1 Read the passage.

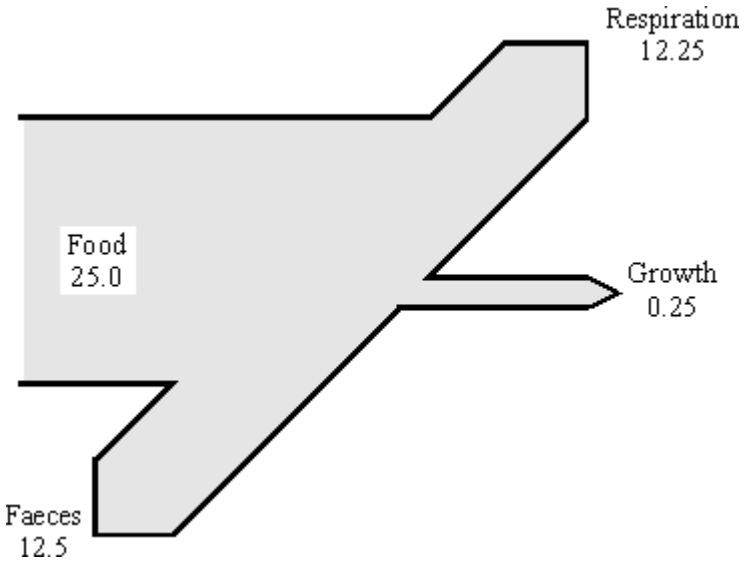
Glutton up a gum tree

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."

The diagram shows the flow of energy through a koala.
The numbers show units of energy.



(i) Calculate the percentage of the food intake which is converted into new tissues for growth. Show your working.

_____%

(2)

(ii) Give **three** different ways in which the koala uses the energy released in respiration.

1. _____

_____

2. _____

_____

3. _____

_____

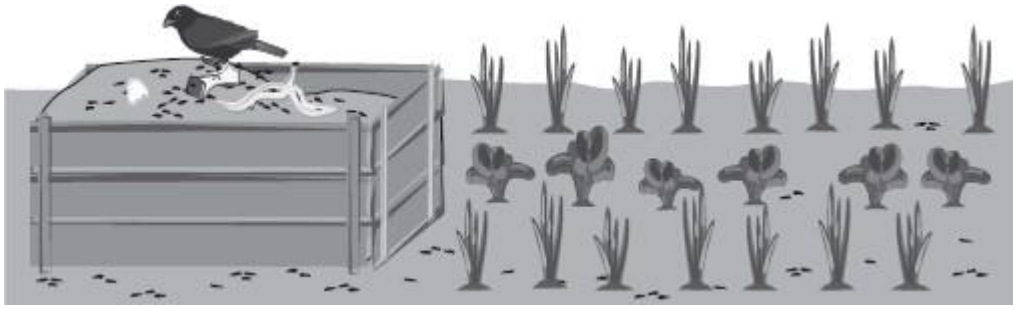
(3)

(Total 5 marks)

2 A chef built a compost heap to recycle his vegetable and fruit peelings.

The compost heap soon had many earthworms living in it. The earthworms burrowed through the compost heap and ate the vegetable and fruit peelings. Blackbirds visited the compost heap and ate some of the earthworms.

The image shows the compost heap in the chef's vegetable garden.



(a) Suggest **two** reasons why having a compost heap is useful to the chef.

_____

_____

_____

_____

(2)

(b) The chef covered the compost heap with a plastic sheet. The plastic sheet stopped the birds eating the earthworms and also helped the decay process.

Suggest how the earthworms **and** the plastic sheet helped to speed up the process of decay.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

3 The figures below show the levels of carbon dioxide in air from 150 000 years ago.

TIME	CARBON DIOXIDE CONCENTRATION
1500 years ago	270 parts per million
1800 AD	290 parts per million
1957	315 parts per million
1983	340 parts per million

(a) Explain why carbon dioxide levels in the atmosphere are changing.

(3)

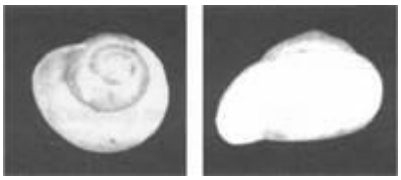
(b) It is suggested that the increased level of carbon dioxide in the air is causing the atmosphere to warm up (the "Greenhouse Effect").

Describe, as fully as you can, **two** major effects of global warming and how these may affect the human population.

(6)

(Total 9 marks)

4 *Cepaea nemoralis* is a snail which is found on sand dunes. It may have a plain or banded shell. The snails are found on grass stalks and leaves.



Plain

Banded

A scientist collected young unbanded snails and kept them until they were fully grown and mated them.

The eggs laid produced 35 unbanded and 12 banded snails.

(a) Explain these figures as fully as you can. You may use a genetic diagram if you wish to make your answer clearer.

(7)

Variation in colour

Variation in banding

(b) The snail shells show a lot of variation in colour. They are yellowy/green, brown, pink or cream. The banding varies from a single wide band to a mixture of thick and thin bands.

Describe briefly the factors which have produced this variation and explain how these factors may themselves have arisen.

_____

_____

_____

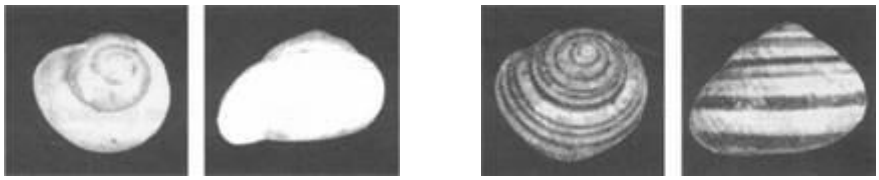
_____

_____

(4)

(Total 11 marks)

5 *Cepaea nemoralis* is a snail which is found on sand dunes. It may have a plain or banded shell. The snails are found on grass stalks and leaves.



Plain Banded

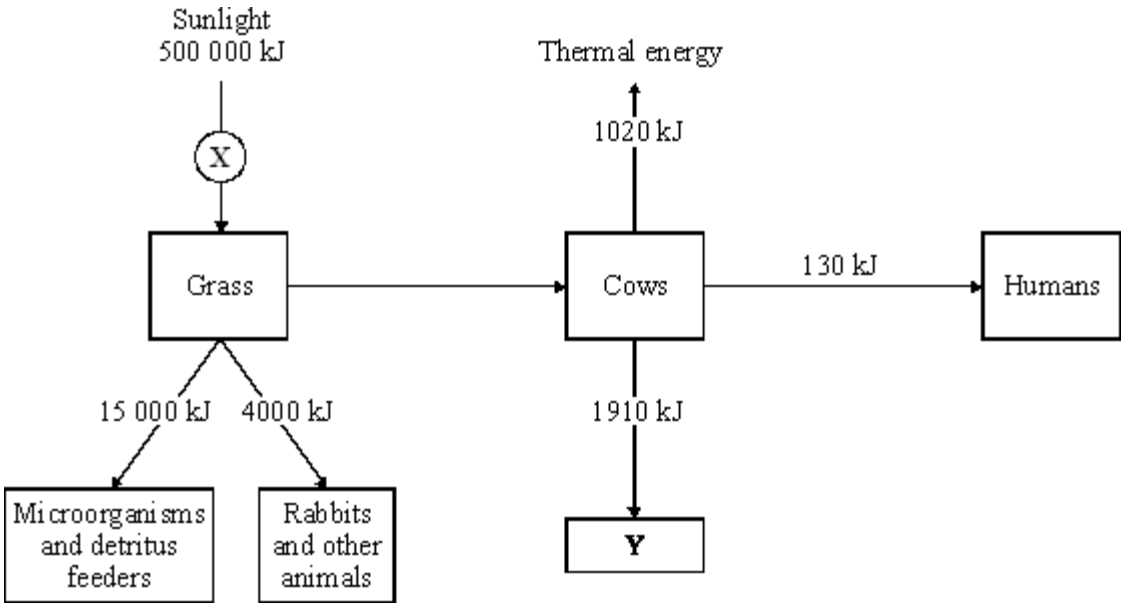
When a scientist collected snails on the sand dunes he got 450 banded
280 unbanded.

Snails are eaten by birds. Sand dunes have clumps of grasses growing on them.

Suggest why there were more banded than unbanded snails on the sand dunes.

(Total 4 marks)

6 The diagram shows the amounts of energy that are transferred, over a period of time, through some living things in a grassland habitat.



(a) Calculate the amount of energy transferred from the grass to the cows.

_____

_____

Amount of energy = _____kJ

(1)

(b) **X** is a process in plants.

(i) Calculate the amount of energy usefully transferred by process **X**.

_____

_____

_____

Amount of energy = _____kJ

(1)

(ii) Name process **X**.

_____

(1)

(c) Give **two** ways in which energy is 'lost' from the cows at **Y**.

1. _____

_____

2. _____

_____

(2)

(d) Describe how hormones can be used to improve the efficiency of producing food from plants.

_____

_____

_____

_____

(2)

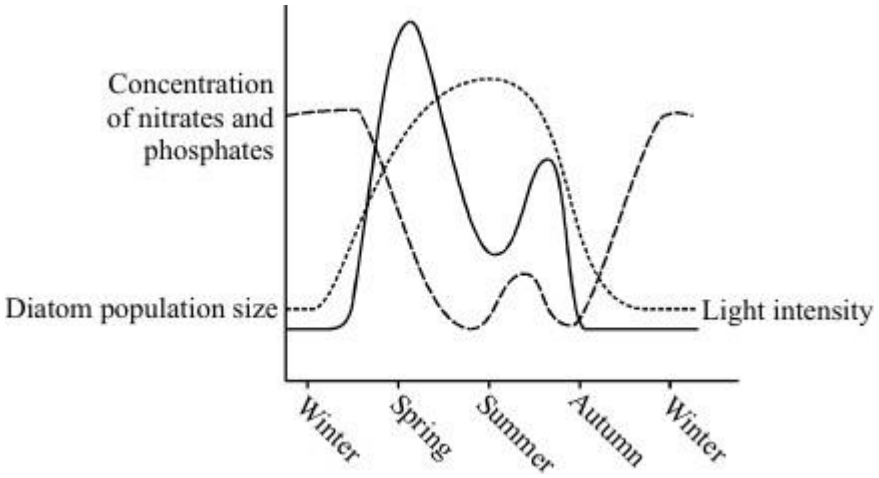
(Total 7 marks)

7 A food chain in the North Atlantic Ocean is:

diatoms → small fish → large fish

The graphs show how over a year:

- the population size of diatoms in the North Atlantic varies;
- the light intensity alters;
- the concentration of nitrate and phosphate minerals alters.



(a) Explain why the light intensity is a major factor in controlling the numbers of diatoms.

_____

_____

_____

(2)

(b) (i) Suggest **two** reasons why the population of diatoms decreases between spring and summer.

1. _____

_____

2. _____

_____

(2)

(ii) Give **two** reasons why the population of diatoms decreases in autumn.

1. _____

_____

2. _____

_____

(2)

(c) Use the information on the graph to suggest what change causes the number of diatoms to increase in the late summer. Give a reason for the change.

_____

_____

_____

(2)

(Total 8 marks)

8 Earthworms are important soil organisms. When they burrow, they help to bring air into the soil as well as improving drainage. Earthworms also bury leaves in the soil. These decay making the soil more fertile. Earthworms in turn are eaten by voles, moles, foxes, badgers and birds.

New Zealand flatworm

In some parts of the United Kingdom, earthworms are being killed by New Zealand flatworms. The animals are spreading quickly and have no natural enemies.

The flatworms do not make their own burrows. They only use the burrows made by the earthworms in order to attack them.

(a) Explain, as fully as you can, why it is important to control or get rid of these New Zealand flatworms in Britain.

(4)

(b) Suggest **one** possible way, giving **one** advantage and **one** disadvantage, that this New Zealand flatworm could be controlled.

(3)

(Total 7 marks)

Mark schemes

1 (i) 0.25 × 100 / 25

gains 1 mark

but
1%

gains 2 marks

2

(ii) muscle contraction / limb movement / moving around / chewing
heartbeat / breathing / internal muscle activity
maintaining body temperature / keeps body warm
active uptake synthesising substances (*reject* growth)

any three for 1 mark each

3

[5]

2 (a) any **two** from:

- disposes of his kitchen waste
- releases nutrients for his plants
- saves him money on fertiliser
- improves soil structure.

allow will help his plants / vegetables to grow

2

(b) any **three** from:

- earthworms allow (more) air / oxygen to enter
- earthworms break wastes into small(er) pieces

accept earthworms increase surface area of wastes

- plastic sheet keeps the heap warm
- plastic sheet keeps in water
- microorganisms / bacteria / fungi cause decay / breakdown / decomposition / digestion (of waste)

allow decomposers

ignore detritivores / earthworms

- (microorganisms / bacteria / fungi) are more active / digest / breakdown materials faster in warm / moist / aerobic conditions.

*need reference to earthworms **and** sheet for full marks*

*allow decomposers rate must be linked to microorganism **and** a factor*

3

[5]

3 (a) *idea:*
more (fossil) fuel burned (do not credit simply more people/cars/industry)
deforestation = less photosynthesis
deforestation = more respiration/burning

each for 1 mark

3

(b) *idea*:
climate change

for 1 mark

warmer/colder/drier/wetter
food production affected/starvation
mayor ecosystems destroyed/damaged

any two for 1 mark each

6

<u>sea level rise</u>

for 1 mark

low land flooded
less food grown/starvation
homes/factories flooded

any two for 1 mark each

Allow
polar ice caps melt
sea water expands

[9]

4 (a) idea

- unbanded dominant/plain **or** banded recessive
- because banded appears in young/
- parents heterozygous/Bb
- offspring BB } credit response consistent with parents
  Bb } even if not both heterozygous
  Bb }
  bb }

  Accept any clear and consistently used notation
- identify BB, Bb as plain
- identify bb as banded
- ratio 3:1 unbanded/banded (stated or clearly implied
- matches 35:12 results e.g. <u>all</u> the outcomes clearly identified as banded/unbanded)

for 1 mark each

7

(b) *idea*

- many genes control [accept "continuous variation"]
- many alleles for a gene/large genepool
- snails can inherit lots of different combinations
- mutation (gives rise to many alleles)
  allow selection allows alleles to be passed on unless [very]disadvantageous or if advantageous

any 4 for 1 mark each

[Also credit, for 1 mark each, up to 2 causes of mutation, e.g. mistakes in cell division, radiation]

4

[11]

5 *idea*

- banded snails camouflaged/less easily seen
- fewer banded eaten [by birds]
- more banded survive to breed
- more genes for banded passed on
  or more banded snails in population

for 1 mark each

N.B.
Accept reverse of all above for plain snails
*All 4 marks may be gained by a relatively short response

[4]

6 (a) 3060 (kJ)

1

(b) (i) 22060 (kJ)

1

(ii) photosynthesis

1

(c) faeces / undigested food

reference to movement and respiration are neutral

urine / urea

2

accept excretion / waste / droppings if both of the mark points are not gained

(d) any **two** from

- control ripening
- herbicides
- prevent over ripening in transport
- stimulate root growth

other growth references are not neutral

- use in tissue culture to produce large numbers of plantlets

2

[7]

7 (a) diatoms photosynthesise **or** are producers

1

the amount of growth depends upon the energy **or** light they get

accept more light means more growth
or *they multiply more in more light*
do not accept they need light

1

(b) (i) eaten by small fish

do not accept eaten by fish

1

minerals **or** nitrate **or** phosphates
or nutrients **or** food supply used up
or reduced

1

(ii) any **two** from

gets colder
light decreases
end of their life span **or** die

accept more being eaten than being formed

eaten by small fish

do not accept a decrease in nitrates
or *phosphates*

1

(c) increased minerals **or** nitrates **or** phosphates

1

any **one** from

due to death **or** decay of diatoms **or** fish

do not accept death of large fish

1

influx of minerals in an ocean current

*do not accept extraneous pollution **or** dumping by a ship*

1

[8]

8 (a) *idea:*
soil wetter
soil less aerated
less food for moles/voles/foxes/badgers/birds
soil less fertile (less leaves in soil <u>not</u> enough on its own)
less food grown
earthworms die out/fewer earthworms
(<u>not</u> just "earthworms get eaten")

any 4 for 1 mark each

4

(b) method
advantage
disadvantage
*e.g.**

- chemical
- kills worm/affects reproduction/maintains earthworm population
- persistent/food chain/kill earthworm

or

- import biological central/predator/disease/parasite
- kills worm/affects reproduction/maintains earthworm population
- may attack other animals/cause same sort of problems as New Zealand worms

(* credit other plausible suggestions for method/advantage/disadvantage)

for 1 mark each

3

[7]