Differentiation in Science Made Easy

Each book in this series:

• helps teachers to easily differentiate learning in science
• supplies absorbing worksheets on a diversity of science topics, presenting each topic at three different levels of ability
• is designed for independent work that both reinforces learning and challenges students further
• includes worksheet answers, which students can use to mark their own work, further supporting independent learning.

Wouldn’t it be wonderful if everyone in your science class could build on their learning about the same topic at a level that suits their individual needs and abilities? The good news is – there is a series that can help you make this ideal into a reality. The worksheets in Differentiation in Science Made Easy cover the same content at three levels: basic, proficient and advanced. Dealing with a great range of curriculum topics within each of four broad areas of science, the worksheets are carefully designed to achieve an appropriate balance between directly reinforcing learning and challenging higher-order thinking, based on each student’s current level of learning. Another emphasis is on lively questions that clearly make the connection between science topics and everyday life. The net result is a collection of engrossing worksheets that support and motivate students to work independently and productively.
Differentiation in Science MADE EASY

BOOK 4: Worksheets at three levels for earth and space science

Samantha York
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Introduction

This *Differentiation in Science Made Easy* series is designed to help teachers easily differentiate learning in a range of science topics at Years 9–11 in New Zealand and Years 8–10 in Australia. For each topic, worksheets cover the same content at three levels:

- **In the basic** worksheets the activities are geared to help the learner directly reinforce their learning from the lesson the teacher has taught. They lead the learner from the concrete to one or two higher-order questions so that the learner can experience success in science and is challenged to begin to improve their understanding in this area.

- **The proficient** worksheets also start by reinforcing the content of the lesson but move more quickly to challenge the learner to apply their knowledge to higher-order questions.

- **The advanced** worksheets are designed to be a challenge to engage and enthuse the able students in your class. For this reason, they focus strongly on higher-order, abstract questions designed to get learners to think about the content being taught in new ways.

This book covers earth and space science topics ranging from the carbon cycle to the solar system to earthquakes and volcanoes. Book 1 deals with biology, Book 2 with physics and Book 3 with chemistry.

How to use this resource

For each area of content, there are three worksheets that can be photocopied for student use. The worksheets are not designed to be done consecutively by all students; rather each student completes one worksheet for each content area.

Teachers could allocate worksheets to groups of students according to level of ability. Alternatively it may be more appropriate for the learner to gauge their own level of understanding and then select the level of worksheet that would suit them. For this alternative approach to operate effectively, learners would need to be able to take risks in their learning and initially would require support and guidance to select the appropriate level for their ability.

The worksheets are designed to take approximately 20 minutes for students to finish. If the student is taking longer or finishing sooner, that is an indication that they are not working on a worksheet at the appropriate level.

Answers to the worksheets are available at the back of this book. If students use them to mark their own work, this would be another way to promote independent learning.
Seasons and tides

1. Match each term with the correct description.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neap tide</td>
<td>(a) Forms high tides that are extremely high and low tides that are extremely low</td>
</tr>
<tr>
<td>Summer</td>
<td>(b) Forms high tides that are quite low and low tides that are quite high</td>
</tr>
<tr>
<td>Spring tide</td>
<td>(c) Occurs when the Earth is tilted towards the Sun so the Sun’s rays are concentrated over a small area of the Earth</td>
</tr>
<tr>
<td>Winter</td>
<td>(d) Occurs when the Earth is tilted away from the Sun so the Sun’s rays are spread out over a large area of the Earth</td>
</tr>
</tbody>
</table>

2. Complete each of these sentences.
(a) Tides are caused by the ___________________ of the ___________________ pulling on the Earth’s water.
(b) Because the Earth rotates on its axis every ________ hours there are ________ high tides and ________ low tides every ________
(c) The correct order of the seasons is: ___________________, ___________________, ___________________, ___________________.
(d) When one half of the Earth is experiencing ________________, the other half is experiencing ________________
(e) In ___________________ the day length is ________________ whereas in ___________________ the days are ________________ and cooler.
(f) The Earth rotates from east to west which means the Earth rotates (clockwise or anticlockwise?).

3. For each type of tide listed below, create a set of diagrams that show the position of the Sun, Moon and Earth.

<table>
<thead>
<tr>
<th>Neap tide</th>
<th>Spring tide</th>
</tr>
</thead>
</table>

4. For the seasons of summer and winter, draw parallel light rays that demonstrate how the Sun’s light rays hit the Earth. Draw your diagrams in your book.
1. Complete each of these sentences.
   (a) Tides are caused by the ___________________ of the ______________ pulling on the Earth's water.
   (b) Because the Earth rotates on its axis every __________ hours there are __________ high tides and
       __________ low tides every __________
   (c) The correct order of the seasons is: __________________, __________________, __________________,
       __________________
   (d) When one half of the Earth is experiencing __________________, the other half is experiencing
       __________________
   (e) In __________________ the day length is __________________ whereas in __________________ the
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3. For the seasons of summer and winter, draw parallel light rays that demonstrate how the
   Sun's light rays hit the Earth.

4. High tides happen twice each day, whereas a spring tide happens only twice per month. Explain why this
   is so.
1. For each type of tide listed below, create a set of diagrams that show the position of the Sun, Moon and Earth.

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2. For the seasons of summer and winter, draw parallel light rays that demonstrate how the Sun’s light rays hit the Earth.

3. High tides happen twice each day, whereas a spring tide happens only twice per month. Explain why this is so.

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4. Seasons are said to be caused by the tilt of the Earth. That is, the amount of energy hitting the earth in summer differs from the amount during winter due to the angle of the Sun. Explain why this means summer is hotter than winter.

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Our solar system

1. Match each planet with its description.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>(a) Is known for its rings and has over 30 moons</td>
</tr>
<tr>
<td>Venus</td>
<td>(b) Is also called the red planet</td>
</tr>
<tr>
<td>Earth</td>
<td>(c) Is the planet in our solar system that sustains life</td>
</tr>
<tr>
<td>Mars</td>
<td>(d) Is named for the Roman god of the sea; was discovered because Uranus’s orbit was not behaving as it should so astronomers hypothesised that another planet was affecting it</td>
</tr>
<tr>
<td>Jupiter</td>
<td>(e) Is the closest planet to the Sun</td>
</tr>
<tr>
<td>Saturn</td>
<td>(f) Is hotter than Mercury due to its thick, gaseous atmosphere which traps heat from the Sun</td>
</tr>
<tr>
<td>Neptune</td>
<td>(g) Is the biggest planet in the solar system and has over 60 moons</td>
</tr>
<tr>
<td>Uranus</td>
<td>(h) Has a tilt of over 90° so essentially rotates on its side</td>
</tr>
</tbody>
</table>

2. The planets in our solar system orbit a star known as the Sun. Give three facts about the Sun.

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___________________________________________________________________________________________

3. Describe a satellite and explain how it can be natural or artificial.

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4. Space distances are very large so the unit of distance is the light year. Explain what the term light year means.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________
1. List the names of the planets in the solar system, in order from the Sun.

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2. Mercury is the closest planet to the Sun but Venus is hotter than Mercury. Explain why this is so.

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3. Space distances are very large so the unit of distance is the light year. Explain what the term light year means.

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4. The Earth has one natural satellite and thousands of artificial satellites. Explain what a satellite is and how it can be considered to be natural or artificial.

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5. Jupiter and Saturn are the planets with the most moons in the solar system. Explain in terms of mass and gravity why this is so.

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5. In 2007 science textbooks were rewritten as Pluto was removed from the planet list and renamed a dwarf planet. Explain why this decision was correct due to Pluto’s orbit compared to the orbit of a planet.

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___________________________________________________________________________________________
___________________________________________________________________________________________
1. Complete the following passage.

There are three main types of rock: (a) ______________________, (b) ______________________ and (c) ______________________

(d) ______________________ rock is formed from volcanoes whereas (e) ______________________ rock is baked deep underground. The final rock type, (f) ______________________, is made up of fragments of rock that have been cemented together over time and are the only rock type to have (g) ______________________

2. Draw your own rock cycle on the diagram below. Use the words from the box to label your diagram.

3. Match each term with its definition.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weathering</td>
<td>(a) Molten igneous rock that is underground</td>
</tr>
<tr>
<td>Magma</td>
<td>(b) The process in which rocks are broken down into smaller pieces</td>
</tr>
<tr>
<td>Erosion</td>
<td>(c) Molten igneous rock that is above the ground</td>
</tr>
<tr>
<td>Pressure</td>
<td>(d) The force felt by rock deep underground due to the weight of rock above it</td>
</tr>
<tr>
<td>Lava</td>
<td>(e) The process in which small sediments of rock are transported from their original location</td>
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4. Marble is a beautiful metamorphic stone that is formed deep underground from the sedimentary rock limestone. Explain the process by which limestone becomes marble.

___________________________________________________________________________________________
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The rock cycle

1. Draw your own rock cycle on the diagram below. Use the words from the box to label your diagram.

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<tr>
<th>Weathering and erosion</th>
<th>Melting</th>
<th>Heat and pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weathering and erosion</td>
<td>Metamorphic</td>
<td>Igneous</td>
</tr>
<tr>
<td>Sedimentary</td>
<td>Heat and pressure</td>
<td>Melting</td>
</tr>
</tbody>
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3. Marble is a beautiful metamorphic stone that is formed deep underground from the sedimentary rock limestone. Explain the process by which limestone becomes marble.

4. Sedimentary rock is often laid down in layers. Explain which layer in a rock column will be the oldest.

5. Granite is a rock commonly used for kitchen benches as it contains multicoloured, large crystals that are interesting to look at. Explain how this igneous rock is formed, in terms of its large crystal size.
1. Match each term with its definition.

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5. Pumice and obsidian are both igneous extrusive rocks. Obsidian is classed as a glass whereas pumice is a light rock filled with lots of holes. Compare and contrast the formation of these two types of rock, referring to their density and the gas content of the lava that produces these rocks.

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6. Coal is a sedimentary rock that is made from compressed plant material. Explain this process.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________
1. Use the diagram to help you answer these questions.

(a) Put the rocks in order from youngest to oldest.

_______________________________________
_______________________________________
_______________________________________

(b) The igneous rock appears to go right through all the layers of rock. Explain how this situation could come about in real life.

________________________________________________________________________________________
________________________________________________________________________________________

2. Use this fossil chart to answer the questions below.

<table>
<thead>
<tr>
<th>Location 1</th>
<th>Location 2</th>
<th>Location 3</th>
<th>Location 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer 1</td>
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</tr>
<tr>
<td>Lamp shell</td>
<td>Snail</td>
<td>Coral</td>
<td>Lamp shell</td>
</tr>
<tr>
<td>Layer 2</td>
<td>Layer 2</td>
<td>Layer 2</td>
<td>Layer 2</td>
</tr>
<tr>
<td>Snail</td>
<td>Coral</td>
<td>Ammonite</td>
<td>Snail</td>
</tr>
<tr>
<td>Layer 3</td>
<td>Layer 3</td>
<td>Layer 3</td>
<td>Layer 3</td>
</tr>
<tr>
<td>Coral</td>
<td>Gastropod</td>
<td>Sea urchin</td>
<td>Gastropod</td>
</tr>
<tr>
<td>Layer 4</td>
<td>Layer 4</td>
<td>Layer 4</td>
<td>Layer 4</td>
</tr>
<tr>
<td>Ammonite</td>
<td>Ammonite</td>
<td>Sea urchin</td>
<td>Sea urchin</td>
</tr>
<tr>
<td>Layer 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sea urchin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) Which is the youngest fossil? Give the reason for your answer.

________________________________________________________________________________________
________________________________________________________________________________________

(b) Explain which fossil is the oldest.

________________________________________________________________________________________
________________________________________________________________________________________

(c) Put all the fossils in order from youngest to oldest.

<table>
<thead>
<tr>
<th>6 (youngest)</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1 (oldest)</th>
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</tr>
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<td></td>
<td></td>
<td></td>
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</tbody>
</table>

2. Explain how scientists can use fossils to get a better understanding of the climate conditions of the Earth at the time the fossils were buried.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

3. Freeze thaw weather occurs when water gets into cracks in rocks, freezes and then thaws. Explain how freeze thaw weather can lead to rocks splitting up.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
1. Use this fossil chart to answer the questions below.

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<tr>
<td>1</td>
<td></td>
<td></td>
<td>1 (oldest)</td>
</tr>
</tbody>
</table>

2. Explain the difference between a mould fossil and a cast fossil.

________________________________________________________________________________________
________________________________________________________________________________________

3. Explain how scientists can use fossils to get a better understanding of the climate conditions of the Earth at the time the fossils were buried.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

4. Scree slopes high in mountains consist of small, jagged rocks that are like sharp gravel. Explain how freeze thaw weather (where water gets into cracks in rocks, freezes and then thaws) leads to the formation of scree slopes. Write your answer in your book.

________________________________________________________________________________________
________________________________________________________________________________________
Volcanoes

1. In your book, create a picture of a “typical” volcano and label it with the words from the box.

| crater | vent | magma chamber | cone | lava flow | ash cloud |

2. Finish each of these sentences.

(a) An active volcano is a volcano that

(b) A dormant volcano

(c) An extinct volcano

3. Describe three warning signs that could mean a volcano is about to erupt.

4. Is each of the following statements true or false? Circle your choice then give a reason for your answer.

(a) Volcanoes can be located anywhere. True/False

(b) Volcanoes erupt to keep the core of the Earth cool so the ground does not get too hot. True/False

(c) Australia has no active volcanoes. True/False

(d) Volcanoes look the same everywhere. True/False

(e) Hot springs are an indicator of volcanic activity below the surface of the Earth. True/False
1. Finish each of these sentences.

(a) An active volcano is a volcano that

(b) A dormant volcano

(c) An extinct volcano

2. Describe three warning signs that could mean a volcano is about to erupt.

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(b) Australia has no active volcanoes. True/False

(c) Volcanoes look the same everywhere. True/False

(d) Hot springs are an indicator of volcanic activity below the surface of the Earth. True/False

4. When people draw volcanoes, they will often draw a stratovolcano with its classic cone shape. The lava that comes out of this type of volcano is intermediate in nature and “sticky” so it does not flow far. Explain how a stratovolcano begins life as a small mound, growing slowly over time into a big, cone-shaped mountain.
1. Finish each of these sentences.
   (a) An active volcano is a volcano that

   ___________________________________________________________

   ___________________________________________________________

   ___________________________________________________________

   (b) A dormant volcano

   ___________________________________________________________

   ___________________________________________________________

   ___________________________________________________________

   (c) An extinct volcano

   ___________________________________________________________

   ___________________________________________________________

   ___________________________________________________________

2. Volcanoes usually give warning signs of an impending eruption. Answer these questions in your book.
   (a) Describe three warning signs that could mean a volcano is about to erupt.

   ___________________________________________________________

   ___________________________________________________________

   ___________________________________________________________

   (b) Explain how two of the warning signs you have listed show that a volcano may erupt.

3. Is each of the following statements true or false? Circle your choice then give a reason for your answer.
   (a) Volcanoes can be located anywhere. True/False

   ___________________________________________________________

   ___________________________________________________________

   (b) Volcanoes look the same everywhere. True/False

   ___________________________________________________________

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   (c) Hot springs are an indicator of volcanic activity below the surface of the Earth. True/False

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Earthquakes

1. Fill the gaps to complete this passage.

   Earthquakes occur under the ground where massive amounts of energy are released as (a) ________, (b) ________ and (c) ________ waves.

   They can be measured by the (d) ____________________ scale, which is a scale out of 10 and measures how much (e) ____________________ is released by the earthquake.

   Earthquakes can also be measured by the (f) ____________________ scale, which measures the effect the earthquake had on (g) ____________________

2. Match each of these terms with its definition.

<table>
<thead>
<tr>
<th>Term</th>
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<td>Epicentre</td>
<td>(b) How much energy is released by the earthquake as measured on the Richter scale</td>
</tr>
<tr>
<td>Aftershock</td>
<td>(c) The area of Earth’s surface directly above where the earthquake started</td>
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<tr>
<td>Fault</td>
<td>(d) Lesser earthquake after the main shock of an earthquake</td>
</tr>
<tr>
<td>Magnitude</td>
<td>(e) The place inside the Earth where the earthquake originated</td>
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3. Draw two diagrams below: one of primary and the other of secondary earthquake waves.

<table>
<thead>
<tr>
<th>Primary waves</th>
<th>Secondary waves</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
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</table>

4. Explain why Australia has very few earthquakes each year in comparison with its close neighbour, New Zealand.

   ____________________________________________
   ____________________________________________
   ____________________________________________

5. In the first major earthquake in Canterbury, New Zealand in 2010, many residents were woken by a rumbling noise before they felt the first P wave. Explain why this is a common phenomenon.

   ____________________________________________
   ____________________________________________
   ____________________________________________
Earthquakes

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___________________________________________________________________________________________
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4. The Mercalli and Richter scales measure different aspects of earthquakes.
   (a) Describe what each measurement scale measures about earthquakes.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

   (b) Compare and contrast these two measurements.

________________________________________________________________________________________
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5. Explain why scientists are still unable to predict the location and time of earthquakes.

________________________________________________________________________________________
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Earthquakes

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   (a) Describe what each measurement scale measures about earthquakes.

   ______________________________________________________________________________________
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   (b) Compare and contrast these two measurements.

   ______________________________________________________________________________________
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2. The first two earthquake waves, P and S waves, are emitted by the Earth’s movement at slightly different times. In your book, explain how the arrival times of the P and S waves from three different seismic stations are used to locate the epicentre.

3. Explain why Australia has very few earthquakes compared with its close neighbour, New Zealand.

   ______________________________________________________________________________________
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   ______________________________________________________________________________________

5. Explain why scientists are still unable to predict the location and time of earthquakes.

   ______________________________________________________________________________________
   ______________________________________________________________________________________
   ______________________________________________________________________________________

6. If scientists were able to predict earthquakes, what would be the implications, both positive and negative?

   ______________________________________________________________________________________
   ______________________________________________________________________________________
   ______________________________________________________________________________________
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3. Check whether each statement below is correct. If it is, then put a tick next to it. If you find mistakes, rewrite it in your book so that it is a correct statement.

(a) It is a myth that diamond is the hardest substance known to humanity as titanium has now taken this status.

(b) Gold is valued because it is unreactive and easy to find as itself.

(c) Iron pyrite is called fool’s gold because it looks like gold but when you do the streak test on it, the streak is dark – not yellow like gold’s streak.

(d) The outback of Australia is full of iron ore because it is the same colour as iron.

4. Explain how gold panning succeeds in swirling the water and the non-gold material away from the gold in the pan.
1. Match each of these terms with its definition.

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4. Explain how gold panning succeeds in swirling the water and the non-gold material away from the gold in the pan.

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5. Answer these questions in your book.

(a) Explain in terms of property how you can tell the difference between iron pyrite (fool's gold) and gold.

(b) Diamonds are popular in jewellery but, as they are expensive, transparent cubic zirconia can be used instead. Outline a simple test a jeweller could do to show whether the stone is a cubic zirconia.
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   (b) Diamonds are popular in jewellery but, as they are expensive, transparent cubic zirconia can be used instead. Outline a simple test a jeweller could do to show whether the stone is a cubic zirconia.

5. Marble is a common material used in kitchen benches. It contains a high proportion of the mineral calcite, which has a hardness of 3 (relatively soft).
   (a) Explain why a knife should never be used on a marble bench.
   (b) Explain what would happen to the bench if fruit juice or soft drink was spilled on it and not wiped up immediately.
1. Fill the gaps to complete the following passage.

Weathering breaks rocks down into smaller (a) ____________ The three types of weathering are:
(b) ________________ weathering, eg, sand blasting by sand; (c) ________________ weathering,
eg, acid rain dissolving rock; and (d) ________________ weathering, eg, tree roots splitting rock.

Erosion processes pick up and move those weathered fragments to different (e) ____________
The four main ways in which erosion occurs are: (f) ________________ eg, erosion by waves;
(g) ________________ eg, windblown particles; (h) ________________ eg, glaciers; and
(i) ________________ eg, rocks fall down a slope.

2. Decide whether each of these situations is an example of weathering or erosion and circle your choice.

(a) A rabbit burrows in a rock crack. Weathering/Erosion
(b) A stream runs down a hill. Weathering/Erosion
(c) Limestone is dissolved over time by water. Weathering/Erosion
(d) A flood undercuts a river bank. Weathering/Erosion

3. Many harbours become filled with sediment washed in by rivers and streams. Describe what actions would be needed to allow ships to enter and leave such a harbour.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

4. Explain why rivers in flood are usually brown and discoloured.

___________________________________________________________________________________________
___________________________________________________________________________________________

5. Explain why different rocks weather at different rates, leaving unusual rock formations.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

6. Explain how trees growing can cause weathering of rocks over time.

___________________________________________________________________________________________
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The four main ways in which erosion occurs are: (f) _______________ eg, erosion by waves;
(g) _______________ eg, windblown particles; (h) _______________ eg, glaciers; and (i) _______________ eg, rocks fall down a slope.

2. For each of the following situations, decide whether it is an example of weathering or erosion. Circle your choice and then explain it.
(a) A rabbit burrowing in a rock crack is an example of weathering/erosion because ______________________________________
(b) A stream running down a hill is an example of weathering/erosion because ______________________________________
(c) Limestone that water dissolves over time is an example of weathering/erosion because ______________________________________

3. Explain why rivers in flood are usually brown and discoloured.
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5. Explain how trees growing can cause weathering of rocks over time.

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________

6. Explain why river stones are always rounded whereas rock transported by a glacier is sharp and jagged.

___________________________________________________________________________________________

___________________________________________________________________________________________

___________________________________________________________________________________________
1. Use the words from the box to label the black arrows in the diagram below.

<table>
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<tr>
<th>Photosynthesis removes CO₂ from …</th>
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Organic compounds in dead organisms

Organic compounds in green plants

Organic compounds in consumers

CO₂ in the air and dissolved in water, particularly oceans

Organic compounds in fossil fuels

Answer the rest of the questions in your book.

2. Describe why carbon is so important to living things.

3. Describe the main sources of carbon on Earth.

4. Explain why decomposers are used in situations such as sewage treatment plants and in compost heaps.

5. Explain why plants are both consumers and producers of carbon. Refer to respiration and photosynthesis in your answer.

6. Explain how the environment is affected by humans continuing to burn fossil fuels.
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Organic compounds in dead organisms

Organic compounds in green plants

Organic compounds in consumers

Organic compounds in fossil fuels

CO₂ in the air and dissolved in water, particularly oceans

Answer the rest of the questions in your book.

2. Describe the forms of carbon that are in the atmosphere.

3. Describe the main sources of carbon on Earth.

4. Explain why decomposers are so important to the cycling of carbon around the planet.

5. Explain why plants are both consumers and producers of carbon. Refer to respiration and photosynthesis in your answer.

6. Explain how the environment is affected by humans continuing to burn fossil fuels.

7. Coal consists mainly of carbon and is a locked source of carbon. Explain what a locked source is.
1. Use the words from the box to label the black arrows in the diagram below.

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Death  
Death  
Feeding  
Burning  
Respiration

Organic compounds in dead organisms

Organic compounds in green plants

Organic compounds in consumers

CO$_2$ in the air and dissolved in water, particularly oceans

Organic compounds in fossil fuels

Answer the rest of the questions in your book.

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5. Explain how the environment is affected by humans continuing to burn fossil fuels.

6. Coal consists mainly of carbon and is a locked source of carbon. Explain what a locked source is.

7. One proposal is to trap millions of tonnes of carbon as CO$_2$ underground in mined gas fields. Explain the benefits of this action in terms of global CO$_2$ levels and climate change.
1. Rewrite each of these statements to make it true.

(a) The Moon rotates around the Earth once a year.

________________________________________________________________________________________
________________________________________________________________________________________

(b) The Moon is a source of light just like the Sun, which is why we see it in the sky.

________________________________________________________________________________________
________________________________________________________________________________________

(c) When there is a gibbous moon, you cannot see the Moon in the clear night sky.

________________________________________________________________________________________
________________________________________________________________________________________

(d) A solar eclipse is where the Earth puts a shadow on the Moon.

________________________________________________________________________________________
________________________________________________________________________________________

2. Label the diagram below with the correct phases of the Moon. Use the words from the box.

New moon  
Full moon  
Waxing crescent  
Waning gibbous  
Half moon (first quarter)  
Last half moon (last quarter)  
Waxing gibbous  
Waning crescent

3. Explain why a full moon is generally seen once a month.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

4. A lunar eclipse occurs when the Earth comes between the Sun and a full moon. In your book, draw and label a diagram that shows the position of the Sun, Moon and Earth when a lunar eclipse is occurring.
1. Rewrite each of these statements to make it true.
   (a) The Moon rotates around the Earth once a year.

   ______________________________________________________________________________________
   ______________________________________________________________________________________

   (b) The Moon is a source of light just like the Sun, which is why we see it in the sky.

   ______________________________________________________________________________________
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2. Label the diagram below with the correct phases of the Moon. Use the words from the box.

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   Full moon
   Waxing crescent
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   Waning crescent

3. Explain why a full moon is generally seen once a month.

   ______________________________________________________________________________________
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   ______________________________________________________________________________________

4. A lunar eclipse occurs when the Earth comes between the Sun and a full moon. Explain how a lunar
eclipse could occur once a month.

   ______________________________________________________________________________________
   ______________________________________________________________________________________

5. In your book, explain why a solar eclipse (where the Moon’s shadow falls on the Earth) is far less common
than a lunar eclipse, even though the Moon comes between the Sun and Earth every month.

6. Explain the effect the Moon has on water on Earth. Write your answer in your book.
1. Label the diagram below with the correct phases of the Moon. Use the words from the box.

- New moon
- Full moon
- Waxing crescent
- Waning gibbous
- Half moon (first quarter)
- Last half moon (last quarter)
- Waxing gibbous
- Waning crescent

2. Explain why a full moon is generally seen once a month.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

3. A blue moon is a full moon seen twice in one calendar month. Explain why “once in a blue moon” is actually not that uncommon.

___________________________________________________________________________________________
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4. A lunar eclipse occurs when the Earth comes between the Sun and a full moon. Explain how a lunar eclipse could occur once a month.

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<td>Convection current</td>
<td>(b) Place where one plate dives under another plate</td>
</tr>
<tr>
<td>Convergent plate boundary</td>
<td>(c) Outdated theory that explained why continents had been joined and are now apart. Had the flaw of not giving the mechanism for continents moving apart</td>
</tr>
<tr>
<td>Divergent plate boundary</td>
<td>(d) Place where two plates collide towards each other</td>
</tr>
<tr>
<td>Subduction</td>
<td>(e) Place where two plates are moving away from each other</td>
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2. For each of the following statements, decide whether it is true or false. Circle your choice and give a reason for your answer.

(a) The continents of South America and Africa look like they are jigsaw pieces that can join up so they must have once been joined.  True/False
__________________________________________________________________________________________
__________________________________________________________________________________________

(b) Fossils of the same kind of ancient fern were found in South America, Antarctica, Australia and Africa so the fern must have lived in very hot and very cold regions at the same time. True/False
__________________________________________________________________________________________
__________________________________________________________________________________________

(c) The middle of the Atlantic Ocean has a massive, deep sea trench that is pushing the two tectonic plates apart. This observation provided evidence for the theory of plate tectonics. True/False
__________________________________________________________________________________________
__________________________________________________________________________________________

3. In your book, describe the evidence for the theory of continental drift.

4. Describe a fault line.

__________________________________________________________________________________________
__________________________________________________________________________________________

5. Answer these questions in your book.

(a) Explain what sea floor spreading is and how it drives plate tectonics.

(b) Explain how convection currents work to move the tectonic plates far above them in the Earth’s crust.
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<td>Convection current</td>
<td>(b) Place where one plate dives under another plate</td>
</tr>
<tr>
<td>Convergent plate boundary</td>
<td>(c) Outdated theory that explained why continents had been joined and are now apart. Had the flaw of not giving the mechanism for continents moving apart</td>
</tr>
<tr>
<td>Divergent plate boundary</td>
<td>(d) Place where two plates collide towards each other</td>
</tr>
<tr>
<td>Subduction</td>
<td>(e) Place where two plates are moving away from each other</td>
</tr>
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2. For each of the following statements, decide whether it is true or false. Circle your choice and give a reason for your answer.

(a) The continents of South America and Africa look like they are jigsaw pieces that can join up so they must have once been joined.  
True/False

(b) Fossils of the same kind of ancient fern were found in South America, Antarctica, Australia and Africa so the fern must have lived in very hot and very cold regions at the same time.  
True/False

(c) The middle of the Atlantic Ocean has a massive, deep sea trench that is pushing the two tectonic plates apart. This observation provided evidence for the theory of plate tectonics.  
True/False

3. Answer these questions in your book.

(a) Explain what sea floor spreading is and how it drives plate tectonics.

(b) Explain how convection currents work to move the tectonic plates far above them in the Earth’s crust.

4. The San Andreas Fault in the United States and the Alpine Fault in New Zealand are both examples of a transform fault. Explain what a transform fault is.
1. For each of the following statements, decide whether it is true or false. Circle your choice and give a reason for your answer.

(a) The continents of South America and Africa look like they are jigsaw pieces that can join up so they must have once been joined. True/False
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___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

4. The Southern Alps in the South Island of New Zealand are exactly at a plate boundary between the Australian and the Pacific plates. Explain, in terms of the tectonic plate boundary, how this mountain range has formed.
___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

5. Explain why Australia has few earthquakes, hot springs and no active volcanoes whereas its close neighbour New Zealand has many earthquakes, volcanoes and hot springs. Write your answer in your book.
1. Match each of the following terms to its definition.

<table>
<thead>
<tr>
<th>Term</th>
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<tr>
<td>Convection</td>
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</tr>
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<td>(b) A cycle of heat rising and then falling; it heats gases and liquids</td>
</tr>
<tr>
<td>Radiation</td>
<td>(c) Method of heat transfer in liquids and gases</td>
</tr>
<tr>
<td>Convection current</td>
<td>(d) Method of heat transfer in a vacuum</td>
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<tr>
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2. Describe what the Earth’s two sources of heat are.

___________________________________________________________________________________________

3. Explain how the core of the Earth heats the Earth’s crust.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

4. Describe what is happening to the particles in this diagram as they are heated, rise and then fall again in a convection current.

________________________________________________________
___________________________________________________________________________________________
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5. Explain, in terms of convection, conduction and radiation, how the energy from the Sun travels to the surface of the Earth to heat it.

___________________________________________________________________________________________
___________________________________________________________________________________________
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6. Great ocean currents such as the Gulf Stream keep northern oceans warmer than they should be as they move warm water from the equator north. Describe how this warm water is transported in the ocean.

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___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

5. Explain how a convection current causes wind on Earth.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

6. The Fremantle Doctor is a cooling sea breeze that the southern part of Western Australia experiences in the summer months. Explain how it occurs.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

7. In your book, explain the role of the polar ice caps in regulating the Earth’s temperature.
1. Fill the gaps to complete this passage.

The atmosphere is made up of three layers: the (a)______________________, (b)______________________ and (c)______________________

The heat from the Sun travels through space to earth by (d)______________________ While in the atmosphere, infrared radiation can be absorbed by particles in the atmosphere such as (e)______________________ and (f)______________________ and it cannot be reflected back out into space. The result can be global (g)______________________

2. Describe the greenhouse effect.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

3. State three greenhouse gases.

___________________________________________________________________________________________

4. Describe what greenhouse gases do to the heat energy from the Sun compared with non-greenhouse gas particles that are also in the atmosphere.

___________________________________________________________________________________________
___________________________________________________________________________________________

5. In your book, explain why scientists say that the Earth’s atmosphere is like glass in a greenhouse.

___________________________________________________________________________________________

6. In summer, weather forecasts often give information on the UV index. What are they referring to?

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7. Explain why rising carbon levels in the atmosphere worry scientists in relation to greenhouse gases.

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6. Explain the effect of a thinner ozone layer on the rates of skin cancer in Australia and New Zealand.

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___________________________________________________________________________________________
1. Label this diagram of the Earth.

   (a) _______________________________________________________________

   (b) _______________________________________________________________

   (c) _______________________________________________________________

   (d) _______________________________________________________________

2. Describe the Earth’s core in terms of content, state and temperature. ____________________________________________________________

3. Describe where the thickest part of the Earth’s crust is. Explain your answer. ____________________________________________________________

   ____________________________________________________________

   ____________________________________________________________

4. Explain how the Earth’s mantle is like golden syrup. ____________________________________________________________

5. Describe the evidence supporting the idea that the crust of the Earth is not continuous but rather is cracked like a cracked hardboiled egg. ____________________________________________________________

   ____________________________________________________________

6. Explain, with reference to convection currents, how heat travels from the mantle to the crust. ____________________________________________________________

   ____________________________________________________________

7. Explain why the inner core is solid even though the outer core is liquid. ____________________________________________________________

   ____________________________________________________________

8. Explain how the phenomenon of sea floor spreading leads to new crust being made. ____________________________________________________________

   ____________________________________________________________
1. In the space below, draw and label a diagram of the Earth and its four layers.

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7. Explain why it is currently impossible to travel to the centre of the Earth.

8. In your book, explain how volcanic eruptions can help scientists understand the world beneath our feet.
Layers of the Earth

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7. Explain how volcanic eruptions can help scientists understand the world beneath our feet.

8. In your book, explain how the four layers of the Earth were formed, according to scientists.
1. Write each term from the box in the correct sentence below.

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Geostationary satellite</th>
<th>Artificial satellite</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>is a naturally occurring small mass object orbiting another larger object.</td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>is a manmade object launched into space to orbit another larger object.</td>
<td></td>
</tr>
<tr>
<td>(c)</td>
<td>is a manmade object that orbits the Earth every 24 hours and so sits above the same spot on the Earth.</td>
<td></td>
</tr>
</tbody>
</table>

2. List at least five uses of artificial satellites in everyday life.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

3. Most artificial satellites orbit the Earth for many years. Explain where they get their energy from.

___________________________________________________________________________________________

   (a) Sun-synchronous satellites are designed so that their position is fixed relative to the Sun throughout the year. Explain how this feature helps to make accurate weather forecasts.
   (b) Most meteorological satellites orbit the Earth about 15 times per day. Explain how this characteristic would improve the weather forecasts you receive.

5. Earth-surveying satellites can help in a variety of settings. Explain the advantages of using earth-surveying satellites over Australia during bush fire season.

___________________________________________________________________________________________
___________________________________________________________________________________________
___________________________________________________________________________________________

6. State how long a weather satellite would take to orbit the Earth if it orbited the Earth 15 times per day.

___________________________________________________________________________________________

7. Voyager 2 reached Uranus in 1986. It used both nuclear power and solar power. Why did it require two sources of fuel?

___________________________________________________________________________________________

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2. Complete the table by choosing the satellite from the box that is most suited to each of the uses listed.

<table>
<thead>
<tr>
<th>Use</th>
<th>Most suitable type of satellite</th>
</tr>
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<tbody>
<tr>
<td>(a) Looking at crops growing in Africa</td>
<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td>(c) Mapping the hole in the ozone layer over the Tasman Sea</td>
<td></td>
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<tr>
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<td>Earth-surveying satellite</td>
</tr>
</tbody>
</table>

2. Compare and contrast a geostationary satellite and a polar-orbiting satellite by drawing up a table like the one below and writing the descriptions on the left in the correct column.

<table>
<thead>
<tr>
<th>Uses a static dish to receive signal</th>
<th>Geostationary satellite</th>
<th>Polar-orbiting satellite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signals can always be received in any particular place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs a moving dish to receive signals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travels at the same speed as the Earth rotates so it always seems to be above the same bit of sky</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is used in mapping and monitoring weather and climate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is used in communications, GPS locations, weather monitoring and television transmission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is above the Earth’s horizon for only a short time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travels over or near to both poles</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


   (a) These satellites are designed so that their position is fixed relative to the Sun throughout the year. Explain how this feature helps to make accurate weather forecasts.

   (b) Most meteorological satellites orbit the Earth about 15 times per day. Explain how this characteristic would improve the weather forecasts you receive.

4. Explain the advantages of using earth-surveying satellites over Australia during bush fire season.

5. In your book, explain how data from an earth-surveying satellite can help humanitarian workers to deal with drought in Africa.
1. Match each term to its definition.

<table>
<thead>
<tr>
<th>Term</th>
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<tr>
<td>Comet</td>
<td>(a) A small piece of an asteroid that is found on Earth</td>
</tr>
<tr>
<td>Black hole</td>
<td>(b) A piece of rock with a little ice that causes a streak as it falls through Earth’s atmosphere</td>
</tr>
<tr>
<td>Meteor</td>
<td>(c) A space object made mostly of ice with some rock</td>
</tr>
<tr>
<td>Meteorite</td>
<td>(d) A region of space where gravity is so intense even light cannot escape</td>
</tr>
</tbody>
</table>

2. These statements are incorrect. Rewrite each one so that it is true.
   (a) Comets always have tails.

   (b) Asteroids are mostly ice so will melt if they hit Earth.

   (c) You can see a black hole.

   (d) Meteors are falling stars.

3. Describe the similarities and differences between meteors and meteorites.

4. Explain the main difference between comets and asteroids.

5. On the diagram below, label the parts of the comet listed in the box.

   - Nucleus
   - Tail of ionised gases
   - Tail composed of dust
   - Coma

   (a) [Label]
   (b) [Label]
   (c) [Label]
   (d) [Label]
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</tr>
<tr>
<td>Coma</td>
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</table>

(a)  (c)  
(b)  (d)  

5. The Woodleigh asteroid crater in Western Australia is estimated to be up to 120 km across. Explain the possible impact of a large asteroid such as this hitting Earth.
1. These statements are incorrect. Rewrite each one so that it is true.
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   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

3. Explain the main difference between comets and asteroids.

   __________________________________________________________
   __________________________________________________________

4. Explain the direction that a comet’s tail will always be in as it orbits the Sun.

   __________________________________________________________
   __________________________________________________________

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   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

6. Explain why black holes are often described as vacuum cleaners of space, sucking debris from around the area.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
**Extraction of resources**

1. Australia is rich in natural mineral resources. Complete the table below by listing five major resources mined in Australia and a common use of each one.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Common use</th>
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2. The box below contains the main steps involved in producing aluminium from bauxite, but they are out of order. Write them in the correct order.

- Slurry is filtered to remove impurities.  
- Resulting slurry is pumped to a digester where sodium hydroxide dissolves aluminium.  
- Carbon dioxide gas is bubbled through to cause aluminium oxide to precipitate out.  
- Mixture is boiled so water is removed, leaving behind aluminium oxide (alumina).  
- Alumina is smelted to aluminium.  
- Bauxite is crushed and ground to give small pieces.

(a)  
(b)  
(c)  
(d)  
(e)  
(f)  

3. Olympic Dam in South Australia is believed to have the world’s largest uranium reserve.

(a) Describe two uses of uranium.  

(b) Explain why Australia wants to mine uranium.  

(c) Give some reasons why some people do not want uranium mined on Australian soil.
1. Australia is rich in natural mineral resources. In your book, draw up a table like this one. Then complete it by listing five major resources mined in Australia and a common use of each one.

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   (a) Describe two uses of uranium.
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3. Coal deposits are found in Australia and coal mines are relatively common. The coal mine of Anglesea in Victoria supplies much of the electricity needed for the nearby Point Henry aluminium smelter.
   (a) In your book, explain why environmentalists oppose coal mining due to its effect on the atmosphere.
   (b) Complete the table below by listing three uses of aluminium and a reason why it is a good metal for each use.

<table>
<thead>
<tr>
<th>Use</th>
<th>Reason</th>
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(c) White aluminium oxide is extracted from a red ore found in Australia. What is the name of this ore?

(d) Explain, in terms of aluminium's reactivity, why electricity must be used to extract aluminium from aluminium oxide or alumina.
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   __________________________________________________________________________________________
   __________________________________________________________________________________________
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3. Use the information in the table below to explain how steel can be made from iron ore found in Western Australia. Write your answer in your book.

<table>
<thead>
<tr>
<th>Raw material</th>
<th>Contains</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron ore (haematite)</td>
<td>Iron oxide</td>
<td>A compound that contains iron</td>
</tr>
<tr>
<td>Coke</td>
<td>Carbon</td>
<td>Burns in air to produce heat, and reacts to form carbon monoxide (needed to reduce the iron oxide)</td>
</tr>
<tr>
<td>Limestone</td>
<td>Calcium carbonate</td>
<td>Helps to remove acidic impurities from the iron by reacting with them to form molten slag</td>
</tr>
<tr>
<td>Air</td>
<td>Oxygen</td>
<td>Allows the coke to burn, and so produces heat and carbon monoxide</td>
</tr>
</tbody>
</table>
**Answers**

**Seasons and tides (pp 5–7)**

**Basic**
1. Neap tide (b); Summer (c); Spring tide (a); Winter (d)
2. (a) gravity, Moon  
   (b) 24, two, two, day  
   (c) spring, summer, autumn, winter  
   (d) summer, winter (or reverse order)  
   (e) summer, longer, winter, shorter  
   (f) anticlockwise
3. **Spring tides**

   Tides are the strongest when the Sun, Earth and Moon are all in a line. This happens when the Moon is in either the new moon or the full moon position.

   **Neap tides**

   Weaker tides occur when the Moon is in the first or third quarter position. Also, regardless of whether it is a spring or neap tide, there are always two high tides: one on the side facing the Moon and the other on the opposite side of the Earth.

4. For a spring tide to happen, the Moon and the Sun must be lined up in the same plane, which only occurs twice per month.

4. The same amount of energy comes from the Sun in both seasons. However, in summer this energy is hitting a smaller area of the Earth's surface so heats it up to a higher temperature which makes summer hotter.

**Our solar system (pp 8–10)**

**Basic**
1. Mercury (e); Venus (f); Earth (c); Mars (b); Jupiter (g); Saturn (a); Neptune (d); Uranus (h)
2. **Facts may include any three of the following (or others to be checked by the teacher):** The Sun is a main sequence star; is yellow; releases energy due to nuclear fusion; is made up of hydrogen and helium.
3. A satellite is a mass orbiting a bigger mass that is not the Sun. A natural satellite is formed when the universe is formed whereas an artificial satellite is launched into space.
4. A light year is the distance that a particle of light can travel in one year.

**Proficient**
1. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune
2. Venus has a thick, gas-filled atmosphere that traps the heat energy from the Sun so it heats to higher temperatures than Mercury which has no atmosphere to trap heat energy.
3. A light year is the distance that a particle of light can travel in one year.
4. A satellite is an object that orbits or rotates a bigger object due to gravity. It is a natural satellite if it was formed at about the same time as the universe was; it is artificial if it is launched into space.
5. Jupiter and Saturn are very large planets and so have a large mass. As a result, they attract lots of smaller masses to rotate around them and so have lots of natural satellites or moons.

**Advanced**
1. Venus has a thick, gas-filled atmosphere that traps the heat energy from the Sun so it heats to higher temperatures than Mercury which has no atmosphere to trap heat energy.
2. A light year is the distance that a particle of light can travel in one year.
3. A satellite is an object that orbits or rotates a bigger object due to gravity. It is a natural satellite if it was formed at about the same time as the universe was; it is artificial if it is launched into space.
4. Jupiter and Saturn are very large planets and so have a large mass. As a result, they attract lots of smaller masses to rotate around them and so have lots of natural satellites or moons.
5. Pluto's gravity does not clear a path in its own orbit so it cannot be considered to be a planet.
The rock cycle (pp 11–13)

Basic
1. (a) sedimentary
   (b) igneous
   (c) metamorphic (or any other order for (a) to (c))
   (d) igneous
   (e) metamorphic
   (f) sedimentary
   (g) fossils

2. Weathering (b); Magma (a); Erosion (e); Pressure (d); Lava (c)

3. Weathering (b); Magma (a); Erosion (e); Pressure (d); Lava (c)

4. Limestone is buried deep underground with great amounts of rock on top which creates pressure on the limestone. The pressure changes the minerals in the limestone so the limestone changes into marble.

Proficient
1. See answer to question 2 for Basic worksheet.
2. Weathering (b); Magma (a); Erosion (e); Pressure (d); Lava (c)
3. See answer to question 4 for Basic worksheet.
4. The layer that is buried the deepest is the oldest layer as it must have been buried first.
5. Large crystals result from very slow cooling. This indicates that granite has cooled down very slowly underground in a dyke or sill.

Advanced
1. Weathering (b); Magma (a); Erosion (e); Pressure (d); Lava (c)
2. See answer to question 4 for Basic worksheet.
3. The layer that is buried the deepest is the oldest layer as it must have been buried first.
4. Large crystals result from very slow cooling. This indicates that granite has cooled down very slowly underground in a dyke or sill.
5. Pumice is formed when the lava is filled with gas which dissolves when it is erupted out of the volcano and so the rock is filled with holes and is very light. Obsidian is really glassy because it has been superheated and the lava has little or no gas in it.
6. Over time, more plant material is laid down which causes pressure on the layers below. Heat and pressure that occur because of the burial cause the plant material to form coal.

Strata and fossils in rocks (pp 14–16)

Basic
1. (a) Igneous intrusion, sandstone, greywacke
   (b) It could occur through a volcanic eruption that extruded the igneous rock through the other rocks.
2. (a) Lampshell is the youngest as it is the fossil that is in the topmost layer.
   (b) Sea urchin is the oldest as it is in the layer that has been laid down first.
   (c) 6 Lamp shell; 5 Snail; 4 Coral; 3 Gastropod; 2 Ammonite; 1 Sea urchin

Proficient
1. See answer to question 2 for Basic worksheet.
2. If it is a fossil from a tropical plant or animal and it is buried in a cold area, this indicates that the area was once warm like the tropics (and vice versa).
3. The water gets into a crack and expands when frozen. This expansion forces the rock outwards a little and extends the crack. Over time, this process leads to the rock splitting.

Advanced
1. See answer to question 2 for Basic worksheet.
2. A mould fossil is formed by the impression left in rock by the remains of an organism. A cast fossil occurs when the mould is filled in by precipitating minerals.
3. If it is a fossil from a tropical plant or animal and it is buried in a cold area, this indicates that the area was once warm like the tropics (and vice versa).
4. In freeze thaw weather, the water gets into cracks in rocks and expands when frozen. This expansion forces the rocks outwards a little and extends the cracks, which over time leads to the rocks splitting. The small split rocks pile up on the slope of the mountain and, over a very long time, form scree slopes.

Volcanoes (pp 17–19)

Basic
1. Composite volcano

Volcano diagram:
- Ash cloud
- Crater
- Vent
- Lava flow
- Summit
- Flank
- Sill
- Branch pipe
- Conduit (pipe)
- Layers of lava and ash emitted by the volcano
- Rock layers of Earth’s crust
- Magma chamber

2. (a) An active volcano is a volcano that has had at least one eruption during the past 10 000 years.
   (b) A dormant volcano is an active volcano that is not erupting but that is expected to erupt again.
   (c) An extinct volcano has not had an eruption for at least 10 000 years and is not expected to erupt again in a comparable time in the future.

3. Answers may include any three of the following: small earthquakes; emission of sulfur-rich gas; crater lake heating up; steam coming out of vents.

4. (a) False. Volcanoes tend to be located along plate boundaries or in known hotspot areas where the crust is particularly thin.
   (b) False. Volcanoes erupt when molten rock is pushed upwards through a weakness in the Earth’s crust; the cause has nothing to do with the inner temperature of the Earth.
   (c) True. Australia is not on a plate boundary and does not have a hotspot.
   (d) False. There are many different types of volcano and their shape depends on the type of lava that is erupted out of them. The runnier the lava, the more gentle the slope on the side of the volcano.
(e) True. Hot springs have a heat source below the ground that heats the water so are an indication of volcanic activity.

Proficient
1. See answer to question 2 for Basic worksheet.
2. Answers may include any three of the following: small earthquakes; emission of sulfur-rich gas; crater lake heating up; steam coming out of vents.
3. (a) False. Volcanoes tend to be located along plate boundaries or in known hotspot areas where the crust is particularly thin.
   (b) True. Australia is not on a plate boundary and does not have a hotspot.
   (c) False. There are many different types of volcano and their shape depends on the type of lava that is erupted out of them. The runnier the lava, the more gentle the slope on the side of the volcano.
   (d) True. Hot springs have a heat source below the ground that heats the water so are an indication of volcanic activity.
4. Each time there is an eruption from a stratovolcano, the sticky lava does not flow far down the slopes before cooling and hardening; so over time subsequent layers of lava cool and harden and cause the cone of the volcano to grow to a steep-sided cone.

Advanced
1. See answer to question 2 for Basic worksheet.
2. (a) Answers may include any three of the following: small earthquakes; emission of sulfur-rich gas; crater lake heating up; steam coming out of vents.
   (b) Sample answer: Small earthquakes may be a sign that magma deep within the volcano is moving, indicating an impending eruption. A crater lake that is heating up could indicate hot magma is rising closer to the surface of the crust, which is transferring heat to the water in the lake and so it heats up.
3. (a) False. Volcanoes tend to be located along plate boundaries or in known hotspot areas where the crust is particularly thin.
   (b) False. There are many different types of volcano and their shape depends on the type of lava that is erupted out of them. The runnier the lava, the more gentle the slope on the side of the volcano.
   (c) True. Hot springs have a heat source below the ground that heats the water so are an indication of volcanic activity.
4. Each time there is an eruption from a stratovolcano, the sticky lava does not flow far down the slopes before cooling and hardening; so over time subsequent layers of lava cool and harden and cause the cone of the volcano to grow to a steep-sided cone.

Earthquakes (pp 20–22)

Basic
1. (a) Primary wave (b) Secondary wave (c) Mercalli (d) Richter
   (e) Energy (f) The surroundings (g) Richter
2. Focus (e); Epicentre (c); Aftershock (d); Fault (a); Magnitude (b)

Advanced
1. See answer to question 4 for Proficient worksheet.
2. Because the speed of each wave is known, the difference between the arrival times of each wave tells you how far the wave has travelled. Getting these data from three or more spots gives you the location of the source of the waves (the epicentre).
3. New Zealand is on the boundary of the Pacific and Australian plates which are moving past each other and as a result the country gets lots of earthquakes. Australia is not on a plate boundary and so gets very few earthquakes.
4. The sound wave caused by the ground moving travelled faster than the P and S waves and so the residents heard the earthquake before they felt the shaking.
5. The Richter scale measures the energy released by the earthquake waves; the Mercalli scale measures the effect the earthquake has on the surroundings.
6. They both measure earthquakes but in different ways. The Richter scale is based on the amount of energy released and gives it in numbers (measurements) whereas the Mercalli scale is based on damage caused, which may be misleading because of factors such as poor construction of buildings and their age.

Earthquakes originate deep in the crust and mantle of the Earth. Scientists do not yet have enough understanding of the conditions at this depth to predict when earthquakes occur.
Rocks and minerals (pp 23–25)

Basic
1. Minerals (b); Lustre (d); Habit (g); Cleavage plane (f); Mohs hardness scale (c); Streak test (a); Magnetic (e)
3. (a) Diamond is the hardest substance known to humanity; titanium is hard but not as hard as diamond.
(b) Gold is valuable because it is rare. In earlier times it was valuable because it was rare and able to be found as itself.
(c) Correct.
(d) The outback of Australia is rich in iron ore but not because it is the same colour as iron.
4. Gold is dense so sinks to the bottom of the gold pan when swirled. The lighter, less dense material is carried out of the gold pan by the swirling motion, leaving the heavy gold behind.

Proficient
1. Minerals (b); Lustre (d); Habit (g); Cleavage plane (f); Mohs hardness scale (c); Streak test (a); Magnetic (e)
3. Iron ore is mined in this area because the red dust is rich in iron.
4. See answer to question 4 for Basic worksheet.
5. (a) Iron pyrite is less dense (lighter) than the gold and so will appear light in your hand compared with the same amount of gold.
(b) The jeweller could do a test by trying to make a scratch mark on the stone. Only a diamond will scratch another diamond but if the stone is a cubic zirconia it will be scratched by a knife.

Advanced
1. Minerals (b); Lustre (d); Habit (g); Cleavage plane (f); Mohs hardness scale (c); Streak test (a); Magnetic (e)
2. Iron ore is mined in this area because the red dust is rich in iron.
3. See answer to question 4 for Basic worksheet.
4. (a) Iron pyrite is less dense (lighter) than the gold and so will appear light in your hand compared with the same amount of gold.
(b) The jeweller could do a test by trying to make a scratch mark on the stone. Only a diamond will scratch another diamond but if the stone is a cubic zirconia it will be scratched by a knife.
5. (a) The bench is soft so a knife will mark or scratch it.
(b) Fruit juice and soft drink are both acids; marble is made of carbonates which fizz with acid. So, if left to sit on the bench, the fruit juice or soft drink would “eat” into the bench, leaving it pitted and marked.

Erosion and weathering (pp 26–28)

Basic
1. (a) rocks (f) water
(b) physical (g) wind
(c) chemical (h) freeze thaw
(d) biological (i) gravity
(e) locations
2. (a) Weathering (c) Weathering
(b) Erosion (d) Erosion
3. The harbour needs to be mechanically dredged to remove the silt and sand that have clogged it so that the harbour remains deep and its channels are clear for boats to enter and leave safely.
4. Rivers in flood carry great volumes of water and also huge amounts of sediments and particles. The sediments cause the brown discolouration.
5. Some rocks are softer than others due to the way in which they are formed. When wind hits rocks, it weathers the softer rocks faster than the harder rocks. As a result, more of the harder rocks are left in the formation.
6. Tree roots push down between weaknesses in rocks. As the tree grows, the roots get bigger and bigger and so push the rocks apart, causing them to break into smaller pieces, which is a kind of weathering.

Proficient
1. See answer to question 1 for Basic worksheet.
2. (a) Weathering because the rabbit is making the natural gap in the rock bigger and wearing the rock into smaller rocks.
(b) Erosion because the stream is carrying small particles away from their original location.
(c) Weathering because the limestone is being chemically weathered away by the acid dissolving the carbonate.
3. Rivers in flood carry great volumes of water and also huge amounts of sediments and particles. The sediments cause the brown discolouration.
4. See answer to question 5 for Basic worksheet.
5. Tree roots push down between weaknesses in rocks. As the tree grows, the roots get bigger and bigger and so push the rocks apart, causing them to break into smaller pieces, which is a kind of weathering.

Advanced
1. See answer to question 1 for Basic worksheet.
2. (a) Weathering because the rabbit is making the natural gap in the rock bigger and wearing the rock into smaller rocks.
(b) Erosion because the stream is carrying small particles away from their original location.
3. Rivers in flood carry great volumes of water and also huge amounts of sediments and particles. The sediments cause the brown discolouration.
4. See answer to question 5 for Basic worksheet.
5. Trees grow slowly. They start as very small plants with very small roots that can anchor to tiny gaps or cracks in rocks. Over time, as the tree grows, so do the roots and they get thicker and deeper, causing the rocks to become more and more cracked. Eventually the rocks split off because the tree root is deep and big.
6. River stones are rounded because as they are transported in the water they are knocked against other stones that are also moving due to the water, which rounds and smooths them. In a glacier, the stones are encased in ice so they do not knock against other stones and they do not roll; therefore when the glacier retreats and leaves behind the stones, they are sharp and jagged.
Carbon cycle (pp 29–31)

Basic
1. Carbon compounds in dead organisms
2. Carbon is the basis for life and so is essential for life on Earth.
3. On Earth, carbon is found in living things, in carbon dioxide in the air, and as rock (coal).
4. Decomposers break down dead organisms and objects so that their components can be released to the environment to be used again.
5. Plants use carbon (as carbon dioxide) to produce energy from the Sun in the process called photosynthesis. They also expel carbon as carbon dioxide when they respire.
6. As humans continue to burn fossil fuels, great amounts of carbon dioxide are released into the atmosphere. The carbon dioxide absorbs heat energy from the Sun, causing the environment to heat up and contributing to the gradual increase in the temperature of the planet over time.

Proficient
1. See answer to question 1 for Basic worksheet.
2. Carbon is in the atmosphere as carbon dioxide, carbon monoxide and methane gas.
3. On Earth, carbon is found in living things, in carbon dioxide in the air, and as rock (coal).
4. Decomposers break down dead organisms, releasing their carbon into the environment to be recycled and used again. As a result of this process, carbon is available for use around the planet.
5. See answer to question 5 for Basic worksheet.
6. See answer to question 6 for Basic worksheet.
7. If this action was successful then the levels of carbon dioxide in the atmosphere would reduce, stabilising Earth’s temperature. As a result, climate change and rising sea levels – which are predicted to occur with rising carbon dioxide levels – would be averted.

Phases of the Moon (pp 32–34)

Basic
1. (a) The Moon rotates around the Earth once a month.
2. On Earth, carbon is found in living things, in carbon dioxide in the air, and as rock (coal).
3. Decomposers break down dead organisms, releasing their carbon into the environment to be recycled and used again. As a result of this process, carbon is available for use around the planet.
4. The Moon is always between the Earth and the Sun for half of its rotation around the Earth so every month a part of the world could have a lunar eclipse.
5. A solar eclipse is rarer because the Sun is so much further away from the Earth than the Moon and, if the eclipse is to occur, the Moon, Sun and Earth need to be lined up, which is not a common phenomenon.
6. The Moon has gravity one sixth that of Earth. This gravity pulls on the Earth’s water and causes bulges or high tides twice a day as that area of water is closer to the Moon and is pulled by the Moon’s gravity.

Advanced
1. See answer to question 1 for Basic worksheet.
2. On Earth, carbon is found in living things, in carbon dioxide in the air, and as rock (coal).
3. Decomposers break down dead organisms, releasing their carbon into the environment to be recycled and used again. As a result of this process, carbon is available for use around the planet.
4. See answer to question 5 for Basic worksheet.
5. See answer to question 6 for Basic worksheet.
6. A locked source means that the carbon has been stored in a stable state for a very long time – in the case of coal, for thousands or millions of years.

Advanced
1. See answer to question 2 for Basic worksheet.
2. See answer to question 3 for Basic worksheet.
3. Because the rotation of the Moon around Earth is 28 days, every 28 days there is a full moon. However, the calendar months of Earth vary from 28 to 31 days so the Moon rotation is out of sync with them and it
is relatively common to have a full moon twice in a calendar month.

4. The Moon is always between the Earth and the Sun for half of its rotation around the Earth so every month a part of the world could have a lunar eclipse.

5. A solar eclipse is rarer because the Sun is so much further away from the Earth than the Moon and, if the eclipse is to occur, the Moon, Sun and Earth need to be lined up, which is not a common phenomenon.

6. The Moon has gravity one sixth that of Earth. This gravity pulls on the Earth’s water and causes bulges or high tides twice a day as that area of water is closer to the Moon and is pulled by the Moon’s gravity.

When plates meet – plate boundaries (pp 35–37)

Basic
1. Continental drift (c); Convection current (a); Convergent plate boundary (d); Subduction (b); Divergent plate boundary (e)
2. (a) True because they have fossils of the same kinds of non-flying animals on them, which means they must have been joined once.
   (b) False because the same species of fern cannot adapt to all of those living conditions. Rather, the places the fern was found were grouped together before the continents split apart and so the fern had the same living conditions.
   (c) True because new crust is being formed at this deep sea trench which is pushing tectonic plates together at the other end.
3. The theory stated that the continents were once joined together. Its evidence was that the coast lines join up and different continents have the same fossils. The continents drifted apart (although the theory did not identify any mechanism to cause this, which is its greatest flaw) to their present day locations.
4. A fault line is a weakness in the Earth’s crust.
5. (a) Sea floor spreading is where new crust is being made. This new crust pushes older crust away from the trench and so is pushing on the plates, which causes plates to be moving into other plates at other locations.
   (b) In the mantle, convection currents of hot particles rise and cooler particles sink, moving things above them. Far above these events, starting in the crust, the tectonic plates move.

Proficient
1. Continental drift (c); Convection current (a); Convergent plate boundary (d); Subduction (b); Divergent plate boundary (e)
2. See answer to question 2 for Basic worksheet.
3. See answer to question 5 for Basic worksheet.
4. A transform fault occurs when two plates of the same density are moving along each other; one plate is moving in one direction and the other plate is moving in the opposite direction.

Advanced
1. See answer to question 1 for Basic worksheet.
2. See answer to question 5 for Basic worksheet.
3. A transform fault occurs when two plates of the same density are moving along each other; one plate is moving in one direction and the other plate is moving in the opposite direction.

How is heat cycled around the Earth? (pp 38–40)

Basic
1. Convection (c); Conduction (e); Radiation (d); Convection current (b); Electromagnetic radiation (a)
2. The Sun and the Earth’s core are the two sources of heat.
3. The core of the Earth heats the mantle. The mantle is a thick liquid and so heat is distributed throughout the mantle via convection currents. The rising particles through the mantle give their heat energy to the bottom of the crust, heating it.
4. As the particles are heated, they move apart which means they become less dense. Because they are less dense than the surrounding particles, they rise gradually, losing heat energy. At the top of the convection current, they have lost all of their heat energy to the surroundings and so become more dense and drop down to be heated again.
5. Energy from the Sun travels to the edge of the atmosphere of Earth via radiation; travels through the atmosphere of Earth by convection; and heats the surface of the Earth via conduction.
6. Warm water rises and wind moves it north. As it gives out its heat energy, it sinks and is recycled again to be heated at the equator.

Proficient
1. Convection (c); Conduction (e); Radiation (d); Convection current (b); Electromagnetic radiation (a)
2. The core of the Earth heats the mantle. The mantle is a thick liquid and so heat is distributed throughout the mantle via convection currents. The rising particles through the mantle give their heat energy to the bottom of the crust, heating it.
3. See answer to question 4 for Basic worksheet.
4. Energy from the Sun travels to the edge of the atmosphere of Earth via radiation; travels through the atmosphere of Earth by convection; and heats the surface of the Earth via conduction.
5. Warm water rises and wind moves it north. As it gives out its heat energy, it sinks and is recycled again to be heated at the equator.
6. As warm air rises, cooler air comes in to take its place and this movement to air causes wind to be formed.

Advanced
1. Convection (c); Conduction (e); Radiation (d); Convection current (b); Electromagnetic radiation (a)
2. The core of the Earth heats the mantle. The mantle is a thick liquid and so heat is distributed throughout the mantle via convection currents. The rising particles through the mantle give their heat energy to the bottom of the crust, heating it.
3. Energy from the Sun travels to the edge of the atmosphere of Earth via radiation; travels through the atmosphere of Earth by convection; and heats the surface of the Earth via conduction.

4. Warm water rises and wind moves it north. As it gives out its heat energy, it sinks and is recycled again to be heated at the equator.

5. As warm air rises, cooler air comes in to take its place and this movement to air causes wind to be formed.

6. Land heats up faster than the ocean, which means air rises above the land. The air from the ocean rushes in to replace this rising hot air over the land and a cooling sea breeze is formed.

7. Polar ice caps are white and very reflective so they can reflect a lot of the heat energy that strikes them from the Sun back out into space. In this way, they act to control the Earth’s temperature. If they disappear, then the temperature of the Earth will rise a lot faster.

**The greenhouse effect (pp 41–43)**

**Basic**

1. (a) troposphere
   (b) stratosphere
   (c) ionosphere (or (a) to (c) can be in a different order)
   (d) radiation
   (e) carbon dioxide
   (f) methane (or (e) and (f) can be in reverse order)
   (g) warming

2. The greenhouse effect means that the Earth is warming because greenhouse gases in the atmosphere are trapping solar radiation; the gases allow sunlight to pass through but they absorb the heat from the Sun.

3. Carbon dioxide, methane, nitrogen dioxide

4. Greenhouse gases trap the heat from the Sun; the other gases allow the heat and the sunlight to pass through them.

5. Glass in a greenhouse traps heat from the Sun and raises the temperature of the greenhouse to very high levels. Because greenhouse gases in the atmosphere are working in the same way to trap heat on Earth and making temperatures rise, scientists say that the atmosphere is like glass in a greenhouse.

6. They are referring to the amount of ultraviolet radiation in the atmosphere.

7. Carbon forms carbon dioxide and methane, two of the major greenhouse gases. So when carbon levels rise, that means the levels of carbon dioxide and methane are rising and so is the temperature on Earth.

8. As temperatures rise, the polar ice caps – which have previously locked up a lot of water – are melting and so sea levels are rising.

**Advanced**

1. The greenhouse effect means that the Earth is warming because greenhouse gases in the atmosphere are trapping solar radiation; the gases allow sunlight to pass through but they absorb the heat from the Sun.

2. The layer of carbon dioxide is reflecting a lot of heat energy from the Sun back to the Earth and is only releasing a small amount of heat energy into outer space.

3. Greenhouse gases trap the heat from the Sun; the other gases allow the heat and the sunlight to pass through them.

4. See answer to question 5 for Basic worksheet.

5. They are referring to the amount of ultraviolet radiation in the atmosphere.

6. The ozone layer is thinner over Australia and New Zealand, which means there is a higher level of UV radiation in the atmosphere and a higher risk of excess sun exposure. As a result, levels of skin cancer in Australia and New Zealand are higher than they should be.

7. Carbon forms carbon dioxide and methane, two of the major greenhouse gases. So when carbon levels rise, that means the levels of carbon dioxide and methane are rising and so is the temperature on Earth.

8. As temperatures rise, the polar ice caps – which have previously locked up a lot of water – are melting and so sea levels are rising.

**Layers of the Earth (pp 44–46)**

**Basic**

1. (a) Crust (c) Outer core
   (b) Mantle (d) Inner core

2. It is a very hot solid and rich in iron so is magnetic.

3. The thickest part is underneath the Himalayan mountains because they are the tallest mountain range in the world and then added to their thickness is the usual thickness of the crust underneath them.

4. It is like golden syrup as it is a very thick, slow-moving liquid.

5. Earthquakes and volcanoes happen along plate boundaries. When you plot the locations of earthquakes and volcanoes, you can see the outlines of the tectonic plates, which are cracks in the crust.

6. Particles are heated up because the core is very hot. The hot particles rise in a convection current, transferring heat energy through the mantle to the crust.

7. The inner core is solid because of the extreme pressure it is under from the weight of all the mantle and crust on top of it.

8. The existing sea floor is being pushed apart by new crust. If you date layers in the sea floor either side of a trench, they match, which shows new crust is being made and pushing the existing sea floor outwards.
4. **Basic** Satellites (pp 47–49)

   - Crust
   - Mantle
   - Outer core
   - Inner core

2. See answer to question 3 for Basic worksheet.
3. See answer to question 5 for Basic worksheet.
4. Particles are heated up because the core is very hot. The hot particles rise in a convection current, transferring heat energy through the mantle to the crust.
5. The inner core is solid because of the extreme pressure it is under from the weight of all the mantle and crust on top of it.
6. See answer to question 8 for Basic worksheet.
7. The temperatures on the way to the centre of the Earth are too extreme and so, using today’s technology, you would melt before you got there.
8. Volcanic eruptions give out material from below the crust, which scientists can study to gain more information about the world beneath our feet.

### Advanced

1. See answer to question 1 for the Proficient worksheet.
2. The thickest part is underneath the Himalayan mountains because they are the tallest mountain range in the world and then added to their thickness is the usual thickness of the crust underneath them.
3. Particles are heated up because the core is very hot. The hot particles rise in a convection current, transferring heat energy through the mantle to the crust.
4. The inner core is solid because of the extreme pressure it is under from the weight of all the mantle and crust on top of it.
5. The existing sea floor is being pushed apart by new crust. If you date layers in the sea floor either side of a trench, they match, which shows new crust is being made and pushing the existing sea floor outwards.
6. See answer to question 7 for Proficient worksheet.
7. See answer to question 8 for Proficient worksheet.
8. After the initial formation of the Earth, the layers formed because some of the rocks that contained the heavier elements (iron-rich rocks) sank towards the centre of the Earth and the lighter rocks "floated" on top and hardened. This process took many millions of years.

### Satellites (pp 47–49)

#### Basic

1. (a) Satellite  
   (b) Artificial satellite  
   (c) Geostationary satellite

2. Any five of the following (and other answers are also possible): international telephone calls, weather forecasts, GPS on cars or in mobile phones, television, radio, storm tracking, spying.
3. They have solar panels so get their energy from the Sun.
4. (a) With this design feature, they cross the equator at the same time each day so it is easy for weather forecasters to line up images from previous days and get an accurate picture of what is happening with the weather. It also keeps the angle of the sunlight hitting the Earth as constant as possible so images can be compared from season to season over the years.

(b) Weather conditions can be seen 15 times per day and so the forecasts can be made based on data that are at most only 96 minutes old, keeping forecasting up to date.

5. With an earth-surveying satellite, it is possible to see where the bush fires have started and to direct crews to those locations to fight the fires. In addition, the satellite can be used to warn residents of how close fires are and of their direction and speed.
6. 5 760 s or 96 minutes
7. Its journey was out in deep space and the solar panels would not work all the time so it needed another source of fuel.

#### Proficient

1. (a) Satellite  
   (b) Artificial satellite  
   (c) Geostationary satellite

2. (a) Earth-surveying satellite  
   (b) Geostationary satellite  
   (c) Sun-synchronous satellite  
   (d) Earth-surveying satellite

3. See answer to question 4 for Basic worksheet.
4. With an earth-surveying satellite, it is possible to see where the bush fires have started and to direct crews to those locations to fight the fires. In addition, the satellite can be used to warn residents of how close fires are and of their direction and speed.
5. Its journey was out in deep space and the solar panels would not work all the time so it needed another source of fuel.

#### Advanced

1. (a) Earth-surveying satellite  
   (b) Geostationary satellite  
   (c) Sun-synchronous satellite  
   (d) Earth-surveying satellite

2. Geostationary: (a), (d), (f) Polar-orbiting: (b), (c), (e), (g), (h)
3. See answer to question 4 for Basic worksheet.
4. With an earth-surveying satellite, it is possible to see where the bush fires have started and to direct crews to those locations to fight the fires. In addition, the satellite can be used to warn residents of how close fires are and of their direction and speed.
5. With an earth-surveying satellite, it is possible to see how many crops are growing and predict how abundant the crop will be. If the crop is looking sparse, humanitarian workers can begin to move food aid into the region well in advance of any famine so there is no transport delay to get in the way of helping people.

#### Objects in space (pp 50–52)

#### Basic

1. Comet (c); Black hole (d); Meteor (b); Meteorite (a)
2. (a) Comets have tails when they are close enough to the Sun for the heat to melt the ice, creating the tail.
(b) Asteroids are mostly rock that melts as it comes through Earth’s atmosphere.
(c) Black holes contain so much gravity that light cannot escape so you cannot see a black hole.
(d) Meteors are not falling stars; rather, they are pieces of asteroid that are entering Earth’s atmosphere.

3. Meteors and meteorites are made up of the same material (small pieces of asteroids). However, a meteorite is a meteor found on the surface of Earth whereas a meteor is seen in Earth’s atmosphere but has not landed.

4. Comets are mostly ice with a little rock whereas asteroids are mostly rock with a little ice.

5. (a) Tail composed of dust
   (b) Coma
   (c) Tail of ionised gases
   (d) Nucleus

Proficient
1. See answer to question 2 for Basic worksheet.

2. Meteors and meteorites are made up of the same material (small pieces of asteroids). However, a meteorite is a meteor found on the surface of Earth whereas a meteor is seen in Earth’s atmosphere but has not landed.

3. Comets are mostly ice with a little rock whereas asteroids are mostly rock with a little ice.

4. (a) Tail composed of dust
   (b) Coma
   (c) Tail of ionised gases
   (d) Nucleus

5. A large asteroid hitting Earth could cause so much dust and particles to go up into the atmosphere that photosynthesis would stop for some time, which would have catastrophic effects on the food chain of the planet.

Advanced
1. See answer to question 2 for Basic worksheet.

2. Meteors and meteorites are made up of the same material (small pieces of asteroids). However, a meteorite is a meteor found on the surface of Earth whereas a meteor is seen in Earth’s atmosphere but has not landed.

3. Comets are mostly ice with a little rock whereas asteroids are mostly rock with a little ice.

4. The tail will always be pointing away from the Sun as it is heated ice and dust that streams out behind the comet as it orbits the Sun.

5. A large asteroid hitting Earth could cause so much dust and particles to go up into the atmosphere that photosynthesis would stop for some time, which would have catastrophic effects on the food chain of the planet.

6. The gravity of a black hole is so dense and strong that objects and debris surrounding it are sucked into it, leaving the area of space around the black hole free of debris.

**Extraction of resources (pp 53–55)**

**Basic**

1. Possible answers: Gold – jewellery; Aluminium – cans; Uranium – radioactive sources; Iron – making of steel for production; Copper – pipes

2. (a) Bauxite is crushed and ground to give small pieces.
   (b) Resulting slurry is pumped to a digester where sodium hydroxide dissolves aluminium.
   (c) Slurry is filtered to remove impurities.
   (d) Carbon dioxide gas is bubbled through to cause aluminium oxide to precipitate out.
   (e) Mixture is boiled so water removed, leaving behind aluminium oxide (alumina).

(f) Alumina is smelted to aluminium.

3. (a) To provide fuel for nuclear power stations; for weapons.
   (b) It is a valuable mineral and very expensive so, because Australia is rich in uranium, mining would be highly profitable.
   (c) Uranium can be used in weapons that leave thousands of people dead and many later generations of people sick. Mining it may make Australia a target for terrorists who wish to use the uranium to make weapons.

**Proficient**

1. Possible answers: Gold – jewellery; Aluminium – cans; Uranium – radioactive sources; Iron – making of steel for production; Copper – pipes

2. See answer to question 3 for Basic worksheet.

3. (a) Coal is composed of carbon which, when burnt, releases carbon dioxide into the atmosphere.

   Carbon dioxide is a greenhouse gas which absorbs heat from the Sun and so contributes to the greenhouse effect and global warming.

   (b) Possible answers: Window frames – light and strong and unreactive with the elements so durable; “Tin” foil – light and strong foil that keeps moisture out and heat in so good for food storage; Aluminium cans – easy to shape into a can and unreactive so does not taint the drink.

   (c) Bauxite

   (d) Electricity must be used as aluminium is very reactive and forms a strong ionic bond with oxygen from the air. This bond needs lots of energy to be broken and so electricity is used to break the bonds between the aluminium and the oxygen.

**Advanced**

1. See answer to question 3 for Basic worksheet.

2. (a) Coal is composed of carbon which, when burnt, releases carbon dioxide into the atmosphere.

   Carbon dioxide is a greenhouse gas which absorbs heat from the Sun and so contributes to the greenhouse effect and global warming.

   (b) Bauxite

   (c) Electricity must be used as aluminium is very reactive and forms a strong ionic bond with oxygen from the air. This bond needs lots of energy to be broken and so electricity is used to break the bonds between the aluminium and the oxygen.

3. Iron ore contains lots of iron oxide which is rich in iron. This is heated using coke in an air-filled furnace. The coke contains carbon which takes the oxygen out of the iron ore and makes carbon monoxide, leaving behind the iron. The limestone is then reacted with the remaining iron to remove impurities, leaving behind iron.
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Each book in this series:

- helps teachers to easily differentiate learning in science
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