The Fair Test Lab: Paper helicopters

SNC1W, Unit 1: Thinking Like a Scientist, Lesson 4. 75 minutes. Teacher lesson plan.

Lesson at a glance

A fair test lets the data speak. When we change one variable, control the rest and repeat our trials, we can say with confidence what caused the result.

What students do: Students build paper helicopters and test how wing length affects fall time. They write a hypothesis, control variables, run three trials for each wing length, calculate averages, graph the results and write a conclusion using the lab report structure they will use all year.

Curriculum expectations

Code	Students will…
A1.2	apply a scientific experimentation process and associated skills to conduct investigations, making connections between their observations and findings and the scientific concepts they are learning
A1.5	apply their knowledge and understanding of safe practices and procedures, including the Workplace Hazardous Materials Information System (WHMIS), while planning and carrying out hands-on investigations
A1.4	apply coding skills to investigate and to model scientific concepts and relationships

From The Ontario Curriculum, Grade 9: Science, De-streamed (SNC1W), 2022. A = STEM Skills, Careers, and Connections; B = Biology; C = Chemistry; D = Physics; E = Earth and Space Science.

Learning goals and success criteria

Learning goals	Success criteria
• We are learning to carry out a fair test safely. • We are learning to write a lab report conclusion.	• I can follow a procedure safely. • I can collect and record data for three trials. • I can calculate averages and graph my results. • I can write a conclusion that uses my data.

Materials and preparation

- **Slides:** The Fair Test Lab deck.
- **Handouts:** Helicopter Lab (page 1), Results and Conclusion (page 2). Lab report template (Lab Skills Kit).
- **Per group:** Template strips of paper (or plain paper, ruler and scissors), one paper clip, a stopwatch or phone timer, a metre stick.
- **Space:** A clear area with a safe 2 m drop height: the teacher holds the helicopter from a secure step stool, or use a stairwell landing with permission.

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- **Safety:** Students do not stand on chairs, desks or stools. Carry scissors pointing down. Keep the drop area clear.

Lesson sequence

Time (min)	Part	Teacher	Students	Look for
0–10	**Hook**	Drop two helicopters.	Predict.	
10–20	**Plan**	Hypothesis and variables.	Write.	IV and DV correct.
20–45	**Build and test**	Four wing lengths, three trials each.	Collect data.	Same drop height, timer method.
45–55	**Averages**	Calculate.	Average.	
55–70	**Graph and conclude**	Lab report model.	Write.	Conclusion uses data.
70–75	**Exit**	Exit ticket.	Answer.	

Differentiation

- **Support:** Pre-cut helicopters with wing lengths marked.
- **ELL:** Conclusion frame: “As the ___ increased, the ___ …”
- **Challenge:** Predict the fall time for a 12 cm wing, then test your prediction.

Assessment

Type	Tool	Purpose
Assessment for learning	Helicopter Lab and Results and Conclusion	Experimentation process (A1.2) and safe practices (A1.5)

Helicopter lab: worked averages

- **4 cm:** (1.38 + 1.45 + 1.43) ÷ 3 = 4.26 ÷ 3 = 1.42 s
- **6 cm:** (1.70 + 1.75 + 1.68) ÷ 3 = 5.13 ÷ 3 = 1.71 s
- **8 cm:** (1.98 + 1.91 + 1.96) ÷ 3 = 5.85 ÷ 3 = 1.95 s
- **10 cm:** (2.15 + 2.08 + 2.13) ÷ 3 = 6.36 ÷ 3 = 2.12 s
- **Conclusion:** As wing length increased from 4 cm to 10 cm, average fall time increased from 1.42 s to 2.12 s. This supports the hypothesis: longer wings catch more air, so there is more air resistance to slow the fall.

Teacher notes

- Safety: Only the teacher (or a supervised adult) stands on a secure step stool. Students time and record from the floor. Keep a clear landing zone and walkways.

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- Check that every student has a signed safety contract before this lab.
- To build a helicopter: cut a strip about 4 cm wide and 20 cm long. Cut down the middle from the top to make two wings of the chosen length; fold one forward and one back. Fold the bottom up once and add a paper clip.
- The sample data set is original. Real class data will vary; the pattern (longer wings, longer fall time) usually holds up to about 10 cm.

Coming up

Lesson 5, Research Like a Scientist.

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