

# Science Inquiry Task

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## Level 5 Task A

### Detergent Investigation!

This task asks students to determine which detergent works best for cleaning dishes. Students will be challenged to decide on criteria and approaches to measuring the effectiveness of different detergents, and to design and conduct an investigation that controls for relevant variables. The inquiry skills of focus are, 'Planning and Conducting', 'Analysing and Evaluating', and 'Communicating'.



# Science Inquiry Assessment – An Introduction to the SIAs

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Science inquiry is increasingly recognised as a critically important aspect of a science education. Students need not only to be introduced to the concepts of science through which we understand the world, but also to the inquiry practices through which science has investigated and established this knowledge. For students to be literate in interpreting and using science in their lives, they need to be aware of how science operates. This is increasingly important in these times of unlimited access to social media and the fake news that can be promoted.

Often, with practical activities in science, the focus is on illustrating concepts without special attention to developing investigative practices. Even with activities where students develop their own inquiries or aspects of these, the particular inquiry practices are often neither independently focused on nor assessed, reducing the opportunity to systematically develop students' capabilities with inquiry.

These inquiry assessment tasks have three aims:

- 1. To help teachers and students clarify the meaning of different aspects of science inquiry practices; what these involve and how they might be recognised and assessed as a progression. They can help develop for teachers a language to discuss science inquiry practices and outcomes.*
- 2. To provide the tools for assessing student inquiry at different points in the primary years. These can be used to track student inquiry learning over time.*
- 3. To provide exemplar inquiry activities that can develop students' inquiry practices in contexts that engage their interest. These can be used to stimulate the development of further inquiry activities in a range of topics.*

## Using the tasks:

The tasks are designed to be used independently of curriculum units, matched to different year levels and covering a range of inquiry practices.

However:

- They can be matched to curriculum topics by utilising them flexibly at different year levels. Most could be adapted to focus on skills at higher or lower levels.*
- Tasks are designed to focus on three of the science inquiry skills. However, they can be adapted to focus on other skills and, depending on the assessment processes used, one or two skills might be of particular focus. For the Grade 6 tasks, rubrics are produced for all 5 inquiry skills but teachers would preferably choose from these rather than attempt to track them all.*
- Assessment can involve multiple data sources: field notes as students' work on tasks; notes on student productions; students' answers to questions; and presentations of group reports.*
- The tasks and advice to teachers assume that teachers interact with students to scaffold their inquiries but make judgments about the extent of support needed. Similarly, they are group tasks but students report individually, so that judgments need to be made about the role of each student in a group.*
- The tasks are designed around activities that are intrinsically captivating for students, but this depends on teachers constructing a narrative to bring these to life. For this, open questioning and introductory discussions to provide ways into the activity are important.*
- Teachers need to make judgments about the nature and specificity of the introductory discussions to support students to the point where they can productively engage with the tasks. The support for students may be at this whole class level, but during the tasks also tailored to particular students and groups so that ideally each student works at their own level. This support might be through targeted questioning, modelling, or suggestions and encouragement to pursue specific directions.*
- Prior to engaging with the tasks teachers need to be clear about its purposes and the levels of student inquiry practices that could be encouraged/engaged with. Students will of course come up with surprising and inventive ideas, and care should be taken to not constrain these possibilities.*

## Level 5 Task A: Detergent Investigation!

### Task Summary:

This task asks students to determine which detergent works best for cleaning dishes. Students will be challenged to decide on criteria and approaches to measuring the effectiveness of different detergents, and to design and conduct an investigation that controls for relevant variables. The inquiry skills of focus are, 'Planning and Conducting', 'Analysing and Evaluating', and 'Communicating'.

### Question for investigation:

How can we investigate which detergent is the best for cleaning dishes?

### Equipment list and preparation:

The list for this task is as follows:

	EQUIPMENT	DESCRIPTION
	Four different detergents	Ensure that they are all the same kind of detergent (similar concentration). You may like to choose at least one eco-friendly brand.
	A source of warm water	Not too hot. Department policy is for hot liquids in the classroom to not be hotter than 45 degrees
	Source of fatty/oily food	Such as Vegemite.
	Timer clock	Should be visible to the whole class. One suggestion is to project an online timer.
	Glasses or plastic cups	Four for each group of students.
	Popsicle sticks or plastic knives	To smear the food. Will need four per group of students.

### Conducting the task:

Included in the online materials are PowerPoint slides that can be used to introduce and guide the students through the assessment. Students perform the investigation in groups but report individually.

The experiment question should be derived and connected to everyday experiences of washing dishes. This investigation challenges students to think about how detergents act to clean, and what substances make good test cases for clean-up. More importantly, this investigation requires application of inquiry skills 'Planning and Conducting', 'Analysing and Evaluating', and 'Communicating'

Students design an experiment that investigates the question: *How can we investigate which detergent is the best for cleaning dishes?* Comparing eco-friendly vs normal detergents can add an extra dimension.

Students will need to think about how they will compare the four detergents – what is meant by 'best' in terms of cleaning – speed, or quality finish? Point out that vegemite will be used to test, and discuss why this might offer a good test (mainly their oil/fat content). Provide students with information about the relative cost of the detergents. Ask students to draw on their experience to think about which detergent might work best.

Instructions to students:

- *Carry out the investigation, record and analyse your data, and write a report showing your methods, your findings, and your conclusion.*
- *Talk with your group and discuss possible explanations for your findings and then explain your ideas using drawings, or writing, or demonstration.*

The following discussion points may help to guide students through some of the questions in their worksheets:

- Q1. *How can we investigate which detergent is the best for cleaning dishes? How will you compare detergents?*
- Q2. *Predict which detergent will be the best and why you think that.*

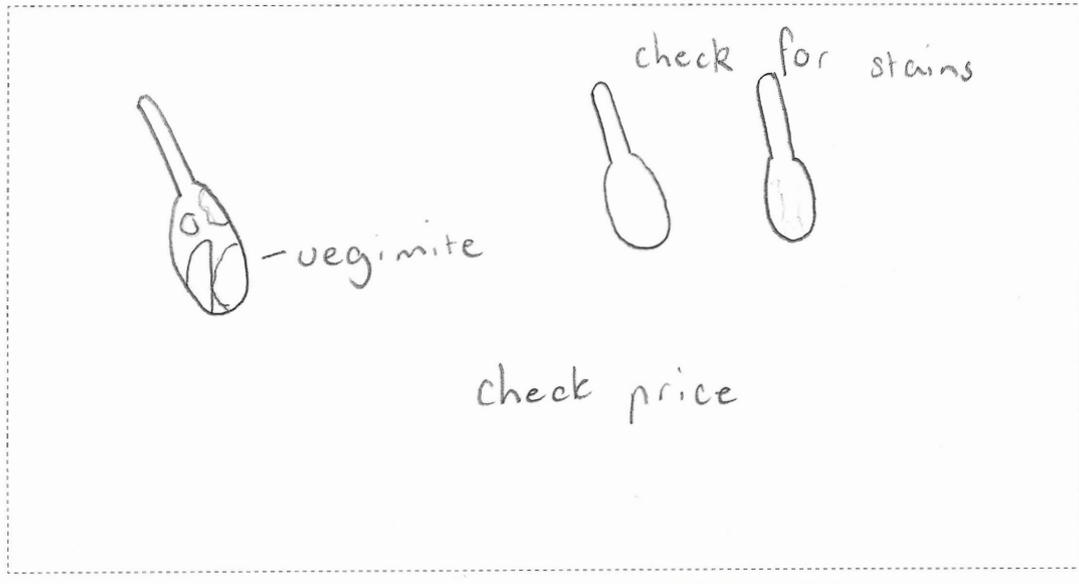
- Q3. *Design a procedure to compare the detergents — what will you measure? (using a thin film of the substance on the knife is preferable, to track the clean-up. The choice is between judging the quality of clean-up after a given number of stirs, or counting the number of stirs to remove the food). Consider using warm water (not hotter than 45 degrees).*
- Q4. *What will you keep the same in each case to make the test fair? (Amount of detergent, water, and temperature of the water, type of stirring, speed and number).*
- Discuss the strategy to be used to collect data. Elicit responses that discuss a table. Workshopping some ideas on the board is possible but dont direct.*
- Q5. *How to design a sheet to record and analyse results.  
Enable students to work through the final reflective questions.*
- Q6. *Design a graph or diagram to communicate the results.*
- Q7. *What is your conclusion? Which detergent is best at cleaning dishes? Comment on your prediction.*
- Q8. *Were your results similar to other groups? If not, what might have caused the differences?*
- Q9. *How could your investigation be improved, if you did it again?*

### Gathering evidence:

Verbal responses in groups or whole class; observation of and discussion with students planning and conducting the investigation and completing the table/graph, and the amount of support they need; the written report including an explanation. This task could assess three inquiry skills. They can be assessed using the following evidence: observation of student engagement with conducting the investigation, student interpretation of the data, their ability to represent what happened and draw conclusions, as well as their reflections. The following work samples provide examples of student achievement at three levels.

# Level 5 Task A: Student Work Samples

Design a procedure to compare the detergents- what will you measure? Use text and illustrations to explain your set-up.



**Low** Lacking detail

## Results

We recorded our results by-

Smell test

1. Palmolive
2. Morning fresh
3. Eco store
4. Earth choice.

Cleanest

1. Morning Fresh
2. Eco store
3. Palmolive
4. Earth choice

The stick smell

1. Morning fresh
2. Earth choice
3. Eco store
4. Palmolive

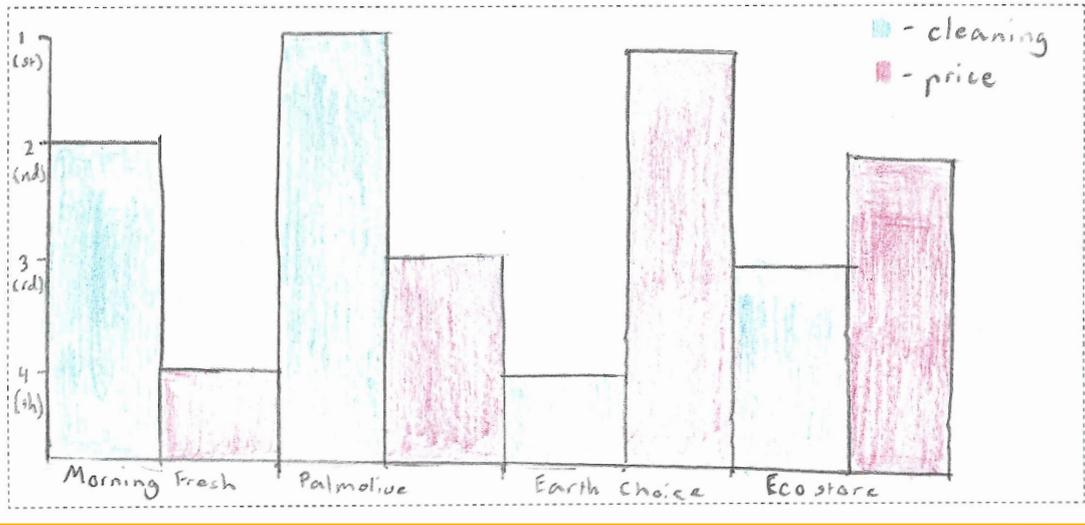
Morning Fresh  
MORNING FRESH



**Low-medium** Clear ranking of brands across criteria but no clear quantitative measure

**Representing the data**

Use a graph or other representation to show your results clearly, comparing the detergents.



**Medium** Clear representation of the ranking against two variables but has not plotted quantitative data.

**Results**

Rank	Detergent	Categories			Total
		Value	Smell	Speed	
4	Earth Choice	8	3	4	19 / 40
3	Eco Store	6	11	6	17 / 40
2	Palmolive	3	7	7	23 / 40
1	M. Fresh	1	9	9	10 / 40

**Medium-high** Clear representation of results using appropriate table conventions.

# Level 5 Task A: Detergent Investigation!

What is the best paper glue?

How can we compare which is best at glueing paper or craft?

## 1 Conducting the investigation

What might we mean by 'which detergent works best?'.

Predict which detergent will be the best, and worst, and why you think that.

Design a procedure to compare the detergents - what will you measure?

What will you keep the same in each case to make the test fair?

How will you record your results? Design a template to record and analyse your results.

Apart from how well they clean, are there other factors that might influence which detergent you would recommend to buy?

## 2 Reporting

How will you present your data?

### Your Equipment



Plastic popsicle sticks for smearing

Fact sheets showing the ingredients and cost of each brand of detergent



Fatty/oily food



## Level 5 Task A: Detergent Investigation!

### 3 Results

Was your prediction correct?

What is your conclusion? – which detergent works best?

Can you think about how detergents work to remove oil and grease?

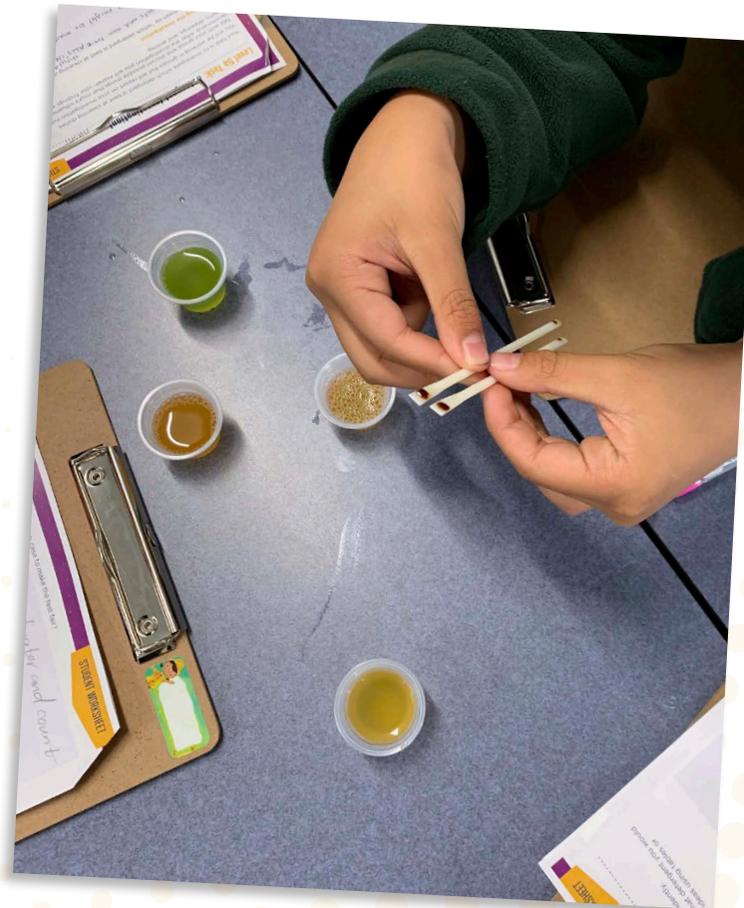


### 4 Reflection

Were your results similar to other groups?

What might have caused differences?

How could your investigation be improved if you did it again?



## Level 5 Task A: Detergent Investigation!

Name: \_\_\_\_\_

Your task is to investigate which detergent is the best for cleaning dishes?

You will be working in groups but will report on your investigation independently. Talk with your group and discuss ideas about what influences detergents ability to clean. After the investigation you will explain your findings and ideas using tables or graphs, drawings, and writing.

### Conducting the investigation

Q1. How can we investigate which detergent is the best for cleaning dishes? How will you compare detergents?

Q2. Predict which detergent might be the best and explain why you think that. This is your hypothesis.

Q3. Design a procedure to compare the detergents – what will you measure? Use text and illustrations to explain your set-up.

Q4. What will you keep the same in each case to make the test fair?

**Results**

Q5. Design a table to use to record your results.

**Analysing and communicating the results**

Q6. Design a graph or diagram to communicate your results.

**Conclusion**

Q7. What is your conclusion? Which detergent is best at cleaning dishes? Comment on your prediction.

**Evaluation**

Q8. Were your results similar to other groups? If not, what might have caused differences?

Q9. How could your investigation be improved, if you did it again?

# Group Scoring Template

Choose the appropriate outcome/s to focus your assessment on. It may be possible to assess three outcomes for some students or you may choose to use two or one outcome to assess the entire class.  
*Suggested use:* student initials and notes can be recorded in the space for each outcome/level.

Victorian Curriculum Level 5-6		
Approaching (3-4)	Achieved (5-6)	Exceeded (7-8)
<b>Planning &amp; Conducting</b>		
<p>Suggest ways to plan and conduct investigations to find answers to questions, including consideration of the elements of fair tests.</p> <p>Safely use appropriate materials, tools, equipment and technologies.</p> <p><i>4: Actively contributes to discussions on planning the investigation and measurement processes.</i></p>	<p>With guidance, plan appropriate investigation types to answer questions or solve problems and use equipment, technologies and materials safely, identifying potential risks.</p> <p>Decide which variables should be changed, measured and controlled in fair tests and accurately observe, measure and record data.</p> <p><i>6: Takes an active role in design with consideration of variable control and data recording. This includes articulating the nature of the measure and control of stirring, temperature, amount of detergent and water, smearing of vegemite.</i></p> <p><i>5: Does this under guidance.</i></p>	<p>Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</p> <p>In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task.</p> <p><i>7: Operates independently to plan and conduct, efficiently controlling variables and comparing the detergents.</i></p>
<b>Analysing &amp; Evaluating</b>		
<p>Compare results with predictions, suggesting possible reasons for findings.</p> <p>Reflect on an investigation, including whether a test was fair or not.</p> <p><i>4: Identifies which variables were controlled adequately and suggests causes for results.</i></p>	<p>Compare data with predictions and use as evidence in developing explanations.</p> <p>Suggest improvements to the methods used to investigate a question or solve a problem.</p> <p><i>6: Uses tables and graphs to compare detergents. Uses scientific ideas and representations to interpret/explain findings. Suggests limitations to data and ways of improving design.</i></p> <p><i>5: Does this under guidance.</i></p>	<p>Use scientific knowledge and findings from investigations to identify relationships, evaluate claims and draw conclusions. Reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected, and identify improvements to the method.</p> <p><i>7: Uses tables and graphs to convincingly compare detergents.. Uses abstract scientific ideas to interpret findings and suggests and explains limitations to the findings and ways of improving the investigation.</i></p>

# Group Scoring Template (cont.)

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## Communicating

Represent and communicate observations, ideas and findings to show patterns and relationships using formal and informal scientific language.

*4: Uses scientific language to describe patterns in data, and suggests reasons for these.*

Communicate ideas and processes using evidence to develop explanations of events and phenomena and to identify simple cause-and-effect relationships.

*6: Develops explanations based on scientific ideas (e.g. detergent capturing or absorbing grease) and relates these to the data.*

*5: Does this with prompting.*

Communicate ideas, findings and solutions to problems including identifying impacts and limitations of conclusions and using appropriate scientific language and representations.

*7: Develops explanations and communicates these through a range of data and visual representations.*



