



Senior Science
Disasters

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S
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Contents

Use the table of contents to record your progress through this book. As you complete each topic, write the date completed, then tick one of the three remaining columns to guide your revision for later. The column headers use the following codes:

?? = Don't understand this very well at all.

RR = Need to revise this.

OK = Know this.

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Introduction

Each book in the 'Surfing' series contains a summary, with occasional more detailed sections, of all the mandatory sections of the syllabus, along with questions and answers.

It is envisaged this book will be useful in class for both initial understanding and revision, while the more traditional textbook can remain at home for more detailed analysis.

All types of questions — multiple choice, short response, structured response and free response — are provided. Questions are written in exam style and use the verbs specified by the Board of Studies so that you will become familiar with the concepts of the topic and answering questions in the required way.

Answers to all questions are included.

A topic test at the end of the book contains an extensive set of summary questions, including multiple choice and free response questions. These cover every aspect of the topic, and are useful for revision and exam practice. Marking guidelines are supplied where appropriate.

Verbs To Watch

When you are answering questions in this book, your textbook or any examinations, make sure you answer what the question is asking. To do this, you will have to know what each of the terms below means — they dictate what sort of an answer is required. It is essential that you learn their meanings as required by the Board of Studies. Your exam answers will be marked according to what these terms indicate your answer should be saying.

account/account for	State reasons for, report on, give an account of, narrate a series of events or transactions.
analyse	Identify components and the relationships among them, draw out and relate implications.
apply	Use, utilise, employ in a particular situation.
appreciate	Make a judgement about the value of something.
assess	Make a judgement of value, quality, outcomes, results or size.
calculate	Determine from given facts, figures or information.
clarify	Make clear or plain.
classify	Arrange into classes, groups or

compare	categories. Show how things are similar or different.
construct	Make, build, put together items or arguments.
contrast	Show how things are different or opposite.
critically (analyse/evaluate)	Add a degree of level of accuracy, depth, knowledge and understanding, logic, questioning, reflection and quality to an analysis or evaluation.
deduce	Draw conclusions.
define	State the meaning of and identify essential qualities.
demonstrate	Show by example.
describe	Provide characteristics and features.
discuss	Identify issues and provide points for and against.
distinguish	Recognise or note/indicate as being distinct or different from, note difference between things.
evaluate	Make a judgement based on criteria.
examine	Inquire into.
explain	Relate cause and effect, make the relationship between things evident, provide why and/or how.
extract	Choose relevant and/or appropriate details.
extrapolate	Infer from what is known.
identify	Recognise and name.
interpret	Draw meaning from.
investigate	Plan, inquire into and draw conclusions about.
justify	Support an argument or conclusion.
outline	Sketch in general terms; indicate the main features.
predict	Suggest what may happen based on available information.
propose	Put forward (a point of view, idea, argument, suggestion etc.) for consideration or action.
recall	Present remembered ideas, facts or experiences.
recommend	Provide reasons in favour.
recount	Retell a series of events.
summarise	Express concisely the relevant details.
synthesise	Pull together various elements to make a whole.

1 Natural Disasters

We all know that life is not totally safe. There are many **hazards** that could cause us harm, for example, financial loss, injury or even death. Near to where I live is one of the largest geological faults close to Sydney (Figure 1.1). Near the fault is a National Park in which bushfires regularly occur. Both are a hazard as a bushfire may burn down my house and an earthquake may occur along the fault. If either of those events happens, there could be a lot of damage, not only to my house but to my neighbours as well. If the damage is on a large enough scale, we call it a disaster. Some major Australian disasters are listed in Table 1.1.



Figure1.1 Hazards The Glenbrook fault is beneath the bush of the Blue Mountains National Park.

Disasters in Australia

The Commonwealth Government says a disaster has occurred 'when the normal community and organisational arrangements cannot cope with a hazard impact'. Another definition is that a disaster is a condition or event of significant destruction, disruption or distress to a community. In this course, we define a **disaster** as events associated with large-scale environmental or structural damage and/or loss of life. Whichever definition we use, a disaster is not good news. Part of life is thinking ahead and making sure we minimise the impact disasters may have.

We can classify natural disasters as shown in Table 1.2. We will look at disasters where humans help cause the problem in the next unit. Although natural disasters cause more than \$1 billion in damage each year, Australia is not affected as badly as many nations. This is partly due to the Australian continent being geologically stable and not prone to major earthquakes. It is also due to our relatively small population.

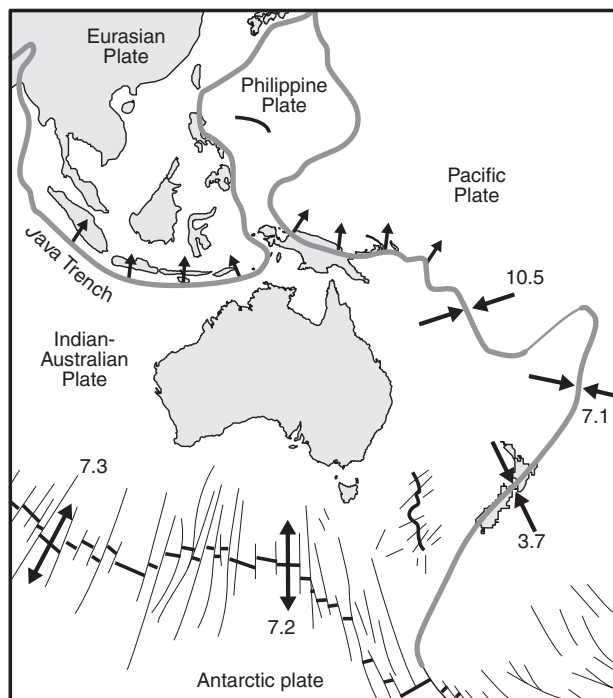


Figure 1.2 Geologically stable Australia sits in the middle of a crustal plate. The numbers show the movement in centimetres per year.

Our worst disasters are due to **meteorological** causes. Adverse weather, such as tropical cyclones, bushfires, floods, droughts, heatwaves, severe wind and rain storms, hail and tornadoes, occurs frequently in Australia. Heatwaves have cost the most lives, with more than 400 people dying in a heatwave in 1939. Today, most people are prepared for such events and there is little loss of life. Severe cyclones occur in the less populated far north while storm surges affecting urban areas occur less frequently. However, bad weather causes regular disruptions to work and transport, and costs hundreds of millions of dollars of damage annually. Severe droughts occur roughly once or twice a decade and usually last for extended periods. The greatest overall economic damage is caused by flood and drought.

Other disasters are caused by **geological** forces. The Australian continent is relatively geologically-stable as it sits in the middle of a crustal plate (Figure 1.2). As a result, it is less likely to experience adverse geological hazards such as earthquakes, tsunamis, landslides and volcanoes. The same is not true for New Zealand, Papua New Guinea and Indonesia, which are located along the edges of crustal plates. Moderate-sized earthquakes, however, do occur in Australia. In December 1989, the Newcastle earthquake resulted in 13 deaths and 160 injuries and the damage bill was well over \$4 billion. Tsunamis (incorrectly called tidal waves) are rare in Australia. An earthquake in Chile in 1960 produced a tsunami that damaged the eastern seaboard and there were other tsunamis in 1977 and 1994 along the north-west coast of Western Australia.

There are no active volcanoes in Australia (Figure 1.3), and landslides in Australia are usually the result of soil saturation and human activity.



Figure 1.3 Volcanic eruption at Mt Pinatubo in the Philippines caused widespread devastation.

Although presenting a very low risk, disasters are possible due to **extraterrestrial** comets or asteroids. If such large masses were to collide with the Earth, it could cause a major regional disaster or even a world-wide catastrophe. There are many past impact sites in Australia, such as the Wolf Creek crater in Western

Australia. Such impacts in the past are believed to have caused the extinction of the dinosaurs amongst many other species.

In terms of cause of death, the most serious disasters have been **biological**. The great influenza epidemic in 1918 killed more than 10 000 Australians. The AIDS epidemic has so far cost at least 20 million lives worldwide. Modern hygiene and medicine has greatly reduced the impact of disease, but not eliminated the problem. Human disease epidemics, such as influenza, Ross River fever, Hepatitis and AIDS, still occur. Agriculture is damaged by vermin and insect plagues, such as rabbits, mice and locusts. Various exotic animal diseases, such as 'foot-and-mouth' and anthrax do not occur in Australia but would devastate the economy if they were to enter the country. Food-crops can suffer from fungal and bacterial disease epidemics.

Table 1.1 lists six major disasters that have struck Australia. There is detailed information about these and other disasters at this website:

<http://www.ema.gov.au/archives/ematrack/EMATrackIntro.html>

Table 1.1 Australian natural disasters

Name	Occurrence	Consequences	Reduce future damage	Monitor the disaster
Cyclone Tracy	Darwin in December 1974	65 people died and around 650 were injured; most buildings severely damaged or destroyed; city evacuated	Building codes strengthened to reduce damage	Cyclone watch using satellite imagery and weather radar
Ash Wednesday bushfires	Victoria and South Australia in February 1983	75 deaths; more than 12 000 injured; extensive destruction of houses and forests	Building codes for houses in bushfire areas changed; improved coordination of emergency services	Use of satellites and other weather monitoring technology to predict danger periods
Western Sydney floods	Sydney in October 1986	6 deaths; 30 injured; extensive flooding and hail damage	Major drainage works designed to hold water and slow runoff; new houses required to have stormwater holding pits	Monitor runoff in subsequent storms to determine effectiveness of drainage works
Newcastle earthquake	Newcastle December 1989	13 deaths; 160 injured; extensive damage to the city of Newcastle	Building code modified to increase earthquake resistance	Continued monitoring or earthquake activity; not possible to accurately predict earthquakes
Sydney bushfires	Sydney in December 1993 and January 1994	4 deaths; 206 homes destroyed and more than 800 000 hectares of bush burnt.	Improved coordination of emergency services	Use of satellites and other weather monitoring technology to predict danger periods
Sydney hailstorm	Sydney in April 1999	1 death; 50 injured; extensive damage to roofs, windows and motor vehicles. Entry of water damaged many carpets and furnishings. The most expensive storm in Australian history.	Better selection of materials for use on roofs	Storm radar installed to detect the presence of hail and give warnings

Table 1.2 *Natural hazards*

Type	Name	Cause and effect
Meteorological	Flood	Extreme rainfall cannot be absorbed by soil and waterways resulting in areas of land being submerged or even washed away.
	Coastal erosion	Storms can erode coastal areas, especially coastal sand dunes with buildings located on them.
	Tornado	Extreme rotating windstorm, common in USA but rare in Australia. Causes extreme damage along a narrow path.
	Cyclone/Hurricane	Huge rotating low pressure systems with very strong winds causing wind damage and flooding over wide areas.
	Gale	Strong winds on a wide front causing damage to trees, buildings and other structures.
	Storm surge	A major rise in sea level associated with the low pressure and winds of cyclones. Submerges low-level areas and often causes more deaths than the cyclone itself.
	Lightning	Major discharge of electricity damaging buildings, electrical systems, communication systems, causing bushfires and sometimes killing people.
	Drought	Lack of rainfall over large areas and for long periods of time. Can cause extreme hardship and economic losses.
	Ice/freeze	Not common in Australia, but occurs overseas where extreme cold freezes water in pipes and the formation of large masses of ice on trees and electrical wiring causes breakages and fires.
	Snowstorms	Not common in populated parts of Australia, but can bury large areas disrupting transport and isolating people in dangerous conditions.
	Bushfire	Common in Australia and very severe in windy dry seasons. Causes damage to forests, property and some deaths.
	Hailstorm	Common but not often destructive. However, when the hailstones are large they can cause major damage to buildings and vehicles.
	Heatwaves	The second largest cause of death after disease. Long periods of extreme heat affect the elderly and very young.
Geological	Earthquake	Shaking of the ground causes collapse and otherwise damages buildings, e.g. Newcastle 1989.
	Tsunamis	Once called 'tidal waves'. They are produced by earthquakes at sea. They destroy ships and drown many people along coastal areas.
	Expanding soils	Clay soils expand when wet and contract when dry causing damage to buildings.
	Landslide	Most in Australia are due to extreme rainfall, but can be caused by earthquakes.
	Volcano	None in Australia, but common in New Zealand and Indonesia. Lava and ash can destroy farms and cities.
Extra-terrestrial	Comet or asteroid	Path crosses the orbit of the Earth and may cause mass destruction, e.g. extinction of dinosaurs
	Meteorite	Rocks from space destroy small areas.
Biological	Human disease epidemic	The most disastrous of all, sometimes killing millions, e.g. influenza, malaria, Ross River fever, hepatitis, AIDS.
	Insect or vermin plague	Most damaging to agriculture but can carry human diseases, e.g. rabbits, mice, rats, mosquitoes, locusts.
	Exotic animal disease	Most damaging to agriculture, e.g. 'foot-and-mouth', anthrax.
	Crop disease	Most damaging to agriculture, e.g. 'rust' and other fungal disease.

Disasters and Insurance

We can all afford to replace some items that are damaged or destroyed. If you break a cup or drop a bottle of soft drink, the financial consequences are not great. But what happens if your car crashes, the home burns down or the person who earns the family income dies? Very few people can afford to replace cars, homes

or an income. That is why people and businesses should insure against those financial losses that they cannot reasonably afford to suffer. It can get worse. Suppose you have borrowed money for the house or car. If the house is destroyed or the car is stolen, you could owe money on items you no longer have! Most people take out insurance in the following areas:

- motor vehicle insurance
- house insurance
- contents insurance
- life insurance.

Businesses will have additional insurance cover. Unfortunately, 30 per cent of Australians do not have building or contents insurance. Of those people who do have such insurance, 40 per cent do not have enough insurance to replace the house or contents.

We will look at home and contents insurance. There are two main types of contract. A **defined events** policy is usually cheaper and sets out a list of what *is* and *is not* covered by the insurance policy. You need to read these policies carefully. During the 1986 western Sydney floods, many people found that their policies did not cover all the damage. If the water entered their houses through a hole in the roof due to storm damage, they were covered. But if the water entered the house under the door as a result of flood waters from local creeks, they were not covered. The alternative more expensive coverage is called an **accidental damage** policy. This is a much broader coverage, and only lists those things that are *not* covered. Thus, if you spill a can of paint on the carpet, it will be covered by an accidental damage policy unless it is specifically listed as not covered.

The next difference is in how you will be reimbursed if you make a claim. The best but more expensive method is called a **replacement** policy or **new-for-old** policy. If the house burns down it will be replaced by a new one to the same standard. If a camera is stolen, it will be replaced by a new one of the same type. The other type of policy is cheaper and is called an **indemnity** policy. With this type of insurance, you receive the value of the goods at the time they were stolen. Thus if a 10-year-old TV was stolen, you receive enough money to buy another 10-year-old TV but not a new one.

Table 1.3 lists many other terms found in insurance policies. Although based on information from one company, most other companies will have similar terminology.

For You To Do

- Which of the following is an example of a disaster?
 - Your favourite CD is scratched.
 - A bushfire burns the local bush.
 - Your CD player is stolen.
 - Your house is destroyed in a bushfire.
- Which of the following is a meteorological disaster?
 - Lightning destroys power supplies to a city.
 - A tsunami caused by an earthquake destroys coastal towns and suburbs.
 - An earthquake causes a massive landslide that buries a small city.
 - Foot-and-mouth disease infects cattle in a country.
- Which of the following disasters causes the greatest loss of human life in Australia?
 - Volcanic eruption.
 - Heatwave.
 - Floods.
 - Drought.
- Which of the following disasters causes the greatest financial loss in Australia?
 - Earthquake.
 - Volcanic eruption.
 - Floods.
 - Heatwave.
- What is the meaning of the term 'excess' in an insurance policy?
 - The extra premium you must pay because a person is young.
 - The amount you pay when you make a claim on a policy.
 - The amount of money received to ensure new-for-old replacement.
 - The extra that must be paid for an accidental damage policy.
- Define the term 'disaster'.
- Identify three types of natural disaster, and identify a specific Australian example for each one.
- Identify why people insure themselves against a disaster.
 - Discuss the definitions and terminology used for the two major types of home and contents insurance.
- Design a database form for natural disasters to include the following fields:
 - when the natural disaster occurred
 - where the natural disaster occurred
 - the consequences of the disaster
 - techniques employed to reduce the incidence of damage next time
 - techniques employed to monitor disaster in the future.
- For a named Australian natural disaster, answer the following questions.
 - When did the natural disaster occur?
 - Where did the natural disaster occur?
 - What were the consequences of the disaster?
 - Which techniques have been employed to reduce the incidence of damage next time?
 - What techniques have been employed to monitor disaster in the future?

Table 1.3 Insurance terminology (based on NRMA Insurance)

Term	Meaning	Comments
Buildings replacement value	The amount it would cost to totally rebuild the house and all the home improvements on the site at today's prices.	Not all disaster insurance is based on replacement value. Many people are underinsured because of this.
Buildings sum insured	The amount of insurance cover purchased for the home. It is shown on the current Certificate of Insurance.	It is best to be sure that this is sufficient to rebuild the home to its condition before the disaster.
Collectibles	<ul style="list-style-type: none"> • Card collections • CDs, DVDs, tapes, records, game cartridges and discs of any sort • Curios or objects valued as curiosities • Gold or silver items but not coins, sovereigns, bullion, watches and jewellery • Stamps and medals • Uncirculated mint issue or proof coins, ancient or rare coins, sovereigns and bullion • Pictures and works of art. 	Have to be insured separately. In some cases they need to be valued, and generally a list has to be supplied.
Contents	<p>Those items owned by you and your family that are not permanently attached or fixed to the structure of your home. There are four categories:</p> <ul style="list-style-type: none"> • general contents • specified items • unspecified portable valuables, and • specified portable valuables. 	<p>There are some items that are not considered to be contents:</p> <ul style="list-style-type: none"> • animals; plants, trees or shrubs growing in the ground, grass, rocks, landscaping and soil on the site • credit or financial transaction cards • fixtures and any items permanently attached to your home • goods kept for sale, distribution or on consignment; stock used in any business, trade or profession • illegal items, illegal firearms and illegally stored firearms • loose or unset gemstones; manuscripts • motor vehicles; watercraft, sailboards, trailers, caravans, aircraft or aerial devices.
Excess	The amount you pay when you make a claim on this Policy. It is shown on the Certificate of Insurance.	
Fittings	Any items that can be removed from the home without causing damage to the home.	Part of 'contents' insurance.
Fixtures	Any items that are permanently attached or fixed to the structure of the home that cannot be removed without causing damage to the home.	Part of 'home' insurance.
Flood	The covering of normally dry land by water escaping or released from the normal confines of a watercourse or lake, whether or not it is altered or modified. Flood also includes water escaping from the confines of any reservoir, channel, canal or dam.	Often not covered in a policy without a higher premium, or the definition of a flood is restricted. If the water comes from a stormwater drain, you are not covered. If the rain occurred away from where you live you are not covered. Nor are you covered if water enters through an open window.
Home	Any fully enclosed building (with walls and a roof) used primarily for domestic purposes at the site that can be locked up. For Home Buildings Insurance, this also includes any fixtures or home improvements at the site.	This policy covers bushfire, earthquake, and some landslide and flood damage. The landslide must be due to explosion or earthquake. Does not cover tsunami or storm surge.

Table 1.3 (continued) Insurance terminology (based on NRMA Insurance)

Term	Meaning	Comments
Home improvements	Any permanent additions in or around the home that add value to the cost of rebuilding or repairing it, such as a garage, in-ground pool, above-ground pool when enclosed by decking, carport, pontoon, boat jetty and permanent landscaping features. Home improvements are not trees, shrubs, soil or natural bushland.	Check policy details as some items not covered, such as swimming pools during flood. Have documentary or photographic evidence that the improvements were carried out.
Incident	A single occurrence or a series of occurrences arising out of the one event.	
Premium	The total amount paid for the insurance. It is shown on the current Certificate of Insurance.	
Replacement value	The amount it would cost to replace all the contents at today's prices.	Not always specified. Many people are underinsured for this reason.
Site	The land where the home is located and the yard or garden surrounding it used primarily for domestic purposes, at the address shown on the current Certificate of Insurance. The site includes any land or other area that touches the site and for which any statutory authority has made the owner responsible, including the road verge and street lawns.	
Specified items	Contents items that are listed separately for insurance cover inside the home. They include jewellery, watches and collectables.	Under general contents there are limits to what can be claimed unless they are specified.
Specified portable valuables	Those personal items that belong to the owner or family that are listed separately for insurance cover anywhere in Australia.	A list must be supplied and additional premium paid.
Storm	A violent wind, cyclone, tornado, thunderstorm or hail, which may be accompanied by rain or snow. It does not include persistent rain by itself.	
Sum insured	The separate amount of insurance cover you purchased as the replacement value for the: <ul style="list-style-type: none"> • general contents, including contents in storage and unspecified portable valuables and individual items • specified items, and • specified portable valuables. 	
Tools of trade	Those items or equipment used wholly or partly in any business, trade or profession.	
Total sum insured	The total of the separate sums insured for: <ul style="list-style-type: none"> • general contents • contents in storage • specified items • specified portable valuables, and • unspecified portable valuables. 	
You	The person or persons named as the insured on the current Certificate of Insurance.	