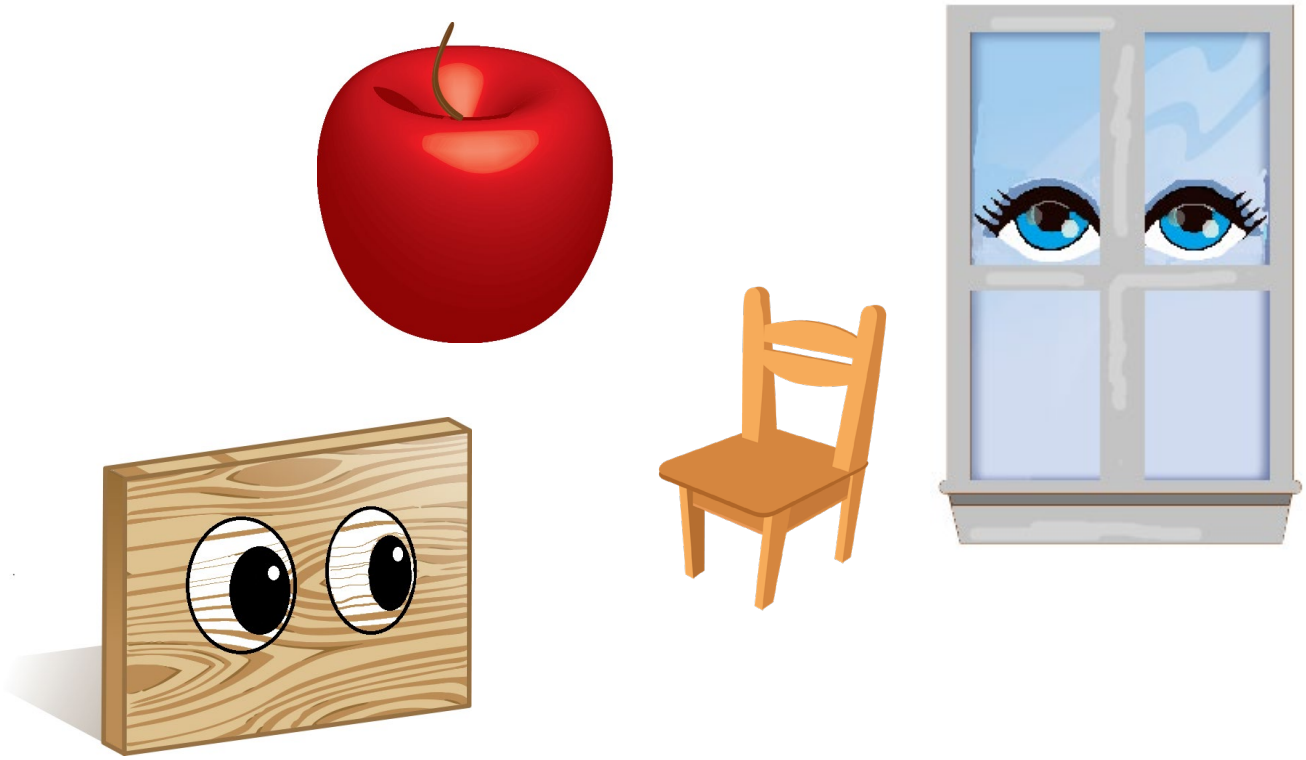
Properties of Materials



Year 4
Chemical Science
and Design Technology
5 Day Print Course

SIDE
SCHOOL OF ISOLATED & DISTANCE EDUCATION

First published 2016

Manager Intellectual Property and Copyright
Department of Education
51 Royal Street
EAST PERTH WA 6004
Email: copyright@education.wa.edu.au

Department of Education

Home Tutors:
It is important to read the Home Tutor Daily Notes before your student starts each day.

Contents

Materials You Will Need
(most are household supplies)

- Paper towel
- Plastic wrap
- Tissue
- Wax paper
- Ruler
- Water
- Teaspoon
- 50 cent coin
- A glass or can with top lid removed no taller than 10cm
- Rubber band (one that will fit tightly around the can)
- Scissors
- Cereal Box
- Marbles (in Math kit, buy at grocery store or use Malteesers)
- Recyclable Materials (Paper rolls, boxes, paper, cans, bottles,etc)
- Stop Watches / Timers
- Pens / Pencils
- Sticky Tape / Masking Tape
- Camera and/or video recorder

Day 1 Materials and their Properties

Over the next five days, you will be discovering and testing the properties of certain materials. You will choose the right materials to design and build a toy.

1.1 What are properties of materials?

Remember that when we use the word '*materials*' in science it means the substance or substances of which a thing is made or composed. A material in science does not refer to fabric. An apple is made of organic material. Organic means natural. Most water bottles are made from plastic material. Plastics are a man-made material. There are now about 300,000 different known materials. As materials scientists create and combine materials in new ways, the number of possible materials is almost infinite.

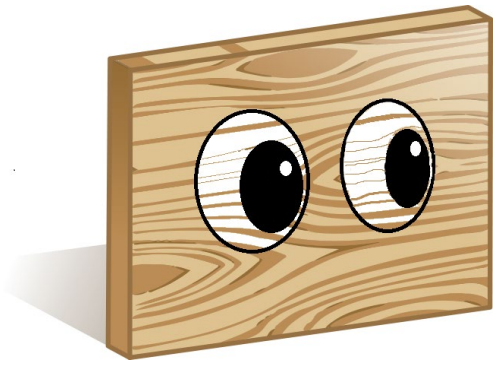
Each material has its own *properties*. When you look at an object, sometimes you are able to see its properties but sometimes you need to test the material to find its properties. A property in science does not refer to the land that we live on but instead it refers to the characteristics of how the material behaves.

Scientists classify matter based on its chemical and physical properties that have been observed and tested. The properties of a material determine how useful it is for particular purposes. For example, rubber is commonly used in the soles of shoes due to the properties which make them suitable for wear including flexibility and durability.

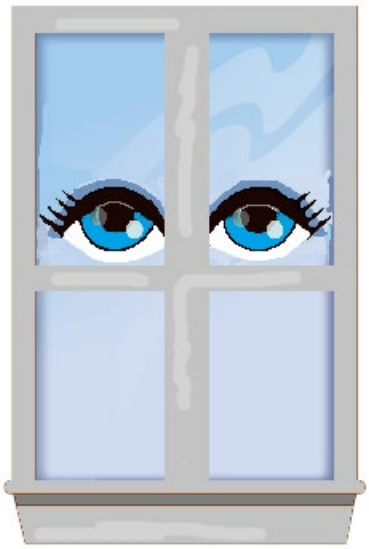
A wooden chair is hard. The hardness is *characteristic* of the chair. We use characteristics to describe an object or substance.

Vinegar is a liquid and in a plastic bottle. The bottle is flexible and not easy to break. The plastic is non-porous meaning it won't let liquids through. When we describe the characteristics of something in science, the scientific word we use is '***properties***.' So 'hard, flexible and non-porous' are scientific properties of the chair and the bottle.

Physical properties are the characteristics of a substance that are called "observable." This means we can find them by using our senses. They are measurable, collectible pieces of information about substances that scientists can gather, record, and compare to previous recordings.



Woody



Clearise

Woody and Clearise have observable properties. Woody is made of wood which is hard and natural. Clearise is transparent making her clear to see through.

Here is a list of physical properties that describe different materials:

Physical Properties of Materials

Shiny – It reflects light.

Strong – It won't break easily.

Flexible – It can be bent easily without breaking.

Rigid – It cannot be bent easily. Not flexible.

Light – It doesn't weigh much.

Heavy – It weighs a lot.

Coloured – Has colour (describe which colour).

Hard – Cannot be scratched easily.

Brittle – Is hard but will break easily.

Malleable – It can be shaped easily.

Transparent – Something you can see through.

Opaque – Something that lets light through but you can't see through.

Solid – Cannot see light through it.

Conducts – Something that allows heat or electricity to pass through it.

Insulating – Something that does not allow heat or electricity to pass.

Viscosity – Thickness of a liquid (viscous or thick).

Runny – The ability for a liquid to flow easily.

Soft – Can be scratched easily.

Absorbent – Soaks up water easily.

Porous – Lets water move through it.

Waterproof – Will not let water pass through it.

1.1 Physical properties of materials

Use the physical properties list to write the properties of the materials you see in the table. **Some** will have **more than one**. Write a couple of your own.

Material	**Properties**
A window	
Plasticine	
Wooden chair	
Plastic bottle	
A metal tablespoon	
A piece of paper	
Copper wire	
Honey	
Water	
Sponge	
Wool jumper	

1.2 Occupation cover up!

Often, an object can be made of different materials depending on what the object is being used for.

Gloves are used by all of us for different reasons. We might use them to play sport, keep our hands warm, keep are hands dry or keep our hands protected. For example, a gardener might where leather gloves when pruning roses. This helps protect their hands from the thorns.

Think about the gloves that working people wear for various occupations.

Why is it important that people consider the gloves they wear for different occupations?

Can you give an example of why a certain type of glove is used?

Many different materials are used to make gloves. What are some that you already know?

The following is a description to the most common types of protective work gloves and the types of hazards they can guard against. You will use this list to match gloves and their uses on your mind map.

Types of Gloves

http://www.aps.anl.gov/Safety_and_Training/User_Safety/gloveselection.html

Disposable Gloves - Disposable gloves are usually made of light-weight plastic or rubber, can help guard against mild irritants and germs.

Fabric Gloves - Made of cotton or fabric blends are generally used to improve grip when handling slippery objects. They also help insulate hands from mild heat or cold.

Leather Gloves -These gloves are used to guard against injuries from sparks or scraping against rough surfaces. They are also used in combination with an insulated liner when working with electricity.

Metal Mesh Gloves - These gloves are used to protect hands form accidental cuts and scratches. They are used most commonly by persons working with cutting tools or other sharp instruments.

Aluminized Gloves - Gloves made of aluminized fabric are designed to insulate hands from intense heat. These gloves are most commonly used by persons working molten materials.

Chemical Resistance Gloves - These gloves may be made of rubber, neoprene, polyvinyl alcohol or vinyl, etc. The gloves protect hands from corrosives, oils, and solvents.

Insulated gloves - These are designed to stop wind, snow and protect hands from extreme cold with insulation.

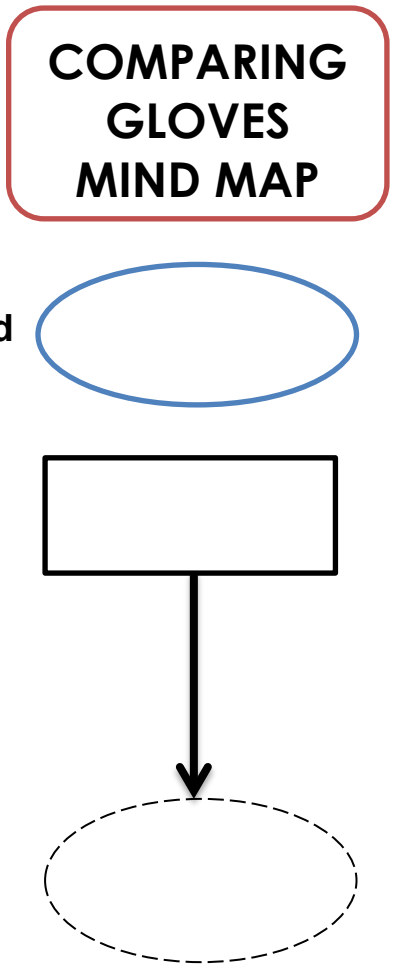
Silicone Gloves - These are used to protect hands from heat.

Boxing Gloves - These are used in the sport of boxing and made of leather and foam to protect the hands from injury.

1.3 Comparing gloves mind map

In this activity you will create a 'mind map.' A mind map is a diagram used to visually organise information. You will organise gloves and who uses them.

Part of the mind map is done for you as an example. See if you can complete the rest of the map using the following instructions:



1. Start in the centre. Follow the gloves to which occupation they are belong.

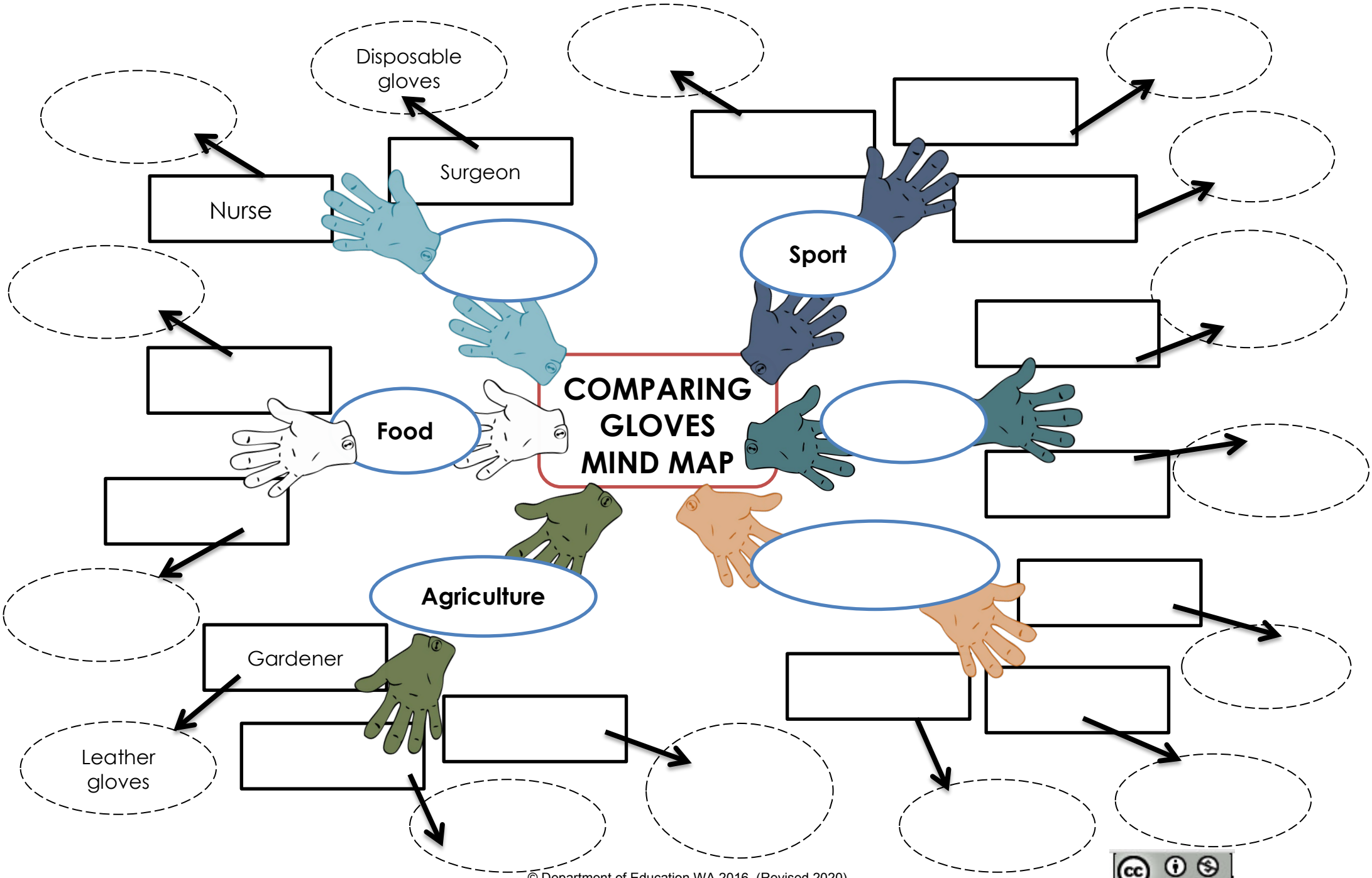
2. The solid ovals are the classification of the occupations or activities:

   Health Care, Food, Agriculture, Science, Sport, and Construction

3. Next use the following list of occupations/ activities to fill in the black rectangles:

   Mountaineer, Surgeon, Farmer, Welder, Arborist, Baker, Boxer, Soccer goal keeper, Forensic scientist, Nurse, Skiers, Laboratory technician, Brick layer, Sandwich maker, Electrician

4. Use the 'Types of Gloves' list on the previous page to match the type of glove used by the person doing the work or sport. Place these in the dashed ovals.



1.4 Materials scientists and their discoveries

The study of materials and their properties is a science. The people that study materials are called ‘Materials Scientists’ or ‘Materials Engineers.’ They study and test materials such as metals, ceramics, and plastics so that we can make new things to help us in our everyday lives. They also improve performance of existing materials and look at ways in which different materials can be used together.

“Materials Science or Materials Engineering is the study of all of the materials we see around us every day. From simple things we take for granted like the can holding our fizzy drink or the pen we write with, to materials pushing the boundaries of technology such as those used in aerospace, sports equipment or medicine.” http://www.iom3.org/about-materials-minerals-and-mining

Even now, scientists are inventing thousands of new materials. Synthetic skin, fabrics that repel ink and substances that capture and store the energy of the Sun.

Before the invention of plastic, the only substances that could be moulded were clays (pottery) and glass. Hardened clay and glass were used for storage, but they were heavy and brittle.

Some natural substances, like tree gums and rubber, were sticky and mouldable. Rubber wasn't very useful for storage because it eventually lost its ability to bounce back into shape and became sticky when heated. http://science.howstuffworks.com/plastic1.htm

Some basic materials that we now take for granted were invented many, many years ago during the 1800s and 1900s. We still use most of these today.

More recently, in 2016, an exciting new material called ‘Graphene’ was created. It is a one-atom-thick layer of carbon one hundred times stronger than steel of the same thickness. It is a nearly transparent material which also carries heat and electricity very well. It can even be used on wearable electronic clothing and form the "skin" of a robot. It is being used to make prosthetic hands more sensitive than real ones.

View - Strange Matter – Ontario Science Centre Learning Object http://www.strangematterexhibit.com/index.html Try each of the activities - Zoom inside Stuff, Transform Stuff, Crush Stuff, Improve Stuff

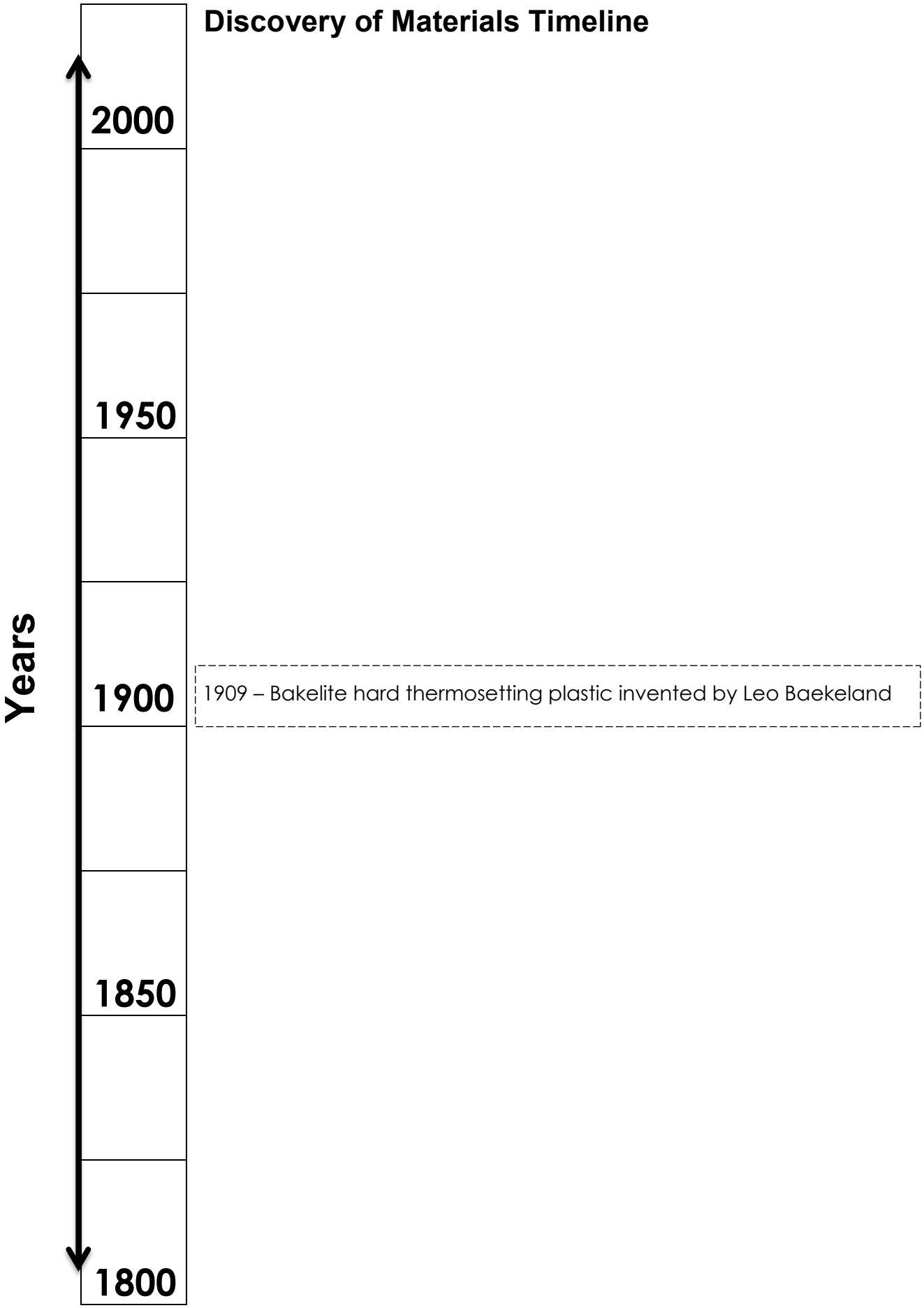
Discoveries Timeline Activity

Cut out these discoveries and glue them in date order along the 'Discovery of Materials Timeline:'

1839 – Vulcanized Rubber invented by Charles Goodyear
1931 – Neoprene was developed by Julius Nieuwland
2010 - Fabrican © Spray on fabric http://www.fabricanltd.com/ A British company has developed a way to bond and liquefy fibres so that textiles can be sprayed out of a can or spray gun straight onto a body or dress form.
1912 – Stainless steel invented by Harry Brearley
1959 – Float Glass developed by the Pilkington Brothers
1909 – Bakelite hard thermosetting plastic invented by Leo Baekeland
1862 - Parkesine (the first plastic) was an organic material coming from cellulose which when heated could be moulded. It retained its shape when cooled.
1938 – Teflon was invented by Roy Plunkett
1965 – Inventor of Kevlar® Stephanie Kwolek, was a DuPont chemist, the lightweight, stronger-than-steel fibre used in bulletproof vests and other body armour around the world.
1931 – Nylon developed by Wallace Carothers
2005 -2010 - Spray on skin developed by Dr. Fiona Wood to use on burn victims
1841 – Alexander Parkes created waterproof fabric with thin coats of rubber
1953 – The first plastic food wrap (Saran Wrap) made by Dow Chemicals
1990s – Hybrid materials – mixtures of organic and inorganic materials at a molecular level for cements and materials for electronics or medical uses.
2016 - Graphene a one-atom-thick layer of carbon a 100 times stronger than steel of the same thickness.

Think about a new material of the future. What would you like to create? Write it on the strip below and cut it out and glue it to your timeline:

Discovery of Materials Timeline



Maths Activity

How long have these materials been around?
Use the timeline to calculate how many years some of these materials have been around. Subtract the year the material was created from the current year. Don't forget to show your working out in the boxes.

Teflon is used as a non-stick coating and in making many different things such as frying pans, raincoats and umbrellas, in paint and sports products.
How long has Teflon been around?

Rubber comes from the rubber tree and is used most commonly in the tyres on our cars and trucks. It is also used for surfaces like floors, in balloons and surgeons gloves.
How long has rubber been around?

Plastic is made from oil, natural gas and coal. These are raw materials which we remove from under the Earth's surface. This is the same fuel we use to run our cars, trucks and other vehicles.
How long has plastic been around?

1.5 Characteristics of materials

When would you wear gumboots? Why? Would you wear a jumper in the desert? Why/Why not?
Walk around your home and look for objects you can write in the left hand column of this table. Complete the rest of the table.

Object	What it is used for?	The material it is made from	Why this material is a good choice
Frying pan	To heat food	Metal	It is good at conducting heat and does not melt over heat. It is hard and waterproof. This helps us to cook food.

1.6 What material am I?

Riddle

I do not break when you drop me. I am certainly not made of brick.
I can not insulate from hot or cold, unless I am thick.
I might melt in a dishwasher. I am waterproof and can be washed.
Often times I am stepped on and sometimes even squashed!

I can be moulded into a shape.
I am bendable but I can still break (- if you bend me too much).
I can make rope and be tied.
I can be different colours when I am dyed.
I am used to make many objects like bottles, jewellery and toys.
I can be a lot of different things, bringing many joys!
What material am I?

Answer: PLASTIC

Choose a secret material of your own. Write a riddle by using only its properties (describing its characteristics, explaining what it does and how it preforms under different conditions).

My riddle:

Day 2 Testing, Testing (Investigation)

2.1 Testing the strength of materials

Scientists have to consider what materials are used for and will test their properties to be able to determine the best material for the job. Today, you are going to investigate a particular property across several materials. The property you will test is strength. Are all packaging materials the same strength and does this change when they are dry or wet?

In this activity, you will test different types of packaging material for their strength by dropping a coin to see whether they will tear when dry and when wet.

What do you already know about the strength of materials?

Does dryness or wetness make a difference to a material's strength? (What it looks like, feels like and how it behaves.)

What is the question you are going to answer by investigating. (Hint: You will find it in the paragraphs above.)

Investigation question:

Make a prediction:

To make a prediction, use your own experience and knowledge as an educated guess.

I think

because

Materials:

- Paper towel
- Plastic wrap
- Tissue
- Baking paper or Wax paper
- Ruler
- Water
- Teaspoon
- 50 cent coin
- A glass or can with top lid removed no taller than 10…
- Rubber band (one that will fit tightly around the can)
- Scissors

Remember to consider making your investigation a fair test.

Make it a fair test!
Before starting the procedure read about fair testing on the next two pages…

Every science investigation needs to be an accurate test and have accurate results. Otherwise the results can be untrue! We need to make it a **fair test**!

What is a **fair test**?

A **fair test** makes sure that the scientific results you are testing are true because you have kept all of the variables the same except for the one you are testing.

Oh!
So what is a **variable**?

Variables are the things that can change during the investigation that can make our results inaccurate. Only one variable can be changed during an investigation. This is the variable that you will measure.

In this investigation, you will need to make sure that the **type of material** is the only thing (variable) you change. Its strength is what you will measure by counting the number of coin drops.

Make sure that the size of the material and where you place it is always the same. The same coin must be used everytime. The height from which the coin is dropped must be the same. When tesing for wet strength the same amount of water you use must be the same too. This will make it a fair test.

Make sure by putting this information in the following **Investigation Variables** table.

Investigation Variables

Measure:	Change:	Keep the same
○ The	○ The type of	○ The ○ The ○ The ○ The ○ The

Why would it not be a fair test if we used different amounts of water?

To be a fair test, why do you need to use the same type of coin?

There are two parts to this investigation.

A. Test the strength of dry materials

Procedure:

1. Place the paper towel on top of the open end of the glass.
2. Use the rubber band to hold the paper towel tightly over the glass.
3. Hold the ruler or measuring stick vertically beside the glass and tuck it into the elastic too. Rest the zero measurement end against the table (the numbers will increase as you go up the measuring tool).
4. Hold the coin 20cm above the top of the paper towel.
5. Drop the coin, edge side first. Observe.
6. Drop the coin until the coin breaks through the material.
7. Take a photo of your investigation.
8. Record the number of drops it takes to break through the paper in your observation table for dry materials page 34.
9. Repeat these steps for each of the different materials in turn, first the plastic wrap, then the tissue, and finally the wax paper. Remember that the other variables must not change (Size of material, drop height, the coin, how the material is placed).
10. Record the number of coin drops it takes to puncture these materials in your dry materials table as well.

B. Test the strength of the same materials when wet

Procedure:

1. Follow the same procedure for testing the dry materials but this time add 1 teaspoon of water to each material surface before you drop the coin.
2. Take a photo of your investigation.
3. Record the number of coin drops it takes to puncture the materials in your wet materials table.

Observations:

Remember that scientists collect information by describing what they see during their investigation.

Draw and label a diagram of your investigation.

Photos of your investigation (label these):

Before:
After:

Observation table:

Strength of the different **dry** materials

	Number of coin drops before tearing
Paper towel	
Plastic wrap	
Tissue	
Wax paper (Baking paper)	

Strength of the different **wet** materials

	Number of coin drops before tearing
Paper towel	
Plastic wrap	
Tissue	
Wax paper (Baking paper)	

Analysing:

Study the results in your table. What do you observe about the information in your table? Describe what happened in words.

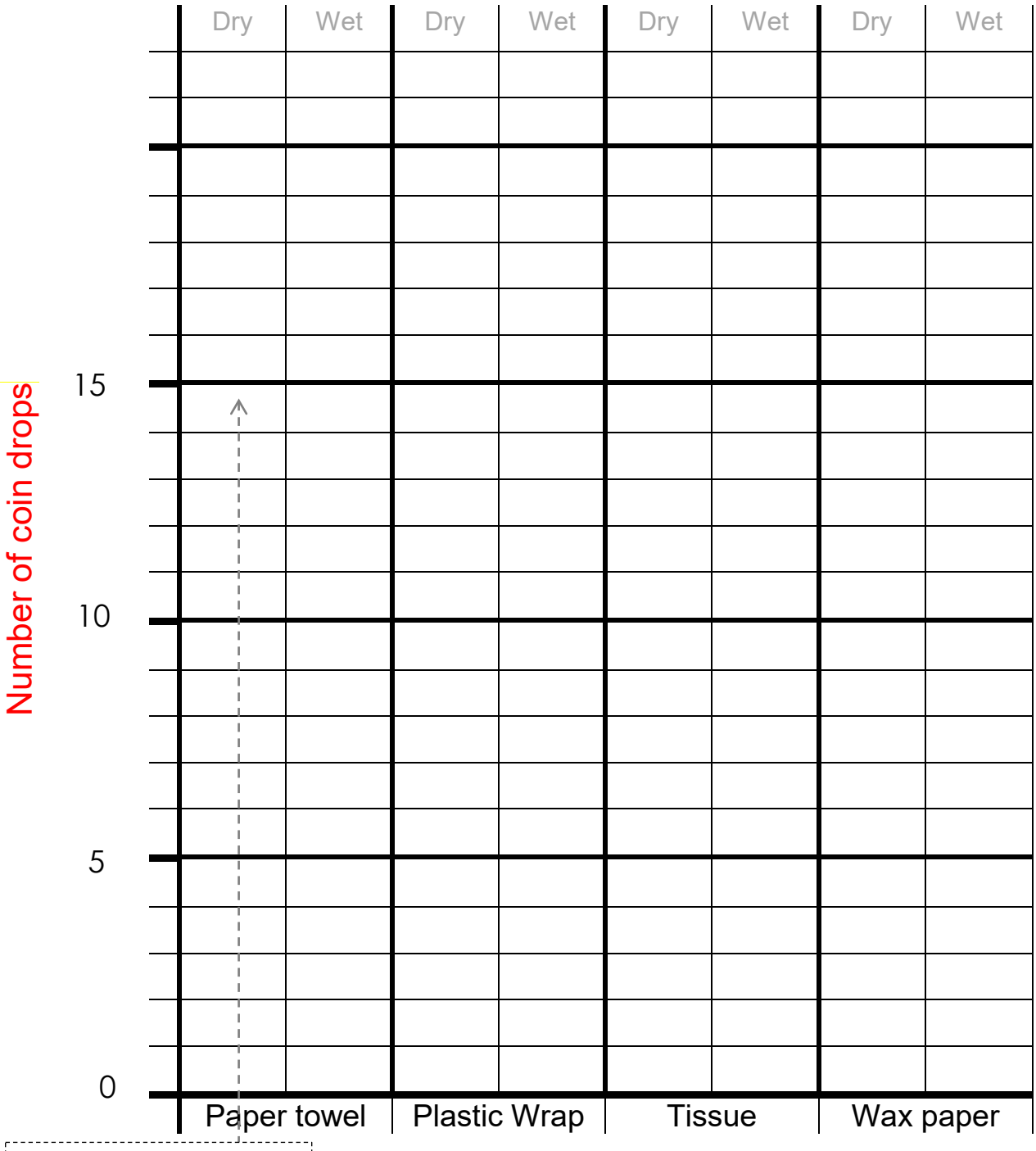
Which of the dry materials is the weakest? How do you know?

Does moisture make materials weaker or stronger?

Describe how the strength of each material affects what it is used for.

Like a scientist, present the data from your tables in a bar graph. Title your graph (tell what it is about – check your investigation question). The types of material are shown along the bottom of the graph and the number of coin drops on the side of the graph.

Title:



Colour up to the number of coin drops which broke through the

Evaluating:

What information does the graph give you which is different from a table?

Did each material behave the same?

Why do you think that is?

Was your investigation a fair test? Why or why not?

Communicating your findings:

Which of the four materials that you tested is the strongest?

Which materials are water repellent? Does repellancy make a difference to the strength?

Why is water repellancy important for some packaging?

What problems did you have during your investigation?

How could you change your investigation to fix these problems?

Was your prediction correct?
Tick yes or no:

Yes ☐ **No** ☐

Day 3 Waste Management

3.1 Packaging Attack!

Rubbish continues to be a problem for many cities and small communities around the world. Rubbish has become worse to deal with because of increasing populations. We create rubbish everyday. Rubbish can be a waste of resources. A good example of this is the packaging from takeaway food containers.

History:

Food packaging has been around for a long time. The paper plate was invented by the German bookbinder Hermann Henschel in 1867.

In 1908, to reduce the spread of tuberculosis and improve public hygiene Lawrence Luellen and Hugh Moore invented a disposable paper cup called the "Health Cup" and later renamed the "Dixie Cup".

A huge change in disposable food service packaging happened in 1948. McDonald's Restaurant no longer served their meals with the use of glasses, plates or cutlery. They created disposable packaging that would be taken away from the restaurant by the customers.

Most of this packaging created a problem with a huge amount of waste going directly to the rubbish tip. Scientists have since given much consideration to the materials being used to make takeaway packaging more environmentally friendly.

Why do we need packaging? http://www.greendustries.com/unido.pdf

- Packaging protects products as they travel, Most of the things we use at home and at work are produced somewhere else so they have to travel a long way to get to us. This avoids damage.

- A well-designed package is attractive and appealing to consumers, and inspires confidence of product safety. This can increase sales.

- Packaging provides a physical barrier between a product and the external environment which ensures hygiene and reduces the risk of product wastage due to contamination.

- Some forms of packaging prolong the life of food.

- Packaging is also used to provide customers with information and instructions, for which there are some legal requirements.

Watch this ABC Behind the News video to learn more about packaging.

BTN Nude foods - http://www.abc.net.au/btn/story/s4422480.htm

3.2 What comes in packaging?

Not only food comes in packaging. Think about all the other things that come in packaging too.

You will do a brainstorm by making a mind map using the outline on the following page.

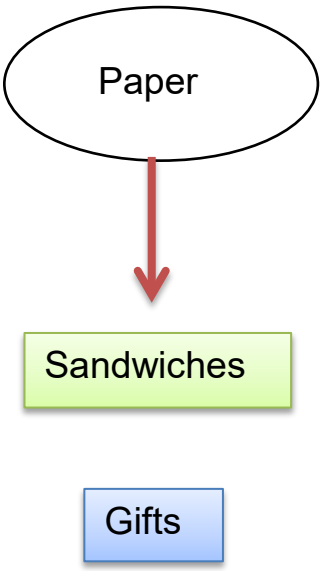
1. Write all of the materials you know that are used for packaging in the circles.

2. Write what are packaged in these materials in the rectangle and connect them with an arrow to the materials.

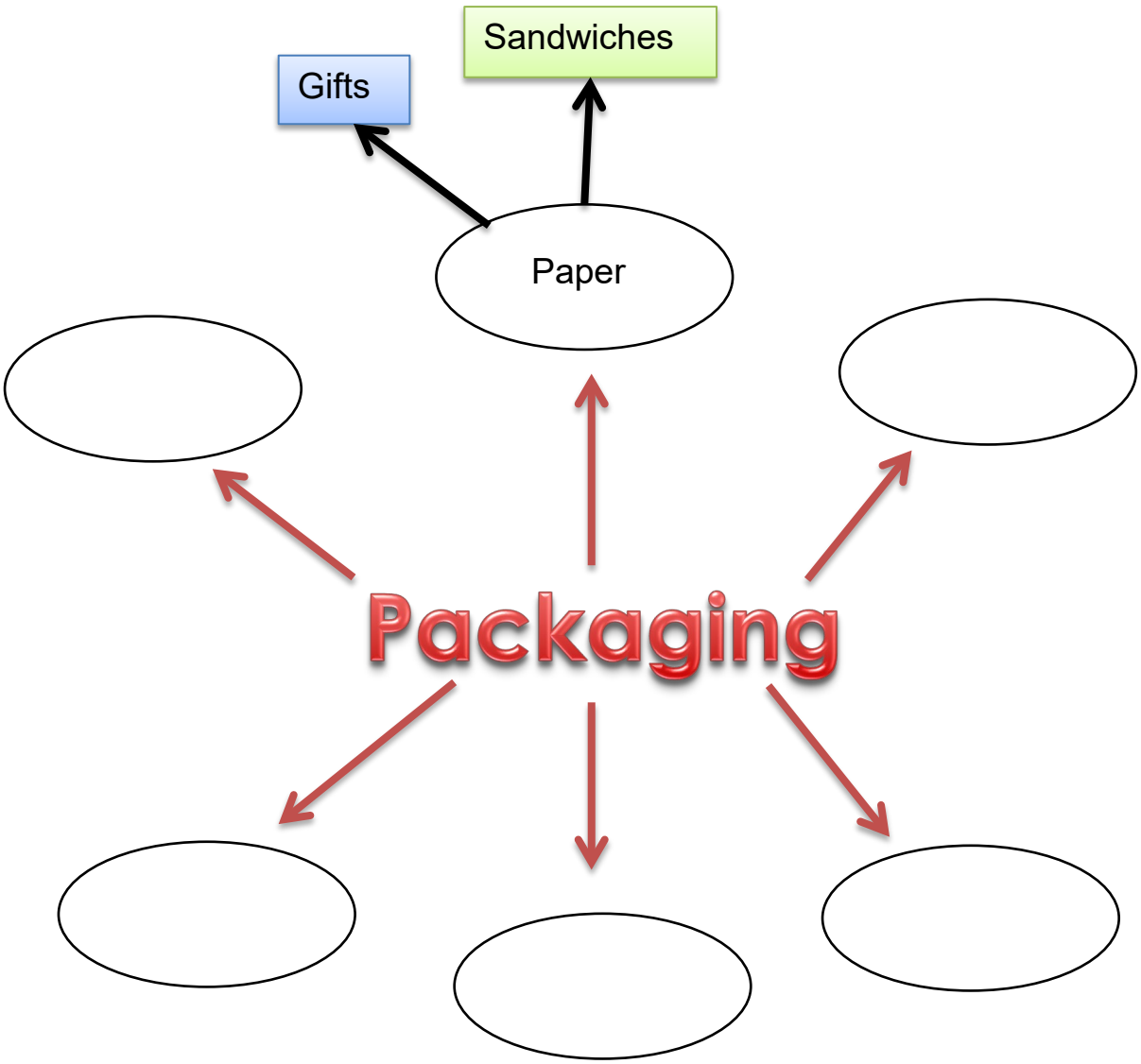
3. Colour in green the boxes with food items that are packaged.

4. Colour in the items blue which are not food items.

This time only one has been done for you:



What comes in Packaging Mind Map



3.3 Packaging a Paragraph!

Choose one of the packaged items from your mind map and use this as the topic of your paragraph.

Item chosen: _____

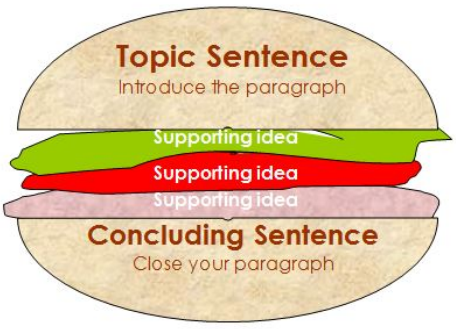
Plan by answering these questions and include this information in your paragraph:

Give examples of what the type of material used does for the item being packaged.

Why do companies choose a certain type of material to package their products?

Tell what you can do with the packaging after it is finished being used.

Don't forget to use proper paragraph structure. This hamburger has all of the parts to a good paragraph. The supporting ideas make it more tasty!



Draft your paragraph below and then edit for spelling, punctuation, grammar, and adding or deleting words. Write your final corrected paragraph on the next page.

DRAFT

(show editing on this page)

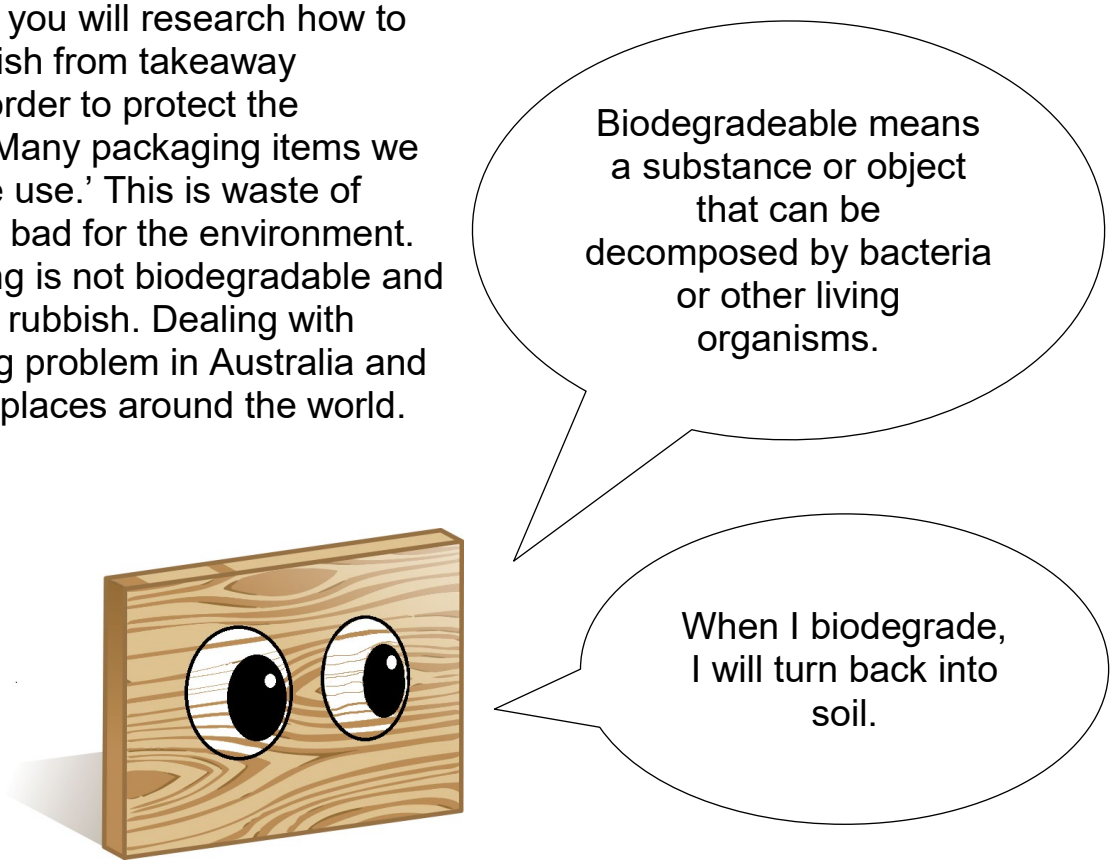
Title:

FINAL COPY

Title:

3.4 What is best?

In this activity, you will research how to deal with rubbish from takeaway packaging in order to protect the environment. Many packaging items we use are ‘single use.’ This is waste of resources and bad for the environment. Most packaging is not biodegradable and ends up in the rubbish. Dealing with rubbish is a big problem in Australia and in many other places around the world.



Read the Waste Fact Sheet from:
http://www.coolaustralia.org/wp-content/uploads/2013/10/Wastefactsheet1.pdf

Explain what is meant by ‘out of sight, out of mind’ when it comes to rubbish.

How much rubbish does the average Australian family produce in a year?

Next, use the internet to research the words:

- biodegradable
- single-use packaging
- biodegradable packaging

What does biodegradable actually mean?

When it comes to packaging, what does the term ‘single use’ mean? Why is this bad for the environment?

What are different types of biodegradeable packaging made from?

Why do people want biodegradable packaging as an option?

3.5 My takeaway food shop

You are the owner of a new takeaway food shop. You have young children and are conscience that they need to grow up in a healthy environment. You would like to do the right thing by making sure the packaging you use in your takeaway shop is environmentally friendly as well.

Your menu consists of:

Research environmentally friendly packaging for these menu items using the following websites or others that you might search. Complete the table on the next page with your choices.

http://www.vegware.com.au/
Watch the movie 'Most Coffee Cups Aren't Recycled'
Click on 'About' to find out about the packaging.
Click on 'Products' to find packaging options.

Or go to either:
http://www.packagingbiodegradable.com.au/
http://environmentalenterprises.com.au/

Environmntally Friendly Food Packaging for My Takeaway Food Shop

Takeaway Food	Product name/ Packaging description	Reason: What properties make these types of packaging environmentally friendly and what properties make these types of packaging right for your food products?
Hamburger		
Chicken Wrap		
Fresh Salad		
Cold juices		
Coffee/Tea		
Websites used for your research:		
Other comments about your packaging choices:		

Day 4 A-Mazing Activity!

4.1 Materials and their use in design

Now that you have learned about different materials and their properties, you will use this knowledge to design a toy. In the past, toys were made from materials such as paper, wood and metal. These materials were able to biodegrade in a rubbish tip and did not cause harm to the environment. Most toys are now are made of plastic. As you know, plastics are harmful to the environment.

You are going to build a simple toy out of recyclable materials. This challenge is about how the properties of materials can affect the speed and direction of a marble moving through a maze. The maze will work by tilting. In this activity, you will follow the steps to the design process to create a toy which fits the rules of this challenge.

The steps to the 'Design Process' are:

Identify the problem
Brainstorm
Design
Build
Test and Evaluate
Redesign
Share

Identify the problem:

Build a toy out of recyclable material with these specific design requirements:

- Only recyclable materials can be used to make your maze.
- The base of the maze must be made out of a cereal box.
- The marble must make at least 10 corner turns from start to reaching the finish.
- It must go through 1 tunnel.
- The maze must have at least 2 curved walls.
- You must have at least two holes to avoid.
- Mark the start and finish.
- You must stick to the design shown on your design plan.

Resources:

- Cereal Box
- Marbles (in Math kit, buy at grocery store or use Malteesers)
- Recyclable Materials (Paper rolls, boxes, paper, cans, bottles,etc)
- Stop Watches / Timers
- Pens / Pencils
- Sticky Tape / Masking Tape
- Camera and/or video recorder
- Scissors

Caution is needed when using cutting tools!

Brainstorm:

What material properties might affect the speed and accuracy of which a marble rolls?

What are some of the materials from your recycling box which might work to build your maze?

Design:

- Research/ search the internet for ideas – Search 'make a marble maze or run'
- Complete a plan by recording the materials and reason for your choice of materials on the following pages
- Draw a diagram of your maze and include labels

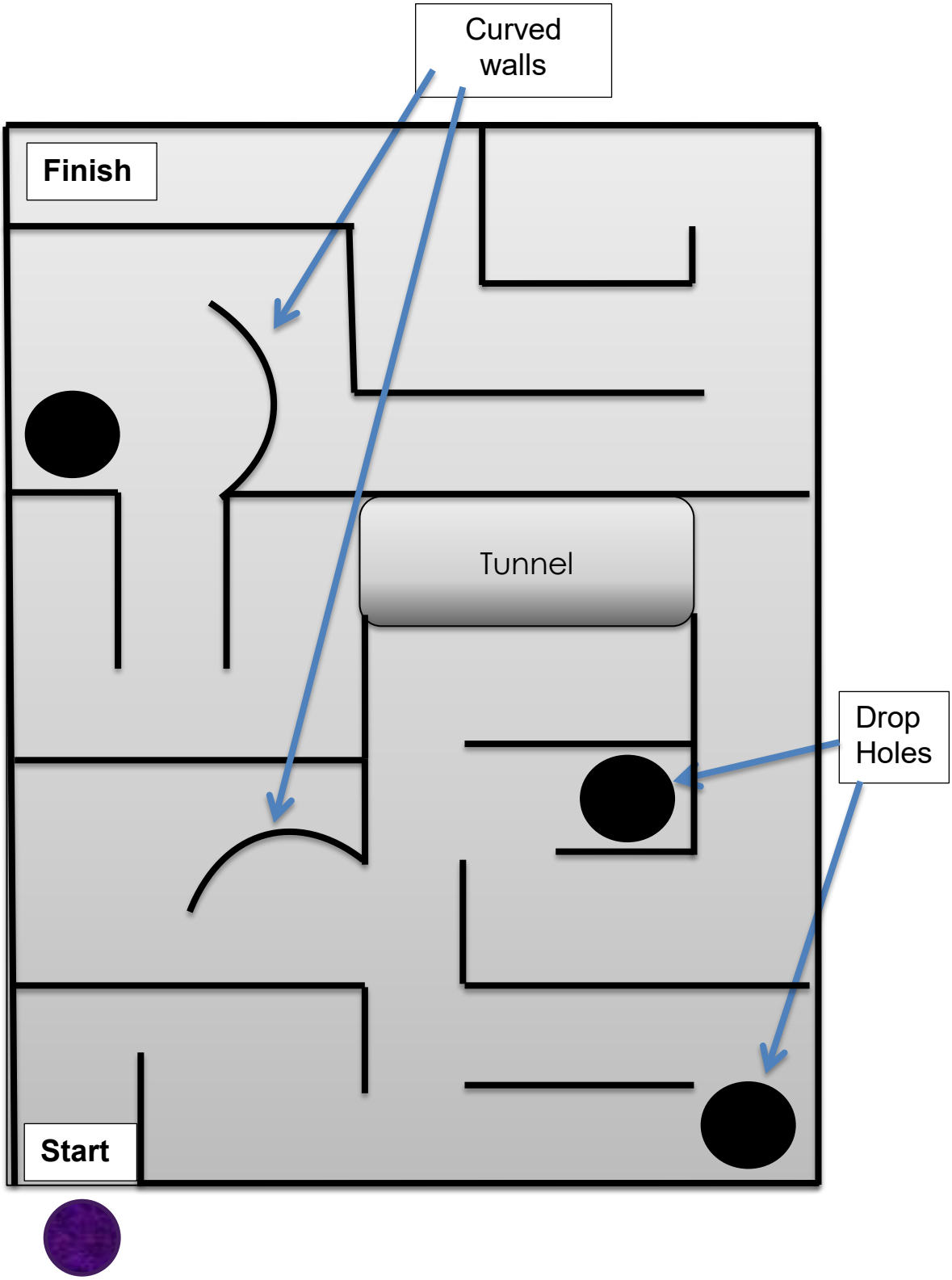
Design Plan:

Materials I Will Use for My Maze Design

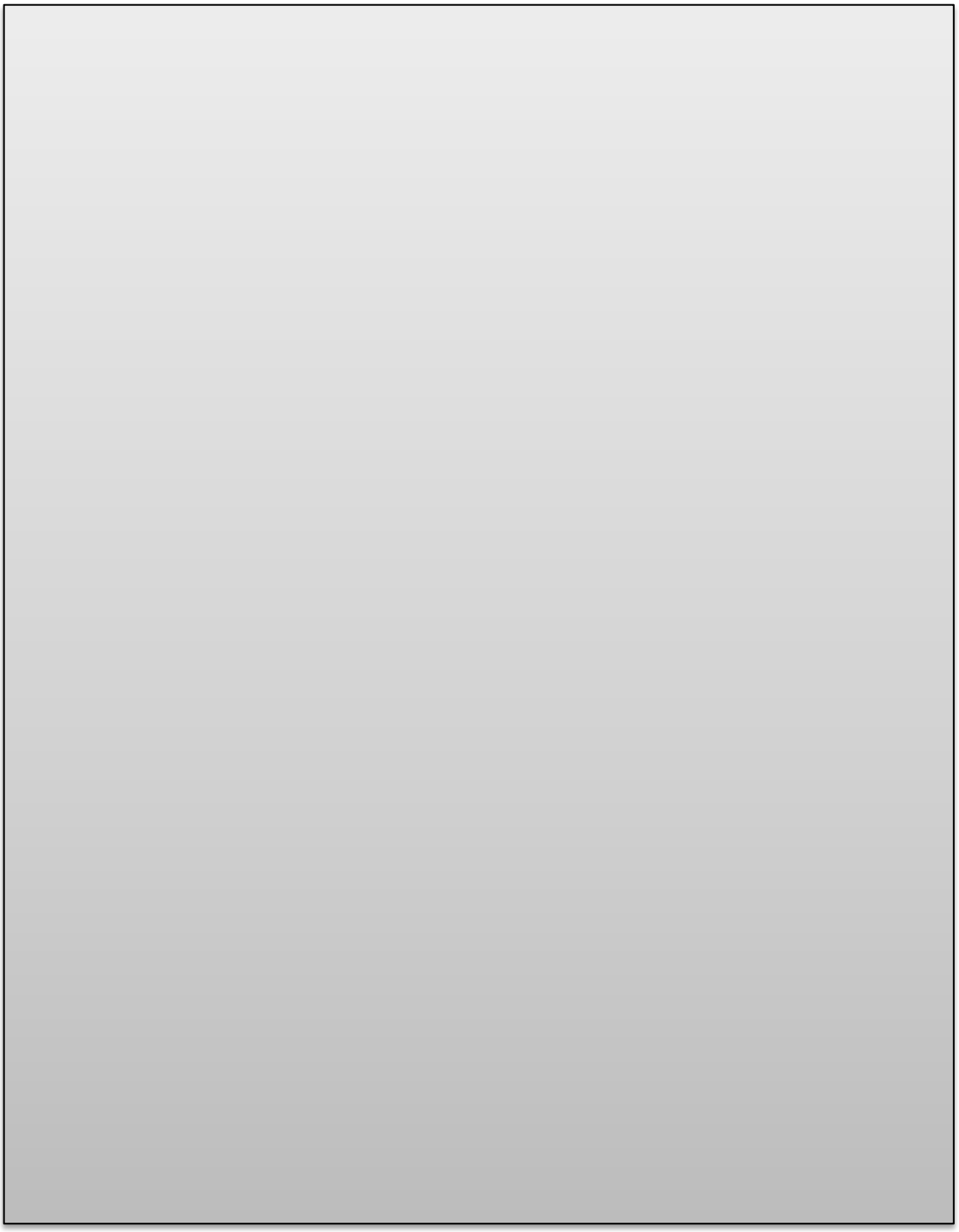
Toy Part	Material	Properties and reason I choose this material
Maze Base	Cereal box (cardboard)	Rigid – provides a flat surface for the marble to roll – makes it easier to hold when playing the game Smooth – the marble will roll easier and faster Paper is a recyclable material.
Walls		
Tunnel		
Curved walls		

Draw a diagram of your maze from a bird's eye view. See an example of a labelled diagram. Include a start and a finish

Maze Design Example Diagram (bird's eye view):



Maze Design Diagram Template:



Build:

Now it is time to use your design and the materials you have chosen to build your maze. Take photos or video as you go as these may be used on Day 5 when you will be sharing your design.

Test and Evaluate:

Once your maze is built and you are happy with the result, it is time to test it. Practise getting the marble from one end to the other. You might like to take photos or video of this as well. Compare your skills to others by timing your run.

Are you happy with your maze?
Tick yes or no:

Yes ☐ **No** ☐

What problems does your maze have?

What can you do to fix the problems?

What alterations will you make and why?

Redesign:

If necessary the design can be altered at this stage.

Share:

You will share your design and toy on Day 5.

Visit this design challenge just for fun:
http://invention.si.edu/tinker-ball
or
http://engineering-games.net/games/gravity.swf

Day 5 Share Your Toy Design

Today you will be creating a multimedia presentation of your marble maze. You will need to present the steps of design technology that you took.

5.1 Prepare for your presentation

Gather together the materials you used, the design diagram and photos or video you took and your finished marble maze.

In your presentation, you will need to describe your maze, the materials you choose and why (think about properties) and the process of designing the toy. You will also explain the steps you took from beginning to end.

Include these headings in your presentation:
Identify the challenge,
Brainstorm,
Design,
Build,
Test and Evaluate,
Redesign
Share

Your presentation needs to be multimodal which means it needs images (moving or still) and audio. You can choose how to present you work. Use your creativity. This might be an audio visual presentation with props, a PowerPoint presentation with visuals and audio or you might use another software program application which has these features.

To start, brainstorm some ideas about what programs you could use, map out the presentation using the steps to design technology, practise what you will say and then put it all together with images.

Have fun!

Student Reflection

Tick the box you feel best describes your work in this set.
☺ = I had a lot of help.
☺☺ = I had a little help.
☺☺☺ = I did it by myself!

Science			
Science Understandings	☺	☺☺	☺☺☺
I can describe a range of common materials such as metals or plastics and their uses.			
I can select materials for uses based on their properties.			
I have considered how the properties of materials affect the management of waste or how they can lead to pollution			
I can investigate a property over a range of materials.			
Science Inquiry Skills	☺	☺☺	☺☺☺
I was able to make a prediction in most of my investigations.			
I followed the steps to a procedure in my investigation.			
I recorded my observations (what I saw) in my investigations in a table.			
I made a graph from the data in my table.			
I presented my research as drawings, photos and words.			
Science as a Human Endeavour	☺	☺☺	☺☺☺
I understand that it is important to ask questions and make observations when working in science.			
I can describe situations where understanding the properties of a material can influence my own and others' actions.			

Design Technology			
Knowledge and Understanding	☺	☺☺	☺☺☺
I can examine models to identify how forces and materials are used in the design of a toy			
I can explore how movement can be initiated by combining materials and using forces			
I can conduct investigations to understand the characteristics and properties of materials and forces that may affect the behaviour and performance of a product or system			
I can experiment with available local materials, tools and equipment to solve problems requiring forces like how my marble will move through the maze.			
I can use the right technologies terms to confidently describe and share with others procedures and techniques for making my maze.			
I can use tools and equipment accurately when measuring, marking and cutting and using a template.			
I can select and use materials, components, tools, equipment and processes with consideration of the environmental impact when building my maze.			
Processes and Production Skills	☺	☺☺	☺☺☺
I can write or explain a sequence of steps to design a solution for a given task.			
I can develop and communicate design ideas and decisions using labelled drawings and appropriate technical terms.			
I can select, and safely use the right parts and equipment to make my maze.			
I can evaluate and justify simple design problems and solutions.			

Which was your favourite activity and why?

Home Tutor Reflection

Tick the box you feel best describes your student's work in this set.

☺ = With a lot of help

☺☺ = With some help

☺☺☺ = On their own

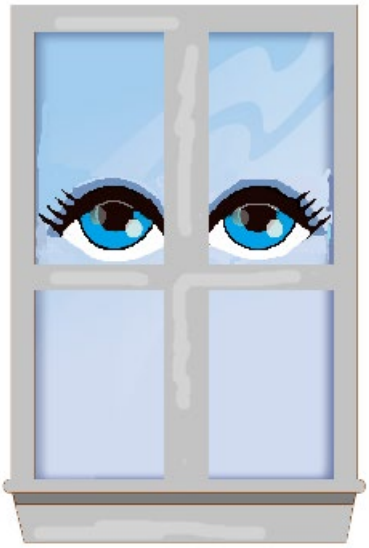
Science Understandings	☺	☺☺	☺☺☺
My student can describe a range of common materials such as metals or plastics and their uses.			
My student can select materials for uses based on their properties.			
My student has considered how the properties of materials affect the management of waste or how they can lead to pollution			
Science Inquiry Skills	☺	☺☺	☺☺☺
My student was able to make a prediction about what would happen in their investigation.			
My student followed the steps to a procedure in their investigation.			
My student understood what observations to record when doing their investigations.			
My student presented their investigation with drawings, photos and words.			
Science as a Human Endeavour	☺	☺☺	☺☺☺
My student understands that it is important to ask questions and make observations when working in science.			
My student can describe situations where understanding the properties of a material can influence my own and others' actions.			

Design Technology			
Knowledge and Understanding	☺	☺☺	☺☺☺
My student examines models to identify how forces and materials are used in the design of a toy			
My student explores how movement can be initiated by combining materials and using forces			
My student conducts investigations to understand the characteristics and properties of materials and forces that may affect the behaviour and performance of a product or system			

My student experiments with available local materials, tools and equipment to solve problems requiring forces like how my marble will move through the maze.			
My student uses the right technologies terms to confidently describe and share with others procedures and techniques for making my maze.			
My student uses tools and equipment accurately when measuring, marking and cutting and using a template.			
My student selects and uses materials, components, tools, equipment and processes with consideration of the environmental impact when building my maze.			
Processes and Production Skills	☺	☺☺	☺☺☺
My student writes or explains a sequence of steps to design a solution for a given task.			
My student develops and communicates design ideas and decisions using labelled drawings and appropriate technical terms.			
My student selects, and safely uses the right parts and equipment to make their maze.			
My student evaluates and justifys simple design problems and solutions.			

Other comments:

Well done!



You have finished this science unit and learned about the properties of materials and how they give us choices when we are using or designing products.

Now that you have finished, send all worksheets to your teacher. Do not forget to include any photos and the multi-media presentation as well.

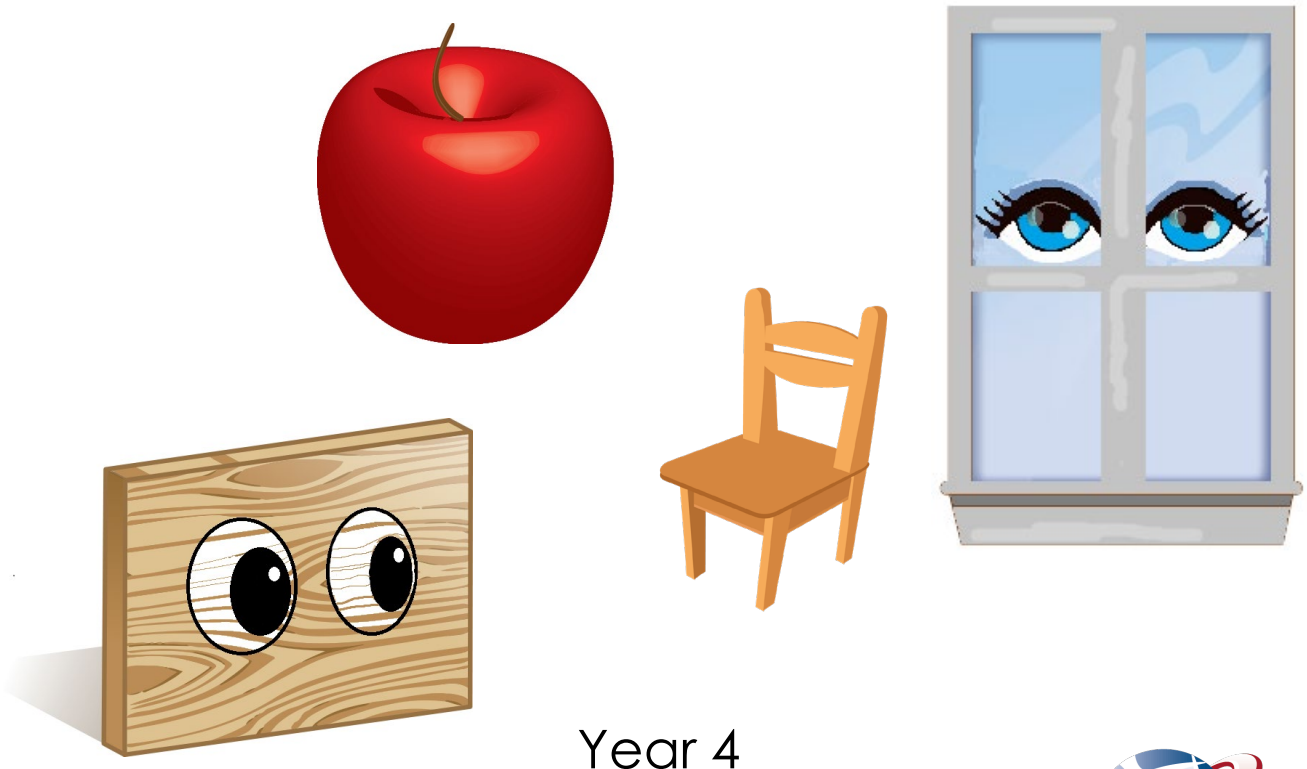
Check this list to make sure all of your work is complete:

Worksheet Checklist:

- 1.1 Physical properties of materials
- 1.2 Occupation cover up
- 1.3 Comparing Gloves Mind Map
- 1.4 Discoveries timeline
- 1.5 Characteristics of materials
- 1.6 What material am I?
- 2.1 Testing the strength of materials
- 3.2 What comes in packaging mind map
- 3.3 Packaging a paragraph
- 3.4 What is best?
- 3.5 My takeaway food shop
- 4.1 Materials and their use in design
- 5.1 Prepare for your presentation
- 5.1 Multimedia Presentation
- Student Reflection Sheet
- Home Tutor Reflection Sheet

HOME TUTOR NOTES

Properties of Materials



Year 4
Chemical Science
and Design Technology
5 Day Print Course

SIDE
SCHOOL OF ISOLATED & DISTANCE EDUCATION

Introduction

Getting started:
This science course should take approximately five days to complete. Home tutors should read the home tutor notes, worksheets and prepare the equipment prior to each day.

“Background information” on the science behind the investigations is for the purpose of the home tutor and not mandatory for the student’s understanding.

Students may need help with reading and understanding the tasks. This should be done together with their home tutors.

Terms such as “investigate, predict, follow a procedure, observe, and record” should be used by the home tutor when working with their students in science. It is important that students become familiar with these terms.

Home tutors should mark their students work with a tick and give written encouragement or use stamps and stickers at the end of each day. Students should be reminded to write their answers using full sentences. They should be encouraged to use scientific words where they can.

Safety:
There is supervision needed in all activities for the purpose of safety. Investigation around heat and sharp objects such as scissors are found in some investigations. A warning sign is used to indicate where this is most necessary.

Materials:
Equipment used for this science course can be found in most households or can be purchased at the local supermarket. Collecting the equipment and ticking off the list together can be the first activity to do with your student in preparation for this course.

Day 1 Materials and their Properties

It is important to this course that studens are able to distinguish between the terms materials and properties as used in science.

1.1 What are the properties of materials?

Read the text with your student to make sure they understand that materials are the substances of which things are made and properties are their characteristics. Talk about the chair and the bottle. Encourage them to give some examples.

Read through the physical properties of materials list and discuss some examples with your student.

Students will use the physical properties list to write the properties of the materials in the table. **Some** will have **more than one**. Write a couple of your own.
Here are some possible answers…

Material	Properties
A window	Shiny, heavy, rigid, transparent, can be brittle, hard
Plastercene	Flexible, colured, malleable, solid
Wooden chair	Hard, strong, rigid, heavy, solid
Plastic bottle	Transperant, waterproof, flexible, light
A metal tablespoon	Hard, shiny, rigid, conducts
A piece of paper	Light, flexible, opaque, absorbant
Copper wire	Hard, flexible, conducts
Honey	Liquid, viscous, runny
Water	Transparent, runny,
Sponge	Absorbant, light, flexible, insulating
Wool jumper	Soild, coloured, insulating

1.2 Occupation Cover-Up

Why is it important that people consider the gloves they wear for different occupations? Give an example.

Gloves are made of different materials for specific uses.
A baker uses an oven mit or a silicone glove which insulates them against heat.
This way they will not burn their hands. If you didn't use the right gloves for the job,
you could hurt yourself.

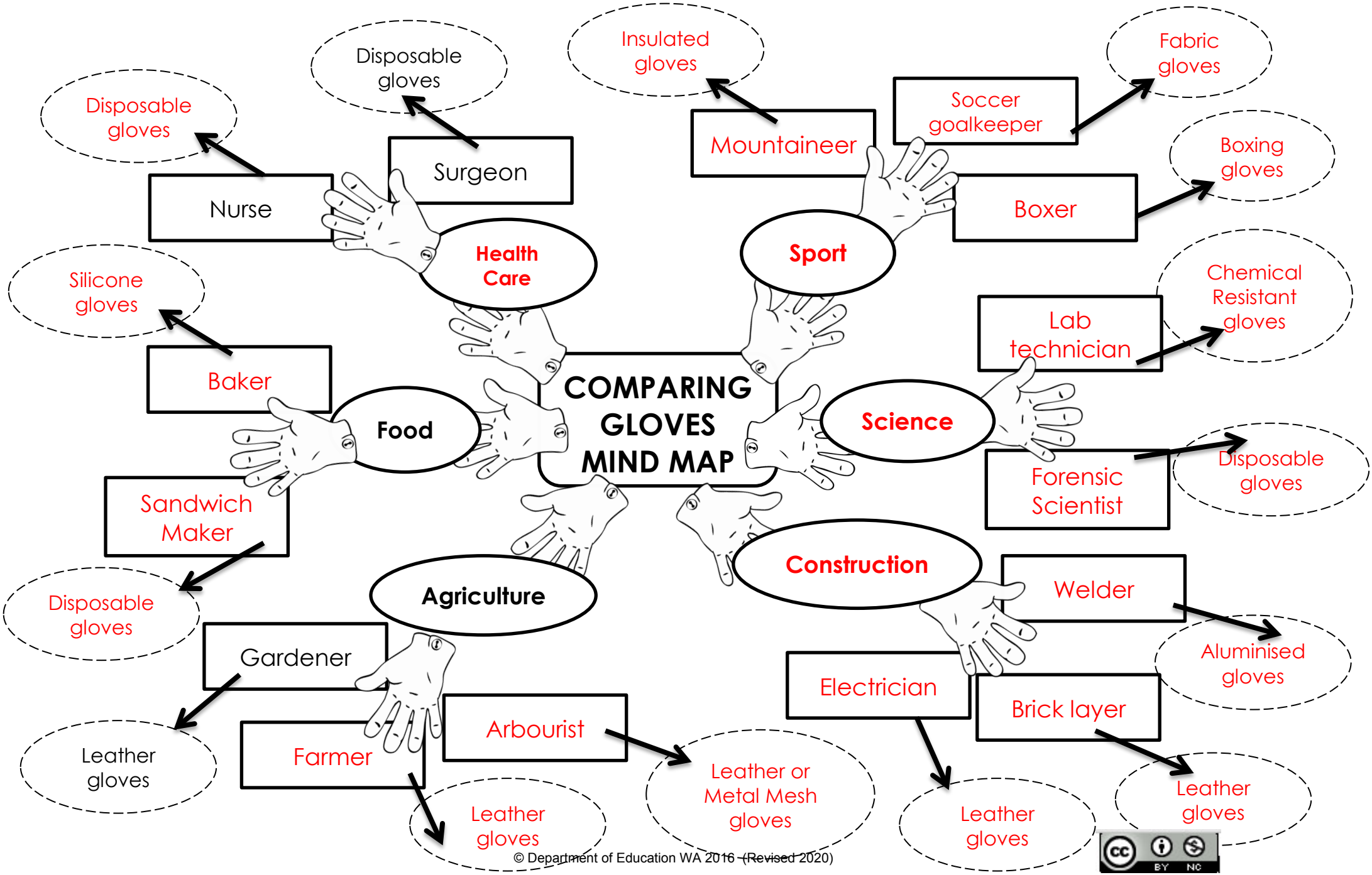
Can you give another example of why a certain type of glove is used?

I wear a glove when I play baseball. It is made of leather and foam and protects
my catching hand from the baseball.

Many different materials are used to make gloves. What are some that you already know?

Leather, fabric, rubber…
Answers will vary.

Students may need assistance with there comparing gloves mind map. Make sure they carefully read through the steps. It is recommended they do this in pencil first.
Have your student look at the examples first.



Discovery of Materials Timeline (200 years)

	1839 – Vulcanized Rubber invented by Charles Goodyear
	1841 – Alexander Parkes created waterproof fabric with thin coats of rubber
1850	1862 - Parkesine (the first plastic)was an organic material coming from cellulose which when heated could be molded. It retained its shape when
1900	1909 – Bakelite hard thermosetting plastic invented by Leo Baekeland
	1912 – Stainless steel invented by Harry Brearley
	1931 – Neoprene was developed by Julius Nieuwland
	1931 – Nylon developed by Wallace Carothers
	1938 – Teflon was invented by Roy Plunkett
1950	1953 – The first plastic food wrap (Saran Wrap) made by Dow Chemicals
	1959 – Float Glass developed by the Pilkington Brothers
	1965 – Inventor of Kevlar® Stephanie Kwolek, was a DuPont chemist ,the lightweight, stronger-than-steel fiber used in bulletproof vests and other body armor around the world.
	1990s – Hybid materials – mixtures of organic and inorganic materials at a molecular level for cements and materials for electronics or medical uses.
2000	2005 -2010 - Spray on skin developed by Dr. Fiona Wood to use on burn victims
	2010 - Fabrican © Spray on fabric http://www.fabricanltd.com/ A British company has developed a way to bond and liquefy fibres so that textiles can be sprayed out of a can or spray gun straight onto a body or dress form.
	2016 - Graphene a one-atom-thick layer of carbon a 100 times stronger than steel of the same thickness.
	2025- Students own example …

Math Activity

How long have these materials been around?
Use the timeline to calculate how many years some of these materials have been around. Subtracting the year the material was created from the current year. Don't forget to show your working out in the boxes.

Teflon is used as a non-stick coating and in making many different things such as frying pans, raincoats and umbrellas, in paint and sports products.
How long has Teflon been around?

For example: If this year is 2016
2016 subtract 1938, the year Teflon was first made.

2016
-1938
78 years old

Rubber comes from the rubber tree and is used most commonly in the tyres on our cars and trucks. It is also used for surfaces like floors, in balloons and surgeons gloves.
How long has rubber been around?

For example: 2016
-1839
177 years

Plastic is made from oil, natural gas and coal. These are raw materials which we remove from under the Earth's surface. This is the same fuel we use to run our cars, trucks and other vehicles.
How long has plastic been around?

For example: 2016
-1862
154 years

1.4 Characteristics of Materials

When would you wear gumboots? Why? Would you wear a jumper in the desert? Why/Why not?
These are rhetorical questions to get the student to start thinking about the purpose of certain properties which various materials hold and how they preform a function.
Walk around your home and look for objects you can write in the left hand column of this table. Complete the rest of the table.
Students may need assistance with items to choose. Encourage object made of different materials, having different properties to show variety in their table and extent of their knowledge.
Examples:

Object	What it is Used For	The material it is made from	Why this materials is a good choice
Saucepan	To heat food	Metal	It is good at conducting heat and does not melt over heat. This helps us to cook food.
Drinking glass	To hold water	glass	Glass is waterproof so can hold a liquid. When it is heated it can be moulded into a drinking glass shape. It is transparent so you can see how much and what is in the glass.
Cotton T-shirt	As clothing	Cotton	Cotton is a fibre which can be woven. It is natural and can be cool in hot weather. It absorbs dye so it can come in different colours.
Answers will vary			
Answers will vary			
Answers will vary			

1.5 What material am I?

Riddle

I do not break when you drop me. I am certainly not made of brick.
I cannot insulate from hot or cold, unless I am thick.
I might melt in a dishwasher. I am waterproof and can be washed.
Often times I am stepped on and even squashed!

I can be moulded into a shape.
I am bendable but I could break - if you bend me too much.
I can be different colours when I am dyed.
I can make rope and be tied.

I am used to make many objects like bottles, containers, jewellery and toys.
I can be lots of things and bring many joys!
What material am I?

Answer: PLASTIC

Choose a secret material of your own. Write a riddle by using its properties (describing or explaining what it does, how it preforms under different conditions).

My riddle:

Answers will vary…

Day 2 Testing, Testing (Investigation)

2.1 Testing the strength of materials

Scientists have to consider what materials are used for and will test their properties to be able to determine the best material for the job. Today, you are going to investigate a particular property across several materials. The property you will test is strength. Are all packging materials the same strength and does this change when they are dry or wet?

In this activity, you will test different types of packaging material for their strength by dropping a coin to see whether they will tear when dry and when wet.

What do you already know about the strength of materials?

It depends on what the material is made out of.
Students may be able to list materials that are strong such as rock, steel or iron.
They may also know that some materials are stronger than others

Does dryness or wetness make a difference to a material's strength? (What it looks like, feels like and how it behaves.)

I think that being wet does make some things weaker. When I put paper in water it falls apart.

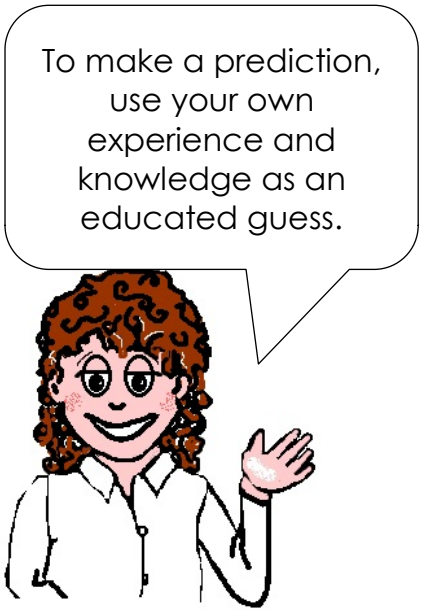
What is the question you are going to answer by investigating. (Hint: You will find it in the paragraph above.)

Investigation question:

Are all packaging materials the same strength and does this change from dry to wet?

Make a prediction (These will vary based on the student's experience)**:**

I think that packaging materials will have different strengths because I have seen paper bags rip when they hold too much and they get soft when they are wet.



Materials:

- Paper towel
- Plastic wrap
- Tissue
- Baking paper or Wax paper
- Ruler
- Water
- Teaspoon
- 50 cent coin
- A glass or can with top lid removed no taller than 10cm
- Rubber band (one that will fit tightly around the can)
- Scissors

Fair Testing

Read and discuss the information on fair testing in the student workbook with your student. Fair testing is a very important component to scientific investigations. If the wrong variables change, the variable that you want to test will have invalid results.

A fair test makes sure that the scientific results you are testing are true because you have kept all of the variables the same except for the one you are testing. Variables are the things that can change during the investigation that can make our results inaccurate. Only one variable can be changed during an investigation. This is the variable that you will measure.

In this investigation, students will need to make sure that the **type** of material (the different papers being tested) is the only thing (variable) that they change during their investigation. Its strength is what they will measure by counting the number of coin drops.

The variables that don't change:

Make sure students know that the size of the material and where they place it is always the same.

The same coin must be used everytime.

The height from which the coin is dropped must be the same.

When tesing for wet strength the same amount of water they use must be the same too. This will make it a fair test.

Investigation Variables

Measure:	Change:	Keep the same
○ The number of drops it takes to break through the different types of paper	○ The type of material (paper towel, tissue, plastic wrap and waxed paper)	○ The size of the material ○ Where the material is placed ○ The coin ○ The height from which the coin is dropped ○ The same amount of water

Why would it not be a fair test if we used different amounts of water?
If you use more water the papers might become weaker and less water might make them stronger.

To be a fair test, why do you need to use the same type of coin?
The same coin must be used so the same weigh is dropped everytime. Some coins have edges which may rip the paper easier and some are smooth which might not.

There are two parts to this procedure.

A. Test the strength of dry materials

Procedure:

1. Place the paper towel on top of the open end of the glass.
2. Use the rubber band to hold the paper towel tightly over the glass.
3. Hold the ruler or measuring stick vertically beside the glass and tuck it into the elastic too. Rest the zero measurement end against the table (the numbers will increase as you go up the measuring tool).
4. Hold the coin 20cm above the top of the paper towel.
5. Drop the coin, edge side first. Observe.
6. Drop the coin until the coin breaks through the material.
7. Take a photo of your investigation.
8. Keep dropping the coin until the coin breaks through the paper towel. Record the number of drops in your dry materials table.
9. Repeat these steps for each of the different materials in turn, first the plastic wrap, then the tissue, and finally the wax paper.
10. Record the number of coin drops it takes to puncture these materials in your dry materials table.

B. Test the strength of the same materials when wet

Procedure:

1. Follow the same procedure from testing the dry materials but this time add 1 teaspoon of water to each material surface.

2. Take a photo of your investigation.
3. Record the number of coin drops it takes to puncture the materials in your wet materials table.

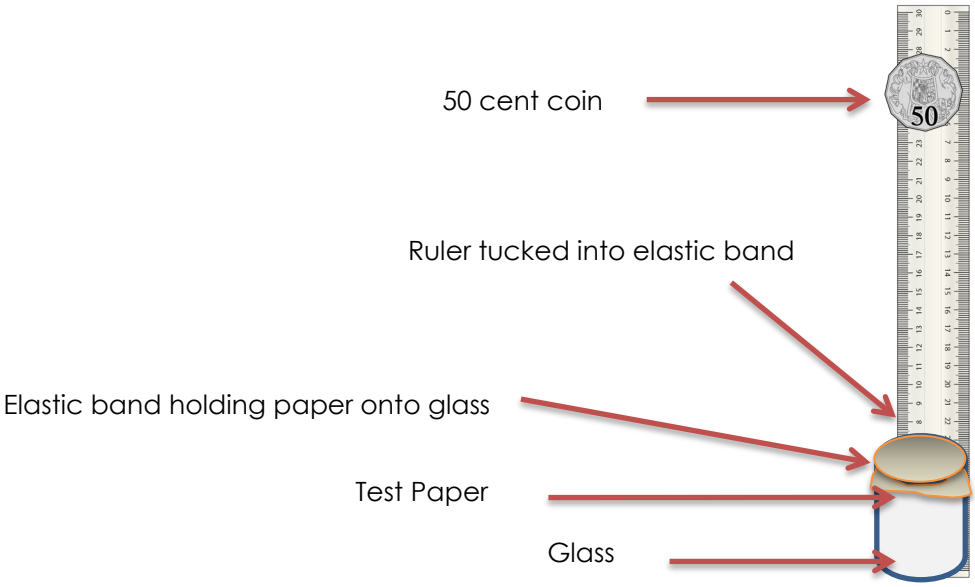
Observations:
Remember that scientists collect information by describing what they see during their investigation.

Students should take photos or video parts of their investigation as part of the observations they make.

They will draw a diagram of their investigation – the way in which they set up their equipment. Remind them that it is a diagram so it needs a title and labels.

For example:

Investigating the Strength of Different Types of Paper



Observation table:

These answers will vary.
The coin should drop through the wet materials faster than the dry materials.
The plastis wrap should be the strongest under both conditions.

Strength of the different **dry** materials

	Number of coin drops before tearing
Paper Towel	6
Plastic Wrap	1
Tissue	2
Wax Paper	16

Strength of the different **wet** materials

	Number of coin drops before tearing
Paper Towel	2
Plastic Wrap	1
Tissue	1
Wax Paper	16

Analysing:

Study the results in your table. What do you observe about the information in your table? Describe what happened in words.

The coin broke through the different papers when dropped from the same height but the amount of times dropped was different for each type of paper.

Which of the dry materials is the weakest? How do you know?

Tissues are the weakest type of paper. It only takes one coin drop to break through.

Which of the dry materials is the strongest? How do you know?

The plastic wrap was the strongest material as it took more coin drops to break through.

Does moisture make materials weaker or stronger?

Note to home tutors – Essentially the water molecules mix with the cellulose molecules making them weaker. When the paper is wet it loses strength because the water molecules get between the cellulose chains and weakens the attraction between them.

It makes materials weaker in the case of paper. It took less coin drops to break through the wet paper.

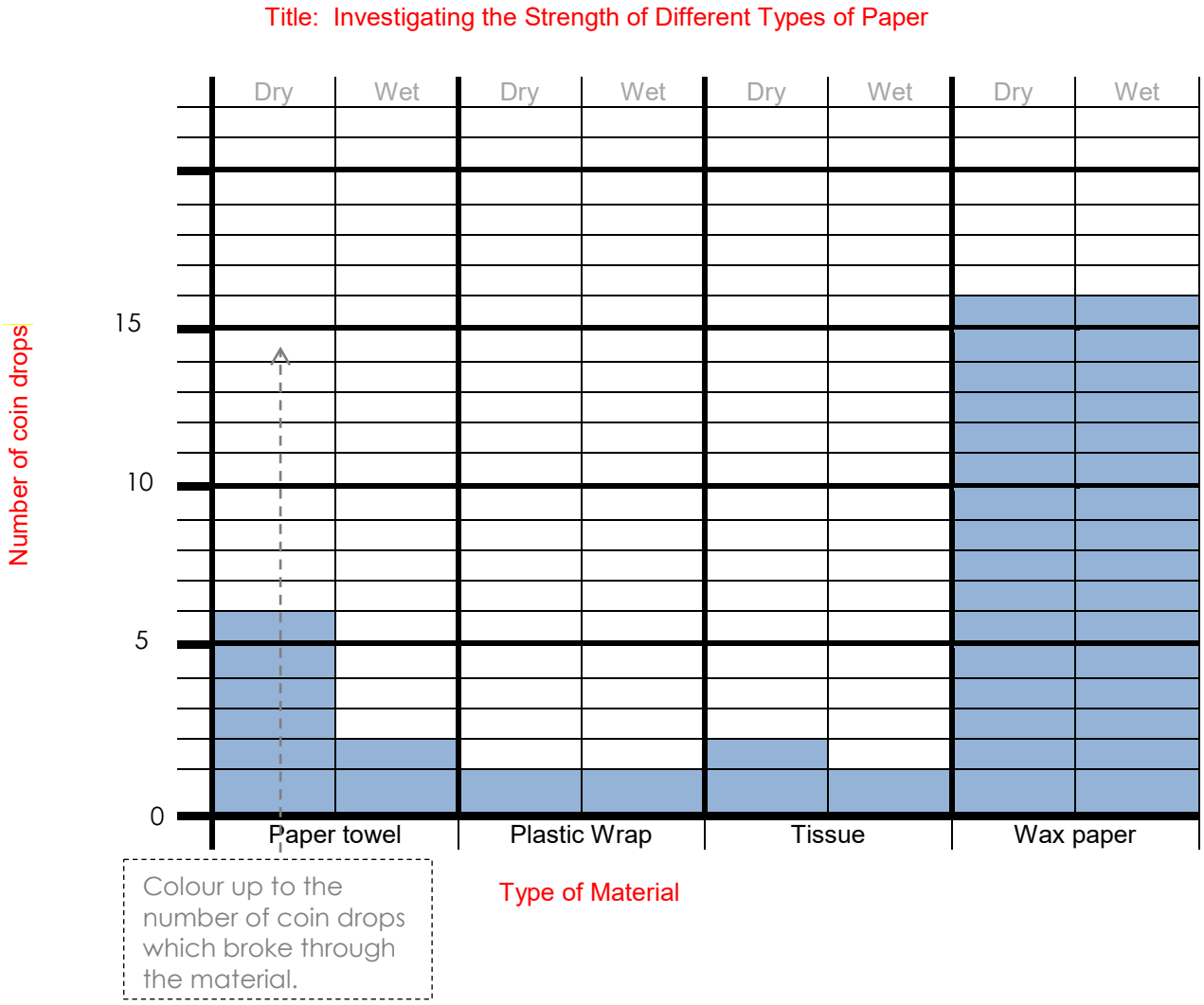
Describe how the strength of each material affects what it is used for.

Tissues are needed to blow noses so the paper can not be too strong otherwise it would be rough. Paper towel needs to be strong enough to soak up water without falling apart. Wax paper is used to wrap sandwiches and is a little waterproof to keep the sandwich from wetting other things in your lunch bag.
Plastic wrap is strong to create a waterproof barrier to keep food fresh.

Student will present their data in a bar graph. Remind your student that a bar graph is useful for comparing their data. The bars provide a visual display for comparing quantities in different

categories. Bar graphs help us to see relationships quickly. Bar graphs can have horizontal or vertical bars. Another name for a bar graph is a bar chart.

Students can title their graph by reviewing their investigation question. The types of material are shown along the bottom of the graph and the number of coin drops on the side of the graph. Here is an example using the data from the observation table.



Evaluating:

What information does the graph give you which is different from a table?
Answers will vary. For example:
The graph gives a comparison of the results as a picture rather than just numbers. It makes it easy to see which of the materials were the weakest and which the strongest.

Did each material behave the same? No

Why do you think that is? Answers will vary. For example:
Some papers are made of wood fibre which absorbs water making them weaker. Some are coated in wax which makes them stronger and more resisitant to water. Plastic is totally resistant to water which makes it strongest

Was your investigation a fair test? Why or why not?
Students should talk about the varaibles that they kept the same.

Communicating your findings:

Which of the four materials you tested is the strongest?
The wax paper seems to be the strongest as it took more coin drops to rip. This was the case for both dry and wet.

Which materials are water repellent? Does repellancy make a difference to the strength?
The plastic wrap and the wax paper repelled the most water. The plastic wrap was not very strong. You would assume repellancy would make a material stronger but not in this case.

Why is water repellancy important for some packaging?
It is strong but also adds protection. If the object is wet, the packaging keep the wetness in. If the object is dry and needs to stay that way when it is being transported it is protected again.

What problems did you have during your investigation?
Answers will vary.

How could you change your investigation to fix these problems?
Students need to offer solutions to the problems they had in their investigations which might directly affect the results.

Day 3 Waste Management

3.1 Packaging Attack!

Read the following information with your student:
Rubbish continues to be a problem for many cities and small communities around the world. Rubbish has become worse to deal with because of increasing populations. We create rubbish everyday. Rubbish can be a waste of resources. A good example of this is the packaging from takeaway containers.

History:
Food packaging has been around for a long time. The paper plate was invented by the German bookbinder Hermann Henschel in 1867.

In 1908, to reduce the spread of tuberculosis and improve public hygiene Lawrence Luellen and Hugh Moore invented a disposable paper cup called the "Health Cup" and later renamed the "Dixie Cup".

A huge change in disposable food service packaging happened in 1948. McDonald's Restaurant no longer served their meals with the use of glasses, plates or cutlery. They created disposable packaing that would be taken away from the restaurant by the customers.

Most of this packaging created a problem with a huge amount of waste going directly to the rubbish tip. Scientists have since given much consideration to the materials being used to make takeaway packaging more environmentally friendly.

Why do we need packaging? http://www.greendustries.com/unido.pdf

- Packaging protects products as they travel, Most of the things we use at home and at work are produced somewhere else so they have to travel a long way to get to us. This avoids damage.
- A well-designed package is attractive and appealing to consumers, and inspires confidence of product safety. This can increase sales.
- Packaging provides a physical barrier between a product and the external environment which ensures hygiene and reduces the risk of product wastage due to contamination.
- Some forms of packaging prolong the life of food.
- Packaging is also used to provide customers with information and instructions, for which there are some legal requirements.

Watch this ABC Behind the News videos to learn more about packaging.
BTN Nude foods - http://www.abc.net.au/btn/story/s4422480.htm

3.2 What comes in packaging?

Students:

1. Write all of the materials you know that are used for packaging in the circles.
2. Write what are packaged in these materials in the rectangle and connect them with an arrow to the materials.
3. Colour in green the boxes with food items that are packaged.
4. Colour in the items blue which are not food items.

This time only one has been done for you:

Packaging Mind Map Example of some possible responses…

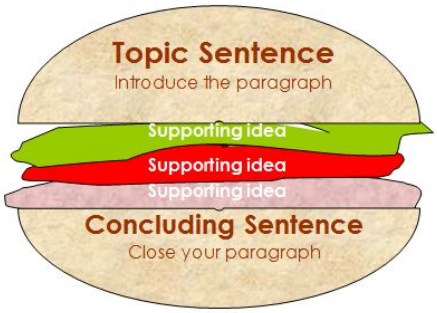
3.3 Packaging a Paragraph!

Students will choose one of the packaged items from their mind map and use this as the topic of a paragraph.

Students generate ideas by answering the following questions. Include this information in their paragraphs:

- Give examples of what the type of material used does for the item being packaged.
- Why do companies choose a certain type of material to package their products?
- Tell what you can do with the packaging after it is finished being used.

Remind students to use proper paragraph structure.
Draw their attention to the hamburger graphic.
This hamburger has all of the parts to a good paragraph. The type and description of the package the students chose should be included in the topic sentence.
The supporting ideas are the various points which give more detail about the topic. The concluding sentence will close the paragraph by summarising what the points found in the paragraph.



Students should draft their paragraph. They will need assistance with editing for spelling, punctuation, grammar, and adding or deleting words. Do this with your student. Use a different colour pen to mark up the draft. Have your student write a final corrected paragraph on the next page.

3.4 What is best?

In this activity, students will compare choices on how to deal with takeaway packaging waste and protect the environment.

Read the Waste Fact sheet from
http://www.coolaustralia.org/wp-content/uploads/2013/10/Wastefactsheet1.pdf
to research ways to get rid of takeaway waste in Australia.

Explain what is meant by 'out of sight, out of mind' when it comes to rubbish.
Example: The phrase 'out of sight, out of mind' usually means that once we throw something away, we don't think about it again. It can also mean we no longer take responsibility for it. This is one reason we have problems with rubbish and the environment.

How much rubbish does the average Australian family produce in a year?
Every year the average Australian family produces enough rubbish to fill a three-bedroom house, producing about 2.25 kg of waste per day.

Next, use the internet to research the words:

- biodegradable
- single-use packaging
- biodegradable packaging materials

What does biodegradable actually mean?

A substance or object capable of being decomposed by bacteria or other living organisms and thereby avoiding pollution.

When it comes to packaging, what does the term 'single use' mean? Why is this bad for the environment?

This means that the packaging can only be used once and then is throw away and ends up in landfill, recycling, compost or as litter.
Another word that has a similar meaning is 'disposable.'

What are different types of biodegradeable packaging made from?

Some examples: Paper and cardboard, Corn starch, Bamboo, Biocane(sugarcane)
Plant based bioplastic, eco friendly non-plastic vegetable packaging.

Why do people want biodegradable packaging as an option?

People that care about the environment and how much rubbish they are producing want biodegradeable packaging as an otion. Many times this could be compsted and create soil rather than waste.

3.5 My takeaway food shop?

'You are the owner of a new takeaway food shop.' You have young children and are conscience that they need to grow up in a healthy environment. You would like to do the right thing by making sure the packaging you use is environmentally friendly as well.

The menu consists of:

Research environmentally friendly packaging for these menu items using the following websites or others that you might search. Complete the table on the next page with your choices.

http://www.vegware.com.au/
Watch the movie 'Most Coffee Cups Aren't Recycled'
Click on 'About' to find out about the packaging.
Click on 'Products' to find packaging options.
Or go to either:
http://www.packagingbiodegradable.com.au/
http://environmentalenterprises.com.au/

Environmntally Friendly Food Packaging for My Shop - Example Answers

Takeaway Food	Product name/ Packaging description	Reason: What properties make these types of packaging environmentally friendly and what properties make these types of packaging right for your food products?
Hamburger	Sugarcane Pulp Clamshell • compostable • made from sugarcane pulp • suitable for hot/wet/oily foods • eco friendly alternative to styrofoam	Non-porous - They are moisture resistant which makes sure that the juices from the hamburger and tomatos don't leak.
Chicken Wrap		
Fresh Salad	Cold clear containers • completely compostable, NO plastic • made from plant-based PLA • light and strong • tight lid seal • safe, non-toxic, BPA free • for foods up to 50°C	
Cold juices		
Coffee/Tea	Double Wall Kraft Eco-friendly Cups • completely compostable disposable coffee cups, NO plastic lining • 72% less carbon than plastic • made from plants • plant based PLA lining • compostable biodegradable cups • great thermal properties • leak proof compostable "non plastic" plant-based PLA lids	

Websites used for your research:
http://www.vegware.com.au/?act=viewCatalogue

Other comments about your packaging choices:
All choices that I made for my takeaway food shop business will help the environment by reducing the amount of rubbish which can not decompose.

Day 4 Design Technology

4.1 Materials and their use in design

Help students get organised for this task by reading the worksheet with them. This is a step by step process and it is importatnt that students follow the design process. Discuss the options they have for materials. These should be items you could find in a household recycle bin. The challenge is specific. Have students stick to the design requirements listed under ‘identify the problem.’

Students will create their own toy marble maze by following the design process:

Design Process:
Identify the problem
Brainstorm
Design
Build
Test and Evaluate
Redesign
Share

Identify the problem:
Build a toy out of recyclable material with these specific design requirements:

- Only recyclable materials can be used to make your maze.
- The base of the maze must be made out of a cereal box.
- The marble must make at least 10 corner turns from start to reaching the finish.
- It must go through 1 tunnel.
- The maze must have at least 2 curved walls.
- You must have at least two holes to avoid.
- Mark the start and finish.
- You must stick to the design shown on your design plan.

Resources:

- Cereal Box
- Marbles (in Math kit, buy at grocery store or use Malteesers)

- Recyclable Materials (Paper rolls, boxes, paper, cans, bottles,etc)
- Stop Watches / Timers
- Pens / Pencils
- Sticky Tape / Masking Tape
- Camera and/or video recorder
- Scissors

Caution is needed when using cutting tools!

Brainstorm:

What material properties might affect the speed and accuracy of which a marble rolls?

Smooth materials without edges will make the marble roll faster. I will try to find smooth cardboard or plastic without rough edges. I will make sure that when I tape my walls on I will smooth out the tape and make sure no sticky parts of the tape are exposed.

Design:

- Research/ search the internet for ideas – 'make a marble maze or run'
- Complete a plan by recording the materials and reason for your choice of materials
- Draw a diagram of your maze and include labels

Design Plan:

Materials I Will Use for My Maze Design

Example answers in red. Student will chose their own construction materials.

Toy Part	Material	Properties and reason I choose this material

Maze Base	Cereal box (cardboard)	Rigid – provides a flat surface for the marble to roll – makes it easier to hold when playing the game Smooth – the marble will roll easier and faster Paper is a recyclable material.
Walls		
Tunnel	Half a toilet paper roll	Rigid – the tunnel will not collapse Shape – already an arch
Curved walls	Plastic bottle	Shape – already a curve Flexible – can be shaped as an open curve

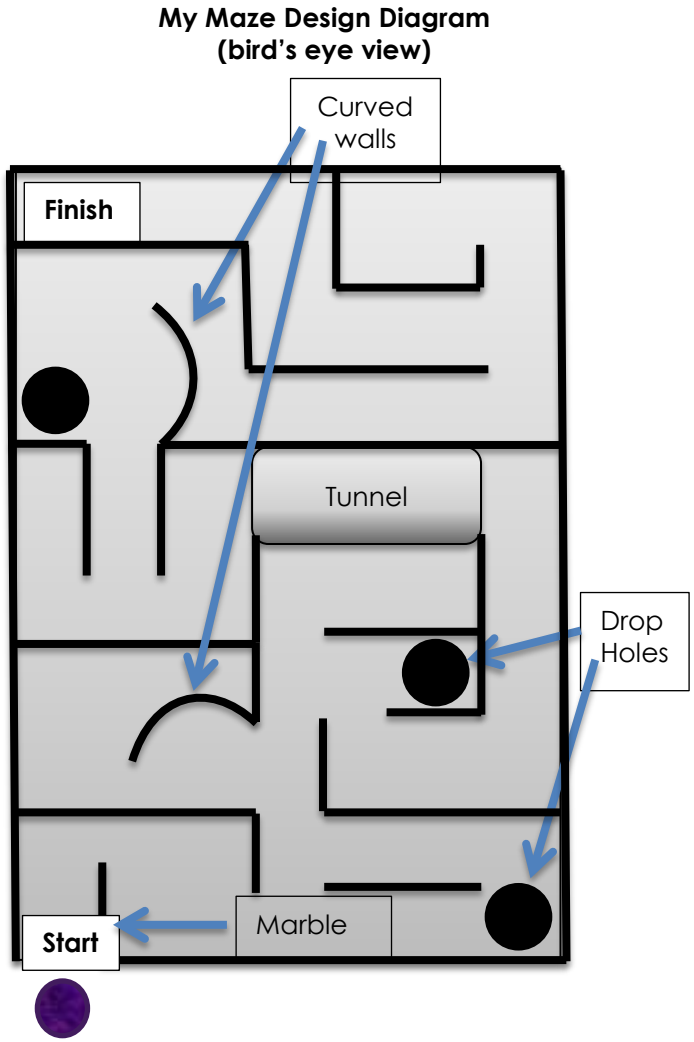
Students will draw a diagram of their maze from a bird's eye view.

Example:

Remind the student they need to:

- Use the template
- Label the parts
- Include a start and a finish

Students may need assistance with cutting materials and holes. The holes do not have to be round and can be square in shape. A reminder to use scissors safely.



Build:
Have students use their design plans and the materials they have chosen to build their maze.

Have students take photos or video as they build as these may be used in Day 5 when they will be sharing the steps to their build and design.

Test and Evaluate:
Once the maze is built and the student is happy with their result, it is time to test it. Practise getting the marble from one end to the other. Once again they might like to take photos or video this as well for their upcoming work on Day 5. Compare their skills to others by timing their runs.

The students own evaluation of their maze is important to a redesign.
What problems does your maze have?
Answers will vary.

What can you do to fix the problems?
Answers will vary.

What alterations will you make and why?
Answers will vary.

Redesign:
If necessary the design can be altered at this stage.

Share:
You will share your design and toy on Day 5.

Visit this design challenge just for fun:

http://invention.si.edu/tinker-ball
or
http://engineering-games.net/games/gravity.swf

Day 5 Share Your Toy Design

Today students will be creating a multimedia presentation of their marble maze. Most importantly, they will need to present the steps of design technology.

5.1 Prepare for your presentation

Gather together the materials used, the design diagram and photos or film taken and the finished marble maze.

In the presentation:

- students will need to describe their maze,
- the materials they choose and why (think about properties)
- the process of designing the toy
- explain the steps they took from beginning to end

Include these headings in the presentation:
Identify the challenge,
Brainstorm,
Design,
Build,
Test and Evaluate,
Redesign
Share

Student presentations need to be multimodal which means it needs images (moving or still) and audio. They can choose how to present their work but will likely need suggestions and assistance with this. Encourage students to use their creativity. This might be an audio visual presentation with props, a PowerPoint presentation with visuals and audio or they might like to use another software program application which has these features.

To start, brainstorm some ideas with your student about what programs they could use. They should map out the presentation using the steps to design technology and practise what they will say and then put it all together with images.

Assessment Pointers Rubric

http://k10outline.scsa.wa.edu.au/media/documents/judgingstandards/year-4/science/assessment-pointers/SCI_Year_04_Judging_Standards_Assessment_pointers_Web-version.pdf

Science Understandings / Chemical:

A Excellent Achievement	B High Achievement	C Satisfactory Achievement	D Limited Achievement	E Very Low Achievement
Describes physical properties of natural and processed materials and justifies how these properties influence the use and suitability of materials.	Describes physical properties of natural and processed materials and explains how these properties influence their use.	Describes physical properties of natural and processed materials and justifies how these properties influence the use and suitability of materials.	Identifies some simple ways that the physical properties or materials influence their everyday use.	Identifies a small number of familiar natural and/or processed materials. Links them to physical properties or uses that are mostly incorrect or inappropriate.
Communicates and assesses ideas for useful materials to suit a purpose. Justifies ideas with explanations and labelled diagrams.	Compares ideas for useful materials to suit a purpose, with short explanations or labelled diagrams.	Relates ideas for useful materials to suit a purpose, using labelled diagrams.	Partially explains ideas about useful materials to suit a purpose, using unlabelled diagrams.	Suggests incorrect or inappropriate materials to suit a purpose. Does not use diagrams to help explain ideas or leaves diagrams incomplete.

Science as Human Endeavour:

A Excellent Achievement	B High Achievement	C SatisfactoryAchievement	D Limited Achievement	E Very Low Achievement
Applies scientific understanding when forming predictions and comparing patterns and relationships.	Uses science understanding when forming predictions and identifying patterns and relationships,	Uses science understanding to make straightforward predictions appropriate to the task.	Uses limited science understanding to make simple predictions related to a task.	When predicting, shows misconceptions in terms of science understandings.
Describes how patterns or relationships can help formulate new questions or predictions or plans for the future.	Describes a pattern or relationship determined by scientists to answer a prediction or question,	Outlines ways to determine patterns or relationships to answer predictions or questions.	Lists examples of questions and predictions that have been tested by scientists.	States that answering a prediction is useful for scientific work.

Communication:

A Excellent Achievement	B High Achievement	C SatisfactoryAchievement	D Limited Achievement	E Very Low Achievement
Clearly communicates ideas, information and results using a range of complex methods correctly, e.g. Venn diagrams, headings and subheadings, labelled diagrams.	Clearly communicates ideas, information and results using a range of methods, e.g. Venn diagrams, labelled diagrams and headings.	Communicates ideas, information and results using a few straightforward methods, e.g. simple diagrams, dot points.	Communicates ideas and results using one or two simple methods, e.g. an unlabelled diagram.	Communicates ideas and results in an unclear or disorganised manner.
Uses appropriate scientific terms directly related to the task.	Uses familiar scientific terms related to the task.	Uses everyday language and some familiar scientific terms.	Uses everyday language and occasional simple scientific terms.	Uses everyday language.

Science Inquiry:

A Excellent Achievement	B High Achievement	C Satisfactory Achievement	D Limited Achievement	E Very Low Achievement
Poses investigation questions related to familiar contexts.	Follows a given model to pose a question to investigate.	With guidance and a given model, poses an investigation question related to a familiar context.	Poses an investigation question using a provided structure, e.g. sentence starters.	Using a provided structure, poses an unsuitable or unclear investigation question.
Makes a plausible prediction about what might happen based on prior knowledge.	Predicts what might happen based on prior experience in a familiar context.	With guidance, makes a prediction based on prior experience in a familiar context.	With guidance, makes a prediction loosely related to the investigation.	With guidance, makes a prediction unrelated to the investigation, or copies a given prediction.
Plans for the investigation by listing materials required and providing clear, correctlysequenced instructions and a labelled diagram of the set-up.	Plans for the investigation by listing materials required and key steps to be taken. Includes a labelled diagram.	With guidance plans for the investigation by listing materials required and providing key steps and a simple diagram with some labels.	Plans for the investigation, omitting some materials or steps. Provides an incomplete diagram or a picture.	Completes a brief plan for the investigation, omitting important steps or materials and/or including procedural errors.
Identifies safety rules and possible risks.	Identifies safety rules.	With guidance, identifies safety rules.	Requires support to identify safety rules for using equipment	Does not identify safety rules. Requires monitoring to use equipment safely.
Constructs a table or completes a provided table to accurately record observations and results, correctly using familiar units.	Constructs a simple table or completes a provided table to record observations and results, using familiar units, e.g. centimetres.	Records observations and results within a provided table or graphic organiser	Partially or inaccurately records observations and results within a provided table or graphic organiser.	Records observations and results within a provided table or graphic organiser, but with a number of omissions and/or errors.
Creates a simple column graph, including a title, labels for axis and scale.	Completes a template of a simple graph including a title, labels for axis and scale.	Follows a given template to construct a column graph to correctly organise data.	Partially completes a provided column graph, with incomplete or incorrectly-represented data.	A provided graph template is incomplete and disorganised.
Identifies whether or not the original prediction was correct and provides an explanation of results based on observations using scientific concepts.	Identifies whether or not the original prediction was correct with direct reference to observations and results, and using scientific concepts.	Identifies whether or not the original prediction was correct and provides a simple explanation based on observations and results.	Identifies whether or not the original prediction was correct and provides reasons that do not reflect the recorded results, e.g. based on prior experience or expectations.	Does not identify whether the original prediction was correct.
Identifies problems experienced in the investigation and makes specific, appropriate suggestions to improve fairness	Identifies problems experienced in the investigation and provides plausible suggestions to improve fairness.	Identifies any problems with the investigation and reflects on ways to improve fairness.	With guidance, makes a simple or general suggestion on how to improve fairness.	Makes a limited or irrelevant suggestion for how to improve the investigation.

Design and Technology

Note: There was no SCSA Judging standard available at the time this unit of work was written.
The following was taken from *Scope and Sequence* P-6
http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/technologies/design-and-technologies2/technologies-overview/Technologies_P-10_Scope-and-Sequence_March_2016.PDF

In Year 4, students will have opportunities to create designed solutions in at least one of the technologies contexts below (Food and fibre production includes Food specialisations in Year 4)

Knowledge and Undertsanding

Engineering principles and systems:
Forces, and the properties of materials, affect the behaviour of a product or system.
Investigate how forces and the properties of materials affect the behaviour of a product or system (ACTDEK011)

- examining models to identify how forces and materials are used in the design of a toy
- exploring through play how movement can be initiated by combining materials and using forces, for example releasing a wound rubber band to propel a model boat
- conducting investigations to understand the characteristics and properties of materials and forces that may affect the behaviour and performance of a product or system, for example woomera design
- experimenting with available local materials, tools and equipment to solve problems requiring forces including identifying inputs (what goes in to the system), processes (what happens within the system) and outputs (what comes out of the system), for example designing and testing a container or parachute that will keep an egg intact when dropped from a height

Materials and techonolgies specialisation:
Suitability and safe practice when using materials, systems and components for a range of purposes
Select and use materials, components, tools and equipment using safe work practices to make designed solutions (ACTDEP016)

- using appropriate technologies terms to confidently describe and share with others procedures and techniques for making, for example cutting and joining materials
- exploring ways of joining, connecting and assembling components that ensure success, and the impact digital technologies have had on these processes
- using tools and equipment accurately when measuring, marking and cutting; and explaining the importance of accuracy when designing and making, for example creating a template, measuring ingredients in a recipe, sowing seeds
- selecting and using materials, components, tools, equipment and processes with consideration of the environmental impact at each stage of the production process
- demonstrating safe, responsible and cooperative work practices when making designed solutions

Processes and Production Skills

Plan a sequence of production steps when making designed solutions individually (ACTDEP018)

Investigating and defining:
Define a sequence of steps to design a solution for a given task.

Designing:
Develop and communicate design ideas and decisions using annotated drawings and appropriate technical terms.

Producing and implementing:
Select, and safely use appropriate components and equipment to make solutions.

Evaluating:
Use criteria to evaluate and justify simple design processes and solutions.

Generate, develop, and communicate design ideas and decisions using appropriate technical terms and graphical representation techniques (ACTDEP015)

- evaluating, revising and selecting design ideas, based on criteria for success and including consideration of ethics, social values and sustainability
- evaluating the functional and aesthetic qualities of a designed solution
- reflecting on the sustainability implications of selected designed solutions
- comparing the amount of waste that would be produced from different design and development options and the potential for recycling waste
- reflecting on designed solutions to critique and assess suitability, sustainability and enterprise opportunities and determine how well they meet success criteria

Year 4: Forces

Overview

Western Australian Curriculum

Year 4 Science

Content strands	
Science Understanding	
Science as a Human Endeavour	
Science Inquiry Skills	

Content Descriptions	
Science Understanding	
Biological Science	
Living things have life cycles (ACSSU072)	
Living things depend on each other and the environment to survive (ACSSU073)	
Chemical Science	
Natural and processed materials have a range of physical properties that can influence their use (ACSSU074)	
Earth and Space Sciences	
Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)	
Physical Sciences	
Forces can be exerted by one object on another through direct contact or from a distance (ACSSU076)	
Science as a Human Endeavour	
Nature and Development of Science	
Science involves making predictions and describing patterns and relationships (ACSHE061)	

Use and Influence of Science	
Science knowledge helps people to understand the effect of their actions (ACSHE062)	
Science Inquiry Skills	
Questioning and Predicting	
With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS064)	
Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS066)	
Planning and Conducting	
With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS065)	
Processing and Analysing Data and Information	
Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS068)	
Compare results with predictions, suggesting possible reasons for findings (ACSIS216)	
Evaluating	
Reflect on investigations, including whether a test was fair or not (ACSIS069)	
Communicating	
Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS071)	

Year 4 Design and Technology

Content strands	
Technology and Society	
Technologies Contexts	
Technologies Contexts	

Content Descriptions	
Technologies and society	
Role of people in design and technologies occupations (ACTDEK010)	
Ways products, services and environments are designed to meet community needs, including consideration of sustainability (ACTDEK010)	
Technologies contexts	
Engineering principles and systems	
Forces, and the properties of materials, affect the behaviour of a product or system (ACTDEK011)	
Food and fibre production	
Types of technologies used in food and fibre production or processing, including how they are used to help meet consumer needs (ACTDEK012)	
Materials and technologies specialisations	
Suitability and safe practice when using materials, systems and components for a range of purposes (ACTDEK013)	
Creating solutions by:	
Investigating and defining	
Define a sequence of steps to design a solution for a given task (WATPPS21)	
Identify and choose the appropriate resources from a given set (WATPPS22)	

Designing	
Develop and communicate design ideas and decisions using annotated drawings and appropriate technical terms (WATPPS23)	
Producing and implementing	
Select, and safely use, appropriate components and equipment to make solutions (WATPPS24)	
Evaluating	
Use criteria to evaluate and justify simple design processes and solutions (WATPPS25)	
Collaborating and managing	
Work independently, or collaboratively when required, to plan, safely create and communicate ideas and information for solutions (WATPPS26)	

General Capabilities and Cross Curriculum Priorities

General capabilities	
Literacy	
Numeracy	
Information and communication technology (ICT) capability	
Critical and creative thinking	
Personal and social capability	
Ethical understanding	
Intercultural understanding	

Department of
Education

Year 4

Science

Properties of Materials