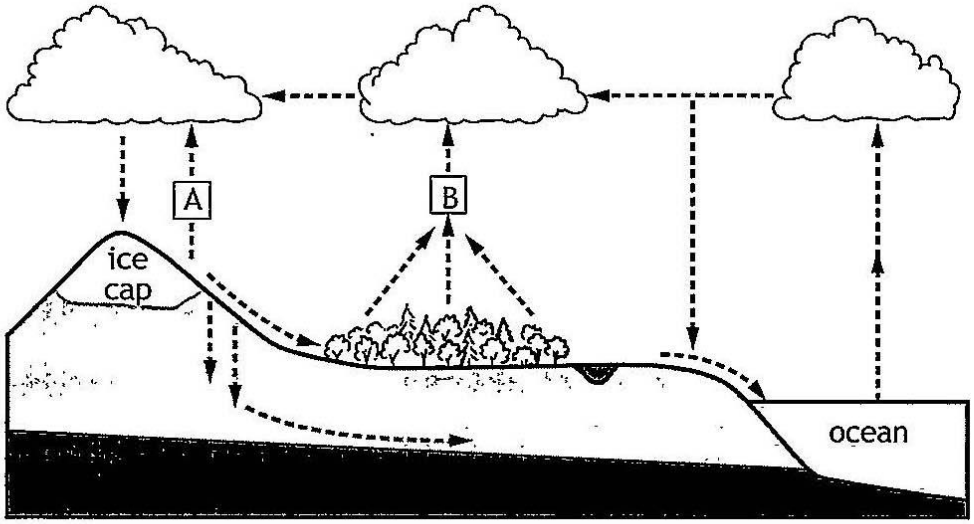
MARKS

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

aquifer

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

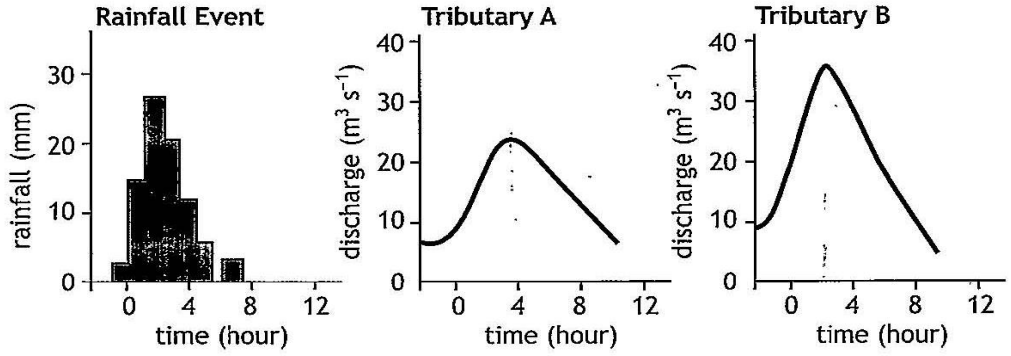
B – transpiration
plant roots uptake water from the soil and some water evaporates from the leaves into the atmosphere.

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

The discharge at Tributary B was much faster than at Tributary A. The peak discharge at A happened roughly 3~~4~~ hours after rainfall where as at B peak discharge was acheived at ~~2~~ hours after rainfall. Both Tributary A and B returned to normal rates at roughly 10 hours after rainfall.

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

Turning fields into arable crop land may affect river discharge (decreasing) as water may be pumped from the river to be used as 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**

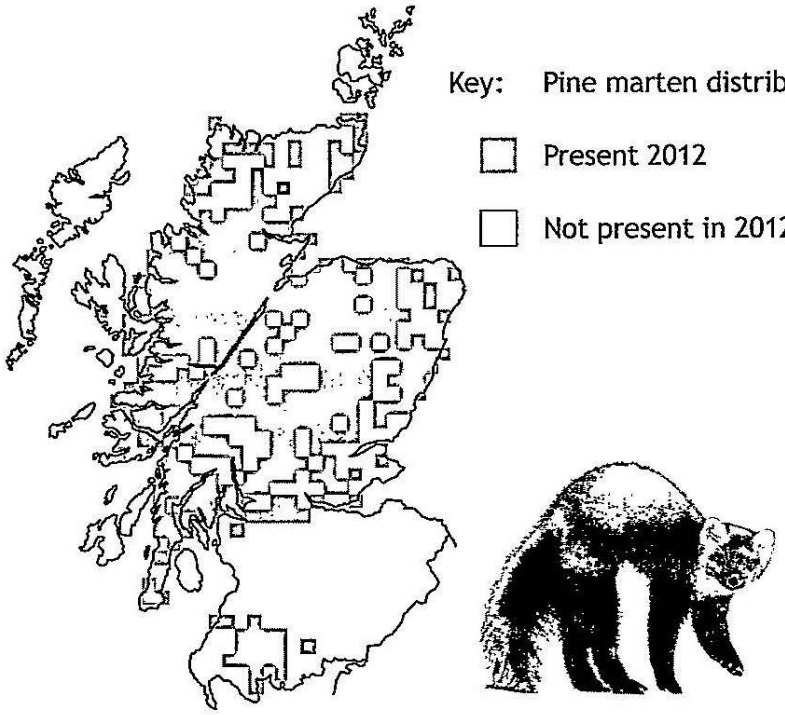
Conservation areas have opened which help to reduce the number of poachers((SSSIs) Scottish Sites of Special Scientific Interests)

SNH (Scottish Natural Heritage) protecting areas by providing responsible routes for tourism etc.

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

~~Numeric~~ Quantitative sampling of scats. Using a random generator for choosing which forests are being sampled would give an unbiased result. It seems to have the impression of larger the forest the more likely of finding a pine marten. The scats are only counted along 1km where a pine marten may not be present more land could have been covered to ensure larger accuracy.

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

300 ~~550~~
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 squirrels spend a larger time foraging in trees where they have more cover from predators. The grey squirrels spend a lot less time in the trees so may be easily targeted by pine martens ultimately reducing the number of grey squirrels and increasing the number of red squirrels that are no longer in competition with the grey ones.

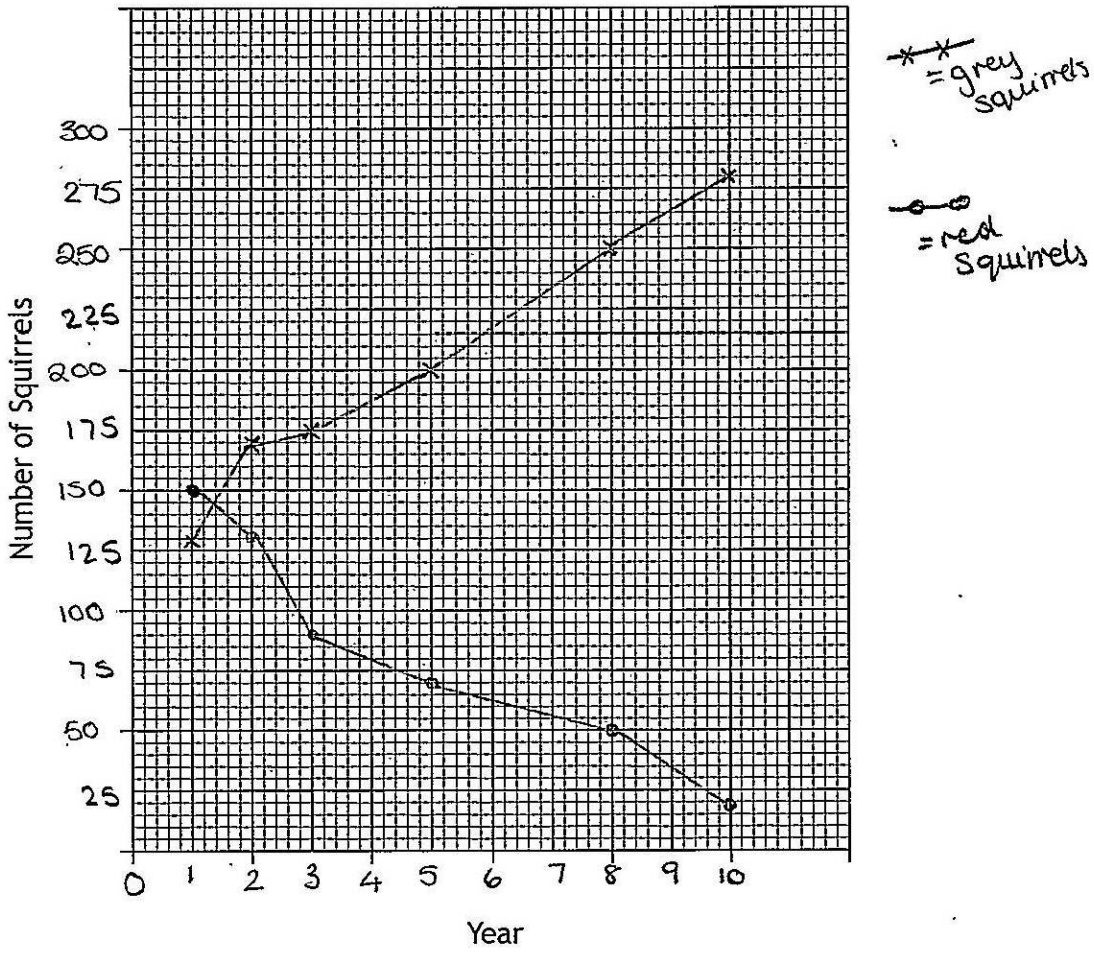
MARKS

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

distribution from hot water vents on the sea floor being buried and ~~completed~~ heated over time. ~~to produce~~ ~~beg~~

(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

6276 → 37979

$\frac{31703}{6276} \times 100$

= 505·15 %.

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

year of volcanic eruption or plate boundary movements allowing new baryte to form and be mined.

MARKS

3. (continued)

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

compaction and heat exposure (from the inner layers of the Earth) can help to create baryte veins which can be mined and processed.

(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

its dense which helps to prevent explosions when the oil + gas is released. as it slows down the rate at which they are released.

(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 can absorb X-rays and gamma rays ~~while being~~ which helps to prevent prolonged exposure of these harmful radiation rays to the patient.

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.

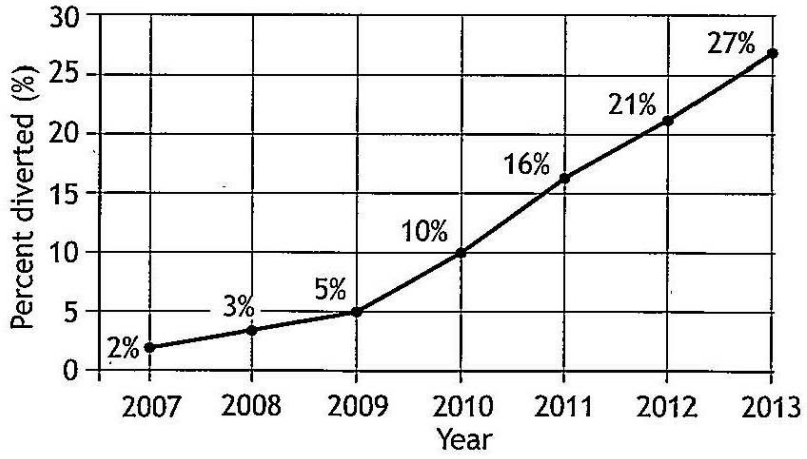
Once a carpet is no longer needed there are a number of options:

- **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

- how much of the product can be recycled to form other products.
- time it would take for the carpet to decompose / burn.

(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.

~~107000 = 27 /.~~
~~27 x 100~~

~~396296.3 tonnes~~
= 396296 tonnes

MARKS

4. (continued)

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

- can produce harmful Green house gases such as CO_2.
- encourages larger numbers of the product to be made which would require more resources possibly leading to habitat loss and pollution.

(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

- does not send the products to landfill which produces harmful methane gases.
- components of products can be reused meaning less resources have to be used such as wood from trees which when harvested can cause habitat loss.

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

- would cost the manufacturer more to develop Something that lasts long enough to be economically viable through cleaning.
- takes up more money + manufacters time to clean and restore products which may not be that profitable.

[Turn over

MARKS

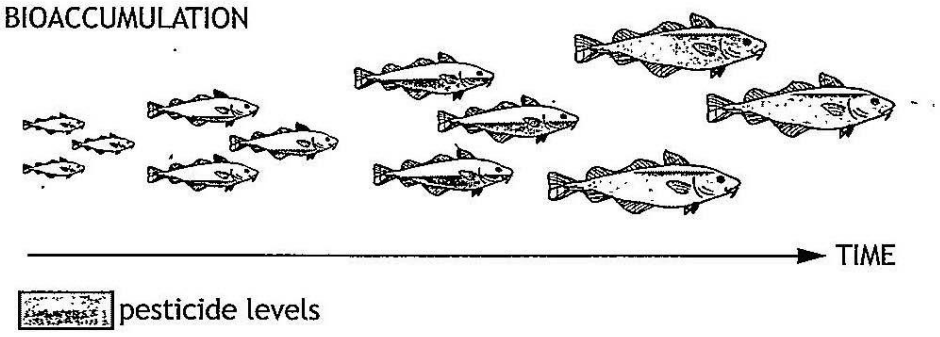
5. (a) A persistent pesticide is one which is not easily broken down in the environment.

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

After being ~~spray~~ sprayed by farmers onto crops, the pesticide may be washed away by rain and carried by surface run off to nearby rivers and lakes.

(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**

~~Overcame~~ If a pesticide is exposed in an aquatic environment, algae and other organisms absorb it. ~~When a~~ in ~~fish~~ relatively small levels. As a fish develops and over ~~e~~ its lifetime eats algae, the level of pesticide in its system increases - as the pesticide is persistant the fish cannot process it and so it builds up - eventually the levels of pesticide may reach those where it is lethal - killing the fish.

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

reduces the risk of chemical pesticides which are non-biodegradable being released into ecosystems. and effecting non target species.

2. Use of biodegradable pesticides

Bacteria in the ground can process these into harmless substances which do not effect other organisms.

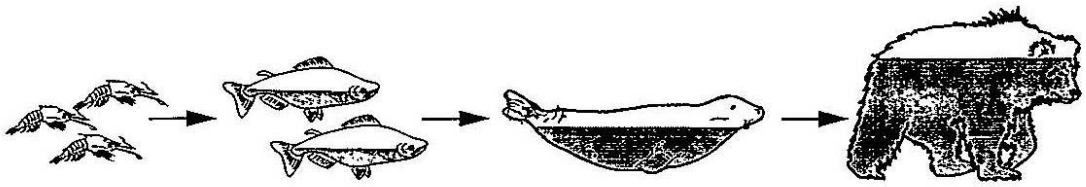
(b) State why the total biomass of organisms usually decreases at each successive trophic level in a food chain. 1

Over time survival of the fittest occurs due to competition and predators.

MARKS

5. (continued)

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



BIOMAGNIFICATION

pesticide levels

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

The larger the predator, the more prey it must consume to survive ∴ if ~~shrimp~~ plankton is effected by a pesticide and fish consume it then the level of pesticide in the fish increases. If a seal comes and eats these fish then the seals pesticide levels increase as it is eating more than one at a time. If a polar bear eats the seal then its levels can become so high that it is fatal

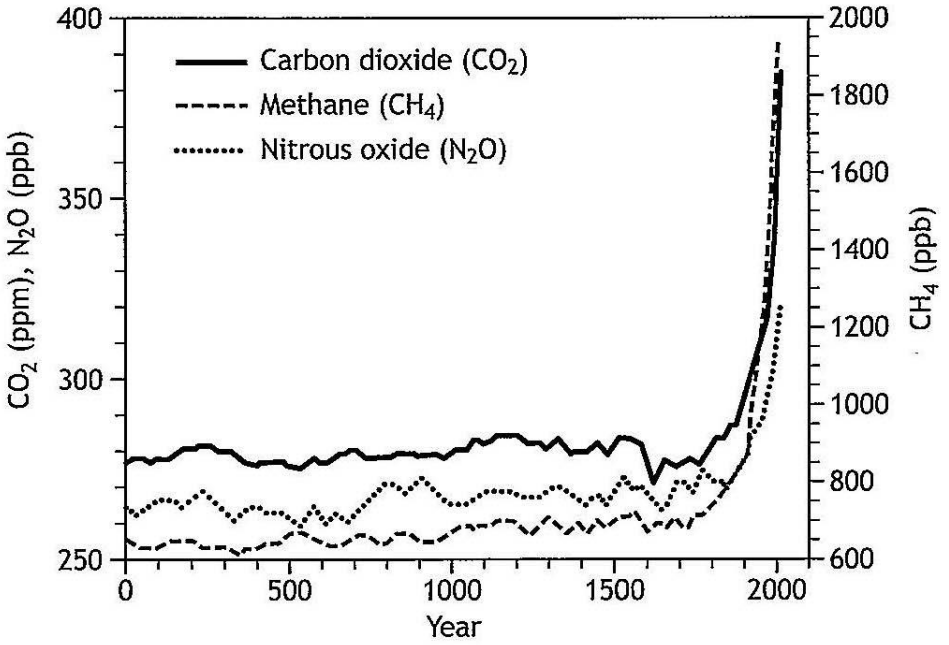
(ii) The food chain above contains both ectotherms and endotherms.

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

Ectotherms do not use energy by maintaing a body temperature and so more energy is passed on at each stage of the food chain. Endotherms have to maintain their body temperature and so use up energy which cannot be passed on.

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 levels of CO_2, CH_4 and N_2O have increased hugely within 2000 years.

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

- excess burning of fossil fuels to provide energy to a growing population.
- destruction of rainforests decreases the amount of CO_2 that can be turned into oxygen by plants.

(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

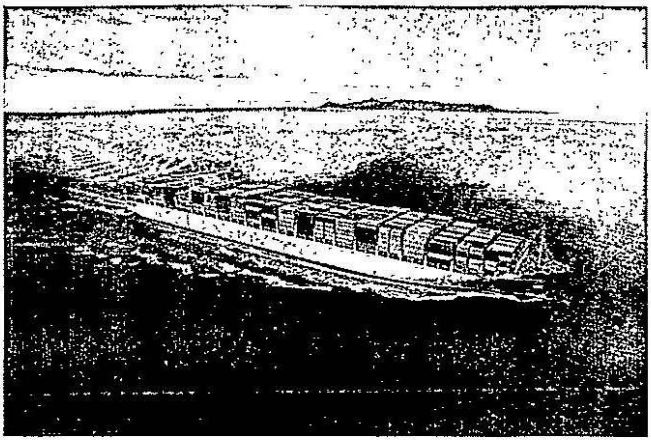
The levels of GHG (greenhouse gases) have fluctuated over time naturally. which creates doubt over wether humans influence these.

[Turn over

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

Takes longer to get to the destination which may lose the company money.

(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

Shipping companies will have to develop + implement these standards which will take time to acheive. meaning that emissions will not be reduced for a long 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**

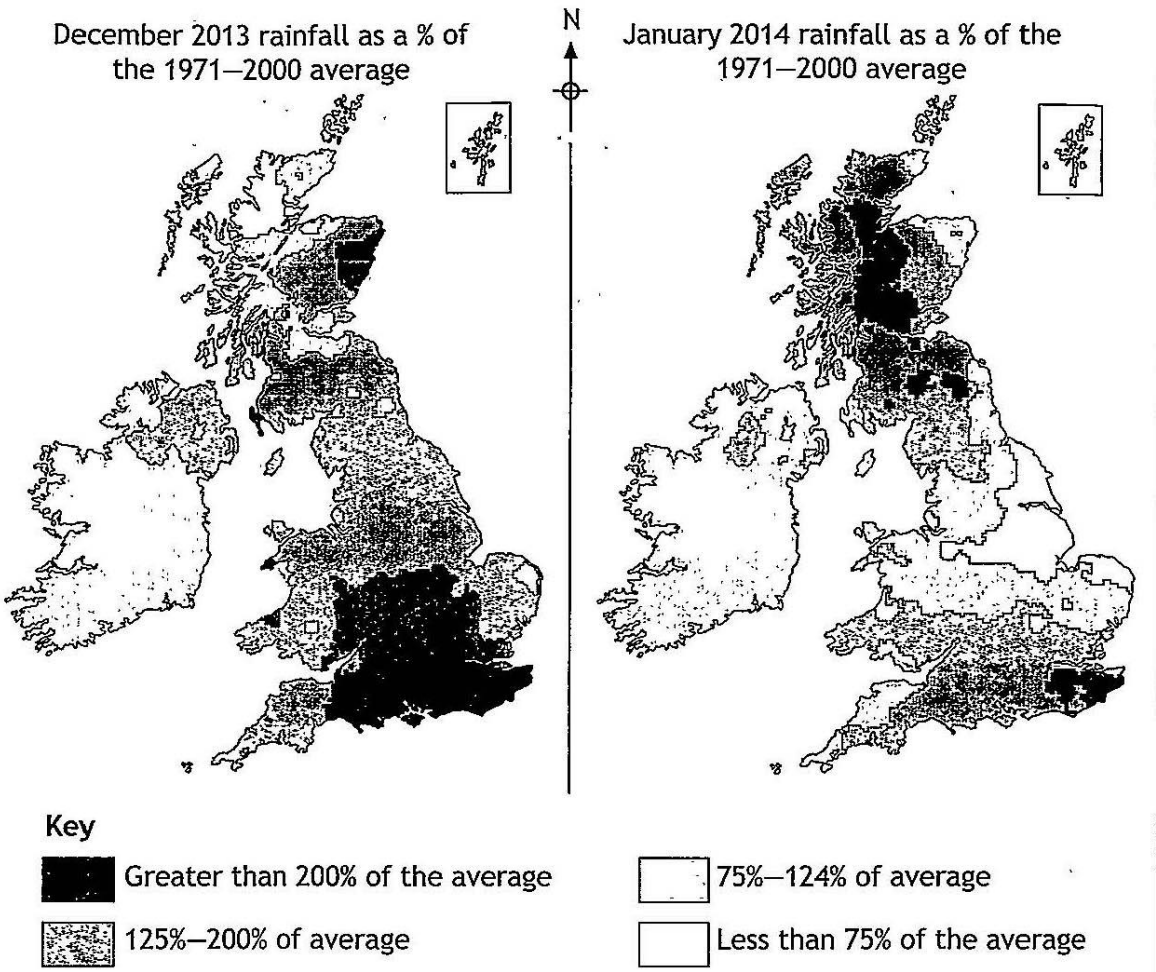
- to ensure that the developments do not produce pollution which can be harmful to occupants ~~and~~ in cities.
- to ensure that it will not result in the destruction of a species habitat / extinction of endangered species.

[Turn over

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

~~aa~~ . There has been a greater level of December rainfall during 2013 in England than the 1971-2000 average.

• There has been a greater level of January rainfall during 2014 in Scotland than the average.

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

because winds may have redistributed pollutant gases in the atmosphere and brought clouds with a higher level of moisture to britain. ??

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

transpiration of plants and trees which release water by evaporation through leaves in rainforests ~~leads~~ contributes to climate variability as these are more humid areas.

(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

Brown earths would saturate and the levels of humus would decrease in layers above as oxygen levels would diminish and organisms would not be able to degrade leaf litter. The water would eventually drain away however through the rocks to an aquifer.

[Turn over

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

- gives farmers subsidies for producing foodstuffs which allows more farmers to expand and make more profit keeping them in business.
- guaranteed minium price allows farmers to make a profit not a loss on their products.

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

Because the population is continuing to grow to a point where the production of food cannot support it, the food production must be sustainable or widespread famines may occur.

(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

- destruction of habitats as forests are cleared to make agricultural land and field boundaries/hedgerows are removed to increased ~~the~~ yield.

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

Seaweed.
can be used to stabalise cosmetics
without them separating.

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

replanting trees for forests.

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

~~hydrocarbon~~ methane deposits formed over time by years of burying and heating of these through heat from the inner core.

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

fracking, the use of controlled explosives and high pressured liquids to create fractures in oil shale ~~which~~ rock which releases oil and gas ready to be extracted by pumping it out of the ground.

(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

provides a source of oil which can be used for production of fuels for a profit/ for providing energy to homes.

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

- chance of methane leaks which may cause pollution
- ~~chance~~ chance of earthquakes and landslides as a result of rock distruption.

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**

Fossil code protects geological heritage by ensuring responsible use / protection of areas where it is required/ where there are SSSIs. !!

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**

10. B. Arguments in favour of re-introduction:

The reintroduction of wolves into Scotland has been extremely controversial, arguments in favour of reintroduction include;

- The reintroduction of wolves would significantly reduce the numbers of red deer which are over-populated in some areas causing habitat destruction.
- The reintroduction of a native species such as the wolf could bring thousands of pounds of profit through tourism which could improve the economy.
- The reintroduction of wolves, reintroduces a native predator which could prevent overpopulation of other species like red deer.
- The reintroduction can provide employment for people in the management and reintroduction process.

Arguments Against Reintroduction:

Arguments against the reintroduction of wolves include.

- The possibility of the wolves feeding on cattle and sheep which could diminish farmers flocks and herds. This could lead to the demand of compensation for loss of livestock.
- If wolves were reintroduced into areas

near urban communities, people and children may be at risk of attack.

- The reintroduction of wolves could attract attention from poachers which may reduce their numbers to extinction again.

- The reintroduction of wolves could lead to diminishing other native species if they are not controlled from over breeding.

- They may not even take to the way the Scottish environment has adapted over the years. Or they may have adapted to other climates which leads to a failure of reintroduction.

11. A. The Landfill Directive.

The benefits of the landfill directive include that a reduction in the amount of waste going to landfill reduces the chance of excess methane building up and possibly causing explosions.
It also helps to prevent excess loss of habitat where new sites would have to be built incase the old ones have to be recovered.
Creates employment opportunities at reaycing centres
It reduces the risk of birds such as seagulls dying due to swallowing/ becoming trapped in waste plastics which are non-biodegradable and left exposed to the elements.
. It encourages people to recycle/reuse their items which can have a long term effect on resources and extraction of resources which with current methods can destroy habitats and damage the environment.

The challenges of the landfill directive can include the fact that some people are too lazy to sort through their waste to see what can be recycled.
Money required to build new, more

accesible recycling centres may not be available without forcing cuts on other aspects of the councils budgets.

- Some things cannot be reacled so there is no option but to burn them for energy reclamaition or to send them to landfill.
- Current landfill sites cannot be closed without covering them and maintaining them to ensure methane ~~gas~~ levees are not risking explosion or seeping through the ground to urban areas. This also requires money or technology which may not be available to local councils.