### VELS OUTLINE: LEVEL 5

#### STRAND: DISCIPLINE-BASED LEARNING

<table>
<thead>
<tr>
<th>Domain</th>
<th>Dimension</th>
<th>Key elements of standards/learning focus</th>
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| Humanities                     | Geographical knowledge and understanding | Standards  
Demonstrate knowledge and understanding of characteristics of Australian and surrounding regions including Antarctica.  
Explain how the interaction of physical processes and human activities creates variations within regions.  
Demonstrate understanding of environmental issues based on inquiry and propose ways to ensure resource sustainability.  
Learning focus  
Use a variety of geographic tools/skills, and an inquiry-based approach, to investigate Australian and surrounding regions including Antarctica.  
Explore how human and physical environments interact over time to change characteristics of regions.  
Extend knowledge and understanding of physical phenomena and of physical processes that produce them.  
Identify major physical features and their links with human activities.  
Investigate environmental issues; suggest/evaluate policies for their effective management and sustainable use of resources. |
| Geospatial skills              |                                          | Collect geographical information from electronic and print media.  
Analyse, evaluate and present geographical information, using a range of forms.  
Construct overlay theme maps using map conventions. |

#### STRAND: INTERDISCIPLINARY LEARNING

<table>
<thead>
<tr>
<th>Domain</th>
<th>Dimension</th>
<th>Key elements of standards/learning focus</th>
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| Communication                   | Listening, viewing and responding | When listening/responding, consider alternate views and recognise multiple viewpoints.  
Presenting                       | Use subject-specific language and communication conventions to convey a clear message.                                                                                                                                                                                                                                      |
| Design, Creativity and Technology | Investigating and designing    | Undertake research relevant to the design brief.                                                                                                                                                                                                                                                                               |
| ICT                             | ICT for communicating         | Exchange ideas and considered opinions through online forums.                                                                                                                                                                                                                                                                 |
| ICT                             | ICT for visualising thinking   | Use a range of ICT tools and data types to visualise thinking strategies when developing understanding.                                                                                                                                                                                                                  |

#### STRAND: PHYSICAL, PERSONAL AND SOCIAL LEARNING

<table>
<thead>
<tr>
<th>Domain</th>
<th>Dimension</th>
<th>Key elements of standards/learning focus</th>
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<tbody>
<tr>
<td>Personal Learning</td>
<td>The individual learner</td>
<td>Seek and respond to feedback in building knowledge and understanding.</td>
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Excerpts from curriculum domains and strands from the Victorian Essential Learning Standards: © VCAA 2005. This is an extract from material produced by the Victorian Curriculum and Assessment Authority, Australia. Students and teachers should consult the Victorian Essential Learning Standards website for more information: http://vels.vcaa.vic.edu.au
<table>
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<tr>
<th>Context</th>
<th>Page references</th>
<th>Discipline links</th>
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| Explore the characteristics of the Antarctic continent, including its ice cover, climate, physical processes, fauna and mineral deposits. | 2–9, 10–11 | **History:** Olympic Games (*Humanities Alive 1*, pp. 96–7)  
**Science:** buoyancy (*Science Alive 2*, p. 220); states of matter (*Science Alive 2*, pp. 2–3, 20) |
| Investigate the difficulties of living in and exploring Antarctica and the impact of human activity. | 4–7, 10–15, 18–23 |  |
| Investigate environmental adaptations, and resource use; threats to the Antarctic environment; possibility of iceberg harvesting. | 8–11, 14–15, 22–3 |  |
| Investigate aspects of Antarctica’s landforms, locations and mineral deposits and potential impacts on Antarctica of global warming. | 2–3, 6–7, 10–11, 14–15 | **English:** write a newspaper article (*English Alive 2*, pp. 110–11) |
| Investigate the resources of Antarctica and their use, and threats to the environment. | 10–15 | **Science:** magnetic fields (*Science Quest 4*, p. 60)  
**Geography:** ozone layer (*Jacaranda SOSE Geography 4*, pp. 110–11) |
| Appreciate the geography of Antarctica including landforms, climate, natural resources, and potential impact of global warming. | 2–7, 10–11, 15 |  |
| Explore the geography of Antarctica; use overlay maps to demonstrate the relationship between bases and resources. | 2–3, 16–17 |  |
| Investigate environmental adaptations and food webs, Antarctica’s resources, environmental threats. | 8–15 | **History:** post-war modernisation of Japan (*SOSE Alive 4*, pp. 40–1) |
| Collect geographical information on Mt Erebus, South Pole weather, mineral resources, oil spill disasters, global warming. | 2–3, 6–7, 10–11, 14–15 | **Maths:** estimating, calculating area |
| Prepare a study map, evaluate satellite images and maps, construct a line graph, annotate a diagram. | 2–5, 8–11 |  |
| Construct an overlay theme map to locate territorial claims, bases and mineral resources. | 16–17 |  |
| Discuss the pros and cons of tourism and ownership of territory in Antarctica. | 10–13 |  |
| Prepare a study map; share information on Mt Erebus through online forums; use diary entries, bumper stickers and newspaper reports. | 2–5, 12–15 | **Science:** food chains and webs (*Science Alive 2*, p. 152) |
| Design a crevasse warning sign, a flag for Antarctica, a bumper sticker, a commemorative tribute to Sir Douglas Mawson. | 4–5, 14–15, 20–1 | **Art:** design a commemorative tribute  
**Drama:** scriptwriting and performance |
| Exchange information discovered on Mt Erebus. | 2–3 |  |
| Use an ICT web tool to investigate South Pole weather; critically evaluate the site’s usefulness. | 6–7 |  |
| Share researched information, discuss controversial topics, consider feedback on flag design. | 2–3, 10–13 |  |
The last wilderness

page 1

Teaching points

We are becoming increasingly aware of the ways in which human activities affect the planet: global warming, greenhouse gases, the hole in the ozone layer, endangered species and environments, and spreading deserts are all examples. Antarctica has long been protected from human impact due to its isolated position and the difficulties its climate poses in exploring such an inhospitable environment. With increasing awareness of the fragility of Earth’s environments and ecosystems, we are in a position to tread more carefully as we explore this unique environment.

In the opening spread, students are introduced to the global importance of Antarctica — our climate and future are linked to its preservation.

Assessment

SUGGESTED RESPONSES TO ACTIVITIES

1. Who do you think this person is and what might he be doing here?
The patch on this person’s sleeve suggests that he is an American. He could be a scientist carrying out research; his field of interest might be Antarctic wildlife. It is also possible that he is a tourist and that this was a chance encounter with the penguins.

2. What dangers do you think he faces?
Extreme cold (temperatures well below freezing), frostbite, hypothermia, becoming disoriented in the white environment, glare from the ice, a sudden blizzard, stepping on thin ice and having it give way, falling down a crevasse

3. Describe the environmental conditions you think exist in this place.
This is a desolate environment, very cold, and covered in ice and snow. It is also very windy where blizzards could rival a cyclone in terms of destructive force and power. The land surface is not flat; there is a landmass beneath the ice including rugged mountain ranges. Glaciers take the place of rivers and crevasses pose a real danger. In winter the sea freezes to double the size of the Antarctic continent.

4. In what ways do you think Antarctica could be changed in the future? Why?
Too many tourists could damage the fragile environment. Research bases change the landscape and care must be taken to properly dispose of waste. A shipping accident — sinking or leaking oil or fuel could also threaten a great many species. Global warming may cause the ice sheets to melt and disrupt the breeding cycle of the wildlife, which is more susceptible to subtle temperature changes. A rise of only one or two degrees is enough to threaten the survival of krill and crustaceans that form the bases of the food chain.

5. Suggest how you think such changes could affect the rest of the world.
The melting of ice sheets and glaciers would cause a rise in sea levels, which would result in low-lying areas being flooded — several islands in the Pacific are already threatened in this way. Ecosystems would be placed under threat and more species would become endangered as breeding patterns were altered.

6. Write the story of this meeting (and what led up to it) from either the man’s or the penguins’ point of view.
This is a creative piece, and responses will vary. The penguins might ask why the human is in their land and might be curious about his clothing. They might also have something to say about the strange dwellings he has built or the rubbish that he has left behind — perhaps they are asking him to clean up the environment. The human might be curious about how the penguins have learnt to adapt to the harsh environment — these are emperor penguins who spend their entire lives here, unlike some other species that leave during the winter and only return to Antarctica to breed during the short summer. The human might also be telling them about the place he is from, what humans do at the bases and why the research is so important.

Antarctica — the facts

pages 2–3

Teaching points

The context for this spread is the Winter Olympics; a fictitious newspaper article (presented in this way to engage student interest) covers typical events on the coldest, driest, windiest and highest continent on the Earth. The fiction presented in the article is then dismantled by the remaining text in the spread so that students gain much information about what it is like in Antarctica. The article and material in the spread provide ample opportunities for discussion.

LINKS TO OTHER DISCIPLINES

History: the origins of the Olympic Games (Humanities Alive 1, pp. 96–7)
English: writing a newspaper article (English Alive 2, pp. 110–11)

Assessment

Activity 8 could form the basis of an ongoing mapping assessment. As students work through the material in the book, they progressively add additional features and information to their map. Activity 9 could also be used as an assessment item. It requires students to conduct some research on Mt Erebus; this could be extended, so that students are required to present a fact file or brief report based upon their research. An assessment template has been included at www.jaconline.com.au/humanitiesalive/ha2 under ‘For the teacher’, which can be customised for this or any other activity to incorporate task-specific and VELS-related criteria.
SUGGESTED RESPONSES TO ACTIVITIES

REMEMBER
1. List the five facts about Antarctica you found the most surprising. Explain.
   Student responses will vary, but some suggestions include: no native people, it is too cold for rain, the average height of Antarctica above sea level is greater than our highest mountain, few plants, wind speeds up to over 70 kilometres per hour, extreme temperature range, no rain in some areas for over two million years, twice the size of Australia, doubles its size in winter, no roads.

2. Why can we see only the top of the David Range above (on top of p. 3 of SOSE Alive Topic Books: Antarctica)?
The rest of the mountain is buried beneath the ice sheet — the average depth of the ice sheet is 2500 metres.

3. Why does Antarctica double in area every winter? Because the surrounding ocean freezes during the winter.

THINK
4. Antarctica is sometimes described as the world’s biggest desert. Why?
   Deserts are defined as areas of low precipitation. Most of Antarctica is too cold for rain, and the interior receives only slightly more snow than the Sahara receives rain. Antarctica is a cold desert.

5. Why do you think there are no native Antarcticans?
   Antarctica is isolated and surrounded by ocean. There was no possibility for people to migrate from other landmasses or to island hop. It is also much too cold and windy.

6. Walk, or measure in the car, a distance of 4.8 km (as straight as possible). How does this help you visualise the depth of some of Antarctica’s ice?
   Students need to do this as a homework task — perhaps the teacher could measure a fixed point (from the school gate) using their own vehicle.

COMMUNICATE
7. Look carefully at the photograph below (on the bottom of p. 3 of SOSE Alive Topic Books: Antarctica) carefully.
   (a) Where do you think the person is going? Suggest why.
   He appears to be walking across the ice sheet, perhaps for whale watching or research.

   (b) What do you think he/she is wearing? Why?
   Boots, thick outer clothing (which is waterproof), gloves, and a jacket with a hood. It is most likely that he is wearing thermal underwear and thick jumpers underneath. This clothing is necessary to protect him from the extreme cold. He appears to be carrying a long pole, perhaps to check the safety of the ice.

   (c) What might be in the backpack? Explain.
   Emergency supplies, flares, first aid, two-way radio — in case the weather turns or he is injured. He may also have food.

8. Throughout this chapter you will see some place names written in green — for example: Mawson station. Locate and label each of these places on a map. (Go to www.jaconline.com.au/sosealive/home/topicbooks.html and click on the map outline of Antarctica for this topic book.)
   Your map is called a study map.
   This is the start of a mapping task. See ‘Assessment’ above.

INQUIRE
9. Use library and Internet resources to find out about Mt Erebus in Antarctica. Share what you discover with a partner using online forums.
   Research task based on Mt Erebus — students could find out its dimensions, its volcanic origins and geology; they might even investigate the number of aircraft that have crashed into this mountain. See ‘Assessment’ above.

Ice, ice and more ice
pages 4–5

Teaching points
This spread develops students’ understanding of the ice that covers the Antarctic continent and the fact that there are different types of ice. It provides the perfect launching pad for exploring glaciers and the hidden dangers of crevasses. The Skillbooster introduces students to the concepts of estimating area and the size of features from satellite images.

LINKS TO OTHER DISCIPLINES
Science: buoyancy (Science Alive 2, p. 220); experiments with different states of water (liquid, solid, gas) (Science Alive 2, pp. 2–3, 20)
Mathematics: estimating, calculating area

Assessment
The Skillbooster allows students to develop skills in working with satellite images. The ‘design and creativity’ activity (activity 7) provides an opportunity for cross-discipline work and will develop student understanding of the dangers of this cold environment. The task could be extended beyond designing a sign to the production of a pamphlet using ICT tools and techniques. An assessment template is included at www.jaconline.com.au/humanitiesalive/ha2 under ‘For the teacher’, which can be customised for this or any other activity to incorporate task-specific and VELS-related criteria.

Activity 8 is also a useful assessment tool: students imagine they are part of an expedition. The task could form the basis of an oral presentation, with different students reporting on different periods of the expedition.
REMEMBER

1. What is the average depth of the ice in Antarctica? What is the maximum depth?
   Average depth 2500 metres; maximum depth 4800 metres

2. Explain the differences between an ice shelf and sea ice.
   An ice shelf is floating freshwater ice that is still anchored to the land. Sea ice is formed when the ocean freezes during the winter months; when the weather warms it will thaw and become liquid once more.

THINK

3. What is the average height above sea level of the polar plateau? Use your atlas to find a place in Australia that is about this height above sea level.
   3000 metres — there is no place in Australia of this height. Mt Kosciuszko, Australia’s highest mountain, is 2228 metres above sea level.

4. On the cross-section (on the bottom of p. 4 of SOSE Alive Topic Books: Antarctica), Alexander Island is shown as an island, even though it appears to be part of the mainland. Explain why.
   The island is connected to the mainland by the ice shelf. This ice has built up over millions of years and forms part of the continent. The weight of the ice depresses landmasses and forces them below sea level. If the ice were to melt, Alexander Island would probably be an island with a similar relationship to Antarctica as Tasmania currently has to mainland Australia.

5. Explain how a ship can strike an iceberg even though it may seem to be a safe distance away from it.
   Because only one-fifth, on average, of an iceberg is visible above the sea. Hence, when the visible part of the iceberg seems to be a long distance away, the part underwater (and close to the surface) may be very much closer.

Skillbooster — estimate area

6. From the photo on the left (on p. 5 of SOSE Alive Topic Books: Antarctica), work out how much larger in area:
   (a) the ‘yellow’ piece of pack ice is than the ‘purple’ piece.
   Yellow — 44 square kilometres; purple — 11 square kilometres. The yellow piece of pack ice is four times the size of the purple piece.
   (b) the ‘pink’ piece of pack ice is than the ‘orange’ piece.
   Pink — 22 square kilometres; orange — 16 square kilometres. The pink piece of pack ice is 6 square kilometres bigger than the orange piece, or approximately 38% larger.

DESIGN AND CREATIVITY

7. Design a sign warning visitors about the dangers posed by crevasses. Your sign must use only pictures (photos or sketches) and symbols.
   Students’ responses will vary, but need to draw attention to the immense depths, unstable land surface and the fact that they are sometimes difficult to spot (perhaps being partly covered by thin ice).

COMMUNICATE

8. The expedition of Ernest Shackleton to Antarctica in 1914–16 is a supreme example of one expedition’s struggle against the ice. Find out more about this famous expedition. Imagine you are one of Shackleton’s men and write a series of diary entries.
   Students need to investigate the expedition of Shackleton (several sites are available on the Internet that could assist with research) and then imagine they were part of the expedition, which includes writing diary extracts. Perhaps this task could be divided up so that students look at different aspects of this expedition, which could then be presented orally to the class.

Cold, dry and windy

pages 6-7

Teaching points

The Antarctic climate is unlike anything students will have or are ever likely to experience. The information in the spread is broken down into manageable chunks that students can easily process and digest. Students use geographical evidence to learn that the temperature is directly related to Antarctica’s position on the globe; this information can be transposed to also explain why the equator is hot, or the impact of ocean currents. Students also learn that in this land of ice and snow, fresh water is a precious resource, obtained from melting ice and not from simply turning on a tap.

Assessment

SUGGESTED RESPONSES TO ACTIVITIES

REMEMBER

1. What is the coldest temperature ever recorded in Antarctica, and where did this occur?
   –89.6°C, recorded at Vostok Base on Antarctica’s polar plateau in 1983

2. Why is smoking banned in most Antarctic bases?
   There is no liquid water. All water is obtained from melting ice, which takes time. Firefighting is very difficult in this region because of this lack of readily available bulk water supply.

3. Explain why you must always wear goggles or sunglasses in Antarctica.
   The white surface reflects the sun’s heat, creating considerable glare.

THINK

4. During which months is it coldest in Antarctica?
   July to August
5. Examine the photograph top left (on p. 7 of SOSE Alive Topic Books: Antarctica). Describe what risks and difficulties someone would face walking across this type of terrain.

The land surface is uneven and it would be very easy to lose your footing. As ice is slippery, it would be difficult to maintain or regain balance. Stumbling on these sharp and jagged edges would pose a high risk of injury.

COMMUNICATE

6. Imagine you have won a competition to spend a week in Antarctica. You have to live in a small tent. In groups of three, discuss how daily activities are made more difficult by the extreme cold and wind. For example, how would you brush your teeth?

This activity requires students to work collaboratively in examining how the climatic conditions would affect everyday activities. Students could consider issues such as bathing, going to the toilet, preparing meals, dressing, teeth cleaning, doing the laundry, preventing items from freezing and so on. The activity could easily be adapted into a roleplay whereby students could undertake research, prepare a short script and then present their play to the rest of the class. This task, and the next, help students to empathise with those who have had to endure such harsh conditions.

7. Sketch the event described in Eric Webb’s diary. Add labels.

Students prepare a sketch based on a text extract. This task reinforces student comprehension.

INQUIRE

8. Research other record climatic conditions, such as the world’s hottest temperature or the world’s wettest place.

Again, students could work in teams and present a report to the class — the hottest and wettest places are suggested in the text. This could be extended to examine living at high altitude or in an area prone to extreme flooding, cyclones, drought or tornadoes.

ICT


Students explore the website. They could present their critique of the website as a short statement, an oral report, or by exchanging views online with other students. Such an activity would engage many of the standards of the ICT domain in the Interdisciplinary Learning strand.

Living in a freezer

pages 8–9

Teaching points

Despite the freezing temperatures, Antarctica is rich in aquatic life. Students are introduced to some of the animals that inhabit the region and the various methods they use to survive. In contrast, man’s vulnerability in this environment is also pointed out. The concepts of food chains and food webs are introduced.

LINKS TO OTHER DISCIPLINES

Science (Biology): food chains and food webs (Science Alive 2, p. 152)

Assessment

SUGGESTED RESPONSES TO ACTIVITIES

COMMUNICATE

1. All animals in Antarctica are linked by what is called a food web. One animal eats another, and then in most cases is food for another. Copy and complete the following diagram with these labels: killer whale, emperor penguin, sperm whale, crab-eater seal and snow petrel. Now add the skua (box and label) to your web.

This activity and the three that follow enable students to investigate and develop an understanding of food webs and food chains. The labels shown in bold in the figure below are those that students need to add.

2. One of the main reasons there are so many crab-eater seals is that humpback whales were hunted almost to extinction. Use your food web diagram to explain this.

Students will need to explain that the numbers of humpback whales have decreased, increasing the food source for the crab-eater seals. The additional food source allows them to breed in greater numbers.

3. Suggest what could happen if krill were to become extinct.

The loss of krill places the rest of the food web in jeopardy, as this is the basis of the food chain. For five creatures this is their only food supply, so unless they can adapt and find a new food source they will die. In turn, animals that eat humpbacks, crab-eater seals, squid and fish, snow petrels and Adelie penguins will then have their food source reduced.
4. Choose one of the animals in the diagram above (on p. 9 of SOSE Alive Topic Books: Antarctica). Use other information in this spread to sketch it in your notebook. Add labels around it to show how this animal has adapted to life in Antarctica.

Students select one of the animals depicted and sketch and label it to show its adaptations.

INQUIRE

5. Use an atlas to mark on a blank map of South America the migration routes of the Magellanic penguin. Estimate how far they migrate each year.

For this mapping task, students need to mark the migration routes of the Magellanic penguin on a map and calculate the distance travelled. These amazing birds can travel over 4800 kilometres in their annual migration.

**The riches of Antarctica**

*pages 10–11*

**Teaching points**

The potential for exploitation of Antarctica’s resources is massive. Early in the twentieth century, the oceans were already largely depleted of life. Although many nations have since stopped taking the larger animals, Japan still regularly visits these southern waters, harvesting whales for scientific purposes. This may prove an interesting discussion point for students, as it is most certainly an international issue. Students should also consider the impact and long-term viability of our continued harvesting of krill, mindful of the impact this has on the rest of the food chain. A discussion of this issue follows on naturally from the previous spread.

Students may not be aware that Antarctica also has other resources that people covet — its mineral stores and its abundant supply of fresh water. The Antarctic Treaty, first signed in 1961 and now with 45 members, currently protects the region; this is an example of nations working together for the benefit of all. Tourism, and the implications of this industry for Antarctica’s environment, is another issue. Many students have probably never considered Antarctica as a possible destination for their next holiday! An analysis of this issue also flows on from earlier work students may have undertaken.

**Assessment**

**SUGGESTED RESPONSES TO ACTIVITIES**

**REMEMBER**

1. **Why is there no mining in Antarctica?**

   The extreme cold, windy conditions and rough seas would make mining operations very difficult and potentially very polluting. The Antarctic Treaty bans mining except for scientific purposes.

**THINK**

2. **What problems would there be in extracting and transporting minerals from Antarctica?**

   Working in the extreme cold — protecting workers from the effects of cold, stabilising equipment and finding anchor points for mining structures and equipment. Wind and blizzards could shut down operations and damage equipment. Also, during the winter, operations would have to be conducted with no daylight. The rough seas or frozen seas would make it very difficult if not impossible to ship in materials and ship out minerals, especially during winter. Pollution would always be a major risk: an oil spill or accident could be environmentally devastating and very difficult to clean up.

3. **Why don’t tourists visit Antarctica during winter?**

   The sea freezes, making access extremely difficult; there are the dangers of boats being trapped, even crushed, in the ice. Also, during winter there are four months of endless night.

4. **If tourism (and the development of tourism facilities) were allowed to develop unchecked in Antarctica, how do you think it might change the region’s characteristics?**

   Accommodation and other tourist facilities could be built (even though basic), which would change the geographical profile of areas within Antarctica from a natural to a built environment. There would be a very high risk of pollution, and the possibility that the natural cycles of animal species could be disrupted. Unchecked tourist development could lead others (e.g. those wanting to push to exploit the region’s resources) to bring pressure on the restraints currently imposed by the Antarctic Treaty.

**Skillbooster — Draw a line graph**

5. **Draw a line graph using the data below. Extend your graph out to 2010 in line with the trend. How many tourists do you think there will be in 2010?**

<table>
<thead>
<tr>
<th>Year</th>
<th>Tourist nos</th>
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<tbody>
<tr>
<td>1996–97</td>
<td>7330</td>
</tr>
<tr>
<td>1997–98</td>
<td>9604</td>
</tr>
<tr>
<td>1998–99</td>
<td>10013</td>
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<tr>
<td>1999–2000</td>
<td>14 762</td>
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<tr>
<td>2000–01</td>
<td>12 248</td>
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<tr>
<td>2001–02</td>
<td>11 588</td>
</tr>
<tr>
<td>2002–03</td>
<td>13 571</td>
</tr>
<tr>
<td>2003–04</td>
<td>27 537</td>
</tr>
<tr>
<td>2004–05</td>
<td>27 950</td>
</tr>
</tbody>
</table>

**Source:** International Association of Antarctica Tour Operators
Students will extend the line graph out to 2010 in accordance with their own projections. The important part of this exercise is that they consider and justify their thoughts. They may decide that tourist numbers might rise slightly or remain constant as a result of endeavours to protect the environment. Or there could be a dramatic increase as more and more people decide to visit the last great wilderness.

COMMUNICATE

6. Do you think tourism should be allowed in Antarctica? Discuss as a class, listening carefully to the opinions of others.

Students need to draw their own conclusions, and be prepared to defend their viewpoints. On the negative side, they may consider issues such as damage to the environment, pollution, generation of waste and sensitive habitats (especially during breeding season). On the other hand, tourism may provide a unique opportunity for education and the display of careful management (e.g. ecotourism). Such opportunities may inform people how other fragile or threatened resources within the world can be managed more sustainably.

INQUIRE

7. Choose a mineral that is found in Antarctica and also mined in Australia. Investigate what it is used for and how it is mined in Australia. Frame key questions to help focus your research.

Students will investigate a mineral resource of their choosing.


This activity involves online investigation using the Jacaranda website. You may like to set this investigation for homework, and conduct a class discussion the following day on student findings, opinions, recommendations on strategies etc.

Science on the ice

pages 12–13

Teaching points

Antarctica is unique in that it is the one continent in the world that no one country has claimed ownership of. Rather, 45 nations have banded together and formulated the Antarctic Treaty, which sets out guidelines for the use and, most importantly, conservation of this continent. Through this collaboration, a community of research bases has been established that enables scientists all over the world to undertake research for the benefit of all.

Antarctica contains a record of our climatic history, frozen in time, which has built up over millions of years. By studying ice core samples, scientists can track the changes to our atmosphere that have happened in the past. Of course, this is only one example of what can be learnt from this pristine environment.

Students should consider not only the benefits of this research, but also the potential negative factors — the waste generated, the risks associated with oil spills, and the impact that construction of research bases has on the marine environment. These bases are built near the coastline where there is no, or minimal, ice thus reducing the area available for breeding colonies.

LINKS TO OTHER DISCIPLINES/TOPICS

Science: magnetic fields (Science Quest 4, p. 60)
Geography: ozone layer (Jacaranda SOSE Geography 4, pp. 10–11)

Assessment

A group assessment task could involve students undertaking a more in-depth analysis of the work done by scientific communities, for instance on climate, marine life or the ozone layer. This research and analysis could be done collaboratively. Teams could then present their findings on the various topics to the rest of the class. The task could be extended to include ICT standards, particularly to help visualise learning, and to present material. Of course, those standards pertinent to the ‘Working in teams’ dimension of the Interpersonal Development domain can also be worked into the task criteria as desired.

SUGGESTED RESPONSES TO ACTIVITIES

REMEMBER

1. Describe the ideal location for a scientific base in Antarctica.

Near the coast for ease of access via helicopter and coast. The land needs to be generally free of ice, otherwise the heat generated by the buildings will melt the ice and they will sink.
2. Why is the state of the world’s ozone layer so important to scientists?
   The ozone layer protects us from the harmful effects of the sun’s ultraviolet rays — any damage to the ozone layer puts the planet and us at greater risk.

3. Why does the pole at the South Pole have to be moved every few years?
   Because the ice sheet on which it sits is not fixed in one spot relative to the location of 90°S, but rather it is gradually moving north at the rate of about 10 metres every year. The location of 90°S does not change.

THINK

4. Referring to the photo (left on p. 13 of SOSE Alive Topic Books: Antarctica), suggest what the geology team are taking with them.
   Sleds pulled by snowmobiles probably contain all food, spare fuel, tarpaulins and shelter in case of inclement weather, medical supplies, radio communication equipment, research equipment, portable stoves and cooking equipment, spare clothes, utensils and personal effects.

COMMUNICATE

5. Do you think countries should be able to own pieces of Antarctica? Write a two-minute speech outlining the reasons for your point of view. Debate this topic as a class.
   Students need to think about and formulate an opinion regarding territorial claims in Antarctica. They might consider such things as the need to protect the environment; nations might be more inclined to conserve something they have a stake in, or does this ownership make it harder to juggle conflicting points of view?

Skillbooster — Annotate an image

6. Sketch the scene shown in one of the photographs in this chapter and annotate it to show the important features.
   Using the guidelines given in the Skillbooster, students sketch a selected photograph from the chapter and annotate it.

DESIGN AND CREATIVITY

7. Design a flag for Antarctica. Present it to a partner, explaining its key features. Give and consider constructive feedback.
   Students design a flag for Antarctica — they could display these around the room. Students are also required to explain the key features of their design to a friend. This task could be run as part of a competition. You might like to ask students to go to www.jaconline.com.au/sosealive/home/topicbooks.html and click on the Flags weblink before they start to give them some idea of symbolism used in flag design. As desired, this task could be extended to include other standards pertinent to the Design and Creativity domain of the Interdisciplinary Learning strand (e.g. considering constructive feedback, choosing from a range of design options etc.)

INQUIRE

8. An even larger environmental disaster than the sinking of the Bahia Paraiso occurred in 1989 when the oil tanker Exxon Valdez sank. Find out about this disaster. Present your findings as a newspaper front page, complete with title, map, text and photographs. Explain why this incident is an environmental warning for any future use of Antarctica.
   Students investigate the impact of oil spills on the environment. They do not necessarily need to limit themselves to the Bahia Paraiso or Exxon Valdez spills, although these provide a useful starting point. They should look closely at the damage caused to the environment and problems associated with cleaning up the environment, and how the nature of the climate magnifies these problems.

The Antarctic Star: Threats abound

pages 14–15

Teaching points

The newspaper style of approach is quite engaging and is most useful in this context with Antarctica and the environment receiving quite a bit of press recently. In this spread, students are presented with details about the impact humans are having on the Antarctic environment — overfishing, tourists disturbing nesting sites, global warming, retreating glaciers, etc. The smaller article (‘Disappearing islands’) highlights the fact that melting ice packs have an impact on places far removed from Antarctica. In this case, the Carteret Islands are shrinking as rising sea levels encroach on low-lying areas. This issue can be further explored by examining the plight of other island nations such as Tuvalu and Tegua.

This spread provides an opportunity for students to consider policies or strategies that could be implemented for the more sustainable use of finite resources.

Assessment

SUGGESTED RESPONSES TO ACTIVITIES

REMEMBER

1. Describe the scene in the photograph of the Japanese whaling ship, opposite (on p. 14 of SOSE Alive Topic Books: Antarctica), including how the people might be feeling.
   Greenpeace activists have placed themselves in the path of the giant whaling vessel. They are protesting at what the Japanese have just done — hunted and killed a whale. The Japanese, on the other hand, see the activists as a nuisance and are prepared to do whatever it takes to continue with their mission. They are hosing the protesters with high-pressure hoses. Feelings and emotions run high on both sides.
2. Describe, in your own words, what tensions are being caused by Japan’s continued whaling activity in Antarctica.

Students may respond in a variety of ways that approximate the facts that follow.

In 1986, the International Whaling Commission (IWC) called for a moratorium (temporary stop) on commercial whaling, because of concerns that some whale species were being fished to the point of extinction. The intent was to allow whaling stocks to increase. Despite the moratorium, Japan has continued whaling activity in Antarctica; it claims this is for scientific purposes. Japan, and other pro-whaling members of the IWC (such as Norway and Iceland) claim that whale stocks have recovered enough for the ban to be lifted. Other members of the IWC disagree.

COMMUNICATE

3. (a) Refer to the pages listed in column 1 for information that will help you complete the second column.

(b) In pairs, discuss each of the issues listed. Decide on a possible solution for each, and write these in the last column.

The suggestions in the table below are not finite answers but merely to assist in ‘kick-starting’ a discussion — the table covers parts (b) and (c) of the question.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Cause of problem</th>
<th>Possible solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whaling (pp. 10, 14)</td>
<td>Hunting of whales to the brink of extinction and ignoring bans; very large numbers of whales are harvested in the name of research</td>
<td>Pressure on nations breaching the ban and extending the ban to outlaw scientific research beyond the use of a specific number of whales</td>
</tr>
<tr>
<td>Fishing (p. 14)</td>
<td>Vessels that exceed bag limits and register their ships in foreign countries to escape prosecution</td>
<td>Increase patrols and bring pressure on nations that turn a blind eye to overfishing — perhaps a heavy fine for those countries who do condone it</td>
</tr>
<tr>
<td>Tourism (pp. 10, 14)</td>
<td>Increasing numbers invading breeding sites</td>
<td>Restrict the shore movement of visitors, perhaps viewing areas could be enforced or roped off</td>
</tr>
<tr>
<td>Global warming (p. 14)</td>
<td>Increasing greenhouse gases causing a rise in global temperatures, which in turn melts ice and could lead to significant rises in sea level, threatening low-lying areas. Kill and other marine life are at risk from this environmental change.</td>
<td>Take concerted action to reduce use of greenhouse gases and invest in alternative fuel sources; put pressure on countries that do not conform (e.g. sanctions)</td>
</tr>
<tr>
<td>Mining (p. 10)</td>
<td>Environment is highly susceptible to change and polluting events</td>
<td>Maintain bans on mining</td>
</tr>
</tbody>
</table>

| Ozone depletion (p. 12) | Greenhouse gases are resulting in ozone depletion. The Earth’s ozone layer is vital as it protects us from the harmful effects of the sun. | Reduce use and reliance on greenhouse gases and invest in alternative sources of energy |
| Oil spills (p. 12) | Ships bringing supplies or taking resources from Antarctica — these spills are difficult to clean up and can kill large numbers of marine creatures. In turn, this can impact on the food chain. | Improve safety on ships — require double hulls so that the risk is reduced, make larger vessels anchor further offshore and use smaller vessels to ferry people and goods to shore |
| Scientific bases (pp. 12, 13) | Stations limit the size of coastal breeding areas. They generate waste and heat, which contributes to melting the ice. | Do not allow the construction of any more bases and reduce the present number; require more resource sharing; introduce very stringent rules regarding waste |

(c) Which issue presents the greatest threat to Antarctica? Give three reasons.

The issue students consider the most pressing will vary. It is more important that they can justify their choice of issue. You might like, too, to extend students’ thinking by asking them to consider how their own views on this issue have changed over time, and why. For example, if a student selects ‘global warming’, he or she might write something like this: Global warming is a major threat because it leads to melting of the polar ice caps which, in turn, has the potential to cause sea levels to rise and threaten low-lying areas. Many of the Pacific Islands are already experiencing rising sea levels, which many attribute to global warming. Global warming also has the potential to cause a rise in the temperature of the seas and to thus threaten the survival of many temperature-sensitive species. Warming sea waters could kill off coral organisms and bleach coral reefs. More damaging storms such as Cyclone Katrina are a real possibility. Rainfall patterns are likely to change, become heavier in some areas and even more sparse and unreliable in others.

(d) Design a bumper sticker to make people aware of the threat this issue poses. Your sticker must contain no more than 30 words and include a picture. The sticker below might give you some ideas (see p. 15 of SOSE Alive Topic Books: Antarctica).

Students should be encouraged to draw on their response for (c) in completing this task.

ICT


Activity 4 is an ICT investigation of global warming. Students could be asked to look at the implications of rising sea levels and the impact of ocean warming on the marine environment of Antarctica and elsewhere.
They could, for example, consider changes to global weather in terms of increased storm activity and cyclones threatening areas further south in Australia. The issue of global warming is increasingly a topic in the public domain. It is important for students to understand the implications as it may well fall on them to resolve the problem as future leaders. It may help students when visualising their thinking as part of this investigation to use ICT software such as Inspiration in developing mind maps of their ideas.

Construct an overlay map
pages 16–17

Teaching points
Students learn the useful skill of constructing an overlay map. This is two maps in one — a base map drawn on paper and a second on tracing paper. An overlay map allows different features to be compared more easily. Students can draw several overlays for the same region if more in-depth analysis of specific themes is required. The spread directly addresses standards pertinent to the ‘Geospatial skills’ dimension of the Humanities — Geography strand.

Assessment
Students can be assessed on how neatly and accurately the task described in activities 1–3 below is completed and their ability to interpret what is shown on the map.

SUGGESTED RESPONSES TO ACTIVITIES

COMMUNICATE

Skillbooster — Construct an overlay map

1. Use the map opposite (on p. 17 of SOSE Alive Topic Books: Antarctica) and a blank map of Antarctica (see www.jaconline.com.au/sosealive/home/topicbooks.html) to construct a base map of Antarctica referring to the Skillbooster. Locate and label territorial claims and scientific stations.

2. On a sheet of tracing paper construct your overlay map, referring to the Skillbooster. On it, locate and label all mineral deposits, coal bearing areas and potential oil and gas areas. (Refer to the map on page 11.)

3. Stick your maps together and complete BOLTSS.
   In conjunction with the Skillbooster, these questions instruct students as to what is required on the base and overlay map. For further assistance, they can also refer to Humanities Alive 1, p. 215. It is also useful to reinforce for students the importance of neatness, accuracy and attention to BOLTSS.

INQUIRE

4. Use the information on your completed overlay map to answer the following questions:

   (a) Which country claims the largest ‘slice’ of Antarctica as its territory?
       Australia

   (b) What advantage does this country have over many others when administering its territory?
       Proximity to its area of control

   (c) Compare the claims of Argentina, Chile and the United Kingdom, both in size and location.
       The claims of these nations are relatively small and there is some overlap.

   (d) Describe the location of most of the known mineral and energy resources.
       They are spread across three-quarters of the continent, predominantly in coastal areas, though there is a conglomeration along the Antarctic Peninsula.

   (e) Which countries operate more than one scientific base in Antarctica?
       Australia, Argentina, USA, United Kingdom, Russia

   (f) What do you notice about the number of scientific bases in those areas with known mineral resources?
       There is a correlation between the number of bases and the location of known mineral resources.

5. Using the map on page 17, shade in the maximum extent of the sea ice on your study map. Add to your legend.
   Students need to add shading to their map and legend.

6. Which countries have scientific bases near or on ice shelves?
   USA, United Kingdom, Argentina, New Zealand, South Africa, Germany, India, Russia

Skillbooster — Estimate area

7. Using the map on page 17, list all the ice shelves. Put the three largest at the top of your list. Use the scale on the map to estimate the area of these large ice shelves.
   Names of ice shelves: Ross, Ronne, Getz, Venable, Larsen, Amery, West, Shackleton, Moscow University, Voyeykov
   Estimated areas: Ross Ice Shelf — 490 000 square kilometres; Ronne Ice Shelf — 449 000 square kilometres; Larsen Ice Shelf — 12 000 square kilometres

Australia and the Antarctic
pages 18–19

Teaching points
In this spread, Australia’s links with Antarctica are explored. Students receive snapshots of information, which provide the perfect springboard for additional research and investigation. (They are set along a line in the snow, which operates as a quasi-timeline.) Students discover that Australia had early links to Antarctica through whaling; they are also introduced to our early explorers and to a brief history of scientific stations.
Assessment

Activity 4 requires students to construct a timeline that will help them gain a time perspective on Australia's links with Antarctica and help them to develop further an important skill. As an assessment item, they could then be asked to select one period from the timeline to investigate further. Alternatively, they could research one of the famous Australians (as per activity 7); this could be extended to include an investigation as in activity 6. Students could use their research to produce a PowerPoint display, annotated visual display or a report using desktop publishing. Another possibility could be for students to investigate the facilities and construction of research stations and come up with a design for the moon or Mars. The most important aspect of this latter task is in developing design solutions pertinent to the design brief (which is developed based on a clear understanding of environmental conditions, functions required of the facility, and aesthetics). An assessment template is included at www.jaconline.com.au/humanitiesalive/ha2 under 'For the teacher', which can be customised for this assessment task or any other to include criteria that are both task-specific and VELS-related.

SUGGESTED RESPONSES TO ACTIVITIES

REMEMBER

1. Which Australian is most responsible for the mapping of much of Antarctica?
   Mawson. He was part of the first expedition that mapped the coastline in 1911, and then used the newly developed technology of flying to continue mapping the continent in 1928 and 1929.

2. Who is Phillip Law?
   Law was in charge of Australia’s Antarctic program from 1949 to 1966.

COMMUNICATE

3. Describe Law base and point out four differences between it and Mawson station (see the photograph on page 23).
   Law base consists of five red, dome-shaped buildings and a square building; they all sit on elevated platforms. This base is different from Mawson station in that the buildings are all temporary and can therefore be moved around to supply ‘instant’ accommodation on an expedition. Mawson station has more buildings and they are different colours, workshops, a wharf and several helipads, satellite communications, waste treatment facilities and medical services. Mawson operates all year round, whereas Law base is only operational during the summer.

4. Construct a labelled timeline from 1800–2000 showing the important events that link Australia and Antarctica.

INQUIRE

6. The text mentions the Australians after whom the Mawson, Davis and Law stations are named, but not the person for whom Casey station was named. Use the Internet and/or library sources to find out who Casey was and for what he is especially remembered.
   Casey station's original name was Wilkes station. It was built by the Americans in 1957 on Clark Peninsula. Australia took over the station in 1959. However, Wilkes station had been built in a poor location and was being threatened by snowdrifts; once these drifts turned into ice they were a threat to the structural supports and buildings. The station was renamed Repstat and moved to the shores of the Bailey Peninsula. Its reconstruction was completed in 1969, after which it was renamed Casey after Australia's Governor-General at the time, Lord Casey. He had been a major supporter of Australia's Antarctic program during its early years in the 1950s and 1960s.
7. Choose one of the Australians mentioned here and research his life and times. In particular, locate more detail on his involvement with Antarctica. Present your findings on a page. Your work must include at least one picture of him. Discuss your findings in small groups.

Student responses will vary. The task gives students an opportunity to respond by using a dominant intelligence.

Australia’s Antarctic hero: Sir Douglas Mawson

pages 20–1

Teaching points

This spread gives a very brief introduction to early exploration of Antarctica by touching on the journeys of Amundsen, Scott and Shackleton. Attention is then turned to the epic journey of Sir Douglas Mawson and the hardships he endured. It is a testament to human determination that he and his companions were able to construct a hut in these conditions and survive the winter without the modern conveniences available to those who live in today’s Antarctic bases. His is a remarkable story and students will be enthralled by what he endured. This spread also offers a range of opportunities to extend students or have them use their imaginations. The spread gives students an opportunity to explore the life and major contributions of a significant Australian, thus having links with one of the standards for Humanities — History.

LINKS TO OTHER DISCIPLINES

Art/craft: design of a commemorative statue
Drama: scriptwriting and performance

Assessment

SUGGESTED RESPONSES TO ACTIVITIES

REMEMBER

1. Why did Mawson travel to Antarctica?

Mawson was keen to explore and map the area of Antarctica that was closest to Australia. He was also a geologist and wanted to discover if there were any valuable minerals Australia could claim.

2. Why is Douglas Mawson remembered as a significant Australian?

He survived the worst conditions ever recorded and was alone for much of his epic journey. It is a miracle that he survived and he is truly one of the world’s greatest polar explorers. The adversity of the trip described in this spread did not prevent him from returning to Antarctica twice more. He is also responsible for claiming the 42 per cent of the continent that is recognised today as Australia’s Antarctic Territory.

3. What is frostbite?

The freezing of human skin and the underlying tissue due to exposure to severe cold. It is not uncommon for badly affected fingers and toes to drop off. The tissue is dead.

THINK

4. Why do you think Scott and Shackleton are more famous than Mawson?

These other explorers were first to Antarctica — Scott and his party all perished and although members of Mawson’s party also perished, he survived. The loss of all members is seemingly more memorable. Shackleton’s adventure captured the imagination as his ship was crushed by pack ice and his party survived on the floating pack ice, without the added comfort of a hut or ice caves. They also took to the open water in a lifeboat and somehow survived the 1300-kilometre trek across the ocean.

5. Suggest why Mawson continued to eat dog livers if they were poisoning him.

Mawson may not have been aware that it was the dog livers that were making him so ill. If he was aware of the dangers of consuming dog livers, given his lack of supplies, the prospect of being poisoned may have been more appealing than the prospect of starvation. In short, he may have thought that this increased his prospects of survival.

COMMUNICATE

6. Choose three key moments in Mawson’s ordeal. Imagine that you are Mawson and write a diary entry of about 6 to 7 lines for each of these events. Remember to include details about how you feel, as well as what is happening.

This activity requires students to develop some empathy and put themselves ‘in the shoes’ of the explorer; as such, it is an assessment tool for gauging student understanding of the ordeal. Students have a host of events to choose from, such as weathering the blizzard in the hut, setting off on their journey, the loss of Ninnis and the supplies, the decision to eat the dogs, the death of Mertz, enduring the poison, the effects of starvation, making the crampons, experiencing frostbite, finding the ice cave and the return to the coast. One entry is included here as a guide.

Seeing the boat departing

You cannot imagine my despair at seeing the boat disappearing into the horizon. With every last ounce of strength I tried to signal to them, but alas they couldn’t see me. I sank to my knees and thought that this was my fate to die in this harsh land alone and that no one would ever truly know my fate or that of my companions.

What is that, do my eyes deceive me — five figures are approaching. I am filled with hope and joy; all is not lost, as these five have remained. One more winter with this fine crew and once again I will be on my way home.

As an extension, students could identify three to six problems that were encountered by Mawson and his fellow explorers and suggest modern day solutions/equipment that might have helped them overcome these problems.
7. The image of Sir Douglas Mawson was chosen as part of the design of the Australian $100 note (see p. 21 of SOSE Alive Topic Books: Antarctica). Imagine, though, that the Australian government wants to go further to ensure he is remembered as a national hero. You have been asked to come up with something. Either design a statue, write a poem or song, or write a speech that pays tribute to Douglas Mawson.

This is a creative piece. Students who design a statue might be able to make it with the assistance of the Art Department, or they might be able to draw their design. The English or Music Department might be able to assist with the composition of a song or poem. With the assistance of the Performing Arts Department, the production of a short play might be possible.

Check and challenge

pages 22–3

Teaching points

The Check and Challenge spread revises much of the information that has been presented throughout the book and in some instances extends this knowledge. Activity 5, for example, examines the possibilities of harvesting icebergs from the Antarctic and towing them to places where there is a scarcity of water.

The Challenge section takes a closer look at Mawson station and its facilities; it allows students to draw upon and extend existing knowledge. Much of the Check section provides useful test revision.

Assessment

SUGGESTED RESPONSES TO ACTIVITIES

CHECK

1. List all the difficulties faced by visitors to Antarctica.
   Difficulties include: extreme cold (average –60°C); blizzards and gale force winds where there is a real danger of becoming lost, disoriented or blown into the sea; frostbite; lack of roads and the need to transport all food and equipment; lack of fresh water (it must be melted from the snow, which is time consuming); difficulty of effectively fighting fires; crevasses are not always obvious and often very deep; moving pack ice, which can trap and/or crush vessels; rough, uneven terrain to navigate.

2. Antarctica contains the world’s deepest depression and the world’s largest glacier. There are a number of other ‘world’ records described in this chapter: how many can you find?
   Coldest recorded temperature of –89.6°C
   Highest continent averaging 2300 metres above sea level
   Windiest continent — gusts up to 320 kilometres per hour
   Driest continent

3. How many tourists visited Antarctica between 2000–01 and 2004–05?
   92 894

4. Are the following statements true or false? Copy them all into your notebook, changing the ones you think are false to make them true:
   (a) The highest rainfall in the world was recorded in Antarctica.
       False. It is too cold in much of Antarctica for rain; in some areas, it has been millions of years since it rained.
   (b) Polar bears inhabit Antarctica.
       False. Polar bears only live in the world’s northern polar regions.
   (c) Frostbite can cause your fingers to fall off.
       True
   (d) Antarctica doubles in area every winter.
       True
   (e) The maximum thickness of the ice sheet is 1000 metres.
       False. The maximum thickness of the Antarctic ice sheet is 4800 metres.
   (f) Some birds eat whales.
       False. Some birds eat the carcasses of whales.
   (g) Some whales have no teeth.
       True
   (h) The latest country to build a base in Antarctica is Australia.
       False. The latest country to build a base in Antarctica was the Czech Republic.
   (i) The flags at the South Pole have to be moved because the ice is moving.
       True
   (j) You can hire a video at the South Pole.
       True
   (k) Eating dog livers is bad for you.
       True
   (l) Trees once grew in Antarctica.
       True
   (m) There are no deposits of coal in Antarctica.
       False. Scientists believe that coal is one of the many mineral deposits beneath Antarctica.
   (n) Law base, in Antarctica, is one of the few bases made up of permanent shelters.
       False. Law base is one of five temporary summer bases.

5. Read the article on the right (on p. 22 of SOSE Alive Topic Books: Antarctica) and complete the following:
   (a) What impacts would a scheme such as this have on Antarctica?
       Icebergs are a natural part of the environment and may provide temporary resting places for birds. Taking the odd iceberg might have a negligible impact, but large-scale harvesting or carving off sections of ice might have a dramatic impact on Antarctica’s fragile ecosystem.
(b) Use this photograph to help you sketch a scene of a large iceberg being towed. A typical iceberg weighs about 32 million tonnes and is about 400 metres by 600 metres in area, with a depth under the water of about 150 metres. Think about the size of boats needed for towing and how such a large piece of ice would be wrapped in plastic.

Students need to do a sketch. Ask them to add appropriate labels to demonstrate their understanding of the challenges etc. posed by this proposal.

(c) Do you think that this scheme could work? Give three reasons for your answer.

There would be problems associated with this scheme—difficulty wrapping the iceberg, expense involved in the operation, how to pump water ashore, how to tow the iceberg to shore. The amount of melting makes this proposal unworkable.

(d) Invent another unusual scheme for one of Antarctica's resources and write a newspaper article describing your idea.

Perhaps students could write about the possibility of constructing wind turbines and sending power back to Australia; or developing a lab to freeze people (cryogenics) — people could be frozen in blocks of ice.

CHALLENGE

6. Examine the photograph of Mawson station below (on p. 23 of SOSE Alive Topic Books: Antarctica) and answer the following questions:

(a) What kinds of balloons do you think would be housed in the balloon building?

Weather balloons

(b) What advantages do helicopters have over aeroplanes in Antarctica?

Helicopters can land without a runway, and in a wider range of weather conditions than aircraft. A landing strip would be subject to ice and snow and would be much harder to maintain. Planes could skid off the runway and operational times would be very limited.

(c) Why do you think the clean air laboratory is so far from the other buildings?

To avoid the risk of contamination

(d) Can you see many windows on the buildings?

Comment on your answer.

Glass is more difficult to transport; it might crack or shatter in the extreme cold or during blizzards. Windows would need to be covered to prevent heat from escaping.

(e) One of the largest buildings is the store. Why do think this is the case and what items do you think are stored in the building?

There are no shops readily available; all supplies need to be brought in via ship or air. Food, shelter and equipment are essential in this environment.

(f) Would you like to spend time working in this environment? Give three reasons why.

This will be a personal choice and will vary with each student's attitudes and views. Reasons for working there might include:

- adventure and experiencing a vastly different environment
- good for people who like the cold rather than the heat
- chance to study the wildlife
- different working environment.

Reasons against working there might include:
- the harsh environment, including the long, dark winter
- restrictions on being able to move around freely and come and go
- being confined indoors too much because of the poor weather conditions
- belief that it is an environment that people should leave alone to ensure the environment is not damaged.

(g) What impacts do you think this human settlement might have (or potentially have) on the environment?

Student responses will vary. Their answers should reflect an understanding of the functions and operations of the built facilities at Mawson station — and the fact that any human settlement produces waste and products.

7. At what time of the year was this photograph taken? Give reasons for your answer.

Most likely in summer — patches of clear ground are visible; it has the appearance of receding snow.

8. Outline some of the problems building teams would have faced when constructing this station.

Building teams would need to cope with the extreme cold and it would be difficult to erect structures wearing gloves and bulky clothing. Moving around would be difficult; the terrain poses problems as does the extreme winds, which can gust to 320 kilometres per hour, not to mention the blizzards. There would be the additional problems of having to bring in all supplies and equipment for the project. There is also the time delay if additional equipment is required or needs replacing. Construction would be a real issue during the Antarctic winter when there is no sunlight.

9. Using supporting evidence and geographical terms, list as many points as you can think of to explain how different Antarctica is from the region in which you live. Give reasons to explain these differences.

Student responses will vary depending on where students live. Ask students to consider such items as landforms, flora and fauna, climate, population, pollution, land use etc.

10. The technique used in the image below (on p. 23 of SOSE Alive Topic Books: Antarctica) is a useful way for pointing out the important features of a particular place. It is a variation of the skill you used on page 13 when annotating an image. The difference is that you use numbers and a numbered key for your labels. Use this image to help you annotate (using numbers and a key) another image of Antarctica from this chapter or elsewhere.

Students annotate a sketch using numbers — in a similar fashion to the one shown on p. 23 of SOSE Alive Topic Books: Antarctica.