Investigate and Innovate with CSIRO

Sun Protection

Year level: Years 5-6, Years 7-8, 9-10
Duration: Teacher specified
Core concepts: Sunscreen, Ultraviolet (UV) radiation protection and surface area

Teacher guide

Acknowledgement of Country

CSIRO acknowledges the Traditional Owners of the lands, seas and waters of the area that we live and work on across Australia. We acknowledge all Aboriginal and Torres Strait Islander peoples and their continuing connection to their culture and pay our respects to Elders past and present. CSIRO is committed to reconciliation and recognises that Aboriginal and Torres Strait Islander peoples have made contributions to all aspects of Australian life including culture, economy and science.

'Eternal Wisdom, Infinite Innovation'
artwork by Rachael Sarra, working with Gilimbaa.

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Overview

Safety considerations:

- It is recommended to hold a class discussion regarding the possible risks and mitigation strategies prior to starting the activity.
- Appropriate PPE should be worn during this activity.
- According to the Cancer Council Australia when working outside:
    - **SLIP** on clothing that covers your shoulders, arms and legs. This is one of the most effective ways to protect your skin.
    - **SLOP** an SPF50+ broad-spectrum, water-resistant sunscreen to create a barrier between UV and your skin.
    - **SLAP** on a SunSmart hat to protect your face, ears and neck.
    - **SEEK** shade whenever you can. Shade alone can reduce UV exposure by up to 75%.
    - **SLIDE** on sunglasses to reduce UV exposure to your eyes.

Key learning goals:

Slide 3 in Sun Protection Classroom PowerPoint Presentation.

CSIRO research:

- CSIRO media: Barrier reef corals deliver world first for sunscreen
- CSIRO YouTube: Making sunscreen with Great Barrier Reef coral

Associated documents: Investigate and Innovate with CSIRO webpage

- Sun Protection- Student Workbook
- Sun Protection- Classroom PowerPoint Presentation (PPT)
- Australian Curriculum and Syllabus links and rubrics

Icons:

Throughout the investigation you will see these icons (*below*) to highlight the type of activity and guidance recommended.

What is the LIA Framework?

The Australian Academy of Science Education Launch, Inquire, Act (LIA) framework helps us structure scientific investigations so that students:

- **Launch** by exploring and connecting to real-world phenomena,
- **Inquire** by investigating and analysing questions, and
- **Act** by applying, communicating and reflecting on our findings.

It's a way to learn science like real scientists do!

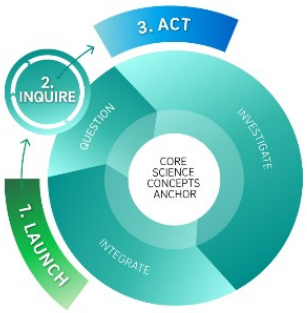

Figure 1 LIA Framework from the Australian Academy of Science.

PHASE 1: LAUNCH	**Purpose:** get curious, connect to the world, and ask a great question. **What you'll do:** Explore a phenomenon or scenario. Think about your own experience and ask: "What's going on here?". Identify what you already know and what you wonder about. Discuss why the topic matters. **Key questions:** • What do I see or experience? • What might be happening? • Why is this important?	Launch
PHASE 2: INQUIRE	**Purpose:** design and carry out an investigation to answer your question. **What you'll do:** Formulate a testable question. Plan your investigation: decide variables, controls, method. Collect data (measure, record, repeat). Graph and analyse results to spot trends or patterns. **Key questions:** • What variables will I change, and what will I measure? • How will I make it fair? • What do my results show?	Inquire
PHASE 3: ACT	**Purpose**: use your findings to communicate, reflect, and apply to the real world. **What you'll do:** Draw conclusions based on your evidence. Reflect on your method: what worked, what could you improve? Apply your understanding: how does your investigation link to real-life scientific research or technology? Share your findings through a poster, presentation, or video. **Key questions:** • What did I learn and why does it matter? • How could I do better next time? • How can this knowledge be used in the real world?	Act

Scientific Inquiry Continuum

The Scientific Inquiry Continuum describes the progression from teacher-directed to student-directed investigation. It supports educators in scaffolding investigation experiences so that students gradually develop the skills and confidence to think, question, and work like scientists.

This continuum is referenced throughout the investigation to help teachers identify the level of inquiry embedded in each activity. Educators are encouraged to move flexibly along the continuum based on students' prior knowledge, readiness, and learning context.

To explore the concept further, please complete 'The Power of Inquiry and Explicit Teaching: A Dual Approach to Teaching and Learning' e-Module linked here.

Scientific Inquiry Continuum

Limited Inquiry

Also referred to as closed or confirmation, can be used for novice learners that may need more structure and scaffolding when introducing new learning concepts. The teacher provides the question(s), method(s), and expected results. Students confirm known principles through structured activities.

Structured Inquiry

Ideal for learners who can manage investigations with guidance. The teacher provides the question and method, but students collect and interpret their own data to reach conclusions

Guided Inquiry

Supports students developing independence and ownership of their learning. Promoted higher order thinking and critical analysis. The teacher provides the question(s), but students design and carry their own methods, collect data and draw conclusions.

Open Inquiry

Student designed and are highly successful once students are proficient in managing independent learning or when a concept needs to be extended for students beyond the key outcomes.

The slides and activities throughout this investigation are labelled with icons that indicate the corresponding inquiry stage. These markers are intended as a guide only. Please use professional judgment to adapt, combine, or re-sequence activities to suit the learners and curriculum goals.

Classroom PowerPoint (PPT) presentation guide

In the PPT, activities correspond with a specific stage or stages of the Scientific Inquiry Continuum and the Australian Academy of Science Education Launch, Inquire, Act (LIA) Framework to guide teachers and students through Sun Protection investigations.

Consult the equipment lists (Investigation #1: Body surface area– Page 9, Investigation #2: Sunscreen types– Page 19) provided in each investigation and adjust resource quantities according to student or group numbers.

Inquiry and Framework stages	**Slide #** *Classroom PowerPoint Presentation (PPT)* **Page #** *(Student Workbook)*	**Teacher guidance**	**Student guidance**
	Slide 2 **Page 3**	Teacher reference slide – Scientific Inquiry Continuum, LIA Framework and icon explanation.	Student reference sheet – Launch, Inquire, Act (LIA) framework and icon explanation.
	Slide 3	Learning Objectives – each colour represents the stage of the Scientific Inquiry Continuum.	
Limited, Structured, Guided - Launch	**Slide 4** **Page 4**	*Launch phase – Formative assessment* - Lead the initial discussion on 'Sun Protection' by encouraging a whole class discussion, think-pair-share and independent recording of prior knowledge on Page 4.	*Launch phase* - Students record initial thoughts/prior knowledge in workbook. Refer to Page 3 to explore 'Launch Phase' in more detail, if required.
	Slides 5-8	Explore the ways we protect a range of household items and animals from the sun through a whole-class discussion. Record initial thoughts on the board. Refer to presenter notes for discussion starters.	Participate in whole-class discussion.

	Slide 9 **Page 5**	*Formative assessment* – Guide students to complete the 'Sun Protection' pre-investigation knowledge assessment on Page 5. Students will then complete the same activity at the end of the investigation to compare their knowledge. Possible answers can be found in the Classroom Presentation presenter notes.	Complete Page 5 'sun protection.' 'Attempt 1' at the beginning of the investigation and 'Attempt 2' at the end of the investigation.
	Slide 10 **Page 6**	*Formative assessment* – Explore the relationship between the Earth and the sun, and how the position of the sun determines the seasons throughout a year. Identify the importance of the tilt of Earth on its axis in relation to the amount of solar radiation being projected on Earth. Pose the questions to the students (Questions are found in the presenter notes) and instruct the students to complete the labelling activity on Page 6. ***Answers*** can be found on Slide 47 of the classroom presentation.	Students label the diagram on Page 6.
	Slide 11 **Page 7**	Watch the video, 'Taking barrier reef coral sunscreen to the world." Refer to presenter notes for discussion questions.	Watch the video about 'Taking Barrier reef coral sunscreen to the world'.
Limited, Structured, Guided – Inquire	**Slide 12** **Page 3**	*Inquire Phase* – Explain the purpose of the inquire phase to design and carry out an investigation to answer the focus question.	Refer to Page 3 to explore the 'Inquire Phase' in more detail, if required.
	Slide 13-14 **Page 7**	Explore the different types of Ultraviolet (UV) light and UV index. Watch the video as a class: UV radiation: WHO's Science in 5. Discuss the 'Solar Radiation' diagram (Slide 14). Please refer to the presenter notes in Slide 14 for discussion notes.	Students use reputable sources to research the different types of UV radiation to complete the 'Compare and Contrast' activity on page 7.

		Students then complete the 'Compare and Contrast' activity on Page 7 using other resources to research (internet, textbooks etc.). **Note:** The compare and contrast page is a foldable activity. Students can follow the instructions to construct the foldable and glue into their workbooks. Students can use the following website to see what the UV radiation index is around Australia and Antarctica: https://www.arpansa.gov.au/our-services/monitoring/ultraviolet-radiation-monitoring/ultraviolet-radiation-index	
	Slides 15-18 **Pages 8-14**	Guide students to complete the **investigation #1 – Body surface area.** **Note:** Instructions can be found on the respective slides and pages for each investigation. Start with the general sun protection starter questions on Slide 15 and discuss as a class. Guide students to complete the Investigation #1: Body surface area questions on Page 8 in their Student Workbook. **Part 1: Eyeball measuring** Guide students through the newspaper surface area pre-investigation on Slide 16 of the Classroom PPT and Page 9 in the Student Workbook. **Part 2: Calculate the surface area of this rectangular humanoid** Students can then calculate the body surface area of the humanoid on Slide 17 and Page 10. **Note:** The measurements are approximations and hidden faces of the objects are not subtracted e.g. neck to torso. ***Answers*** can be found on Slide 48 of the classroom presentation. **Part 3: A better model** In groups, students will now calculate the surface area of their	Students work through investigation (Pages 8-14).

		own body and complete the table. Refer to instructions on Page 11 in the student workbook for more guidance. Students will now calculate 'How much sunscreen to apply' by following the formula on Page 12 in their student workbook. They can write their results in the table provided. Instruct the students to compare their initial prediction (Page 8) to the results of their investigation. Instruct the students to complete the analysis, discussion, evaluation and conclusion questions on Pages 13-14.	
	Slides 19-28 **Page 15-16**	Explore the **Question Formulation Technique (QFT)** process with your students (Slide 19). Explain 'Rules for generating questions' on slide 20. Show the students the sun protection image and video (Slides 21-22) as stimulus for generating a focus question. Complete the phases of the QFT (Instructions on each slide and presenter notes): 1. Produce – Slide 23 (Optional – use sticky notes for this activity). 2. Improve - Slide 24 3. What makes a good question? - Slide 25 4. Refine – Slide 26 5. Prioritise – Slide 27 6. Focus question breakdown - Slide 28 (See presenter notes for focus question example).	Students independently, with a partner and/or in groups of 3-4 complete Page 15 – Investigation focus question activity during the "Produce' phase of the QFT. Students complete Page 16 with their group to identify a focus question.
	Slides 29-35 **Pages 19-22**	Guide students to complete the **Investigation #2 – Investigating sunscreen types (cream vs aerosol)** Begin the investigation with the question 'How much sunscreen do we need to apply to be truly SunSmart?' Guide students through the investigation on Slides 29-35 of the Classroom PPT and Pages 1-22 of	Students record their focus question, variables and prediction (Page 17) and work through investigation (Pages 19-21). Students also keep a detailed 'Process Diary' (Pages 23-28) throughout the investigation. Students can also record their results/findings (Page 22)

		the Student Workbook. Refer to the presenter notes for further instruction.	to inform them of the next phase of the investigation.
	Slide 36- 39 **Page 18, 29-32**	Lead whole-class discussion comparing observations and analysis of results. Guide the students to compare their initial prediction (Page 18) to the results of their investigation (Pages 29-32). Instruct the students to complete the analysis, discussion, evaluation and conclusion questions on Page 18.	Students complete the analysis, discussion, evaluation and conclusion questions on Pages 29-32.
Limited, Structured, Guided - Act	**Slide 40** **Page 3**	*Act Phase* – Explain the purpose of the act phase as using the findings to communicate, reflect, and apply to the real world.	Refer to Page 3 to explore the 'Act Phase' in more detail, if required.
	Slides 41-42 **Page 33**	Watch video – 'Ochre Sun: from Country to the global stage' (Slide 41) and explore how First Nations knowledge is being used in modern skincare science. Guide students to complete a research task using the questions on Slide 42. **Note:** More information can be found in the presenter notes. *Summative Assessment* - Guide students to complete the 'Sun Protection' post-investigation knowledge assessment on Page 5. Students can compare their knowledge.	Watch video - Ochre Sun: from Country to the global stage and explore how First Nations knowledge is being used in modern skincare science and complete the research task on Page 33. Complete 'Attempt 2' of the Sun Protection' post-investigation knowledge assessment on Page 5.
	Slides 43-44 **Pages 33-36**	*Summative Assessment* – Explain how you would like students to prepare a 'Grassroots Campaign' to create a school campaign to promote sun protection. Students are to present their results and communicate their understanding of Sun Protection. Students can use Pages 33- 36 to plan their presentations.	Students will prepare a 'Grassroots Campaign' presentation and use Pages 33-36 to plan.

		Allow students time to plan, prepare and present their campaigns.	
	Slide 45 **Page 37-38**	Instruct the students to complete the Investigation Reflection page independently.	Students to complete the Investigation Reflection page independently.
	Slides 46 **Page 52**	Glossary – teacher to determine whether students populate the glossary independently or through explicit instruction.	Students to complete glossary on Page 52.

Additional resources

	Slide # Classroom PowerPoint Presentation (PPT) **Page # (Student Workbook)**	**Teacher guidance**	**Student guidance**
Open Inquiry – Launch, Inquire, Act	**Slide 4** **Pages 41-51**	For students engaging in the Open Inquiry for Sun Protection, provide the 'Science Investigation Planner' pages to guide them through their independent investigation.	Independently work through the 'Science Investigation Planner' pages to explore the Sun Protection topic.
Optional Supplemental Resources	**Pages 23-28**	Process Diary – Optional	
	Pages 39-40	Take it further – Optional extension activities	
	Pages 53-57	Page 53 – Notes Pages 54-55 – Research Journal Page 56 – Graph paper (5mm) Page 57 – Graph paper (10mm)	

Formative and summative assessments

FOR REFERENCE: (CLASSROOM PPT SLIDE #/STUDENT WORKBOOK PAGE #)

Formative

- About the topic (Slide 4/Page 4) – Assess students' initial ideas, experience, and any connections they may have about sun protection.
- Sun protection pre and post assessment (Slide 8/Page 5). The task is to be completed before and after the investigation to assess an increase in knowledge and understanding.
- Label the diagram (Slide10/Page 6) - Earth and sun relationship.

Summative

- Student presentation/Grassroots campaign (Slide 43-44/Pages 34-36) can be used to assess students learning. Refer to the 'Investigate and Innovate with CSIRO Australian Curriculum and Syllabus links and rubrics' document for assessment guidance.

EXAMPLE – Sun Protection – Lesson overview

Teachers can use this example unit of work to guide their planning.

Week / Lesson	Lesson Duration	LIA Phase	Sun Protection Focus	Student Instruction	Teacher Instruction
Week 1 – Lesson 1	60 min	**Launch**	**Introduction to UV radiation & Sun Protection**— Understanding how UV radiation affects the body and why sun protection matters.	Participate in hook activity (images/video on sunburn, UV index, coral sunscreen). Complete a short pre-quiz to share prior knowledge about sunscreen habits.	Introduce the unit context (Australia's UV environment, risks, and SunSmart behaviours). Facilitate pre-diagnostic quiz and discussion.
Week 1 – Lesson 2	60 min	**Launch**	**Question Generation (Question Formulation technique) & Planning** — Exploring what we want to know about UV exposure and sunscreen effectiveness.	Brainstorm questions about UV radiation, sunscreen effectiveness, or material protection. Work in groups to refine into a testable investigation question. Identify variables and draft a simple method.	Guide question development. Explicitly teach independent/dependent/controlled variables. Support students in designing an initial fair test plan.
Week 2 – Lesson 3	60 min	**Launch → Inquire**	**Safety & Skills Practice** — Handling materials, measuring surface area, and observing UV bead behaviour.	Explore UV beads, observing how colour changes when exposed to sunlight. Practise using timers, rating scales, and consistent measurements.	Model safe handling of materials. Demonstrate how to measure UV bead responses, timing, and consistent data collection. Lead safety briefing (beads, sunscreen, outdoor safety).
Week 3 – Lessons 4 - 5	2 × 60 min (or 1 × 90 min)	**Inquire**	**Estimating Body Surface Area & Sunscreen Needs** — Approximating human surface area using shapes and formulae.	Create a 1 m^2 square by eye and compare to measured accuracy. Predict personal body surface area. Construct basic geometric models (rectangular, cylindrical) to estimate surface area.	Provide materials (newspaper, measuring tools). Teach how to approximate surface area using shapes. Support refinement of student models and calculations.

Week 4 – Lesson 6	60 min	**Inquire**	**Pilot Testing & Method Refinement** — Trialing UV bead setups and refining investigation design.	Conduct a short outdoor pilot: test bead placement, exposure times, and rating scale clarity. Adjust procedures based on findings.	Support troubleshooting of equipment setup and bead visibility. Facilitate reflection discussion on reliability and how methods can be improved.
Week 5 – Lessons 7 - 8	2 × 60 min (or 1 × 90 min)	**Inquire**	**Main UV Investigation** — Comparing materials, sunscreens, and UV-blocking effectiveness.	Carry out the full investigation outdoors. Expose UV beads to controlled sunlight. Collect data at set intervals using consistent methods. Record qualitative and quantitative observations.	Supervise outdoor testing. Ensure safety protocols. Support timing, data accuracy, and control setup. Prompt students to maintain variable control.
Week 6 – Lesson 9	60 min	**Inquire → Act**	**Data Clean-up & Initial Analysis —** Organising observations, colour ratings, exposure times, and sunscreen quantities.	Input results into tables or spreadsheets. Identify patterns, outliers, and anomalies. Begin comparing materials or sunscreens.	Model data organisation techniques. Demonstrate error-checking and calculation of averages. Provide feedback on clarity and completeness.
Week 7 – Lesson 10	60 min	**Act**	**Graphing & Sense-Making** — Interpreting which materials offer the best UV protection.	Construct graphs showing colour change vs time or protection level. Annotate and interpret trends. Answer analysis questions comparing material effectiveness.	Guide graph construction and sense-making discussions. Prompt deeper reasoning: “Why did this material block more UV?”
Optional Week 8 – Lesson 11	60 min (weather alternative)	**Inquire / Act**	**Indoor Repeat or Comparison Test** — Using lamps or alternate light sources to compare UV exposure.	Replicate or extend the investigation indoors with UV lamps or controlled light sources. Compare results to outdoor trials.	Provide alternate UV sources and support comparisons across conditions. Encourage students to consider reliability and limitations.
Week 8–9 (Extension)	60 min	**Act**	**Connecting to Research & Real-World Applications** — Exploring coral-based sunscreens and science communication.	Reflect on investigation reliability and results. Research how CSIRO is developing coral-inspired UV filters. Prepare a short presentation summarising findings and advice for sunscreen use.	Facilitate group discussions linking classroom learning to CSIRO research. Support students to communicate findings clearly and scientifically.

As Australia's national science agency, CSIRO is solving the greatest challenges through innovative science and technology.

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