

92046



Mana Tohu Mātauranga o Aotearoa  
New Zealand Qualifications Authority

## Level 1 Physics, Earth and Space Science 2024

### 92046 Demonstrate understanding of the effect on the Earth of interactions between the Sun and the Earth-Moon system

Credits: Five

#### ASSESSMENT TASK

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the effect on the Earth of interactions between the Sun and the Earth-Moon system.	Explain the effect on the Earth of interactions between the Sun and the Earth-Moon system.	Analyse the effect on the Earth of interactions between the Sun and the Earth-Moon system.

Refer to this document to respond to the task for Physics, Earth and Space Science 2024 92046.

Make sure that you have Resource Booklet 92046R.

Check that this document has page 2 and that the page is not blank.

Do not use chatbots, generative AI, or other tools that can automatically generate content.

**DO NOT TAKE THESE ASSESSMENT MATERIALS OUT OF THE ASSESSMENT ROOM.**

**Achievement**

**TOTAL 10**

This report is about how interactions between the Sun and the Earth-Moon system affects Earth. There are three parts that cover three different effects. Use specific evidence from Resource Booklet 92046R and your own knowledge to respond to all parts of the report.

### **PART ONE: CHANGES IN SHADOW LENGTH IN A DAY**

The length and direction of shadows change throughout the day.

Explain why the length and direction of shadows change.

Your explanation should include:

- How the Sun's height changes throughout a day.
- Why the shadows at 9 a.m., midday, 3 p.m., and 6 p.m. have different lengths.
- Why the shadows at 9 a.m., midday, and 3 p.m. have different directions.
- Why Auckland and Invercargill have different shadow lengths during the same day.

### **PART TWO: SEASONAL CHANGES BETWEEN CHRISTCHURCH AND SCOTT BASE**

Many research scientists fly out from Christchurch Airport to research stations such as Scott Base in Antarctica. These two places experience different day lengths in different seasons.

Explain why there are seasonal changes between Christchurch and Scott Base.

Your explanation should include:

- How the tilt of the Earth creates differences in day length between the seasons.
- The differences between equinoxes and solstices.
- How the Sun's path appears to change throughout the year.
- Why daylengths are different between Christchurch and Scott Base throughout the year.

### **PART THREE: ECLIPSES**

Explain the conditions necessary to observe **solar** and **lunar eclipses** using the figures provided in the resource booklet as needed.

Your explanation should include:

- The relative positions of the Sun, Moon, and Earth during solar and lunar eclipses.
- The relevant phases of the Moon for solar and lunar eclipses.
- Why solar and lunar eclipses do not occur every month.
- Why a lunar eclipse lasts longer than a solar eclipse.

Question 1 answer:

As the earth rotates on its axis, the sun appears to travel across our sky going east to west, this influences the shadows that come from the sun's light. Shadows are made when light hits an opaque object, in this case the sun's light hitting a tree for example. During the day the shadow from the tree will move and change shape, getting longer at sunrise and towards sunset, and shorter around midday. This happens because the sunlight ends up hitting the tree at different angles causing the length and shape of the shadows to change. When the sun rises in the east the tree's shadow will be longer and facing west, when it is midday the shadow will be shorter due to the direct sunlight, and when the sun sets the tree's shadow will be longer and facing east. If you measure the same tree in two different places at the same time, you might actually get different shadow lengths, due to if the sun is facing that area more directly. For example a 20m totara tree measured on a winter day in auckland and in Invercargill, will have different shadow lengths. In Auckland the tree's shadow was 36 m, whereas in Invercargill it was 55m. This is due to Auckland having more direct sunlight than Invercargill.

Question 2 answer:

Seasons are caused by the earth's axis being on a 23.5 degree tilt, depending on the position of a point on earth in relation to the angle and to the sun, the season that point experiences will change. Due to the seasons changing, that point will have differing amounts of daylight during certain periods of time particularly when experiencing solstices and equinoxes. The solstices are when the longest and shortest days occur, the winter solstice being the shortest day and the summer being the longest. Equinoxes on the other hand are days when the day and night balance are equal, hence the name. There are two equinoxes: the spring equinox and the autumn equinox. These factors lead us to the amount of daylight, changing between Christchurch and the scott base at one point in time. In Christchurch when experiencing the winter solstice it is expected that you could get 15 and 25 minutes of daylight and during the summer solstice you'd get 8 hours and 56 minutes. Whereas at the scott base due to its latitude gets 24 hours of daylight during the summer solstice and 0 hours of sunlight during the winter solstice. In both places however the Equinox's always end up having 12 hours of daylight.

Question 3 answer:

Lunar eclipses only occur when the earth casts a shadow over the moon, putting the earth in between the moon and the sun, which can only happen during the new moon phase. Whereas solar eclipses only occur when the moons get put between the sun and the earth, causing the earth to cast a shadow over the moon, which can only happen during the full moon phase. The reason why we don't get eclipses every month is because the moon's orbit is elliptical and tilted at a 5 degree angle to the earth, meaning that it doesn't always line up with the earth and the sun. The points at which the moons do line up with the earth are referred to as lunar nodes, lunar nodes are what allows the eclipses to occur. Another important part is that the shadows of both the earth and moons have different parts, an umbra being the darkest part of the shadow, and the lighter part being referred to as the penumbra. The eclipses take differing amounts of time to occur with lunar eclipses lasting longer than their solar counterpart. Lunar eclipses last longer taking three hours to complete its duration, because it takes a longer amount of time for the earth's umbra to pass over the moons than it takes the Solar eclipse's earth to rotate a point on its axis away from the moon's umbra which only takes 4 minutes.

Diagrams (make sure these are clearly labeled with the question they are relevant to)

**Authenticity statement:**

I state that I have not copied another student's work, I have not copied directly from a published source, I have not shared my work with another student, and I have not brought any materials or devices into a test that are not allowed (this includes phones, earphones, smart watches, writing on body parts etc).

Type your name here to acknowledge you understand the authenticity requirements above:

Signed:

## Achievement

**Subject:** Physics, Earth and Space Science

**Standard:** 92046

**Total score:** 10

Q	Grade score	Marker commentary
One	4	Candidate has described why the length and direction of shadows change throughout a day. However, they do not explain how this happens or how the differences in latitude affects the length of shadow.
Two	3	Candidate has described how the Sun's path changes throughout the year, differences between equinoxes and solstices. However, they do not explain any of the concepts listed above.
Three	3	Candidate describes the location of Sun, Moon, and Earth for a lunar and solar eclipse. However they do not link this to the correct phases of the moon.