15. Relationships of organisms with one another and with the environment

Content

15.1 Energy flow
15.2 Food chains and food webs
15.3 Carbon cycle
15.4 Nitrogen cycle
15.5 Parasitism
15.6 Effects of humans on the ecosystem
15.7 Pollution
15.8 Conservation

Learning outcomes

Candidates should be able to:

(a) state that the Sun is the principal source of energy input to biological systems
(b) describe the non-cyclical nature of energy flow
(c) define the following terms and establish the relationship of each in food webs:
• *producer* – an organism that makes its own organic nutrients, usually using energy from sunlight through photosynthesis
• *consumer* – an organism that gets its energy by feeding on other organisms
• *herbivore* – an animal that obtains its energy by eating plants
• *carnivore* – an animal that obtains its energy by eating other animals
• *decomposer* – an organism that obtains its energy from dead or waste organic matter
• *food chain* – a chart showing the flow of energy (food) from one organism to the next, beginning with the producer (e.g. mahogany tree → caterpillar → songbird → hawk)
(d) describe energy losses between trophic levels and infer the advantages of short food chains
(e) describe and interpret pyramids of numbers and of biomass
(f) describe and state the importance of the carbon cycle
(g) describe the nitrogen cycle in making available nitrogen for plant and animal protein, including the role of
bacteria in nitrogen fixation, decomposition and nitrification (details of denitrification and the names of individual bacteria are **not** required)
(h) understand the role of the mosquito as a vector of disease
(i) describe the malarial pathogen as an example of a parasite and describe the transmission and control of
the malarial pathogen (details of the life cycle of the pathogen are **not** required)
(j) describe the effects of humans on the ecosystem with emphasis on examples of international importance (tropical rainforests, oceans and important rivers)
(k) describe the consequences of deforestation in terms of its effects on soil stability, climate and local human populations
(l) evaluate the effects of:
water pollution by sewage, by inorganic waste and by nitrogen-containing fertilisers
air pollution by greenhouse gases (carbon dioxide and methane), contributing to global warming
air pollution by acidic gases (sulfur dioxide and oxides of nitrogen), contributing to acid rain
pollution due to insecticides
(m) discuss reasons for conservation of species with reference to maintenance of biodiversity, management
of fisheries and management of timber production
(n) discuss reasons for recycling materials, with reference to **named** examples.

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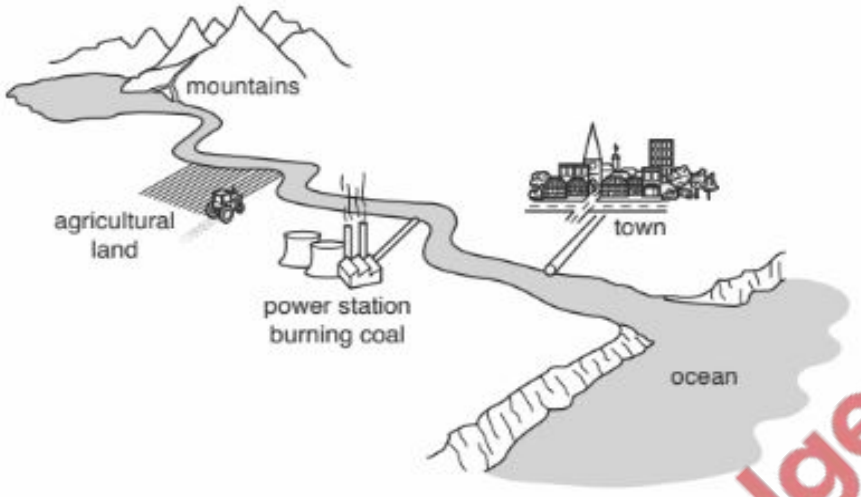
ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

O/N18/21/Q6

The diagram shows the location of several features close to a river that runs from mountains into the ocean.



(a) Describe and explain the possible harmful effects of human activity on the environment at each of the following locations:

the agricultural land, ...

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the power station. .....

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..... [6]

(b) Suggest ways in which people in the town could make changes to their activities in order to reduce the harmful impact that they have on the environment.

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..... [4]

[Total: 10]

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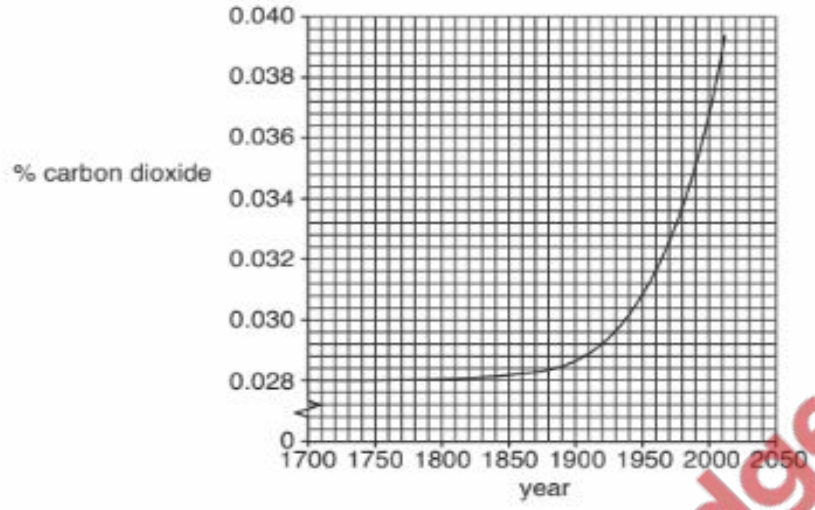
O/N18/22/Q6

The graph shows how the percentage of carbon dioxide in the atmosphere has changed since the year 1700.



(a) Explain how human activity is likely to have contributed to the change in the percentage of carbon dioxide.

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.....[5]

(b) Describe and evaluate the effects of this change in the percentage of carbon dioxide.

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.....[5]

[Total: 10]

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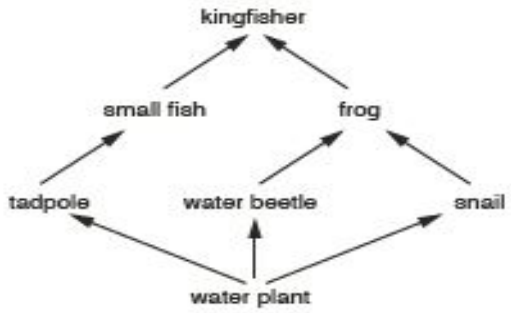
ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

M/J18/21/Q1

The diagram shows a food web in a pond.



(a) (i) Complete the table by writing the correct number of organisms for each statement about the food web. The first number has been written for you.

statement	number
the number of producers	1
the number of consumers	
the number of herbivores	
the number of carnivores	
the number of food chains	

[4]

(ii) Draw and label a pyramid of biomass for one food chain from the food web.

[2]

(b) The pond may become polluted by fertilisers containing nitrogen.

Explain how this pollution might affect the population of frogs in the pond.

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.....[4]

[Total: 10]

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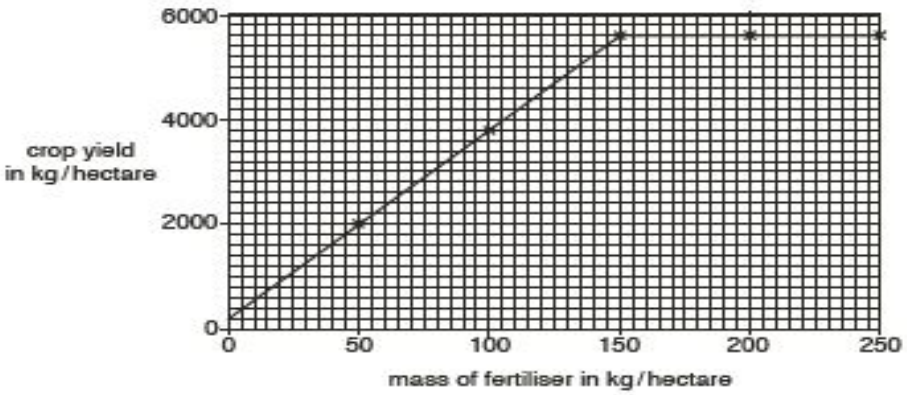
M/J18/22/Q4

The graph shows the effect on crop yield (amount harvested) of using fertilisers that contain nitrogen.



(a) (i) Use the information in the graph to describe the effect on crop yield of using an increasing mass of fertiliser.

.....

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.....[3]

(ii) The nitrogen in the fertiliser is in the form of nitrates.

Describe how the nitrogen in the fertiliser is absorbed by crop plants and used to give an increased yield.

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.....[3]

(iii) Suggest and explain why a farmer may decide to use a mass of fertiliser per hectare which is less than that needed for a maximum crop yield.

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.....[3]

(b) Name one type of mineral ion, other than nitrate, that is required by a plant and state its importance to the plant.

type of mineral ion .....

importance to plant .....

.....

[2]

[Total: 11]

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O/N17/21/Q3

Fig. 3.1 shows the flow of energy within a biological system.

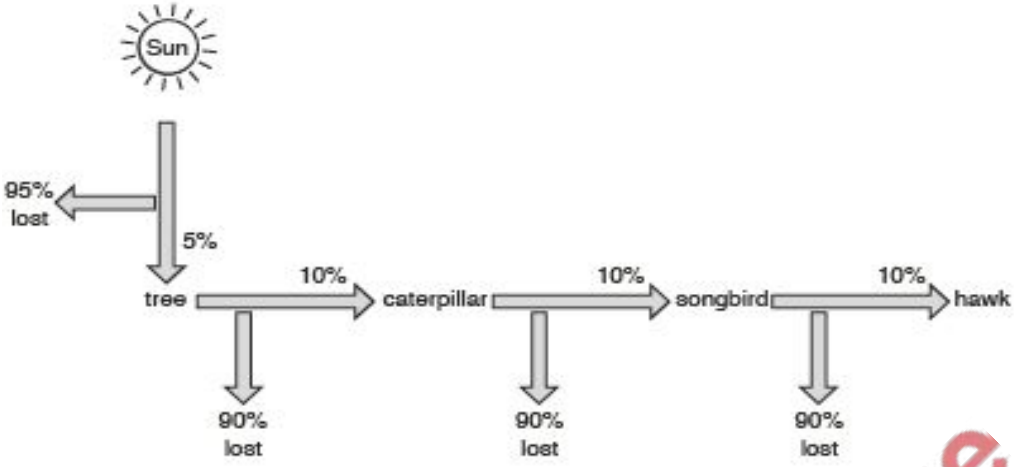

Fig. 3.1

(a) (i) Name the type of chart shown in Fig. 3.1.

.....

[1]

(ii) Name one example, shown in Fig. 3.1, of each of the following types of organism.

producer .....

carnivore .....

[2]

(b) (i) Suggest why only 5% of the energy from the Sun passes to the tree.

.....

.....

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.....[2]

(ii) Describe how energy is lost between the songbird and the hawk.

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.....[3]

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(c) Fig. 3.2 shows two possible uses of the same area of land to produce food.

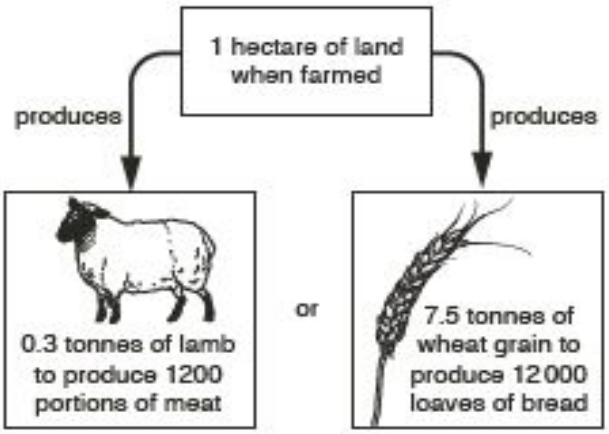

Fig. 3.2

Use the information in Fig. 3.1 and Fig. 3.2, and your own knowledge, to explain why it is possible to feed a greater number of people if the area of land is used to farm crops rather than to farm animals.

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.....[5]

[Total: 13]

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O/N17/22/Q4

4 Fig. 4.1 shows the relationships between a number of organisms living together in a South American rainforest.

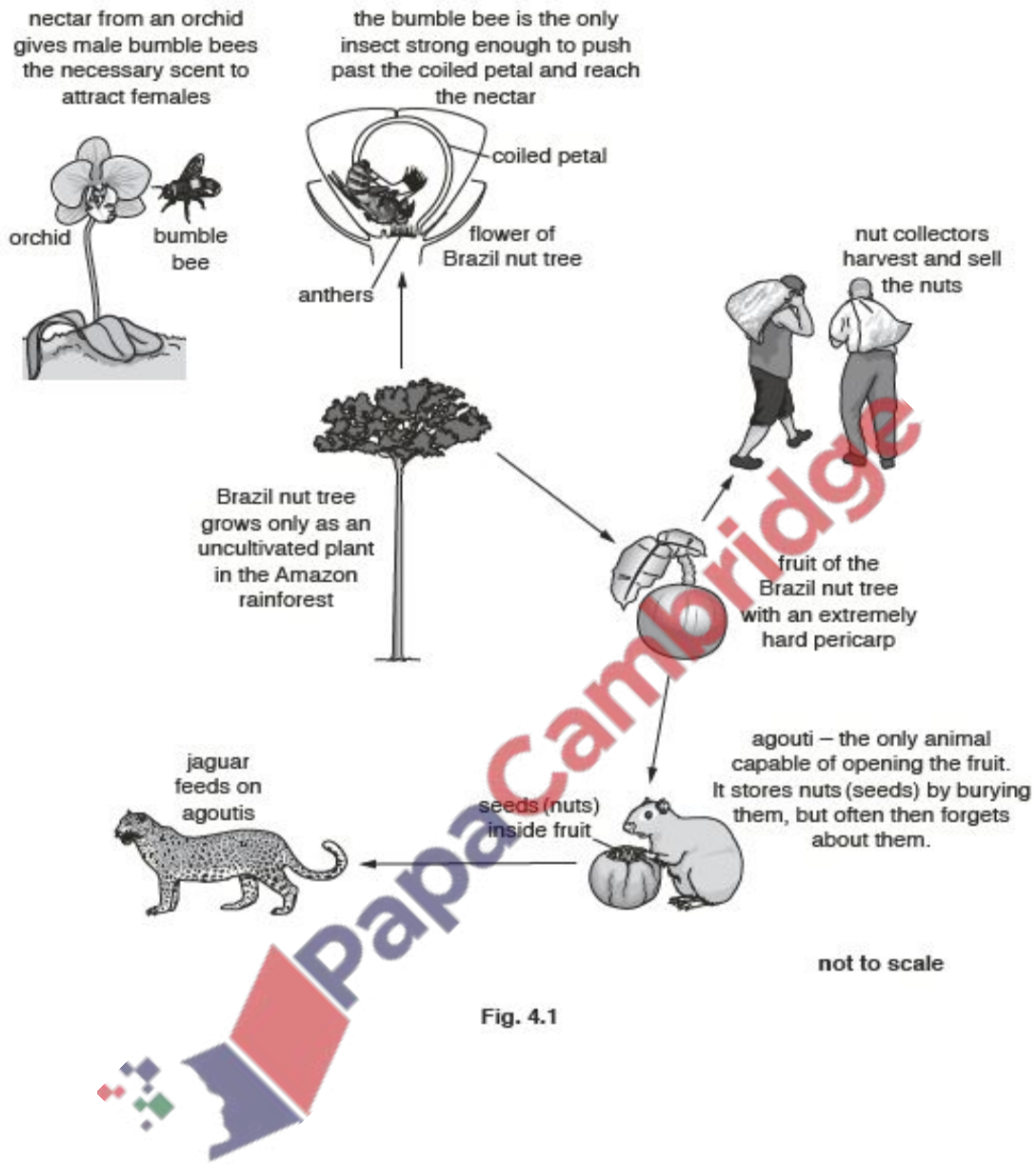

Fig. 4.1

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(a) Fig. 4.2 is an incomplete food web for these organisms. Complete Fig. 4.2 by:

- writing the name of an organism in each box,
- completing the arrows to show the flow of energy.

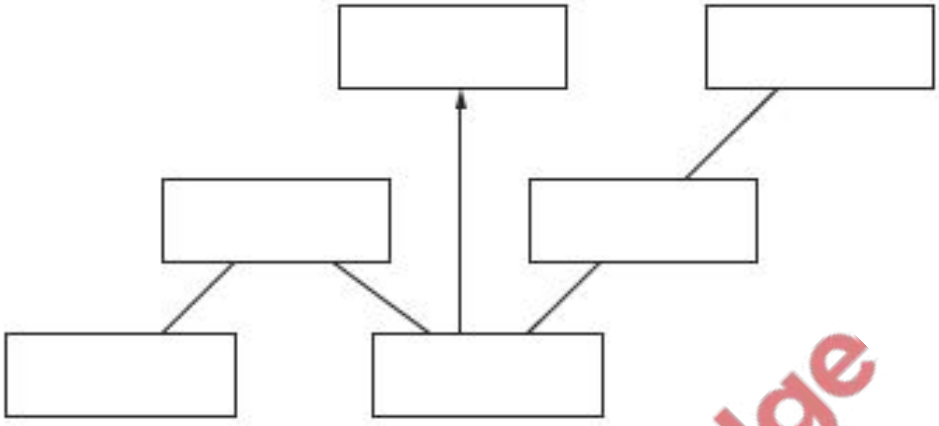

Fig. 4.2

[4]

(b) Name the type of seed dispersal found in the Brazil nut tree. Give a reason for your answer.

.....

.....[2]

(c) Suggest the possible effects on the community in the rainforest if the orchids were killed by disease.

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.....[6]

[Total: 12]

PapaCambridge

M/J17/22/Q8

This is a simple food chain:

tree → insect → bird → fox

(a) Draw and label a pyramid of biomass for this food chain.

[2]

(b) Explain why only a small proportion of the energy in the insects passes to the birds.

.....

.....

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.....

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.....[4]

(c) The foxes are infested with fleas (small, blood-sucking insects).

Draw and label a pyramid of numbers for the complete food chain **including** the fleas.

[4]

[Total: 10]

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M/J17/22/Q9

(a) Explain the measures taken, excluding the use of drugs, to reduce the spread of malaria.

[6]

(b) Quinine was the only drug that was successfully used to protect against malaria until the 1920s.

Suggest why quinine has largely been replaced by more recently-discovered drugs.

[4]

[Total: 10]

PapaCambridge

O/N16/21/Q9

(a) Discuss reasons for the conservation of species with reference to the management of fisheries.

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..... [4]

(b) Describe the consequences of deforestation.

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..... [6]

[Total: 10]

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ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

O/N16/22/Q5

Sweet clover is a member of the pea and bean family (leguminous plants) that grows amongst grass in fields used for cattle feed.

(a) Explain how sweet clover can improve the soil in which it grows.

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.....

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.....[2]

(b) As sweet clover dries, fungi that grow on it produce a chemical (dicoumarol) that prevents blood from clotting.

Suggest a protein that cattle which eat sweet clover affected by such fungi might be unable to produce.

..... [1]

(c) Dicoumarol has been used for many years as a constituent in a form of rat poison.
Fig. 5.1 shows the change in the LD_{50} for dicoumarol in rats from 2000 to 2015.
The LD_{50} is a measure of the amount of poison that will kill 50% of the rats that consume it.

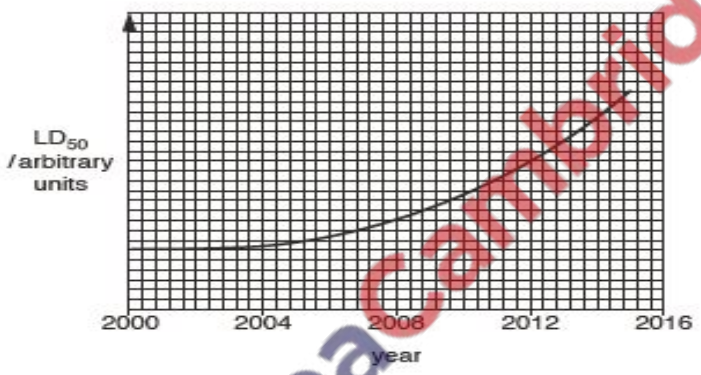

Fig. 5.1

PapaCambridge

(i) Describe the change in the LD_{50} for dicoumarol in rats from 2000 to 2015.

.....

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.....

.....[2]

(ii) Suggest an explanation for the change you have described.

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.....[4]

[Total: 9]

M/J16/21/Q5

Malaria is a disease caused by a parasite that is transmitted from one person to another by a vector.

(a) Name the vector of the parasite that causes malaria.

..... [1]

(b) **(i)** Spread of the vector may be controlled by using an insecticide.

State **two** other ways of controlling the spread of the vector.

1 .....

.....

2 .....

..... [2]

(ii) Resistance to the insecticide can appear in the vector population.

Describe how the process of natural selection may bring about resistance of the vector to insecticide.

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..... [4]

[Total: 7]

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M/J16/21/Q7

(a) Describe how the nitrogen cycle makes nitrogen in the air available for both plant and animal protein.

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..... [5]

(b) Nitrogen can also be made available in the form of nitrogen-containing fertilisers. Describe the possible effects of using nitrogen-containing fertilisers on each of the following:

the production of crops by farmers,

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the environment.

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..... [5]

[Total: 10]

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ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

O/N15/22/Q2

Fig. 2.1 shows a sloth. The sloth is a mammal that lives in the trees of the South American rainforests.

Fig. 2.1

Sloths have the following features:

- They are extremely slow moving.
- Some tear leaves from trees using their lips and the teeth at the back of their mouths.
- They have no front teeth.
- They climb down the tree to deposit their faeces in a hole they dig near the foot of the tree.
- They lose over a quarter of their body weight when they defaecate, which may be once every 6–8 days.
- Their fur is often green since it contains single-celled, plant-like organisms (algae).
- Their fur also contains blood-sucking mosquitoes and many small animals such as adult moths that feed on the algae and on the hair of the sloth.
- Moths lay their eggs in the faeces of the sloth on which the moth larvae feed.
- The major predators of the sloth are jungle cats and the harpy eagle.

(a) The structure and functions of the regions of the sloth's alimentary canal are generally similar to those of a human.

(i) Suggest which type of front teeth are likely to be absent in the mouth of the sloth.

.....[1]

(ii) One region of the sloth's alimentary canal is proportionally much larger than the same part in humans. Suggest which part and give a reason for your answer.

part .....

reason .....

.....

.....[2]

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(b) Complete the food web in Fig. 2.2 to show the feeding relationships of the organisms mentioned on page 4.

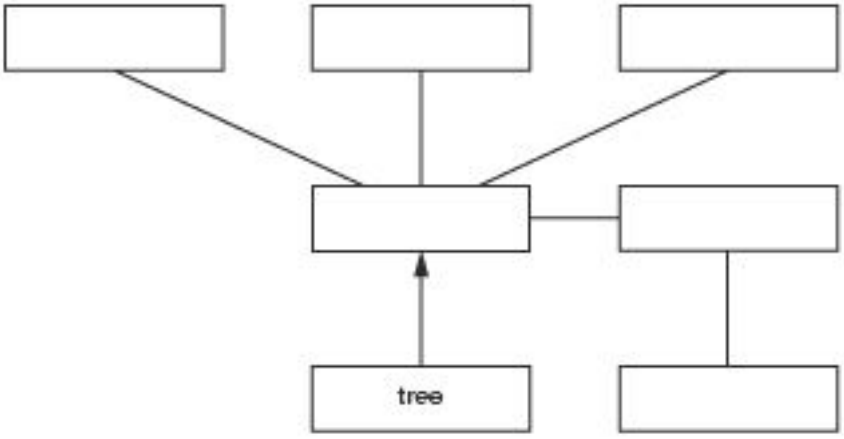

Fig. 2.2

[4]

(c) Suggest and explain an advantage to the slothe of each of the following:

(I) the algae that live in their fur

.....

.....

.....

.....[2]

(II) burying their faeces at the foot of the trees in which they live.

.....

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.....[3]

[Total: 12]

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O/N15/22/Q5

Fig. 5.1 shows some human activities that have an effect on the environment.

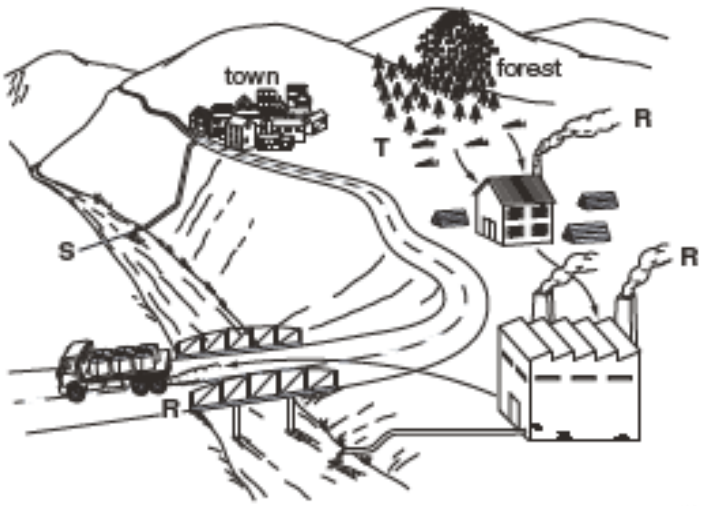

Fig. 5.1

(a) Name **two** gases, other than carbon dioxide, released at R that are harmful to the environment. For each gas, state the harm that it causes.

gas 1 .....

harm caused .....

.....

gas 2 .....

harm caused .....

.....[4]

(b) Explain how recycling could prevent the damage caused to the environment at S and T.

at S .....

.....

.....

at T .....

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.....[3]

[Total: 7]

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M/J15/21/Q5

Fig. 5.1 shows some of the interactions that take place in an aquatic ecosystem.

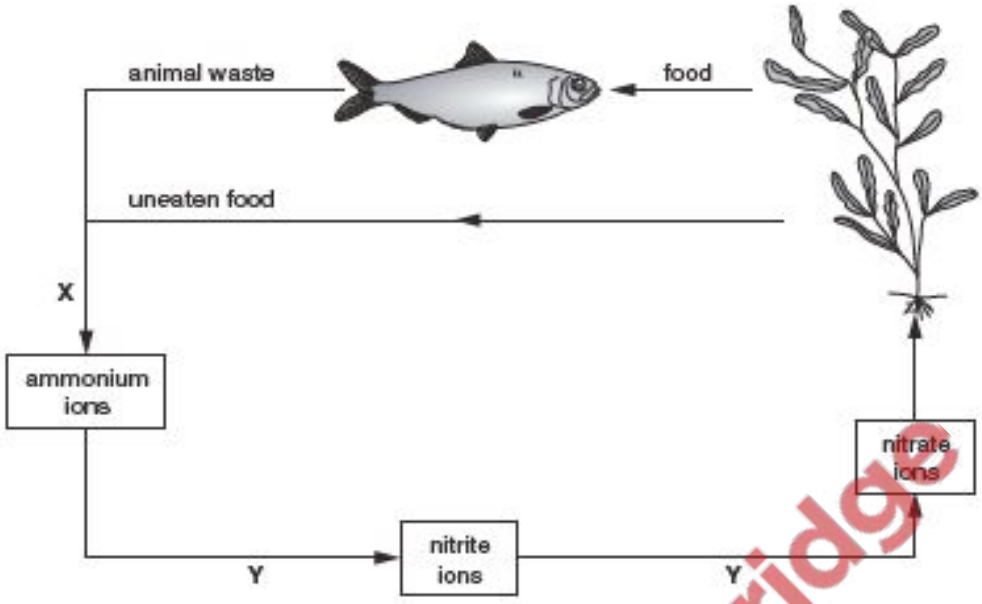

Fig. 5.1

(a) (I) Use the information in Fig. 5.1 to state each of the following:

the trophic level of the aquatic plant

.....

the trophic level of the fish

.....

the chemical element being cycled in this ecosystem.

..... [3]

(II) Explain **one** way, other than for food, that the fish may depend on the aquatic plant.

.....

.....

.....

..... [2]

(b) (I) Name each of the processes represented by the letters **X** and **Y**.

process **X** .....

process **Y** ..... [2]

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(II) Name **one** type of microorganism that will carry out **both** process **X** and process **Y**.

..... [1]

(III) Explain how aquatic plants take up nitrate ions from their surroundings.

.....

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..... [3]

(c) Suggest what effect pollution by nitrogen-containing fertilisers might have on this ecosystem.

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..... [2]

[Total: 13]

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ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

O/N14/22/Q8

(a) (I) Give an example of a food chain involving **four** named organisms.

(II) Draw and label a pyramid of numbers for your food chain.

[4]

(b) Explain how energy is lost along a food chain.

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..... [6]

[Total: 10]

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ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

M/J14/21/Q5

Fig. 5.1 shows a food chain.

Fig. 5.1

(a) (I) Name the trophic level of each of the following organisms in the food chain shown in Fig. 5.1.

tree .....

caterpillar..... [2]

(II) In the space below, draw a pyramid of biomass for the food chain shown in Fig. 5.1. Label each of the trophic levels.

[2]

(III) Describe how the pyramid of numbers for the food chain shown in Fig. 5.1 would differ from the pyramid of biomass. Give an explanation for your answer.

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.....

.....

.....[2]

(b) Some farmers keep animals that they will sell for people to eat. Suggest why these farmers may restrict the activity of these animals and keep the surrounding temperature close to the body temperature of the animals.

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.....[4]

[Total: 10]

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O/N13/21/Q4

Fig. 4.1 shows a field near an industrial site.

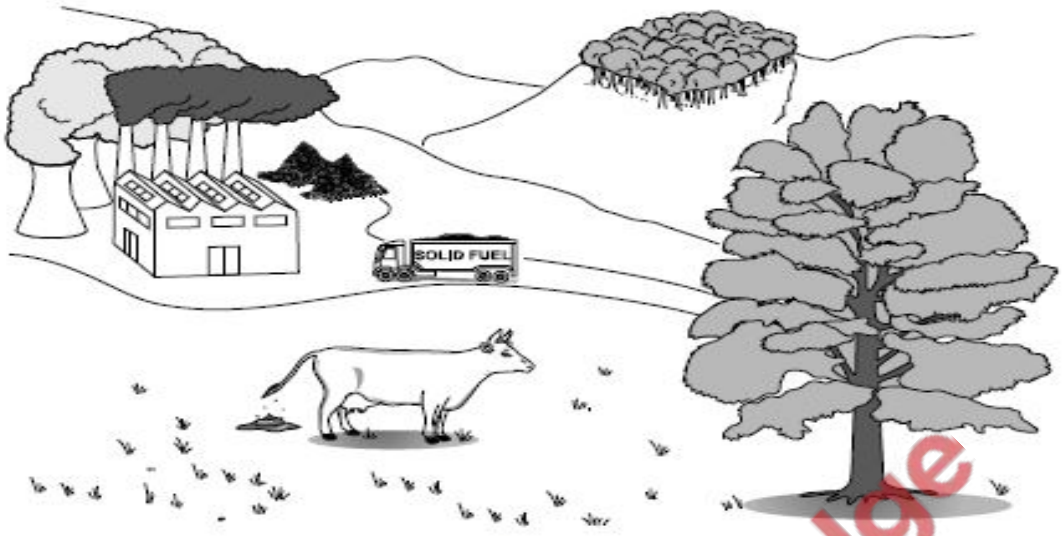

Fig. 4.1

(a) State **two** products released from the factory into the air, that form part of the carbon cycle.

1 .....

2 ..... [2]

(b) Suggest the part played by the trees and the grass in the recycling of water.

.....

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.....

..... [3]

(c) Suggest how the cow and the factory are involved in returning nitrates to the soil.

the cow .....

.....

.....

.....

.....

the factory .....

.....

.....

.....

..... [4]

[Total: 9]

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O/N13/21/Q9

(a) Describe how pyramids of numbers differ from pyramids of biomass.

.....

.....

.....

.....

.....

.....

.....

.....[3]

(b) Describe the ways in which energy is gained and lost between members of a food chain.

energy gained .....

.....

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.....

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energy lost .....

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.....[7]

[Total: 10]

PapaCambridge

M/J13/21/Q9

(a) Malaria is a disease caused by a parasite called *Plasmodium*. The mosquito is the vector of this parasite.

Define the terms *parasite* and *vector*.

parasite

.....

.....

.....

.....

vector

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[4]

(b) Explain how the spread of malaria may be controlled. Refer to **both** *Plasmodium* and the mosquito in your answer.

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.....[6]

[Total: 10]

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ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

O/N12/22/Q9

(a) Explain what is shown by a pyramid of biomass.

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.....[6]

(b) Explain how, for the same organisms, a pyramid of numbers can differ from a pyramid of biomass.

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.....[4]

[Total: 10]

PapaCambridge

M/J12/21/Q8

(a) Describe ways in which farmers can reduce the risk of water pollution.

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..... [5]

(b) With reference to **named** examples, describe the reasons for recycling materials.

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..... [5]

[Total: 10]

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M/J12/22/Q7

(a) Explain what is meant by the term *pyramid of numbers*.

[4]

(b) Explain the fact that energy flow is non-cyclical.

[6]

[Total: 10]

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O/N11/21/Q4

Fig. 4.1 shows the percentage of plants surviving over many thousands of years. During that time, the environment was becoming drier.

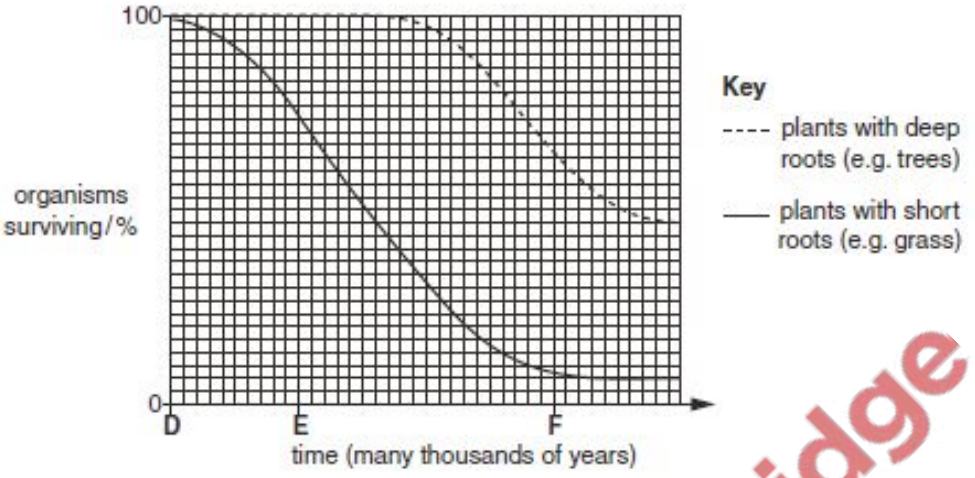

Fig. 4.1

(a) Explain why the number of grass plants is declining more rapidly than the trees at time **E**.

.....

.....

.....

.....[4]

(b) Explain why the variety of types of herbivore was greatest at time **D**.

.....

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.....[2]

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Fig. 4.2 shows the lengths of the necks of a particular species of herbivore at times **E** and **F**.

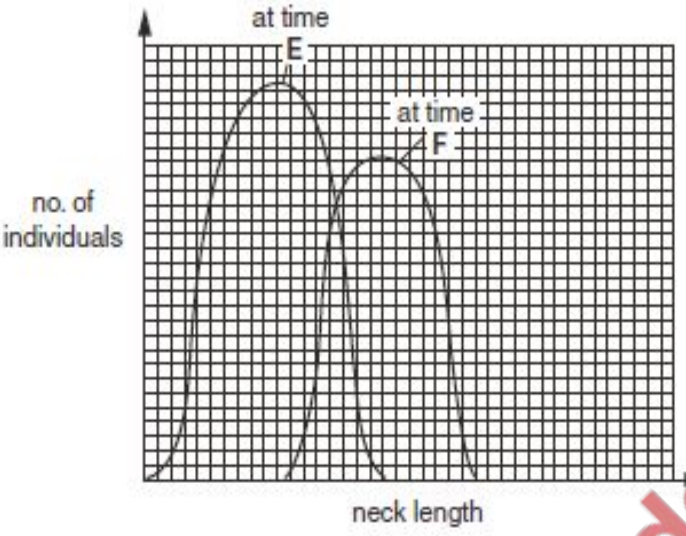

Fig. 4.2

(c) (i) Describe what the graph shows about the herbivores at time **F** compared with those at time **E**.

.....

.....

.....[2]

(ii) Suggest an explanation for the change in neck length of the herbivore between times **E** and **F**.

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.....[1]

[Total: 9]

PapaCambridge

M/J11/21/Q7

(a) Describe how processes that occur in a green leaf play a part in the carbon cycle.

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.....[7]

(b) Explain why varying the light intensity does not always alter the rate of photosynthesis in a plant.

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.....[3]

[Total: 10]

PapaCambridge

M/J11/22/Q3

Fig. 3.1 shows energy flow in a habitat.

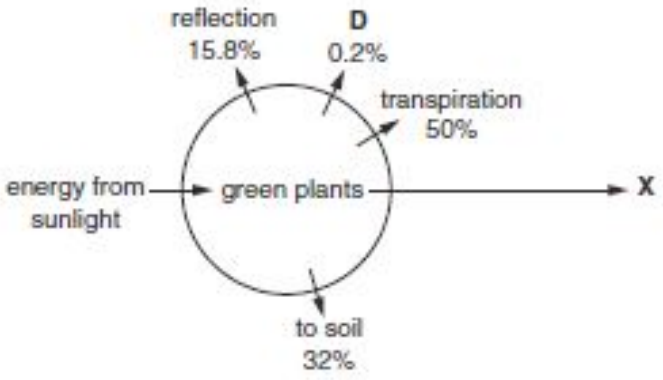

Fig. 3.1

(a) (I) Suggest the identity of **X** in Fig. 3.1. .....[1]

(II) State the form in which energy passes from the green plants to **X**.

.....[1]

(III) Calculate the percentage of energy passing to **X**.

.....[1]

(b) State the name of the process **D** in Fig. 3.1 .....[1]

(c) (I) Describe how energy passes into the soil and is then released.

.....

.....

.....

.....

.....[3]

(II) Suggest how the release of this energy is useful to seeds in the soil.

.....

.....

.....

.....[2]

[Total: 9]

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ECOSYSTEM AND THE ENVIRONMENT P2 QUESTIONS

Mark schemes will use these abbreviations:

; separates marking points

/ alternatives

() contents of brackets are not required but should be implied

R reject

A accept (for answers correctly cued by the question, or guidance for examiners)

Ig ignore (for incorrect but irrelevant responses)

AW alternative wording (where responses vary more than usual)

AVP alternative valid point (where a greater than usual variety of responses is expected)

ORA or reverse argument

underline actual word underlined must be used by candidate

+ statements on both sides of the

+ are needed for that mark

O/N18/21/Q6

6(a) (agricultural land) max 4 marks from

insecticides / pesticides / fertilisers ;

into river / ocean / water ;

eutrophication AW ;

contamination of drinking water ;

soil erosion / leaching / run-off ;

* burning

+ fossil fuels / named fossil fuel ;

* release of carbon dioxide / monoxide ;

* global warming / greenhouse effect or gas ;

* death of river or marine life ;

(power station) max 4 marks from

* burning

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+ fossil fuels / named fossil fuel ;

* release of carbon dioxide / monoxide ;

* global warming / greenhouse effect or gas ;

* death of river or marine life ;

release of sulfur dioxide / oxides of nitrogen ;

acid rain ;

increase in water temperature ;

* A once only for agricultural land or power

station

6(b) reduce / recycle / re-use ;

max 3 marks from list of examples

glass / metal / plastic / water / fishing / use of cars or catalytic converters /

effluent / carrier bags / greenhouse emissions / fossil fuels / oil / sewage / plant

trees / renewable energy ;

O/N18/22/Q6

6(a) rise in population ;

any named human invention requiring an energy supply ;

burning / combustion ;

fossil fuels / coal / oil / gas ;

production / release+ of carbon dioxide ;

deforestation / fewer trees / fewer plants ;

less / no+ absorption / uptake / use

+ of carbon dioxide ;

less / no+ photosynthesis ;

decomposition / decay ;respiration

6(b) greenhouse+ gas / effect ;global warming ;any three further marks from:

• extreme weather AW / flood / drought / storms AW / heat waves ;

• loss of+ homes / habitat / life / crops / land / soil / food / income ;

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• ice melting ;

• rise in sea levels ;

• migration ;

• invasive species more successful ;

• extinction ;

• water AW

+ warms / changed currents / acidified / oxygen depletion ;

• hanged distribution

+ disease / vectors of disease (e.g. mosquito) ;

M/J18/21/Q1

1(a)(i) (1)
6 **;**
3 **;**
3 **;**
3 **;**
4
1(a)(ii) correct shape **;**
correct labels **;**
2
1(b)
more plants / growth of plants / more leaves / algal bloom **AW ;**
eutrophication **;**
reference to nitrate production for
protein **;**
decomposition **/** O_2 used **or**
respiration by bacteria **;**
more food for water beetle / snail **;** less food for water beetle / snail **;**
more food for frogs **;** less food for frogs **;**
population of frogs increases **;** population of frogs decreases **;**
4

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M/J18/22/Q4

4(a)(i) **1** no fertiliser **+** yield is 200 (kg / hectare crop yield) **;**
2 increased / more crop yield **;**
3 reference to 150 (kg / hectare fertiliser) **or** 5600 (kg / hectare crop yield) **;**
4 high fertiliser / above 150 **+** no increase in crop yield **;**
3
4(a)(ii) **1** root hair **;**

2 active transport / against concentration gradient / diffusion / down concentration gradient **;**
3 production **AW** of **+** amino acids / protein **;**
4 increased **AW +** growth **;**
3
4(a)(iii) **1** run-off / leaching **AW ;**
2 eutrophication **or** correct description of process **;**
3 harm to animals **;**
4 high cost / expensive **;**
5 possible economic return not beneficial over increased cost **AW ;**
3
A harm to named animal / 'aquatic life'

O/N17/21/Q3

3(a)(i) food chain **; 1**
3(a)(ii) tree **;**
songbird / hawk **;**
2 A named tree
3(b)(i) doesn't hit leaves / tree **OR** intercepted by other objects **;**
reflected (off leaves) **;**
not used in photosynthesis **;**
2
3(b)(ii) movement / flight **;**
excretion **;**
egestion / faeces **;**
sound / singing **;**
heat / maintaining body temp / warm blooded **;**
respiration **;**
hawk doesn't eat / digest all of songbird(s) **OR**
songbird(s) decay(s) **;**
3
3(c) more food produced **;**
comparative data manipulation **;**
fewer levels in food chain **AW ;**
correct reference to herbivore / carnivore **+** human **;**
correct reference to primary / secondary **+** consumer **;**
less energy lost / more efficient **;**
example of energy not lost (e.g. through movement) **ORA ;**
5 A quote from Fig. 3.2 (e.g. 12 000 loaves vs. 1200 portions of meat)
A 25· more mass / 10· more food products (for wheat)

O/N17/22/Q4

4(a) **Top line** (LHS) humans **AW** / nut collectors **+** (RHS) jaguars **;**
Middle line (LHS) bees **+** (RHS) agoutis **;**
Lower line (LHS) orchids **+** (RHS) (brazil nut) tree **;**
4 four arrow heads drawn **+** all pointing upwards **;**
4 A singular or plural for all names
LHS = Left Hand Side
RHS = Right Hand Side
Ig contents of boxes for point **4**
4(b) animal **;**

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agoutis / humans **AW** / nut collectors **;**
2
4(c) **1** less nectar **;**
2 male bees **+** lack scent **;**
3 female bees **+** not attracted **;**
4 less reproduction of bees **;**
5 less pollination **+** of trees **;**
6 less trees **;**
7 less nut / fruit production **;**
8 loss of jobs (for humans) / negative economic impact **AW ;**
9 less food for agoutis **;**
10 death / reduced population **+** of agoutis **OR** agoutis seek other food **;**
11 less food for jaguars **;**
12 death / reduced population **+** of jaguars **OR** jaguars seek other food **;**

M/J17/22/Q8

8(a) standard pyramid shape with 4 levels **;**
correctly labelled 'tree' **+** 'insect' **+** 'bird' **+** 'fox' **;**
2
8(b) **1** not all insects / not all parts of insect **+** eaten (by birds) **;**
2 (therefore) energy remains in insects (not eaten) **;**
3 not all parts of insect digested / some lost as faeces / egested (by birds) **;**
4 (insects) release **AW** energy in respiration **;**
any **two** uses of energy (by insects) from the following:
5 (electrical) impulses **;**
6 active transport **;**
7 movement / muscle contraction **;**
8 heat (production / loss) **;**
4
8(c) **1** pyramid with 5 levels **+** 'flea' level at top **;**
2 'flea' level larger than **+** immediately above 'fox' level **;**
3 'fox' level smaller than **+** immediately above 'bird' level **;**
4 'bird' level smaller than **+** immediately above 'insect' level **;**
5 'tree' level at bottom **+** of smallest width **;**
4 each level referred to in a marking point
must be labelled to gain credit

M/J17/22/Q9

9(a) (to discourage insects from biting)
1 insect repellent **;**
2 long-(sleeved) clothes **;**
3 nets on / close **+** doors / windows **;**
4 nets **+** over beds / while sleeping **;**
5 paint walls white **;**
(to kill insects / mosquitoes)
6 insecticides / pesticides / reference to fogging / electric insect killer **;**
7* mosquito coils **;**
8 irradiated / sterile male mosquitoes **;**
(to prevent mosquitoes laying eggs / reproducing **OR** to kill larvae)
9 drain ponds / remove stagnant **AW** water / use closed water tanks **;**

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10 (spray) oil / insecticide on ponds **;**
11 stock ponds / lakes with fish **;**
12 use of Bti / *Bacillus thuringiensis (israelensis)* **;**
6
9(b) **1** exposure to / used for **+** a long time / years / decades **;**
2 mutation **;**
3 natural selection **;**
4 resistance (to quinine) **;**
5 (quinine) no longer as effective / recent drugs more effective **;**
6 reference to plasmodium / parasite **;**
7 new drugs cheaper / more easily available / fewer side effects **;**

O/N16/21/Q9

9(a) (to maintain) food stocks (of that species) **;**
farming / maintaining a particular species **;**
provides employment / for financial benefit **AW ;**
reference to maintenance of
biodiversity **/** interrelationship between organisms **;**
reduction in over-fishing of particular species in the
wild **;**
prevent extinction **;**
for re-stocking natural
populations / sustainability / continuity of availability of
supply **;**

9(b) fewer trees **;**
less photosynthesis **;**
less carbon dioxide absorbed / more carbon dioxide
remains in atmosphere **;**
(carbon dioxide is a) greenhouse gas **;**
global warming / correct named outcome of global
warming **;**
less oxygen produced (by photosynthesis) **;**
destruction of habitat / species extinction **;**
loss of soil stability / erosion / leaching **;**
effect on water cycle **;**
adverse effect on recreation value of forest **;**
effect on local human population **;**
medicinal value of plant species **;**
6
A greenhouse effect
e.g. sea levels rise / ice caps melt
e.g. desertification
e.g. loss of homes / loss of employment
Total: 10

O/N16/22/Q5

5(a) 1 bacteria (or correctly named) **+** roots / nodules **;**
2 fix / convert / turn **+** nitrogen **;**
3 ploughing / digging into soil **;**
4 decay / decompose **;**
5 (which produces) nitrates / nitrites / ammonium **;**
2

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Ig ammonia
5(b) fibrinogen / fibrin **; 1 A** thrombin / prothrombin / (pro)thrombokinase / factor VIII
5(c)(i) increase **;**
no change **+** (from 2000) to 2002 / 3 / 4 / first 2 years / first 3 years / first four years **;**
exponential or described / more quickly **AW ;**
2
5(c)(ii) 1 mutation / change / variation **;**
2 reference to genes / DNA **;**
3 resistance (to poison) / better adapted **;**
4 survival **;**
5 breeding / reproduction / produce offspring **;**
6 natural selection / evolution **;**
7 greater amount (of dicoumarol) now required to kill / used to kill / the LD_{50} must be increased **;**

M/J16/21/Q5

5 (a) mosquito / Anopheles ; [1]
(b) (i) drain swamps / prevent stagnation of water AW ;
add oil on water ;
reference to biological control / fish or bacteria into ponds ;
release irradiated males ;
[max 2]
(ii) (resistant) reproduce ;
reference to (resistant) allele / gene ;
inherited / passed on ;
reference to repetition over many generations ;
(resistant) become more common ;
reference to evolution ;
A ORA for each marking point [max 4]
[Total: 7]

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M/J16/21/Q7

7 (a) fix / convert / change / turn (nitrogen in air) ;
reference to lightning ;
reference to bacteria ;
legumes (peas / beans) / root nodules ;
to ammonium ;
to nitrates ;
(nitrates) absorbed + by plants ;
reference to amino acids (in either plants or animals) ;
plants + eaten by animals ;
protein digested (in animals) ;
[max 5]

(b) production of crops:
increases / increased yield ;
(due to) improved growth ;
increased profit / AW ;
environment:
reference to positive effect on
environment e.g. more
photosynthesis reduces
CO_2 / increases O_2 / more wild
plants for insects ;
growth of weeds ;
leaching (into water sources)
AW ;
eutrophication or process
described ;
death of aquatic life ;
possible contamination / pollution
of (drinking) water ;
[max 5]
[Total: 10]

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O/N15/22/Q2

Question Expected Answer Mark Additional guidance
2 (a) (i) incisors / canines ; [1]
(ii)
rectum / colon / large intestine ;
stores faeces / infrequent defaecation AW ;
OR
stomach ;
storing food (ref. defaecation every 6-8 days) ;
OR
ileum / small intestine ;
slower digestion ; [2]
max 1 mark if function does not
match structure
(b) top: harpy / eagle + (jungle) cat + mosquito ;
middle: sloth (left) + moth (right) ;
bottom: (tree) + algae ;
any 4 arrow heads correct ;
[4]
in any order
(c) (i) camouflage / less easily seen ;
so not eaten / escape predators (or named) AW ;
slow moving / cannot escape quickly ; [max 2]
I insulation, source of nutrition
(ii) faeces decay / decompose / broken down / act as fertiliser ;

ions / CO_2 / salts (or named) / nutrients / minerals ;
absorbed by tree / plant ;
used by tree (e.g. growth) ;
provides food / habitat for sloth ;
to hide faeces from predators ; [max 3]
[Total: 12]

O/N15/22/Q55 (a)

any 2 from :
oxides of sulfur ;
acid rain ;
OR
oxides of nitrogen ;
acid rain / greenhouse gas / ref. global warming ;
OR
carbon monoxide ;
effect on O_2 carriage by blood AW / greenhouse gas /
ref. global warming ;
breathing difficulties (related to any correct gas) ; [max 4]
I CFCs, hydrocarbons (methane),
ozone, chlorine
R harm caused if gas incorrect
A plausible harm caused if no gas
named
(b) (S)
recycling of water AW ;
sewage treatment / water treatment / use as fertliliser / use in an
anaerobic digester ;
reduce amount of pollutants entering water ;
prevention of disease / eutrophication / death of or harm to organisms ;
(T)
recycling of paper / tree-based products ;
prevents deforestation ;
prevents named consequence of deforestation e.g. soil erosion,
flooding ;
fewer harmful emissions / less air pollution ;
[max 3]
max 2 marks available for either S
or T
[Total: 7]

M/J15/21/Q5

5 (a) (i) producer / 1st / 1 ;
(primary) consumer / herbivore / 2nd / 2 ;
nitrogen / N ;
[3]
(ii) plant releases oxygen ;
fish uses this (oxygen) for (aerobic)
respiration ;
lay eggs on weed / provides
cover / nesting ;
appropriate explanation for above
point ;

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[max 2]

Question Expected answers Additional guidance Marks
(b) (i) (X) decomposition ;
(Y) nitrification ;
Ig excretion
A ammonification
[2]
(ii) bacteria ; R named bacteria [1]
(iii) active transport ;
ref. use of energy (if active transport
given) ;
diffusion ;
correct ref. concentration gradient ;
ref. roots ;
[max 3]
(c) eutrophication ;
better growth of plants ;
more food for fish ;
increased decay (of plants / waste
products of fish) ;
increased numbers of bacteria ;
more oxygen used / ref. (bacteria)
respiration ;
ref. death of fish / animals ;

O/N14/22/Q8

8 (a) (i) starting with a producer ;
plausible food chain with 3 consumers + arrows in correct direction ;
[max. 4]
I ref to the Sun
(ii) labelled pyramid with organisms named in food chain ;
in correct order with named producer labelled at bottom ;
pyramid of correct proportions for given food chain ;
(b) some organisms / parts remain uneaten ;
energy lost in faeces / undigested food ;
urine / excretory products / excretion ;
respiration ;
energy lost as heat ;
homeostasis / named example ;
in movement / muscular contraction (or any e.g. of same) ;
in nervous impulses ;
catabolic reactions / named ;
active transport ;
ref. decomposition / decay
[max. 6]

M/J14/21/Q5

5 (a) (i) tree: producer / 1st / 1 ;

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caterpillar: (primary / 1st order) consumer / herbivore / 2nd / 2 ;
[2]
(ii) correct shape ;
correctly labelled with names of organisms / trophic levels ;
[2]
(iii) base (of pyramid) narrower / correct shape drawn ;
ref. relative numbers of consumers ;
one tree ;
[2] A labelled on diagram
(b) Accept reverse arguments for marking points.
less energy required ;
to raise body temperature / keep body warm /
thermoregulation ;
ref. movement ;
ref. less muscle activity/use ;
ref. respiration ;
more energy available + increase biomass/grow ;
(farmer) increased productivity / profit / lower feeding costs /
(consumer) lower cost to buy ;
[4] Ig ref to predators / disease
Ig ref. energy production
animals grow faster AW
Total [10]

O/N13/21/Q4

4 (a) Carbon dioxide / CO_2;
carbon monoxide / CO;
soot / particulates / carbon;
[max 2]
(b) water present in soil;
absorbed by root;
ref xylem;
lost to atmosphere + from leaves / aerial parts
or ref to evaporation / transpiration / diffusion ;
released / produced from respiration (or described);
[max 3]
A ground, ref to water table
A forms clouds AW + water vapour
released
(c) (the cow)
excretion;
urea;
ref to faeces ;
decomposition
ref to nitrification;
(max.3)
(the factory)
oxides of nitrogen or named;
dissolved (in rainwater) / ref to acid rain ;
[max 4]
A other named nitrogen excretory
products. I urine
A forms ammonia , nitrite, nitrate
I names of bacteria

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R refs to denitrification and
nitrogen fixation
[Total 9]

O/N13/21/Q9

9 (a) ref. to an ecosystem / food chain / web;
total number v. total mass of organisms (at each trophic level);
biomass pyramids usually pyramid-shaped;
numbers pyramids variable in shape
pyramid of numbers takes no account of size/mass of organism) AW;
[max 3]
A on a diagram with all trophic levels credibly named.
A clear diagrams with correct shape
A clear diagrams with nonpyramidal shape
(b) (energy gained)
by photosynthesis in plants / producers;
from (sun)light;
correct ref. light energy + chemical energy;
eaten by animals;
named food molecule consumed AW;
(energy lost)
as heat;
electrical / nerve impulses;
growth / reproduction;
movement / muscle contraction;
excretion;
[max 7]
[Total 10]

M/J13/21/Q9

9 (a)
parasite:
(an organism) that grows / feeds on or in;
another organism/host;
harms its host;
vector:

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(an animal that) transmits a pathogen / named ;
from one host A/W to another;
[max 4]
Reject "lives off"
(b) take an anti-malaria drug ;
(control of mosquito vector)
kill the mosquito ;
mosquito coils ;
insecticides ;
long lasting chemical sprays ;
screens / nets (bed) ;
repellent spray / DEET on skin ;
clothing + to cover skin / prevent bites ;
sterile males
Modify environment
draining marshes / covering water containers etc a/w.;
oil on surface of water ;
introduce fish to feed on larvae / pupae;
Introduction of Bacillus to kill larvae /
[1]
[max 5]
A correct named drug e.g. Quinine,
Paludrin, Larium, Malarone
A named pesticide e.g. DDT
Accept any refs to removing
standing water
[Total: 10]

O/N12/22/Q9

9 (a) it is a diagram;
of traditional pyramid shape/wider at the bottom;
(showing) mass/weight;
of organisms/living things/plants + animals;
the larger the block the greater the mass;
at each trophic level;
ref. producers;
consumers/herbivores/carnivores;
in an ecosystem/food web/food chain;
shows change in mass/is relative; [Max 6]

(b) represents number;
of individual (organisms);
different organisms differ in mass;
one organism may have many others (feeding) on it;
*thus shape may be different;
not that of a pyramid;
plausible drawing; [Max 4]
[Total: 10]

M/J12/21/Q8

8 (a) ref. use of manures / compost;
prevent animal sewage entering water source;
prevention of run-off from fields;

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any ref. controlled use of fertilizers / nitrates or other named;
example of control method (e.g. only on growing crops, not when rain forecast, no disposal of
waste into water sources, use crop rotation);
use degradable pesticides;
use biological pest control;
grow crops genetically modified to be pest resistant; [5]
(b) making (scarce) resources last longer;
paper + reduction in deforestation;
glass / metal + requires less energy than new production;
plastics + reduction in fossil fuel use;
reduces need for waste disposal / landfill;
ref. non-biodegradability of plastics / glass;
specific e.g. of reuse (as a method of recycling)
(carrier bags, glass bottles, paper, clothes);
ref. to composting / producing animal feed from food waste
+ a valid reason; [5]
[Total: 10]

M/J12/22/Q7

7 (a) (Marking points are available on an annotated drawing)
shows the number of organisms at each (trophic) or named level ;
(R species)
width / length of band indicates the number;
number of organisms decreases towards the top of the pyramid;
correct ref. to two technical terms from the following :
producers / consumers / herbivores / carnivores / trophic level;
(R named example)
in food chain / web / ecosystem (R habitat / named e.g. of a food web);
ref. to an anomalous situation (e.g. trees / single tree); [max. 4]

(b) ref. Sun;
light (energy) to chemical energy;
absorbed by / inside plants or producers / photosynthesis;
named photosynthetic product;
food for / eaten by + animals / herbivores / consumers / decomposers;
lost as heat;
(from) respiration / ref ATP;
any *two uses of energy (for two marks);;
*Any two from: active transport, muscle contraction / movement / locomotion, e.g. of anabolism / protein synthesis / making large molecules, temperature control, nervous impulses, growth, cell division / mitosis / meiosis
does not pass back to producers / plants / Sun; [max. 6]

O/N11/21/Q4

4 (a) no/less water near soil surface;
no/less water for photosynthesis;
no/less* carbohydrate manufacture;
no/less water for salts or named to dissolve/be absorbed/cell sap;
no/fewer proteins*/chlorophyll made (*Accept ‘food’ for ONE mark);
roots too short to reach water;
more herbivores to eat grass;
trees can lose leaves in times of stress; [max 4]

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(b) more food/vegetation in abundance AW;
more different types of habitat;
less competition; [max 2]
(c) (i) (ORA) longer necks;
fewer of them; [2]
(ii) any ONE from: more foliage found higher up/have to eat leaves, mutation, those with shorter necks die/do not breed AW (ORA), natural selection; [1]
[Total: 9]

M/J11/21/Q7

7 (a) carbon dioxide A on equation;
combines with water A on equation;
during photosynthesis;
to make named carbohydrate/protein;
eaten by/passed to consumers/animals;
respiration;
in any 2 named groups of different types of organism;
releases carbon dioxide A with ref to combustion;
leaves decomposed/decay/ refs to methane/fossil fuels
A refs to decomposition in animals/faeces etc if phs mark scored; [max 7]
(b) another named requirement (CO_2/temperature);
in short supply AW;
use of syllabus term limiting factor; [3]
[Total: 10]

M/J11/22/Q3

3 (a) (i) herbivore / named herbivore / consumer / omnivore; [1]
(ii) chemical (energy); [1]
(iii) 2 (%); [1]
(b) respiration; [1]
(c) (i) respiration;
bacteria / fungi / decomposers (N.B. look for idea of organism);
(R the process)
organic or dead matter / organic molecules or named;
energy released + when broken down / decomposed (A acted on by decomposers) / decayed AW / when fossil fuel burnt; [max. 3]
(ii) makes soil warmer / heat released;
for germination;
increases AW rate of enzyme action;
faster AW growth (of radical / plumule); [max. 2]
(R 'for' growth / helps growth)
(R any reference to a seedling / plant)
[Total: 9]

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