Science

WORK SAMPLE PORTFOLIOS

These work sample portfolios have been designed to illustrate satisfactory achievement in the relevant aspects of the achievement standard.

The December 2011 work sample portfolios are a resource to support planning and implementation of the Foundation to Year 10 Australian Curriculum in English, Mathematics, Science and History during 2012. They comprise collections of different students' work annotated to highlight evidence of student learning of different aspects of the achievement standard.

The work samples vary in terms of how much time was available to complete the task or the degree of scaffolding provided by the teacher.

There is no pre-determined number of samples required in a portfolio nor are the work samples sequenced in any particular order. These initial work sample portfolios do not constitute a complete set of work samples - they provide evidence of most (but not necessarily all) aspects of the achievement standard.

As the Australian Curriculum in English, Mathematics, Science and History is implemented by schools in 2012, the work sample portfolios will be reviewed and enhanced by drawing on classroom practice and will reflect a more systematic collection of evidence from teaching and learning programs.

THIS PORTFOLIO – YEAR 8 SCIENCE

This portfolio comprises a number of work samples drawn from a range of assessment tasks, namely:

Sample 1	Investigation report – Solar oven
Sample 2	Investigation – Seed germination
Sample 3	Diagram – Geological features
Sample 4	Experimental report – Rate of reaction
Sample 5	Test – Energy and change
Sample 6	Model design – Digestive system
Sample 7	Investigation report – Heating steel wool

In this portfolio, the student compares physical and chemical changes (WS7) and uses the particle model to explain the behaviour of substances (WS4, WS7). The student identifies different forms of energy and describes how energy transformations cause change (for example, heating and movement) in different systems (WS1,WS5). The student describes the processes that led to particular rock formations (WS3) and constructs models to demonstrate the relationship between structure and function at organ and body system levels (WS6).

Science

The student demonstrates an ability to identify and construct a question for scientific investigation (WS2) and to plan an experimental investigation, including consideration of safety (WS4). The student identifies variables to be changed, measured and controlled (WS2, WS4). The student constructs representations of data to reveal and analyse patterns and trends and uses data when justifying their conclusions (WS1, WS2, WS4). The student explains how modifications to investigation methods could improve the quality of data (WS1, WS4) and communicates science ideas, methods and findings in a range of text types, using appropriate language and representations (WS1, WS2, WS3, WS5, WS6, WS7).

The following aspects of the achievement standard are not evident in this portfolio:

- *examine the different science knowledge used in occupations*
- *explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.*

Science

Work sample 1:
Investigation report – Solar oven

Relevant parts of the achievement standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the time scales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

Summary of task

This task was part of a unit on different forms of energy. Students were given three days to design, construct and report on effectiveness of a solar oven.

Students were asked to investigate whether a solar oven could be used to cook food. In groups of 3 or 4 students, they were required to:

- design and construct a solar oven using materials provided
- predict and measure the maximum temperature of the solar oven
- test the solar oven (including procedure and observations)

Students were then required to individually:

- reflect on the design of the solar oven and make recommendations for improvement
- communicate the method, results and conclusion in a report.

Students were required to take these safety precautions when testing the solar oven:

- **use oven gloves to protect hands from heat when handling the oven or taking temperature measurements**
- **use sunglasses when viewing the oven to protect eyes from glare.**

Science

Work sample 1:
Investigation report – Solar oven

Science Investigation:
Cooking with Solar Energy

Aim

To investigate whether energy from the sun can be used to cook food.

Hypothesis (Prediction)

I think the solar ovens' temperature will rise over 65°C.

Materials

- 1 large box
- 1 small box
- Styrofoam (packing peanuts)
- Black cardboard
- Alfoil
- Sticky tape(clear, black)
- 4 OHT sheets
- Velcro dots
- String

Procedure

1. Place insulation material in bottom of both boxes.
2. Seal holes in both boxes.
3. Cut a different box to make reflectors bigger.
4. Place alfoil on reflectors of large box.
5. Cut a cardboard frame for OHT sheets on small box.
6. Sticky frame on small box.
7. Put small box inside large box and fill gaps.
8. Place the oven in the sun and adjust reflectors.
9. Measure the starting temperature and record.
10. Check oven temperature every 10 mins and record.

Results

Time	*Temperature (°C)*	*Temp. Change (°C)*
10:00am	38 °C	0 °C
10:10am	71 °C	+33 °C
10:20am	82 °C	+11 °C
10:30am	90 °C	+8 °C
10:40am	91 °C	+1 °C
11:25am	100 °C	+9 °C

Discussion

It was found that the temperature in the oven rose to 100°C. It was also found that the hypothesis was correct.
The most likely reason for this excellent result is because of the many layers of insulation. There was also a lot of black for maximum absorption. There were also 4 reflectors.
Of the eight ovens tested the most efficient oven was my groups. I think this is because of all the insulation and absorption.
The design of our solar oven can be improved by more absorption! More insulation! And more reflection!

Annotations

Indicates that solar energy is a form of energy and can be transferred, for example 'to cook food' in a solar oven.

Communicates data in an appropriate table to reveal trends i.e. temperature change over time.

Uses data, trends and experimental design to justify conclusions.

Suggests simple modifications for improvement of experimental design.

Uses appropriate scientific terminology and representations to communicate ideas, methods and findings.

Acknowledgment
ACARA acknowledges the contribution of the trial teachers providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

Science

Work sample 2:
Investigation report – Seed germination

Relevant parts of the achievement standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the time scales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

Summary of task

Students have an understanding of plant growth requirements. They have developed skills in planning and performing first-hand investigations to test ideas.

Students were asked to develop an investigable question in a science area of their own interest and to plan and perform a controlled investigation to test their question or hypothesis. They were required to record their measurements and communicate their method, results and conclusion in a report.

Science

Work sample 2:
Investigation report – Seed germination

Experiment: Seed Germination and Growing Mediums

Aim: To find out what is the best medium for oat seed germination comparison made between potting mixture, sand and seed-raising mixture.

Hypothesis: I beleive the seeds will germinate more successfully in the seed-raising mixture.

Background: Seed germination is the beginning of a ferlilized seed to grow or develp. The seeds need water, sunlight and oxygen to germinate.

Equipment List:
- 90 oat seeds
- 9 pots
- Potting mixture
- Sand
- Seed-raising mixture
- Water
- Sunlight
- Tray
- Watering can

Annotations

Identifies an investigable question.

Identifies variables that influence seed germination.

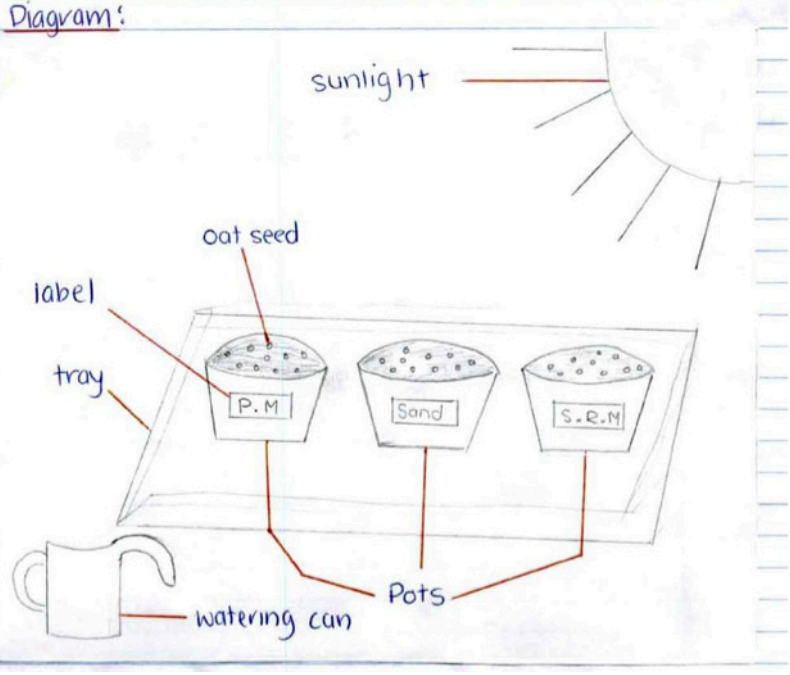
Science

Work sample 2:
Investigation report – Seed germination

Method

1. Set up 3 pots in a row and place them in a tray.
2. Label pots with type of growing medium.
3. Three quarter fill each pot with a growing medium.
4. Place 10 seeds in each ~~pot~~ of the 3 pots.
5. Cover seeds with a thin layer of growing medium.
6. Add water to moisten growing medium.
7. Repeat steps 1 to 6 twice more.
8. Water the seeds in the morning and afternoon.
9. Check the pots each day and keep a record of when the seeds ~~germ~~ germinate.

Diagram:



Annotations

Constructs method with some attempts to control variables.

Uses labelled diagram to communicate experimental design.

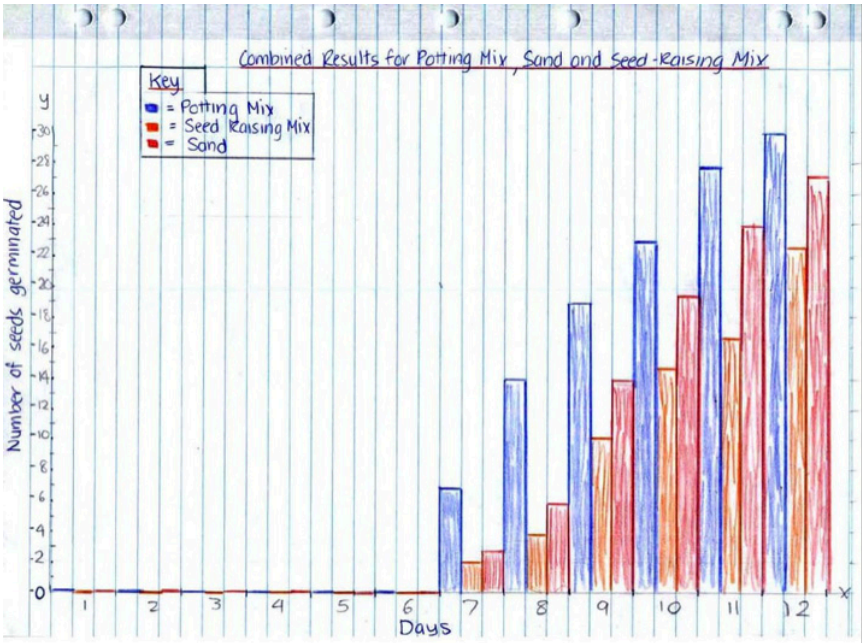
Science

Work sample 2:
Investigation report – Seed germination

Results:

Growing Medium

Pot	Treatment	Seed Germination (days) 1	2	3	4	5	6	7	8	9	10	11	12	Total	Sum Total	Percentage (%)	Combined Percentage
1.	Potting Mix							3	5	6	8	10	10	10		100%	100
2.	Potting Mix							2	4	6	7	9	10	10	30	100%	
3.	Potting Mix							2	5	7	8	9	10	10		100%	
1.	Seed Raising Mix								1	2	4	4	6	6		60%	76.66%
2.	Seed Raising Mix							1	2	4	5	6	7	7	23	70%	
3.	Seed Raising Mix							1	1	9	6	7	10	10		100%	
1.	Sand							1	2	5	6	7	9	9		90%	90%
2.	Sand								1	4	6	8	8	8	27	80%	
3.	Sand							2	3	5	8	9	10	10		100%	



Annotations

Organises data in an appropriate table and attempts to provide summary statistics.

Presents data in a graph to show trends.

Correctly labels axes and provides a title and key.

Science

Work sample 2:
Investigation report – Seed germination

Discussion: Because we had some dificulties when we first attempted this experiment it did not work. Our second attempt worked due to fixing the problems and having a more accurate plan. The potting mix overall was more successful. This was because the potting mix was a loose soil that didn't compact, get soggy or crust over and allowed water to moisten the soil easily. The seed raising mixture was unsucessful because the water didn't peretrate the mixture very well and the medium tended to be drier.

Conclusion: The potting mixture was the most successful in germinatting seeds. My hypothesis was incorrect.

Annotations

Reflects on experimental method and indicates refinements occurred.

Attempts to explain findings with reference to quantitative and qualitative data.

Annotations (Overview)

The student communicates ideas, methods and findings using appropriate language and representations.

Acknowledgment
ACARA acknowledges the contribution of the trial teachers providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

Science

Work sample 3:
Diagram – Geological features

Relevant parts of the achievement standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the time scales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

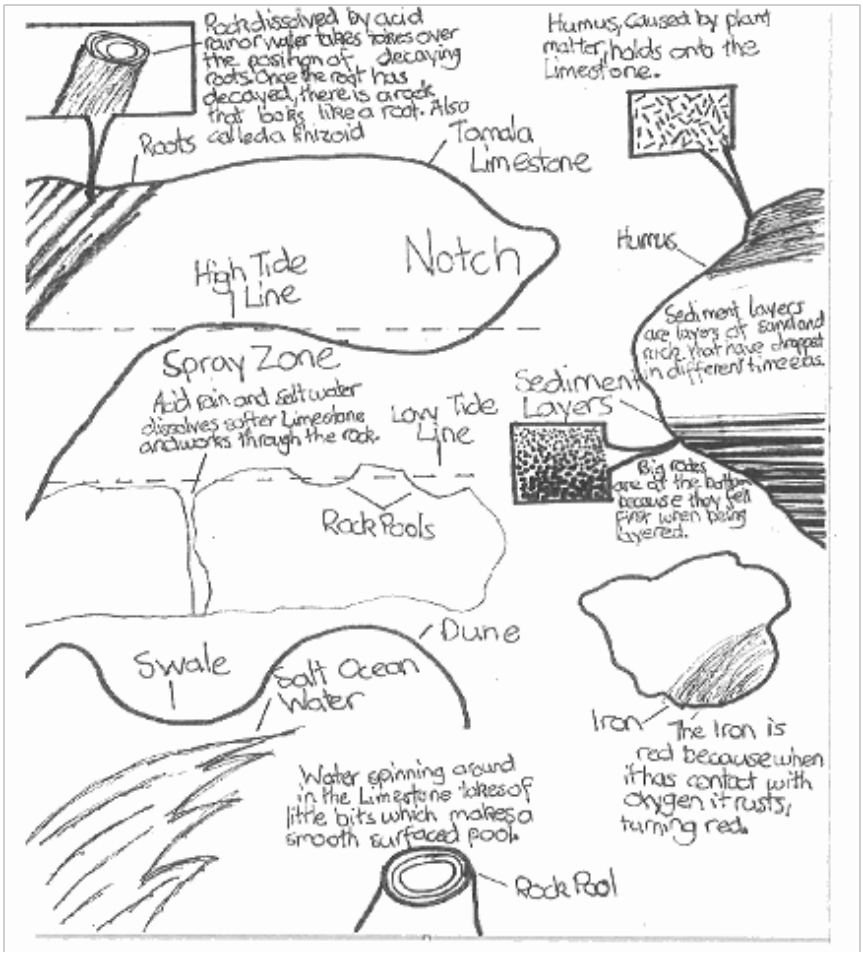
Summary of task

Students had been studying the rock cycle and interpretation of geological formations.

Students were asked to observe some limestone formations on an excursion. They were required to draw labelled diagrams on what they observed and provide an explanation as to what might have caused the observed geological formation.

Science

Work sample 3:
Diagram – Geological features



Annotations

Constructs diagrams to represent physical and chemical processes of weathering and erosion.

Refers to change over time, e.g. layering of rocks.

Annotations (Overview)

The student uses scientific language and appropriate representations to communicate observations and ideas.

Acknowledgment
ACARA acknowledges the contribution of the trial teachers providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards

Science

Work sample 4:
Experimental report – Rate of reaction

Relevant parts of the achievement standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the time scales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

Summary of task

Students had explored the concept of chemical change and the idea that chemical change involves substances reacting to form new substances. They had discussed the effect of heat on particle movement and how the particle model could be used to explain observed chemical phenomena.

Students were asked to complete an experimental plan and conduct an experiment to determine the effect of heat on the rate of reaction.

Science

Work sample 4:
Experimental report – Rate of reaction

1. **Title:** The effect of temperature on the dissolving rate of aspirin.

   (A title is the name of your investigation that helps introduce the report.)

2. **Aim:** To investigate the effect of temperature on the dissolving rate of aspirin.

   (What am I going to investigate? An aim is quite often included in the background information and or provides a description of the Problem you are investigating.)

3. **Hypothesis:** Aspirin will dissolve more quickly in warm water than cold water.

   (What do you think will happen? This is a general statement that you can test through this investigation.)

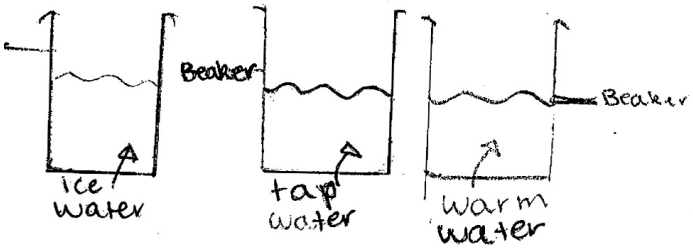
4. **Apparatus and Materials**

   (What equipment will you need? Make a list.)

   250 mL measuring cylinder
   Bunsen burner (if heating required)
   Thermometer
   Stop watch
   ~~Antacid tablets (2)~~ Aspro clear

   (Sometimes a diagram of the apparatus might be appropriate.)

   *** Draw a scientific diagram of your setup:**



Annotations

Constructs labelled diagrams to illustrate set up of apparatus.

Science

Work sample 4:
Experimental report – Rate of reaction

5. Procedure

(An explanation on how you will do the experiment and collect the results - labelled diagrams could be used if appropriate. Start with a description of the variables in your experiment.)

***Fill in the table below:**

List of variables	Controlled Variables	Independent Variable	Dependent Variable
1. Temp. of water		✓	
2. Equipment	✓		
3. Tablet size and type	✓		
4. Time to dissolve			✓
5. Quianty of water	✓		

N.B. Controlled variables are those that you do not allow to change.
An independent variable is a variable that you change or set to change regularly.
A dependent variable is a variable that changes due to a change in the independent variable.

1. 200 mL of ice cold water (from the fridge) was measured and poured into a beaker.
2. The temperature of the water was measured and recorded on the table below.
3. Two aspirin tablets were cut in half.
4. One half of an aspirin tablet was dropped into the water and the time taken for it to completely dissolve was measured using a stopwatch. The solution was not stirred. The time was recorded.
5. Steps 1, 2 and 3 were repeated except using water of different temperatures. E.g. chilled water, tap water, warm water and hot tap water. A Bunsen burner was used to heat the water to the desired temperature.

***Describe exactly how the experiment is a fair test:**
This test is fair because all of the beakers have ~~approximately~~ the same amount of water. They are also using the same tablet type.

6. *Risks

(Safety Statement – state what risks are involved with this investigation.)
The risks that involve this experiment are the chemicals and medicines in the tablet can and could be harmful if entered into eyes or mouth. We are also working with hot water this can be harmful if water is spilt over body.

7. Precautions

(Safety Statement – state what precautions you need to take with this investigation.
The precautions needed for this test are:. that we are working with hot water and chemicals which they could injure themselves

Annotations

Correctly identifies controlled, independent and dependent variables.

Identifies the role of controlling variables in ensuring a fair test.

Identifies safety risks and necessary precautions.

Science

Work sample 4:
Experimental report – Rate of reaction

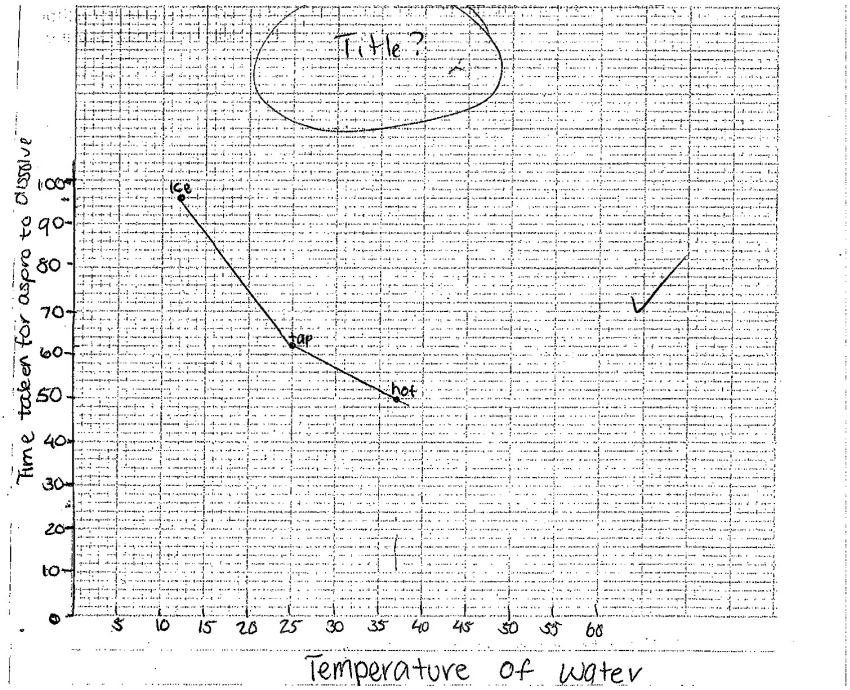
8. Results

(Record your observations and measurements in a presentable form eg a data table. Decide if your data can be presented in as a graph. If so, draw a graph of your results.)

***Record your results in the table below:**

Table 1. Time taken for an aspirin tablet to dissolve at different temperatures.

Temperature (°C)	Time taken to dissolve tablet (seconds)
12° ice water	95 seconds
25° tap	61 seconds
50° hot	37 seconds



Annotations

Records results in a provided table and constructs an appropriate representation (line graph) to reveal trends in the results.

Constructs graph using some appropriate conventions (axes titles).

Science

Work sample 4:
Experimental report – Rate of reaction

9. *Analysis of Results (Discussion)
   a. What do your results tell you? Are there any patterns or trends in your results?
   b. Can you explain the patterns or trends in your results? Try to use some science ideas to help explain what happened.

The results show that when adding heat energy to a chemical reaction the reaction tends to happen faster. There is a chemical reaction happening in all of the beakers after the aspro clear is added because bubbles were let off. Also one of the sign's of a reaction is gas was produced and sound was produced (very quiet) also when the aspro clear turned into a liqud/gas. The partides were moving slow in the aspro clear but when it was put into water that was hot the particles were moving faster, this made the aspro clear turn into a gas/liquid form.

10. *Conclusion
   a. What did you find out about the problem being investigated?
   b. Was the outcome different from your hypothesis (prediction)? How is it different?

The hypothesis said that the hotter the water, the quicker the tablet will dissolve. The experiment agreed with this by testing how long the tablet took dissolve in hotter water.

11. *Evaluation
   a. Did you experience any difficulties doing this investigation? What were they?
   b. Explain how you could improve this experiment , eg. fairness, accuracy.
   c. Are there other investigations that come from this investigation?

It would be better to weigh the tablet and see if the bigger the tablet the more time difference. It would be interesting to repeat the experiment again but add lager amounts of water and see if there is a difference in time. I think my group should correctly mearure the amounts of water as we weren't good at this at the start.

Annotations

Explains why the aspro dissolving in water is a chemical reaction.

Uses the particle model to explain that the particles in hot water move faster than those in cooler water.

Attempts to explain why the increased movement of particles increased the rate of reaction.

Compares results with hypothesis.

Identifies modifications to method to improve accuracy.

Annotations (Overview)

The student communicates science ideas, methods and findings using appropriate language and representations.

Acknowledgment
ACARA acknowledges the contribution of the Association for Independent Schools, New South Wales for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

Science

Work sample 5:
Test – Energy and change

Relevant parts of the achievement standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the time scales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

Summary

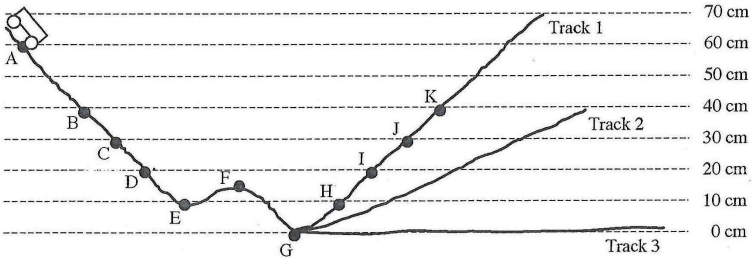
Students had been studying transformation of energy from one form to another.

Students were asked to independently answer the following questions, drawing on their class experiences. The questions were part of a broader test, which was completed by students in test conditions over one class period.

Science

Work sample 5:
Test – Energy and change

Two students, Nicole and Penelope, are designing a roller coaster ride. They decide to create a model of part of the track. They bend a length of flexible plastic track into the required shape. A toy plastic car with wheels represents the roller coaster cars. The diagram shows the shape of the main track with three alternative final sections. The grid at the back shows the height above the lowest point on the track.



Released from	Reaches
A	K
B	J
C	I
D	H

If the car is released above A it flies off the track at F.
If it is released below D it does not pass F.

Q1 If the car is released between A and B, where would you expect it to reach on Track 1?

In between J and K

Q2 The two students are using the height above the horizontal to measure the final gravitational potential energy. Is this a fair way to measure the final energy relative to the initial energy?

- (A) Yes. The loss in energy due to friction will be the same on all tracks.
- B Yes. The car will reach the same height no matter what angle track is used.
- C No. The car loses some energy on the downward path.
- D No. Different-angled tracks are longer and more work is done against friction.

Annotations

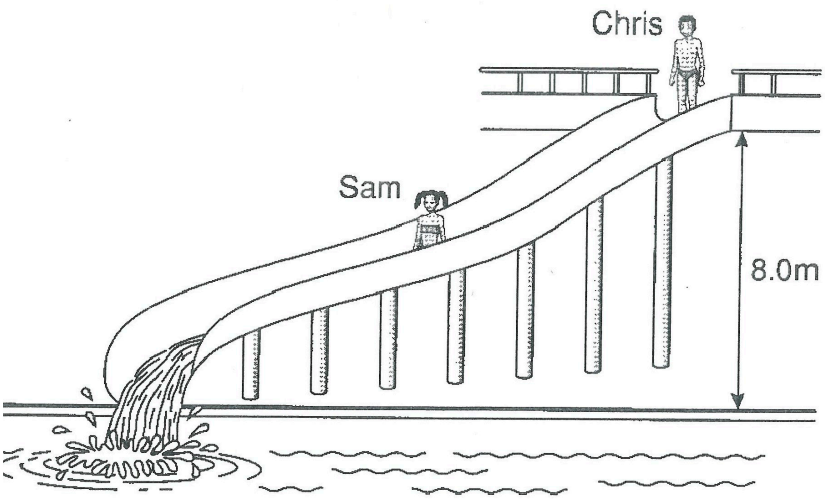
Correctly interprets data to make plausible prediction.

Evaluates the fairness of the method and correctly concludes that the friction stays the same on all tracks.

Science

Work sample 5:
Test – Energy and change

Q2. Water slides at leisure pools are very popular with children.



a) Chris has climbed to the top of the slide. What type of energy has he gained?

Potential

b) Sam is shown moving through a point halfway down the slide. State two types of energy she has.

Potential
Kinetic

c) Describe what happens to Sam's energy as she enters the water.

It gets put into potential from Kinetic.

Annotations

Identifies potential and kinetic energy as different forms of energy.

Explains that as Sam slides down the slide potential energy is transformed into kinetic energy.

Annotations (Overview)

The student communicates science ideas using appropriate language.

Acknowledgement:
ACARA acknowledges the contribution of the trial teachers providing the tasks and work samples. The annotations written by ACARA are referenced to the Australian curriculum achievement standards.

Science

Work sample 6:
Model design – Digestive system

Relevant parts of the achievement standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the time scales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

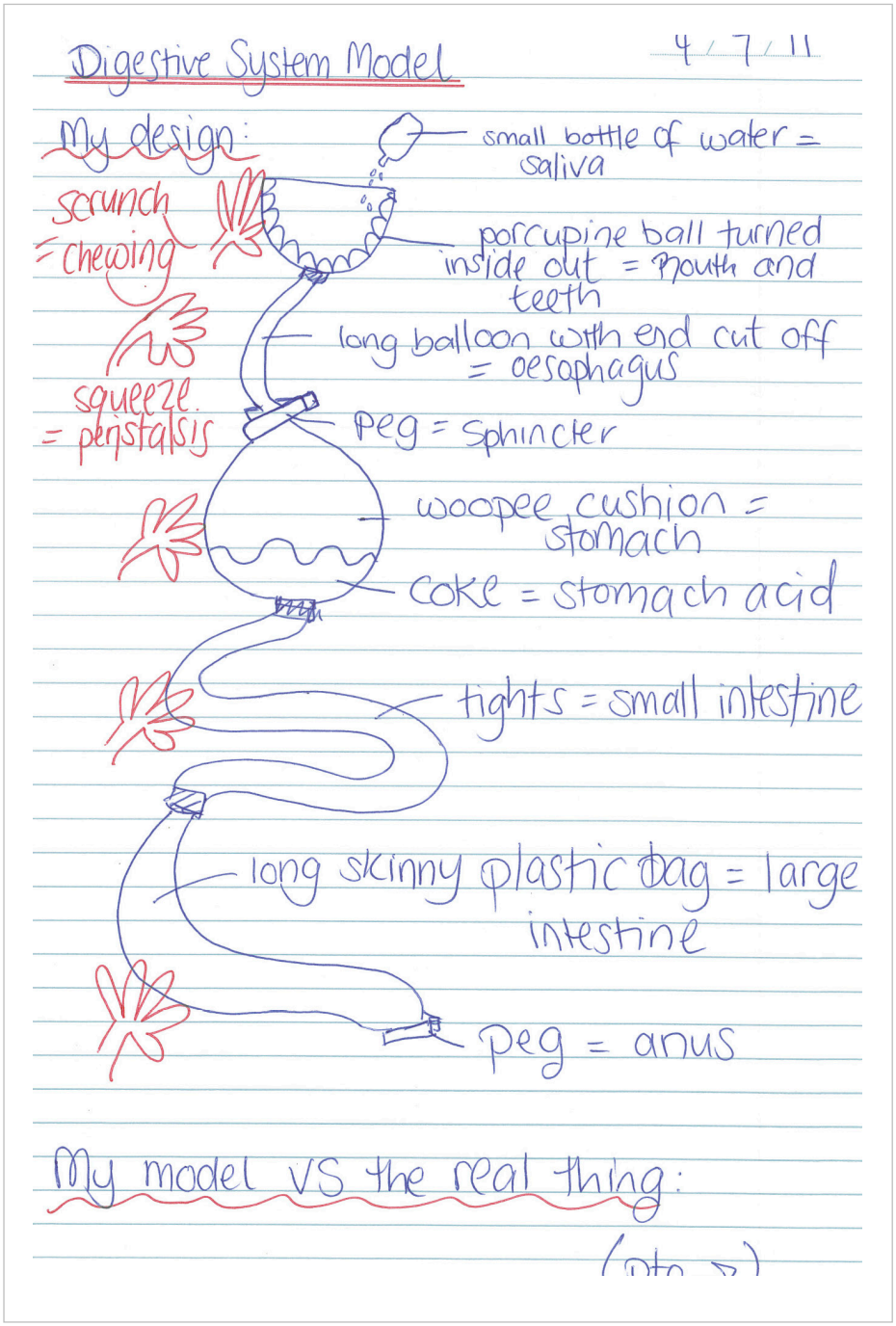
Summary of task

Students had studied the structure and function of the digestive system.

Students were asked to design a model for the digestive system that captured as many aspects of its structure and function as possible. They were then asked to explain the limitations of their model. They completed the task over one 50 minute class.

Science

Work sample 6:
Model design – Digestive system



Annotations

Identifies organs involved in the digestive system and constructs appropriate models for each organ.

Science

Work sample 6:
Model design – Digestive system

Organ	Model vs real thing
* mouth	* no enzymes in the water like there is in saliva * 'teeth' aren't hard enough in the model * no tongue to push the food down * no hard plate * no lips
* oesphagus	* no muscles in tube – need to squeeze with hands
* stomach	* Coke isn't really HCL!! * no mucus layer to stop the acid from burning through
* small intestine	* no proper absorption (tights soak up some water but that's all) * no bile * no ~~diarrea~~ digestive enzymes to break down food.
* large intestine	* not proper size

Overall: * not proper size
* not proper absorption

Annotations

Demonstrates understanding of the function of each organ in digestion.

Demonstrates an understanding of the relationship between organ structure and function, e.g. the mucus layer of the stomach protects the stomach tissues from the effects of the stomach acid.

Annotations (Overview)

Communicates ideas, methods and findings using appropriate language and representations.

Acknowledgment
ACARA acknowledges the contribution of the trial teachers providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

Science

Work sample 7:
Investigation report – Heating steel wool

Relevant parts of the achievement standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the time scales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

Summary of task

Students had been investigating a range of chemical and physical changes, such as melting chocolate, heating sugar and adding chemicals to water and had identified the key observations that give evidence for a chemical change. Previously they had completed work on the kinetic theory of matter in relation to the behaviour of solids, liquids and gases and changes of state.

Students were asked to complete an investigation into burning steel wool. They were provided with a piece of iron wool, a Bunsen burner, a pair of tongs and a heat proof mat and safety glasses. They were asked to heat the steel wool with the Bunsen, at first holding the steel wool 30 cm above the tip of the Bunsen flame. They were then told to lower the steel wool gradually until they thought that a physical change was occurring with the steel wool. Then they would continue to lower the steel wool until they thought a chemical change was occurring. They were asked to list evidence for the changes that they would be looking out for, and to predict the heights at which the changes would occur.

Before they commenced they discussed safety requirements for this investigation; they identified that they should wear the safety glasses when working with the Bunsen burners, hold the iron wool in the tongs at a distance from their bodies, and be careful not to flick the burning wool.

Science

Work sample 7:
Investigation report – Heating steel wool

Heating steel wool

Aim

To see how steel wool is affected by heat.

Equipment

- steel wool
- Bunsen burner
- Tongs
- Heat proof mat
- Safety glasses
- Ruler

Background information

In a physical change, substances can change state, such as melting or particles being broken up into small pieces.

In a chemical change, we might see:

- Colour Changes
- Heat being given out
- Light or sound
- Bubbles of gas.

Prediction

I think the steel wool will start to melt as it gets closer to the flame. Once it is in the flame the steel wool will catch fire (this is a chemical change). We may see smoke being given off.

Annotations

Identifies evidence for a physical change.

Identifies evidence for a chemical change.

Makes a prediction based on previous knowledge of physical and chemical changes.

Science

Work sample 7:
Investigation report – Heating steel wool

Diagrams

Results

When the steel wool was 30 cm above the bunsen burner, there was no change. As we lowered the steel wool it looked like it started to go soft. The ends curled up. This happened when it was about 20cm above the flame.

When we lowered the steel wool it started to glow and bits of the wool went black.

When the steel wool touched the tip of the flame, it glowed really bright and sparks were given off.

Annotations

Records observations.

Science

Work sample 7:
Investigation report – Heating steel wool

Conclusion

The first changes to the steel wool were pysical changes as the steel wool began to melt. Once the wool got hotter, it started to change chemically. We knew this because the colour of the steel wool changed.

Discussion

1. How did your observations compare with others?
Most people had similiar results, except some groups steel wool started sparking before it touched the tip of the flame.
2. What do you think was happening to the particles in the steel wool during the experiment?

When the steel wool was melting, the particles were separating, but when the steel wool started to burn, atoms in the steel wool would have been combining with other atoms to make new substances.

3. Comment on my prediction.
My prediction was mainly right. However, a chemical change seemed to happen before the steel wool was actually in the flame.

Annotations

Describes and compares observations in terms of physical and chemical changes.

Uses the particle model to explain observations, in this case differences between the melting of the steel wool and the oxidation/combustion reactions occurring later.

Relates observation to original prediction.

Annotations (overview)

Communicates science ideas, methods and findings using appropriate language and representations.

Acknowledgment
ACARA acknowledges the contribution of trial teachers providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.