Why do the seasons change?

<table>
<tr><th>Assessment description</th><th>Category</th></tr>
<tr><td rowspan="2">Using secondary sources, students research how the regular movement of the Earth around the sun creates seasonal patterns and global climates that have been evident throughout time.</td><td>Written</td></tr>
<tr><td>Technique</td></tr>
<tr><td></td><td>Research</td></tr>
<tr><td>Context for assessment</td><td>Alignment</td></tr>
<tr><td rowspan="4">Humans have used predictable changes in the seasons throughout history to measure time, predict the weather and plan events.
This assessment builds on students' knowledge of the Earth's place in the solar system from the Year 5 Earth and space sciences and provides them with the opportunity to demonstrate knowledge and understanding of the relative positions and movements of the sun and Earth that create various patterns in time and space.
Teachers could use one of the model observations in Section 1 as a scaffolded teaching and learning experience and an opportunity to provide students with informal feedback prior to them engaging in research to complete Sections 2 and 3 more independently.</td><td>Australian Curriculum v7.0,
Year 7 Science Australian Curriculum content and achievement standard ACARA — Australian Curriculum, Assessment and Reporting Authority
www.australiancurriculum.edu.au

Year 7 Science standard elaborations available at:
www.qcaa.qld.edu.au/downloads/p_10/ac_sci_yr7_se.docx</td></tr>
<tr><td>Connections</td></tr>
<tr><td>This assessment can be used with the QCAA Australian Curriculum resource titled Year 7 plan — Australian Curriculum: Science exemplar available at:
www.qcaa.qld.edu.au/downloads/p_10/ac_science_yr7_plan.doc</td></tr>
<tr><td>Definitions</td></tr>
<tr><td></td><td>Model: A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea.
Primary and secondary sources: In Science, a primary source is information created by the person or persons directly involved in a study or observing an event. A secondary source is information that has been compiled from primary sources by a person or persons not directly involved in the original study or event, e.g. texts found on websites, magazines or textbooks.</td></tr>
<tr><td colspan="2">In this assessment</td></tr>
<tr><td colspan="2">Teacher guidelines
Student booklet
Task-specific standards — continua
Task-specific standards — matrix
Sample response
Assessment resource: Reliability checklist</td></tr>
</table>

Teacher guidelines

Identify curriculum

Content descriptions to be taught		
Science understanding	**Science as a human endeavour**	**Science inquiry skills**
Earth and space sciences • Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the sun, Earth and the moon ACSSU115	**Nature and development of science** • Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world ACSHE119	**Processing and analysing data and information** • Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate ACSIS129 • Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions ACSIS130 **Communicating** • Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate ACSIS133

General capabilities (GCs) and cross-curriculum priorities (CCPs)

This assessment may provide opportunities to engage with the following GCs and CCPs. Refer also to the Resources tab on the Year 7 Science curriculum and assessment page: www.qcaa.qld.edu.au/yr7-science-resources.html

Literacy

ICT capability

Critical and creative thinking

Aboriginal and Torres Strait Islander histories and cultures

Achievement standard

This assessment provides opportunities for students to demonstrate the following highlighted aspects.

By the end of Year 7, students describe techniques to separate pure substances from mixtures. They represent and predict the effects of unbalanced forces, including Earth's gravity, on motion. They explain how the relative positions of the Earth, sun and moon affect phenomena on Earth. They analyse how the sustainable use of resources depends on the way they are formed and cycle through Earth systems. They predict the effect of environmental changes on feeding relationships and classify and organise diverse organisms based on observable differences. Students describe situations where scientific knowledge from different science disciplines has been used to solve a real-world problem. They explain how the solution was viewed by, and impacted on, different groups in society.

Students identify questions that can be investigated scientifically. They plan fair experimental methods, identifying variables to be changed and measured. They select equipment that improves fairness and accuracy and describe how they considered safety. Students draw on evidence to support their conclusions. They summarise data from different sources, describe trends and refer to the quality of their data when suggesting improvements to their methods. They communicate their ideas, methods and findings using scientific language and appropriate representations.

Source: ACARA, The Australian Curriculum v7.0, www.australiancurriculum.edu.au.

Sequence learning

Suggested learning experiences

This assessment leads on from the learning experiences outlined in the QCAA's *Year 7 Science Year level plan*. The knowledge, understanding and skills in the Year level plan will prepare students to engage in this assessment:

- See *Year 7 plan — Science exemplar* www.qcaa.qld.edu.au/downloads/p_10/ac_science_yr7_plan.doc

Adjustments for needs of learners

To make adjustments, teachers refer to learning area content aligned to the child's chronological age, personalise learning by emphasising alternate levels of content, general capabilities or cross-curriculum priorities in relation to the chronological age learning area content. The emphasis placed on each area is informed by the student's current level of learning and their strengths, goals and interests. Advice on the process of curriculum adjustment for all students and in particular for those with disability, gifted and talented or for whom English is an additional language or dialect are addressed in *Australian Curriculum — Student Diversity* materials.

For information to support students with diverse learning needs, see:

- Queensland Curriculum and Assessment Authority materials for supporting children with diverse learning needs www.qcaa.qld.edu.au/10188.html
- Australian Curriculum Student Diversity www.australiancurriculum.edu.au/StudentDiversity/Student-diversity-advice
- The *Melbourne Declaration on Educational Goals for Young Australians* www.curriculum.edu.au/mceecdya/melbourne_declaration,25979.html
- The *Disability Standards for Education* www.ag.gov.au.

Resources

Online — websites teachers may find useful

- University of Nebraska-Lincoln, *Daylight hours explorer* http://astro.unl.edu/classaction/animations/coordsmotion/daylighthoursexplorer.html
- Climate-Charts.com World climates, *Daylight/time of day chart for Cairns* www.climate-charts.com/Locations/a/AU94287000310110.php
- Department of Sustainability, Environment, Water, Population and Communities: Australian Antarctic Division, *Environment/Weather* www.antarctica.gov.au/about-antarctica/environment/weather/sunlight-hours
- BBC Science, *Earth/TV clips* www.bbc.co.uk/science/space/solarsystem/sun_and_planets/earth
- Teachers Domain, *Earth in motion: the seasons* www.teachersdomain.org/resource/ess05.sci.ess.eiu.seasonsgame
- University of Tennessee, *Seasons in the Northern Hemisphere* http://csep10.phys.utk.edu/astr161/lect/time/seasons.html
- Bureau of Meteorology, *Indigenous Seasonal descriptions* www.bom.gov.au/iwk/climate_culture/Indig_seasons.shtml
- Bureau of Meteorology, *Indigenous weather knowledge* www.bom.gov.au/iwk
- Mirima Council, *Miriwoong Seasonal Calendar* www.mirima.org.au/calendar
- CSIRO, Gooniyandi Seasons calendar www.csiro.au/resources/Gooniyandi-Seasons-Calendar

Develop assessment

Preparing for the assessment

Learning experiences in preparation for the assessment could include:

Revising key concepts

- Revise from Year 5 that the Earth is part of a system of planets orbiting around a star (the sun).

Exploring the solar system and seasons

- Create a glossary or word wall of scientific language related to Earth and space sciences.
- Create and use models of the solar system to:
  - show the relative positions and movement of the sun, Earth and moon
  - identify patterns of motion and describe the timeframes over which they occur
  - discuss the purpose, features and limitations of models in representing real objects and processes.
- Investigate Indigenous weather knowledge and seasonal models that differ from the Western four-seasons model, including Indigenous seasonal descriptions and the wet/dry seasonal calendar common in the tropics. (Note that for the purpose of this assessment, the four-seasons model is useful because it enables students to consider the Earth's orientation at four positions in its orbit around the sun).
- Investigate natural phenomena such as lunar and solar eclipses, seasons and phases of the moon.
- Compare times for the rotation of Earth, the sun and moon, and compare the times for the orbits of Earth and the moon.
- Model the relative movements of the Earth, sun and moon and how natural phenomena such as solar and lunar eclipses and phases of the moon occur.
- Explain why different regions of the Earth experience different seasonal conditions.

Developing research skills

- Identify credible sources of information using a reliability checklist or other criteria. Critically judge the quality of resources and acknowledge them using the conventions of a bibliography.
- Develop research and summarising skills.
- Practice organising information in logical ways.
- Use labelled and annotated diagrams to explain scientific concepts and phenomena.
- Develop explanations and draw conclusions and use evidence to support claims.

Implementing

Section 1. Creating a model to explain observations

Student role	Teacher role
• Read Section 1 in the *Student booklet.* • Discuss the observations of the Earth made by the students. • Talk about how the observations may have been made and whether you have made similar observations. • Discuss the sun, Earth, moon model made by the students. • Talk about how the model is similar and different from any models you have seen or used.	• Allocate approximately 1 hour for this section of the assessment. • Using your knowledge of students' personalities and abilities, place students in small groups. • Read each of the observations and features of the model to the students. • Allow them to discuss the observations and the model in relation to their own experiences. • Facilitate class discussions about similarities between the model and own experience • Negotiate with each student the choice of an appropriate scenario in a text suitable for close study. • Encourage students to select a text/section of a text, situation and characters that suits their interests and abilities and fits well with the purpose of the task, and to share it with others (e.g. teacher, classmates, friends) so that they become familiar with it and can explain why they

	have chosen it.
Section 2. Developing scientific explanations	
Student role • Read the instructions for Section 2 in the *Student booklet.* • Conduct research to collect relevant information. • Discuss how judgments will be made about your work and the valued features of the assessment. Clarify with your teacher any questions you may have about the process. • Plan how you will organise your notes and keep a record of the resources accessed. • Construct a table with the headings: observation, scientific explanation, relevant features of the model, pattern and representation. • Access the reliability checklist or other criteria to ensure your use quality resources. • Set goals for the time available for research. • Discuss your plan with your teacher and begin your research.	**Teacher role** • Allocate approximately 2 hours for students to research. • Read the instructions and ensure each student understands the requirements. • Provide the task-specific standards for this assessment and check for understanding of the valued features. • Provide the reliability checklist (or alternative) and how it is to be completed. • Discuss with each student their research plan. • Nominate a checkpoint stage where students discuss the progress towards the assessment.
Section 3. Drawing a conclusion	
Student role • Read the instructions for Section 3 in the *Student booklet.* • Discuss the features of a conclusion and the importance of providing supporting evidence. • Use your knowledge, research, model and identified patterns to draw a conclusion and answer the question. • Review and edit your work against the task-specific standards and check for appropriate use of scientific language.	**Teacher role** • Allocate approximately 1 hour for this section of the assessment. • When the research phase is complete discuss the structure of a conclusion and the importance of supporting evidence. • Read the conclusion question and encourage students to consider the ‘bigger picture’ when developing their response.

Make judgments

When making judgments about the evidence in student responses to this assessment, teachers are advised to use the task-specific standards provided. The development of these task-specific standards has been informed by the Queensland Year 7 standard elaborations. See www.qcaa.qld.edu.au/downloads/p_10/ac_sci_yr7_se.docx

The Queensland standard elaborations for Science

The Queensland Year 7 standard elaborations for Science are a resource to assist teachers to make consistent and comparable evidence-based A to E (or the Early Years equivalent) judgments. They should be used in conjunction with the Australian Curriculum achievement standard and content descriptions for the relevant year level.

The Queensland Science standard elaborations provide a basis for judging *how well* students have demonstrated what they know, understand and can do using the Australian Curriculum achievement standard.

The Australian Curriculum achievement standards dimensions of Understanding and Skills are used to organise the Queensland Science standard elaborations.

The valued features of Science drawn from the achievement standard and the content descriptions for Understanding dimension and Skills dimension are organised as:

- Science understanding
- Science as a human endeavour
- Questioning and predicting
- Planning and conducting
- Processing and analysing data and information & Evaluating
- Communicating.

Task-specific standards

Task-specific standards give teachers:

- a tool for directly matching the evidence of learning in the response to the standards
- a focal point for discussing students' responses
- a tool to help provide feedback to students.

Task-specific standards are not a checklist; rather they are a guide that:

- highlights the valued features that are being targeted in the assessment and the qualities that will inform the overall judgment
- specifies particular *targeted aspects* of the curriculum content and achievement standard
- aligns the valued feature, task-specific descriptor and assessment
- allows teachers to make consistent and comparable on-balance judgments about student work by matching the qualities of student responses with the descriptors
- clarifies the curriculum expectations for learning at each of the five grades (A–E or the Early Years equivalent)
- shows the connections between what students are expected to know and do, and how their responses will be judged and the qualities that will inform the overall judgment
- supports evidence-based discussions to help students gain a better understanding of how they can critique their own responses and achievements, and identify the qualities needed to improve
- encourages and provides the basis for conversations among teachers, students and parents/carers about the quality of student work and curriculum expectations and related standards.

Task-specific valued features

Task-specific valued features are the discrete aspects of the valued features of Science targeted in a particular assessment and incorporated into the task-specific standards for that assessment. They are selected from the Queensland Science standard elaborations valued features drawn from the Australian Curriculum achievement standard and content descriptions.

Task-specific valued features for this assessment

The following table identifies the valued features for this assessment and makes explicit the understandings and skills that students will have the opportunity to demonstrate. This ensures that the alignment between what is taught, what is assessed and what is reported is clear.

Australian Curriculum achievement standard dimensions	Queensland standard elaborations valued features	Task-specific valued features
Understanding dimension	Science understanding	• Explanation of how the relative positions of the Earth, sun and moon affect phenomena on Earth (including day length, climate zones, seasons and eclipses) • Description of observable patterns and timeframes **Section 2**
Skills dimension	Processing and analysing data and information & Evaluating	Drawing on evidence to support a conclusion about the predictability of observations on Earth **Section 3**
	Communicating	Communication using scientific language **Sections 2 and 3**

The task-specific standards for this assessment are provided in two models using the same task-specific valued features:

- a matrix
- a continua.

Matrix and continua

Task-specific standards can be prepared as a matrix or continua. Both the continua and the matrix:

- use the Queensland standard elaborations to develop task-specific descriptors to convey expected qualities in student work — A to E (or the Early Years equivalent)
- highlight the same valued features from the Queensland standard elaborations that are being targeted in the assessment and the qualities that will inform the overall judgment
- incorporate the same task-specific valued features, i.e. make explicit the particular understanding/skills that students have the opportunity to demonstrate for each selected valued feature
- provide a tool for directly matching the evidence of learning in the student response to the standards to make an on-balance judgment about achievement
- assist teachers to make consistent and comparable evidence-based A to E (or the Early Years equivalent) judgments.

Matrix

The matrix model of task-specific standards uses the structure of the Queensland standard elaborations to organise the task-specific valued features and standards A to E (or the Early Years equivalent). The task-specific descriptors of the standard described in the matrix model use the same degrees of quality described in the Queensland standard elaborations.

Teachers make a judgment about the task-specific descriptor in the A to E (or the Early Years equivalent) cell of the matrix that best matches the evidence in the student responses in order to make an on-balance judgment about how well the pattern of evidence meets the standard.

The matrix is a tool for making both overall on-balance judgments and analytic judgments about the assessment. Achievement in each valued feature of the Queensland standard elaboration targeted in the assessment can be recorded and feedback can be provided on the task-specific valued features.

Continua

The continua model of task-specific standards uses the dimensions of the Australian Curriculum achievement standard to organise task-specific valued features and standards as a number of reference points represented progressively along an A to E (or Early Years equivalent) continuum. The task-specific valued features at each point are described holistically. The task-specific descriptors of the standard use the relevant degrees of quality described in the Queensland standard elaborations.

Teachers determine a position along each continuum that best matches the evidence in the student responses to make an on-balance judgment about achievement on the task.

The continua model is a tool for making an overall on-balance judgment about the assessment and for providing feedback on task-specific valued features.

Use feedback

Feedback to students	Evaluate the information gathered from the assessment to inform teaching and learning strategies. Focus feedback on the student's personal progress and the next steps in the learning journey. The task-specific standards for this assessment can be used as a basis for providing feedback to students. Offer feedback that: • maximises students' opportunities to succeed in the assessment by providing feedback on: – making a claim about the problem or observation – providing evidence for the claim from your research or investigation – providing reasoning that links the evidence to the claim – determining the reliability of sources – supporting conclusions with evidence • involves students in the process by providing opportunities to ask follow-up questions • focuses on each student's personal progress relative to previous achievements • identifies the characteristics of a high quality response that aligns with the descriptors in the task-specific standards.
Resources	Hattie, J and Timperley, H 2007 'The Power of Feedback', *Review of Educational Research*, Vol. 77, No.1 pp. 81–112. For guidance on providing feedback, see the professional development packages titled: • *About feedback* www.qcaa.qld.edu.au/downloads/p_10/as_feedback_about.docx • *Seeking and providing feedback* www.qcaa.qld.edu.au/downloads/p_10/as_feedback_provide.docx • *The Roadmap: Dimensions of Teaching and Learning, Teaching and Learning Branch, Education Queensland, 2011,* http://education.qld.gov.au/curriculum/framework/p-12/docs/curriculum-planning-p-10.pdf

Why do the seasons change?

Image: Queensland Curriculum and Assessment Authority, 2013

Collect evidence and use a model to explain observations about day length, climates, seasons and eclipses and draw a conclusion about the predictability of the seasons.

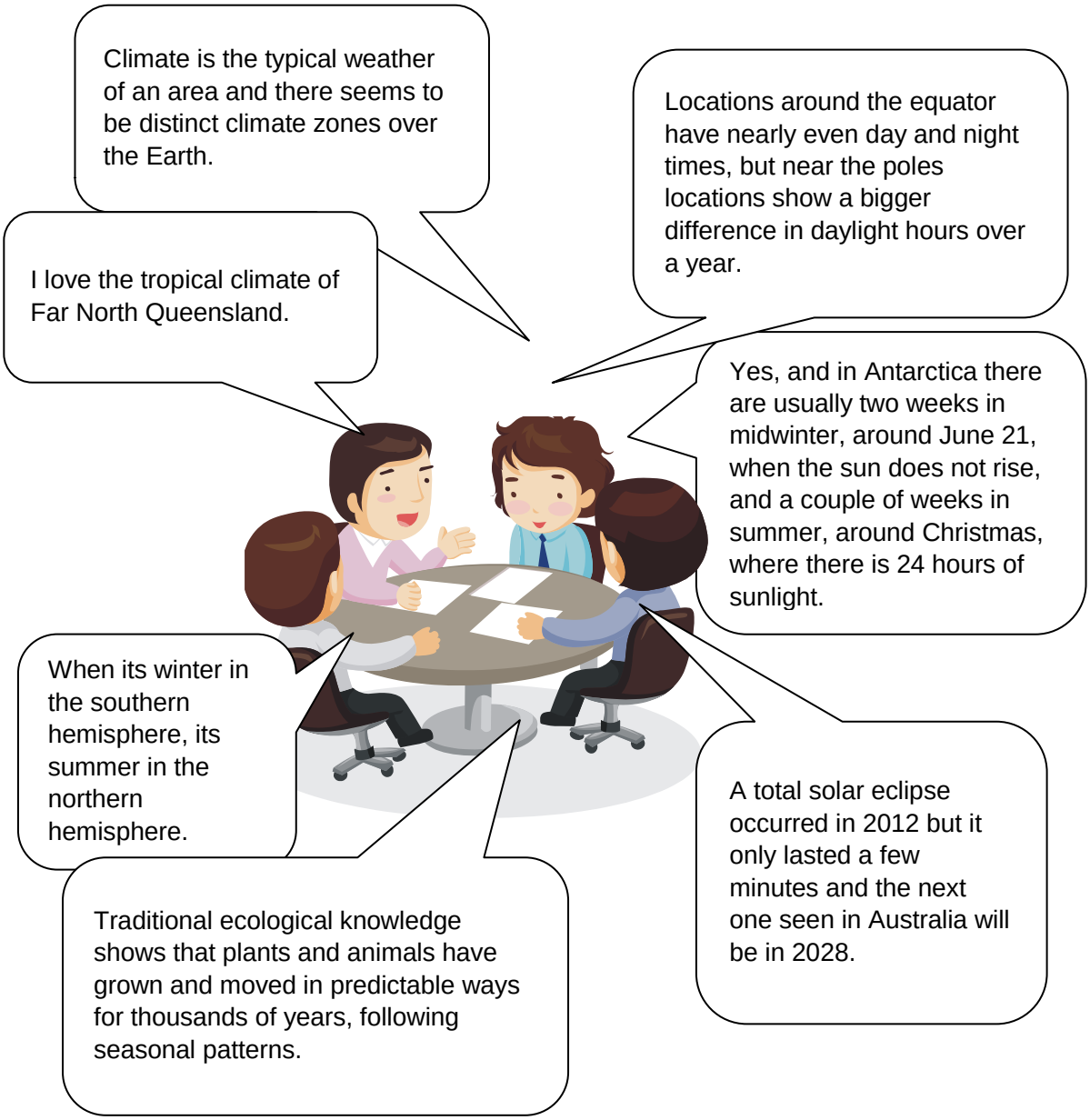
You will:

- use credible sources to research information
- construct scientific explanations for observations about the Earth
- develop representations to support your explanations
- draw a conclusion about the predictability of the seasons.

Section 1. Creating a model to explain observations

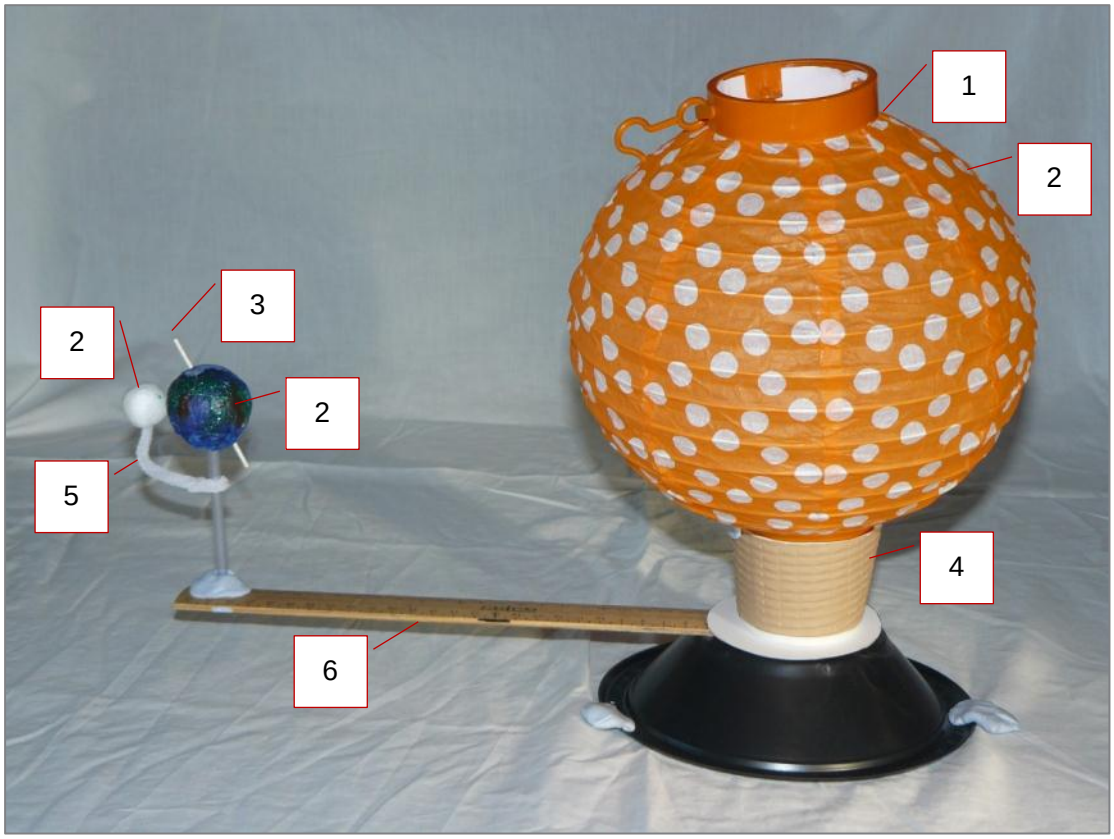
A group of students made the following observations about the Earth.

They grouped similar observations together.



The students then used everyday items to develop a model of the sun, Earth and moon system to help explain some of their observations.

The model is shown below with some features labelled.



Feature key

- **Feature 1** The sun is stationary
- **Feature 2** The Earth, moon and sun are spheres
- **Feature 3** The axis of the Earth is titled
- **Feature 4** The earth can rotate on its axis
- **Feature 5** The moon can rotate around the Earth
- **Feature 6** The Earth orbits the sun at a distance fixed by the arm (in this model)

Section 2. Developing scientific explanations

Develop a scientific explanation for each observation that the students made about the Earth.

For each observation you will:

Investigate

1. Use reliable sources to collect information to explain the observation.

   Hints: The key words in the Wordle below may be helpful as a guide — and don't forget to include a bibliography.

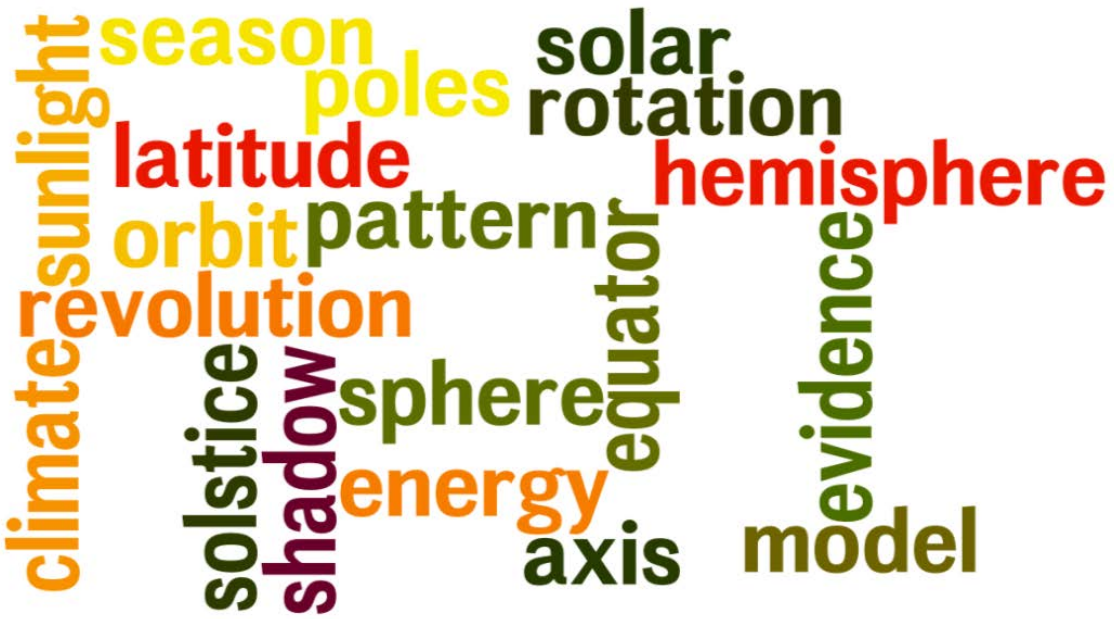
2. Summarise relevant information and keep a bibliography of your sources.
3. Write a scientific explanation for the observation.

   Hint: To write a scientific explanation you should:

   - make a **claim** about the problem or observation
   - provide **evidence** for the claim from your research or investigation
   - provide **reasoning** that links the evidence to the claim.

Analyse

4. Develop a representation to support your explanation.
5. Identify which feature/s of the model supports your explanation and briefly explain how it does this.
6. Identify and explain the pattern and timeframe of the occurrence of the observation.



Section 3. Drawing a conclusion

Evaluate

7. Draw a conclusion to answer the question:

Why are observations of the Earth predictable?

8. Support your conclusion with evidence from your knowledge, explanations and model of the sun, Earth, moon system.
9. Attach your conclusion to the end of your explanations.

Why do the seasons change?

Name .....

Purpose of assessment: To use secondary sources and representations to explain observations about the Earth, describe patterns and draw a conclusion about the predictability of these patterns.

Understanding dimension		Skills dimension		
Science Understanding		Processing and analysing data and information	Communicating	
Section 2 Explanation of how the relative positions of the Earth, sun and moon affect phenomena on Earth (including day length, climate zones, seasons and eclipses)	**Section 2** Description of observable patterns and timeframes	**Section 3** Drawing on evidence to support a conclusion about the predictability of observations on Earth	**Sections 2 and 3** Communication using scientific language	
Justified scientific explanation of how the relative positions of the Earth, sun and moon affect the observations made by the group of students integrated with: • an appropriate representation • identified feature/s of the model and thorough explanation of how it supports the scientific explanation	Identification and thorough explanation of the pattern and timeframe of the observations	Drawing on relevant evidence and patterns from research to support a justified conclusion that answers the question: *why are observations of the Earth predictable?*	Concise and coherent communication about day length, climate zones, seasons and eclipses using appropriate scientific language	**A** / **B**
Explanation of how the relative positions of the Earth, sun and moon affect the observations made by the group of students supported by: • an appropriate representation • identified feature/s of the model	Identification and explanation of the pattern and timeframe of the observations	Drawing on evidence from research to support a conclusion that answers the question: *why are observations of the Earth predictable?*	Communication about day length, climate zones, seasons and eclipses using scientific language	**C** / **D**
Restatement of science knowledge and representations about the Earth, sun and moon	Identification of observable patterns or timeframes	Restatement of information	Communication about day length, climate zones, seasons and eclipses using fragmented language	**E**

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Why do the seasons change?

Name .....

Purpose of assessment: To use secondary sources and representations to explain observations about the Earth, describe patterns and draw a conclusion about the predictability of these patterns.

			A	B	C	D	E
Understanding dimension	Science Understanding	**Section 2** Explanation of how the relative positions of the Earth, sun and moon affect phenomena on Earth (including day length, climate zones, seasons and eclipses)	Justified scientific explanation of how the relative positions of the Earth, sun and moon affect the observations made by the group of students integrated with: • an appropriate representation • identified feature/s of the model and thorough explanation of how it supports the scientific explanation	Informed scientific explanation of how the relative positions of the Earth, sun and moon affect the observations made by the group of students linked to: • an appropriate representation • identified feature/s of the model and informed explanation of how it supports the scientific explanation	Explanation of how the relative positions of the Earth, sun and moon affect the observations made by the group of students supported by: • an appropriate representation • identified feature/s of the model	Partial explanation of how the relative positions of the Earth, sun and moon affect the observations made by the group of students using: • a representation	Restatement of science knowledge and representations about the Earth, sun and moon
		Section 2 Description of observable patterns and timeframes	Identification and thorough explanation of the pattern and timeframe of the observations	Identification and informed explanation of the pattern and timeframe of the observations	Identification and explanation of the pattern and timeframe of the observations	Identification of observable patterns and timeframes	Identification of observable patterns or timeframes
Skills dimension	Processing and analysing data and information	**Section 3** Drawing on evidence to support a conclusion about the predictability of observations on Earth	Drawing on relevant evidence and patterns from research to support a justified conclusion that answers the question: *why are observations of the Earth predictable?*	Drawing on relevant evidence and patterns from research to support a conclusion that answers the question: *why are observations of the Earth predictable?*	Drawing on evidence from research to support a conclusion that answers the question: *why are observations of the Earth predictable?*	Drawing a conclusion that answers the question: *why are observations of the Earth predictable?*	Restatement of information
	Communicating	**Sections 2 and 3** Communication using scientific language	Concise and coherent communication about day length, climate zones, seasons and eclipses using appropriate scientific language	Coherent communication about day length, climate zones, seasons and eclipses using appropriate scientific language	Communication about day length, climate zones, seasons and eclipses using scientific language	Communication about day length, climate zones, seasons and eclipses using everyday language	Communication about day length, climate zones, seasons and eclipses using fragmented language

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Why do the seasons change?

Reliability checklist

Internet site ☐ **Book** ☐ **Magazine** ☐ **Other:** .....

Site name and URL: .....

Author, title and publisher: .....

Date accessed or published: ..... **Page no/s:** .....

Authority — is the author or host an expert in the field?

Clearly identifies the author or organisation. ☐ Yes ☐ No

The author or organisation has qualifications, experience or recognition from other experts in this field. ☐ Yes ☐ No

A contact person or address is available. ☐ Yes ☐ No

The purpose of the site or publication is clearly stated. ☐ Yes ☐ No

What type of organisation is the host of the site? .....

Is this a personal webpage or part of the official website? .....

How did you find this site: ☐ recommended ☐ a link from another site ☐ search engine.

Accuracy — is the information correct?

Are sources of information given? ☐ Yes ☐ No

Does another source agree/support this information? ☐ Yes ☐ No

Is the information provided to:

☐ inform you ☐ persuade you to adopt a particular point of view ☐ sell you something

Currency — how up-to-date is the information?

The material was first written in .....

The site/book was updated in .....

Coverage — is there enough information?

Is there enough detail in the information? ☐ Yes ☐ No

Does the site provide links to further information? ☐ Yes ☐ No

Overall rating: ☐ **Very reliable** ☐ **Reliable** ☐ **Unreliable**

Comments .....

.....