

The total of all marks is 40.

Topic 1: Hazardous Earth

Study Figure 1, which shows a plate boundary along the west coast of South America.

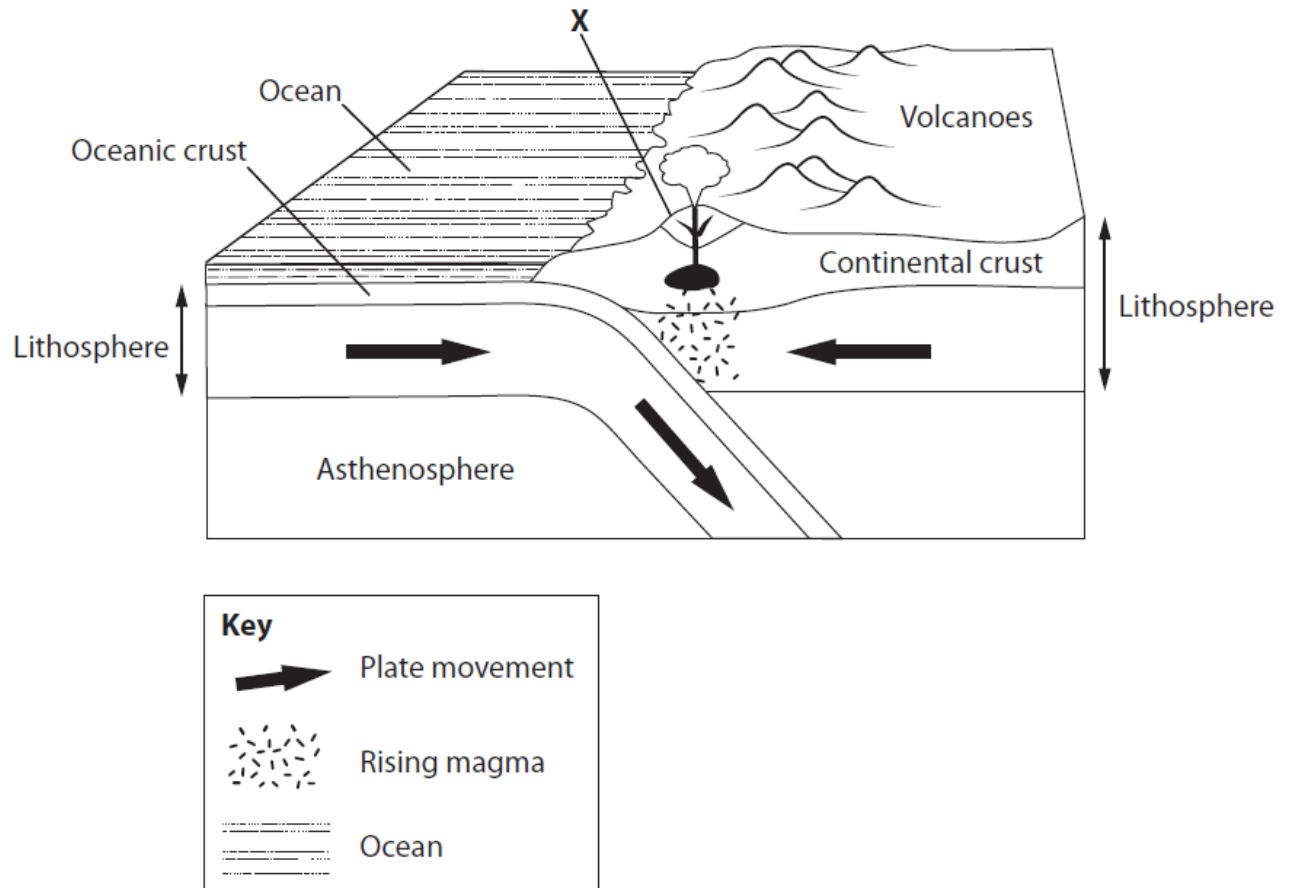


Figure 1

Identify the type of plate tectonic feature shown. (max 1 mark)

- A) A divergent boundary
- B) A hotspot
- C) A convergent boundary
- D) A dense oceanic plate converges with a less dense continental plate

Explain one cause of tectonic plate movement. (*max 3 marks*)

Answer

Allow 1 mark for identifying a cause of tectonic plate movement and further marks for explanation.

- Convection currents cause plate movement (1). These currents are generated by heat from the core (1) and push/pull/drag the overlying plates (1).
- Heat rising and falling in the mantle (1) creates convection currents (1) which are generated by radioactive decay in the core (1).
- Convection currents (1) caused by the radioactive decay of elements in the core (1) push/pulls/drags the tectonic plate (1).
- Ridge push can cause plate movement (1). Newly formed plates at ocean ridges have high elevation (1) which pushes away the plate further from the oceanic ridge (1).
- Slab pull causes the movement of plates (1) denser plates sinking at subduction zones (1) pull the rest of plate along with it (1).

Accept any other appropriate response.

Study Figure 2, which shows the area of ice in the Arctic Ocean each spring between 1978 and 2018.

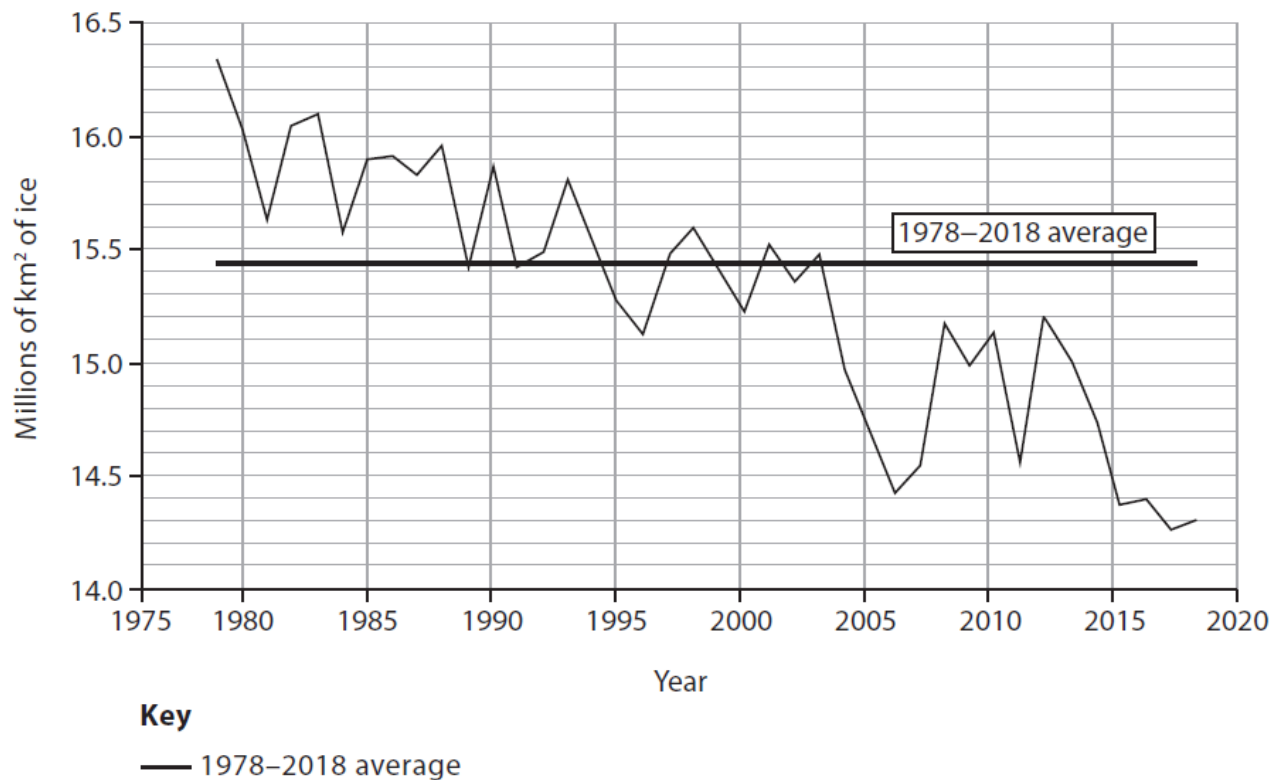


Figure 2

Describe the trend in the area of Arctic ice between 1978 and 2018. Use data in your answer. (max 3 marks)

Answer

Award one mark for each descriptive point up to a maximum of 3 marks.

- Overall, Arctic ice declines in the period shown (1).
- There are fluctuations in the extent of Arctic ice (1).
- Whereas overall ice shows a decline, there are periods when it increases (1).
- In 1978, there was just over 16.3 million km² of ice in the Arctic by 2018 this had fallen to 14.3 million km² of ice.
- 1994 is the first time the ice extent drops below the 1978-2018 average (1).
- Since 2003, the ice extent has been below the 1978-2018 average (1).
- Ice extent fell rapidly between 2003-2006 (1).
- In total, between 1978-2018, the ice extent has reduced by 2 million km² (1).
- The extent of ice increased by 0.7 million km² between 2011-2012. (1).

Max 2 marks if no use of numerical data. Accept any other appropriate response.

Identify one reason for the changing area of Arctic ice shown in Figure 2. (max 1 mark)

Answer

Award 1 mark for any cause of Arctic ice decrease:

- Increased concentrations of greenhouse gases lead to the melting (1).
- Global warming/increased global temperatures (1).
- Climate change / changing temperatures (1).

Accept any other appropriate response.

Explain two ways in which changes in the area of Arctic ice may have consequences for people. (max 4 marks)

Answer

Allow 1 mark for each correctly identifying a why people's lives will be impacted upon by declining Arctic ice levels and a further mark for explanation up to a maximum of two marks each. Note that consequences may be positive as well as negative and the impacts on people may be outside of the Arctic circle.

- Melting Arctic ice will lead to rises in sea levels (1) which may result in coastal flooding (1).

- Melting ice can lead to the destruction of animal habitats (1) which people rely upon to provide food and furs (1).
- Melting sea ice can have an effect on ocean circulation (1) potential leading to climate changes (1).
- Melting Arctic ice can result in the release of methane from permafrost (1) leading to further global warming (1).
- Unstable ice can lead to difficulties when fishing (1) leading to injuries and death (1).
- Melting ice leads to transport becoming difficult (1), isolating communities (1).
- Decreasing Arctic ice can lead to an erosion of indigenous cultures (1) as traditional sources of employment are replaced by work in the oil/gas industry (1).
- Early spring ice melting will give a longer fishing season (1), this will lead to increased incomes for indigenous people (1).
- Melting Arctic ice opens new shipping routes (1), boosting trade and being a source of employment in Arctic towns (1).
- Reduced Arctic sea ice coverage will lead to increased oil exploration in the area (1), this will provide a source of employment for local people (1).

Accept any other appropriate response.

Explain one piece of evidence of natural climate change. (*max 2 marks*)

Answer

Award 1 mark for identifying a source of evidence which can be used to explain natural climates and a further mark for explanation.

- Ice cores (1) can be analysed to determine the amount of carbon dioxide in them (1).
- Historical records such as paintings/diary entries (1) may inform about frost fairs on the Thames/ difficult growing conditions (1). 2
- Tree rings (1) can be examined with greater thickness indicating better growing periods/higher temperatures (1).

Accept any other appropriate response.

Study Figure 3, which shows sources of greenhouse gas emissions in the European Union for 1990 and 2018.

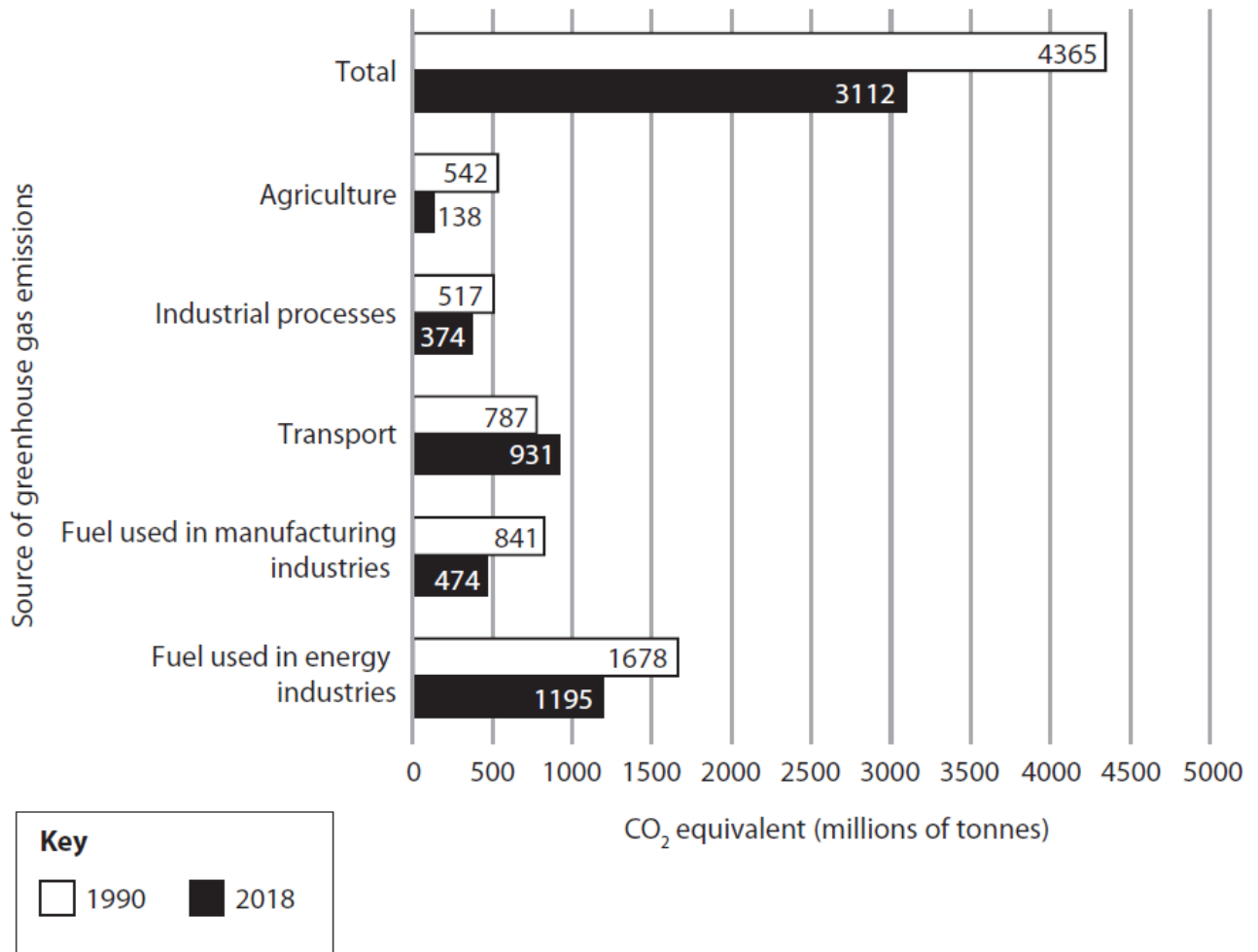


Figure 3

Calculate the percentage decrease in total emissions (CO₂ equivalent) between 1990 and 2018. Give your answer to one decimal place. Show your working below. (max 2 marks)

Answer

Allow 1 mark for each stage of the calculation.

Award 1 mark for showing working of percentage decrease/change (difference between two figures / 1990 figure x 100)

$$1235/4365 \times 100$$

OR

$$100 - (3112/4365 \times 100)$$

OR

$$3112/4365 \times 100 = 71.29. 100 - 71.29 = 28.71$$

Award one mark for the answer to one decimal place. Answer: -28.7% or 28.7% (1).

Explain two reasons why tropical cyclones lose their energy. (*max 4 marks*)

Answer

Award 1 mark for identifying a reason why tropical storms lose energy and further mark for an explanation of that reason up to a max of 2 marks for each explanation.

- When tropical storms reach land (1), they no longer have access to warm water which is their source of power (1).
- Tropical storms lose energy when they move into areas of cooler water (1). They require water with a temperature of above 26.5 degrees Celsius (1).
- They lose energy when they meet different weather systems (1) where winds are blowing in the different directions / wind shear is high (1).

Accept any other appropriate response.

Topic 2: Energy Resource Management

There are many different ways of developing energy resources.

Identify the correct definition of the term fracking. (*max 1 mark*)

- A) Injection of liquid under pressure to release trapped gas in rocks
- B) Planting of trees and crops that will be used for fuel
- C) Cutting down trees and using them for fuelwood
- D) Polluting rivers with the waste from coal and oil extraction

State one reason why energy resources require sustainable management. (*max 1 mark*)

Answer

Award 1 mark for any of the following: Non-renewable energy resources will run out sooner (1). Infrastructure for renewables is not developed enough for this to be the sole contributor in the energy mix (1). The world's population is still growing (1). Demand for energy resources / electricity is expected to keep rising (1).

Accept any other appropriate response.

Study Figure 4. State one possible reason why some people were against the development of wind power at this site. Use evidence from Figure 4 in your answer. (*max 1 mark*)



Figure 4. Wind turbines at Westermeerdijk in the Netherlands, a developed country

Answer

Award 1 mark for any of the following: There are many turbines in Figure 1, and these would have caused lots of CO₂ emissions during construction (1). The wind turbines are very tall which could disrupt migration patterns / kill birds (1). The turbines are right next to a cycle path which might distract / put off people wanting to use it (1). The relief is very flat, which means that the turbine will be visible from miles around (1).

Accept any other appropriate response.

Explain one advantage of using wind power to generate electricity. (max 4 marks)

Answer

Award 1 mark for an advantage of developing wind power, and a further 1 mark for extension of this point through further explanation, up to a maximum of 4 marks.

Wind power is a clean energy resource (1) because it doesn't pollute the air like power plants that rely on combustion of fossil fuels (1) which means that they do not emit greenhouses gases / nitrogen oxides / sulphur dioxide / carbon dioxide (1) which can lead to human health problems / acid rain / global warming (1). Wind power is cost-effective (1) this is because the electricity from wind farms is sold at a fixed price over a long period of time (1) and the fuel (i.e. the wind) is free (1), wind energy avoids the price uncertainty that fuel costs add to traditional/non-renewable sources of energy (1). Wind is a renewable energy resource (1) which means that the supply of wind is

abundant / inexhaustible / will not run out (1) which means that it is a long-term option for a country's energy mix (1) and will still be available when fossil fuels such as coal, oil and natural gas have been exhausted (1). Wind turbines can be built on existing farmland (1) which means that they can benefit the economy in rural areas (1) as farmers can continue to work the land because the wind turbines use only a fraction of the land (1), whilst wind power plant owners make rent payments to the farmer for the use of the land, providing landowners with additional income (1).

Accept any other appropriate response.

Study Figure 5. Identify the percentage of renewables in Germany's energy mix.
(max 1 mark)

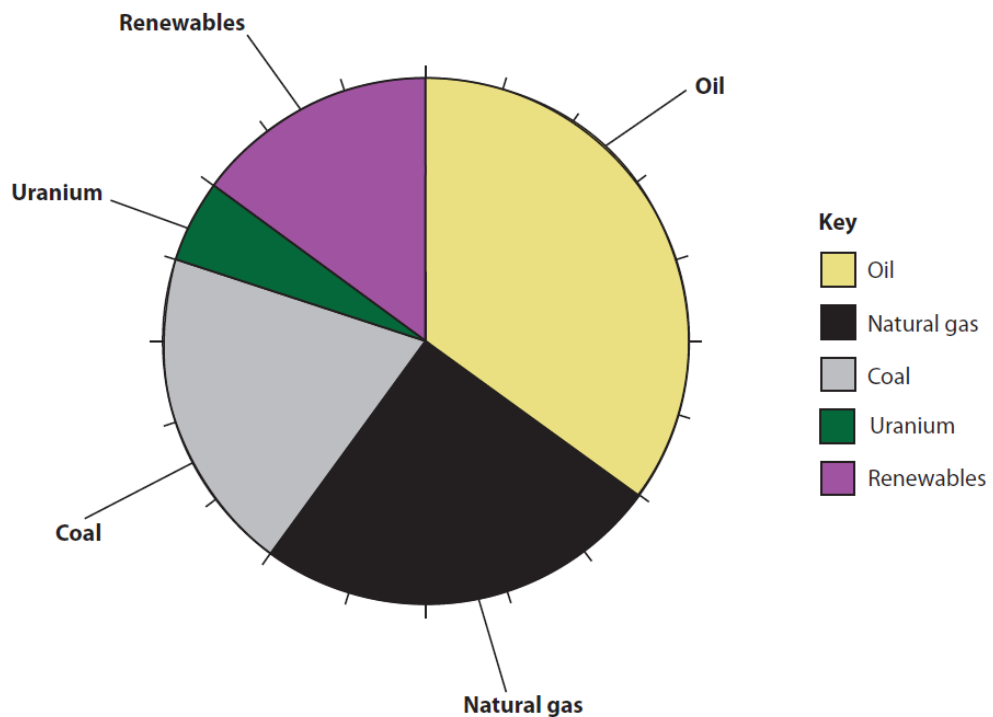


Figure 5. Percentage (%) of energy resources in Germany's energy consumption, 2018

- A) 5%
- B) 15%
- C) 20%
- D) 25%

Germany's total energy consumption in 2018 was 324 million tonnes of oil equivalent (Mtoe). Calculate the amount of energy consumption that was oil in 2018. You must show your working in the space below. Write your answer to one decimal place. (max 2 marks)

Answer

Working to show: $324 \text{ divided by } 100 = 3.24$ (1), $3.24 \times 35 = 113.4$ (1).

Maximum of 1 mark if the correct answer is given without any working shown.

Suggest one reason why uranium has the lowest percentage in Figure 5. (max 2 marks)

Answer

Award 1 mark for a possible reason for the relatively low proportion of uranium used in Germany's energy mix (shown on Figure 2), and a further 1 mark for extension through further explanation, up to a maximum of 2 marks.

Germany's government policy does not favour uranium (1) as it is nonrenewable (1).

Germany may not have particularly large reserves of uranium / larger reserves of fossil fuels (1) which means that this type of energy resource is not cost-effective (1).

Working with uranium is extremely dangerous (1) because a leak / explosion could expose people to radiation (1).

Nuclear power plants are vulnerable to the impacts of natural disasters / terrorist attacks (1) which means that many people do not want a nuclear power station anywhere near their home as they fear for their own safety (1).

Nuclear power stations are very expensive to build (1) which means that the energy provider might have to raise tariffs for the consumer to ensure profits are made (1).

Nuclear waste is very radioactive / has a large potential for it to pollute the environment with radiation (1) which means that it costs a lot of money to ensure that it is disposed of safely (1).

Accept any other appropriate response.

Assess the reasons why the global demand and supply for energy resources has changed over the past 100 years. (max 8 marks)

Answer

Intermediate performance

- Over the last 100 years, global population has grown very quickly, from approximately under 2 billion at the start of the 20th century to over 7 billion today.
- Rapid population growth in the last century has triggered a great increase in the global demand for energy.
- Another reason why demand has gone up has been the growing affluence; this increased wealth has enabled people to afford technology that requires energy (e.g. increased car ownership, kitchen appliances and central heating in homes).
- Advances in technology during the past 100 years have led to an increase in demand for energy to power them. Different types of technology have influenced the growth of

different types of energy resources e.g. the private car revolution led to a growth in oil consumption.

- As country's get wealthier, their capacity to use and to develop new energy resources increases.

High performance

- Rapid population growth has been uneven, with the majority of the growth being in emerging/developing countries; therefore, demand in these countries has grown significantly; in relative terms, this has been a huge shift because the countries previously had very little industry / energy demands.
- As emerging/developing countries become more developed, people are wealthier so that they can afford to use and exploit more energy; this increased ability to supply and develop energy resources is also key to help develop a country's industry – and therefore it's economic development – which further increases wealth and the ability to use more energy.
- As countries get wealthier, they not only are able to use more energy – but the types of energy resources that make up the energy mix can also change; for example, the development of renewables such as wind and solar power is expensive – and therefore not always an option in emerging/developing countries.
- Factors such as government policies and increased awareness about the causes of climate change have influence the amount of different type of energy resources that are used; for example, renewable energy resources are being developed to not just meet growing demand – but also to address changing attitudes.

Level	Mark	Descriptor
Level 1	1-3	<ul style="list-style-type: none"> • Demonstrates isolated elements of understanding of concepts and the interrelationship of places, environments and processes. (Intermediate performance) • Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (High performance)
Level 2	4-6	<ul style="list-style-type: none"> • Demonstrates elements of understanding of concepts and the interrelationship of places, environments and processes. (Intermediate performance) • Applies understanding to deconstruct information and provide some logical connections between concepts. An

		imbalanced argument that synthesises mostly relevant understanding but not entirely coherently, leading to judgements that are supported by evidence occasionally. (High performance)
Level 3	7-8	<ul style="list-style-type: none"> • Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (Intermediate performance) • Applies understanding to deconstruct information and provide logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (High performance)