# IT'S TIME TO CHANGE

## LEARNING and LIVING FOR NATURE

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NaDEET Centre offers week-long programmes for school, youth, educator and adult groups in the Namib Desert. The programme aims to engage participants in sustainable living through first-hand learning and living experiences. Activities include solar cooking, water monitoring and saving techniques and exploration of the Namib's biodiversity and dune landscape. NaDEET strongly believes in the urgent need for all people to take action for the environment.


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# OUR CHANGING WORLD

Hi, I am **Sustainable** Sara!

I live in Namibia. Approximately two million people live here. Compared to the rest of the world, Namibia has a very low population. Our country, however, cannot sustain more people because it is very dry and has little water.

Did you know that on planet Earth there are over 7.5 billion people? All of these people, including you and me, depend on the natural environment for food, water and shelter. We tend to forget that we are also animals and part of an ecosystem. Perhaps this is because we are capable of changing the natural world around us to serve our needs and wants.

But, humans have been changing the environment for thousands of years. Why is this now a problem?

In just the past 100 years, we have rapidly changed the way we live. Our lifestyles demand more energy, water and other resources and we create more pollution and waste than the environment can handle. We cannot continue to live this way because it is unsustainable.

**VOCABULARY**
**Sustain:** To keep going, support
**Sustainable:** Able to keep going or support
**Unsustainable:** Not able to keep going or support

ACTIVITY

Directions: Study and compare the two pictures below.

ACTIVITY

**100 years ago**

**today**

There are many differences between life 100 years ago and today. List at least eight differences below:

1. The river used to be clean; today it is polluted.
2. .....
3. .....
4. .....
5. .....
6. .....
7. .....
8. .....

# FIREWOOD FOR ALL?

Regardless of social, economic or political background, Namibians love firewood. Everyone has a special cultural connection to fire. But our love of firewood has led to over use and pressure on the environment.


The environmental problems that we have created are often difficult to solve. Let us look at the example of deforestation.

Trees are a renewable resource. Renewable resources are formed or restored by natural processes. For example, soil, air, water and animal life are all renewable resources. Just because it is renewable however, does not mean it cannot be over-utilised. When too many trees are cut down and not replaced in an area, it is called deforestation.

**Did you know?**
**Non-renewable resources** are not replaced by natural processes or the replacement rate is slower than the human timescale. For example, oil, coal, iron ore and desert landscapes are all non-renewable resources.

Many areas in Namibia are faced with serious deforestation. Deforestation is caused by:

- human over-population
- intensive use for cooking, building and crafts
- a limited number of trees
- insufficient replanting and regrowth of trees

Deforestation is only one of many problems that we face today. Environmental problems are caused for different reasons, but are often inter-linked.


**Directions: Help Sustainable Sara match the environmental problem with the correct definition and the correct picture by drawing a line to connect them.**


CLIMATE CHANGE

Misuse of scarce water resources through over-consumption, broken infrastructure and inappropriate use.


Change of the Earth's average weather due to human caused global warming.

HIGH ENERGY CONSUMPTION

Throwing waste anywhere instead of using appropriate facilities

APATHY

High use of energy to maintain an industrial lifestyle

LITTERING AND ILLEGAL DUMPING

WATER WASTING

Not caring

# NATURE IS A WONDERFUL TEACHER

Hi, I am Addy, the Horned Adder.

We can often find solutions to our environmental problems by looking and learning from nature. What better place to look than where I live - the Namib Desert.

Did you know that the Namib is one of the oldest deserts on earth? And, did you know it is Namibia's namesake? "Namib" is a word from the Nama language. It means a large plain in a desert.

Many people believe that a desert is an empty place with no life. This is not true. Although the desert has a harsh climate, there are many different living things here. It took millions of years for the desert to form. This gave living things time to adapt to the new environmental conditions.

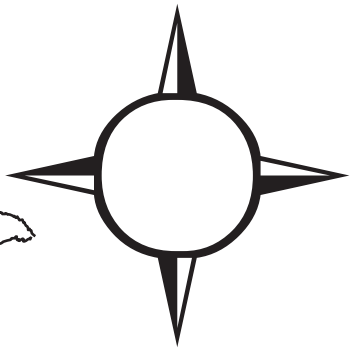
**What makes a desert a desert?**
A desert ecosystem is controlled by water or the lack of water.
There are three main factors that are used to determine a desert. They are:
1. Low, unpredictable rainfall
2. High evaporation rates
3. Extreme temperature conditions

In a desert ecosystem, there is more water lost than gained making it a very dry place.

**VOCABULARY**
**Adapt**: To fit into the environment to survive


Directions: Using the map, complete the following tasks:


1. Colour in the area on the map that shows the Namib Desert.
2. Find and label the correct dots for Swakopmund, Walvis Bay and Lüderitz.
3. Label the Orange (Gariep), Kunene and Kavango Rivers.
4. Find and label the correct directions on the compass.





Join us on a trip to the Namib Desert.

There we are going to learn from nature to lead a more sustainable lifestyle!

# THE ENERGY BALANCE

**Energy** cannot be destroyed. It can only change from one form to another. Examples of different forms are heat, light, electric and chemical energy.

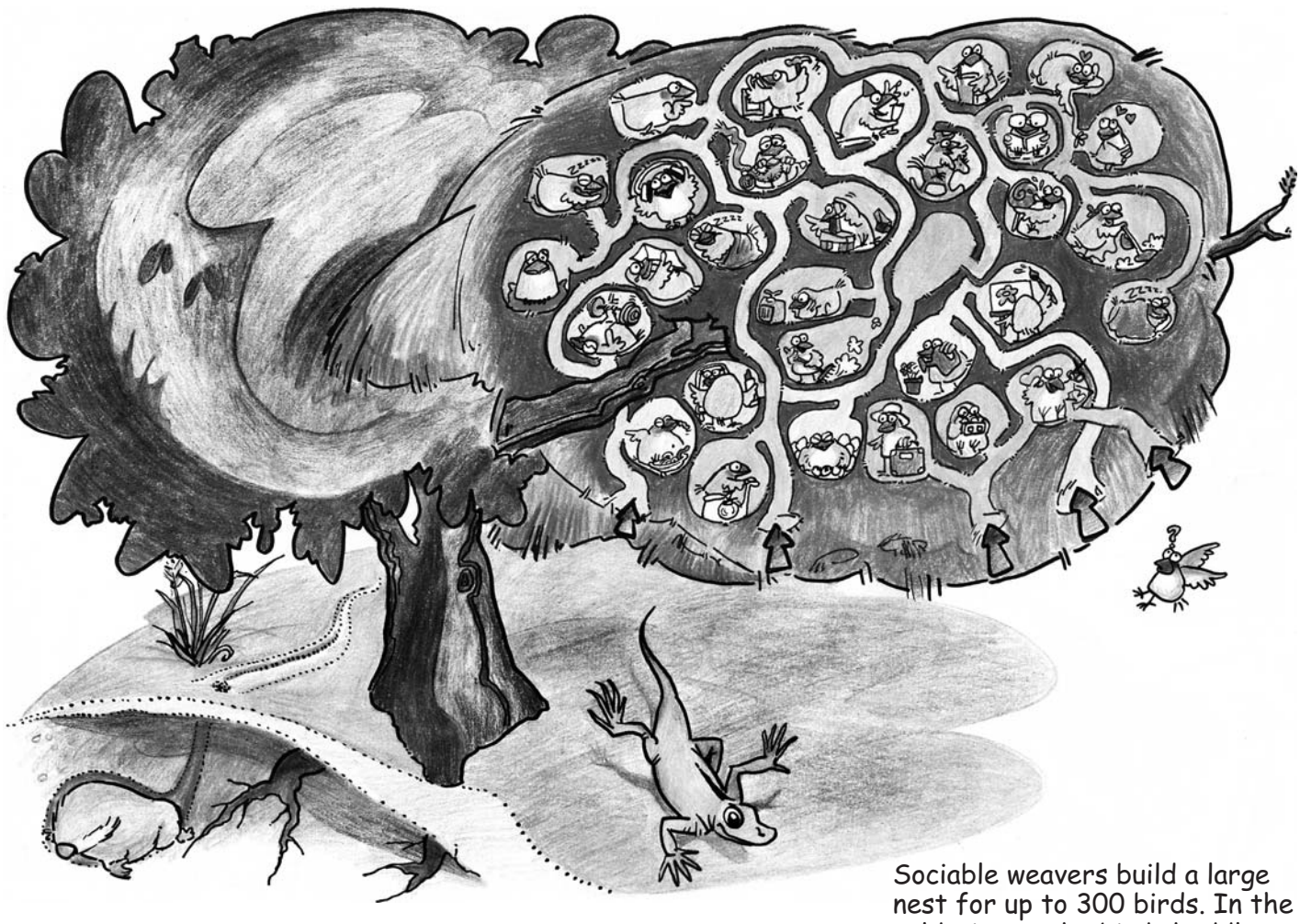
All energy on Earth is originally from the sun. In the Namib Desert there is plenty of solar energy. As the base of the food chain, plants use sunlight to make their own energy. This is called photosynthesis. Animals get energy from the food they eat.

Of course, animals and plants also use up energy to get food. In the Namib, it is not guaranteed that there is always enough food available. So living things need to save as much energy as they can to be **energy efficient**.

**VOCABULARY**
**Energy:** The ability to do work
**Energy efficient:** To waste as little energy as possible

One of the main energy challenges to desert animals and plants is adjusting to extreme temperature changes. These are not just seasonal but also daily with differences of more than 20° C in one day.


Directions: Discover how the golden mole, shovel-snouted lizard and the Sociable weaver bird are energy efficiency experts. Then complete the maze to help the Sociable weaver bird find a place inside the nest.

The golden mole can reduce its metabolism - all the processes that produce energy and growth - to allow its body temperature to match the temperature of the sand. This is called **PHYSICAL THERMOREGULATION.**

The shovel-snouted lizard is a cold-blooded animal that needs to warm up to become active. If it is too hot, it does a 'thermal dance' to cool off its feet. This is called **BEHAVIOURAL THERMOREGULATION.**

Sociable weavers build a large nest for up to 300 birds. In the cold winter, the birds huddle together to create warmth. In the hot summer, the birds all roost in their own compartments to stay cool. These well designed and constructed nests keep the average nest temperature between 20-30°C year round. This is called **INSULATION.**

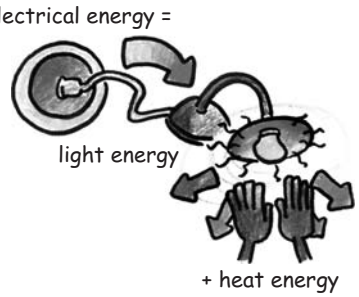
# BE MORE ENERGY EFFICIENT!

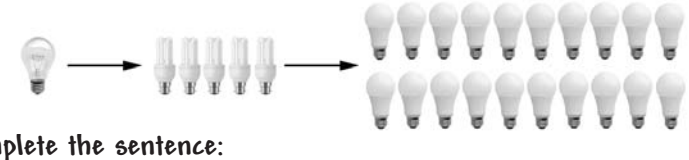
Wow! It is amazing what desert animals can do to stay cool (or warm) and still save energy. Most humans use lots of energy to heat or cool our homes and for lighting, cooking, entertainment and transport. Do you turn on the fan when it is hot? Do you use a fire or heater when it is cold? We learned about three different methods of energy efficiency from the desert animals: physical thermoregulation, behavioural thermoregulation and insulation. Here are some ways that you can adapt your lifestyle to be more energy efficient.


Directions: Read and complete each activity below:


## CHANGE YOUR LIGHTBULBS!

Traditional incandescent light bulbs produce light and heat energy. This is a waste of energy because we just need the light. Today there are more energy efficient light bulbs available such as compact fluorescent (CFLs) and light emitting diodes (LEDs).



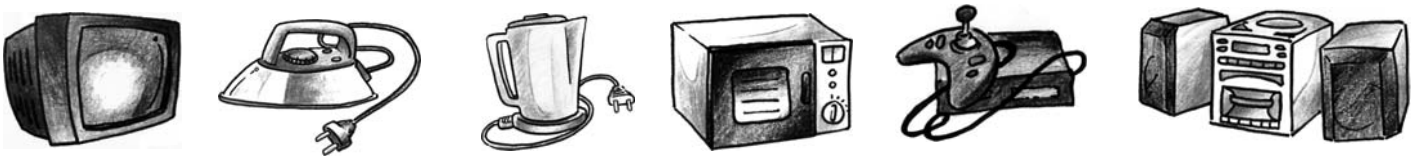
Unscramble the letters to complete the sentence:

The amount of energy needed to power one .....(tescdinancen) light bulb can power

..... (ivfe) compact fluorescent light bulbs or twenty .....(del) lights!

## TURN OFF THE LIGHT!

The easiest way to save energy is to turn off lights and appliances that are not in use. Sometimes this can be difficult because many appliances have a small light (standby light) or digital clock on at all times. Look at the appliances below and circle the ones that are wasting energy because they have a standby light or digital clock!



## USE A FUEL-EFFICIENT STOVE!

Do you cook using firewood? Energy is wasted when we use an open-fire because the heat produced escapes. By using a fuel-efficient stove, the heat is trapped around the pot. Therefore less firewood is needed to cook your food. Compare and colour in the heat to see where it goes.

## USE DIRECT SOLAR POWER TO COOK!

Each time energy is changed from one form to another, some energy is lost in the form of heat. Look at the two drawings below. The arrows represent the conversion of energy from one form to another. Fill in the box the number of times energy is converted in each picture. Then circle the most energy efficient method.

A)


B)

# IT'S FREE, CLEAN AND RENEWABLE!

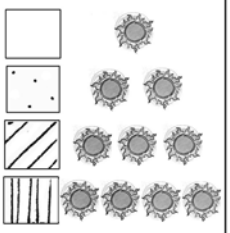
Worldwide humans are primarily dependent on **fossil fuels** for industrial and household energy. In Namibia many people still depend on firewood for their household needs. At their current usage rate, these fuel sources are unsustainable. Luckily there are other sources of energy like solar, wind and hydro-power that are sustainable. These energy sources are clean and are readily available on most of our planet. Namibia is one of the countries worldwide that has the most solar power.

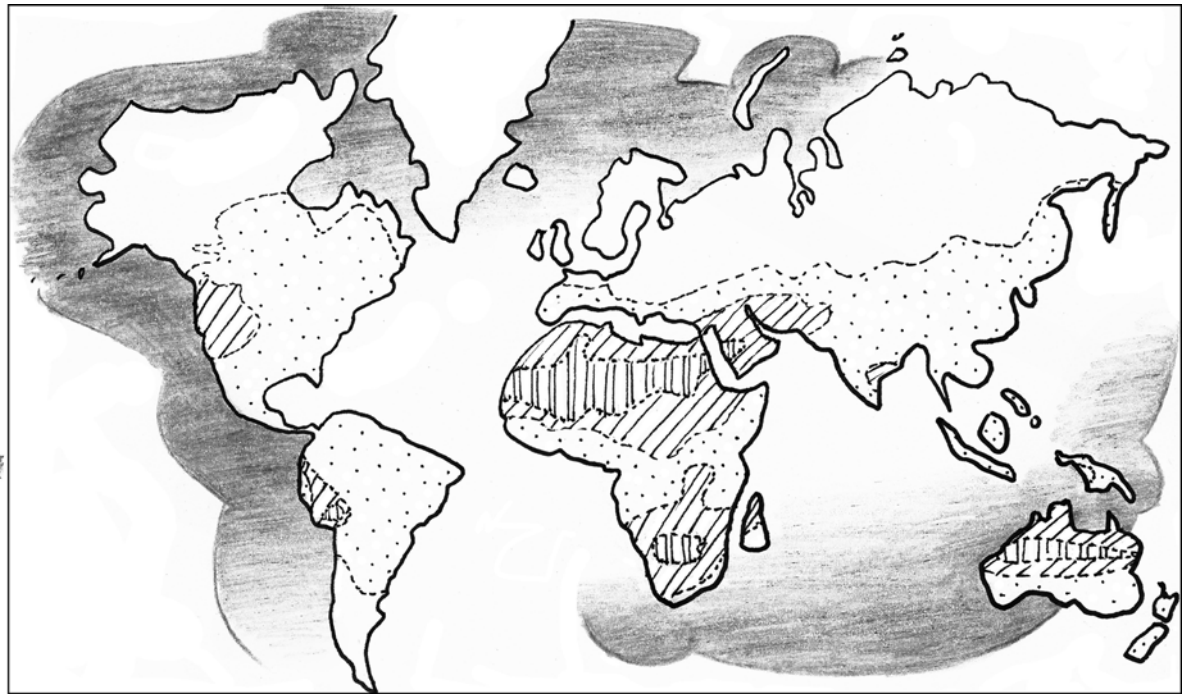
**What are fossil fuels?**
Fossil fuels were created by the compression of dead plant and animal materials in the Earth over millions of years. Oil (petrol and diesel), gas, and coal are all examples of fossil fuels. When fossil fuels are burned, gases such as carbon dioxide ($CO_2$) are released. These cause global warming.


Directions: Check out the solar world map and key below. Using the key, choose four colours to represent the different amounts of solar radiation. Colour in the map correctly.


## SOLAR WORLD MAP

KEY:





In the Namib Desert, we have plenty of solar and wind power. Let's find out how desert plants use this power to grow and reproduce.

## PLANTS AND SOLAR ENERGY

Plants are the best example of how nature uses the sun as a source of energy! During photosynthesis plants convert sunlight into energy. Plants are the basis of most food chains.

## PLANTS AND WIND ENERGY

The Namib Desert has a lot of wind. It plays an important role in shaping the landscape. Many grasses depend on wind to disperse their seeds. The seeds of the tall bushmen grass have a long feathery awn. Wind blows the seed. When the seed lands, the feathery awn is pushed by the wind and drills the seed deep into the ground where it can germinate after rains.

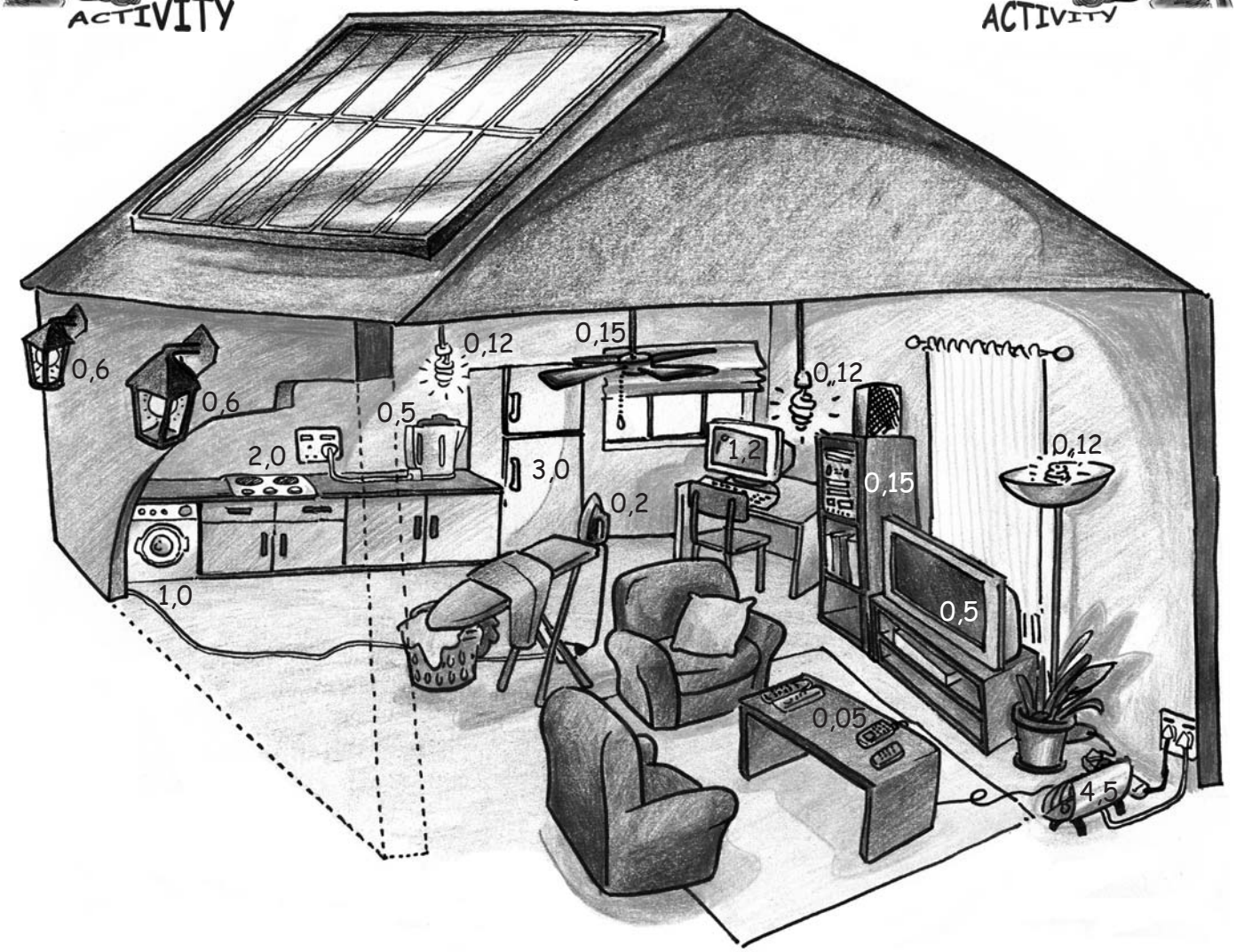
## DESERT ANIMALS ALSO USE SOLAR AND WIND POWER

The oryx often stands on top of a dune where the wind can cool it off. Reptiles, like me, use the sun to warm up in the mornings to become active.

# SOLAR POWER HOUSE

Namibia has so much sunshine available, we should be utilising it. Look at the picture of the solar powered house below. The roof of the house is covered in solar panels to generate electricity. Although the solar panels can produce a lot of electricity, they cannot power all of the household items all of the time.


**Directions: Study the solar power house below. Each solar panel on the house produces 0,5 kwh/day on a sunny day. The solar power house is filled with a variety of common electrical appliances. We will measure the electricity usage of the appliances in kilowatt hours per day (kwh/day). The average kwh/day is stated on each appliance.**


**Answer the questions and fill in the chart below:**

| Energy Consumption Chart | |
|---|---|
| **APPLIANCE** | **KWH/DAY** |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| TOTAL | |

1. How many solar panels are there? .....
2. Complete the equation to calculate how much energy is produced on a perfect sunny day:

   ...../day/panel x ..... # of panels = .....total kwh produced
3) Fill in the chart to calculate how many items you can use. Make sure that your total energy consumption does not exceed the total amount of kwh produced.

4) Circle the appliances you will use.

5) Which appliances did you leave out? Why?

.....

.....

.....

.....

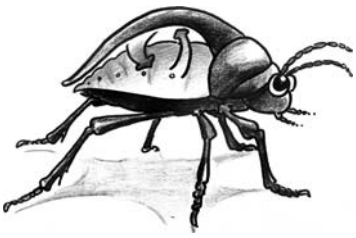
# WATER IS PRECIOUS

While there is plenty of sunshine, water is one of the Namib Desert's most limited resources. The Namib has low rainfall and very high **evaporation** due to the ever-present sun. This means that the desert loses more water than it gains.

Animals and plants in the Namib Desert have adapted in unique ways to conserve the little water that is available. Let's explore how nature has developed ways to survive with the resources that it has.

**VOCABULARY**
**Evaporation:** The process whereby liquid water turns into water vapour
**Transpiration:** The loss of water through the surface of a plant

## A MINI WATER CYCLE

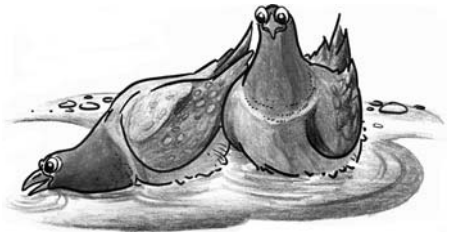


All insects breathe out of openings on their body called spiracles. Like humans, when the tok tokkie breathes out, it also breathes out moisture. This moisture is trapped inside a small cavity made by the fused wings of the tok tokkie. When the tok tokkie breathes in again, it inhales the moist air.

What do you think is more important for insects in the Namib Desert: Saving water or being able to fly? Why?

## WAITING OUT THE HEAT OF THE DAY

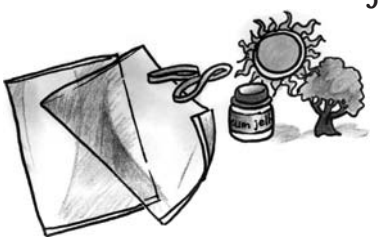
The Namaqua sandgrouse flies many kilometres each day to find water. It will only look for water during the early morning and just before sunset. The Namaqua sandgrouse travels during these times to avoid the hottest part of the day. This protects the bird from losing too much water.



## WATERPROOFING

The waxy leaves and stems of many desert plants like the !Nara reduce the amount of water lost to **transpiration**. Depending on the amount of sunshine, some desert plants can produce more or less wax. How does wax protect the leaf? Similar to candles, wax and water do not mix. The wax, therefore, acts as a protective layer that prevents the water from escaping.


Directions: In this experiment we want to demonstrate the effectiveness of a waxy layer. You will need two plastic bags, two elastic bands, petroleum jelly, leaves on a tree or bush and sunlight.

1) Find two small branches with leaves that are similar and on the same side of the plant.

2) Put one plastic bag around one branch and secure it tightly with the elastic band.

3) On the second branch, cover all the leaves with a layer of petroleum jelly. Then put the second plastic bag around the branch and secure it tightly with the elastic band.

4) Wait for an hour and then compare the amount of water in the two plastic bags.

What happened? .....

.....

# HELP SUSTAINABLE SARA SAVE WATER!

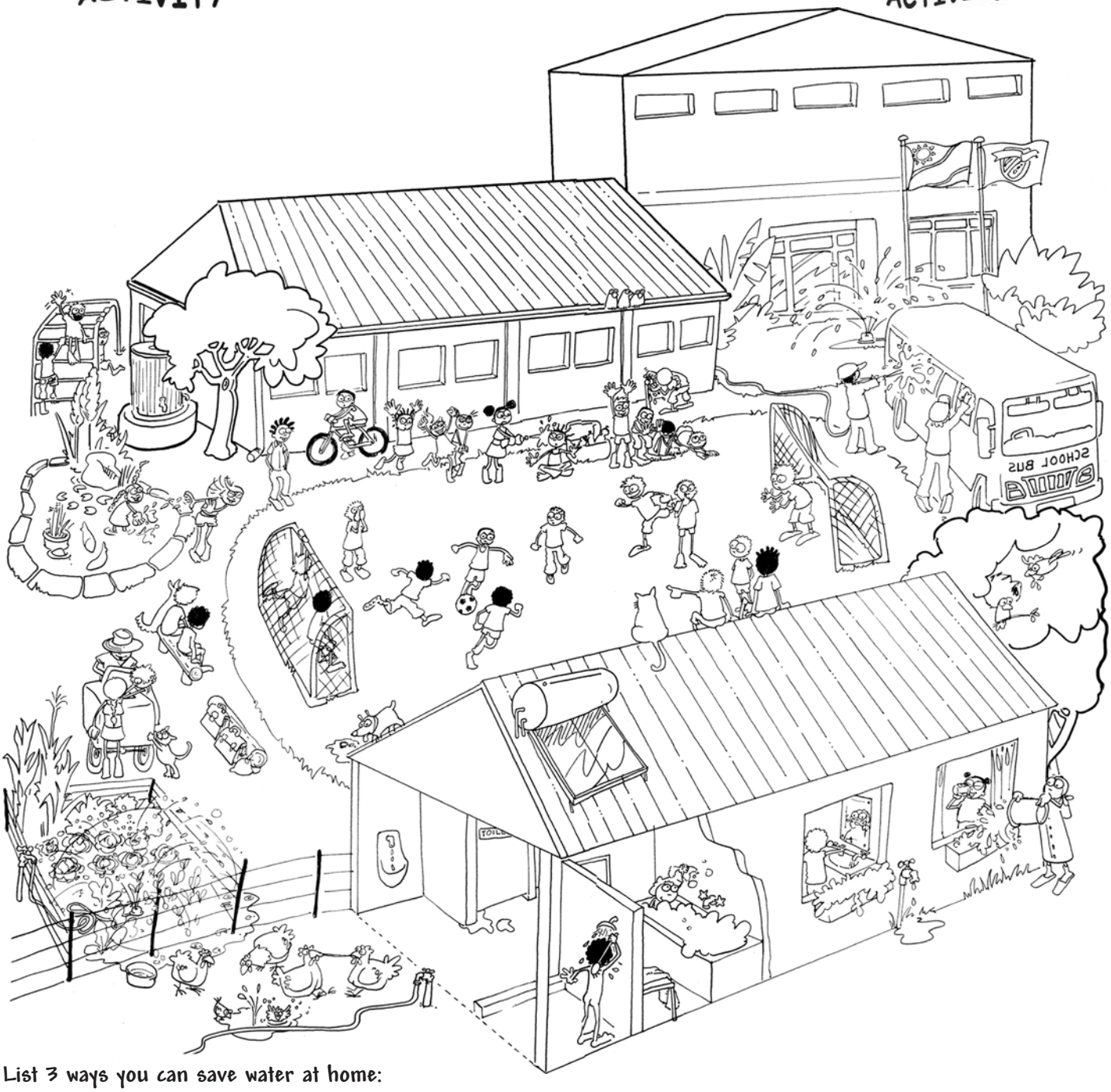
We have learned that desert animals and plants have many different strategies to save water. As humans we always look for ways to get more water instead of saving the water that we already have. Do you waste water? For example, do you turn off the tap when you brush your teeth?

Apply the knowledge that you have learned and help the school and hostel below to conserve our precious water.

**Directions:**

**Study the picture below of the school and hostel. The children and school staff are using water for different activities. Some of them are using water responsibly while others are wasting it. Help Sustainable Sara find the 13 different places where the children and school are <u>wasting</u> water. Colour them in!**






**List 3 ways you can save water at home:**

1. .....

2. .....

3. .....

# NATURE'S RECYCLERS

Almost everything that we do creates waste products of some sort. When we prepare food, we create litter. When we bathe, we create "waste water". When we drive a car, we create air pollution. All of these are waste products.

In the Namib Desert, animals and plants also create waste. The desert ecosystem, however, has found ways to **reduce**, **reuse** and **recycle** many of these waste products. Remember that all waste products have some value to them. For example, they can be storing energy, nutrients or water.

**VOCABULARY**
**Reduce:** To use less
**Reuse:** To use again
**Recycle:** To use again after changing it

## DETRITUS

The main source of food in the Namib Desert is small pieces of plant material, insects and faeces. This is called detritus.

Tok tokkie beetles and fishmoths are the main consumers of detritus and therefore play the important role of recyclers. They release important nutrients into the soil and therefore back into the food chain.

## DUNG

All animals excrete droppings. The dung beetle is very resourceful and reuses the dung of animals like the gemsbok and scrub hare. It lays its eggs in the dung and uses it as a food source.

## MOULTED SKIN

The chameleon sheds its skin as it grows larger. It recycles the skin by eating it. The skin is an important source of calcium and therefore provides the chameleon with a much needed mineral.

## DRIED GRASSES AND TWIGS

Many birds use plant material to build their nests. They scavenge around their local environment for pieces of grass, branches and other materials such as bird feathers. Birds build their well-designed homes using only these recycled materials.

## WORD SEARCH

Directions: Help Addy complete the word search.
Find and circle the words in the list below.
The words can be in the following directions:


→ ↑ ↓ ↙ ↘ ←


### WORDS

| | |
|---|---|
| REDUCE | BRANCHES |
| REUSE | SKIN |
| RECYCLE | CHAMELEON |
| DUNG BEETLE | EGGS |
| CALCIUM | DETRITUS |
| NEST | FISHMOTH |
| GRASS | TOK TOKKIE |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G | R | A | S | S | H | L | T | D | R |
| U | I | E | K | S | I | T | S | E | N |
| N | S | I | D | C | O | T | C | T | S |
| O | N | K | N | U | S | Y | B | R | L |
| E | C | K | I | R | C | A | R | I | D |
| L | A | O | R | L | O | E | A | T | I |
| E | L | T | E | E | B | G | N | U | D |
| M | C | K | G | E | U | T | C | S | E |
| A | I | O | E | G | G | S | H | G | I |
| H | U | T | L | O | T | U | E | S | U |
| C | M | H | T | O | M | H | S | I | F |

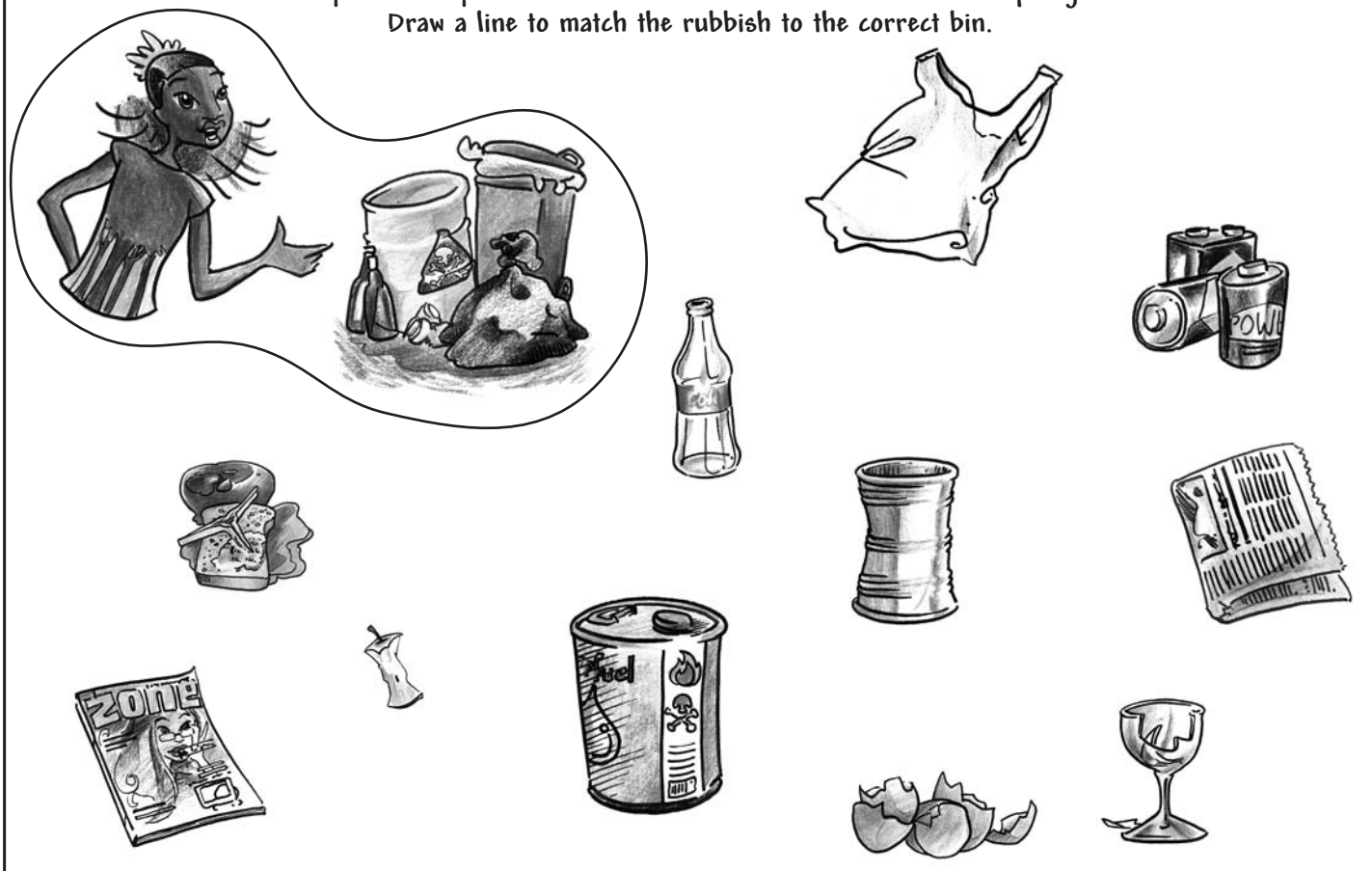
# BE LESS WASTEFUL

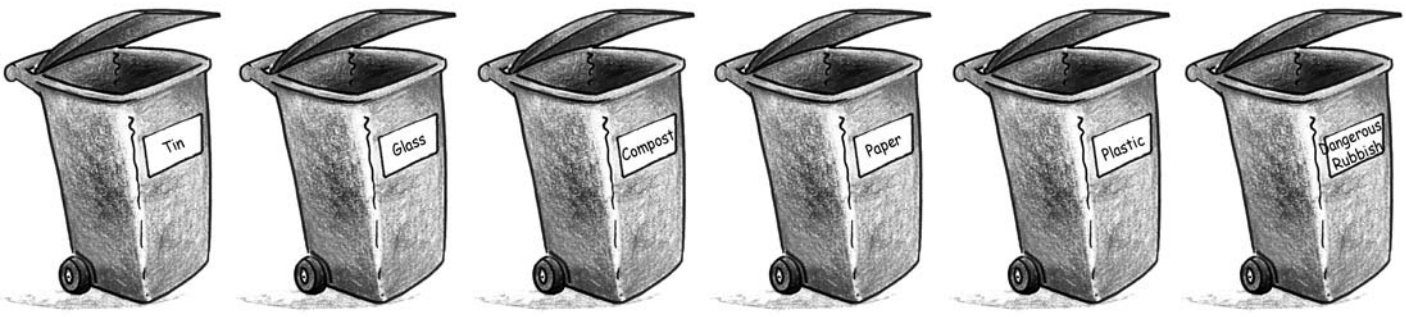
When it comes to waste, most people just do not care. Some people just throw their rubbish on the ground creating litter. We have learned that animals in the desert try to recycle or reuse all waste products as these can also be useful resources.


Directions: Here are some examples of reduce, reuse and recycle.
Identify the items and fill in the missing spaces below:


| becomes compost | becomes | becomes |
|---|---|---|

Sustainable Sara has found a rubbish bin filled with all kinds of waste.
Help her to separate the rubbish into the correct bins for recycling.
Draw a line to match the rubbish to the correct bin.




TIN GLASS COMPOST PAPER PLASTIC DANGEROUS RUBBISH

## FIND OUT MORE

What happens to the dangerous rubbish? Phone your municipality to find out what happens with household rubbish and where you can recycle.

# EVERY PERSON MAKES A DIFFERENCE

I understand that there are environmental problems, but I do not see how I can make a difference? Government and big businesses need to solve the environmental problems, not me.

Yes, governments and businesses need to protect the environment, but so do you. Every individual needs to:
1) Become aware
2) Learn about the problem and the environment
3) Care about solving the problems
4) Take action to solve the problems


**Directions:**
**Get started by becoming aware. Do you know what impact your lifestyle has on the environment? Take this Lifestyle Quiz to find out.**


| QUESTIONS | YES | NO |
|---|---|---|
| Do you grow your own food? | | |
| Do you solar cook? | | |
| Do you use a fuel-efficient stove? | | |
| Do you compost? | | |
| Do you have indigenous trees in your garden? | | |
| Do you bring your own bag when you buy something? | | |
| Do you buy in bulk instead of small containers? | | |
| Do you walk/bicycle more than you use a car? | | |
| Is your house well insulated? | | |
| Do you turn the lights off when you leave the room? | | |
| Do you use energy efficient light bulbs? | | |
| Do you turn the tap off when you brush your teeth? | | |
| Do you use both sides of a piece of paper? | | |
| Do you use solar energy to heat your shower/ bathing water? | | |
| Do you exercise or play sport in your free time? | | |
| Do you volunteer and help others? | | |

**SCORING:** Are you living an environmentally-aware lifestyle? Do you know the impacts of all of your choices? Count the number of yes / no and check out how well you did.

**12-16 "yes" answers:** CONGRATULATIONS! You are just like Sustainable Sara. Keep learning and caring about your environment. You do make a difference!

**8-11 "yes" answers:** YOU ARE GETTING THERE! Keep on making changes to your lifestyle. Remember to think about the environment first.

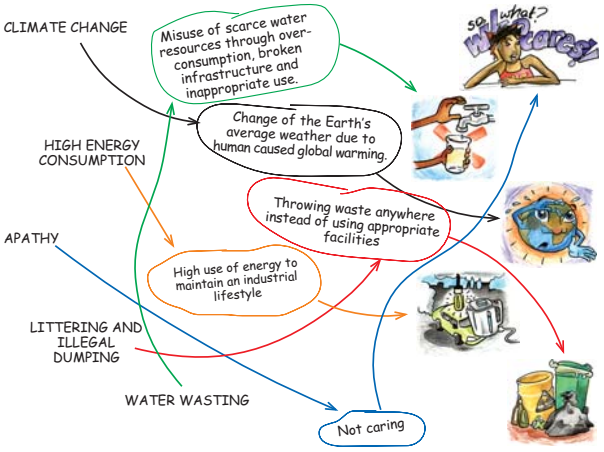
**0-7 "yes" answers:** IT'S TIME TO CHANGE! Use this activity book to help make your lifestyle more sustainable.

# SOLUTIONS

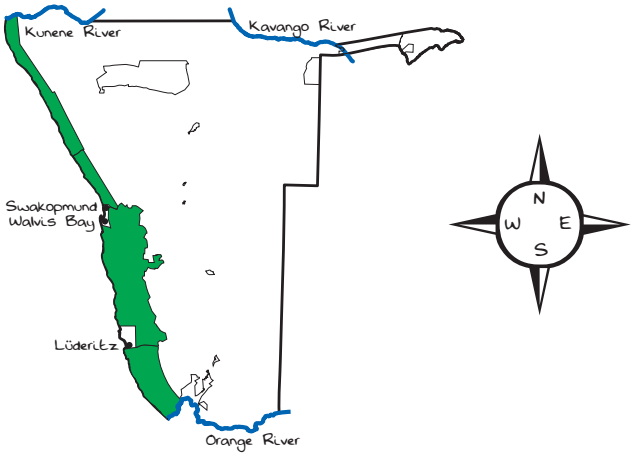
## Page 3

1. The river used to be clean; today it is polluted.
2. The air used to be clean; today it is polluted.
3. People used to spend time outdoors; today they are just indoors
4. People used to cook on fire; today they use electricity
5. There used to be a lot of wildlife, today there is little.
6. There was no litter, today there is litter
7. People used to get water from the river, today it is from the tap.
8. People used to live in traditional houses, today they live in houses with tin roofs.

## Page 4



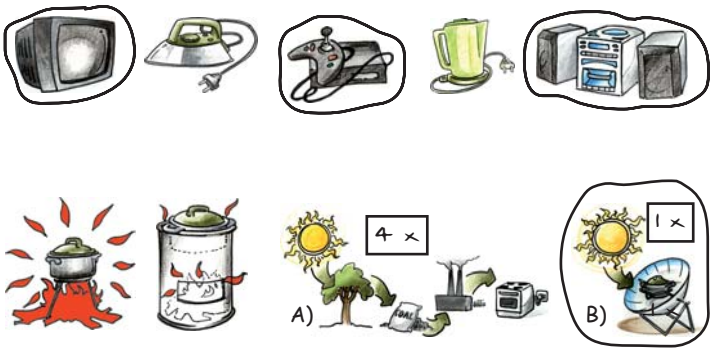

## Page 5



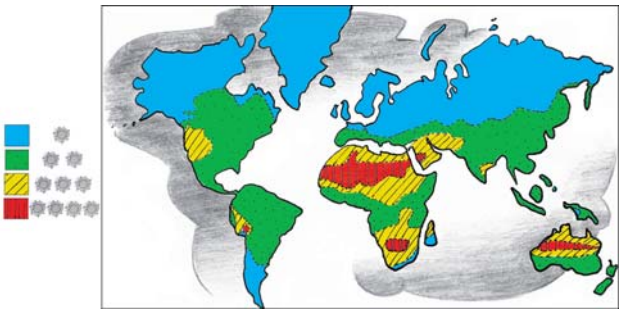

## Page 6

## Page 7

The amount of energy needed to power one incandescent (tescdinancen) light bulb can power five (ivfe) compact fluorescent light bulbs or twenty led (del) lights!




## Page 8



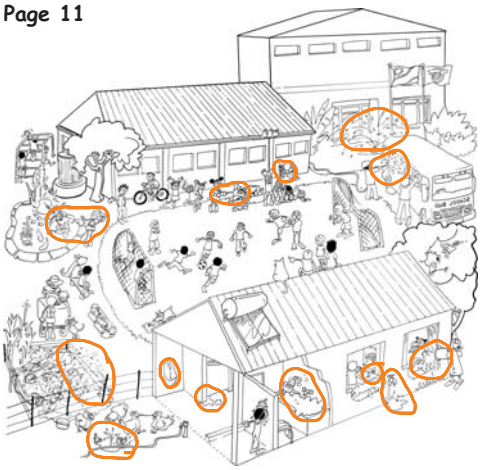
## Page 9

1. How many solar panels are there? 12
2. Complete the equation to calculate how much energy is produced on a perfect sunny day: 0.5 /day/panel x 12 # of panels = 6 total kwh produced
3) Fill in the chart to calculate how many items you can use. Make sure that your total energy consumption does not exceed the total amount of kwh produced. Different answers may be given. Total may not be more than 6 kwh
5) Which appliances did you leave out? Why? Answers may vary. Most likely you left out the heater because it uses 4.5 kwh.

## Page 10

4) What happened? The leaves covered in petroleum jelly lost little or no water. The uncovered leaves lost a lot of water to transpiration.

## Page 11



## Page 12

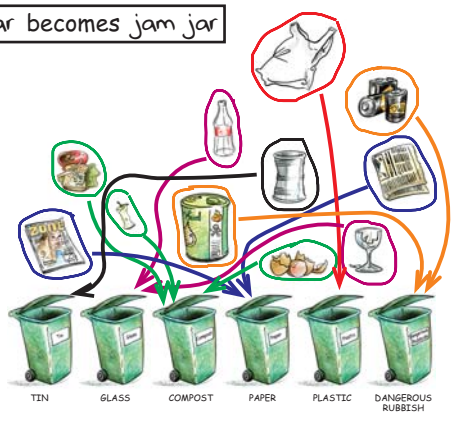
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G | R | A | S | S | H | L | T | D | R |
| U | I | E | K | S | I | T | S | E | N |
| N | S | I | D | C | O | T | C | T | S |
| O | N | K | N | U | S | Y | B | R | L |
| E | C | K | I | R | C | A | R | I | D |
| L | A | O | R | L | O | E | A | T | I |
| E | L | T | E | E | B | G | N | U | D |
| M | C | K | G | E | U | T | C | S | E |
| A | I | O | E | G | G | S | H | G | I |
| H | U | T | L | O | T | U | E | S | U |
| C | M | H | T | O | M | H | S | I | F |

## Page 13

banana peel becomes compost

old yoghurt cup becomes pencil holder

old jar becomes jam jar

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