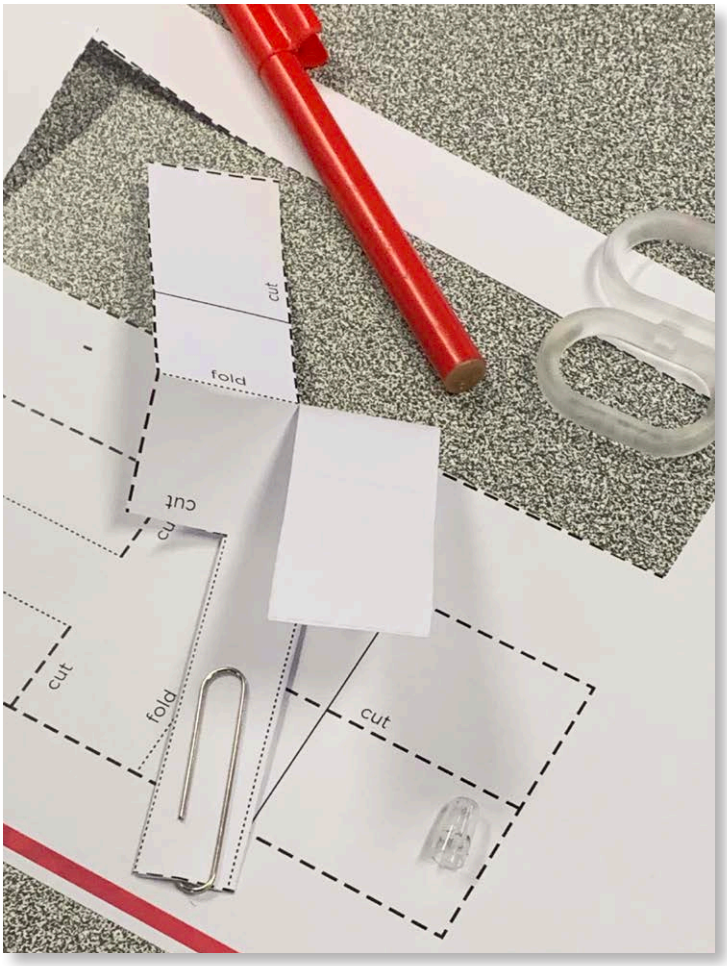
Science Inquiry Task

Level 6 Task A
Wonderful Whirlybirds!

Students will be assessed on their ability to plan and conduct a controlled, fair investigation that allows them to determine how they can alter a whirlybird so that it drops more slowly. Students will be required to process and evaluate their data, and explain their results. This task addresses all five inquiry skills, with the intention of offering the flexibility to focus on the skills that are pertinent to individual classes and assessment requirements.



Science Inquiry Assessment – An Introduction to the SIAs

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 6 Task A: Wonderful Whirlybirds!

Task Summary:

Students will be assessed on their ability to plan and conduct a controlled, fair investigation that allows them to determine how they can alter a whirlybird so that it drops more slowly. Students will be required to process and evaluate their data, and explain their results. This task addresses all five inquiry skills, with the intention of offering the flexibility to focus on the skills that are pertinent to individual classes and assessment requirements.

Question for investigation:

How can we investigate the factors affecting the speed of a whirlybird?

Equipment list and preparation:

To complete this task, each group of students will need:

- ☐ A stopwatch or other timing device
- ☐ A set of the whirlybird templates
- ☐ Paper clips
- ☐ Scissors

Conducting the task:

Included in the materials on-line is a power point slide 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 connected to everyday experiences. The context is 'air and flight', and in particular the forces of air and gravity on a whirlybird's flight.

The teacher should demonstrate the construction of the whirlybird using the template, and students should each make one (using the pattern, and one or two paper clips) and try it. Each group should keep one of these as a control whirlybird. They should then engage in a discussion about what factors might affect the way the whirlybird falls. A list could be put on the board, from which each group chooses one feature (such as wing length, number of paperclips, body length) to investigate how they can alter this to make the whirlybird drop more slowly. Discourage suggestions that involve complex and uncontrolled changes that will not allow comparison.

Students are asked to formulate a research question concerning the effect of their chosen feature (e.g. does a whirlybird's wing size effect its speed of fall?)

The following questions may help to guide students through their investigation and align with some of the questions in their worksheet:

Q1.a What factors do you think affect the flight of the whirlybird?

Q1.b What might you change to make the whirlybird drop more slowly? Write a question you will investigate.

Q2. Why do you think this will affect the whirlybird flight? (your hypothesis)

Q3. Design a procedure to test your idea. What will you measure?

Q4. What things will you keep the same, to make the test fair?

Q5. How will you record your results? Design a template to use to write down your results.

Q6. Carry out the investigation and record the results in the sheet you designed, and write a report showing your methods, your findings, and your conclusion.

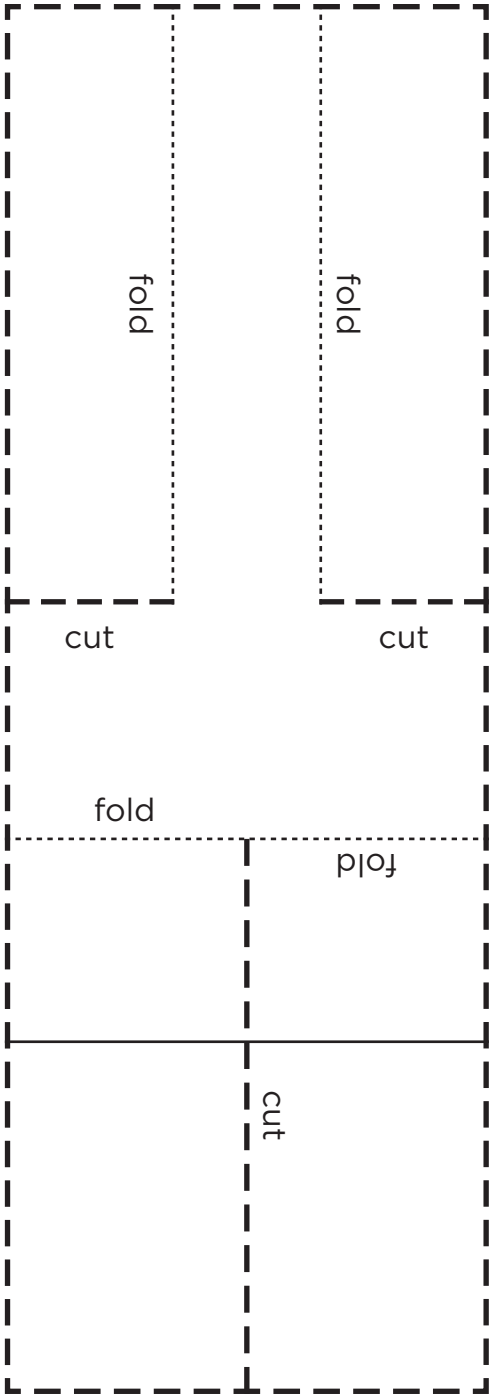
Talk with your group and discuss possible explanations for your findings and then explain your ideas using drawings, or writing, or demonstration.

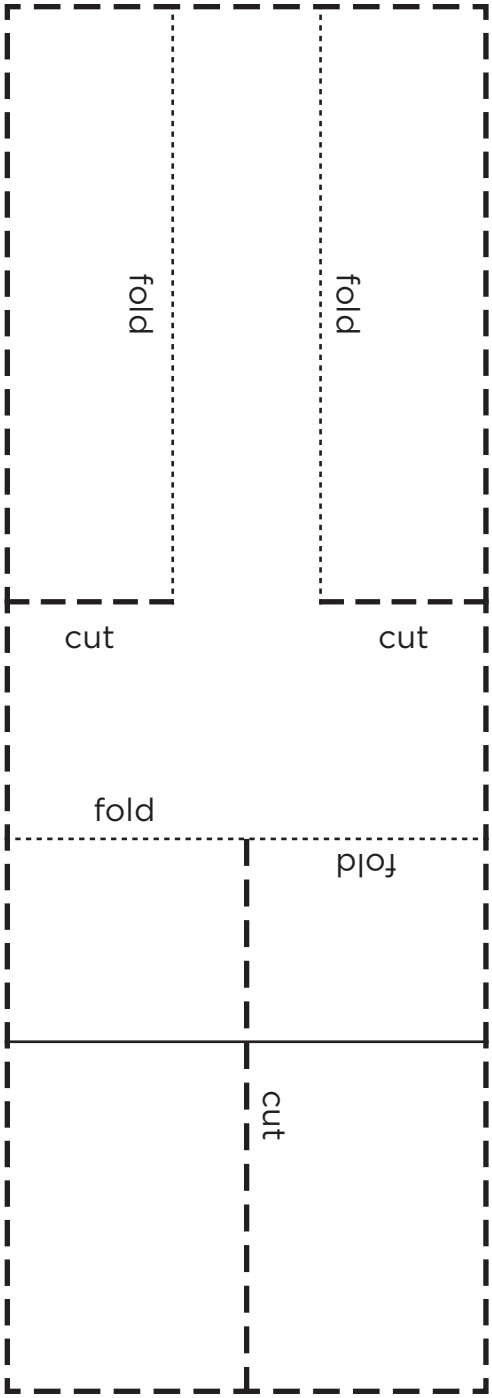
Gathering evidence:

Verbal responses in groups or whole class; observation of and discussion with students planning and conducting the investigation and completing the table and graph (e.g. are they careful to control the drop height, and timing technique? Can they explain their hypothesis?), and the amount of support they need; the written report including an explanation.

Level 6 Task A: Wonderful Whirlybirds!

This is the template to be used by students to conduct the investigation. Each student will need one copy of this or more.



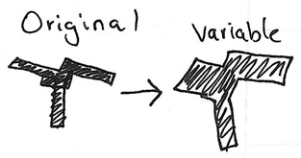


Level 6 Task A: Student Work Samples

Why do you think this will affect the whirlybird flight? This is your hypothesis. Use diagrams if it will help you explain your answer.

I am going to ~~t~~ make the whirlybird fall slower by ~~adding~~ widening the ~~WB~~ blades. We have decided to do this because we think the wider the blades, the more air it catches and the slower it drops.

Design a procedure to test your idea. What will you measure?



- We will widen the blades of the WB
- We will measure how long it takes to drop the ground.

What things will you keep the same, to make the test fair?

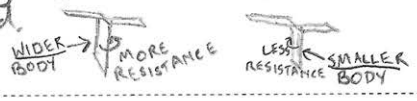
We will keep the original design the same, so we can compare the differences easily.

Low-medium Attempts scientific explanation but is lacking detail about fair testing.

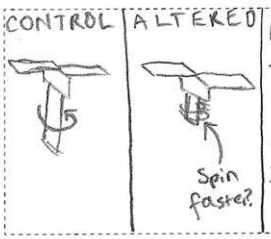
Why do you think this will affect the whirlybird flight? This is your hypothesis. Use diagrams if it will help you explain your answer.

OUR HYPOTHESIS

We think that making the body smaller will make it fall slower because it will take weight off the whirly bird, making it lighter, and it will make slightly less resistance in the spin of the whirlybird.



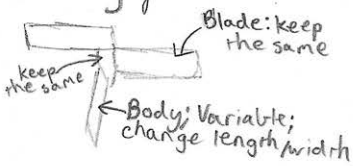
Design a procedure to test your idea. What will you measure?



Measure:
- height of drop (same)
- length of blade (same)
- length of body (variable)
- width of body (variable)
- time taken for Control
- time taken for Altered

What things will you keep the same, to make the test fair?

We will keep the following factors the same;
- length of blade
- height of drop
- material used



Medium-high Have considered scientific ideas and attended to variable control, using clear diagrams.

Level 6 Task A: Wonderful Whirlybirds!

What factors do you think affect the flight of the whirlybird?
What change can you make to a whirlybird so that it drops more slowly?
What is your reasoning?

1 Conducting the investigation

What question are you investigating?

Why do you think this will affect the whirlybird flight?
This is your hypothesis.

What will you measure?

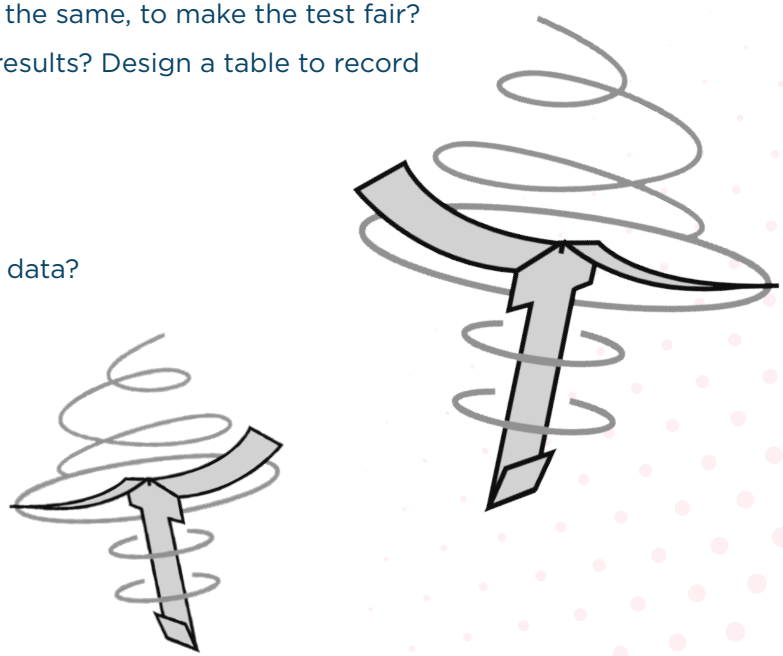
Design a procedure to test your idea.

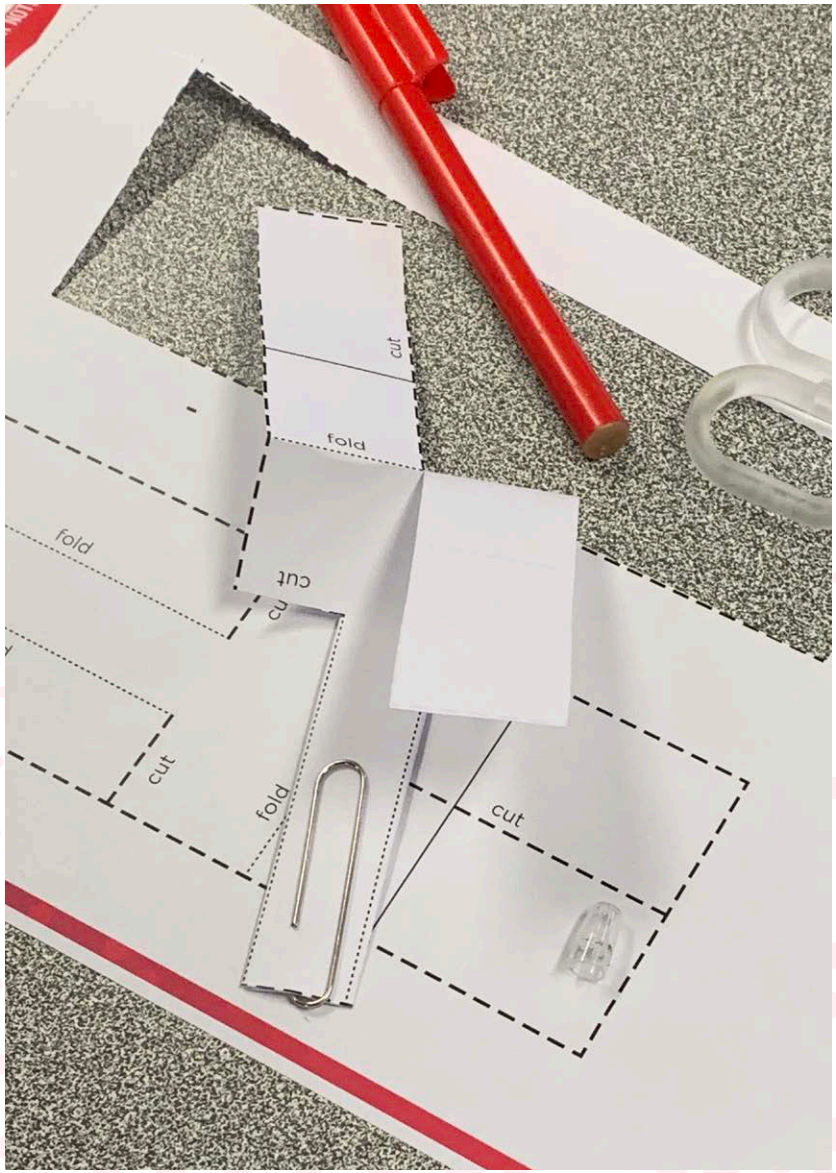
What things will you keep the same, to make the test fair?

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

2 Reporting

How will you present your data?





Level 6 Task A: Wonderful Whirlybirds!

3 Results

Was your prediction correct?

What is your conclusion? — which detergent works best?

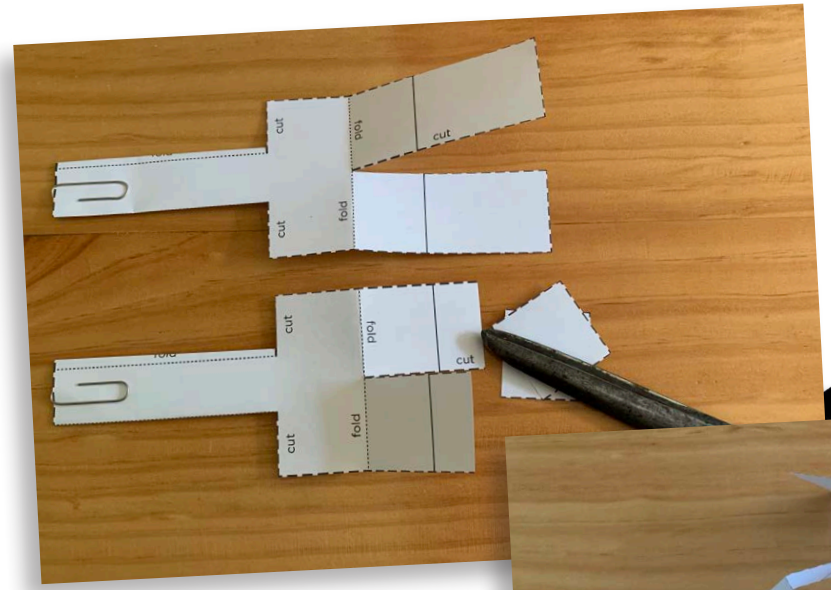
Can you think about how detergents work to remove oil and grease?

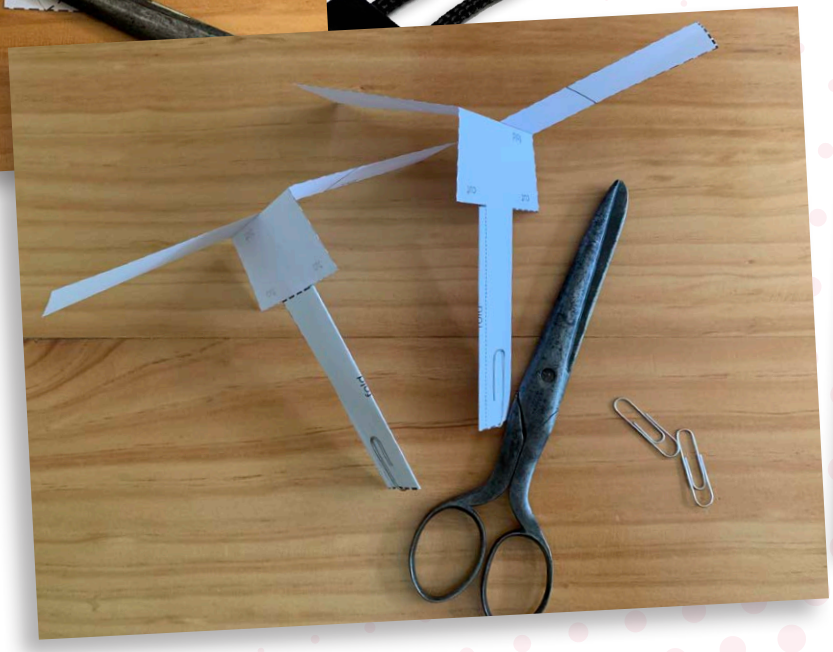
4 Reflection

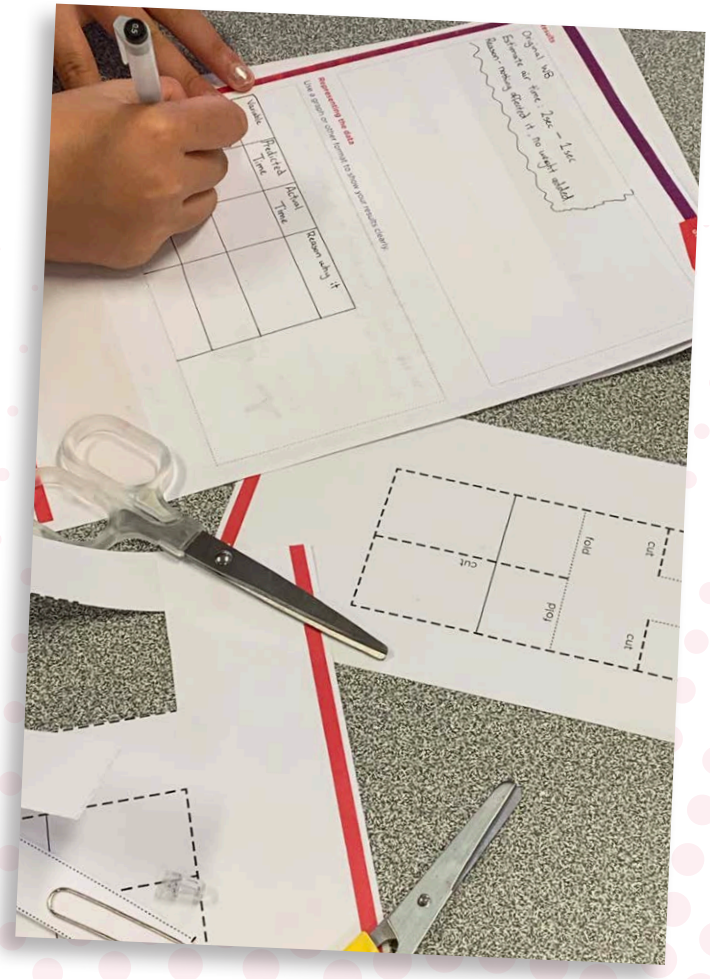
Were your results similar to other groups?

What might have caused differences?

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







STUDENT WORKSHEET

Level 6 Task A: Wonderful Whirlybirds!

Name:

Your task is to make a change to the design of a whirlybird so that it drops more slowly.

You will be working in groups but will report on your investigation independently.

Talk with your group and discuss possible ways of slowing the whirlybird drop time, and then explain your ideas using drawings, or writing, or demonstration.

Conducting the investigation

Q1. What question are you investigating?

Q2. Why do you think this will affect the whirlybird flight? This is your hypothesis. Use diagrams if it will help you explain your answer.

Q3. Design a procedure to test your idea. What will you measure?

Q4. What things will you keep the same, to make the test fair?

Results

Q5. Design a table 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? Did your idea affect the flight of the whirlybird, and why? Comment on your prediction.

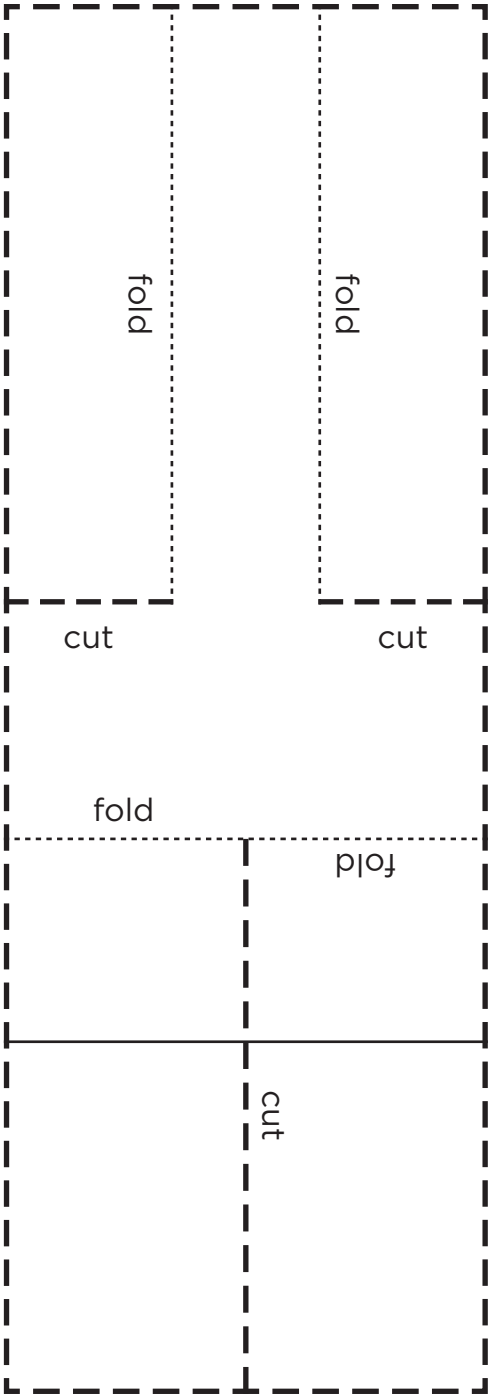
Evaluation

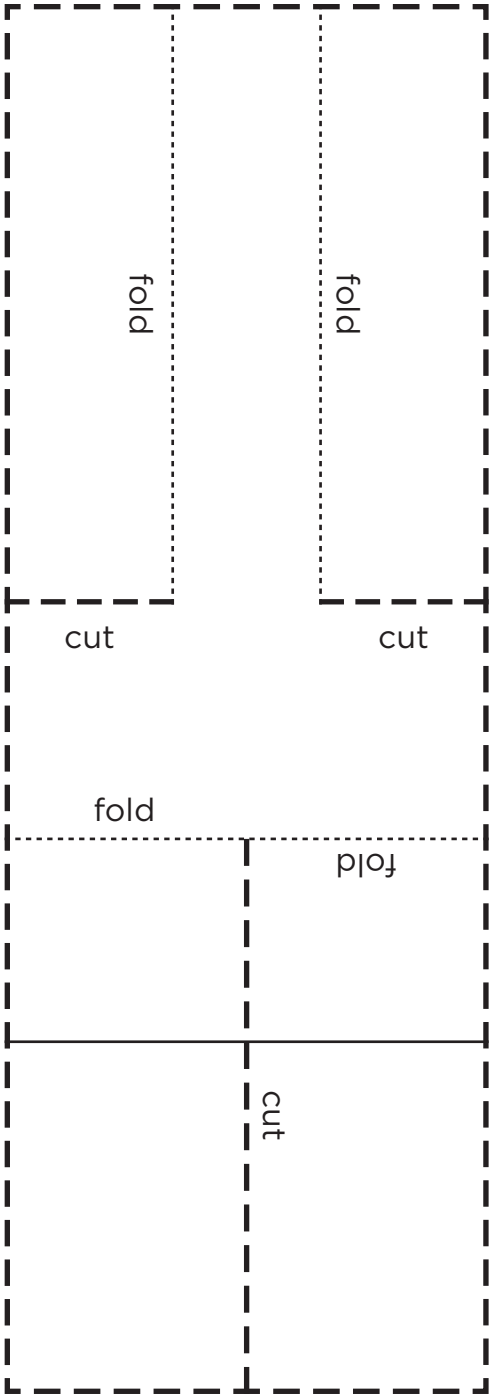
Q8. Were your results similar to other groups? Were there other factors that made the whirlybird fly slower?

Q9. Why do these factors cause differences in whirlybird flight times?

Q10. How could your investigation be improved, if you did it again?

Level 6 Task A: Wonderful Whirlybirds!





Group Scoring Template

All 6 inquiry outcomes have been developed for you, so that you can 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)**
Questioning & Predicting		
With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge. *4: Selects appropriate questions and investigative processes from options arising from discussion.*	With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be based on previous experiences or general rules. *6: With guidance, formulates testable hypotheses concerning whirlybird flight, drawing on scientific reasoning.* *5: Does this with support.*	Identify questions, problems and claims that can be investigated scientifically and make predictions based on scientific knowledge. *7: Independently formulates testable questions and hypotheses, reasoning on the basis of scientific ideas.*
Planning & Conducting		
Suggest ways to plan and conduct investigations to find answers to questions, including consideration of the elements of fair tests. Safely use appropriate materials, tools, equipment and technologies. *4: Actively contributes to discussions on planning the investigation and measurement processes.*	With guidance, plan appropriate investigation types to answer questions or solve problems and use equipment, technologies and materials safely, identifying potential risks. Decide which variables should be changed, measured and controlled in fair tests and accurately observe, measure and record data. *6: Takes an active role in the investigative design with consideration of variable control and reliable data recording..* *5: Does this under guidance.*	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. *7: Actively and imaginatively participates in investigative design and implementation, controlling for a range of variables including height of drop, timing approaches, control of whirlybird features. Ensures accurate data.*

Group Scoring Template (cont.)

Recording & Processing		
Use formal measurements in the collection and recording of observations. Use a range of methods including tables and column graphs to represent data and to identify patterns and trends. *4: Constructs, with guidance, data representations such as tables, mean drop times, and explanations of findings.*	Construct and use a range of representations, including tables and graphs, to record, represent and describe observations, patterns or relationships in data. *6: Uses tables and graphs to identify and processe patterns of flight times, and describes these efficiently in words and drawings.* *5: Does this under guidance.*	Construct and use a range of representations, including graphs, keys and models, to record and summarise data from students' own investigations and secondary sources, and to represent and analyse patterns and relationships. *7: Independently constructs representations of flight times using tables and graphs and processes these to establish meaningful patterns. Efficiently records whirlybird features, with annotations, to help analyse findings.*
Analysing & Evaluating		
Compare results with predictions, suggesting possible reasons for findings. *Reflect on an investigation, including whether a test was fair or not.* *4: Identifies which variables were controlled adequately and suggests causes for results.*	Compare data with predictions and use as evidence in developing explanations. Suggest improvements to the methods used to investigate a question or solve a problem. *6: Uses scientific ideas and representations to interpret/explain findings. Suggests limitations to data based on experimental design, and suggests improvements in processes..* *5: Does this under guidance.*	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. *7: Uses abstract scientific ideas to interpret findings and suggests limitations to this and ways of improving the investigation.*

Group Scoring Template (cont.)

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 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.*

Class Grid

	Victorian Curriculum Level 5–6								
	Questioning & Predicting			**Planning & Conducting**			**Recording & Processing**		
Student Name	**Approaching (3–4)**	**Achieved (5–6)**	**Exceeded (7–8)**	**Approaching (3–4)**	**Achieved (5–6)**	**Exceeded (7–8)**	**Approaching (3–4)**	**Achieved (5–6)**	**Exceeded (7–8)**
	With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge. *4: Selects appropriate questions and investigative processes from options arising from discussion.*	With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be based on previous experiences or general rules. *6: With guidance, formulates testable hypotheses concerning whirlybird flight, drawing on scientific reasoning.* *5: Does this with support.*	Identify questions, problems and claims that can be investigated scientifically and make predictions based on scientific knowledge. *7: Independently formulates testable questions and hypotheses, reasoning on the basis of scientific ideas.*	Suggest ways to plan and conduct investigations to find answers to questions, including consideration of the elements of fair tests. Safely use appropriate materials, tools, equipment and technologies. *4: Actively contributes to discussions on planning the investigation and measurement processes.*	With guidance, plan appropriate investigation types to answer questions or solve problems and use equipment, technologies and materials safely, identifying potential risks. Decide which variables should be changed, measured and controlled in fair tests and accurately observe, measure and record data. *6: Takes an active role in the investigative design with consideration of variable control and reliable data recording..* *5: Does this under guidance.*	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. *7: Actively and imaginatively participates in investigative design and implementation, controlling for a range of variables including height of drop, timing approaches, control of whirlybird features. Ensures accurate data.*	Use formal measurements in the collection and recording of observations. Use a range of methods including tables and column graphs to represent data and to identify patterns and trends. *4: Constructs, with guidance, data representations such as tables, mean drop times, and explanations of findings.*	Construct and use a range of representations, including tables and graphs, to record, represent and describe observations, patterns or relationships in data. *6: Uses tables and graphs to identify and processe patterns of flight times, and describes these efficiently in words and drawings.* *5: Does this under guidance.*	Construct and use a range of representations, including graphs, keys and models, to record and summarise data from students' own investigations and secondary sources, and to represent and analyse patterns and relationships. *7: Independently constructs representations of flight times using tables and graphs and processes these to establish meaningful patterns. Efficiently records whirlybird features, with annotations, to help analyse findings.*

Class Grid (cont.)

	Questioning & Predicting	Planning & Conducting	Recording & Processing

Class Grid (cont.)

Student Name	Victorian Curriculum Level 5–6					
	Analysing & Evaluating			Communicating		
	Approaching (3–4)	**Achieved (5–6)**	**Exceeded (7–8)**	**Approaching (3–4)**	**Achieved (5–6)**	**Exceeded (7–8)**
	Compare results with predictions, suggesting possible reasons for findings. *Reflect on an investigation, including whether a test was fair or not.* *4: Identifies which variables were controlled adequately and suggests causes for results.*	Compare data with predictions and use as evidence in developing explanations. Suggest improvements to the methods used to investigate a question or solve a problem. *6: Uses scientific ideas and representations to interpret/explain findings. Suggests limitations to data based on experimental design, and suggests improvements in processes.* *5: Does this under guidance.*	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. *7: Uses abstract scientific ideas to interpret findings and suggests limitations to this and ways of improving the investigation.*	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 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.*

Class Grid (cont.)

	Analysing & Evaluating	Communicating