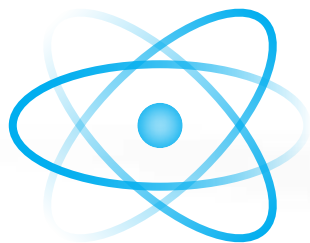


SCIENCE
CURRICULUM LEVELS 2–3



Investigating Paper

SCL207 2015/1



Science Curriculum Levels 2–3

The Nature of Science

The Nature of Science strand is the overarching science strand. Through it, students learn what science is, how scientists work, as well as ways science knowledge is created and used.

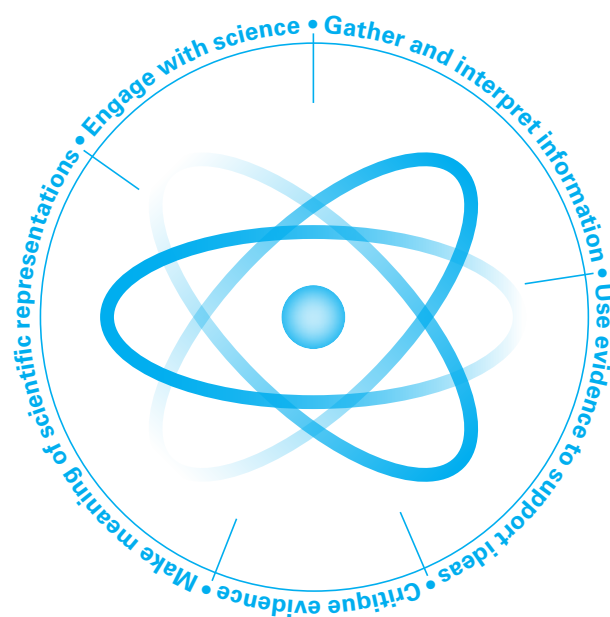
This is done through the context strands of the Living World, Planet Earth and Beyond, the Physical World and the Material World.

It involves:

- understanding about science
- investigating in science
- communicating in science
- participating and contributing.

The skills that scientists use are:

- gather and interpret information
- use evidence to support ideas
- critique evidence
- make meaning of scientific representations
- engage with science.



When you see this icon in the activities, you will know you are practicing and using these nature of science skills.

Key competencies

Key competencies are skills, knowledge and values that help us live, learn and work independently and with others.

The key competencies you will focus on in this topic are:

- using language, symbols and texts
- thinking.

As you work through this unit, think about which of these key competencies are being used.

You could:

- talk together about the key competencies you are using, and how you know
- write examples in your journal of how you are using the key competencies.

Making sense of the material world

The **Material World strand** involves the study of matter and the changes it undergoes.

- Group materials in different ways, based on the observations and measurements of the characteristic chemical and physical properties of a range of different materials.
- Compare chemical and physical changes.

Introduction

In this topic you will investigate:

- different types of paper
- compare different papers and record your findings
- make predictions and test your ideas
- make paper.

Learning Outcome

At the end of this topic you will be able to use the information you've observed and gathered (evidence) to describe the different properties of paper.

Learning Intentions

I will:

- describe and compare the properties of different types of paper
- make predictions and test my ideas
- make recycled paper, describing its properties and the process of making it.

You will:

- observe, predict and test the different properties of paper
- record what you find out so others can understand your results
- use your knowledge to make recycled paper.

Assessment

Your teacher will give feedback on:

- the activities in the recording journal
- your own investigation on the properties of paper
- the assessments and evaluations on the inside back cover.

How to do the work

Spread this work over two to three weeks, for example an hour a day over three days a week.

WHEN YOU SEE THESE ICONS:



*Check for more information using the internet or other resources.
A page with useful sites is included in this resource. Some refer to specific activities.*

RECORDING JOURNAL



Keep all your results in a journal, this may be electronic or paper.

When you are asked to add results to your journal, if you have made an electronic journal, take a photo or video and add that to the journal.

Make sure you give all journal entries a heading which links them back to the activity.

YOU NEED:

- your recording journal
- samples of at least six different kinds of paper found around your place
- a magnifying glass
- bulldog clips or pegs
- internet access.

Supervisor

Help your student to:

- **read and work their way through this resource**
- **discuss/talk about their learning as they go**
- **record their observations and learning in their recording journal.**

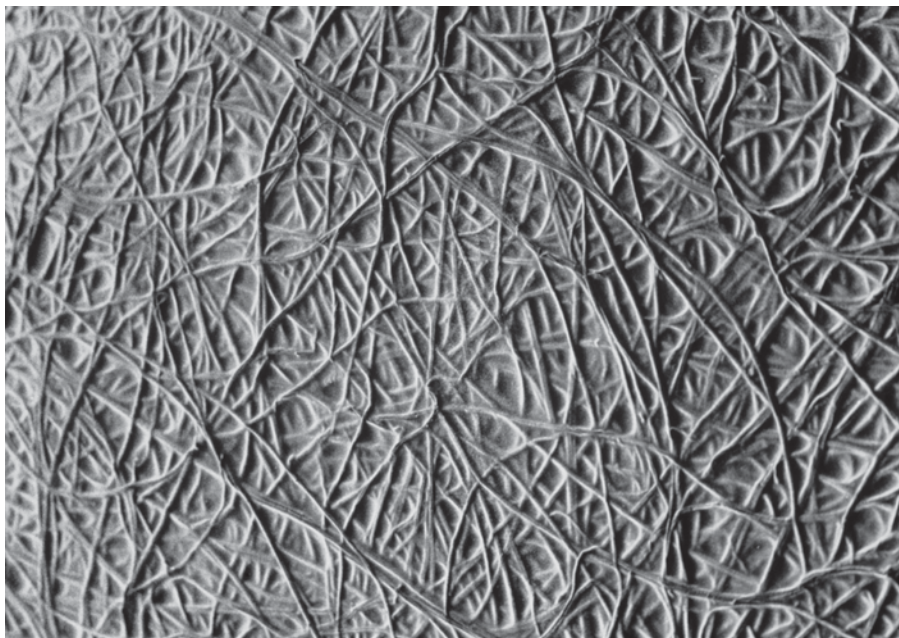
Activity 1

What is paper?

Talk with your supervisor about the different types of paper you know of, and why you think they're paper.



In your recording journal list the different types of paper you know of, and say why you think they're paper.



White paper surface. The smooth paper looks rough when magnified.

Paper is made from fibres which are pressed together. A fibre is a long thin thread.

Collect as many of these materials as you can:

- newspaper
- aluminium foil
- cellophane
- plastic food wrap
- tissue
- plastic bag
- greaseproof paper
- biscuit wrappers
- writing paper
- polythene
- thin cardboard
- lolly wrappers.



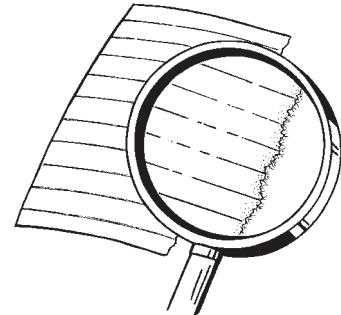
Gather and interpret information

Use evidence to support ideas

Tear a piece of newspaper.

Look closely at the torn edges with a magnifying glass.

Can you see the fibres at the torn edge of the paper?



Do this with each of the samples you collected.

If you can see fibres at the torn edges, it's paper.

If there are no fibres, it's not paper.



Record your results in your recording journal by gluing a small piece of each sample onto a chart that looks like this:

Paper	Not paper

Activity 2

The properties of paper

You're going to do some tests to investigate the **properties** of different types of paper.

You need:

Five different kinds of paper each about A4 size.

These could be:

- paper towels
- newspaper
- wallpaper
- cardboard
- brown paper
- tissues
- magazines
- toilet paper
- paper serviettes
- cartridge paper.
- writing paper
- advertising leaflets
- gift wrapping paper
- lunch wrapping paper

Properties are the things that make something unlike anything else.

A property describes how an object looks, feels or acts. So in science it means that solids look, act, or feel differently than liquids or gases.

Cut each piece of paper into four equal pieces (about 15 cm by 10 cm).

Place the pieces of paper in four piles, each containing one sample of your five papers.



In your recording journal (or a separate larger sheet of paper if you prefer) create a chart that looks like this:

Paper sample	Paper sample 1	Paper sample 2	Paper sample 3	Paper sample 4	Paper sample 5	My recycled paper
						You'll make and test your own paper later
Name of paper						
It is used for ...						
Feel						
Folding						
Ripping						

Glue a small sample of each type of paper on the top row of your chart.
Write the name of the paper and what it is used for underneath.
Leave the other spaces blank to record the results of the tests as you do them.



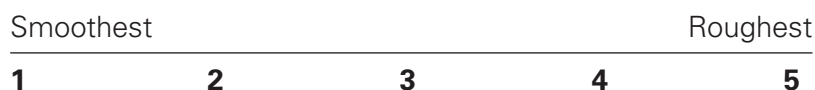
Gather and interpret information

Use evidence to support ideas

Test 1 Feel

Look closely at each type of paper.
Feel each piece with your eyes closed. Describe how it feels to your supervisor.
Grade the papers from the smoothest to the roughest.
Number the smoothest paper 1, and the roughest paper 5.

Is it smooth or rough,
soft or firm?
Which paper is it?



Record the numbers on your chart.

Test 2 Folding

Predict which of your papers you think will fold easily.
Fold each sample of paper in half three times.
Let it go and see if it stays folded.
Grade the papers in order of easiest to fold.

Which sample is the
easiest to fold?
Which is the hardest to
fold?
Which is the most
springy?
Which is the least
springy?



Record the numbers on your chart.

Test 3 Ripping

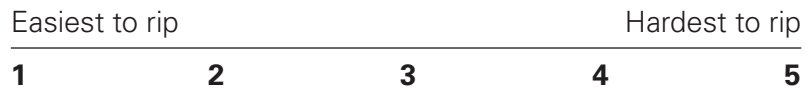
Predict which of your paper samples you think will rip most easily.

Hold each sample in two hands. Pull the paper very gently at first, then harder till it rips.

Do this with all your paper samples.

Grade your samples in order.

Which sample is
easiest to rip?
Which is hardest?



Record the numbers on your chart.

At the bottom of your chart write a summary of what you've found out about the five papers.

You need to look at your chart (the data or information you've gathered) and think about what it's telling you (interpret it).

Activity 3

More about the properties of paper

It is easier to tear paper in one direction than another.

You need:

- a piece of tissue or a paper towel
- other types of paper
- a magnifying glass.

Fibres in paper line up in rows. This gives the paper a grain. A paper's grain is the direction in which most of the fibres lie.



Gather and interpret information

Use evidence to support ideas

Test 1 – Observing closely

Look carefully at your paper through the magnifying glass.

Can you see the grain?

Try this with other kinds of paper.

I saw little fine lines in the paper.
This must be the grain.



In your recording journal describe and record what you noticed. Add photos if you are able.

Test 2 – Ripping with the grain

You need:

- two pieces of newspaper
- some other pieces of paper to test.

Notice which way the print on the newspaper runs.

Tear one piece across the print, and the other along the print.

Is it easier to tear one way or the other? Make a **prediction** first then see if you were right.

Try this test with some other types of papers. What did you find out?

I found that the paper ripped straighter and more easily one way.



Talk with your supervisor; look in books or on the internet to see if you can find out why this might be.



In your recording journal, show what you found out.

Test 3 – Can you see through it?

You need:

- five different types of paper
- a torch.

Talk with your supervisor about which paper you think will let more light through.

Hold each paper sample over the end of a torch.

How much light can you see through the paper?

Repeat this with all the paper samples.

You might be able to think of other ways to test the transparency of your papers – for example holding them up against the window, or trying to use them as tracing paper.

Grade your papers in order of transparency.

You're making a prediction based on what you know already. Scientists do this all the time, then test their ideas.

**If it lets light through, it's transparent.
If it doesn't let light through, it's opaque.**

Lets most light through
(transparent)

Lets least light through
(opaque)

1 2 3 4 5



In your recording journal create a chart that looks like this. Paste a sample in each of the boxes, or add an image, in order of transparency. Record the name/type of the paper underneath.

Paper sample	1	2	3	4	5
in order of transparency	Transparent				Opaque
Name/type of paper					
Most transparent					

Activity 4

How strong is paper?

A very important property of paper is its strength.

You need:

- 5 different types of paper
- 2 bulldog clips or paper clips (straightened then bent into an S shape)
- an empty yoghurt pot
- marbles, coins or stones to use as weights (they should all be the same).

The strength of paper is important because it is used for many different things. For example you wouldn't use the same strength of paper for blowing your nose and carrying the shopping!



Gather and interpret information

Use evidence to support ideas

Test 1 – Finding out how much paper can carry before it tears.

Cut equal sized strips from your five pieces of paper.

Talk with your supervisor about which paper you think will be the strongest.

Fold the top of a strip and hold it in a bulldog clip attached to a nail in the wall. (You could use a paper clip bent into an S shape if you don't have a bulldog clip.)

Fold the other end of the strip and hold it in another bulldog clip. Tie an empty yoghurt pot to the second bulldog clip, with string.

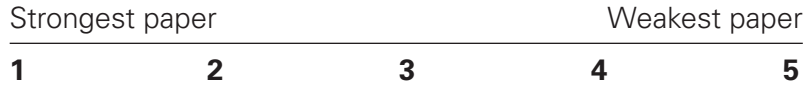
Place the weights carefully in the yoghurt pot until the paper tears.

You're making a prediction. Scientists do this all the time then test their ideas.



Repeat the test with each type of paper. After each test, record the weight or number of stones/marbles/coins required to tear each strip of paper.

Grade the papers in order of strength.



In your recording journal create a chart that looks like this. Paste a sample in each of the boxes in order of strength. Record the name of the paper underneath.

Paper sample in order of strength	1 Strongest paper	2	3	4	5 Weakest paper
Name/type of paper					
Strongest paper					

Test 2 – Wet paper

Repeat Test 1 with the 5 different types of paper.

Before testing, dip each strip into a bowl of water. Bring it straight out and shake it.

Talk with your supervisor first about how you think this might change the results. Make a **prediction** then carry out the test to see what happens.



*In your recording journal record what happens. You could create a chart like the one above, but make it clear you are testing **wet** paper.*

Test 3 – Folding paper

Can you stand a piece of paper on its edge?

Try folding the paper in half. Does it stand up now?

Try folding different types of paper in different ways, to see if they can balance a small book or magazine. Which one holds the most?



In your recording journal draw or record your best result.

Activity 5

Soak it up

Sometimes we want paper to be **absorbent** – we want paper that can soak up liquids. This is another important **property** of some types of paper.

Test 1 – Paper for mopping up spills



Gather and interpret information

You need:

- five different kinds of paper (paper towels, tissues, kitchen paper, writing paper, magazine pages, newspaper, advertising paper ...)
- a bowl of water
- measuring jug
- magnifying glass.



Cut each sample of paper into two (about 20 cm by 20 cm)

Look at each sample through the magnifying glass. Can you notice any fibres?

Talk with your supervisor about which sample you think will soak up water best.

Make a **prediction** then test the samples to find out.

Dip each sample of paper into a bowl of water.

Shake it gently then squeeze the water out into the measuring jug.

Measure the amount of squeezed water.

I wonder if smooth, shiny paper will soak up water.



In your recording journal record your findings. Create a chart that looks like this.

Type of paper	Amount of squeezed water



Use evidence to support ideas

What do your results tell you? Record which paper absorbed the most water and which paper would be the best for mopping up spills.

Test 2 – Soaking up liquid

You need:

- five different kinds of paper each about 20 cm by 20 cm
- food colouring or water based dye
- an eye dropper, straw or teaspoon
- newspaper.

Lay out a piece of each type of paper on several layers of newspaper.

Use an eye dropper, straw or teaspoon to put 3 drops of dye onto each.

Observe carefully to see which paper absorbed the most liquid.

Soaks up the most liquid		Soaks up the least liquid
1	2	3
		4
		5



In your recording journal create a chart that looks like this. Paste a sample in each of the boxes in order of most absorbent. Record the name of the paper underneath.

Paper sample	1	2	3	4	5
in order of absorbency	Soaks up most liquid paper				Soaks up least liquid
Name/type of paper					
Most absorbent paper					

Test 3 – Magic water lilies

You'll need:

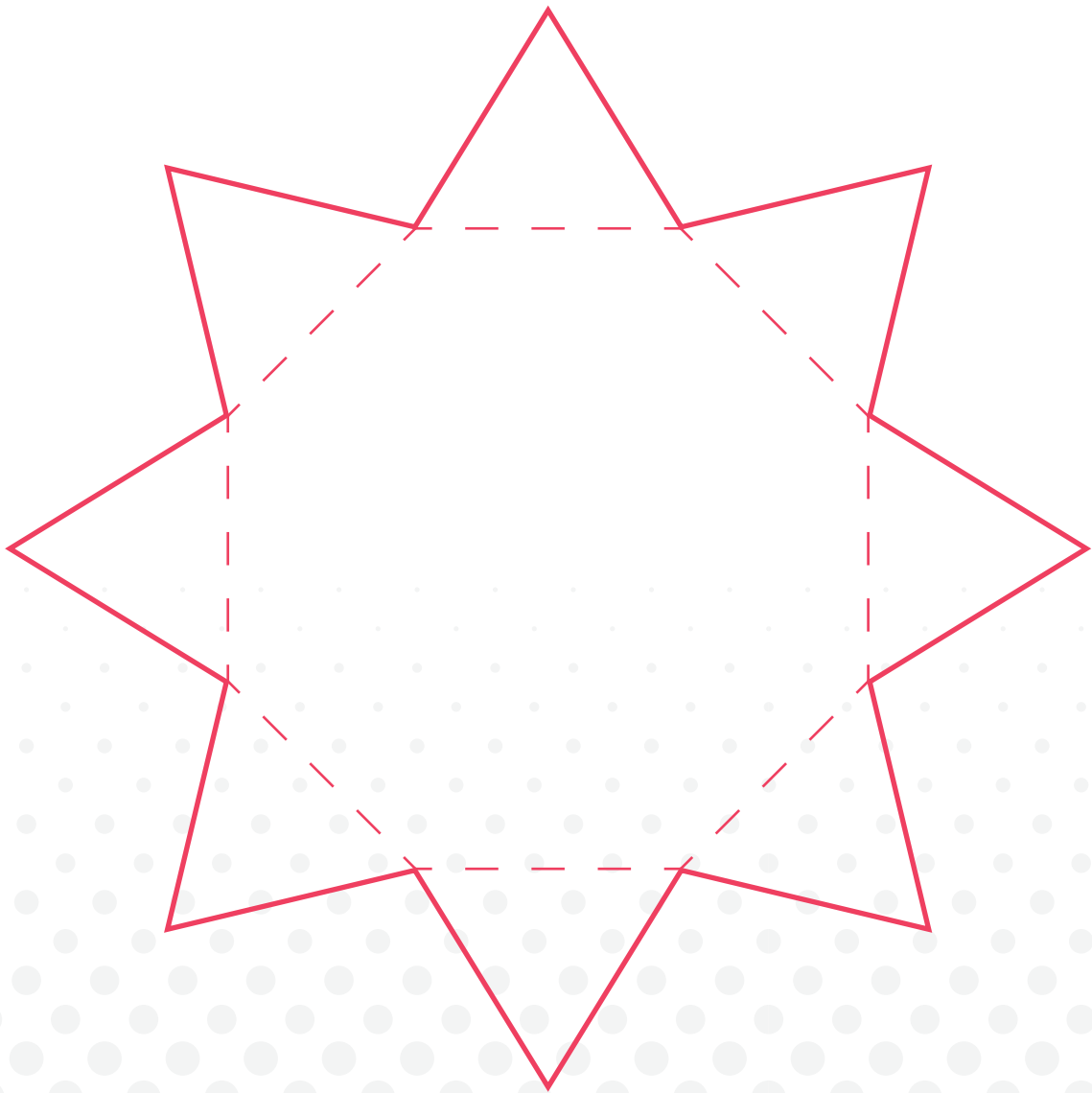
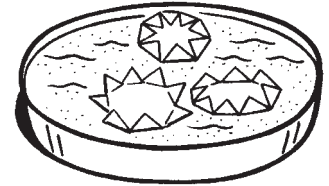
- different types of paper
- a piece of card
- a bowl of water.

Using the template below, cut out water lily shapes from several different kinds of paper.

Fold the petals along the dotted lines.

Place the water lilies in a bowl of water and watch what happens.

Did your lilies open?





In your recording journal record what happened. Create a chart that looks like this.

Lilies made of different kinds of paper	What happened

Talk with your supervisor, look in books or use the internet to find out why this happens, and record what you found out.

Try:

- different sized water lilies
- different numbers of petals
- other materials like cellophane, tinfoil, different plastics.



In your recording journal record what you found out.

What I tried	What happend

Activity 6

Making paper

Most paper is made from wood pulp from trees like pines. Some forests are grown especially for making paper.



Talk with your supervisor, look in books or on the internet to find:

- *at least one place in New Zealand where paper is made*
- *the process of making paper.*

Look around you to see the many ways in which paper is used.



In your recording journal list 10 different uses of paper.

Paper we throw away

Talk about the paper that's thrown away every day.

Some paper can be used again to make more paper.
This is called **recycling**.

Talk about some reasons why it's a good idea to recycle paper.



In your recording journal record three reasons why it's good to recycle paper.



Make meaning of scientific representations

Engage with science

You are going to make some recycled paper. It will take about two days.

You could look in books or on the internet to find out how to do this, or you could follow the process below. Sometimes people use slightly different methods to make their paper (for example, using a blender.)



You need:

- paper scraps (thin white paper like tissue is best)
- a bucket or large bowl
- a potato masher
- an egg beater or blender
- a frame for straining the pulp. Make this by stretching a piece of net material or some old pantyhose over an empty ice cream container lid or an old picture frame
- paper or cloth kitchen towels.

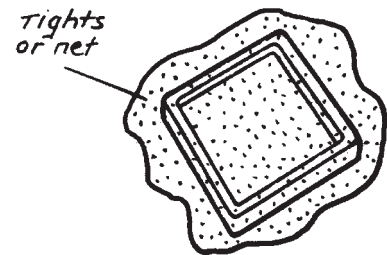
Step 1 Tear and soak the paper

Tear the scrap paper into small pieces, the smaller the better.

Put them in a bucket, cover them with warm water and leave to soak overnight.

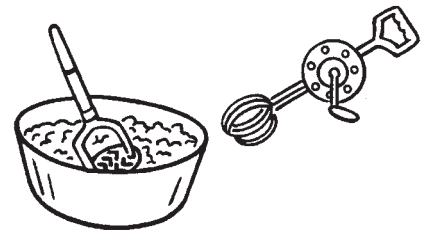
Step 2 Make a frame for straining the pulp

Stretch some old mesh curtain, gauze fabric or old pantyhose over a plastic ice cream container lid, with the centre cut out to make a frame. Attach it with a stapler.



Step 3 Turn your paper into pulp

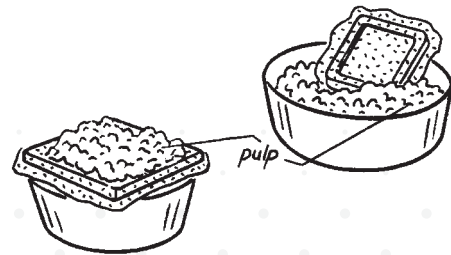
Mash the softened paper with a potato masher. Use an egg beater or blender to make it really pulpy or do another batch in this way to compare the end products.



Step 4 Spread the pulp on the frame

Dip the frame into the pulp and spread a layer of pulp over the frame.

Let the water drain out of the pulp over a bowl overnight.



Step 5 Press and dry out the paper

Tip the pulp layer onto a kitchen cloth or paper to dry.

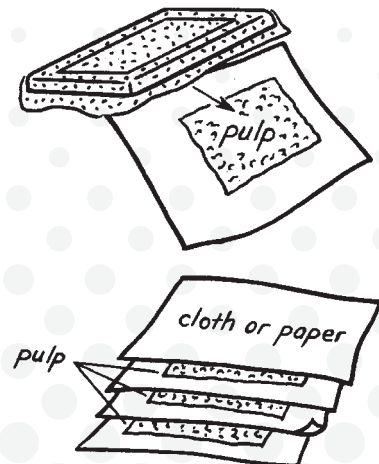
Place another cloth or paper over the pulp layer and press out any water with a rolling pin.

Make alternate layers of pulp then cloth or paper.

Cover with plastic and put some heavy weights on top.

Leave to dry for at least a day.

Separate the layers and carefully take out the sheets of recycled paper.



Activity 7

My paper

Use a magnifying glass to look carefully at your paper. Can you see the fibres?

Cut out three 20 cm x 20 cm pieces of your paper.

Test them as you did in Activity 3 to find:

- how smooth it is
- how easy it is to fold
- how easy it is to rip.

You might think of other ways to test the properties of paper or you might want to try some of the ways you found on the internet.

If you do this then make sure you include it in your recording journal.

If you want to try making paper again, you could add glitter, bark flakes, holepunch foil spots, coloured paper, or flowers to the pulp.



Paste a sample of your paper on the chart in your recording journal. Write what you found out in the boxes under your sample.

Using recycled paper

Can you think of a use for your recycled paper?



Make meaning of scientific representations

Engage with science

Being curious

Do you have an idea or question of your own you want to investigate, or is there something about paper you want to find out more about – for example, the history of paper, what was the first paper made out of, who made the first paper.

Add your own investigation to your journal or choose your own way to present your findings.

Investigating paper - helpful websites

Properties of paper – page 5

The science behind tearing paper

<http://indianapublicmedia.org/amomentofscience/science-tearing-paper/>

How to get paper to tear where you want it

www.bfranklincrafts.com/TipsTechniques/TipsTechniquesTearPaper.html

More about the properties of paper – page 8

Properties of materials

www.sciencekids.co.nz/gamesactivities/materialproperties.html

Properties of matter

http://schools.bcsd.com/fremont/5th_sci__matter_properties_of_matter.htm

How strong is paper? – page 10

Magic tube – strong tissue paper

www.stevespanglerscience.com/lab/experiments/magic-tube-strong-tissue-paper

How strong is paper

www.science-sparks.com/2011/10/31/how-strong-is-paper-taken-from-cracking-chemistry/

The greatest tearing strength

www.primaryscience.ie/media/pdfs/col/Paper_Strength_Activity.pdf

Paper towel testing

www.tappi.org/paperu/fun_science/teststrength.htm

Soak it up – page 12

Which is the most absorbent?

<https://explorable.com/paper-towel-experiment>

Absorption

<http://teachbesideme.com/rainbow-science-absorption>

Water absorption – page 14

Water lily lesson

http://wikieducator.org/Water_Lily_Lesson

Magic flower

www.abc.net.au/science/surfingscientist/magic.flower.htm

Magic water lily

<http://safeshare.tv/w/dCqIBeyKhT>

Page 17 Making paper – page 16

How paper is made

<http://safeshare.tv/w/uBzLFgqrVh>

Paper making lesson

<http://safeshare.tv/w/TSepkCAfhd>

Paper making process

www.carlemuseum.org/studioblog/?tag=papermaking-with-children

How to make paper in your own kitchen

<http://indianapublicmedia.org/amomentofscience/how-to-make-paper-your-own-kitchen/>

How to make recycled handmade paper inlaid with leaves and petals

www.mommy-labs.com/creative-kids/art_craft_projects_kids/how-to-make-recycled-handmade-paper-inlaid-with-leaves-and-petals/





Acknowledgements

Every effort has been made to acknowledge and contact copyright holders.
Te Aho o Te Kura Pounamu apologises for any omissions and welcomes more accurate information.

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Cover: Flowing sheets of paper, 11016357

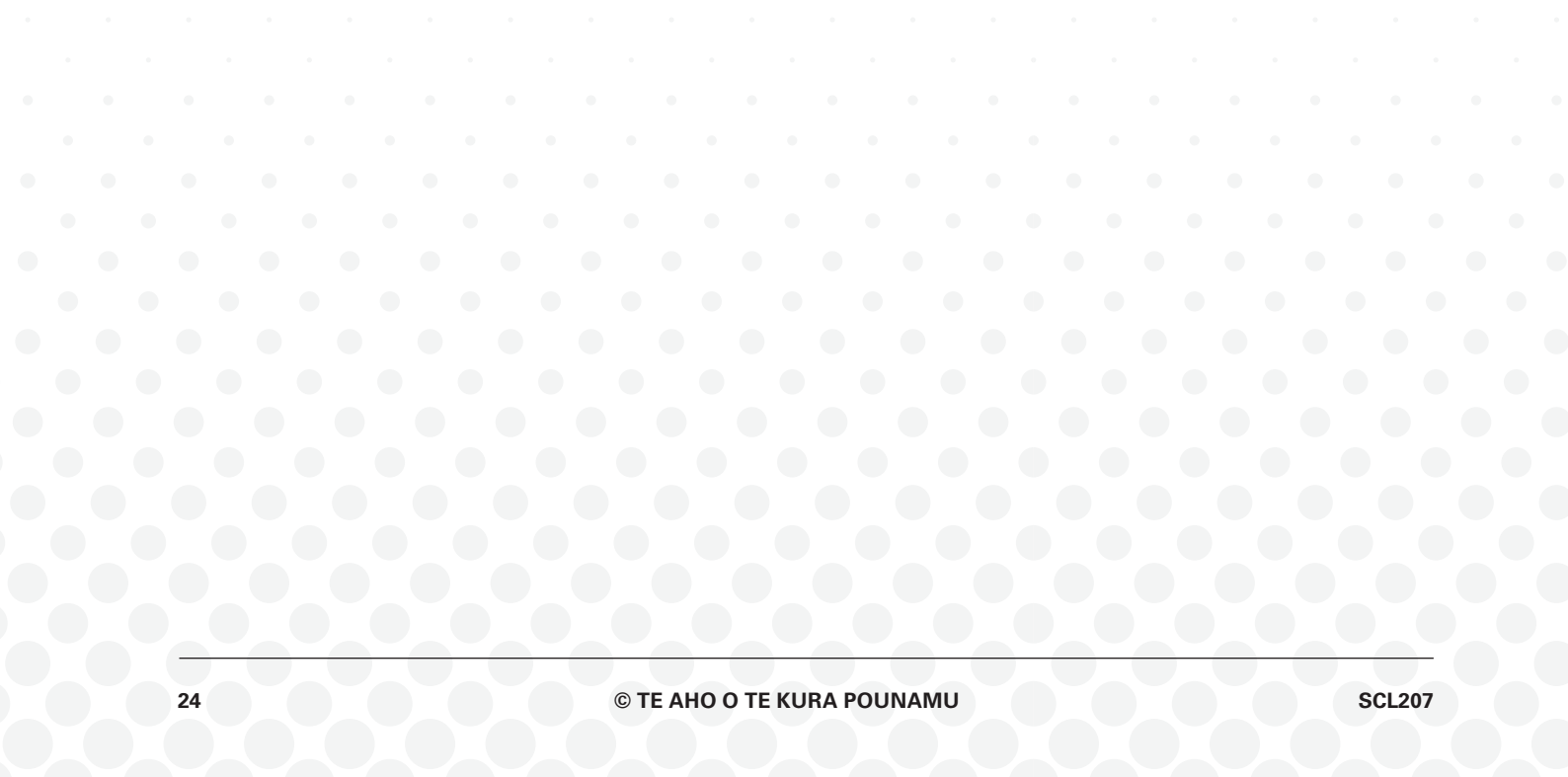
Paper towel, 22362209

Ball of paper, 15301022

Photo: Making paper in frame. Mychillibin 100463-967

Image: Scanning Electron Micrograph (SEM) of the surface of a paper sample at 110 times magnification. © David Scharf/SPL/Getty Images 140580621

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Assessment and Evaluation

SCL207

Tick the boxes that best match your learning.

Name	Student ID No.
------	----------------

I can	Not attempted	Had a go	Succeeded	Did very well	Did an excellent job
Describe, test and compare the properties of different types of paper.		Able to describe, the properties of some types of paper.	Able to describe and test the properties of different types of paper.	Able to describe, test and compare the properties of different types of paper.	Able to describe, test and compare the properties of different types of paper, with clearly recorded results.
Use evidence to support predictions and ideas about paper.		Able to predict and support an idea with some evidence.	Able to predict and support more than one idea with evidence.	Able to predict and support more than one idea using a range of evidence.	Able to predict and support ideas using multiple sources of evidence.

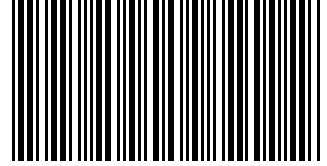
Student comment

Supervisor comment

Comment on the way your student used evidence from the tests/investigations to support their ideas.

Any other comments.

Teacher feedback



SCL207 2015/1

**STUDENTS – PLACE STUDENT ADDRESS LABEL BELOW OR
WRITE IN YOUR DETAILS.**

FULL NAME _____

ID NO. _____

ADDRESS _____

www.tekura.school.nz