



# Answers

## Sun, Earth, Moon

### Year 7 Science

### Chapter 10

<b>p216</b>	<ol style="list-style-type: none"><li>1 Geocentric indicates a model in which Earth is the centre of the universe.</li><li>2 Pythagoras' reasoning was that the sphere is the perfect shape and therefore the Earth, being perfect, must be a sphere.</li><li>3 I think that Aristotle's observation that during a lunar eclipse, the Earth's shadow on the Moon is always round is the strongest for deducing a spherical Earth.</li><li>4 I think that Aristotle's observation that when moving from north to south, different stars rise above the southern horizon. is the weakest for deducing a spherical Earth.</li><li>5 I think that Aristotle's reasoning is strong enough to deduce that the Earth is close to spherical.</li></ol>
<b>p219</b>	<ol style="list-style-type: none"><li>1 The Sun can, in an instant, deliver enough energy into the eye to heat and permanently damage the retina.</li><li>2 The sun is vital to our life on Earth. The sun provides our heat and light energy. The sun supports almost all life on Earth through photosynthesis. The Sun's energy also drives our climate and weather.</li><li>3 Our Sun generates its energy through the nuclear fusion of hydrogen into helium. The Sun is made up of about 75% hydrogen and 25% helium.</li><li>4 The energy from the Sun is processed in a number of ways: Plants photosynthesise sunlight into chemical energy (food). Fossilised plants and animals store energy in the form of oil, coal, and gas. Solar energy is converted to heat energy and electrical energy by a variety of solar equipment.</li><li>5 The next year of maximum activity will occur around 2023.</li><li>6 The reasoning for thinking that low sunspot activity is linked with low temperatures on Earth would be that the less the activity then less energy is transmitted to Earth.</li></ol>
<b>p221</b>	<ol style="list-style-type: none"><li>1 The Earth spins on an axis which is tilted at <math>23.5^\circ</math>. The axis is an imaginary line from the north pole to the south pole.</li><li>2 The stars appear to move towards the west as we move towards the east.</li><li>3 The <math>23.5^\circ</math> tilt as Earth spins on its axis causes the seasons. The tilt of the Earth causes some parts of Earth to have longer days than nights, summer, while other parts have shorter days than night, winter.</li><li>4 A year is the time taken for the Earth to orbit the Sun. During a year the Earth spins on its axis 365.25 times. Thus there are 365.25 days in a year.</li><li>5 Our calendar has 365 days for three years and then 366 days for one year (leap year). The leap year is a time correction.</li><li>6 A leap year happens whenever the last two digits of the year is divisible by 4. For example 2012 (<math>12 \div 4 = 3</math>) is a leap year. 2023 will not be a leap year.</li></ol>

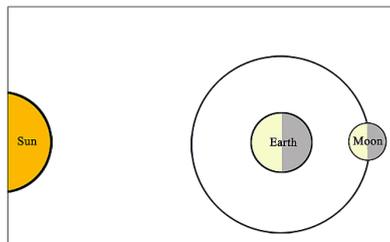
p223

- 1 The main reason for the Earth's seasons are the tilt of the Earth's axis **and** Earth's orbit of the Sun.
- 2 The year is divided into four seasons:  
In **summer** the days are their longest which leads to increased heating. Traditionally, the summer months are November, December, January.  
In **autumn** the days are shortening and the temperatures are decreasing. Traditionally, the autumn months are February, March, April.  
In **winter** the days are their shortest which leads to decreased heating. Traditionally, the winter months are May, June, July.  
In **spring** the days are increasing and the temperatures are increasing. Traditionally, the spring months are August, September, October.
- 3 Winter temperatures less than summer temperatures because there is less Sun in winter than in summer.
- 4 An equinox occurs twice a year, around 20 March and 22 September. The word itself has several related definitions. The oldest meaning is the day when daytime and night are of approximately equal duration.
- 5 During our winter, it is possible for the night to be 24 hours at the southern pole.
- 6 During our winter, it is possible for the day to be 24 hours at the northern pole.
- 7 When it is spring in the southern hemisphere, it is autumn in the northern hemisphere?
- 8 There would be no seasons if the Earth wasn't tilted. There may be some differences during our orbit around the Sun as we come closer, warmer, or further away, cooler.

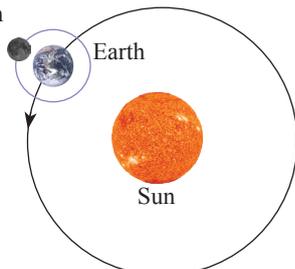
p227

- 1 The two main surfaces of the moon are the cratered highlands and the smooth maria which are massive craters flooded by molten lava. They can be identified on a photo of the moon.
- 2 The gravitational attraction between the Earth and the moon is the reason why the same side of the moon is always facing Earth.
- 3 29.5 days between one full moon and the next full moon?
- 4 A bit under 15 days.
- 5 A 'blue moon' happens when there are two full moons in the one month. A Blue Moon happens on average about once every 2.7 years.

6



- 7 A new moon so dark because there is no sunlight striking the surface of the moon.
- 8 Relatively, more meteorites hit the moon than the Earth because the moon has little atmosphere. Many meteors are burned up or shattered on entry into Earth's atmosphere.

<p><b>p228</b></p>	<ol style="list-style-type: none"> <li>1 A solar eclipse happens when the moon casts a shadow on the Earth.</li> <li>2 It is rare for a total solar eclipse to happen where you live because moon casts a narrow shadow over the Earth.</li> <li>3 A solar eclipse only happens during a new moon because that is when the moon is between the Earth and the Sun.</li> <li>4 In ancient times, total solar eclipses were frightening because the sun disappears in the middle of the day and the day quickly turns into night.</li> </ol>
<p><b>p229</b></p>	<ol style="list-style-type: none"> <li>1 A lunar eclipse happens when the Earth casts a shadow on the moon.</li> <li>2 The size of the Earth's shadow means that it can take several hours for the moon to pass through the Earth's shadow.</li> <li>3 The Earth's shadow can cast a red shadow on the moon as light is refracted through the Earth's atmosphere (Reddish colouring similar to that of sunrises and sunsets).</li> <li>4 You wouldn't be able to see a lunar eclipse during the middle of the day because you would be on the wrong side of the Earth to be able to see the Earth's shadow on the moon.</li> <li>5 A lunar eclipse can only happen during a full moon because the Earth needs to be between the Sun and the moon.</li> </ol>
<p><b>p230</b></p>	<ol style="list-style-type: none"> <li>1 I think that Aristotle's observation that during a lunar eclipse, the Earth's shadow on the Moon is always round is the strongest for deducing a spherical Earth.</li> <li>2 I think that Aristotle's observation that when moving from north to south, different stars rise above the southern horizon. is the weakest for deducing a spherical Earth.</li> <li>3 I think that Aristotle's reasoning is strong enough to deduce that the Earth is close to spherical.</li> <li>4 a) As ships approach land, we first see the masts and then the ship rises out of the sea. This wouldn't happen if the Earth was flat. b) The curvature of the Earth can be seen from a plane at high altitudes.</li> <li>5 Measurements across Lake Ayre showed that the water surface is flat. Water surfaces are flat. The surfaces of the oceans are flat. Thus the Earth is flat.  The measurements across Lake Ayre weren't accurate enough to measure the curvature of the Earth.</li> </ol>
<p><b>p230</b></p>	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 60%;"> <ol style="list-style-type: none"> <li>2 The moon orbits the Earth every 29.5 days.</li> <li>3 The Earth to orbits the sun every 365.25 days.</li> <li>4 The Earth makes 365.25 revolutions in a year?</li> <li>5 Aristarchus (310-230 BC?) conclusions that the sun was much larger than the Earth led to his theory that the Earth circled the Sun.</li> </ol> </div> <div style="width: 35%; text-align: center;"> <p><b>1</b> Moon</p>  <p>Earth</p> <p>Sun</p> </div> </div>

p231

- 1 The Sun can, in an instant, deliver enough energy into the eye to heat and permanently damage the retina.
- 2 The sun is vital to our life on Earth. The sun provides our heat and light energy. The sun supports almost all life on Earth through photosynthesis. The Sun's energy also drives our climate and weather.
- 3 Our Sun generates its energy through the nuclear fusion of hydrogen into helium. The Sun is made up of about 75% hydrogen and 25% helium.
- 4 The energy from the Sun is processed in a number of ways: Plants photosynthesise sunlight into chemical energy (food). Fossilised plants and animals store energy in the form of oil, coal, and gas. Solar energy is converted to heat energy and electrical energy by a variety of solar equipment.
- 5 Sunspots are dark spots on the sun's surface. Sunspots are dark because the area of intense magnetic activity reduces the temperature of the area.
- 6 Solar flares occur when built up magnetic energy is suddenly released. Solar flares occur around sunspots. Solar flares emit massive amounts of energy and project clouds of electrons, atoms, and ions into space.
- 7 The Earth's magnetic field helps to protect us from solar winds. This suggests that solar flares may contain clouds of electrons, atoms, and ions.
- 8 The reasoning for thinking that low sunspot activity is linked with low temperatures on Earth would be that the more activity the more energy that is transmitted to Earth.

p231

- 1 The Earth spins on an axis which is tilted at 23.5°. The axis is an imaginary line from the north pole to the south pole.
- 2 The stars appear to move towards the west as we move towards the east.
- 3 The 23.5° tilt as Earth spins on its axis causes the seasons. The tilt of the Earth causes some parts of Earth to have longer days than nights, summer, while other parts have shorter days than night, winter.
- 4 A year is the time taken for the Earth to orbit the Sun. During a year the Earth spins on its axis 365.25 times. Thus there are 365.25 days in a year.
- 5 Our calendar has 365 days for three years and then 366 days for one year (leap year). The leap year is a time correction.
- 6 A leap year happens whenever the last two digits of the year is divisible by 4. For example 2012 ( $12 \div 4 = 3$ ) is a leap year. 2018 will not be a leap year.

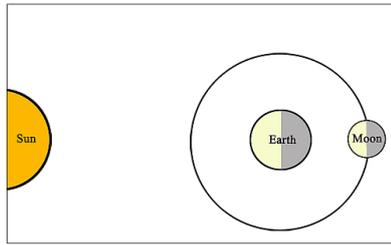
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  - In **summer** the days are their longest which leads to increased heating. Traditionally, the summer months are November, December, January.
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- 4 During our winter, it is possible for the night to be 24 hours at the southern pole.
- 5 During our winter, it is possible for the day to be 24 hours at the northern pole.
- 6 When it is spring in the southern hemisphere, it is autumn in the northern hemisphere?
- 7 If the Earth was tilted at 45°, there would be greater differences in the seasons as parts of the Earth would be further away producing cooler winters. The summers would be more concentrated further north and further south.

p232

- 1 The two main surfaces of the moon are the cratered highlands and the smooth maria which are massive craters flooded by molten lava.
- 2 29.5 days between one full moon and the next full moon?
- 3 A bit under 15 days.
- 4 A 'blue moon' happens when there are two full moons in the one month. A Blue Moon happens on average about once every 2.7 years.

5



- 6 The gravitational pull of the moon on our oceans is strong enough to cause them to bulge towards the moon. The bulge side is high tide and oceans on the other side of the Earth are at low tide.
- 7 There are two high tides per day because the Earth rotates faster than the moon. The time between each high tide is around 12 hours 25 minutes.
- 8 The 'dark side' of the moon, the other side of the moon, isn't always dark. It will be lit, or not lit, by the Sun depending on the phases of the Sun.

p233

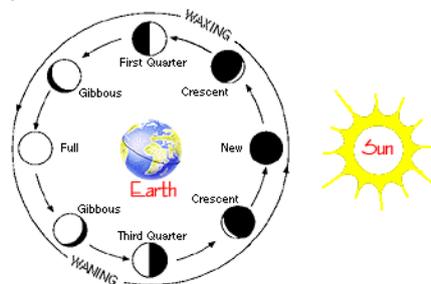
- 1 a) Number of cubes that have been used = 10  
b) Number of cubes needed to complete = 17
- 2 X's next move is to prevent O from winning by placing an X in the top right of the top layer. O then must place an O on the top right of the middle layer to prevent X winning. X's best move is to then place an X bottom right of the top layer.

p234

- 1 The four phases of the moon are: new moon, first quarter, full moon, last quarter.

2

The Moon as seen from Earth

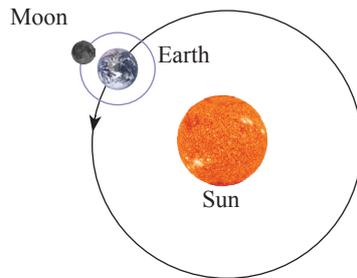


- 3 A solar eclipse happens when the moon casts a shadow on the Earth.
- 4 It is rare for a total solar eclipse to happen where you live because moon casts a narrow shadow over the Earth.
- 5 A solar eclipse only happens during a new moon because that is when the moon is between the Earth and the Sun.
- 6 In ancient times, total solar eclipses were frightening because the sun disappears in the middle of the day and the day quickly turns into night.

p234

1 A lunar eclipse happens when the Earth casts a shadow on the moon.

2



- 3 The size of the Earth's shadow means that it can take several hours for the moon to pass through the Earth's shadow.
- 4 The number of lunar eclipses in a single year can range from 0 to 3.
- 5 You wouldn't be able to see a lunar eclipse during the middle of the day because you would be on the wrong side of the Earth to be able to see the Earth's shadow on the moon.
- 6 A lunar eclipse can only happen during a full moon because the Earth needs to be between the Sun and the moon.

p235

- 1 b)
- 2 Distance to the moon = 390 000 km
- 3 a) Weight of 100 kg on Earth =  $ma = 100 \text{ kg} \times 9.8 \text{ m/s}^2 = 980 \text{ N}$   
b) Weight of 100 kg on moon =  $ma = 100 \text{ kg} \times 1.6 \text{ m/s}^2 = 160 \text{ N}$
- 4 c) Roughly works with the exception of the last two planets. The other options are incorrect.

p236

- 1 a) If the tilt of the Earth was  $0^\circ$ , there would be no seasons. The equator would be a similar temperature all year round and be hotter because it would be the closest to the Sun. The poles would have the same amount of sunlight all year round and not be as cool.  
b) If the Earth was tilted at  $45^\circ$ , there would be greater differences in the seasons as parts of the Earth would be further away producing cooler winters. The summers would be more concentrated further north and further south.  
c) If the Earth stopped spinning a day and night would take a complete orbit of the Sun to be completed. It would be very hot during the very long day and very cold during the very long day.
- 2 Most satellites in orbit around the Earth are at a height of not less than 300 km and a speed of around 28 000 km/h.  
a) If a satellite slows, it will fall back to Earth. The space shuttle slowed its speed as a controlled method of getting back to Earth.  
b) If a satellite increased speed, it would move further away from Earth.  
c) Satellites don't usually orbit the Earth at a height of less than 300 km because of the large speed needed to overcome the pull of gravity. The further from Earth the less speed needed to maintain a fixed orbit.
- 3 As the Earth spins towards the east, the stars appear to move in the night sky from east to west. Some man-made satellites, however, appear to move from west to east in the night sky. How come?  
Earth's rotation provides considerable horizontal thrust to launched satellites meaning considerable fuel savings and generally lower costs. Thus most satellites orbit in the Earth's rotation direction, towards the east. Satellites seen moving from west to east are moving faster than Earth's rotational speed. Satellites appearing to move from east to west are probably moving to the east but at a slower speed than Earth's rotation.
- 4 The approximate data below is being used to make a rough model of the size and positions of the Earth, moon, and Sun.  
a) If a tennis ball (roughly 7 cm diameter) is used to represent the the moon:  
The approximate diameter of the Earth =  $14000/3500 \times 7 \text{ cm} = 28 \text{ cm}$   
The approximate diameter of the Sun =  $1400000/3500 \times 7 \text{ cm} =$   
b) If the distance between the tennis ball (moon) and the model of the Earth is 8 m  
The approximate distance Earth to Sun =  $160000000/400000 \times 8 \text{ m} = 3200 \text{ m}$

5 'The Earth is a globe spinning on its axis every 24 hours. The Earth orbits the Sun every year. The moon orbits the Earth every 29.5 days.'

- a) A day on the moon, a complete phase of daylight and night, is approximately 29.5 Earth days (The same side of the moon faces the Earth).
- b) The number of moon days in a year is approximately  $365.25/29.5 = 12.4$  Earth days
- c) When an object turns around an internal axis (like the Earth turns around its axis) it is called a rotation. When an object circles an external axis (like the Earth circles the sun) it is called a revolution.

6 Draw a rough sketch of the positions of the Sun, Earth, and moon so that the following phase of the moon is seen.

