



THE UNIVERSE IS YOUR CLASSROOM

GLOBAL LEARNING TOOLKIT

FOUR READY-TO-RUN SCIENCE SESSIONS

SCHOOLS / LIBRARIES / ASTRONOMY CLUBS / DARK SKIES

FREE FACILITATOR PLANS AND LEARNER INVESTIGATIONS

Science you can actually use.

INDEPENDENT AND FREE ASTRONOMY EDUCATION

This handbook offers four guided learning activities that can be delivered separately or as a connected programme. Each includes a timed facilitation plan, scientific framing, evidence questions and a printable learner investigation.

- | | | |
|----|--------------------------|--------|
| 01 | The Moon's Changing Face | 40 MIN |
| 02 | Design a Better Night | 45 MIN |
| 03 | A Sky from Another Place | 40 MIN |
| 04 | A Satellite for Good | 45 MIN |

FOUR LEARNING COMMUNITIES

Schools: classroom discussion and evidence-led enquiry. Libraries: flexible drop-in exploration. Astronomy clubs: an independent beginner learning bridge. Dark-sky organisations: public stewardship education and critical review.

Global Academy. Specialist regional adaptations for New Zealand, Pacific islands and Middle East / GCC are available in the accompanying interactive toolkit.

The Moon's Changing Face



40-MINUTE FACILITATOR PLAN

Explain lunar phases using sunlight and an observer's changing viewpoint.

KEY EXPLANATION

Sunlight illuminates roughly half the Moon. From Earth, we see different portions of this sunlit half as the Moon orbits our planet. Regular lunar phases are not Earth's shadow.

FOUR-STEP SESSION

05 MIN

Predict

Sketch a crescent, quarter and full Moon. Identify the source of moonlight.

10 MIN

Model

Use a shaded lamp and ball to represent Sun and Moon. Move the ball around a stationary learner and watch its illuminated portion.

15 MIN

Compare

Draw three model positions and match them to common phases. Describe why the shadow of Earth is not the cause of ordinary phases.

10 MIN

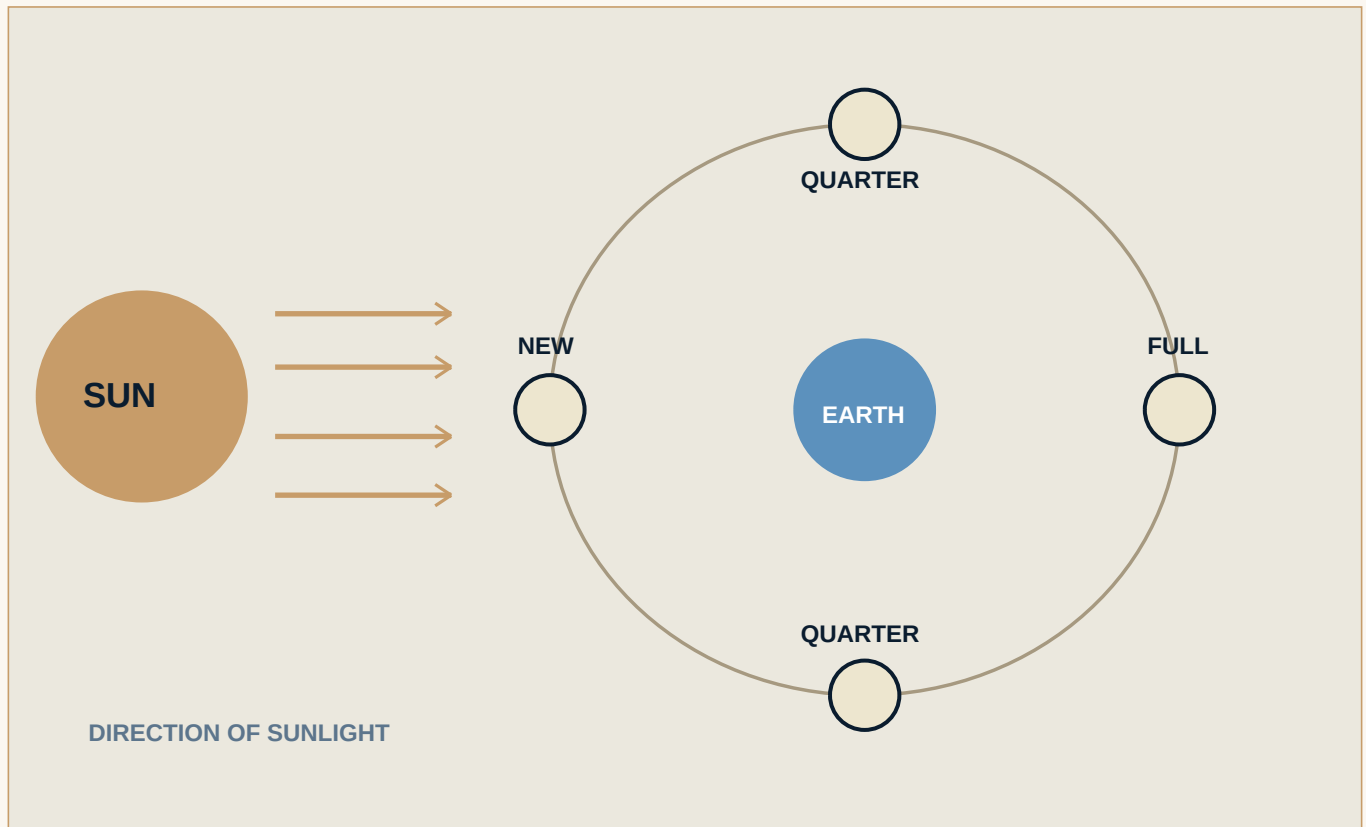
Explain

Use evidence from the model and the NASA guide to explain the change. Describe one limitation.

Safety: Do not stare into a bright lamp. Never look at the Sun through binoculars or telescopes without suitable specialist equipment and expert supervision.

Why the Moon Has Phases

SUNLIGHT / EARTH / MOON GEOMETRY



WHAT THE DIAGRAM EXPLAINS

Lunar phases are explained by how much of the Moon's sunlit half we see from Earth. The diagram shows four relative positions around Earth in a simplified orbital view.

INVESTIGATION QUESTION

Point out when the Moon is roughly between Earth and the Sun and when Earth lies roughly between Moon and Sun. How does the visible fraction change?

SOURCE

<https://science.nasa.gov/moon/moon-phases/>

NOTE: Not to scale. Moon appearance and illuminated-side orientation vary by observer and geometry; this is not a prediction for a date.

The Moon's Changing Face - worksheet

RECORD A PREDICTION, OBSERVATION, REASON AND CONCLUSION.

01 PREDICT

Draw the expected crescent and quarter Moon.

02 OBSERVE

Record three illuminated-ball positions.

03 REASON

Explain which viewing geometry changed.

04 CONCLUDE

State your explanation and one limitation.

Source: <https://science.nasa.gov/moon/moon-phases/>

Design a Better Night



45-MINUTE FACILITATOR PLAN

Assess a paper lighting plan against five responsible-lighting principles.

KEY EXPLANATION

Responsible outdoor light is useful, targeted, low level, controlled and warm-coloured where possible. A classroom site sketch cannot prove legal or photometric compliance.

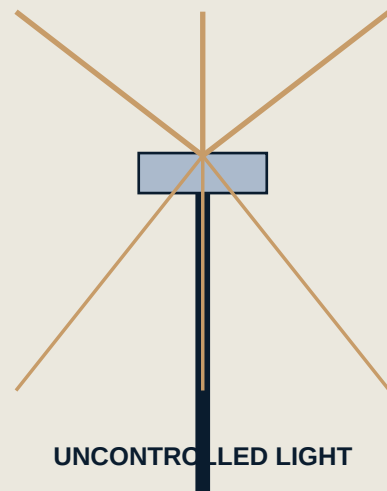
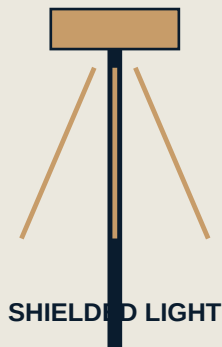
FOUR-STEP SESSION

- | | |
|---------------|---|
| 05 MIN | Notice
Compare necessary path light with an unnecessarily bright upward-facing fixture. |
| 10 MIN | Investigate
Review the five principles and mark locations where lighting is needed for safety, use or accessibility. |
| 20 MIN | Redesign
Sketch fixture location, shielding, lowest useful brightness, timing and warmer colour. Describe trade-offs. |
| 10 MIN | Present
Justify one improvement and note the missing information a qualified local designer would require. |

Safety: No electrical inspection, trespass or roadside field work is required. This is not a lighting installation plan or certification.

Design Better Outdoor Lighting

USEFUL / TARGETED / LOW LEVEL / CONTROLLED / WARM



ASK: Is light needed, well directed and controlled?

WHAT THE DIAGRAM EXPLAINS

Compare a necessary downward-shielded light with an uncontrolled fixture that wastes light upward and outside its purpose. Real design also considers access, glare, site context and local rules.

INVESTIGATION QUESTION

Name one action for each of DarkSky's Five Principles: useful, targeted, low level, controlled and warm-coloured.

SOURCE

<https://darksky.org/what-we-do/advancing-responsible-outdoor-lighting/>

NOTE: Schematic only. It does not constitute a lighting design, photometric test or DarkSky certification.

Design a Better Night - worksheet

RECORD A PREDICTION, OBSERVATION, REASON AND CONCLUSION.

01 PURPOSE

Identify which activities need light and when.

02 FIVE PRINCIPLES

Apply useful, targeted, low level, controlled and warm coloured.

03 RECOMMEND

Sketch one improvement and justify it.

04 LIMITS

What evidence or expert review is still needed?

Source: <https://darksky.org/what-we-do/advancing-responsible-outdoor-lighting/>

A Sky from Another Place



40-MINUTE FACILITATOR PLAN

Explain how an observing location affects the approximate appearance of reference stars.

KEY EXPLANATION

Earth's spherical geometry means sky altitude and visibility change with latitude. The ASTRAVYR Southern Sky Explorer is deliberately a simplified eight-star learning model, not a live observing forecast.

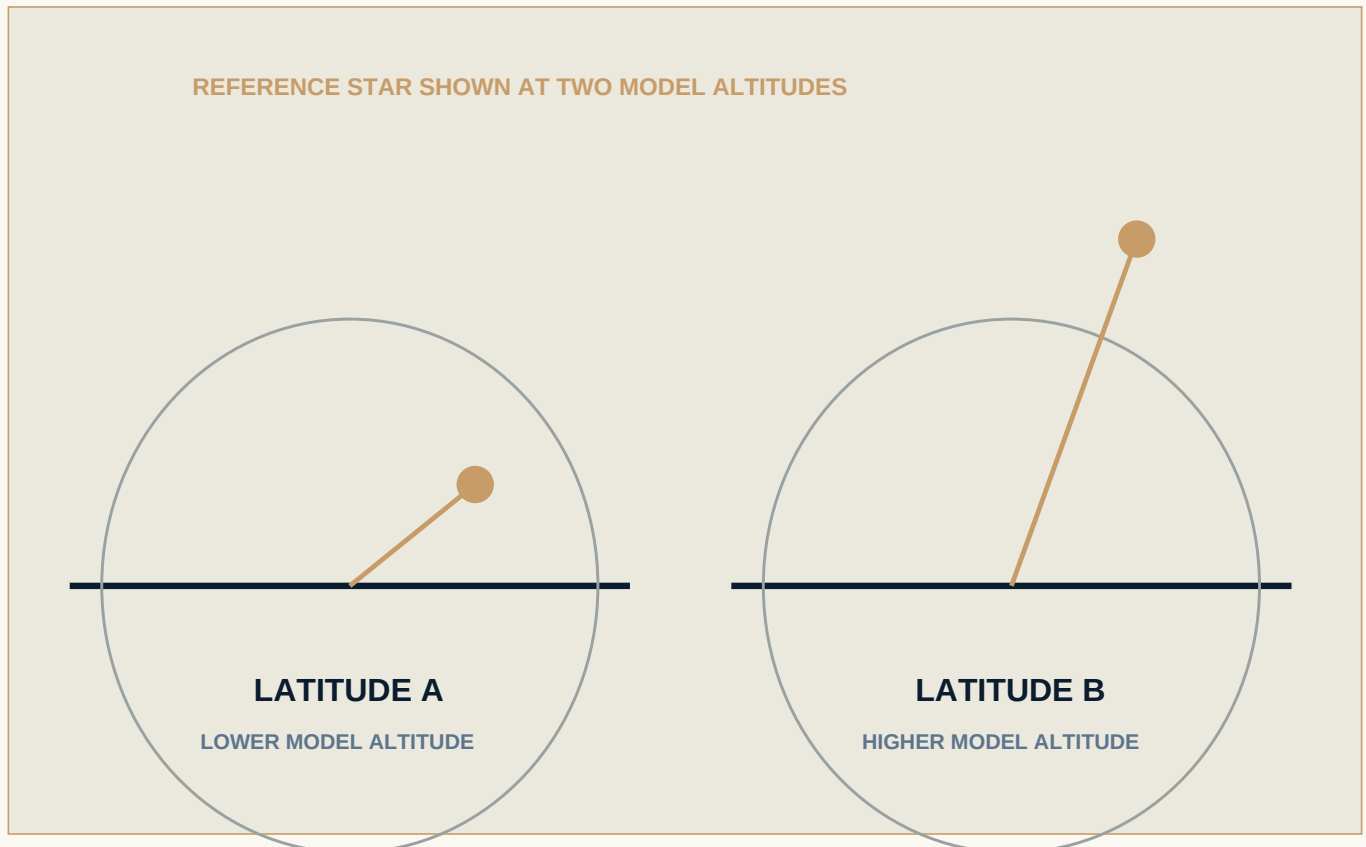
FOUR-STEP SESSION

- | | |
|---------------|--|
| 05 MIN | Predict
Choose two places with different latitudes and predict the visibility of a reference star. |
| 10 MIN | Explore
Compare two location presets using the Academy Southern Sky Explorer. |
| 15 MIN | Compare
Record approximate star altitudes or directions and explain the latitudinal difference. |
| 10 MIN | Communicate
Produce two horizon diagrams and state the model limitations. |

Safety: A printed model comparison works indoors. Do not enter exact pupil/home locations or assume the model gives tonight's clouds or local horizon.

Why the Sky Changes with Latitude

HORIZON / REFERENCE STAR / OBSERVATION



WHAT THE DIAGRAM EXPLAINS

Earth's geometry means the altitude and visibility of a reference star can change with an observer's latitude. The drawn star heights are illustrative, not measured real-sky coordinates.

INVESTIGATION QUESTION

Using the ASTRAVYR Southern Sky Explorer, compare one reference star at two preset latitudes. Which parts of your result are modelled rather than directly observed?

SOURCE

<https://astro4edu.org/resources/>

NOTE: The Academy reference-sky tool is a simplified eight-star model and not a current-night pointing or weather forecast.

A Sky from Another Place - worksheet

RECORD A PREDICTION, OBSERVATION, REASON AND CONCLUSION.

01 PLACES

Choose two broad location or latitude presets.

02 REFERENCE STAR

Record the chosen star and model altitude.

03 COMPARE

Explain a difference and a similarity.

04 LIMITATION

Why is this not a precise pointing chart?

Source: <https://astro4edu.org/resources/>

A Satellite for Good



45-MINUTE FACILITATOR PLAN

Connect a community science question to relevant Earth-observation measurements.

KEY EXPLANATION

Satellite instruments observe physical quantities. Their measurements help answer questions, but interpretation requires context, limitations and sometimes ground validation.

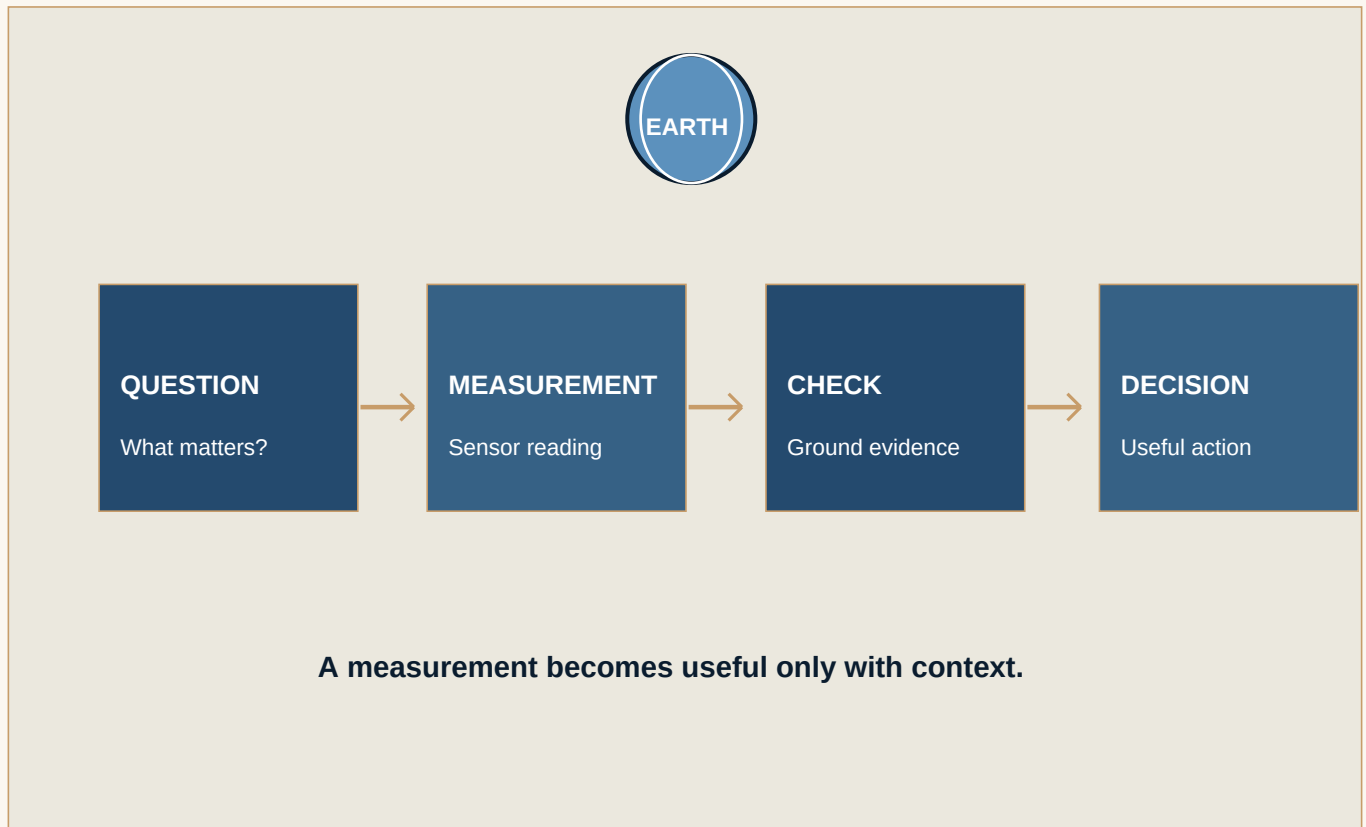
FOUR-STEP SESSION

- | | |
|---------------|---|
| 05 MIN | Question
Choose a real environmental topic such as vegetation, sea temperature or smoke. |
| 10 MIN | Research
Review a NASA Earth-science example and identify its directly measured quantity. |
| 20 MIN | Design
Draw a mission card with question, proposed sensor measurement, decision users and checks. |
| 10 MIN | Share
Explain why data could be misinterpreted without context. |

Safety: Paper exercise only. No rocket construction, actual spacecraft operation or student contact details are required.

How Satellite Observations Help

MEASUREMENT / VALIDATION / DECISION



WHAT THE DIAGRAM EXPLAINS

A satellite sensor observes a physical quantity. Scientists compare it with other information and account for limitations before people use the result for environmental or community decisions.

INVESTIGATION QUESTION

What measurement would be useful for a question about sea temperature, vegetation or smoke? What extra evidence could check the interpretation?

SOURCE

<https://science.nasa.gov/earth/>

NOTE: The diagram is a general information flow, not an actual mission specification or guarantee of an observation.

A Satellite for Good - worksheet

RECORD A PREDICTION, OBSERVATION, REASON AND CONCLUSION.

01 QUESTION

Identify an environmental observation goal.

02 MEASUREMENT

Describe one useful sensor observation.

03 USE

Explain who benefits from that information.

04 UNCERTAINTY

Identify one reason data may be incomplete.

Source: <https://science.nasa.gov/earth/>

One Academy. Different skies.

USE ONE FRAMEWORK AND LOCALLY APPROPRIATE EXAMPLES

GLOBAL LEARNING

Compare observing locations and methods across different continents. Keep the science common, while allowing examples to vary.

NEW ZEALAND DARK SKIES

Link observing and lighting to documented DarkSky International places. Matariki/Puanga cultural lessons need appropriate local knowledge holders.

PACIFIC SKIES

Explore coastal horizons, clouds, humidity and satellite applications relevant to island environments. Do not invent Indigenous navigation traditions.

MIDDLE EAST CELESTIAL

Compare desert and city astronomy; consider heat, dust and light. Source historical astronomy from named collections and knowledgeable regional educators.

Quality, care and independence.

SAFE SCIENCE

No compulsory night visits, road-side surveys, electrical work or specialist instruments. Offer indoor versions. Never look at the Sun through optical equipment without appropriate specialist solar protection and expert supervision.

SCIENTIFIC LIMITS

Models are simplified teaching tools. Distinguish what learners observed from predictions, measurements and assumptions. A lighting sketch is not a compliance design. The Southern Sky Explorer is not a live sky-position forecast.

AGE AND INCLUSION

Facilitators adapt language, literacy, physical access and task length. Learner worksheets ask for no name, home address, age, email or precise location. Do not upload participants' responses to a third-party service without consent.

REGIONAL AND CULTURAL CARE

Original Indigenous astronomical cultural content should be developed and reviewed with the relevant authorised community knowledge holders. Do not present research agencies, educators or DarkSky groups as partners or approvers.

SOURCE LIBRARY

NASA Moon Phases: <https://science.nasa.gov/moon/moon-phases/>

DarkSky outdoor lighting: <https://darksky.org/what-we-do/advancing-responsible-outdoor-lighting/>

IAU Astronomy Education: <https://astro4edu.org/resources/>

NASA Earth science: <https://science.nasa.gov/earth/>

ASTRAVYR Space Academy is a free independent educational initiative of Apollo NZ Global. Completion does not provide a formal qualification and the Academy does not claim third-party accreditation.