# Science

Year 9
Satisfactory

## WORK SAMPLE PORTFOLIO

Annotated work sample portfolios are provided to support implementation of the Foundation – Year 10 Australian Curriculum.

Each portfolio is an example of evidence of student learning in relation to the achievement standard. Three portfolios are available for each achievement standard, illustrating satisfactory, above satisfactory and below satisfactory student achievement. The set of portfolios assists teachers to make on-balance judgements about the quality of their students' achievement.

Each portfolio comprises a collection of students' work drawn from a range of assessment tasks. There is no pre-determined number of student work samples in a portfolio, nor are they sequenced in any particular order. Each work sample in the portfolio may vary in terms of how much student time was involved in undertaking the task or the degree of support provided by the teacher. The portfolios comprise authentic samples of student work and may contain errors such as spelling mistakes and other inaccuracies. Opinions expressed in student work are those of the student.

The portfolios have been selected, annotated and reviewed by classroom teachers and other curriculum experts. The portfolios will be reviewed over time.

*ACARA acknowledges the contribution of Australian teachers in the development of these work sample portfolios.*

## THIS PORTFOLIO: YEAR 9 SCIENCE

This portfolio provides the following student work samples:

| | |
|---|---|
| Sample 1 | Investigation report: Chemical change |
| Sample 2 | Research report: Chemical change |
| Sample 3 | Investigation report: Solar oven |
| Sample 4 | Investigation report: Refraction of light |
| Sample 5 | Written test: Changing Earth |
| Sample 6 | Worksheet: Ecosystems |
| Sample 7 | Venn diagram: Control and regulation |
| Sample 8 | Research report: Bionic eye |
| Sample 9 | Digital presentation: Plate tectonics |

In this portfolio, the student explains chemical processes with reference to atoms and energy transfers (WS1, WS2) and describes examples of photosynthesis and combustion as important chemical reactions (WS2). The student applies the wave model of energy transfer to explain phenomena (WS3, WS4). The student explains some global features in terms of geological processes and timescales (WS5, WS9) and provides a simple analysis of how biological systems function and respond to external changes with reference to interdependencies (WS6, WS7). The student explains how technological factors have influenced scientific developments (WS5) and predicts how future applications of technologies might affect people's lives (WS8).

# Science

## Year 9

Satisfactory

The student demonstrates the capacity to design questions that could be investigated using a range of inquiry skills and methods, including the control and accurate measurement of variables and systematic collection of data (WS1, WS3). The student analyses trends in data (WS1, WS3, WS4, WS9), identifies relationships between variables and reveals inconsistencies in results, suggesting specific improvements to improve the quality of the evidence (WS1, WS3, WS4). The student uses appropriate language and representations to communicate findings and ideas (WS1, WS2, WS3, WS4, WS5, WS6, WS7, WS8, WS9) and designs text to communicate to specific audiences (WS1, WS2, WS9).

# Investigation report: Chemical change

## Year 9 Science achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.*
>
> *Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.*

## Summary of task

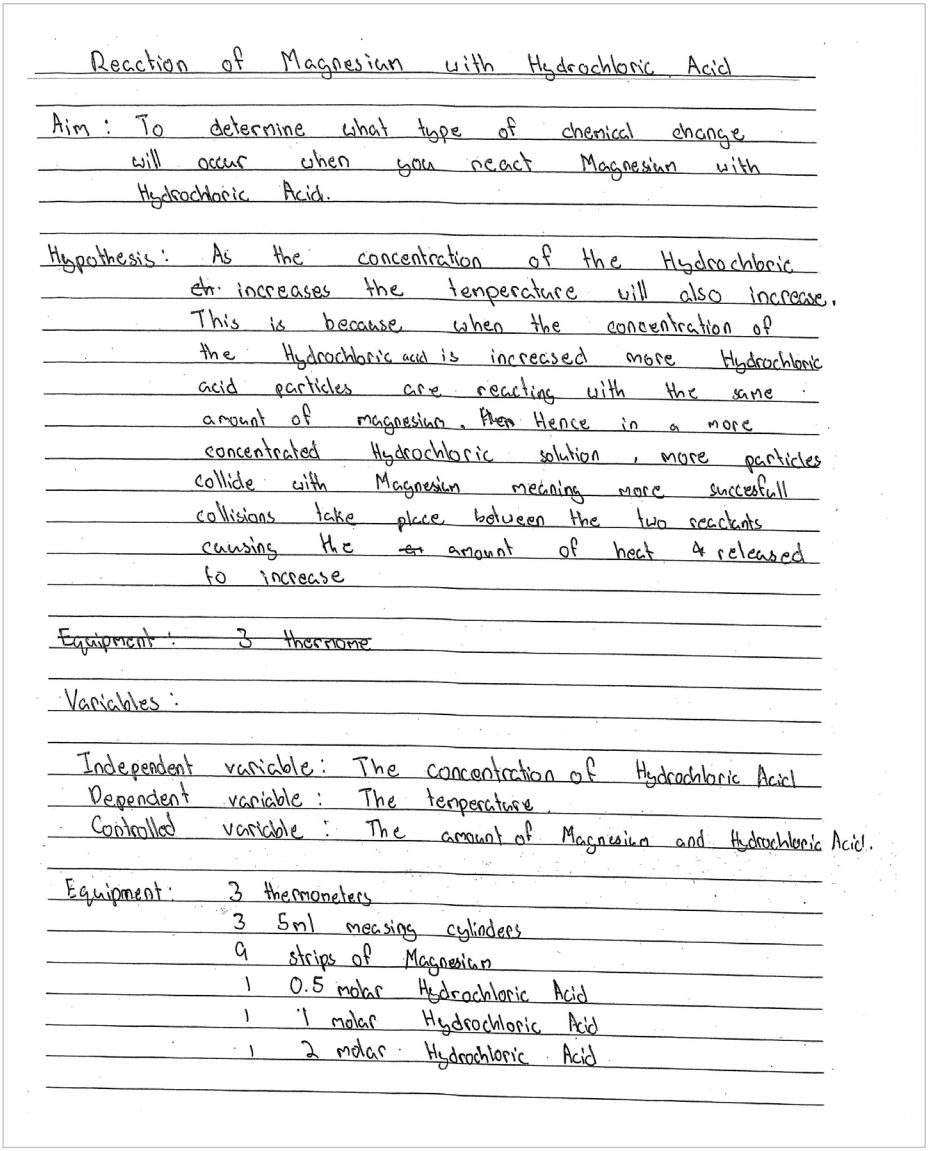
Students had investigated a range of chemical reactions and explored the use of the atomic model to explain and predict chemical processes. Students had been introduced to the classification of endothermic and exothermic reactions and some everyday applications of these.

In this task students were asked to work in groups to investigate the energy changes involved in chemical reactions. A range of chemicals and equipment was provided. Students were required to develop a question, design an appropriate method and select ways to present their data in a scientific report appropriate for an audience of their peers.

**Students were advised of the following safety precautions when handling hydrochloric acid: be careful to avoid skin contact as well as clothing contact; wear safety goggles at all times while handling the hydrochloric acid and report any spills immediately.**

The practical component of this task was undertaken in three lessons. In the fourth lesson, students completed their written investigation report individually under test conditions. A set of guidelines for writing a practical report was provided.

# Investigation report: Chemical change



Reaction of Magnesium with Hydrochloric Acid

Aim: To determine what type of chemical change will occur when you react Magnesium with Hydrochloric Acid.

Hypothesis: As the concentration of the Hydrochloric ~~ac~~ increases the temperature will also increase. This is because when the concentration of the Hydrochloric acid is increased more Hydrochloric acid particles are reacting with the same amount of magnesium. ~~Then~~ Hence in a more concentrated Hydrochloric solution, more particles collide with Magnesium meaning more successfull collisions take place between the two reactants causing the ~~or~~ amount of heat & released to increase

~~Equipment: 3 thermome~~

Variables:

Independent variable: The concentration of Hydrochloric Acid
Dependent variable: The temperature
Controlled variable: The amount of Magnesium and Hydrochloric Acid.

Equipment: 3 thermometers
3 5ml measing cylinders
9 strips of Magnesium
1 0.5 molar Hydrochloric Acid
1 1 molar Hydrochloric Acid
1 2 molar Hydrochloric Acid

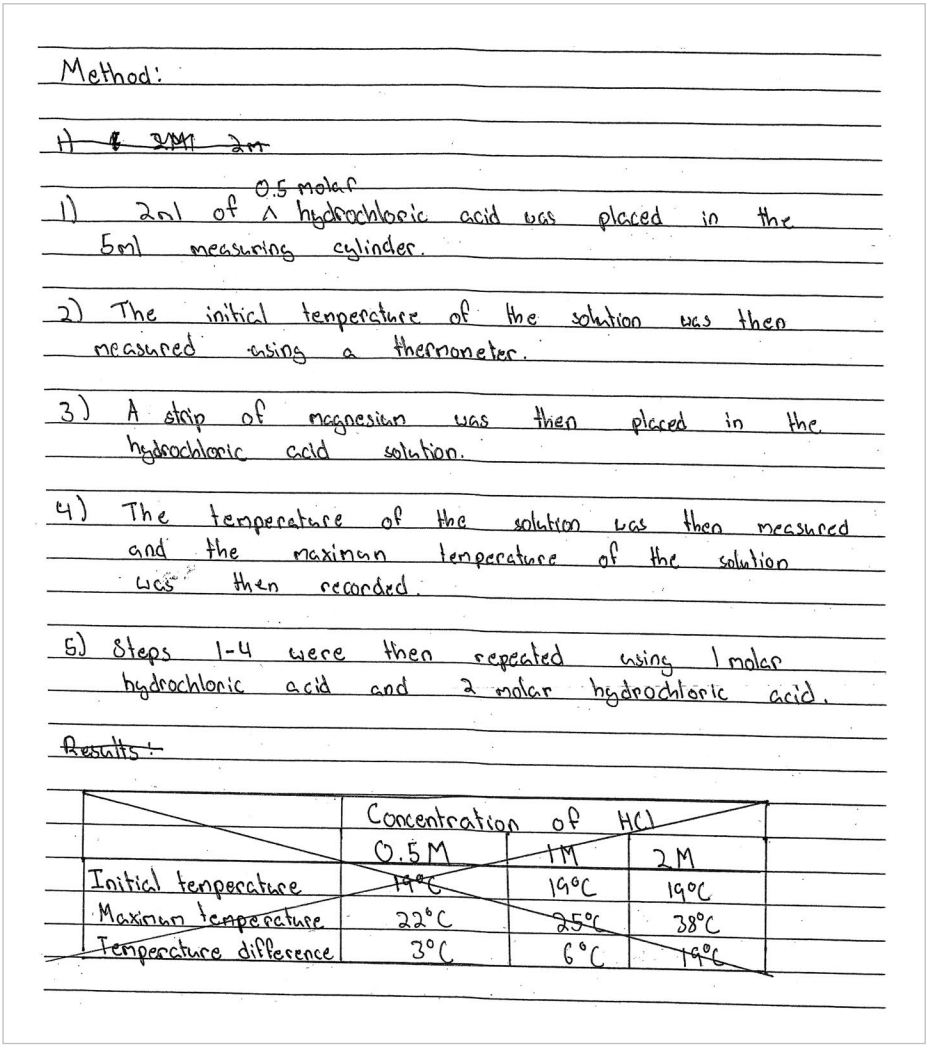
## Annotations

*Develops an aim that reflects a question to be investigated.*

*Suggests a plausible hypothesis that partially explains the relationship between heat production and increased concentration of reactants.*

*Identifies independent, dependent and controlled variables.*

# Investigation report: Chemical change



Method:

~~1) 2ml of 1M hydrochloric acid was placed in the 5ml measuring cylinder.~~

1) 2ml of 0.5 molar hydrochloric acid was placed in the 5ml measuring cylinder.

2) The initial temperature of the solution was then measured using a thermometer.

3) A strip of magnesium was then placed in the hydrochloric acid solution.

4) The temperature of the solution was then measured and the maximum temperature of the solution was then recorded.

5) Steps 1-4 were then repeated using 1 molar hydrochloric acid and 2 molar hydrochloric acid.

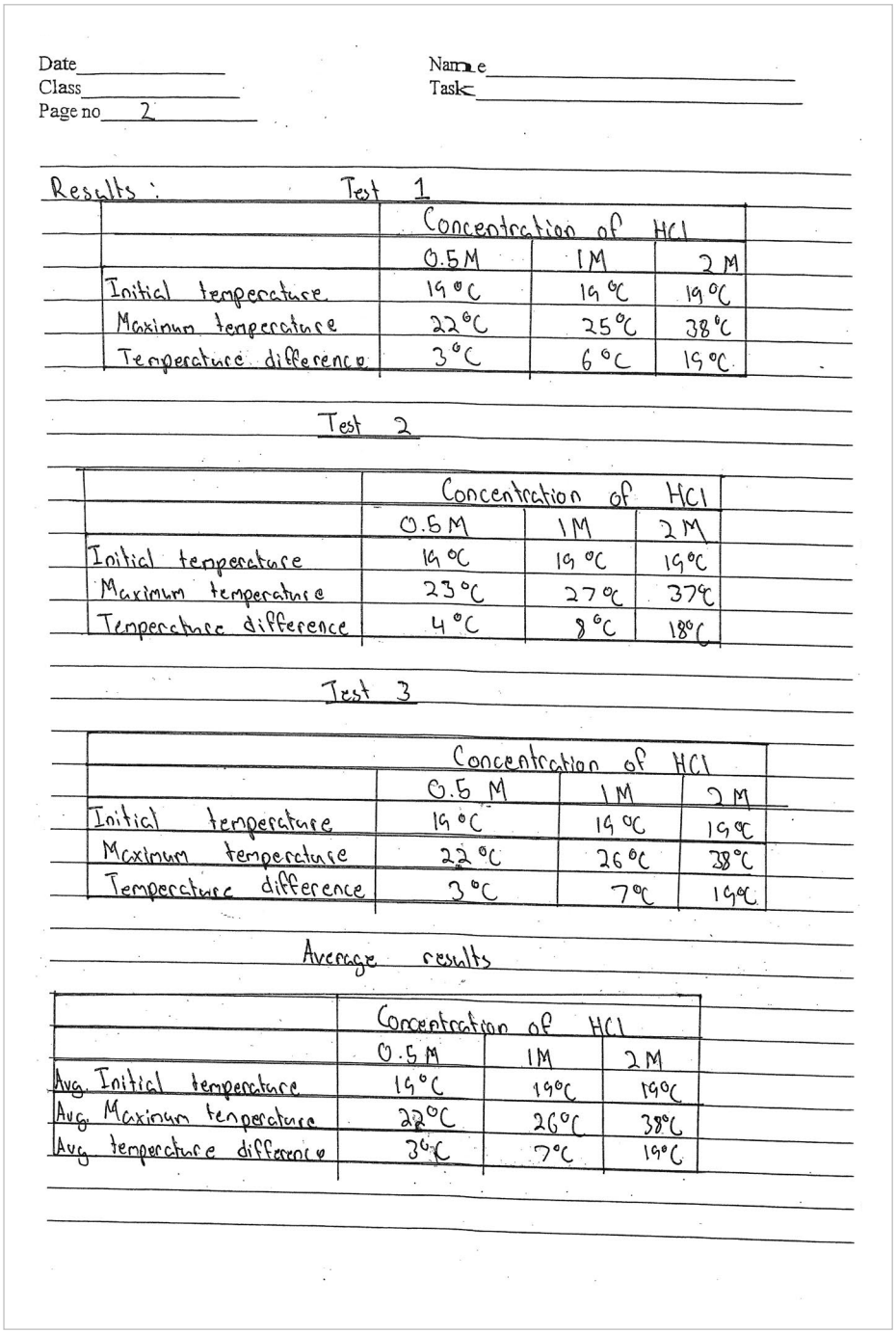
~~Results:~~

| | Concentration of HCl | | |
|---|---|---|---|
| | 0.5 M | 1M | 2M |
| Initial temperature | ~~19°C~~ | 19°C | 19°C |
| Maximum temperature | 22°C | ~~25°C~~ | 38°C |
| Temperature difference | 3°C | 6°C | ~~19°C~~ |

## Annotations

*Designs a logical method to test the hypothesis, including measurement of variables and systematic collection of data.*

# Investigation report: Chemical change



Date _____ Name _____
Class _____ Task _____
Page no 2

Results: Test 1

| | Concentration of HCl | | |
|---|---|---|---|
| | 0.5M | 1M | 2M |
| Initial temperature | 19°C | 19°C | 19°C |
| Maximum temperature | 22°C | 25°C | 38°C |
| Temperature difference | 3°C | 6°C | 19°C |

Test 2

| | Concentration of HCl | | |
|---|---|---|---|
| | 0.5M | 1M | 2M |
| Initial temperature | 19°C | 19°C | 19°C |
| Maximum temperature | 23°C | 27°C | 37°C |
| Temperature difference | 4°C | 8°C | 18°C |

Test 3

| | Concentration of HCl | | |
|---|---|---|---|
| | 0.5 M | 1M | 2M |
| Initial temperature | 19°C | 19°C | 19°C |
| Maximum temperature | 22°C | 26°C | 38°C |
| Temperature difference | 3°C | 7°C | 19°C |

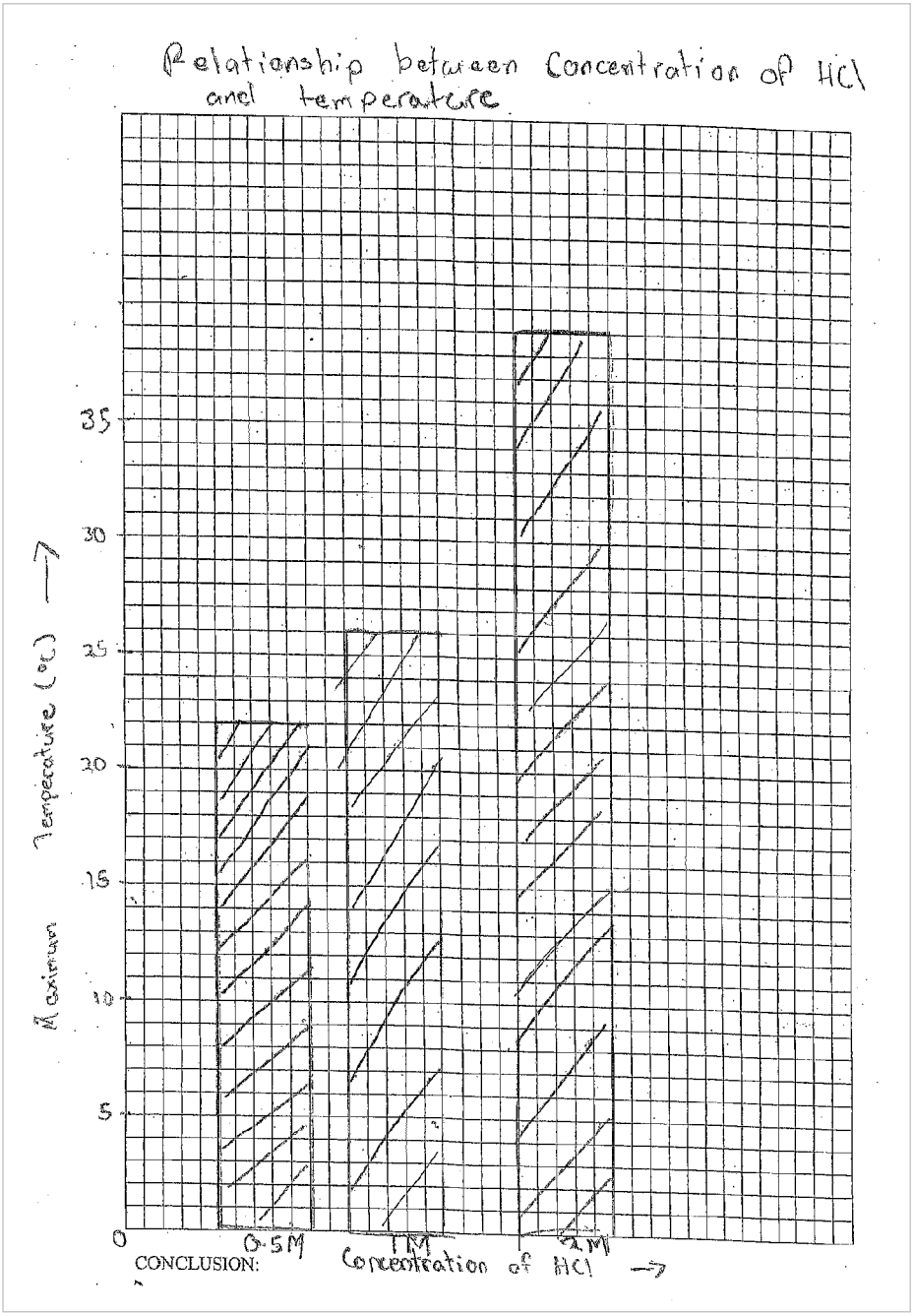
Average results

| | Concentration of HCl | | |
|---|---|---|---|
| | 0.5M | 1M | 2M |
| Avg. Initial temperature | 19°C | 19°C | 19°C |
| Avg. Maximum temperature | 22°C | 26°C | 38°C |
| Avg. temperature difference | 3°C | 7°C | 19°C |

## Annotations

*Designs tables to record concentration and temperature data.*

# Investigation report: Chemical change

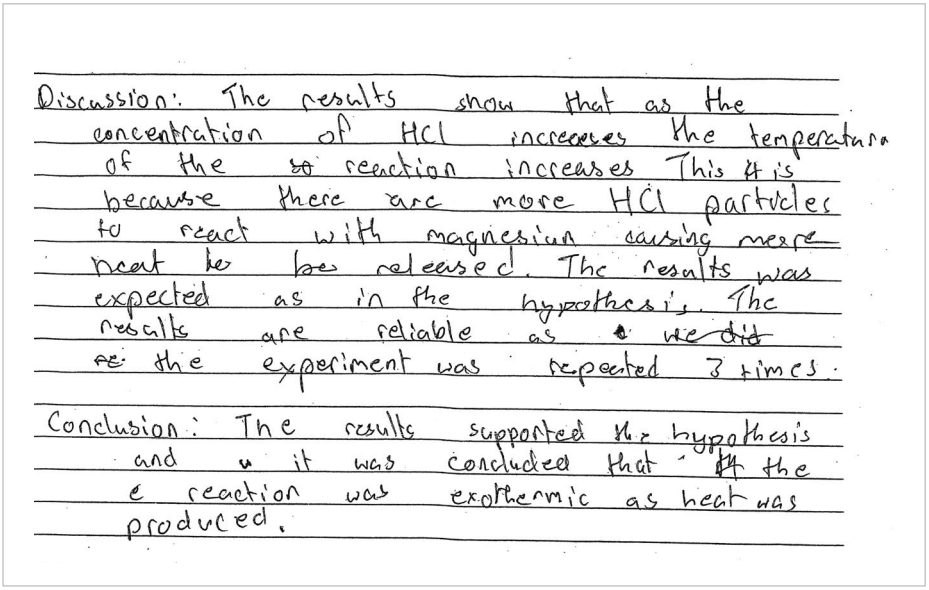



## Annotations

*Selects average maximum temperature data to use as evidence.*

*Uses some graphing conventions when constructing a bar graph to represent the relationship between concentration and temperature.*

# Investigation report: Chemical change



Discussion: The results show that as the concentration of HCl increases the temperature of the ~~so~~ reaction increases This it is because there are more HCl particles to react with magnesium causing more heat to be released. The results was expected as in the hypothesis. The results are reliable as ~~we did~~ ~~as~~ the experiment was repeated 3 times.

Conclusion: The results supported the hypothesis and it was concluded that ~~the~~ the reaction was exothermic as heat was produced.

## Annotations

*Analyses evidence to identify the relationship between concentration and temperature change and provides an explanation with reference to atoms and energy transfers.*

*Justifies the reliability of the data with reference to the number of trials.*

*Uses data to justify conclusions and explains the nature of an exothermic reaction.*

## Annotations (Overview)

*The student uses language and representations to communicate science ideas to a specific audience.*

# Research report: Chemical change

## Year 9 Science achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.*
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> *Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.*

## Summary of task

Students had been introduced to the atomic model and the ways in which this could be used to explain chemical structures and processes. They had investigated a variety of chemical reactions and classified them as endothermic or exothermic, linking this to energy transfers and transformations.

In this task, students were asked to research how chemical changes impact on society and develop a report suitable for a general public audience. Students were given two weeks to complete the task outside of class time.

# Research report: Chemical change

## Introduction

The difference between a chemical change and a physical change is that a physical change is the change of one substance's state, for instance the evaporation of water to create steam. Such a change is easily reversed, because the substance's chemical composition, or molecular make up, remains the same (in this case $H_2O$). A chemical change however is not easily reversed, due to the fact that one or more substances, or reactants, react to form a product (or products), therefore changing the chemical composition of the substance, for instance the decomposition of $H_2O$ to make $H_2$ and O. A chemical change however can be indicated by a change of state, but the change of state of two or more substances, unlike the physical change, which involves only one.

Chemical changes occur in two types, natural and man-made. Natural chemical changes occur in nature without any human influence. Examples of natural chemical change are photosynthesis, which is water and carbon dioxide which react to create glucose and oxygen with the help of the catalyst sunlight, oxidation, and digestion, which is the process of food being digested to form nutrients and waste products. Man-made chemical reactions are reactions that would not occur without human influence. Examples include combustion, and although it occurs naturally, it has been utilised by people for warfare, energy production, and even entertainment, nuclear, and batteries, both of which are used as a source of energy.

Chemical reactions such as the examples stated above are used by people in everyday life in order to address common problems. For example, combustion is used every day by people across the world. Combustion being an exothermic reaction, gives out energy, thus producing heat. Because it produces heat it is utilised by people in order to cook and produce heat to keep warm. This addresses problems such as hypothermia, a serious condition which occurs when in the cold unprotected for long periods of time, and is potentially life threatening. It addresses hypothermia because the heat produced warms the blood and therefore the body. It is a proven method of countering hypothermia and therefore is effective. Another application of combustion is the fact that many food sources have to be cooked in order for them to be edible or of nutritional value and the heat once again provides a way to do so.

The chemical change combustion has benefits and disadvantages in its natural occurrence. When combustion occurs naturally, its advantages are that fire encourages germination in many plant species, and it produces wood ash, and when wood burns, nitrogen and sulfur

## Annotations

*Describes chemical changes as involving changes to the chemical composition of substances.*

*Describes examples of chemical reactions and indicates why they are important.*

*Explains energy transfer in exothermic chemical reactions.*

# Research report: Chemical change

are lost as gases, and calcium, potassium, magnesium and trace element compounds remain. The remaining carbonates and oxides are valuable liming agents, raising pH, thus neutralizing acid soils. Soil that is acidic and low in potassium will benefit from wood ash.[1] These two results of combustion are advantageous because they help to improve biodiversity, improve and strengthen many of the next plants to grow there, and therefore improve future ecosystems that will form there, due to the germination of the plants and the benefits of the nutrients released when wood burns. If combustion in nature however is not controlled it can develop into a bushfire, a form of natural disaster, which is destructive to ecosystems and biodiversity and endanger the lives of people and their properties, because they are very hard to stop and burn all in their paths. Such losses are very disadvantageous because when plants are burnt and killed it also reduces the amount of oxygen produced, which can have negative long term effects because people and other living organisms need oxygen in order to survive, and if not enough oxygen is being produced through photosynthesis, then life on earth will become extinct. Another disadvantage is that severe fires destroy large areas of land, which results in the destruction of many habitats and ecosystems, as well as losing biodiversity. Man-made combustion also has its advantages and disadvantages. One of the major advantages of man-made combustion is that after the invention of the steam engine by Dennis Papin and others during the 18th century. The steam engine used combustion to heat water, turning it to steam, which powered the pistons which in turn powered the machinery. The steam engine played a major role in the industrial revolution, which led to many of the technologies essential to life today, including electricity, an essential to modern day lifestyles in the developed world. The technologies that have resulted from the exploitation of combustion in the steam engine has also contributed to the development of transport, which in this modern era is also essential to the human race. However, the exploitation of combustion by people has had many negative effects as well. In order for the steam engine to work, it needs fire to boil the water, and for the fire to be continuous it needs fuel. When fuel burns it produces smoke, which is a form of pollution. Unfortunately at the time the fact that it is a form of pollution was unknown, and the fuels used became more efficient to the machinery, but worse for the atmosphere. The pollution from machinery will have a detrimental long term effect on the Earth's climate, through global warming, which means that eventually,

[1]Howard, D. (n.d.). *Using fireplace ashes in your garden*. Retrieved May 19, 2012, from emmits burg: http://www.emmitsburg.net/gardens/articles/frederick/2004/ashes.htm

## Annotations

*Applies knowledge of chemical reactions and energy transfer to explain in detail the positive and negative social and environmental implications of combustion reactions.*

*Identifies the role of the steam engine in further scientific developments.*

# Research report: Chemical change

unless the use of the pollutants are ceased, the climatic conditions on Earth will be so severe that it will no longer be able to support life.

As stated before, combustion has both positive and negative implications on the environment. The positive implications are that when plants are burnt it encourages germination and the ashes left behind are effective fertilisers. This combination is beneficial because although the initial burning of the plants destroys many ecosystems, the seeds that will germinate and grow in their place will be stronger and healthier because of the ashes. This in turn will create stronger ecosystems and habitats ecosystems. The negative implications of combustion on the environment are that firstly the smoke produced b firstly the smoke produced by it is a form of pollutant, and in this modern era, combustion is one of the most widely used chemical reactions, meaning that the level of pollution is high. With so much pollution the Earth's atmosphere and climatic conditions are becoming worse, and because of this the Earth is likely to be no longer suitable for sustaining life, meaning a mass extinction. Although combustion has some environmentally positive implications, the benefits of them are minimal in comparison to the negative implications which are far more serious, and if not addressed will result in serious consequences.

## Annotations

## Annotations (Overview)

*The student uses appropriate language and representations to communicate findings and ideas to a specific audience.*

# Investigation report: Solar oven

## Year 9 Science achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.*
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## Summary of task

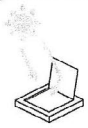
Students had completed a number of tasks to develop their science inquiry skills. They had been exploring sustainable energy use and simple technologies that could be used as alternatives to electric appliances.

Students were asked to research solar ovens and how they work. They were then required to design and build their own solar oven and test its performance. A template was provided which students used to document their procedure and findings. Students were required to explain trends and patterns in their data and to complete an evaluation of their investigation.

**Students were warned that handling the solar ovens when hot could cause burns, so protective clothing should be worn. They were provided with welder's gloves to protect their hands when taking temperature measurements.**

# Investigation report: Solar oven

**INVESTIGATION : MAKE A SOLAR OVEN**



NAME: _____ MARK _____

**AIM:**

**INVESTIGATE THE FACTOR(S) THAT CAN AFFECT HOW WELL A SOLAR OVEN PERFORMS.**

**WHAT TO DO:**

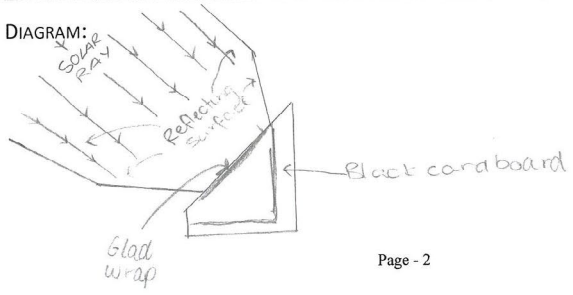
1) 'WHAT IS A SOLAR OVEN'? (RESEARCH ON THE INTERNET)

A solar oven or solar cooker is a device which uses sunlight as its energy source

2) WITH A DIAGRAM **EXPLAIN** HOW A SOLAR OVEN WORKS. (FIND EXAMPLES/EXPLANATION ON THE NET)

A solar oven works by turning light rays from the sun into heat. The light is reflected and directed to the centre of the oven. The centre needs to be a dark spot as the dark color will absorb the heat. The top of the oven is covered in glad wrap or clear glass/Plastic.

DIAGRAM:

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## Annotations

# Investigation report: Solar oven

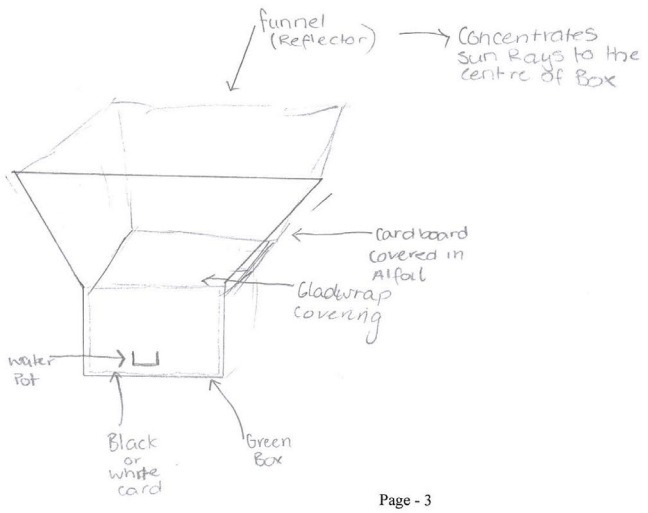
3) My Solar Oven!!

Follow these steps...

- Design a solar oven *that you can make* in 2 or 3 lessons.
- With a *labelled diagram (showing the materials used)*, explain the choice in these materials and how *your* solar oven works.
- Now build your oven and test it

Our solar oven works by reflecting the suns heat rays of the aluminium foil Reflectors and concentrating it into the centre of the green box where a small pot of water will be heated. We will make to solar ovens; one with a black interior and the other white they will both be positioned in the same amount of sunlight and after a period of time we will measure the temperature of the water. Our experiment is to test if the Solar oven will get hotter with a black or white interior.

Labelled Diagram:

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## Annotations

# Investigation report: Solar oven

**PLANNING AND REPORT WRITING SCAFFOLD**
**Science Investigations & Practicals**

**Student name** _____

**Task** **SOLAR OVEN INVESTIGATION** **Date** _____

Other members of your group _____

**INVESTIGATE:**

**HOW CAN I IMPROVE THE PERFORMANCE OF MY SOLAR OVEN?**

**Phase one: Planning**

What is the problem you are investigating?

If the amount of reflectors varies the heat of the solar oven.

What do you know about this topic from personal experience and from science?

Removing one panel won't make much of a difference, but as you remove more the temperature will continue to decrease as the sun won't be focused into the centre of the oven.

What variables may affect the phenomenon you are investigating?

- The amount of light/Sun
- Amount of panels
- Positioning of the oven
- Angle of the panels.

## Annotations

*Identifies a question to be investigated.*

# Investigation report: Solar oven

Which of the variables are you going to investigate as your independent variable (this is the variable you will change to see what effect it has on the dependent variable)?

The variable we are going to investigate as the independent variable is the amount of panels.

How will the independent variable be changed in the experiment?

We will test the oven then remove one panel and test again, repeating this process until only one reflecting panel remains.

What is the dependent variable (i.e. the variable that responds to changes in the independent variable)?

The dependent variable is the temperature of the water inside the oven.

How will you measure the dependent variable?

We will place a small pot of water inside the oven then place it in the sun for a period of time, then we will measure the temperature of the water. This will be done in each test.

What question are you Investigating?

**OR**

What hypothesis are you testing? State your hypothesis as a relationship between the independent and dependent variables.

Does the amount of reflecting panels affect the temperature of the solar oven.

Predict what you think will happen. Explain why.

I think that as we remove the panels the temperature of the oven will decrease because all of the suns/lights

## Annotations

*Identifies the independent variable and how it will be changed.*

*Describes the dependent variable and how it will be measured.*

# Investigation report: Solar oven

What variables are to be controlled (kept constant) to make it a fair test?

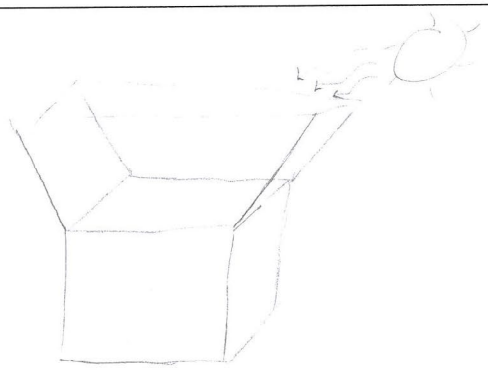
- The amount of light
- Amount of water
- Positioning of the oven
- Positioning of the water
- Angle of the panels
- Starting temperature of water

Describe your experimental set-up using a labelled diagram and explain how you will collect your data.

We will place our solar oven in the sun (or under the light) and put 100ml of water in a small cup into the oven. After 5 minutes we will use a thermometre to test the temperature of the water.

We will collect our data and record it in a table before placing the information recorded into a graph.

Diagram:



Are there any special safety precautions?

The light will get hot so you have to be careful not to touch the globe and burn yourself. Also if you look at the light for too long it may damage your sight.

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## Annotations

*Identifies a range of variables to be controlled in the investigation.*

*Partially describes a method which provides opportunities to control and measure variables.*

*Describes how safety issues have been considered.*

# Investigation report: Solar oven

**Phase two: Experimenting**

Carry out some preliminary trials. Were there any problems?

Not all sides were reflecting the light as the light box was to close but if it was further away it wouldn't heat the oven

How did you modify your experiment to fix the problems?

we removed 1 reflecting panel at a time to see if it made a difference to the temperature.

Collect and record the data you need to test your hypothesis. Draw your data table here.

*Title of table:* TEMPERATURE

| Panels | Trial 1 | Trial 2 | Trial 3 | Average |
|---|---|---|---|---|
| 4 | 18°C | 18°C | 19°C | 18.3°C |
| 3 | 17°C | 17°C | 18°C | 17.3°C |
| 2 | 17°C | 18°C | 18°C | 17.6°C |
| 1 | 16°C | 16°C | 17°C | 16.3°C |

How did you make sure your data were accurate?

We made sure our data we collected was accurate by conducting multiple trials, each under the same condition and removing out liers before finding our average temperature.

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## Annotations

*Trials method and identifies improvements.*

*Systematically collects and records data.*

*Improves reliability by conducting multiple trials; identifies that outliers should not constitute evidence.*

# Investigation report: Solar oven

**Phase three: Data analysis**

What is the **best** way to present your data? Is it appropriate to draw a graph? What type of graph is most suitable?

USE EXCEL TO GENERATE A GRAPH

- Remember to plot the *independent variable* on the horizontal axis.
- Remember that the title of the graph should mention both the independent and dependent variables.

PRINT YOUR GRAPH OUT AND ATTACH TO THIS DOCUMENT

Analyse your data. Are there any patterns or trends in your data? What is the relationship between the variables you have investigated? Is the hypothesis supported by the data?

As the surface area of reflecting panels increased so did the temperature apart from the second and third trials where the average temperature dropped slightly. Our hypothesis of "Does the amount of reflecting panels affect the temperature of the solar oven" was supported by our data because as we changed the amount of panels the temperature also changed.

Using science concepts explain the patterns, trends or relationships you have identified in your data. What is your conclusion?

When we took away panels the light had nothing to reflect off so the heat escaped and wasn't being concentrating. The temperature got neigher when we had 2 panels than when we had three as probably because the panel we took away wasn't reflecting any light.

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## Annotations

*Analyses data to identify the relationship between the number of reflectors and final average temperature of the water.*

# Investigation report: Solar oven

**Phase four: Evaluation**

What were the main sources of experimental error (sample size and selection, measurement error, poor control of variables)?

In our experiment we had poor control of variables because we couldn't go out side and use the sun as our heat source like we had planned. Instead we had to use a lightbox which had to be held very close to the oven meaning the panels weren't of much use.

How confident are you with your conclusions? How much uncertainty/error is associated with your data?

We are not very confident with our conclusions because when you first turn on the light it doesn't give off much heat but the longer you leave it the hotter it gets which means the first trials will be colder than the last.

How could the design of the experiment have been improved to reduce error?

We could have made our box smaller so that the heat was more concentrated on the area where the thermometre.

What have you learned about the topic of your investigation? Was the outcome different from your prediction? Explain.

Our prediction/hypothesis was that the more panels you have, the heigher the temperature in the oven will be and thats what happened. When we had 4 panels it got up to $18.\bar{3}$°c and 1 panel was only $16.\bar{3}$°c.

What have you learned about the methods of investigating in science?

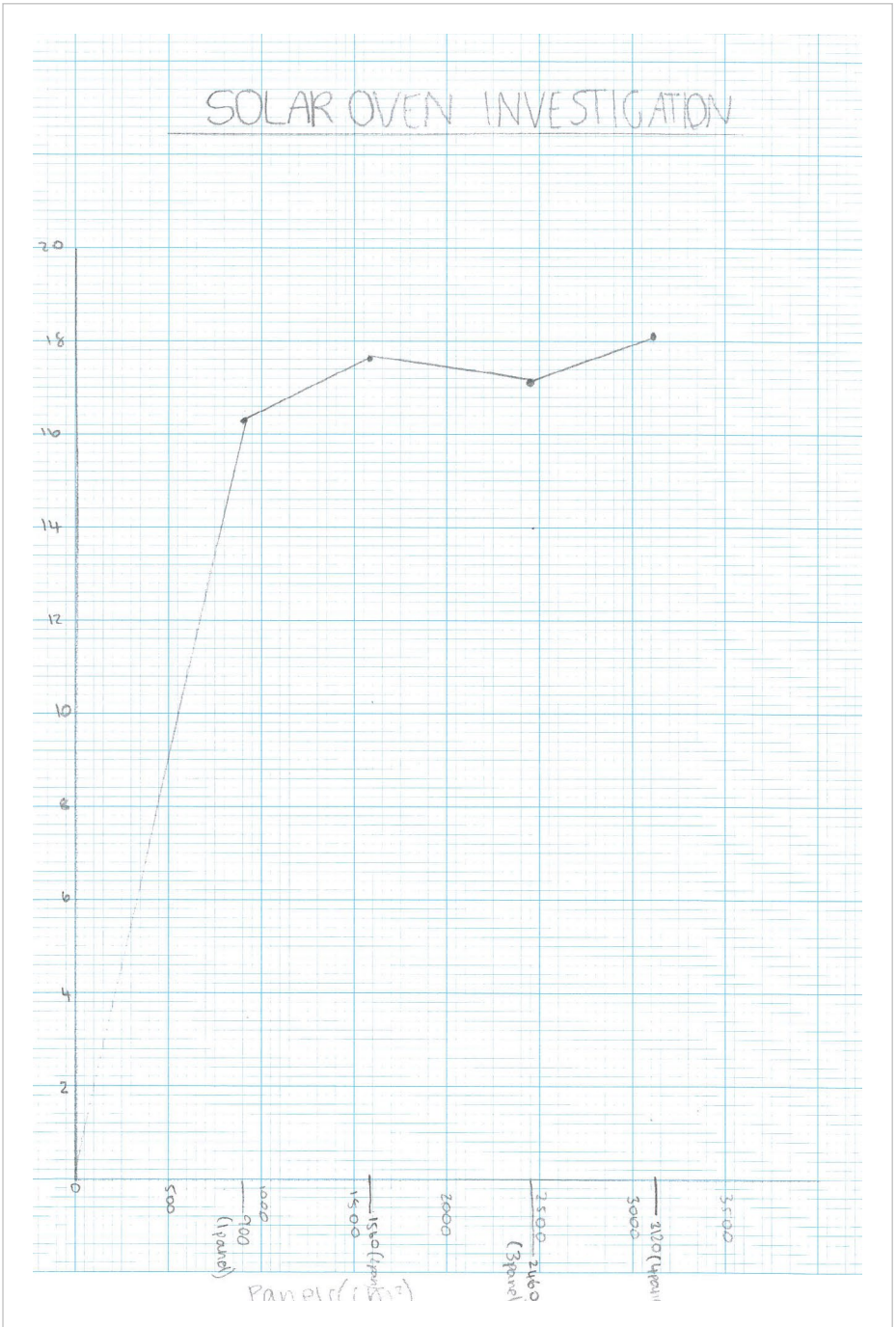
By conducting multiple trials you can remove any outliers and average it out. This makes it more of a fair test. Also you can make it a fair test by bringing the temperature back to the starting point before trialing again.

Page - 9

## Annotations

*Evaluates the method in detail to identify probable sources of error and suggests a feasible action to improve the quality of the data.*

# Investigation report: Solar oven




## Annotations

*Uses a graph to display findings.*

## Annotations (Overview)

*The student uses appropriate language and representations to communicate findings and ideas.*

# Investigation report: Refraction of light

## Year 9 Science achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

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> *Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.*

## Summary of task

Students had been introduced to the wave model of light, and investigated reflection, refraction and total internal reflection phenomena, including constructing representations to indicate the transfer of energy.

Students were asked to complete an investigation to collect quantitative data to support the law of refraction. They were required to relate their findings to their knowledge of light waves and energy transfer and connect them to everyday phenomena.

**Students were warned that the use of light boxes presented a low risk of electrocution and burns and they were required to follow appropriate procedures to ensure the light boxes were set up away from water sources and not handled when they became hot.**

Two 50-minute lessons were allocated to the investigation. Students completed the report independently outside of class time.

# Investigation report: Refraction of light

**Variables**

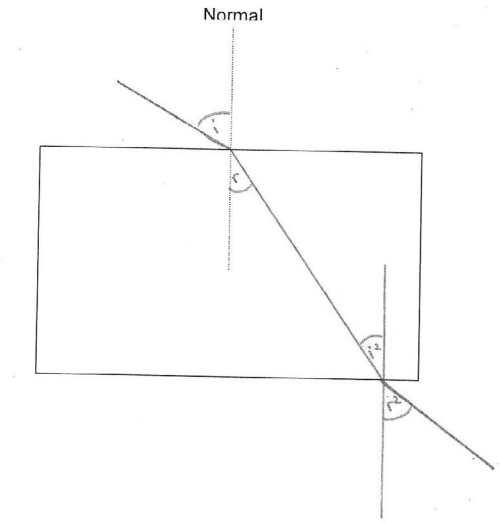
Independent: The independent variable is the ray of incidence,

Dependent: Dependent variable is angle of refraction and incidence

Controlled to ensure a fair test: the initial normal is always in the same spot, the rectangle (block) the same lightbox slit

**Results**

Diagram 1




## Annotations

*Identifies the independent, dependent and controlled variables in the investigation.*

*Represents the movement of light through a more dense medium.*

# Investigation report: Refraction of light

Table

| Test | | Trial 1 | Trial 2 | Trail 3 |
|---|---|---|---|---|
| Light entering glass from air | Angle of incidence $i$ | 58° | 34° | 67° |
| | Angle of refraction $r$ | 34° | 28° | 49° |
| Light entering air from glass | Angle of incidence $i_2$ | 34° | 27° | 48° |
| | Angle of refraction $r_2$ | 57° | 33° | 53° |

**Discussion**

Does the light bend towards or away from the normal as it enters the glass block?

The light bends towards the normal as it enters the glass block.

Which way does it bend as it leaves?

It bends away as it leaves.

Complete the following statement – As light travels from a less dense medium to a more dense medium it bends towards the normal, as it travels from a more dense medium to a ~~more~~ less dense one it bends away from the normal.

Did your findings reflect your hypothesis? Explain

The results didn't reflect the hypothesis, in the experiment the light bends towards the normal but in the hypothesis it says away.

What can you determine from your table of results? (What results were similar?)

The results show that the angle of incidence is very similar to the angle of refraction (2) and the angle of refraction is similar to the angle of incidence

## Annotations

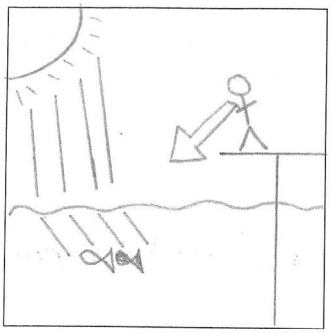
*Collates data in a provided table.*

*Describes the movement of light through a more dense medium with reference to the normal.*

*Analyses data to identify the relationship between angles of incidence and refraction.*

# Investigation report: Refraction of light

Explain in detail the effect refraction has on either spear fishing, the bending of a pencil in water, the twinkling of the stars or the variation in the size of the sun (midday compared to sunrise and sunset).



When spearfishing fishermen need to take in mind that the light coming from the water which is a more dense medium (water) to the less dense medium (air) it refracts away from the normal. This means that when the fishermen look at the fish in the water their actually looking at the refracted fish.

What errors occurred and explain how they affected your results.

An error that occured was in trial 3, the angle of refraction (2) wasn't a similar angle to the angle incidence which ment a human error had occured and either it wasn't drawn accurately or the block moved spots.

**Conclusion**

In conclusion, the aim was to investigate how a light beam refracts through a transparent block and to determine the law of refraction. The results shown that the angle of incidence is similar to the angle of refraction (2) and the angle of refraction is similar to the angle of incidence (2).

## Annotations

*Applies knowledge of the wave model of light to partially explain the apparent position of a fish when spearfishing.*

*Identifies possible sources of inconsistencies in results.*

## Annotations (Overview)

*The student uses appropriate language and representations to communicate findings and ideas.*

# Written test: Changing Earth

## Year 9 Science achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.*
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> *Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.*

## Summary of task

Students had completed a unit on plate tectonics and changes to Earth's crust. They had investigated the development of the theory of plate tectonics and the evidence that supports the theory. They had analysed a range of landforms and earthquake and volcanic events to identify the contributing plate movements.

Students were required to complete a unit test following completion of the unit. They had 90 minutes to complete the test in closed book test conditions. The work sample includes a selection of the test items.

# Written test: Changing Earth

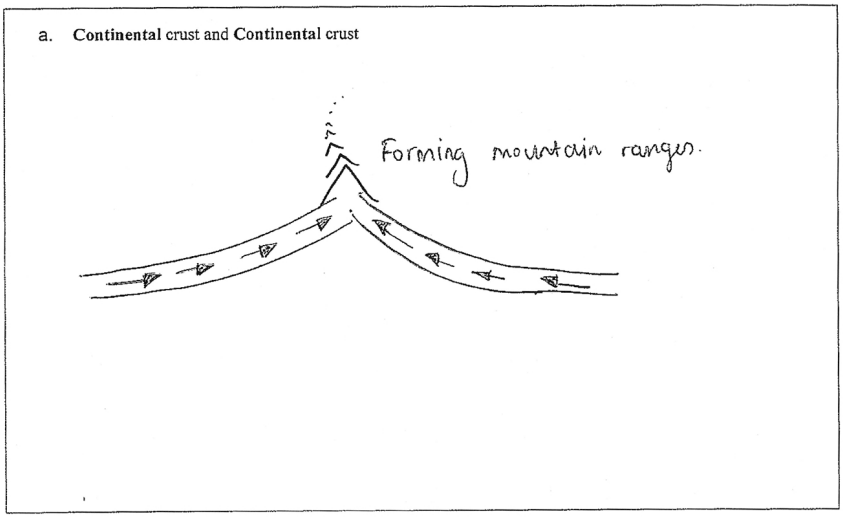
**PART 2 – MEDIUM DIFFICULTY QUESTIONS**

4. a) In the boxes below **illustrate** a convergent boundary between:

   i) Continental and continental crust. (Box 'A')
   ii) Oceanic and oceanic crust. (Box 'B')

In your illustration, be sure to **identify** the direction that each plate is moving **and** name the landform that each boundary produces.

a. **Continental** crust and **Continental** crust

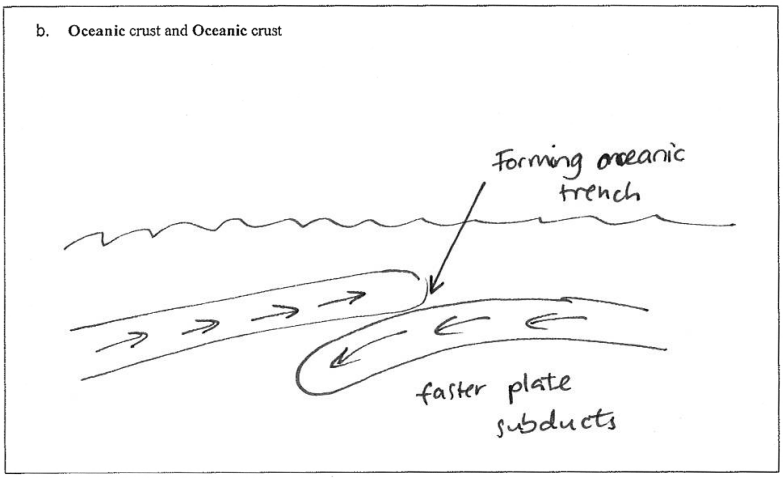



## Annotations

*Uses arrows to represent plate movement and shows that the collision between two continental plates results in mountain building.*

# Written test: Changing Earth

b. **Oceanic** crust and **Oceanic** crust




b) **Explain** why a convergent boundary between a continental plate and an oceanic plate always produces a volcanic island and a deep ocean trench.

A convergent boundary between a continental plate and oceanic plate produces a volcanic island because the continental plate is thicker than the oceanic and the ocean so it overrites and goes upwards to form volcan

trench is formed because of the gap that is made when the oceanic plate subducts.

## Annotations

*Uses arrows to represent plate movement and shows that a faster moving oceanic plate subducts to form an oceanic trench.*

*Describes the plate movements involved in the formation of a deep ocean trench.*

# Written test: Changing Earth

8. In 1912, a scientist called Alfred Wegener suggested a hypothesis called continental drift. Wegener's continental drift hypothesis states that "*all the continents used to form a single land mass, called Pangea, before breaking apart and 'drifting' into their current positions*". Despite the evidence Wegener had collected, his theory was rejected by the scientific community. However, in light of new evidence the scientific community have revised Wegener's hypothesis and incorporated it into the theory of plate tectonics.

**Justify** the following statement: "Without modern technology, Wegener's theory of continental drift would never have been accepted by the scientific community". In your justification make sure to:

a) **Identify** one piece of technology that provided new evidence in support of Wegener's theory of continental drift
b) **Explain** one (1) new piece of evidence that has been collected that supports Wegener's theory of continental drift
c) **Explain how** this evidence **supports and extends** Wegener's original theory

A piece of evidence that would provide new evidence on Wegener's theory would be how scientists can tell that continents move an amount of centimetres each year, because of the convection current causing the plates to more slightly grow bigger ^ A piece of technology that is annuel today and would not have been in 1912 to support Wegener's theory would be, satellites, to detect how far continents move every year. This evidence supports Wegener's theory because it proves that even though the plates may only be moving small amounts of centimetres, it still shows the he was right about the continental drift theory.

## Annotations

*Identifies a technology that provides new evidence to support continental drift theory and partially describes that evidence.*

## Annotations (Overview)

*The student uses appropriate language and representations to communicate ideas and findings.*

# Worksheet: Ecosystems

## Year 9 Science achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.*
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## Summary of task

Students had completed a unit on ecosystems, including conducting field work in their local heathland and completing a case study on the Biosphere 2 experiment. They had investigated how matter and energy move through an ecosystem, and the different ways this can be represented.

This task was a revision exercise undertaken at the end of the unit. Students worked individually, with no access to resources, other than the Wetland Food Web diagram. They were given 40 minutes to complete the task. A recommended word count was given for the first question as a guide to the level of depth required by students in their answers.

# Worksheet: Ecosystems

1. Explain what the "Wetland Food Web" diagram shows. (50-100 words)

The wetland food web provides an example of an ecosystem and the relationships between the animals and plant life which live in it. It also shows where the energy goes to when a consumer or producer is eaten.

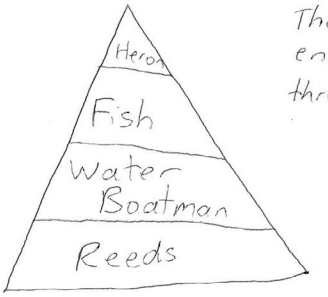
2. A pollution leak into the creek that occurred above this wetland caused the water quality to decrease; all the water boatman died and the mosquitos bred excessively. Predict the possible effects of these changes on the other living things in the wetland.

If the water boatman died off, it would result in the the disappearance of the diving beetle. Dragonflys, lizards, and Herons would all have less food as a result of this. However, the predators of the mosquito would have population boosts due to an increase in the mosquito population.

3. Explain how oxygen and carbon are cycled in this system.

Sunlight is absorbed by the water plant life which produces oxygen for the animal life to breathe. The carbon dioxide produced by the animals breathing is taken in by the plants.

4. Choose one biomass chain that contains 3 consumers and draw a food pyramid. Briefly explain what the biomass pyramid represents.




The food pyramid represents the energy being passed upwards through the ecosystem.

## Annotations

*Explains a food web in terms of feeding relationships and energy transfer.*

*Describes some effects of pollution on specific populations in a wetland in terms of interdependencies.*

*Explains how oxygen and carbon (as carbon dioxide) are transferred between producers and consumers.*

*Constructs a biomass pyramid that shows the relative numbers of organisms in a food chain and identifies that a transfer of energy occurs.*

## Annotations (Overview)

*The student uses appropriate language and representations to communicate science ideas.*

# Venn diagram: Control and regulation

## Year 9 Science achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

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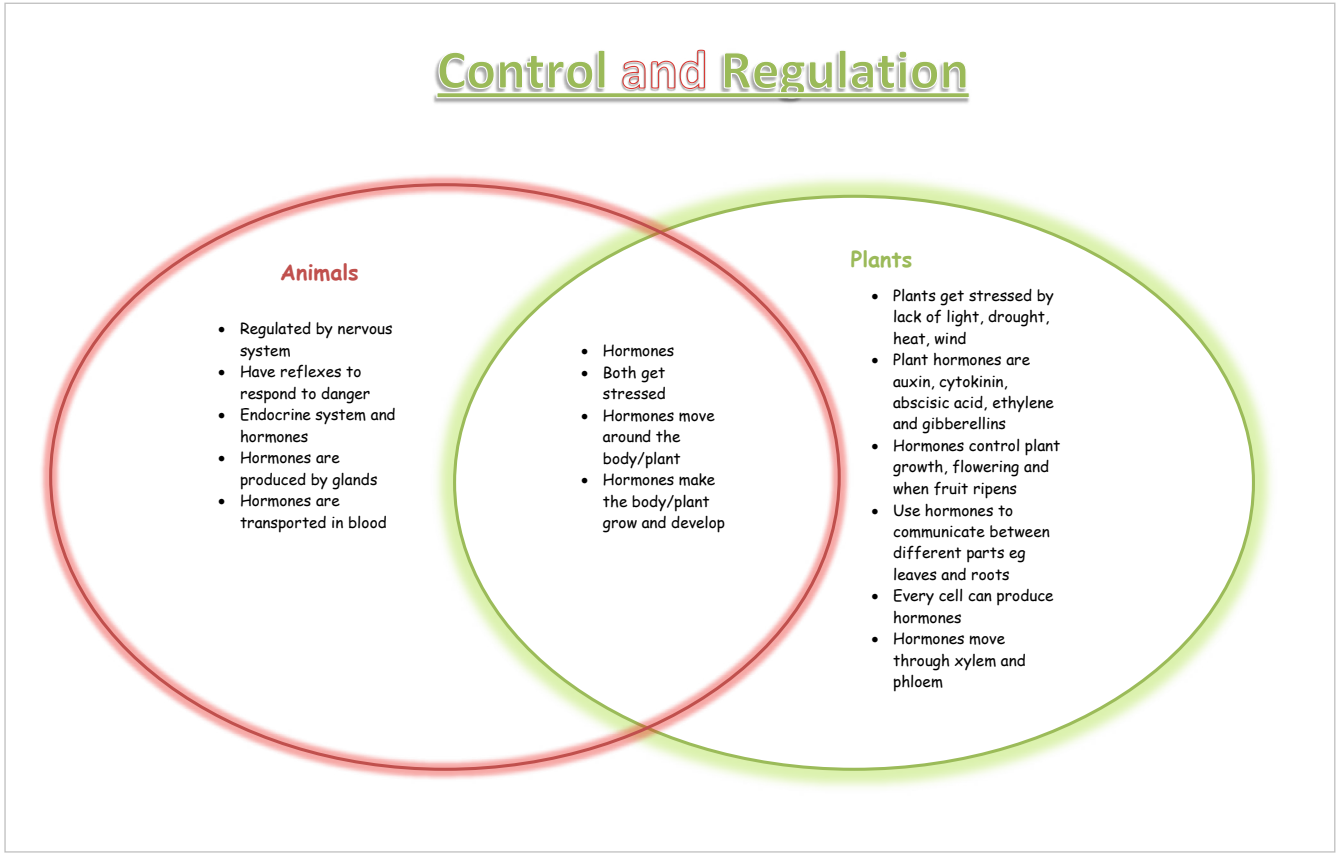
## Summary of task

Students had studied the human nervous and endocrine systems, particularly the role of the central nervous system, the peripheral nervous system and hormones. They had not explored any aspects of plant responses to environmental change.

Students were asked to research how plants use hormones to respond to their environment and to construct a Venn diagram to show the similarities and differences between the plant and animal mechanisms for control and regulation of systems. They completed their research in pairs over one class lesson and constructed the Venn diagram summary as a homework task.

# Venn diagram: Control and regulation




## Annotations

*Provides a simple analysis of similarities and differences in animal and plant mechanisms for responding to environmental change.*

*Identifies that both plants and animals use hormones to respond to changes in the external environment and to control growth and development.*

*Indicates that body system responses rely on interdependencies between systems, organs, cells and specific chemicals (hormones).*

## Annotations (Overview)

*The student uses appropriate language and representations to communicate findings and ideas.*

# Research report: Bionic eye

## Year 9 Science achievement standard

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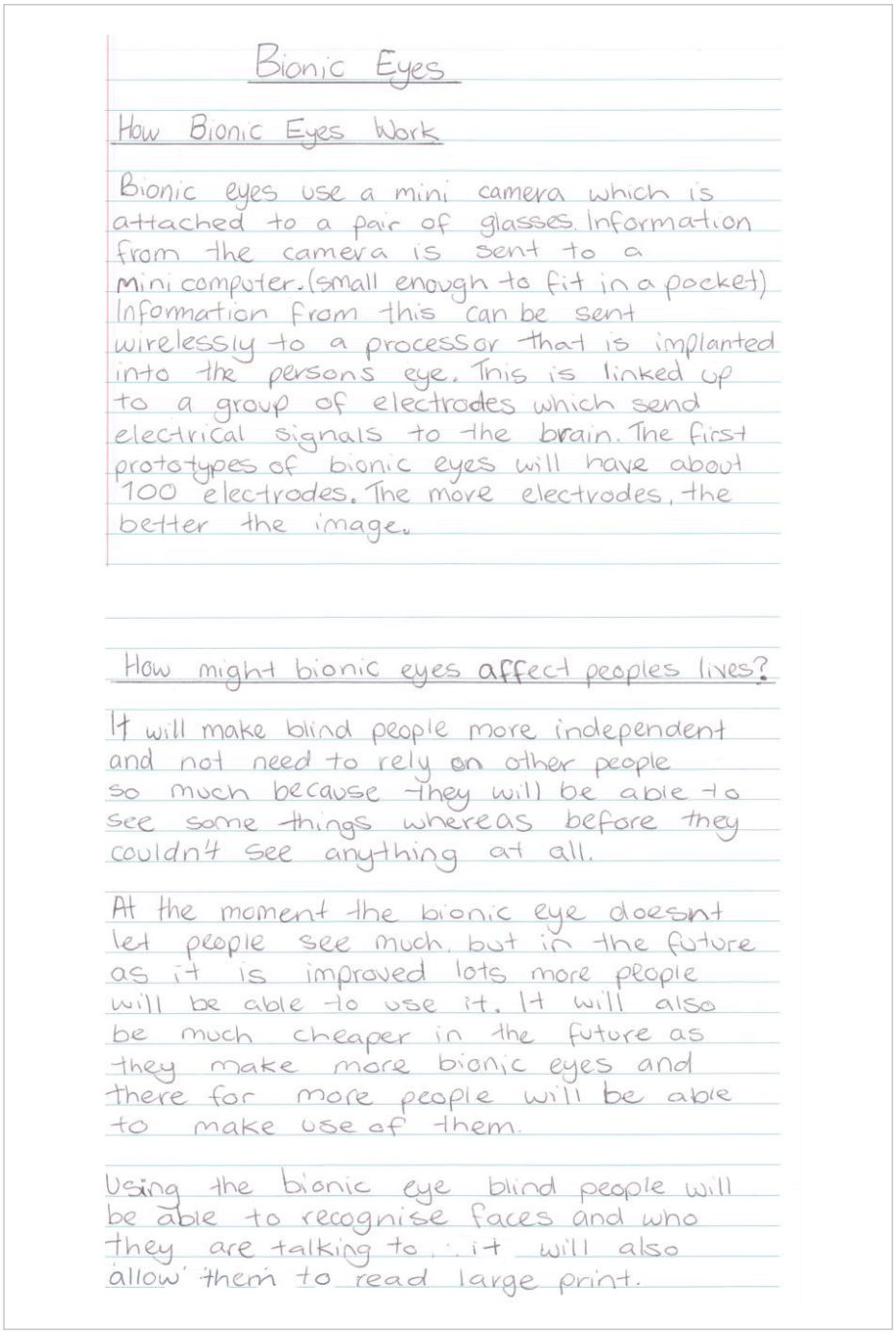
## Summary of task

Students had been studying energy transfer in the context of sound, light and electricity. They had considered how the structure of the eye enables light waves to be detected and how eyes work, including how information is passed on to our brains.

Students were asked to research how bionic eyes have been developed in Australia, provide a description of how bionic eyes work, and how they might impact people's lives. They were asked to produce a brief report on their findings. They were provided with one 50-minute lesson to begin their research and were required to complete the task at home.

# Research report: Bionic eye



Bionic Eyes

How Bionic Eyes Work

Bionic eyes use a mini camera which is attached to a pair of glasses. Information from the camera is sent to a mini computer. (small enough to fit in a pocket) Information from this can be sent wirelessly to a processor that is implanted into the persons eye. This is linked up to a group of electrodes which send electrical signals to the brain. The first prototypes of bionic eyes will have about 100 electrodes. The more electrodes, the better the image.

How might bionic eyes affect peoples lives?

It will make blind people more independent and not need to rely on other people so much because they will be able to see some things whereas before they couldn't see anything at all.

At the moment the bionic eye doesnt let people see much, but in the future as it is improved lots more people will be able to use it. It will also be much cheaper in the future as they make more bionic eyes and there for more people will be able to make use of them.

Using the bionic eye blind people will be able to recognise faces and who they are talking to. it will also allow them to read large print.

## Annotations

*Gives a clear description of the function of the bionic eye, including how signals are transferred from one form of energy to another.*

*Describes how bionic eyes could impact people's lives.*

*Describes how future improvements in the technology could decrease the cost and increase access to technology.*

*Describes how future developments of the technology may affect people using bionic eyes.*

## Annotations (Overview)

*The student uses appropriate language and representations to communicate findings and ideas.*

# Digital presentation: Plate tectonics

## Year 9 Science achievement standard

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## Summary of task

Students had begun a unit of work on plate tectonics. They were involved in a series of activities, which they were asked to compile in a digital presentation to show how their understanding developed. They were asked to develop the presentation for an audience of their peers.

Students were asked to:

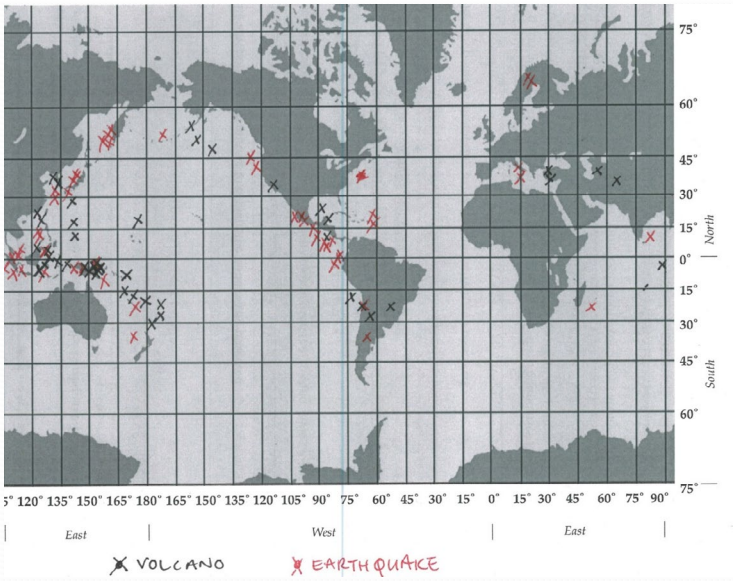
- map recent earthquakes and volcanic eruptions and describe the patterns they observed
- complete a 'jigsaw' of tectonic plates and describe how this compared to the pattern observed in the map (mentioned above)
- develop a hypothesis to explain the observed pattern
- watch a video on plate tectonic theory and present a summary of main points
- select their own analogy for Earth's structure and explain the limitations of the model
- describe the formation of a number of geological features
- reflect on their hypothesis.

They presented their learning as a slideshow, developing the presentation in class over two lessons.

# Digital presentation: Plate tectonics

## Location of earthquakes and volcanoes

Patterns observed:
•Earthquakes and volcanoes seem to be mostly occurring along the coast lines or across islands.
•They seem to occur in similar places.

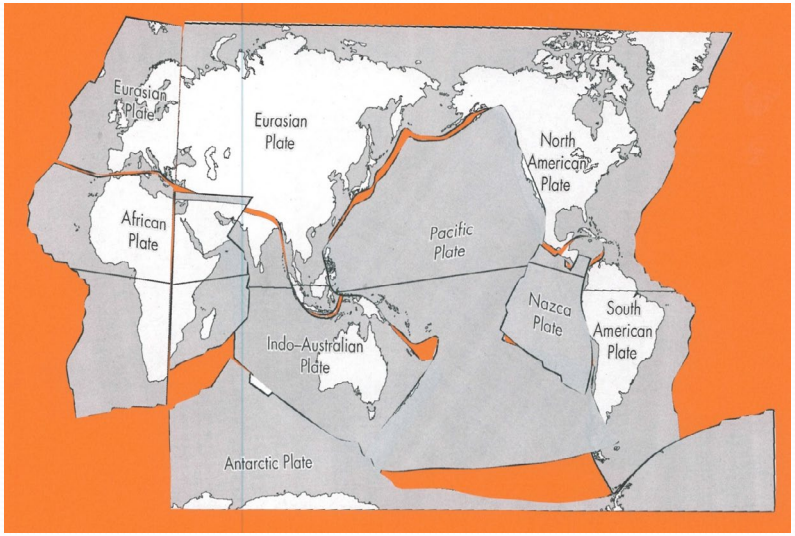



## Annotations

*Maps the location of earthquake and volcanic events and describes observed patterns.*

# Digital presentation: Plate tectonics

## Continental plate jigsaw

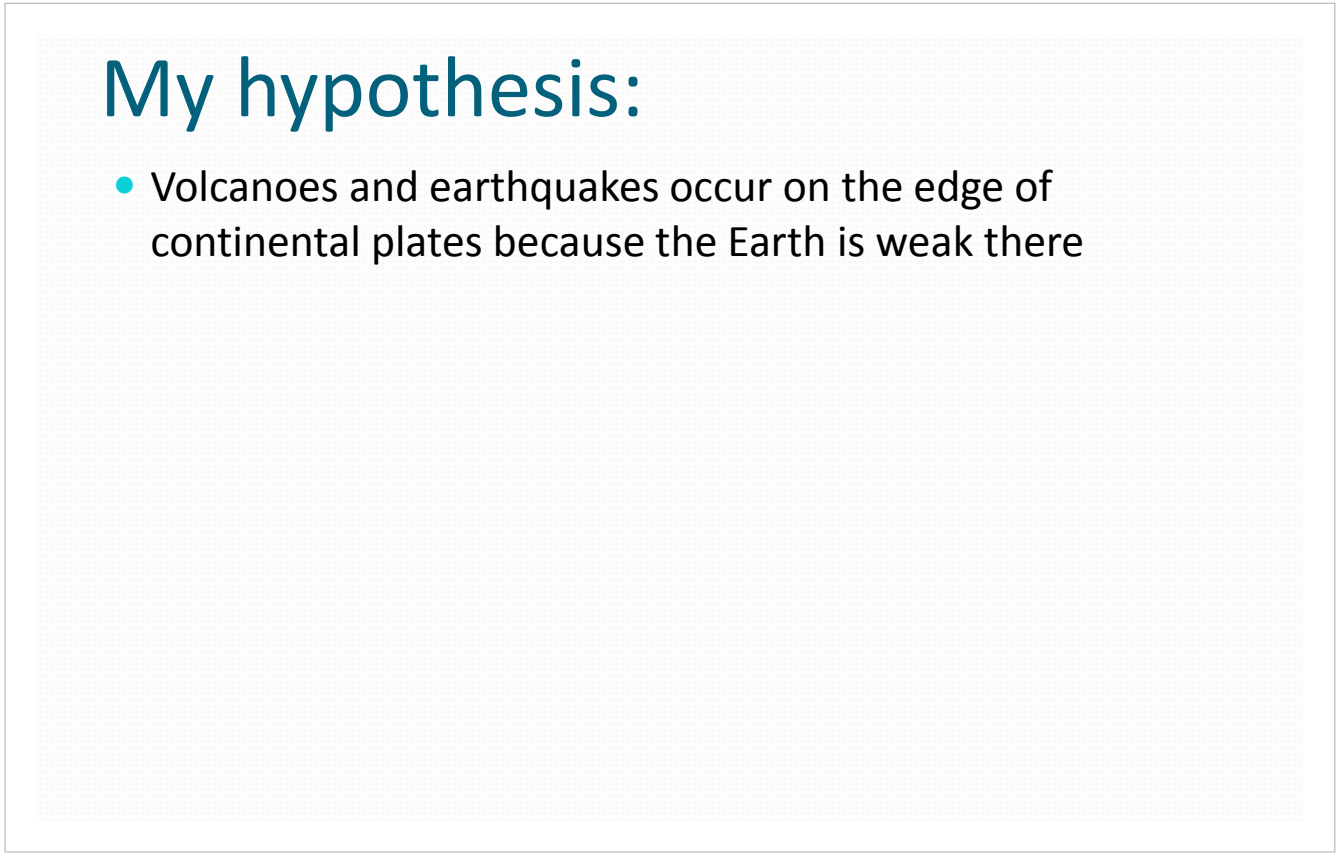



Observations:
- the continental plates do seem to fit together like a jigsaw
- Lots of the earthquakes and volcanoes in the map are on the edges of the continental plates

## Annotations

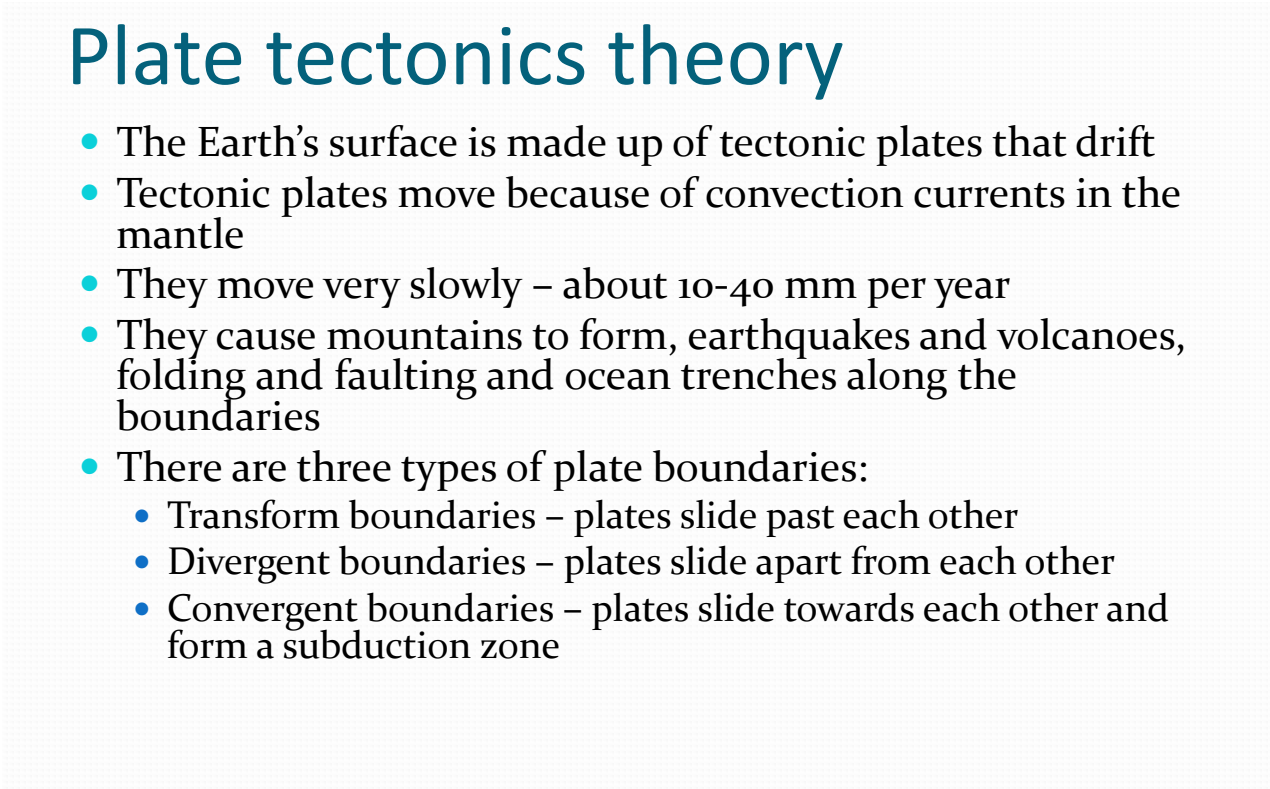
*Analyses data in both slides to connect earthquake and volcanic activity to plate boundaries.*

# Digital presentation: Plate tectonics




**Annotations**

# Digital presentation: Plate tectonics




## Annotations

*Describes key elements of plate tectonic theory.*

*Recognises that tectonic plates move very slowly.*

# Digital presentation: Plate tectonics

## Tectonic plates analogy

Cracking the shell of a boiled egg is like the surface of the Earth.
It is like the surface of the Earth because it has plates that fit together like a jigsaw and move up against each other.
It isn't like the Earth because it doesn't have a layer that moves underneath the surface and it doesn't have a hot core. The egg shell doesn't fold and bend so it can't show mountains or trenches.

### Annotations

*Recognises restrictions of analogy: lack of interior layers and relative 'brittleness' of crust.*

# Digital presentation: Plate tectonics

## Features of Earth

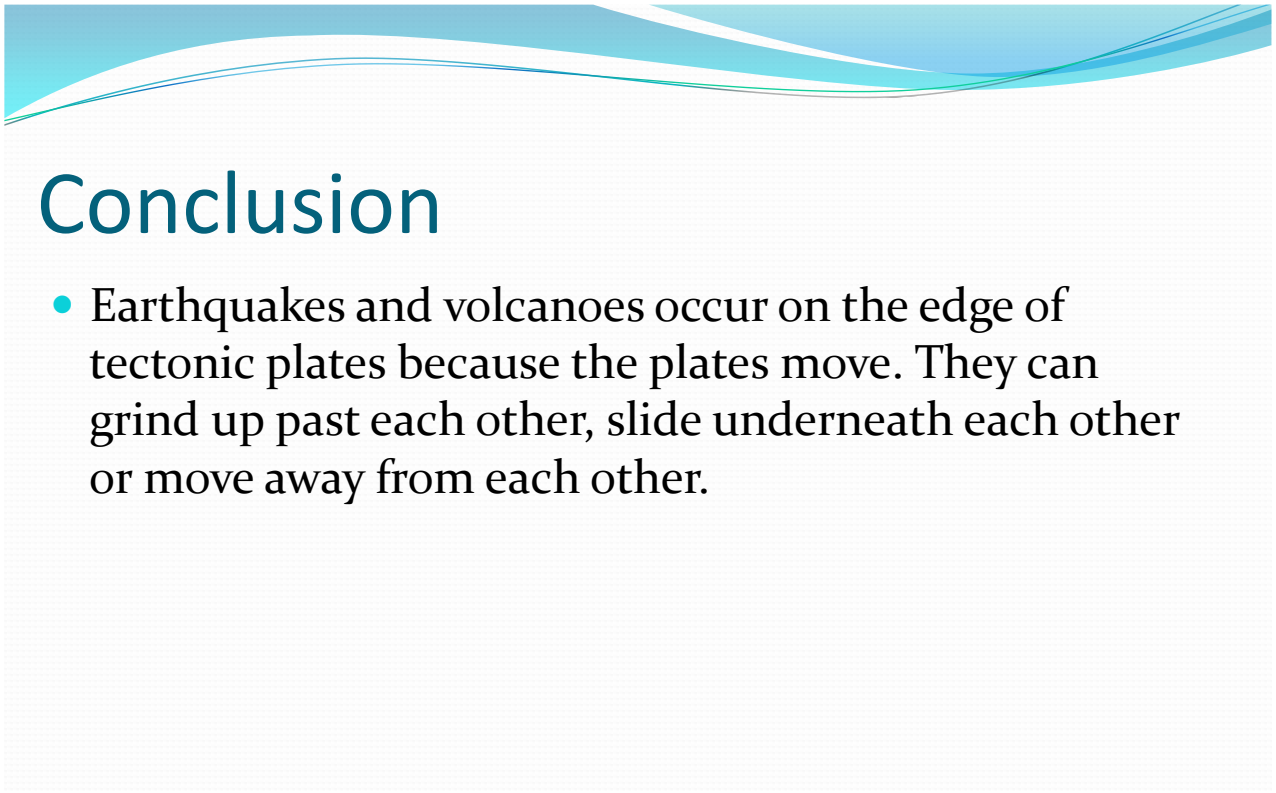
| Feature | Explanation |
|---|---|
| Mariana Trench | This is the deepest part of the oceans. It was formed because the pacific plate subducted beneath the mariana plate. The plates meet at the bottom of the trench. |
| San Andreas fault | This is a strike-slip fault that occurs when the pacific plate and the north american plate grind past each other |
| Himalayas | Started to form about 70 million years ago when the plates collided and caused the sea bed to fold. The Himalayas are still growing at about 5mm per year as the Indian plate keeps moving north about 2cm each year. Lots of earthquakes occur in the Himalayan region. |
| Few earthquakes and volcanoes in Australia | Australia is right in the middle of the indo-Australian plate |

### Annotations

*Identifies the geological processes that have led to a range of geological features.*

*Identifies the slow rate of geological change.*

# Digital presentation: Plate tectonics




## Annotations

*Identifies that plate movement is critical to earthquake and volcanic activity.*

## Annotations (Overview)

*The student uses appropriate language and representations to communicate ideas and findings.*