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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Physics, Earth and Space Science RAS 2023

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

EXEMPLAR

Excellence

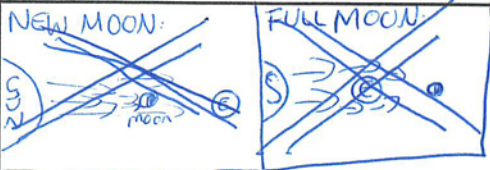
TOTAL 19

PART ONE: LUNAR PHASES

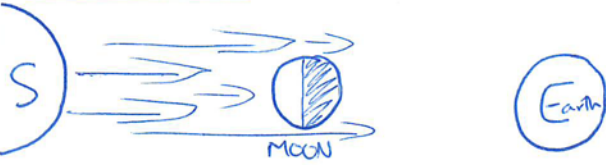
One side of the moon is always lit by the sun's light. As the moon orbits the earth, we on earth see different parts of the lit side. This is why we see phases of the moon. For example, when it is a new moon, the moon is in between the earth and the sun, so the side of the moon which is lit by the sun is facing away from us on earth. This means we can not see the lit side, and that is called a new moon because on earth we can't see any of the moon because the side facing us is not lit up. During a full moon the earth is in between the sun and moon. Sunlight goes around the earth and lights up the side of the moon which is facing us on earth. Because we can see the full side of the ~~earth~~^{moon} lit up, this is called a full moon. When the moon is at the first quarter and third quarter points of its orbit, the sun and moon are at right angles to the earth. This means from on earth we can only see half of the lit side which is facing the sun. That is how we ^{have} half moons in the phases of the moon: because we can only see half of the lit side of the moon.

The lunar cycle takes 29.5 days because this is how long it takes ~~to orbit the~~ for the moon to orbit the earth once. ~~So from the time there is a new moon, and then the moon has gone through~~ The moon's phases are caused by its orbit around the earth, and one orbit takes 29.5 days, so this is how long it takes for the lunar cycle.

The moon rises at different times each day depending on which phase it is in, and depending on its orbit and earth's rotation. These factors cause it to rise at different times.



NEW MOON:



FULL MOON:



PART TWO: TIDES

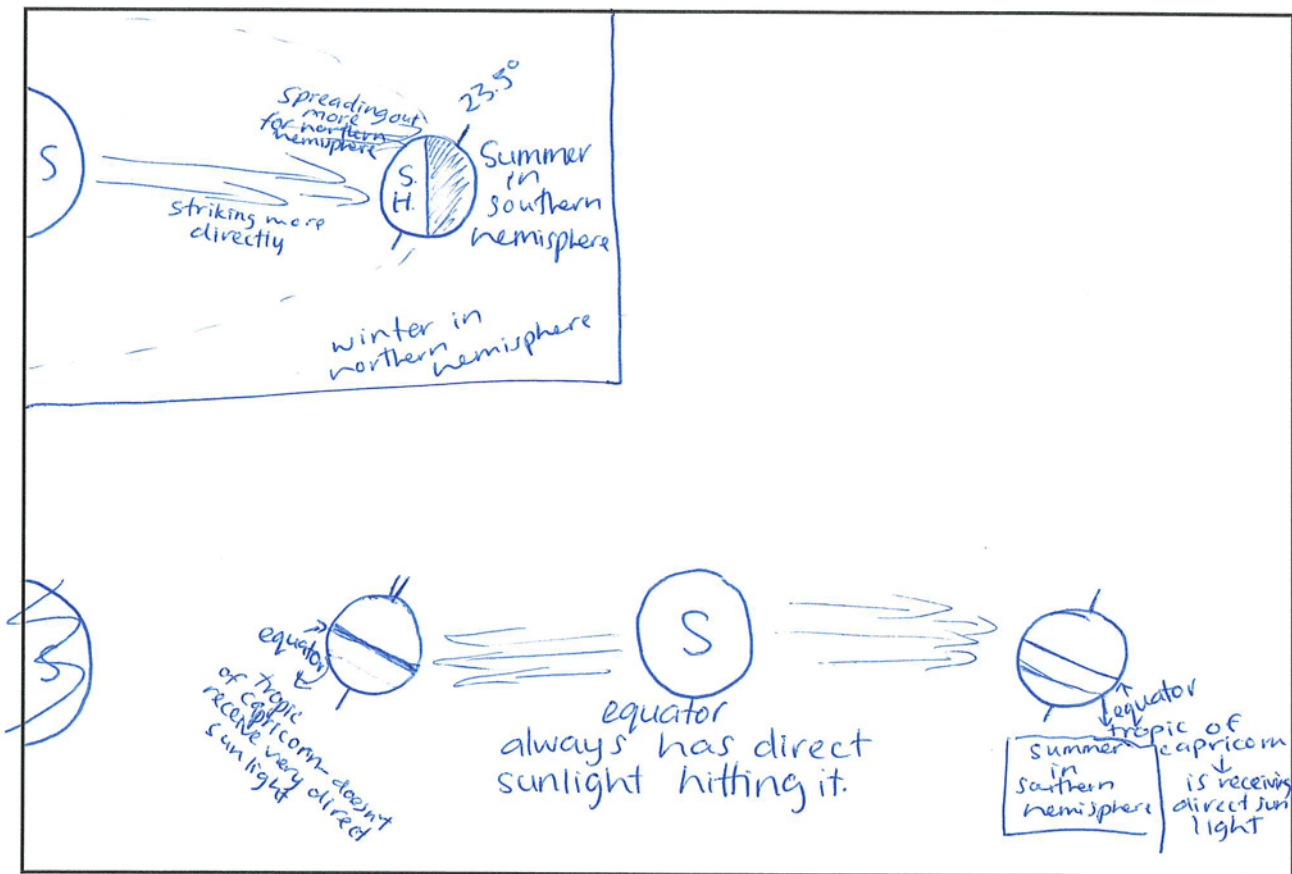
Tides are caused by the sun and moon's gravitational pull on the earth. High tides are caused twice a day ~~by~~ and they occur when the area is in the tidal bulge. The tidal bulge is caused by ~~the~~ the moon's gravitational pull on one side of the earth, and the pull of inertia ~~which~~ on the opposite side of the earth. So the side of the earth facing the moon, and the opposite side which is facing away have the high tide, and the other two sides have low tide. Because of the earth's rotation, there is always two high tides in a day: ~~when in the gravita'~~ once from the gravitational pull of the moon, ^{when facing the moon} and once from the pull of inertia ^{when facing away from the moon} between the two high tides there is low tides.

A spring tide occurs when the sun, moon, and earth are in alignment, and the gravitational pull of the sun and moon combined, causes the highest high tides and the lowest low tides. A neap tide occurs when the moon is at first-quarter or third-quarter, and the sun and moon are at 90° angles to each other which causes the gravitational pull from each to partly cancel out each other's effect. This results in moderate tides where the difference between high ~~low~~ and low is the least. Spring tides and neap tides occur every 14 days because this is the time between the four moon phases ^{each phase} when these tides occur. There is 14 days between ^{each phase} new moon, first quarter, ~~third quarter~~, and full moon, and third quarter.

A king tide is a spring tide when the moon is at its perigee, which means it is at the point of its orbit when it is closest to earth. New Zealand experiences king tides at irregular intervals because ~~it~~ it has to be both a new or full moon and the moon must be at its perigee for this to happen, and because of the slight tilt in the moon's orbit, ~~both~~ both things don't occur at the same time regularly. That is why the intervals

PART THREE: SEASONS

Seasons on earth ^{are caused} because of the earth's tilt as it orbits the sun. The earth is tilted 23.5° on its axis which causes one hemisphere to be facing the sun more than the other. This is what causes the seasons in ^{the} two hemispheres. Summer in New Zealand occurs when the southern hemisphere is tilted towards the sun. When it is tilted towards the sun it means the angle of insolation is smaller, meaning that the sun's rays are hitting the earth at a more direct angle. When the sunlight is striking at a more direct angle it means it is spreading over less area which makes the energy more concentrated, therefore increasing the temperature. And that is how summer is caused. Winter is the opposite. In winter the southern hemisphere is tilted away from the sun, which means that the angle of insolation is larger. This means that the sun rays are hitting the southern hemisphere less directly and is spreading over a larger area; more m^2 . This means that the sunlight is less concentrated which lowers the temperatures, causing winter. In between summer and winter the southern hemisphere is neither tilted at or away from the sun, which results in middling temperatures. ^{in spring + autumn} The United Kingdom is ~~the~~ in the northern hemisphere which means that although they have the same seasons as the southern hemisphere, they have them at opposite times of the year. This is because when the southern hemisphere is tilted towards the sun; meaning we have summer - the northern hemisphere is tilted away from the sun, which means the energy hitting them is hitting at a lower angle and is spreading out, which lessens the concentration of energy and lowers the temperature. Winter. Again, when we have winter; pointing away from the sun - they are tilted towards it ~~and~~ and have summer. That is why the United Kingdom in the northern hemisphere has opposite seasons



to New Zealand in the southern hemisphere. The equator is in the middle of the earth which means it receives the most direct sunlight of any point on earth. Because it is in the middle, there will always be almost direct sunlight hitting it, whether the southern hemisphere is ~~face~~ tilted towards the sun or whether the northern hemisphere is. ~~That is why the equator~~ In contrast, NZ is down the bottom of the earth in the southern hemisphere on the Tropic of Capricorn. This means that it only receives direct sunlight (or more direct sunlight) ~~in the~~ when the southern hemisphere is tilted towards the earth. That is why the equator experiences little seasonal variation compared to New Zealand.

Excellence

Subject: Physics, Earth and Space Science RAS

Standard: 92046

Total score: 19

Q	Grade score	Marker commentary
One	M5	Candidate has explained two phases of moons in terms of their relative positions of Earth-Moon-Sun system.
Two	E7	Candidate has discussed why Aotearoa/NZ experiences king tides at irregular intervals.
Three	E7	Candidate has discussed how the relationship between Earth and Sun in terms of orbit and tilt can cause variation in radiation and seasons.