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NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA
QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Level 1 Physics and ESS RAS 2022

92046 Demonstrate understanding of the effects on planet Earth of interactions between the Sun and the Earth-Moon system

Credits: Five

PILOT ASSESSMENT

STIMULUS MATERIAL

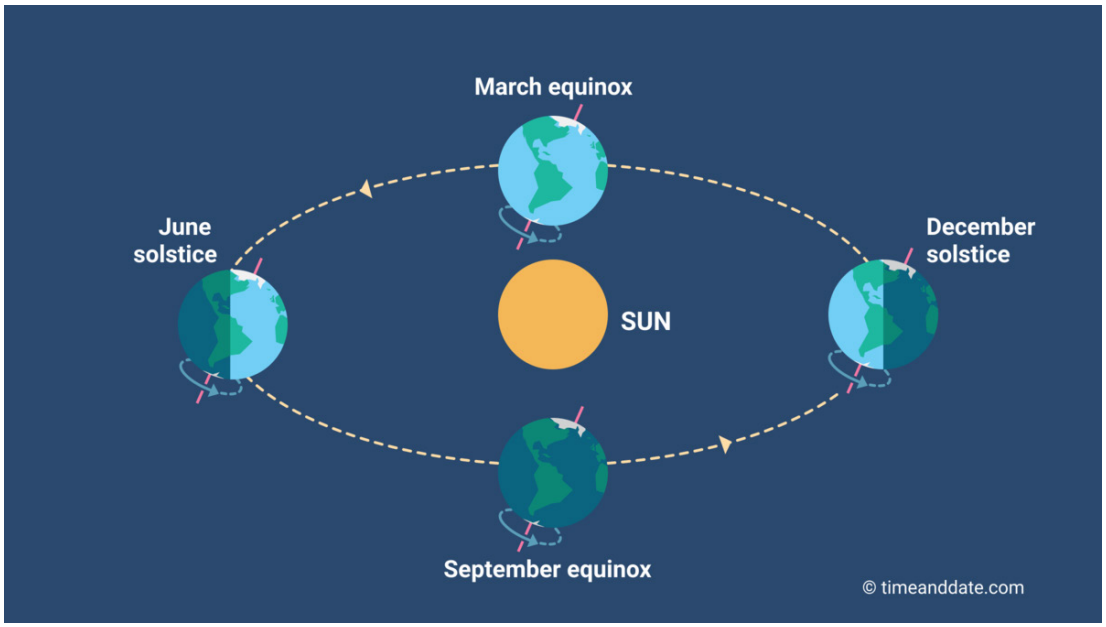
Refer to this booklet to answer the questions for Physics and ESS RAS 92046.

Check that this booklet has pages 2–7 in the correct order and that none of these pages is blank.

YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.

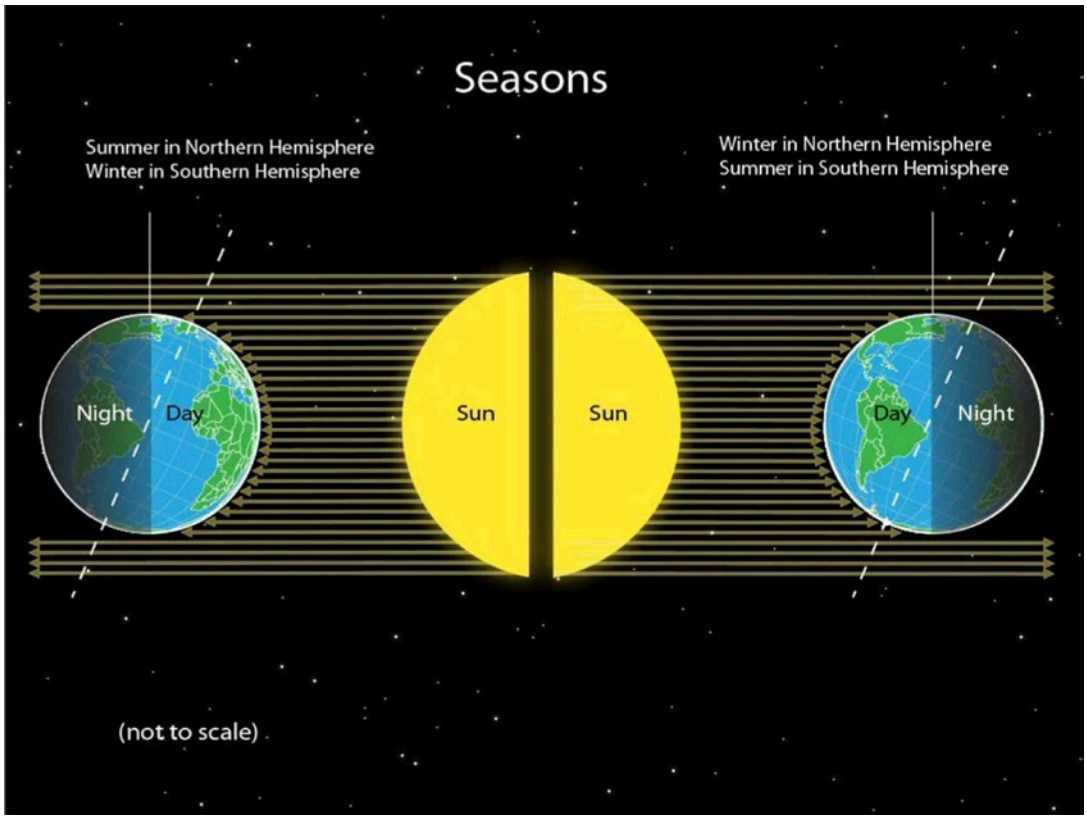
RESOURCE A: SEASONS

While the Earth is rotating on its axis, it is also orbiting the Sun once every 365.25 days. Also, the Earth is on a tilt of about 23.5°, causing it to be unevenly heated by the Sun.



Source: www.timeanddate.com/calendar/aboutseasons.html

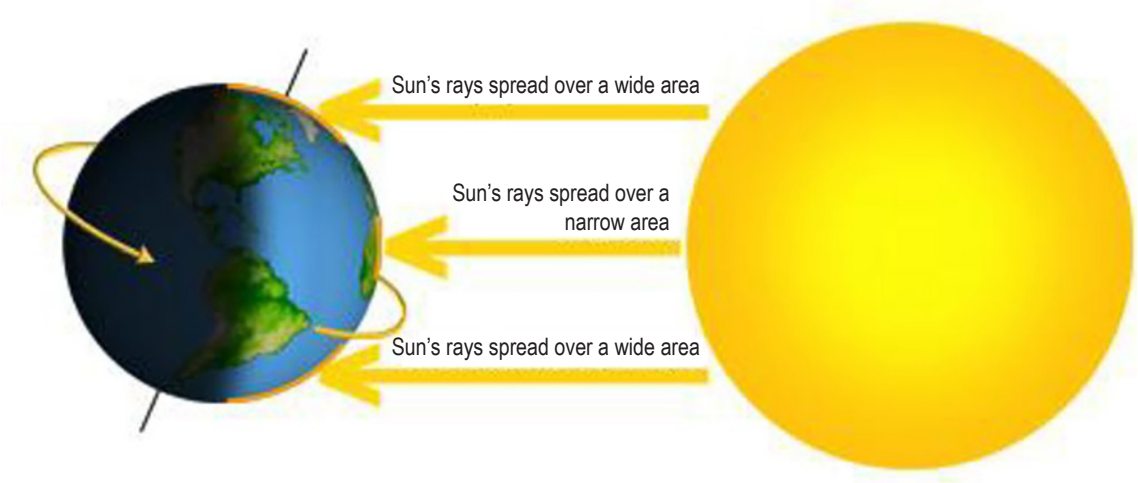
This results in the four seasons: summer, winter, spring, and autumn. Seasons happen at opposite times for the Northern and Southern Hemisphere. When the Southern Hemisphere is tilted towards the Sun, it experiences summer while the Northern Hemisphere experiences winter. When the Southern Hemisphere is tilted away from the Sun, it experiences winter while the Northern Hemisphere experiences summer. The same happens with Spring and Autumn: where the Southern Hemisphere will be experiencing spring, the Northern Hemisphere will be experiencing autumn.



www.insightsonindia.com/world-geography/physical-geography-of-the-world/climatology/weather-climate/weather-seasons-climate/

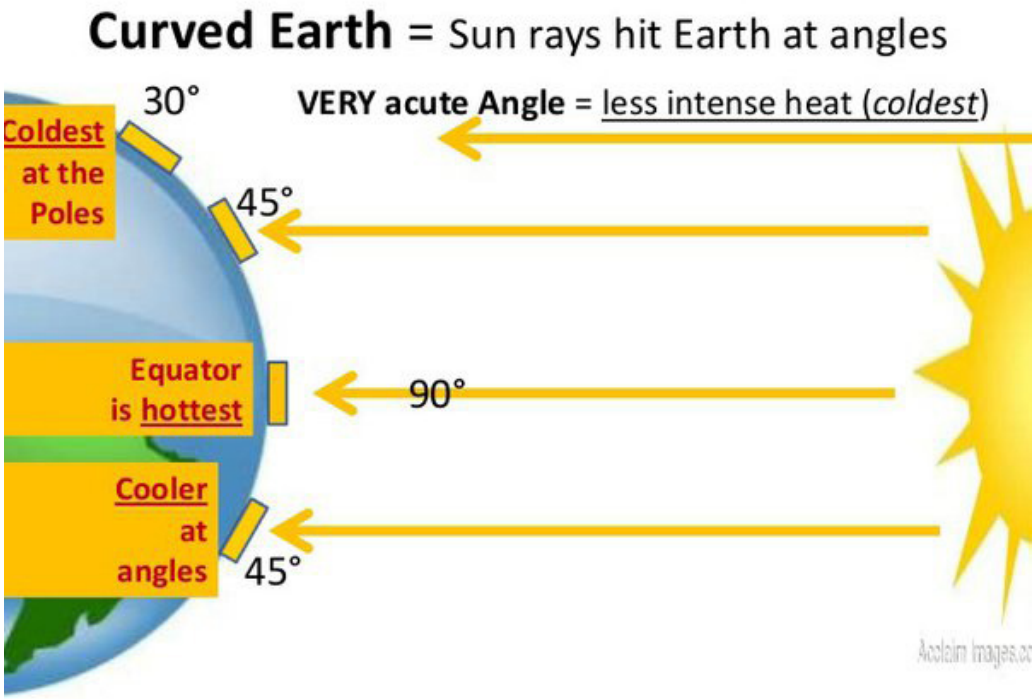
RESOURCE B: ANGLE OF INSOLATION

The angle of insolation is the angle at which the Sun's rays strike the Earth's surface. At the poles, the Sun's rays are spread over a much larger area than at the Equator. This is due to the angle at which the rays strike the surface. At the poles, the rays strike at a lower angle, whereas at the Equator they strike at a higher angle.



Source: https://slideplayer.com/slide/17080080/

The angle at which the Sun's rays strike the surface of the Earth determines the temperature of the surface. The higher the angle, the more direct the sunlight, the warmer the surface increased (greater solar radiation).

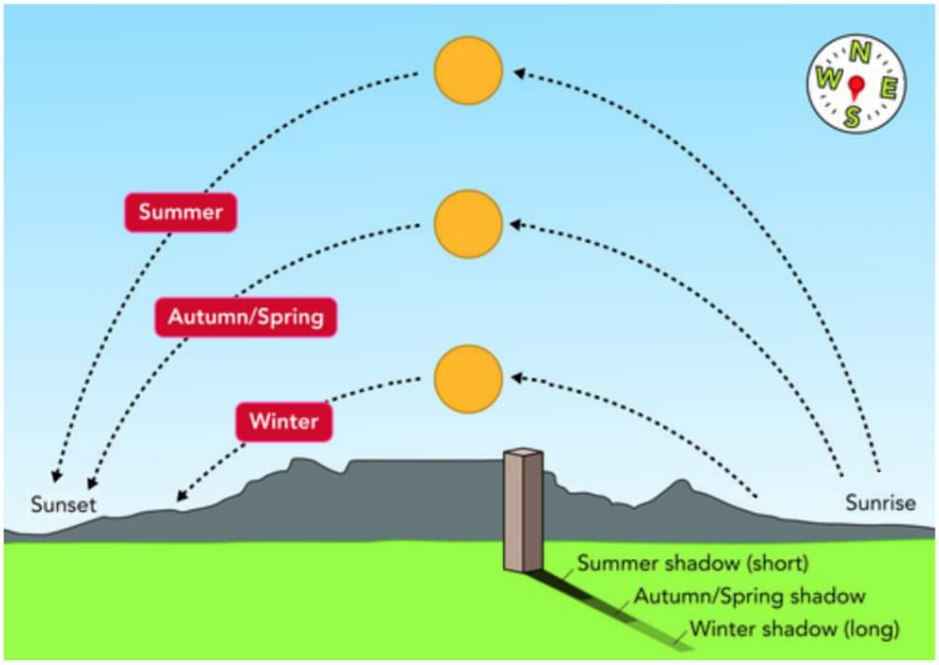


Source: https://pt.slideshare.net/jeremylowe581/solar-energy-and-its-affect-on/9?smtNoRedir=1

RESOURCE C: SUNRISE AND SUNSETS IN AOTEAROA/NEW ZEALAND

Source: www.spacecentre.nz/resources/faq/solar-system/earth/rotation-speed.html

The Earth rotates once every 24 hours about its axis, causing the Sun to appear to be moving across the sky. This movement of the Earth causes the Sun to appear to be rising in the East and setting in the West.



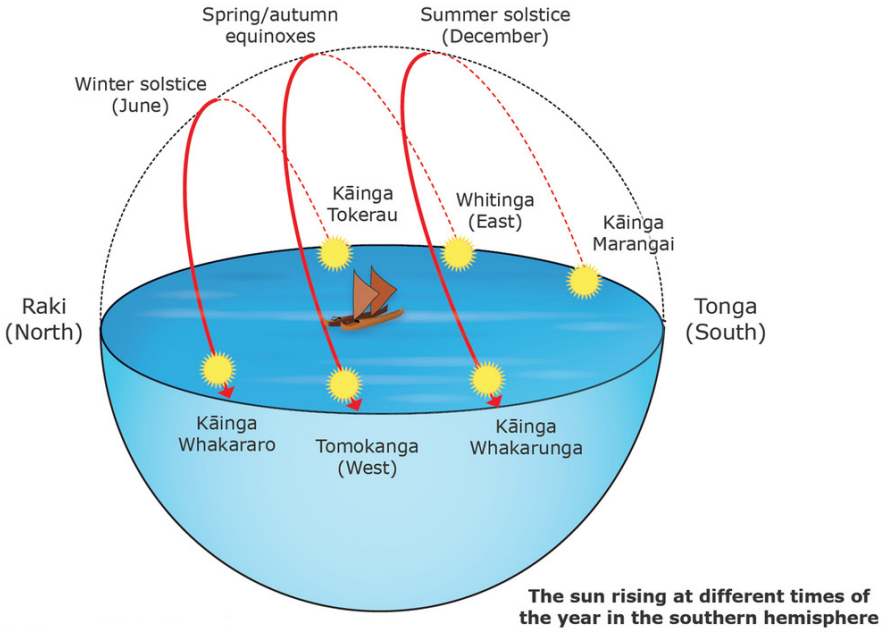
Source: https://intl.siyavula.com/read/science/grade-7/relationship-of-the-sun-to-the-earth/18-relationship-of-the-sun-to-the-earth?id=toc-id-11

In summer, the Sun is higher in the sky than in winter, meaning that it takes more time to travel across the sky from sunrise to sunset; therefore there are more hours of daylight. The number of daylight hours during the year occurs due to the tilt of the Earth's rotational axis relative to the Sun.

RESOURCE D: MĀORI NAVIGATION

Māori travelled to Aotearoa/New Zealand from an area between the **Tropic of Capricorn** and the **Equator**.

Source: https://teara.govt.nz/en/map/2510/pacific-migration-routes



https://www.sciencelearn.org.nz/images/683-sun-rising-in-the-southern-hemisphere

Māori used the Sun as part of their navigation across the Pacific Ocean to Aotearoa/New Zealand. They recognised that it rose in the East and set in the West. Furthermore, Māori recognised that the Sun was higher in the sky, and this changed where it rose and set.

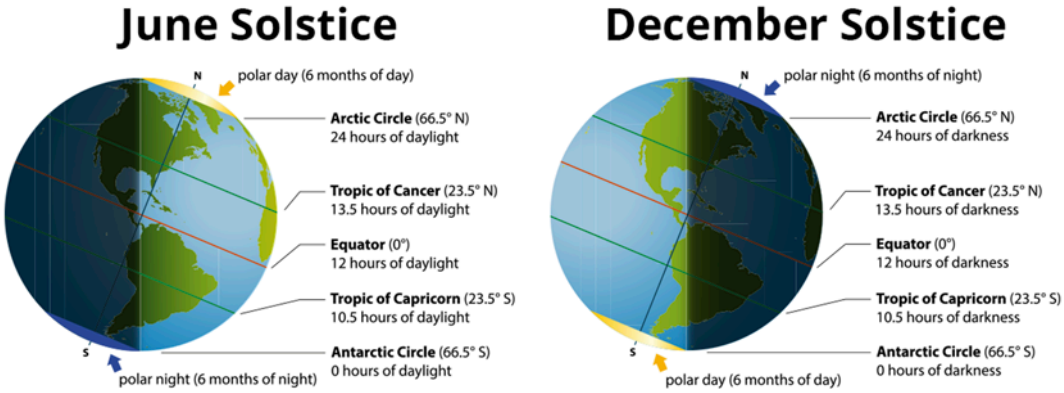
Māori recognised the changing path of the Sun and used the name Kāinga for where the Sun lives:

North east: Kāinga Tokerau.
South east: Kāinga Marangai.
North west: Kāinga Whakararo
South west: Kāinga Whakarunga

RESOURCE E: EQUINOXES AND SOLSTICES

A change in the season is marked by a specific point in the Earth's orbit known as a solstice and equinox.

Solstice

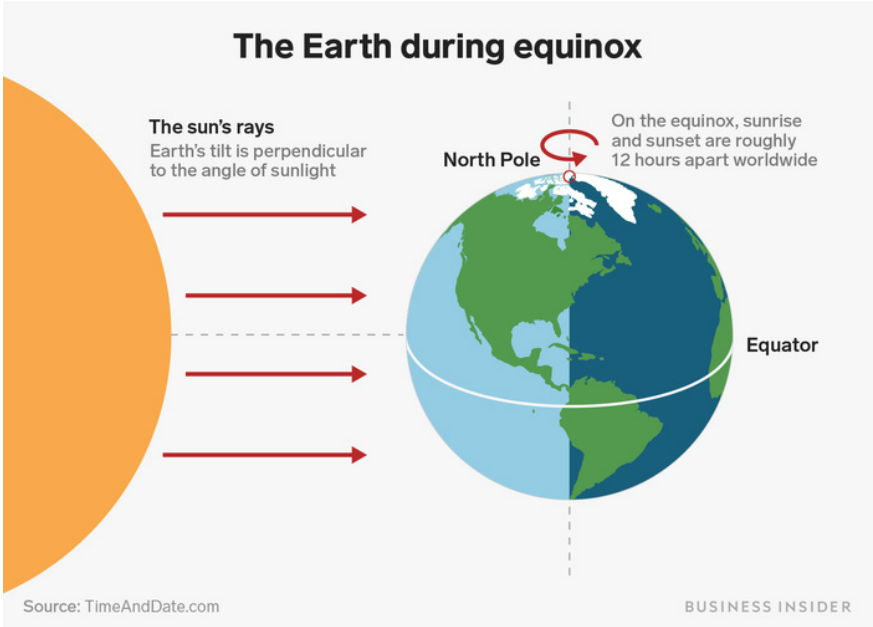


Source: www.thesuntoday.org/solstice-equinox/2021-june-solstice/

The solstices are the two points in the Earth's orbit around the Sun where the Sun appears to reach either its northernmost or southernmost point in the sky for the year. The winter solstice occurs when the Earth is tilted as far away from the Sun as it will be all year and results in the shortest (number of daylight hours) day of the year. While the summer solstice occurs when the Earth is tilted as close to the Sun as it will be all year resulting in the longest day.

Equinox

An equinox occurs twice a year when the amount of daylight hours is the same as the number of night time hours all over the Earth. These happen in March (about 21 March) and September (about 23 September).



Source: https://www.businessinsider.in/science/news/the-fall-equinox-comes-on-tuesday-a-planetary-scientists-simple-animation-explains-what-equinoxes-are-and-how-they-work-/articleshow/78219817.cms

RESOURCE F: SUNRISE AND SUNSET TIMES FOR AUCKLAND AND DUNEDIN

Two cities in the same country can have different day lengths on any one day. Day length changes due to a number of factors including:

- the tilt of the Earth
- latitude.

Latitude is how far north or south of the Equator you are. Locations at similar latitudes will have similar day lengths. Day length changes during the year, as the Earth orbits the Sun. In summer, the further south you are in Aotearoa / New Zealand, the earlier the sun rise will be and the later the sunset. In winter this is opposite, with locations further north in Aotearoa / New Zealand having a longer day length.

Adapted from: https://newzealandmap360.com/new-zealand-geography-map

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