Year 11 Science: Day and night, and the seasons in New Zealand

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Which season does New Zealand have when the Southern Hemisphere is tilted towards the Sun?

2. Christchurch is at about 43.5°S. Calculate the height of the midday Sun there on 22 December.

3. Use the sunrise and sunset table: how much longer is Christchurch's day on 22 December than on 21 June?

4. Earth is closest to the Sun on 4 January. Explain why this is not the reason New Zealand has summer then.

5. In which direction does the Sun rise in Auckland on 21 June?

Exam-style question: summer evenings in Invercargill

A student moves from Auckland (37°S) to Invercargill (46°S). In December she notices it is still light at 9:30 pm, but in June it is dark by 5:15 pm. Use the sunrise and sunset table above.

6. Describe why Invercargill has day and night, and why the Sun rises in the east.

7. Explain why Invercargill's days are longer and warmer in December than in June. Refer to Earth's tilt and orbit.

8. Discuss why Invercargill has longer days than Auckland in December, shorter days in June, and almost the same day length in September.

Fix the mistake

9. Correct this statement: "Summer happens because Earth is closer to the Sun."

10. Correct this statement: "Earth's axis tips towards the Sun in summer and away in winter."

11. Correct this statement: "It is hotter in summer because there is more sunlight."

12. Correct this statement: "In summer the Sun is directly overhead in New Zealand at midday."

Answer key (for parents and tutors)

1. Which season does New Zealand have when the Southern Hemisphere is tilted towards the Sun?
   Summer (December to February).
2. Christchurch is at about 43.5°S. Calculate the height of the midday Sun there on 22 December.
   90 − 43.5 + 23.4 = 69.9, so about 70°.
3. Use the sunrise and sunset table: how much longer is Christchurch's day on 22 December than on 21 June?
   15 h 26 min − 8 h 56 min = 6 h 30 min longer.
4. Earth is closest to the Sun on 4 January. Explain why this is not the reason New Zealand has summer then.
   At the same time of year the Northern Hemisphere, at almost the same distance, has winter, and the distance changes by only about 3%; New Zealand has summer because the Southern Hemisphere is tilted towards the Sun.
5. In which direction does the Sun rise in Auckland on 21 June?
   North of east (north-east), because in winter the Southern Hemisphere is tilted away from the Sun.
6. Describe why Invercargill has day and night, and why the Sun rises in the east.
   Earth spins on its axis once every 24 hours. Invercargill has day when it is turned to face the Sun and night when it is turned away. Earth spins from west to east, so the Sun appears to rise in the east (Achieved).
7. Explain why Invercargill's days are longer and warmer in December than in June. Refer to Earth's tilt and orbit.
   Earth's axis is tilted 23.4° and keeps pointing the same way as Earth orbits the Sun each year. In December the Southern Hemisphere is tilted towards the Sun, so more of Invercargill's daily circle is in sunlight (15 h 49 min of daylight) and the Sun climbs high (about 67°), so its radiation is concentrated. In June the hemisphere is tilted away: only 8 h 35 min of daylight and a midday Sun near 20°, so the radiation is spread over more ground for fewer hours and it is colder (Merit).
8. Discuss why Invercargill has longer days than Auckland in December, shorter days in June, and almost the same day length in September.
   Excellence links latitude to tilt: in December the Southern Hemisphere leans towards the Sun, and the further south a place is, the larger the part of its daily circle that stays in the lit half, so Invercargill (15 h 49 min) beats Auckland (14 h 42 min). In June the same tilt puts more of the far-south circle in darkness, so Invercargill (8 h 35 min) has less daylight than Auckland (9 h 38 min). At the September equinox neither hemisphere leans towards the Sun, so the boundary between day and night passes through both poles, cuts every circle of latitude in half, and both cities get about 12 hours.
9. Correct this statement: "Summer happens because Earth is closer to the Sun."
   Earth is closest in early January, when the Northern Hemisphere has winter; seasons come from the tilt, not the distance.
10. Correct this statement: "Earth's axis tips towards the Sun in summer and away in winter."
    The axis always points the same way in space; it is Earth's position in its orbit that decides which hemisphere leans towards the Sun.
11. Correct this statement: "It is hotter in summer because there is more sunlight."
    Say there is more solar radiation per square metre, because the Sun is higher, and that it shines for more hours each day.
12. Correct this statement: "In summer the Sun is directly overhead in New Zealand at midday."
    The Sun is only ever overhead between 23.4°N and 23.4°S; in Auckland it peaks at about 77°, always to the north.