How materials are cycled

Describe how carbon returned to the atmosphere.

_____

Describe how carbon is removed from the atmosphere.
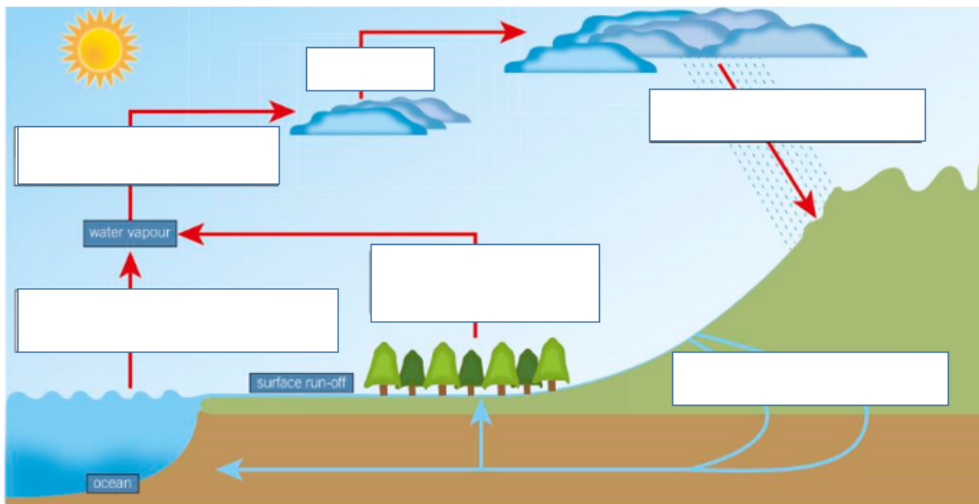
_____

Describe how water is returned to the atmosphere.

_____

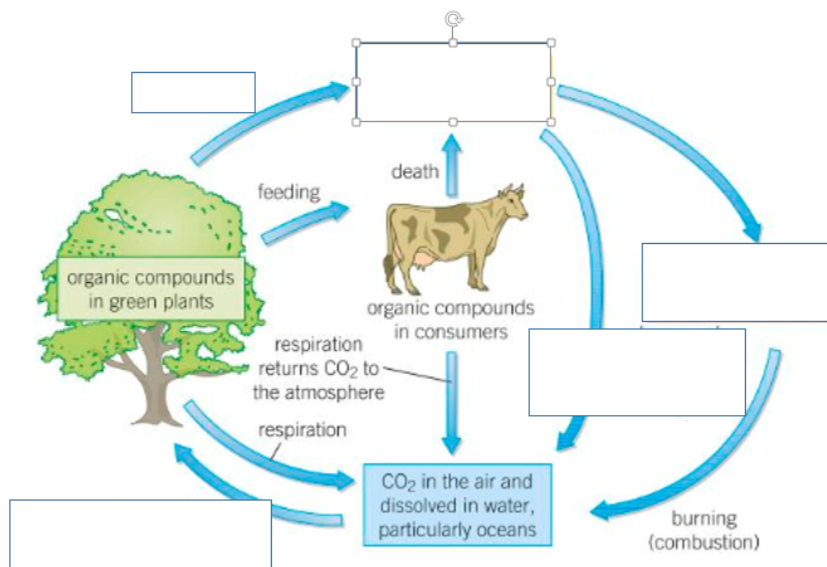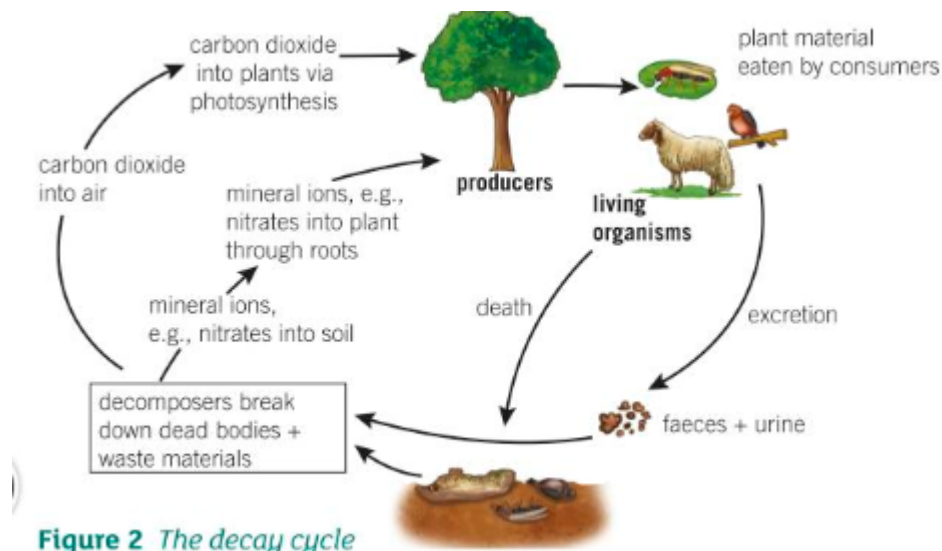Describe how water is removed from the atmosphere.

_____

_____

Figure 2 *The decay cycle*

The diagram shows part of the carbon cycle.
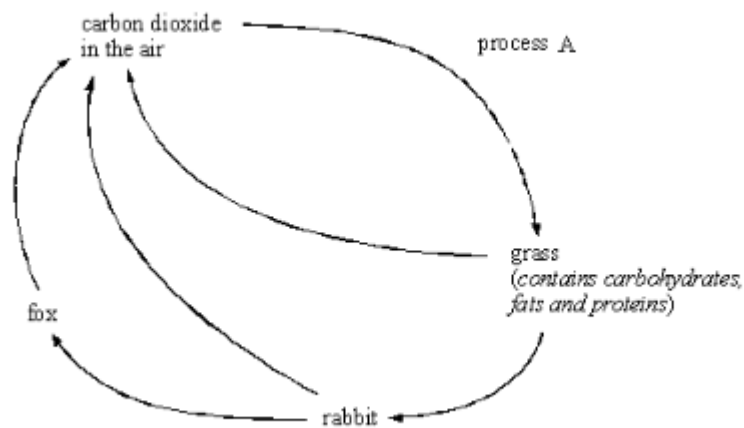
(a) Write down the name given to process A.

_____

(1)

(b) Explain, as fully as you can, how some of the carbon in the grass becomes part of the fox's body.

_____

_____

_____

_____

_____

(3)

(Total 4 marks)

Biodiversity

Biodiversity is the variety of all the different species of organisms on earth, or within an ecosystem. Great biodiversity ensures the stability of ecosystems by reducing the d………………….. of one species on another for food, s…………………….. and the maintenance of the physical environment.

The future of the human species on Earth relies on us maintaining a good level of biodiversity. Many human activities are r………………………. biodiversity and only recently have measures been taken to try to stop this reduction

Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on e…………………………… and biodiversity. These include:

- B……………………….. programmes for endangered species.
- Protection & regeneration of rare h……………………….
- Reintroduction of field margins and hedgerows in a………………………… areas where farmers only grow one crop
- Reduction of d……………………………. and carbon dioxide emissions by some governments
- Recycling resources rather than dumping waste in l………………………..

Rapid g…………………… in the human population and an increase in the s………………… of living mean that increasingly more r…………………….. are used and more w…………. is produced. Unless waste and chemical materials are properly handled more pollution will be caused. Pollution can occur:

- In w…………………, from sewage, fertiliser or toxic chemicals
- In a…………., from smoke and acidic gases
- On land, from l………………… and from toxic chemicals.

P…………………………. kills plants and animals which can reduce biodiversity.

Humans reduce the amount of l……………… available for other animals and plants by b………………….., quarrying (large scale removal of rocks/minerals), f……………… and dumping waste.

The destruction of p……………… bogs, and other areas of peat to produce garden compost reduces the area of this habitat and thus reduces the variety of different plant, animal and microorganism species that live there. The decay or b……………… of the peat releases c…………………. dioxide into the atmosphere.

Large scale d…………………………… in tropical areas has occurred to provide l………….. for cattle and rice fields and to grow crops for biofuels.

Deforestation increases the amount of carbon dioxide in the atmosphere as there are less plants to remove carbon dioxide through p…………………………… and some of the land will be cleared by b…………………… the forests which will release carbon dioxide into the atmosphere.

The increase in carbon dioxide and methane in the atmosphere has contributed to g………………………. w…………………………... This increase in global temperatures is likely to lead to ice caps m…………………….,

increasing sea levels and significantly changing h………………………….. Changing temperatures could also affect breeding, migration patterns and food c………………….. in a number of unpredictable ways.

Biodiversity

Define the term 'biodiversity'.

_____

Why is biodiversity useful within an ecosystems?

_____

Give examples and explain human activities which reduce biodiversity.

_____

Waste management

Describe three ways in which humans can cause pollution.

_____

Describe the effects of pollution on plants and animals.

_____

Land use

State examples of how humans reduce the amount of land available for other animals and plants.

_____

What is peat and what is it used for?

_____

Describe how the destruction of peat bogs have effected species that live there.

_____

Describe the effects of decaying and burning peat.

_____

Deforestation

Why does deforestation occur?

_____

_____

Explain the problems caused by deforestation.

_____

Global warming

Describe how global warming occurs.

_____

What evidence is there for global warming?

_____

Why do some think global warming is a myth?

_____

What are the consequences of global warming?

_____

Maintaining biodiversity

Describe positive interactions humans have in an ecosystem.

_____

Describe negative interactions humans have in an ecosystem.

_____

Describe five programmes put into place by humans to reduce the negative effects they have caused.

_____

_____

_____

Read the passage.

Glutton up a gum tree

Along the banks of the Cygnet River on Kangaroo Island, the branches of the dying gum trees stretch out like accusing fingers. They have no leaves. Birds search in vain for nectar-bearing flowers.

The scene, repeated mile upon mile, is an ecological nightmare. But, for once, the culprit is not human. Instead, it is one of the most appealing mammals on the planet – the koala. If the trees are to survive and provide a food source for the wildlife such as koalas that depend on them, more than 2000 koalas must die. If they are not removed the island's entire koala population will vanish.

Illegal killing has already started. Worried about soil erosion on the island, some farmers have gone for their guns. Why not catch 2000 koalas and take them to the mainland? "Almost impossible," says farmer Andrew Kelly. "Four rangers tried to catch some and in two days they got just six, and these fought, bit and scratched like fury."

Use the information from the passage and your own knowledge and understanding to give the arguments for and against killing koalas to reduce the koala population on Kangaroo Island.

_____

_____

_____

_____

_____

_____

(4 Marks)

Trophic levels

Trophic (f…………………) levels can be represented by numbers. Trophic level 1 will be p……………………… such as plants and algae, which can make their own food by photosynthesis. Trophic level 2 will be h………………………. that eat the plants and algae. These could also be referred to as primary consumers. Trophic level 3 will contain secondary consumers which are c………………………. that will eat herbivores. T…………………….. consumers will be trophic level 4. These will be carnivores that eat other carnivores. A……………. predators are carnivores with no p……………………..

D……………………… (bacteria and fungi) break down dead plant and animal matter by secreting e……………………….. into the environment. Small soluble food molecules then d…………………… into the microorganism.

B…………………….. is a term used to describe the mass of organic matter. Pyramids of biomass represent the relative a……………………… of biomass in each trophic level of a f……………. c……………………... The producers (trophic level 1) are always at the b……………………… of the pyramid, with the subsequent levels then represented in the order of the food chain.

Only about 1% of the light energy that strikes a plant is converted into chemical energy stored in g………………….., as some of the light energy is reflected off the leaf.

Food chains are not e…………………. Only about 10% of the biomass from each level is transferred to the level above it. For this reason the size of each bar of the pyramid will d……………………… at each level.

Biomass (energy) is lost at each level due to the use of glucose in r…………………… (e.g. for movement), material being passed out as waste such as u……….. in the urine. In addition to this some of the material eaten will be passed out as f………..

Levels of organisation

Name an example of a producer.

_____

Define the term 'producer'.

_____

Name an example of a consumer.

_____

Define the term 'consumer'.

_____

The diagram below shows a food chain in a garden.

Lettuce   ⟶   Snail   ⟶   Shrew
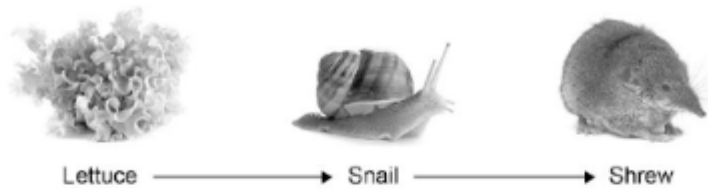
Lettuce © destillat/iStock/Thinkstock; Snail ©Valengilda/iStock/Thinkstock; Shrew © GlobalT/iStock/Thinkstock

(a)   Name **one consumer** shown in the diagram above.

_____

                                                                       (1)

(b)   Name **one carnivore** shown in the diagram above.

_____

                                                                        (1)

(c)   A disease kills most of the shrews in the garden.

     Suggest why the number of snails in the garden may then increase.

_____

_____

                                                                       (1)

(d)   What is the name given to all the snails in the garden shown in the diagram above?

     Tick **one** box.

     Community   ☐

     Ecosystem   ☐

     Population   ☐

     Territory   ☐

                                                                          (1)

An oak wood contained the following:

200 oak trees

150 000 primary consumers

120 000 secondary consumers

(a) Draw and label a pyramid of biomass for **this** wood. (Your pyramid does **not** have to be drawn to scale.)

(2)

(b) A scientist estimated the total amount of energy flow through each level of the pyramid per year.

The results were:

Energy absorbed by oak trees   4 600 000 kJ per m^2 per year

Energy in sugar produced by trees   44 000 kJ per m^2 per year

Energy transferred to primary consumers   2 920 kJ per m^2 per year

Energy transferred to secondary consumers   700 kJ per m^2 per year

(i) Calculate the percentage of the energy absorbed by the trees that is transferred to sugar by photosynthesis. Show your working.

Answer .... %

(2)

(ii) Suggest **two** reasons why a large proportion of the energy is not transferred to sugar.

1 ....

....

2 ....

....

(2)

(iii) Give **three** reasons why some of the energy in the primary consumers is not passed on to the secondary consumers.

1 ....

....

2 ....

....

3 ....

....

(3)

(c) Conditions may change considerably during the course of a summer's day.

Explain how different factors may determine the rate of photosynthesis at different times of the day.

....

....

....

....

(3)

(d) In autumn, the leaves fall from the oak trees. The leaves contain some proteins.

Explain how the nitrogen in these proteins is made available for the oak trees to use again.

....

....

....

....

....

....
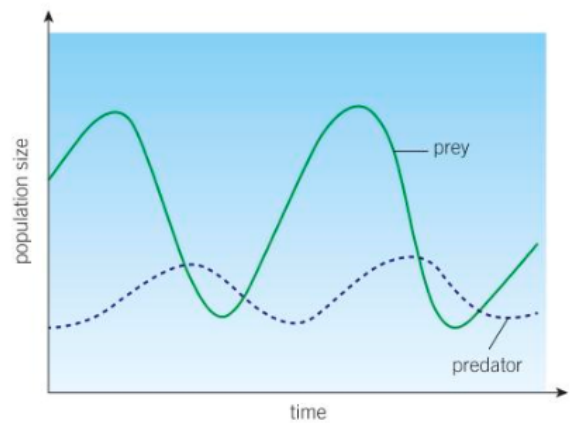
(4)
(Total 16 marks)

Predator-prey cycles

The diagram shows a relationship between predators and prey in a stable community.
In a stable community the populations of predator and prey rise and fall in linked cycles.
Explain the cyclical relationship between predator and prey as

shown in the graph.

....

....

....

....

....

....

Figure 2 *The numbers of many different predator–prey populations show typical rises and falls*

Food Production

Food security means having e……………………….. food to feed a p…………………… Biological factors which are threatening food security include:

- Increasing b……………. rates, causing population growth.
- New p…………… & p……………………….. that affect farming
- The cost of a………………………… inputs (seeds, fertilisers, fuels, machinery, labour)
- Environmental change causing d…………………., f……………… or unseasonal weather
- Conflicts (e.g. w………….) which affect the availability of water and food
- Changing d………………… in developed countries increasing demand for already scarce food resources.

I………………………. farming techniques increase the e……………………….. of food production by r……………………….. energy transfer from food animals to the environment. In oceans or rivers fish may swim large distances to find f……………., migrate and are exposed to predators. In fish farms the fish will be kept in a limited s……………….., enclosed from predators and may be fed high p………………… food to increase g…………………….. rates and thus the potential output of the farm.

Battery farming of animals works in a similar way by restricting e………………… losses to the environment, however there are concerns about the e……………….. of intensive farming techniques with many people believing that the animals should be kept in better c……………………… with more room to lead a natural life.

Can you…?	☺	😐	☹
7.1 Adaptations, interdependence and competition			
Suggest the factors for which organisms are competing in a given habitat			
Suggest how organisms are adapted to the conditions in which they live			
Define an ecosystem			
Define interdependence			
Explain what is meant by a "stable community"			
Explain how a change in an abiotic factor would affect a given community			
List abiotic factors			
Explain how a change in a biotic factor might affect a given community			
List biotic factors			
Explain how organisms are adapted to live in their natural environment			
Define an extremophile			

7.2 Organisation of an ecosystem			
Define a producer, primary consumers, secondary consumers and tertiary consumers			
Construct food chains			
Explain the use of transects and quadrats			
Explain why, in a stable community, the numbers of predators and prey rise and fall in cycles			
Recall the carbon cycle			
Recall the water cycle			
Explain the role of microorganisms in cycling materials through an ecosystem.			
State factors which affect the rate of decay(biology only)			
Recall that biogas generators can be used to produce methane gas as a fuel.			
Evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information (biology only) (HT only)			
State some environmental changes			
7.3 Biodiversity and the effect of human interaction on ecosystems			
Define biodiversity			
State the benefit of ensuring a great biodiversity			
Explain how human activities are reducing biodiversity			
Understand that rapid growth in the human population and an increase in the standard of living mean that increasingly more resources are used and more waste is produced. Unless waste and chemical materials are properly handled, more pollution will be caused			
Explain how pollution can occur on land, in air and in water			
State how humans reduce the amount of land available for other animals			
Explain the destruction of peat bogs			
State why large-scale deforestation in tropical areas has occurred			
List the consequences of deforestation			
Describe global warming			
State the biological consequences of global warming			
Explain how humans are trying to reduce these negative effects			
7.4 Trophic levels in an ecosystem (biology only)			
List the tropic levels (biology only)			
State the role of decomposers (biology only)			
Construct a pyramid of biomass (biology only)			
Explain how the loss of biomass at each trophic level affects the number of organisms at each level. (biology only)			
Recall that only approximately 10% of the biomass from each trophic level is transferred to the level above it. (biology only)			
State reason for losses of biomass			
4.7.5 Food production (biology only)			
List some factors affecting food security (biology only)			
Explain 'Factory farming' to restrict energy transfer from food animals to the environment. (biology only)			
Explain sustainable fishing security (biology only)			
Understand that modern biotechnology techniques enable large quantities of microorganisms to be cultured in industrially controlled vats for food. (biology only)			
State that the fungus Fusarium is useful for producing mycoprotein, (biology only)			
Recall that GM bacterium produces human insulin. (biology only)			

Answers

Adaptations, interdependence & competition

An ecosystem includes the interactions of a community of living organisms with each other and with the non-living parts of their environment.

Within a community each species depends on other species for food, shelter, pollination, seed dispersal etc. If one species is removed it can affect the whole community. This is called interdependence. A stable community is one where all the species and environmental factors are in balance so that the population sizes remain fairly constant.

To survive and reproduce, organisms require a supply of material from their surroundings and from other living organisms there.

Plants in a community or habitat often compete with each other for light and space, and for water and mineral ions from the soil. Animals often compete with each other for food, mates and territory.

Abiotic (non-living) factors which can affect a community include light intensity, temperature, moisture levels, soil pH and mineral content, wind intensity and direction, carbon dioxide levels for plants and oxygen levels for aquatic animals.

Biotic (living) factors which can affect a community include the availability of food, new predators arriving, new pathogens, and one species outcompeting another so the numbers are no longer sufficient to breed.

Feeding relationships within a community can be represented by food chains. All food chains begin with a producer which synthesises molecules. This is usually green plants or alga which make glucose by photosynthesis. The energy in the glucose is then passed on through the food chain be feeding. The arrows in a food chain show the direction of the flow of energy.

Producers are eaten by primary consumers, which in turn may be eaten by secondary consumers and then tertiary consumers.

Consumers that kill and eat other animals are called predators, and those eaten are called prey. In a stable community the numbers of predators and prey rise and fall in cycles. As the number of prey organisms increases the number of predators will increase as there is more food available. As the number of predators increases the number of prey will decrease as more are being eaten. This fall in the number of prey organisms will lead to a lack of food for the predators so their population will decrease, which will then allow the population of prey organisms to increase again.

Organisms have feature (adaptations) that enable them to survive in the conditions in which they normally live. These adaptations have arisen over many years through evolutionary changes.

Adaptations may be structural, behavioural (e.g. migration, breeding behaviour) or functional (such as the way that enzymes work).

Some organisms live in environments that are very extreme, such as high temperature, pressure, or salt concentration. These organisms are called extremophiles. Bacteria living in deep sea vents at very high temperatures are examples of extremophiles.

All materials in the living world are recycled to provide the building blocks for future organisms.

The water cycle provides fresh water for plants and animals on land before draining into the seas. Water from the seas will then be evaporated, and eventually form clouds and will fall back to Earth as precipitation (rain or snow)

In the carbon cycle photosynthetic organisms take in carbon from the air as carbon dioxide during photosynthesis. The glucose made during photosynthesis contains carbon ($C_6H_{12}O_6$) which may then be through the food chain be feeding. Carbon will be returned to the atmosphere as carbon dioxide when the glucose is used in respiration, or through combustion if plants are burnt such as in deforestation.

When organisms die microorganisms such as bacteria and fungi will return carbon to the atmosphere as carbon dioxide during decomposition and break down other compounds into mineral ions which will be returned to the soil.

Gardeners and farmers try to provide optimum conditions for the rapid decay of biological material. The compost produced is used as a natural fertiliser for growing garden plants of crops.

Warm temperatures increase the activity (reproduction and respiration) of microbes, while moist conditions prevent them from drying out, although the microorganisms may not survive if conditions become waterlogged. Keeping compost aerated provide the microbes with oxygen for respiration.

Anaerobic decay produces methane gas. Biogas generators can be used to produce methane gas as a fuel.

Q1.

(a) points plotted accurately

$+ \frac{1}{2}$ square

deduct 1 mark per error
ignore the line

2

(b) 30 **or** correct from candidate's graph
accept 30 000 lynx
*do **not** accept 30 000*

1

(c) (i) fall
mark (i) and (ii) separately

1

(ii) fewer hares **or** lack of food
*do **not** accept <u>no</u> hares or food*

1

(d) kills / preys / preys on / hunts / catches
<u>**and**</u> eats / for food (other) animals
*must have the eat **and** kill for the point*

1

(a) use of random numbers to place quadrats;
number of individuals counted in large number of quadrats;
little variation random, large variation - clustered;

3

(b) less competition;
for water / nutrients;

2

[5]

Mark schemes

Q1.

(a) any **two** from:
control variables from information given
- area of bed sampled
- sampling time
- size of net
- kicking action
- net position

2

(b) any **two** from:
must be ideas related to <u>a</u> sample
- some animals not dislodged
ignore reliability etc
- some animals missed / through / escaped net
- invertebrates difficult to identify
- invertebrates from outside area

2

(c) 10 to 99 or 10 – 99 or 99 to 10 or 99 – 10

1

(d) any **two** from:
- increased / goes up
allow increase implied from all data described
- 0 at sample 4
- to (more than) 100

2

(e) mayfly

1

because not found downstream of point where sewage enters stream
or only in the unpolluted water

1

[9]

Q2.

(a) (i) 20

1

(ii) 12000

1

(b) area of strips

or

length / width / size of transect

or

number of transects

1

(c) (i) since squirrels mobile

or

squirrels could be counted twice

or

squirrels hide

1

(ii) any **two** from:
- numbers of larders observed likely to be lower than actual
do not accept squirrels share larders
or squirrels have more than one larder
- since unlikely that all could be spotted if 5 m away
- old larder
- squirrels moved on / died
- young squirrels
- haven't made a larder

2

(d) (i) 0 to 6.8

1

(ii) any **one** from:
do not accept squirrels prefer blue spruce
- squirrels prefer blue spruce cones / seeds / nuts as food
- <u>more</u> cones / food
- <u>more</u> nesting sites
- <u>fewer</u> predators / competitors

1

[8]

(a)   photosynthesis
                for 1 mark

                                                                                    1

(b)

*   grass eaten by rabbit

*   rabbit eaten by fox

*   carbon becomes part of fats/proteins in the fox's body

*   or passes along the chain as (carbohydrate) / fat / protein
        each for 1 mark
        [Do not accept 'carbon gets into fox's body', for third mark]

                                                                                    3

                                                                            [4]

Biodiversity

Biodiversity is the variety of all the different species of organisms on earth, or within an ecosystem. Great biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another for food, shelter and the maintenance of the physical environment.

The future of the human species on Earth relies on us maintaining a good level of biodiversity. Many human activities are reducing biodiversity an only recently have measures been taken to try to stop this reduction

Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on ecosystems and biodiversity. These include:

*   breeding programmes for endangered species.
*   Protection & regeneration of rare habitats
*   Reintroduction of field margins and hedgerows in agricultural areas where farmers only grow one crop
*   Reduction of deforestation and carbon dioxide emissions by some governments
*   Recycling resources rather than dumping waste in landfill.

Rapid growth in the human population and an increase in the standard of living mean that increasingly more resources are used and more waste is produced. Unless waste and chemical materials are properly handled more pollution will be caused. Pollution can occur:

*   In water, from sewage, fertiliser or toxic chemicals
*   In air, from moke and acidic gases
*   On land, from landfill and from toxic chemicals.

Pollution kills plants and animals which can reduce biodiversity.

Humans reduce the amount of land available for other animals and plants by building, quarrying (large scale removal of rocks/minerals), farming and dumping waste.

The destruction of peat bogs, and other areas of peat to produce garden compost reduces the area of this habitat and thus reduces the variety of different plant, animal and microorganism species that live there. The decay or burning of the peat releases carbon dioxide into the atmosphere.

Large scale deforestation in tropical areas has occurred to provide land for cattle and rice fields and to grow crops for biofuels.

Deforestation increases the amount of carbon dioxide in the atmosphere as there are less plants to remove carbon dioxide through photosynthesis and some of the land will be cleared by burning the forests which will release carbon dioxide into the atmosphere.

The increase in carbon dioxide and methane in the atmosphere has contributed to global warming. This increase in global temperatures is likely to lead to ice caps melting, increasing sea levels and significantly changing habitats. Changing temperature could also affect breeding, migration and food chains in a number of unpredictable ways.

pros e.g.:

gum trees survive therefore less soil erosion
therefore food webs not disrupted
if no culling, whole Koala population may die
easier to cull because Koalas are difficult to catch

cons e.g.:

Koala's 'right to life' / ethical issue
better to transfer to reserves on mainland than kill
could use tranquillisers to catch without killing
could allow population to stabilise naturally

    max 4 of the above; max 3 pros or cons.

[4]

(a)   snail
      or
      shrew
            additional incorrect answer negates correct answer
                                                                    1

(b)   shrew
            additional incorrect answer negates correct answer
                                                                    1

(c)   fewer shrews to eat them
                                                                    1

(d)   population
                                                                    1

Food Production

Food security means having enough food to feed a population. Biological factors which are threatening food security include:

- Increasing birth rates, causing population growth.

- New pests & pathogens that affect farming

- The cost of agricultural inputs (fertilisers, fuels, machinery, labour)

- Environmental change causing droughts, flood or unseasonal weather

- Conflicts (e.g. wars) which affect the availability of water and food

- Changing diets in developed countries increasing demand for already scarce food resources.

Intensive farming techniques increase the efficiency of food production by restricting energy transfer from food animals to the environment. In oceans or rivers fish may swim large distances to find food, migrate and are exposed to predators. In Fish farms the fish will be kept in a limited space, enclosed from predators and may be fed high protein food to increase growth rates and thus the potential output of the farm.

Battery farming of animals works in a similar way by restricting energy losses to the environment, however there are concerns about the ethics of intensive farming techniques with many people believing that the animals should be kept in better conditions with more room to lead a natural life.