubbish. Single energy savers in the rubbish do not cause anyone any harm, but if millions and millions of energy savers collect in landfill sites over many years, it could eventually cause ground water to be contaminated.

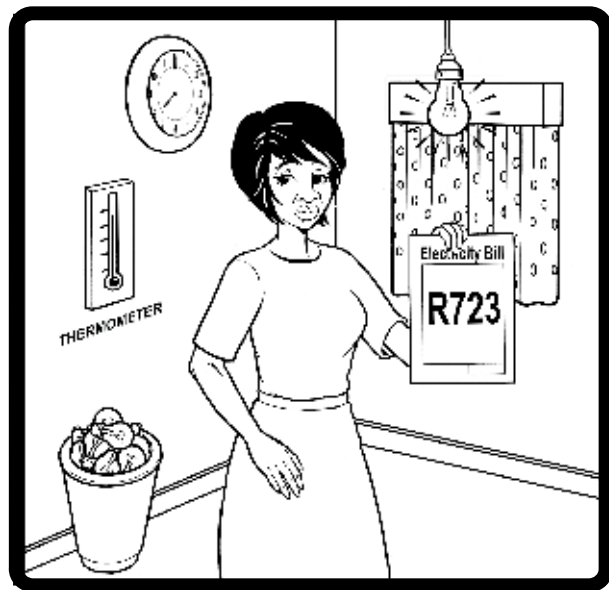


This activity is for Grades 4, 5 and 6.

- Ask the learners to find the difference between picture A and picture B on their own. [Individual activity].
- Learners need to number each corresponding difference in each picture e.g. 1, 2, 3...
- Give the learners about 5 minutes to do the activity.
- Have a discussion on the two pictures as the learners give the differences e.g. when the learners say that the lady in picture A is happy and the lady in picture B is sad, follow-up with: Why do you think the lady in picture A is happy? [She is using energy wisely; she is using energy-saving lights; she has a low account].



Picture A



Picture B



1. Write down the differences between pictures A and B.

Picture A	Picture B
1. Uses energy-saving lights	8. Uses old light bulbs
2. The bin is empty	9. The bin is full
3. The lady is smiling	10. The lady is sad
4. The bill is low	11. The bill is high
5. The temperature is low	12. The temperature is high
6. Open curtain - using natural light	13. Closed curtain - not using natural light
7. The light is off in the morning (8am)	14. The light is on in the morning (8am).

- 2.1 How much is the electricity account in picture A? [R254]
- 2.2 How much is the electricity account in picture B? [R723]
- 2.3 Work out the difference between the electricity accounts. [$R723 - R254 = R469$].
- 2.4 Give reasons why the amounts on the electricity accounts are different? [The lady in picture A: is using energy-saving lights - her account is lower; she is practising being energy-wise by using natural light (window); the lights are off at 8.00am].
3. Do you think the lady in picture B is doing the right thing by leaving the lights on until 8.00am? Give reasons for your answer. [Listen to the learners views; you could add that she is not using energy-saving habits].
4. Give 2 differences between the energy-saving light (compact fluorescent light - CFL) and the old light bulb (incandescent light)? [CFL - gives off less heat/lasts longer; old light bulb - gives off more heat/does not last as long as a CFL].

Activity 2: The cost of using energy-saving lights or old light bulbs.



This activity is for Grades 4, 5 and 6.

- This activity is a follow-up to Activity 1.
- Use the pictures of the ladies.
- Make certain that you go over pictographs and graphs before giving the learners the tasks on graphs.
- Give the learners the worksheets to answer the questions on their own.



Did you know?

Bar graphs and Histograms

- There is a difference in the way bar graphs and histograms are drawn.
- Bar graphs usually show categorical data - e.g. energy use of a fridge, television, geyser. Bar graphs are used to compare variables.
- Histograms usually show continuous data - data that represents measured quantities e.g R100, R200, R300... Histograms are used to show distribution of variables.
- The bars in bar graphs are usually separated. In histograms the bars are adjacent (next) to each other. Sometimes bar graphs may have no space between the bars. Histograms are never drawn with spaces between the bars - the bars are next to each other.



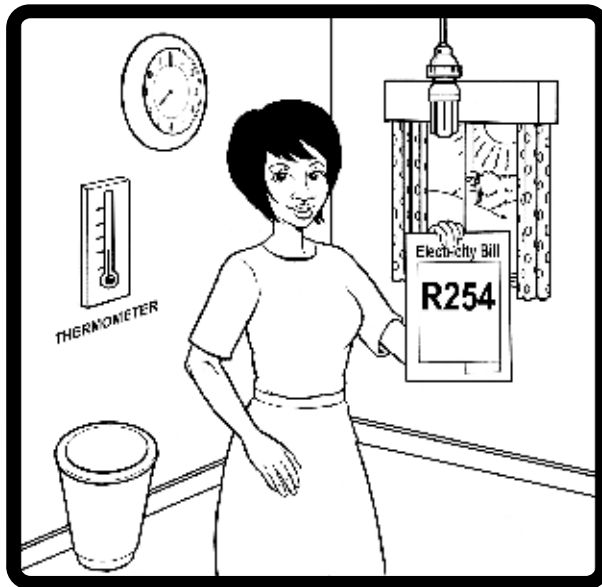
Pictographs

- A pictograph is a way of showing information using pictures or images. This is a simple way of introducing learners to presenting information in tables and graphs later on.

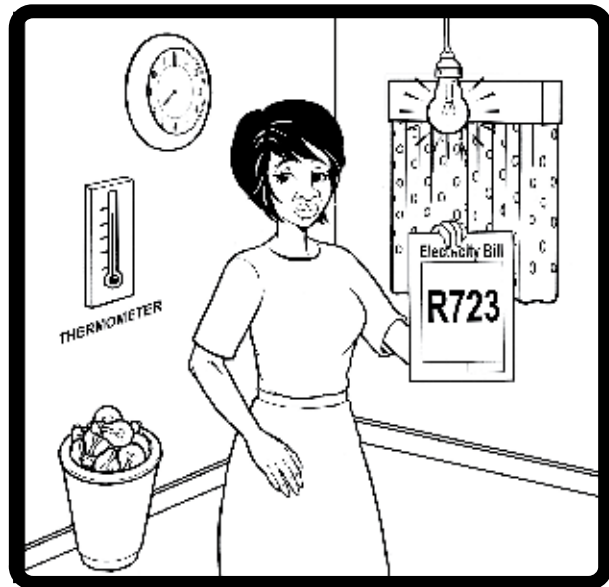


Lower wattage saves you money. Sometimes a lower wattage bulb can be used instead of a higher wattage bulb eg the light needed in a passage does not have to be as bright as the light needed to read by. Using a lower wattage bulb means you save energy.

I. Study pictures A and B.



Picture A



Picture B

- 1.1 If the lady's electricity account in picture A is R5 using 1 energy-saving light for the month, complete table 1 to show her electricity account if she uses 2,3,4 5 or 6 energy-saving lights. The light bulb in picture A was on for the same amount of hours as in picture B:

Number of energy-saving lights used for the month	Electricity Account
1 energy-saving light (CFL)	R5
2 energy-saving lights (CFLs)	R10
3 energy-saving lights (CFLs)	R15
4 energy-saving lights (CFLs)	R20
5 energy-saving lights (CFLs)	R25
6 energy-saving lights (CFLs)	R30

Table 1. Cost of using energy-saving lights

- 1.2 If the lady's electricity account in picture B is R10 using 1 old light bulb for the month, complete table 2 to show her electricity account if she uses 2,3,4 5 or 6 old light bulbs. The light bulb in picture A was on for the same amount of hours as in picture B:

Number of old light bulbs used for the month	Electricity Account
1 old light bulb	R10
2 old light bulbs	R20
3 old light bulbs	R30
4 old light bulbs	R40
5 old light bulbs	R50
6 old light bulbs	R60

Table 2. Cost of using old light bulbs



This activity is for Grades 5 and 6.

- 1.3 What is the total cost, in rands, of the energy efficient bulbs in table 1?
 1.4 What is the total cost, in rands, of the energy wasting bulbs in table 2?

2.1 Draw a pictograph to show the information in table 1. One picture should represent one unit of money in the pictograph.

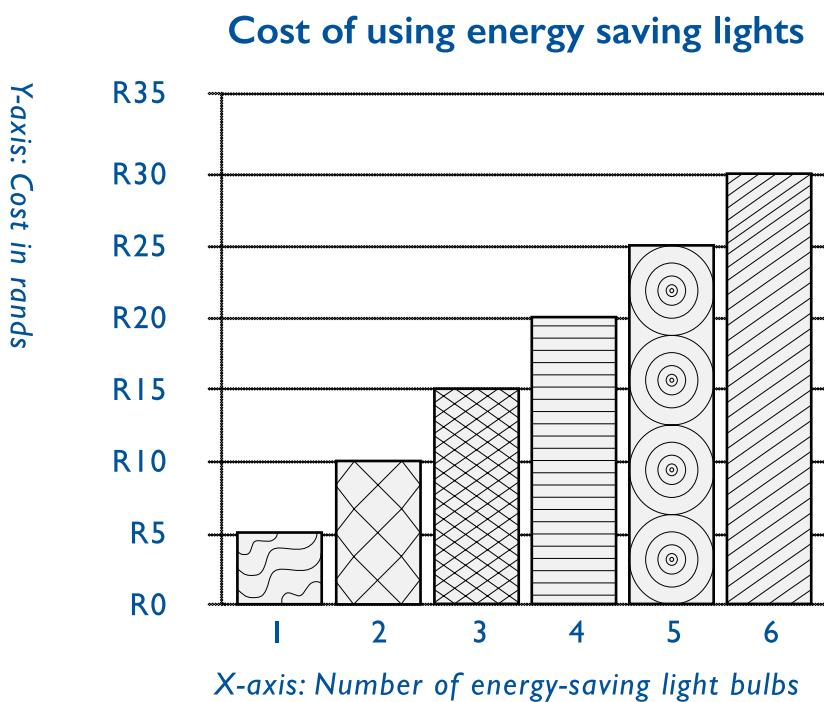
Number of energy-saving lights	1	2	3	4	5	6
Cost	● R5	● ● R10	● ● ● R15	● ● ● ● R20	● ● ● ● ● R25	● ● ● ● ● ● R30

Cost of using energy-saving lights. One unit = ● R5

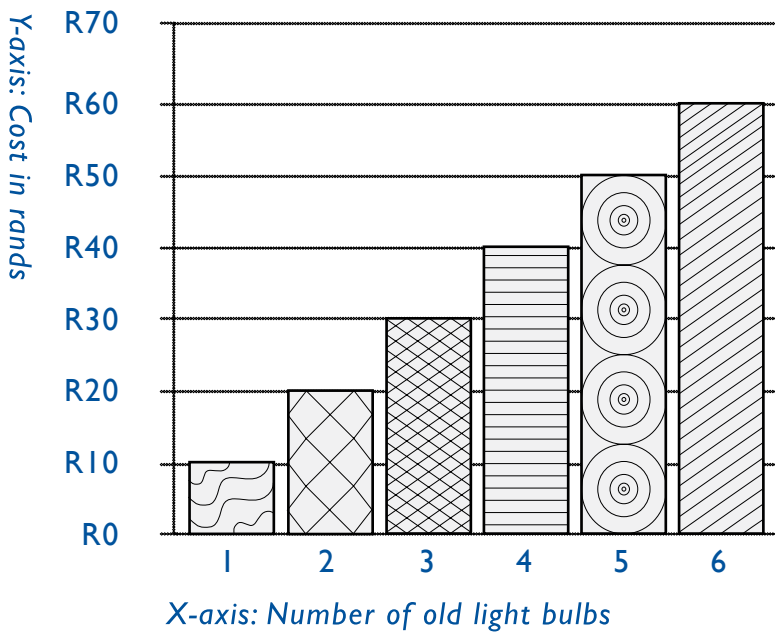


* Grade 4: can draw two separate pictographs - one for the number of energy-saving lights and the other for costs.

2.2 Draw a bar graph to show the information in table 1. Label your graph.



3. Complete table 3 using the information from the graph to show the cost of using old light bulbs.



Number of old light bulbs used for the month	Electricity account
1 old light bulb	R10
2 old light bulbs	R20
3 old light bulbs	R30
4 old light bulbs	R40
5 old light bulbs	R50
6 old light bulbs	R60

Table 3. Old light bulbs

4. What 2 things can you say about the cost of electricity from the information in table 1 and table 2? [Using old light bulbs costs more; the more lights you use the more you pay].
5. Even if you have energy-saving lights, how can you use them in a way that will help to use energy wisely (also keeping the electricity account low)? [Switch off any lights or appliances that you are not using. Switch off lights when there is enough natural light; use lower watt value lights where possible; use one bulb in a room where possible or the lowest number if the rooms are big].

For grade 5 and 6.

6. If 10 households used 5 energy savers each, and each light bulb uses 11 watts per light bulb, what is the total amount of electricity used by all the households for lighting? [$10 \times 5 \times 11 = 550W$].
7. In one year, 10 households disposed of 4 old light bulbs and 2 energy savers each. All the energy savers were disposed of using the retailer take back collection points thereby disposing of them safely. The old light bulbs were disposed of by recycling as they have glass that can be used again. How many light bulbs were disposed of using the retailer collection points in that year? [20]

Activity 3: Survey – The use of lights at Sipho’s house



This activity is for Grades 4, 5 and 6.

- This activity is based on a survey of the floor plan of the house.
- Explain to the learners that a survey involves gathering or collecting information to understand what is happening in a particular situation.
- Make certain that you go over pictographs and graphs before giving the learners the task.
- Discuss the floor plan with learners for them to understand the given information.
- Give the learners worksheets and tell them to answer question one on their own.

























A survey was done at Sipho’s house. The following is a floor plan of Sipho’s house showing the number, kind of lights and the watt value of the lights. The old light bulbs are 60W and the energy-saving lights are 15W.

<p>Bedroom 1</p>	<p>Bedroom 2</p>	<p>Passage</p>
<p>Kitchen</p>	<p>Lounge</p>	<p>Toilet</p>
<p>Bathroom</p>	<p>Outside</p>	<p>Garage</p>

- 1.1 How many old light bulbs (incandescent light bulbs) does Sipho use in his house. [Old light bulbs - 18]
- 1.2 How many energy-saving light bulbs (compact fluorescent light bulbs) does Sipho use in his house? [Energy-saving light bulbs - 6]
2. Use tally marks to complete the following tally table.....

Type of bulb	Tally Marks	No.
Old light bulbs	//// // // //	18
Energy-saving lights	/// /	6

3. Set 1: Altogether how many energy-saving lights (compact fluorescent lights) are used in the bedrooms and passage? [6]
4. Altogether how many old light bulbs (incandescent lights) are used in the garage, lounge and kitchen? [8]
5. Draw a pictograph showing the tally marks above.

Energy-saving lights								
Old light bulbs			 	 	  	  	  	  



*Grade 4 can draw separate pictographs.

6. There are 2 lights in the passage and 2 lights in the toilet.
- 6.1 Calculate the watt value of the lights in the passage [30W].
- 6.2 Calculate the watt value of the lights in the toilet [120W].
- 6.3 Which lights use more energy? [The old light bulbs].
- 6.4 Calculate the total watt value of the old light bulbs (incandescent lights) in the house [18 x 60 = 1080 watts] or the learners can add the wattage per room and then get the total.
7. Calculate the total watt value of the energy-saving lights (compact fluorescent lights) in the house? [6 x 15 = 90 watts] or the learners can add the wattage per room and then get the total.
8. Siphso found that his electricity account is very high. Give Siphso some advice on how he can bring down his electricity account. [Change all the lights to energy-saving lights; do not switch all the lights on at night; switch the lights off as soon as there is enough natural light in the morning; he can use sensor lights in the garage/outside - these lights only come on when there is movement; outside he can use lights powered by solar energy].

For grade 6 only:

9. If 200 households used 9 old light bulbs of 60 watts each, and all these bulbs were replaced with energy saving bulbs that used 11 watts each, what would the total saving in electricity be? [200 x 9 x 60 = 108 000W (old bulbs). 200 x 9 x 11 = 19 800 watts (energy saving bulbs). Total saving by replacing old for new bulbs is 88 200 watts].

Activity 4: Using energy wisely - The Television (TV)




This activity is for Grades 4, 5 and 6.

- Explain to the learners that a survey involves gathering or collecting information to understand what is happening in a particular situation.
- You need to get the information from the class.
- Give each learner a worksheet with the table.
- Do the first part of the activity as a class i.e. filling in the information on the table.
- Read each question and ask the learners to put their hands up (straight) if it applies to them.
- Count the number of hands that have been put up.
- Ask all the learners to record the information on the table.
- Tell the learners to answer the questions on their own.
- The figures given in the table are only examples - you will need to get the actual information from the learners in your class.



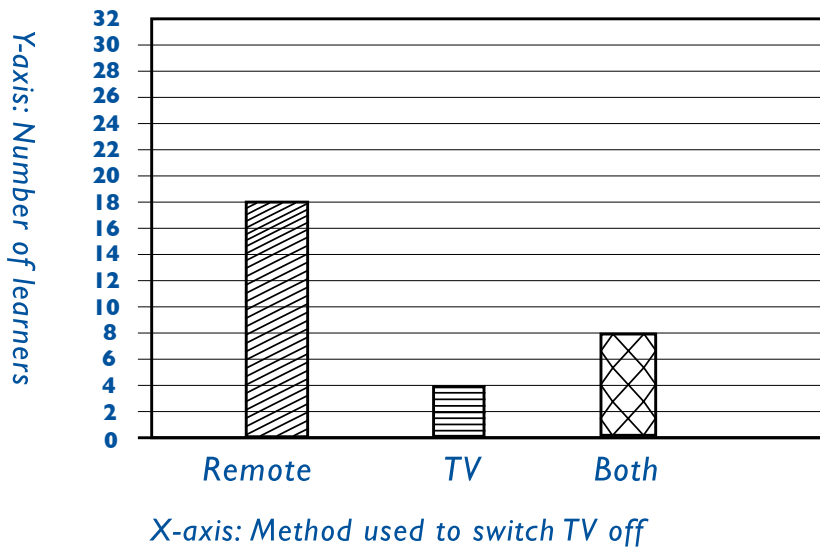
1. Gather the relevant information from your class by completing the survey form below. Use the example below:

Survey: Television (TV)	
Date of survey: 23 November 2013	
Survey Conducted by: Jabu Mpshe	
Grade: 6	
Total number of learners in class: 40	


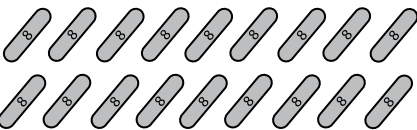

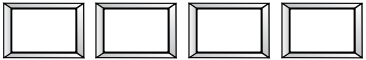
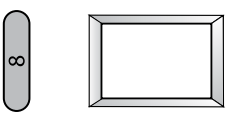
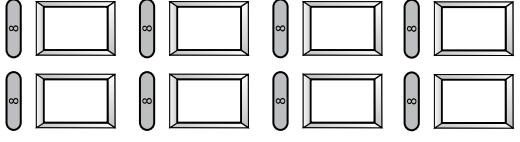
No.	Item	Number	Percentage
1.	How many learners are there in class?	40	100%
2.	How many learners have a television (TV) at home?	30	75%
3.	How many learners do not have a television (TV) at home?	10	20%
4.	How many learners switch the television (TV) on and off using the remote control?	18	45%
5.	How many learners switch the television (TV) on and off using the switch on the television (TV)?	4	10%
6.	How many learners switch the television (TV) on and off sometimes using the switch on the television (TV) and sometimes with the remote?	8	20%

2. Why is it important to find out how many learners do not have televisions (TVs) at home? [The survey is about televisions - learners who do not have a television may put their hands up and this will give incorrect information].
3. Sometimes not having a television (TV) is an advantage. List some of the advantages of not having a television (TV). [Nothing to distract you from doing your homework; more time to play outside; more time to spend talking to family; do not see any violence; do not waste time watching television; saves on energy bill; more time to do other things].

4. Draw a bar graph to show the information from questions 4, 5 and 6 of the survey. Label your graph.



5. Complete the pictograph to show the information for questions 4, 5 and 6.

<p>Remote</p> 		18
<p>TV switch</p> 		4
<p>Remote & TV switch</p> 		8
TV on and off – remote, switch or both		



*Grade 4: can draw 3 separate pictographs (TV - remote control; TV - switch; TV - both).

6. What can you say about the way learners switch the television (TV) on and off?
[Most learners use the remote control to switch the TV on and off].
7. What do you think is the most efficient way to switch off?
[Switch the TV off using the switch on the TV; when you switch off using the remote control the light is on - it means that the TV is not completely switched off - energy is being wasted].
8. Write down the *Golden Rule* for the use of electricity?

Switch it off if you are not using it.

For Grade 6 only:

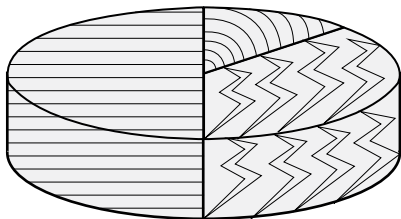
9. Look at the percentage column where you have filled in the information you have gathered.
 - 9.1 What is the highest percentage recorded?
 - 9.2 What was this percentage for?
 - 9.3 What was the lowest percentage recorded?
 - 9.4 What was it for?

Activity 5: Which appliance uses the most electricity at home?



This activity is for Grades 4, 5 and 6.

- Make certain that you go over pictographs and graphs before giving the learners the tasks on graphs.
- Give the learners the worksheets to answer the questions on their own.
- Read the information in the pie chart and answer the questions. The pie chart shows the amount of energy used by 3 appliances.
- Keep in mind that as long as energy is flowing through or a light is on you are using electricity and have to pay for it. **You pay for the electricity you use.**



1. Which 3 appliances are shown on the pie chart? [Standby - remote control TV; fridge; geyser].
2. Which appliance do you think uses the most amount of energy in a house? [Geyser].
3. Which appliance uses the second most amount of energy in a house? [Fridge].
4. Which appliance uses the third most amount of energy in a house? [All appliances on standby like a remote control TV - switched off with a remote].

5. Complete the table for the geyser which shows the fraction of energy used by the different appliances.

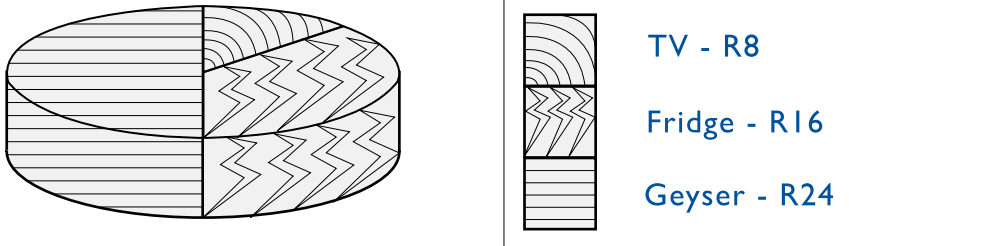
Appliance	Time left on for the day	Energy used	Cost
Fridge	24 hours	$\frac{2}{6}$	R16
TV on standby (switched off with the remote control)	24 hours	$\frac{1}{6}$	R8
Geyser	24 hours	$\frac{3}{6}$	R24

- 5.1 Which appliance do you think uses the most amount of energy in the house? Explain why you have chosen that appliance. [Geyser - on for 24 hours, continuously heats water - costs the most].

For Grade 5 and 6 only:

- 5.2 Which appliance uses the second most amount of energy in a house? Explain why you have chosen that appliance. [Fridge - on for 24 hours, costs the second most].
- 5.3 Which appliance uses the third most amount of energy in the house? Explain why you have chosen this appliance. [All appliances on standby like a remote control TV - switch off by remote - costs third most].
- 5.4 Although the television (TV) is switched off, why is there still a cost or payment? [When you switch off using a remote control the light is on - it means that the TV is not completely switched off - energy is still being used].
- 5.5 What is the energy-wise way to switch off the television (TV)? [Switch off using the switch on the TV].

- 5.6 Draw a pie chart to show the amount paid for the electricity used by each appliance - television (TV), geyser and fridge. Label your pie chart.



Pie Chart: Amount paid for the use of appliances

- 5.7 Complete the pictograph to show the amount paid for each appliance. One picture should represent one unit of money on the pictograph.

TV						R8
Fridge						R16
Geyser						R24
Cost of using appliances ● R2						



* Grade 4: can draw 3 separate pictographs: (TV; fridge; geyser).

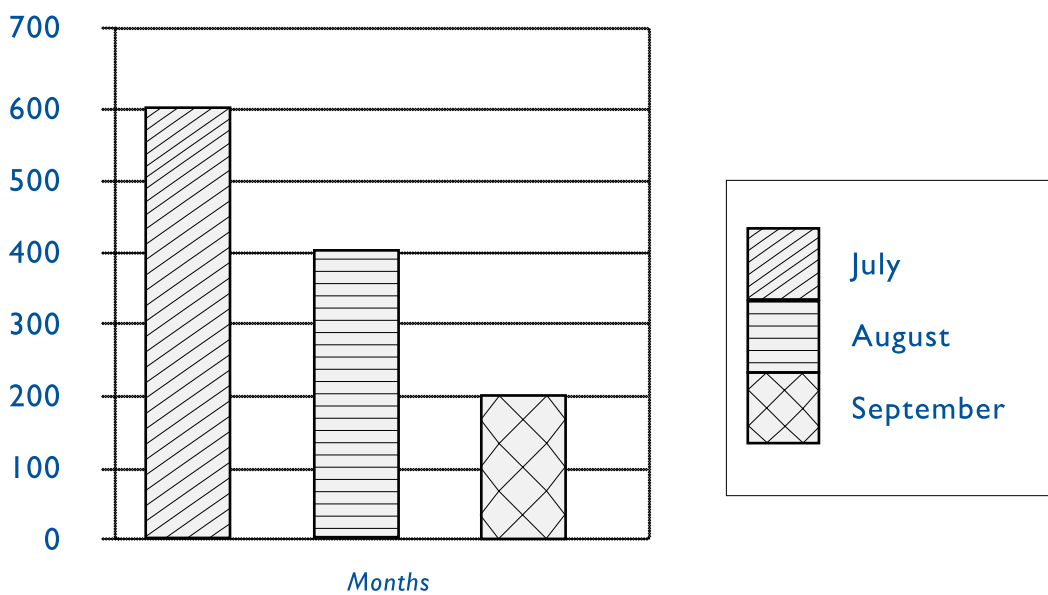
Activity 6: Electricity accounts - You pay for the electricity you use.



This activity is for Grades 5 and 6.

- Make certain that you go over pictographs and graphs before giving the learners task on graphs.
- Give the learners the worksheets to answer the questions on their own.

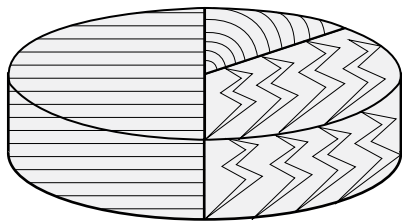
The following bar graph shows the electricity account for a family of 5 living in a three-bedroom house in South Africa. They use heaters in winter and their air-conditioners are on in summer.



I. Complete the table below using the information from the graph.

Month	July	August	September	Total
Account	R600	R400	R200	R1200

2. Draw a pie chart to show the electricity account for July, August and September.
Label your pie chart.



Pie chart: Electricity account for 3 months

- 2.1 In which month was the most electricity used? Why do you think this was the case? [Remember when the seasons start and end in South Africa].
[July. It is winter and the heaters are used - heaters use up a lot of electricity].
- 2.2 Explain why the electricity account in October is likely to be far less than July?
[The weather warms up - heaters are not necessarily used].
- 2.3 Why do you think that the electricity account for January can be as high as in August? [It is summer and the air-conditioner is probably on all day].

- 2.4 Write down ways in which the electricity account can be brought down in July and January by reading the the information below, by applying what you have learnt about energy-saving lights and energy-saving tips.

Technology that uses electricity to make us feel warm in winter or cool in summer can use a lot of energy.

Winter:

- Using blankets, warm clothes and eating food while it is fairly warm can save energy in winter.
- Make certain that windows are closed tightly and any space under the doors is covered.
- Open the curtains as soon as the sun rises to warm up the house. This prevents cold air from coming into the house and warm air from leaving the house.

Summer:

- Use light clothes and drink lots of water.
- Open the curtains much later or keep the curtains closed to filter the sunlight keeping the house cooler for much longer.
- Switch off the lights as soon as there is enough light. In summer the sun rises early.
- When using an air-conditioner make sure that windows are closed tightly and any space under the doors is covered. This prevents the cool air from leaving the house.
- Also remember quite often the temperature drops in the evenings - so you can turn off the air-conditioner for a while.

[July - all that applies for winter; January - all that applies for summer].

