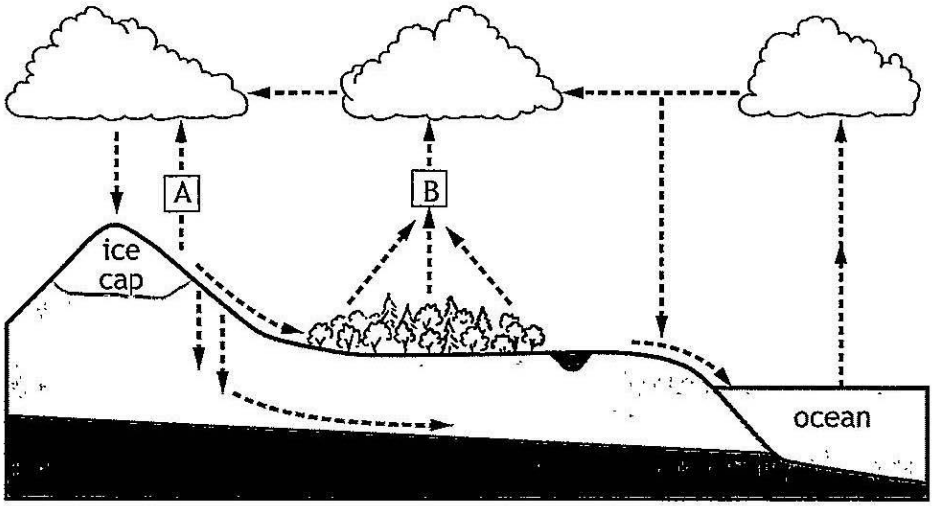
MARKS

Total marks — 100

Attempt ALL questions

Questions 10 and 11 each contain a choice

1. The model hydrological cycle below illustrates the storage and movement of water in its various states above, below and across the Earth's surface.



Model Hydrological Cycle

(a) (i) State a form of natural subterranean water storage. 1

Underground wells.

(ii) Name and describe the process occurring at either A or B. 2

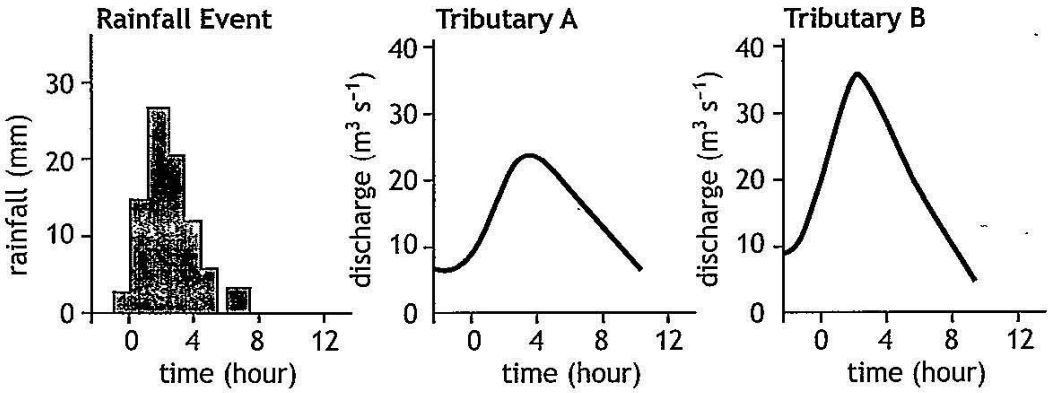
A – Sublimation where water goes from Sol.d ~~liquid~~ to gas without changing to a liquid inbetween

1. (continued) MARKS

(b) The measurement of river discharge can be recorded on a river hydrograph.

In the diagram below, the rainfall event graph shows the distribution of rainfall over a twelve hour period in a river catchment.

The hydrographs illustrate the discharge of two tributaries within the river catchment during the same rainfall event.



(i) Compare the discharge between the two tributaries during the rainfall event. 3

- Tributary B had a shorter time of discharge but a ~~faster~~ faster discharge.
- Tributary B has a smaller lag time and faster start at discharging water
- Tributary B has a much larger discharge than tributary A.

(ii) Explain how a change of land use may affect river discharge. 2

farming on the plains of the river may decrease the rivers discharge due to the water being lower than usual due to irrigation.

MARKS

2. The pine marten (*Martes martes*) is an omnivorous cat-sized member of the weasel family. At different seasons, its diet includes fungi, berries, birds, eggs, beetles, carrion, and small mammals, including squirrels. It is an agile hunter, which hunts both in the trees and on the ground.

Although it was once commonly found in Britain, by the early 20th century the pine marten's range had been reduced to small populations in the pine forests of the north-west Scottish Highlands. Since 1950 it has expanded its range significantly, but it remains a rarely seen animal with an estimated population of only 4000 in 2012.

(a) Suggest **two** changes in the management of the countryside which have taken place since 1950 that would have helped the pine marten numbers to increase. 2

1. A ~~significant~~ increase in the grey Squirrel population increases the amount of food available therfore increasing population

2. Large tree farms increase the pine martens habitat therfore increasing population

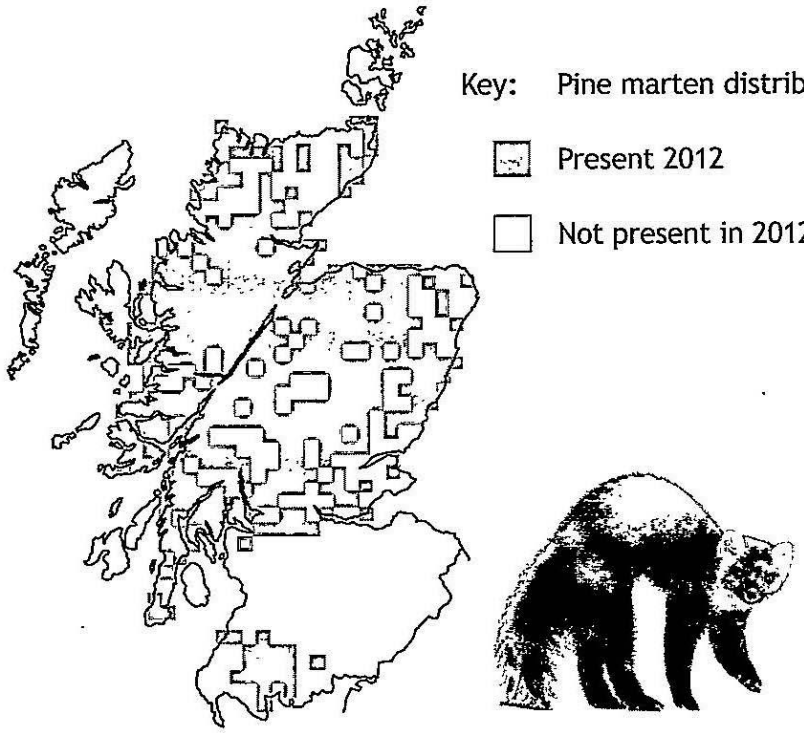
Bans

1. on very harmful insecticides and fungicides have seen an increase of insects and fungi which both increase the amount of food available for the pine marten

2. (continued) MARKS

(b) The diagram shows the distribution of the pine marten in Scotland as recorded in surveys carried out in 2012.

The squares on the map represent 10 km × 10 km areas (hectads) in which pine martens were surveyed and recorded as being present.



The distribution of the pine marten in 2012 was determined by walking along a forest track for 1 km and counting the number of scats (faeces) left by the pine martens. This was carried out in the largest forest in each hectad.

Earlier research suggested that if a breeding population of pine martens was present in an area, at least seven scats would be recorded for every 4 km of transect walked.

Discuss the validity of the technique used and how it might be improved. 3

These results could be seen to be innaccurate because they do not determine actual numbers of pine martens. They could be improved by walking all woodlands present in each hectad, confirm other sightings of the pine marten present in each hectad, and using a better recording technique as ~~this~~ counting scat is to vague.

MARKS

2. (continued)

(c) The native red squirrel (*Sciurus vulgaris*) is under threat in Scotland from the introduced North American grey squirrel (*S. carolinensis*).

The table compares some features of the two species.

Squirrel species	*Mean mass* (g)	*Percentage of time spent foraging in trees* (%)
Red	300	67
Grey	550	14

(i) Calculate, as a simple whole number ratio, the mean mass of the red squirrel in relation to that of the grey squirrel. 1

Space for calculation

6 : 11

red squirrel 6 : 11 grey squirrel

(ii) The expansion of the pine marten distribution has reached areas of the country where both red and grey squirrels are found.

With reference to data in the table above, suggest why it may be advantageous to the red squirrel that this predator is entering the area where both squirrel species are present. 2

The red squirrel spends a majority of its time foraging in the trees whereas both the grey squirrel and the pine martin would be in competion on the ground

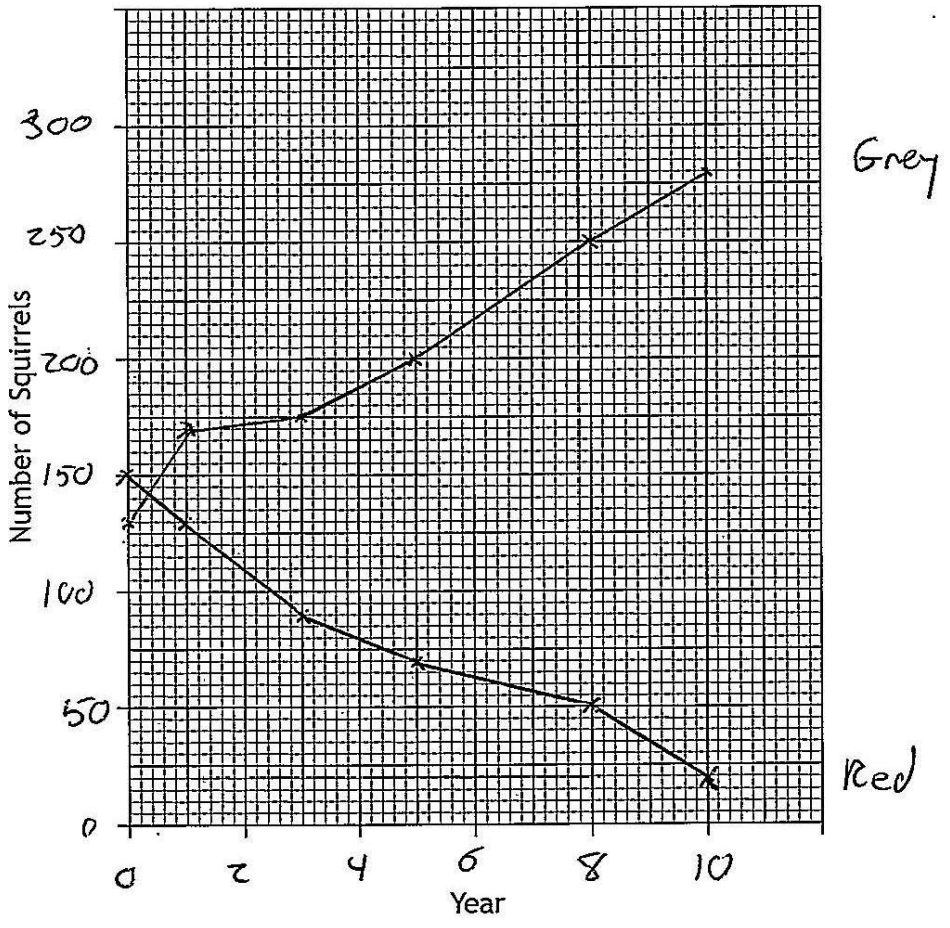
MARKS

2. (c) (continued)

(iii) The table below shows the populations of grey and red squirrels which were recorded in an area of woodland over a 10 year period.

Year	*Numbers of squirrels of each species*	
	Grey	*Red*
0	130	150
1	170	130
3	175	90
5	200	70
8	250	50
10	280	20

Draw a line graph to show the numbers of grey and red squirrels over the period of the study. 2



MARKS

3. Baryte is an abundant mineral that has many industrial uses.

(a) State **one** way in which baryte forms. 1

Chemical action on salts by water

~~Chemical action~~

(b) The table below shows Argentina's baryte production from 2003 to 2009.

Year	*Production* (tonnes)
2003	6934
2004	2762
2005	3355
2006	6276
2007	37 979
2008	3170
2009	4000

(i) Calculate the percentage change from 2006 to 2007. 1

Space for calculation

605% increase

(ii) Suggest a possible reason for the sharp increase in baryte production in 2007. 1

Discovery of large deposits of baryte.

MARKS

3. (continued)

(c) Explain how soil-forming processes can result in commercially viable deposits of baryte. 2

(d) Baryte is used in many industries, often in the form barium sulfate.

(i) State a reason for the use of barium sulfate as an additive in oil drilling. 1

It is non flammable

(ii) Barium sulfate is commonly used as a "barium meal" in biomedical imaging, to diagnose abnormalities within certain internal organs.

Explain why barium sulfate is suitable for use in biomedical imaging. 2

It is pale and milky-white in colour and it decomposes quickly.

MARKS

4. Carpets and carpet tiles consist of an upper layer of "pile" attached to a backing. The pile can be made from either natural or synthetic fibres and usually consists of twisted tufts which are often heat-treated to maintain their structure. The backing is primarily made of latex.

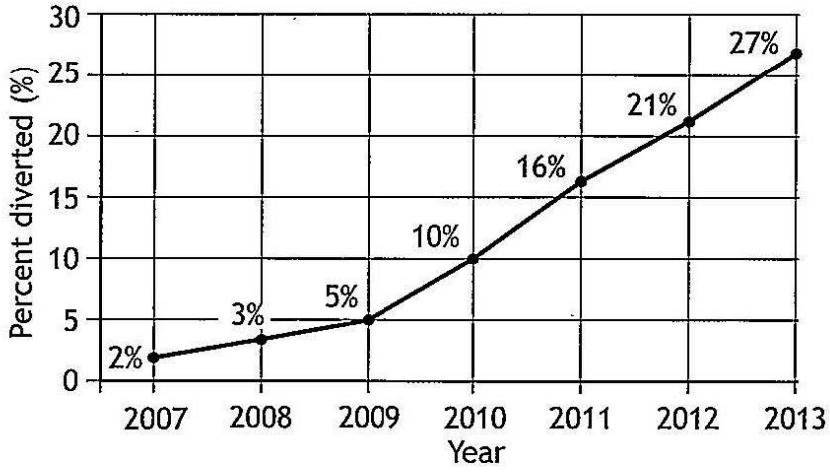
Once a carpet is no longer needed there are a number of options:

- **Reuse:** carpet tiles are cleaned and reused.
- **Recycle:** components of the carpet are separated for recycling.
- **Energy recovery:** carpets are shredded, mixed with other materials and used as secondary fuel for industry, or burned as a fuel to create electricity.
- **Disposal:** mainly to landfill.

(a) State **two** factors which would be considered in the life cycle analysis of a product such as a carpet. 2

1. The condition of the carpet
2. what the carpet is made from

(b) The graph below shows the total percentage of carpets being diverted away from landfill in the UK from 2007 to 2013.



107 000 tonnes of carpets were diverted away from landfill in 2013. The remainder was sent to landfill.

Calculate, to the nearest tonne, the mass of carpets deposited in landfill in 2013. 1

Space for calculation.

~~396,297 tonnes~~

396,297 tonnes

4. (continued)

(c) Suggest **two** disadvantages of energy recovery compared to recycling. 2

1. Energy is needed to breakdown the materials.

2. not all of the carpet can be used in ~~exp~~ energy recovery.

(d) In addition to selling carpets, some manufacturers use a "closed-loop approach" to their business. They lease out carpet tiles which are then collected back, cleaned and reused. This is called a circular economic model.

A linear economic model is one where manufacturers take resources, make goods out of them and sell these. The majority of these goods end up in landfill.

(i) Suggest **two** environmental benefits that the circular economic model has over a traditional linear economic model. 2

1. less raw materials needed to produce ~~more~~ goods

2. The majority of their goods avoid land fill and stay in use therefore less waste and energy used to dispose of them.

(ii) Suggest **two** reasons why manufacturers may be resistant to using the closed loop approach. 2

~~might be expensive running machines which~~

1. less of their goods would be purchased as they have longer life spans.

2. not economically viable for a company to keep re-using their old wares.

MARKS

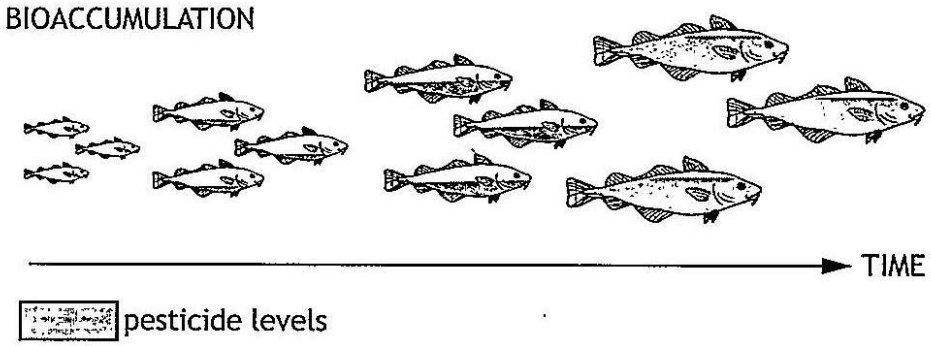
5. (a) A persistent pesticide is one which is not easily broken down in the environment.

(i) Explain how a persistent pesticide might enter a marine ecosystem. 2

A chemical used in fish farms to kill bacteria might escape the area of intended use and end up in the wild food chain.

(ii) The diagram below shows one way in which a persistent pesticide builds up in a marine fish species in the Arctic.

In the diagram, the axis labelled TIME refers to the growth of individual fish.



Explain, with reference to the diagram, the process of bioaccumulation. 2

Bioaccumulation is the build up of a harmful chemical as it is passed along the food chain through predation. If an animal at the high end of the food chain consumes enough contaminated prey it can build the chemical up to lethal quantities.

MARKS

5. (a) (continued)

(iii) Suggest how the following actions by farmers would help to reduce the effect of bioaccumulation. 2

1. Conversion to organic farming

No harmful chemicals being used so no risk of them accumulating in animals

2. Use of biodegradable pesticides

If a pesticide does find its way into the food chain it will have degraded enough at this stage not to be a harmful quantity

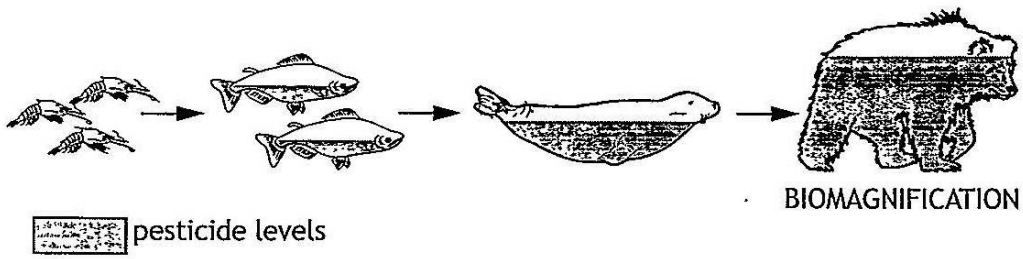
(b) State why the total biomass of organisms usually decreases at each successive trophic level in a food chain. 1

There is a smaller number of organisms of each type as they progress up the food chain.

MARKS

5. (continued)

(c) The diagram below shows the way in which persistent pesticides build up in an Arctic food chain.



(i) Explain the process by which low levels of a persistent pesticide in marine waters can result in the death of large carnivores. 2

Due to a persistant pesticide being in very small quantities in smaller organisms it isn't such an issue, but when larger organisms eat large quantities of its pray which contain persistant pesticides it builds up into a lethal doseses and can be very harmful.

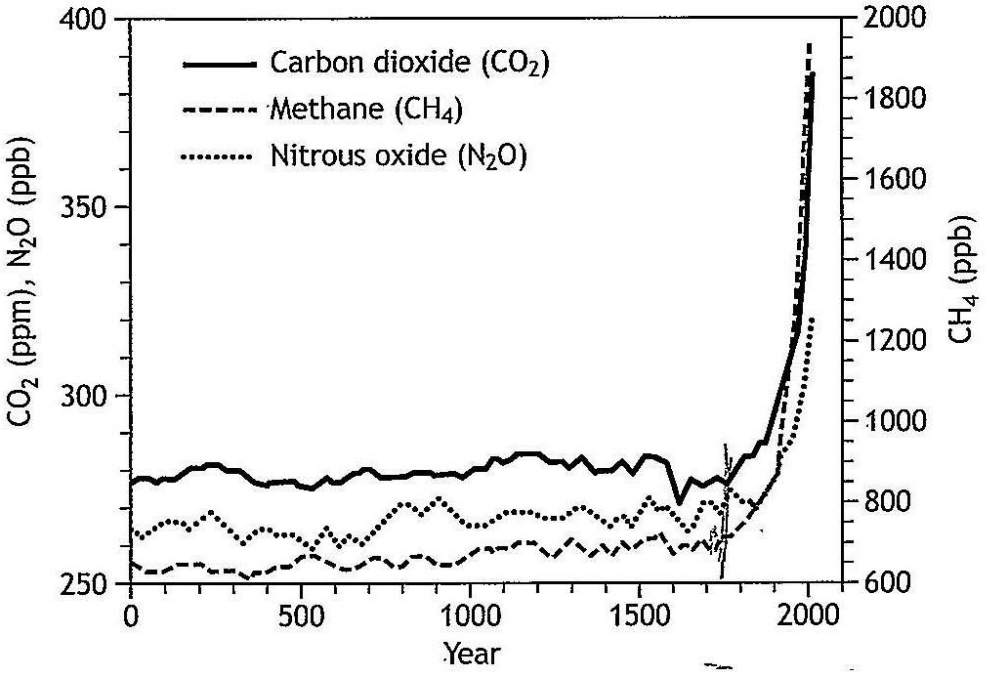
(ii) The food chain above contains both ectotherms and endotherms.

Explain why food webs involving mainly ectotherms contain longer food chains than those involving mainly endotherms. 2

Ectotherms do not require to use energy on body heat therefore can pass a larger amount of energy on hence extending the food chain.

MARKS

6. (a) The graph below shows greenhouse gas concentrations in the atmosphere up to the year 2000. Concentration units are parts per million (ppm) or parts per billion (ppb), indicating the number of molecules of the greenhouse gas per million or billion molecules of air.



(i) Describe the general trend shown on the graph. 1

The graph remains at a steady level until around 1750 where it starts to increase dramatically.

(ii) Suggest **two** possible causes for this change. 2

1. a much larger human population
2. The discovery & burning of fossil fuels.

(b) In 2013, the Intergovernmental Panel on Climate Change (IPCC) said that "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century."

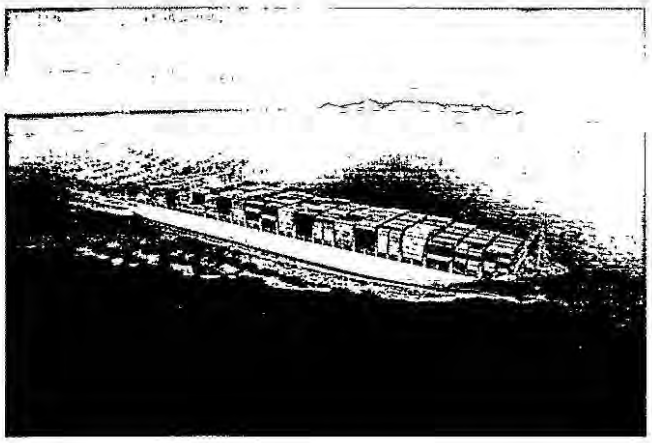
Explain why the IPCC cannot say for certain that human influences are the dominant cause of climate change. 1

* Due to there being no hard proof of it being a human problem despite all the evidence

MARKS

6. (continued)

(c)



CO_2 emissions from shipping have increased by more than 90% since 1990 and are currently responsible for 3% of global CO_2 emissions. One proposal to reduce emissions is slow steaming, which involves reducing the speed of the ship by 10%.

(i) Suggest a reason why shipping companies may choose not to use slow steaming. 1

~~It would have their profits~~

It would have a negative impact on their profits

(ii) The Energy Efficiency Design Index is a new set of design standards which will encourage the construction of ships that are more energy efficient.

Suggest a reason why the new design standards may not have an immediate effect in reducing greenhouse gas emissions. 1

It won't have an immediate affect due to the older model of ship still being used for a period of time.

MARKS

6. (continued)

(d) The growth in international shipping has led to enlargement of ports and extensions to existing dockside facilities.

State **two** reasons why such developments require environmental assessment. 2

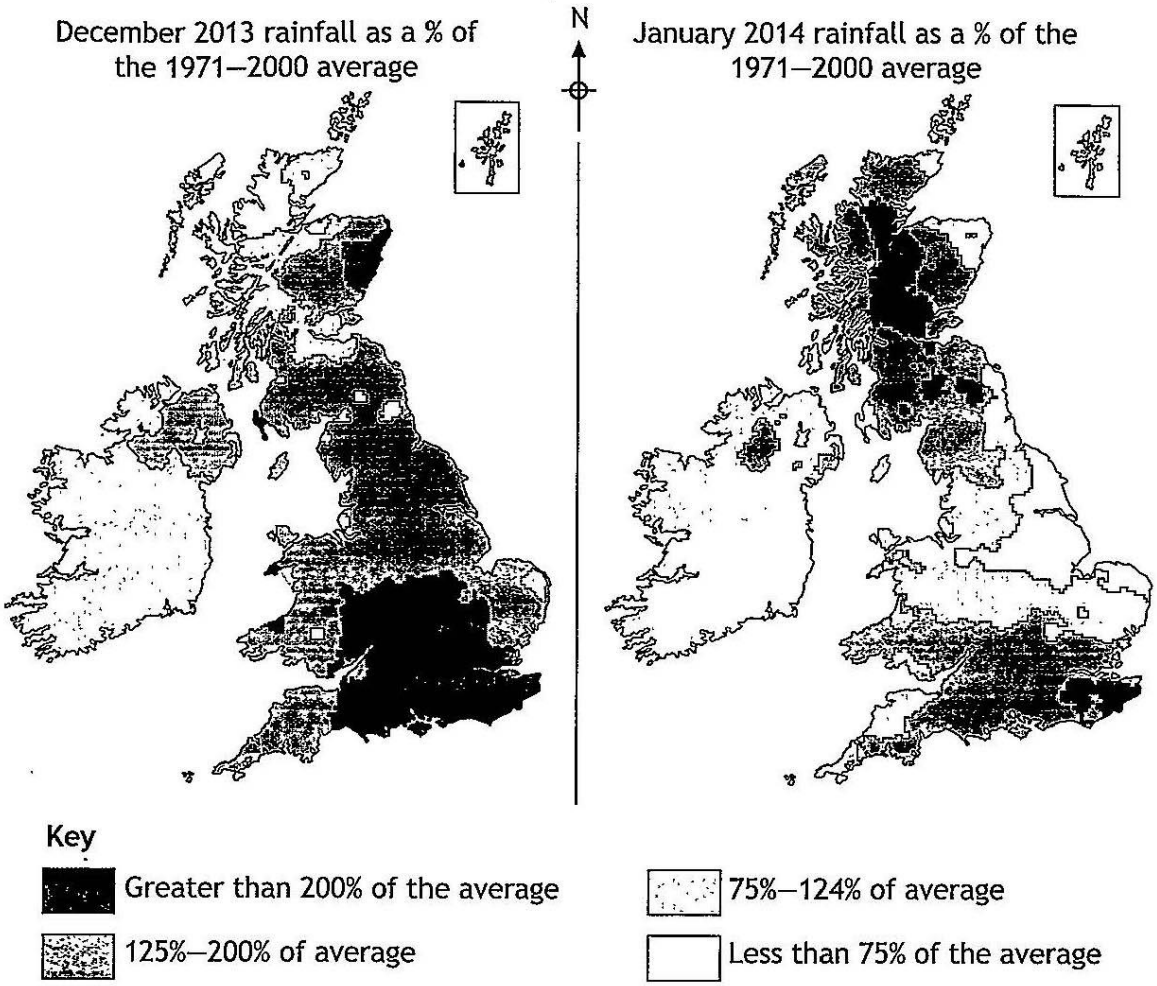
1. To make sure removal of sediment from under the port to accomodate large ships does not damage ecosystems or the environment.

2. To make sure water levels in the ports are large enough not to get build ups of dangerous chemicals

MARKS

7. The winter of 2013–14 was the wettest on record in parts of the UK. It also brought flooding to large parts of the south of England.

The images below show rainfall in the UK across two months in the winter of 2013–14.



(a) Identify **two** changes in rainfall distribution shown in the diagrams. 2

1. January shows it is abt wetter than in the north than in the south, whereas this was the opposite in december

2. December generally sees a large percentage of the UK with above average rainfall.

MARKS

7. (continued)

(b) The extreme weather conditions experienced during the winter of 2013–14 resulted in much debate around anthropogenic and natural climate variability.

(i) Explain why climate variability might have accounted for the higher than average rainfall levels in parts of Britain in January 2014. 2

Due to the rainfall levels being staggeringly higher than usual however could be said it is down to climate variability not climate change.

(ii) Describe how a named natural factor contributes to climate variability. 2

wind can contribute to climate variability due to many anthropogenic gases created and catalysing extreme weather events

(c) South West England experienced flooding during the winter of 2013–14.

Suggest how flooding might impact on the structure and composition of brown earth soils. 2

flooding may resulting in the washing away of nutrients humus in the soil and moder ~~trees~~ present in brown soils which could lead to dead soil or saturated soil

MARKS

8. The EU Common Agricultural Policy (CAP) was created in 1962 in order to provide affordable food for citizens and a fair return for farmers. Initially it did this by providing a guaranteed minimum price for specific agricultural products — this was called market support.

(a) The CAP supports agriculture within the EU.

Describe **two** ways in which CAP achieves this. 2

1. Subsidise farmers crops to keep farms financially stable
2. Create a market in which farmers can easily sell their produce.

(b) Explain why EU policy aims to improve the sustainability of food production. 2

It aims to improve sustainability because of the rising population and the scarcity of food resources.

(c) Early versions of CAP encouraged increased food production which indirectly impacted on other aspects of the environment.

Explain an environmental impact of increased food production. 2

loss of hedgerows resulted in massive loss of ecosystems and organisms present in the countryside

MARKS

8. (continued)

(d) Non-food crops represent a viable alternative for many European farmers.

Describe the use of a named non-food crop. **2**

Rape Seed oil is a non-food crop which can be used as a fuel source.

(e) Suggest a non-agricultural land use into which farmers can diversify. **1**

planting hedgerows to increase biodiversity.

MARKS

9. Since 2014 the British Geological Survey and the Department for Energy and Climate Change have worked together to estimate the volume of shale gas in the British Isles.

(a) (i) Describe briefly the formation of shale gas. 2

Shale gas is formed in ~~Shale~~ oil Shale and is produced by the decomposition of matter ~~of~~ over thousands of years.

(ii) Describe a method of shale gas extraction. 2

Hydraulic fracturing is a method of ~~extraction~~ extraction and this is done by drilling into the oil shale and ~~s~~ explosives to access the gas which is then pumped to the surface.

(b) The development of shale gas extraction is proving to be controversial in many countries.

(i) Suggest a reason why a national government may be in favour of developing shale gas extraction within their country. 1

It would sustain a countries energy needs for a ~~decades~~ long time

(ii) Suggest **two** reasons why some local people may object to the extraction of shale gas in their area. 2

1. The deep drilling and the extraction of gases can cause ~~can cause~~ earthquakes

2. The liquids used in fracking can sometimes get into water ways and water tables, polluting them permanently and making them unuseable.

MARKS

9. (continued)

(c) In 2014, six UK conservation organisations launched the report "Are We Fit to Frack?" which suggested setting up zones in which no shale gas extraction would be permitted.

Outline the role of a named land designation in conserving the UK's geological heritage. 2

SSSI's (Site of ~~Specific~~ Special scientific interest) are used to conserve areas which are of great scientific value or have great geological importance.

MARKS

For questions 10 and 11 choose to answer **either** A or B. Write your answers on the following pages. Diagrams may be used where appropriate.

10.A The introduction of non-native species causes ecological concern globally. A large number of non-native species, such as the grey squirrel, have been introduced to the UK, both deliberately and accidentally.

Discuss the impacts of non-native species, using a named example other than the grey squirrel, under the following headings:

(a) Impacts on local biodiversity

(b) Minimisation of these impacts **10**

OR

B A 2010 report compiled for the Cairngorms National Park Authority identified twenty-three nationally extinct species that have the potential to live in Scotland again. However, species reintroduction has been a controversial subject in recent years.

Discuss the re-introduction of nationally extinct species, using named example(s), under the following headings:

(a) Arguments in favour of re-introduction

(b) Arguments against re-introduction **10**

11.A In 2013 Scotland produced approximately 20 million tonnes of waste. This came from both domestic and industrial sources. In recent years the Scottish Government has introduced legislation to manage this waste.

Discuss the benefits and challenges of a piece of waste management legislation you have studied. **10**

OR

B The Scottish Government is using climate change and renewable energy policies to minimise greenhouse gas emissions in line with international targets.

Discuss the benefits and challenges of a national policy or relevant piece of legislation relating to climate change or renewable energy which you have studied. **10**

SPACE FOR ANSWERS MARKS

10 (a) (i) There are many extinct species in the UK which have been getting attention due to the possibility of re-introduction. Such extinct animals such as the wolf or the lynx have been named as possible contenders for reintroduction. With many wild deer levels soaring in Scotland and the negative impact they are causing on ecosystems, re-introducing a predator of these animals is an efficient way to keep there levels in check. Furthermore, re-introduction would see increased bio diversity in Scotland and a viable solution to cull booming deer levels.

(b) However re-introduction of an animal such as a wolf or lynx has many negatives. Although they would contribute to the culling of deer, many farmers argue that they would also hunt their livestock and pose a threat to their livelihood. They could also have a threat to human safety because there is no evidence to say that the wolf or lynx would not be afraid to attack a human. There is also the problem that with such high levels of rabbit and deer in Scotland, the population of the wolf once it to be reintroduced would soar to very high levels and there would then be the problem of huge numbers of aggressive wild beasts to deal with.

SPACE FOR ANSWERS (continued) MARKS

11 (B) Carbon taxation is a method used by the UK government to ensure businesses and companies are limited to the amount of CO_2 they can give off before being fined for giving of harmful chemicals. It works by allowing a company a threshold of carbon that they give off which and they are taxed on to hopefully force companies to find more financially better options of finding energy than being taxed