

6 Fig. 6.1 shows energy flow through an ecosystem. The energy is measured in $\text{kJ m}^{-2} \text{yr}^{-1}$.

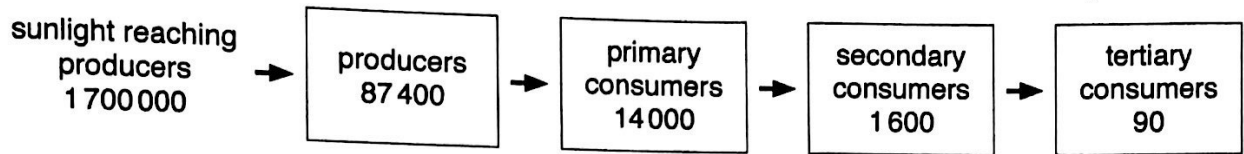


Fig. 6.1

(a) State **two** ways in which energy is lost between trophic levels.

1 Energy is lost in the form of heat during respiration.

2 Energy is lost in uneaten parts of dead bodies, faeces and excretory products like urine.

Do not confuse excretion and egestion.
X "excretion of faeces"

(b) Calculate the percentage of energy lost between the secondary and tertiary consumers on Fig. 6.1.

Give your answer to the nearest whole number.

Show your working.

$$\% \text{ energy lost} = \frac{1600 - 90}{1600} \times 100\%$$

$$= 94.375\%$$

$$\approx 94\%$$

$$\frac{94}{100} \times 100\% = 94\%$$

(c) Explain why there are usually very few predators of tertiary consumers.

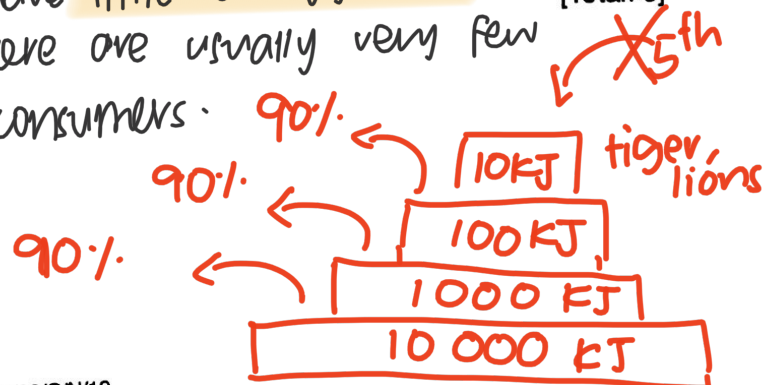
• A large amount of energy of about 90% is lost at each trophic level, in the form of heat or excretory waste.

• Down the food chain, less and less energy is available for organisms at the next trophic level.

• Tertiary consumers have little energy to be passed on, hence there are usually very few predators of tertiary consumers.

[Total: 6]

Strong ans:
Refer to % loss of E.



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Oct/Nov 2019 Paper 2 (11)

Section B

Answer **three** questions.

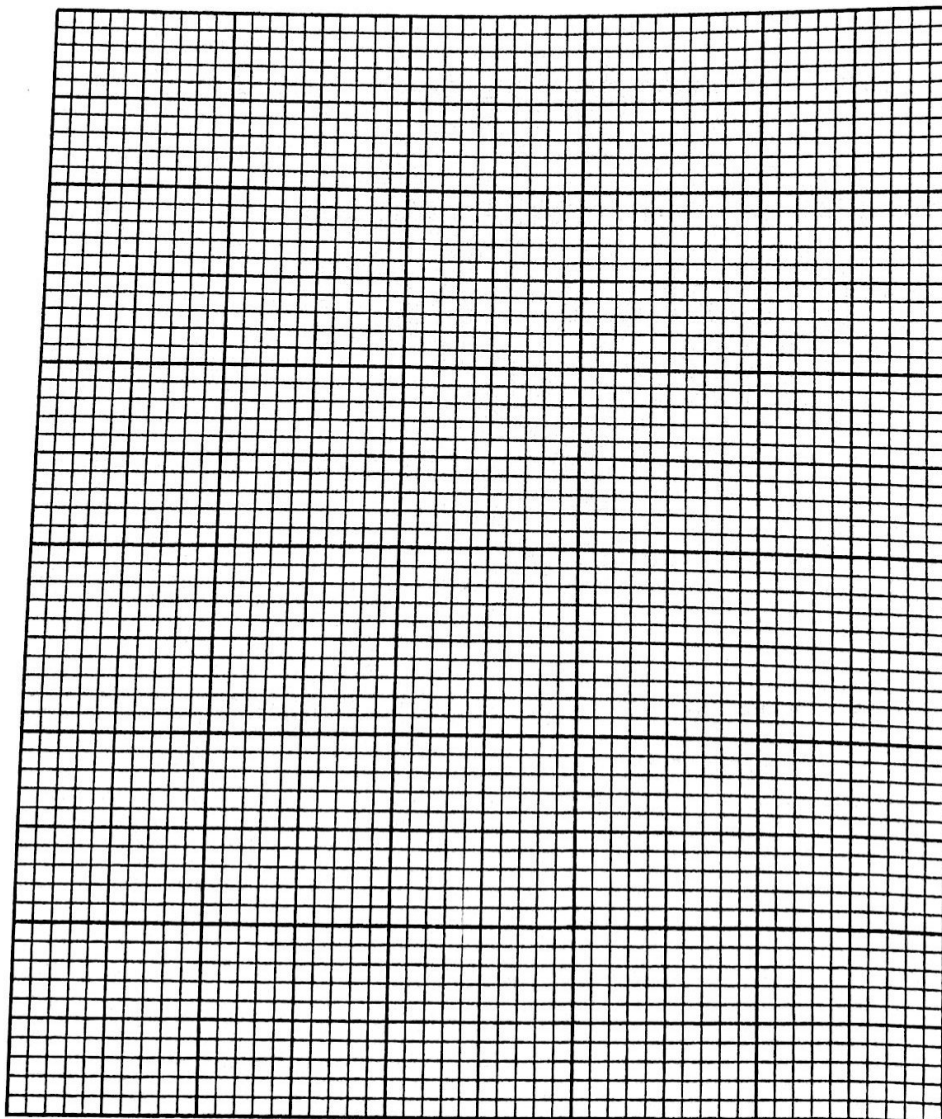
Question 9 is in the form of an **Either/Or** question. Only one part should be answered.

- 7 Table 7.1 shows the relationship between the year of fishing and the percentage of fish caught in the North Sea that had a body length of 40 cm and longer.

Table 7.1

year	1993	1998	2003	2008	2013
percentage of fish caught	5.0	5.2	5.6	7.2	16.3

- (a) (i) Plot a line graph of the data in Table 7.1 on the grid.



(II) Using your graph, determine the percentage of fish (40 cm and longer) caught in 2010.

..... % [1]

(b) (i) Describe the relationship shown by the data in your graph.

.....

.....

.....

.....

..... [2]

(ii) Having a large proportion of fish in the sea that are 40 cm and longer is a positive indicator of fish stocks.

Suggest why it is a positive indicator.

Having a large proportion of fishes in the sea that are 40 cm and longer indicates that young fishes are able to survive, grow and reproduce in the sea, thereby indicating that our fishes are not being overfished, and fish stocks are sufficient.

[Total:]

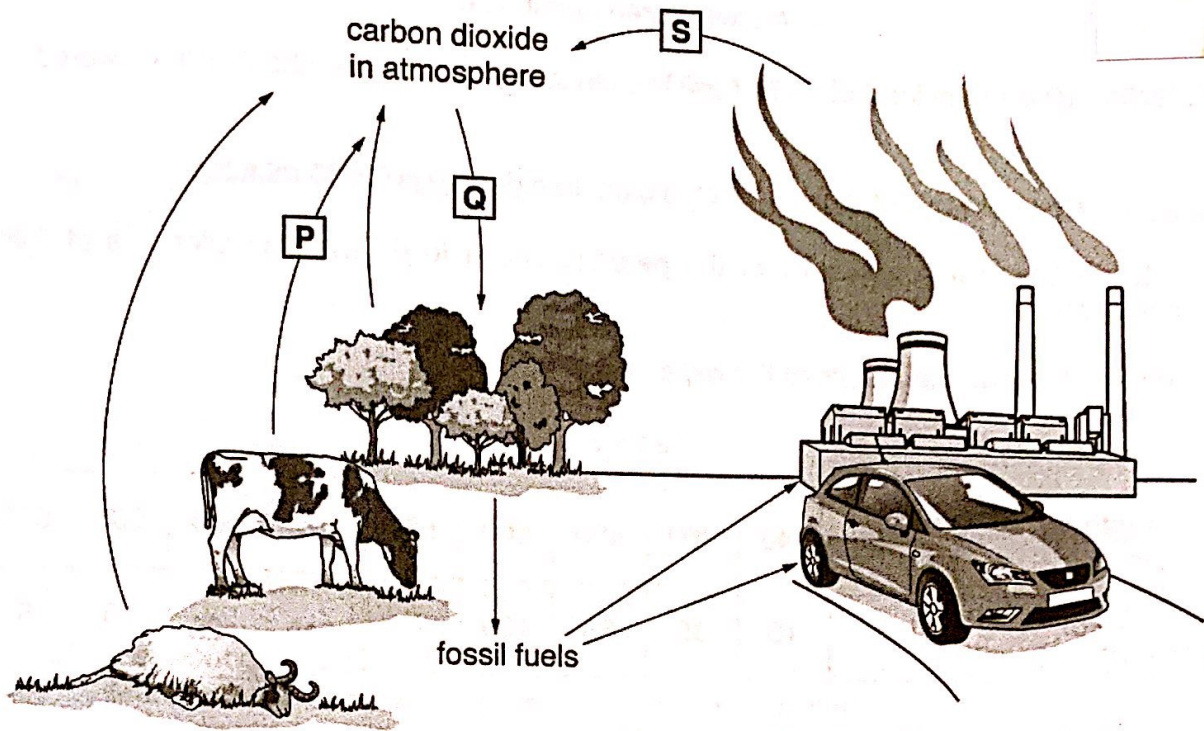


Fig. 7.1

- (a) Explain the importance of the processes labelled P, Q and S in Fig. 7.1.

P is respiration. Plants and animals respire, releasing carbon dioxide into the atmosphere. S is combustion. Combustion of fossil fuels releases carbon dioxide into the atmosphere. P and S hence ensures a continuous supply of carbon dioxide for plants to carry out photosynthesis, Q, which converts light energy into chemical energy, food, which non-photosynthetic organisms use to stay alive. Q also removes carbon dioxide from the atmosphere, reducing the rate of global warming. [3]

- (b) Describe the role of bacteria and fungi in the carbon cycle. defn

Bacteria and fungi are decomposers. They break down dead organic matter and release carbon dioxide back into the atmosphere to be used again by green plants. This allows carbon to be continually recycled. [3]

[Total: 6]

3 Fig. 3.1 shows part of a food web in a tropical rainforest.

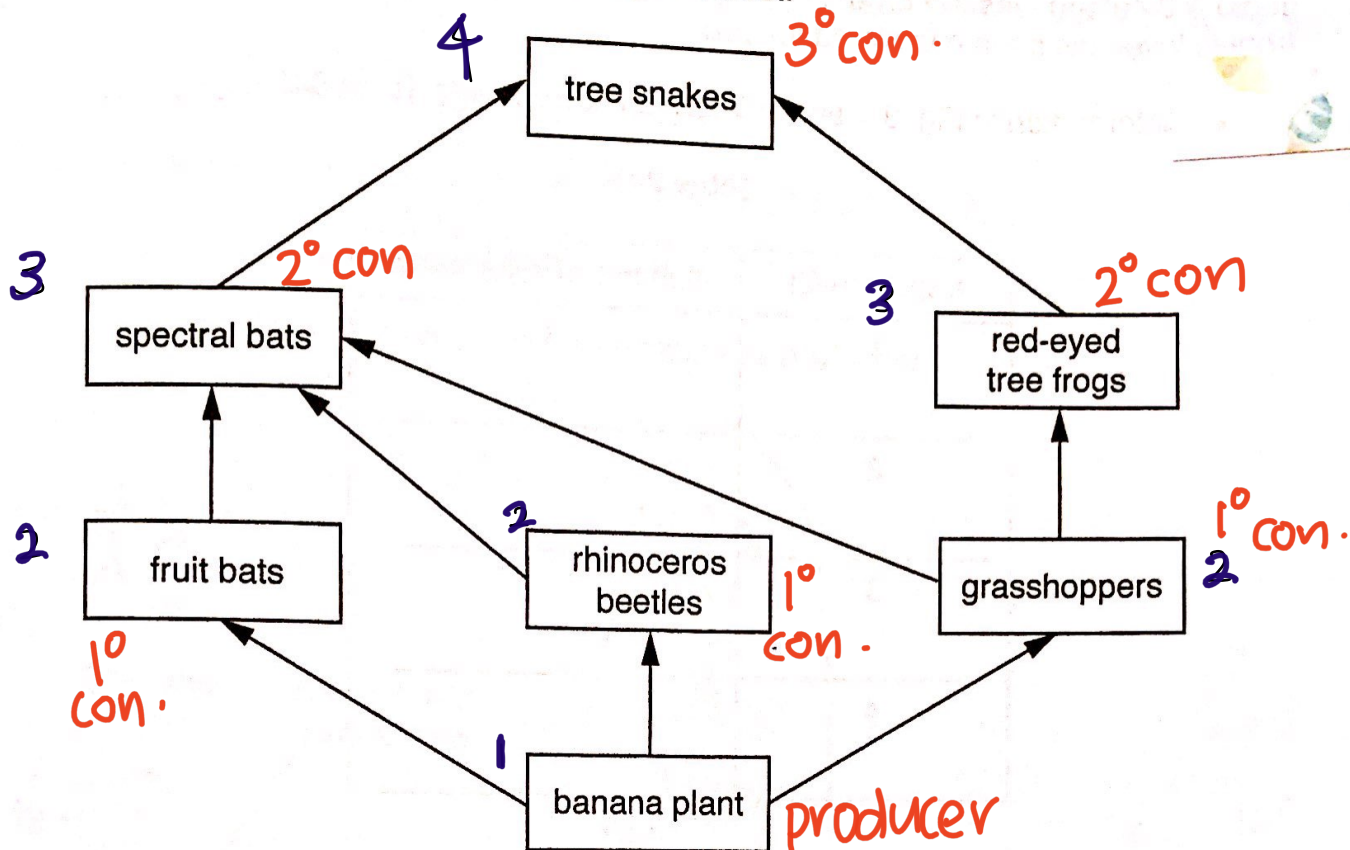


Fig. 3.1

*answer should provide context

(a) Explain why the banana plant is described as the producer in the food web.

...The food web always starts with a producer, in this case the banana plant, which...
...makes its own food by photosynthesis, converting light energy to chemical energy. [1]

(b) Table 3.1 shows the results of an ecological study in part of a rainforest.

Table 3.1

animal	number recorded
spectral bats	4
fruit bats	9
tree snakes	2
grasshoppers	29
rhinoceros beetles	36
red-eyed tree frogs	6

Table 3.2 categorises the organisms from Fig. 3.1 and Table 3.1 into trophic levels. The first trophic level has been completed for you.

Use the information in Fig. 3.1 and in Table 3.1 to complete Table 3.2.

Table 3.2

trophic level	number of organisms
1	1
2	74
3	10
4	2

1° con.

2° con

3° con

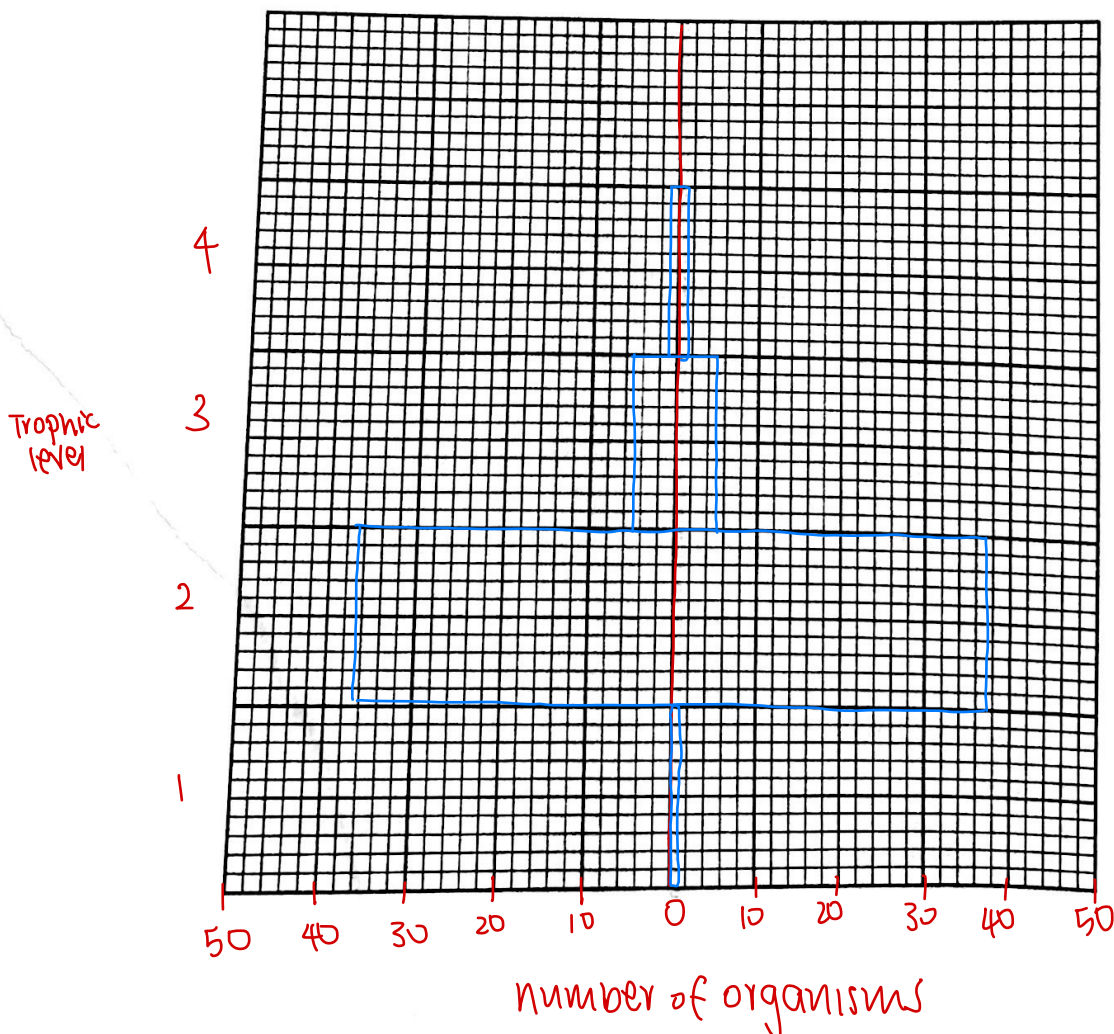
* count the number of organisms, not species.

9 + 29 + 36

4 + 6

[3]

(c) Use the information in Table 3.2 to draw and label a pyramid of numbers on the grid.



[3]

[Total: 7]

6 Fig. 6.1 gives some information about the feeding relationships in a tropical rainforest.

- Some of the most common food sources for consumers in the forest are orchids, banana plants, bamboo plants and the seeds from many other tropical trees.
- Macaws feed on orchids and seeds.
 - Fruit bats feed on banana plants and orchids.
 - Monkeys feed on banana plants and bamboo plants.
 - Pythons feed on fruit bats, monkeys and macaws.
 - Jaguars feed on monkeys and macaws.

Fig. 6.1

- (a) Fig. 6.2 shows a food web based on the information in Fig. 6.1. Use the information in Fig. 6.1 to complete the food web by adding **two** arrows and naming the organisms in boxes 1 and 2. [4]

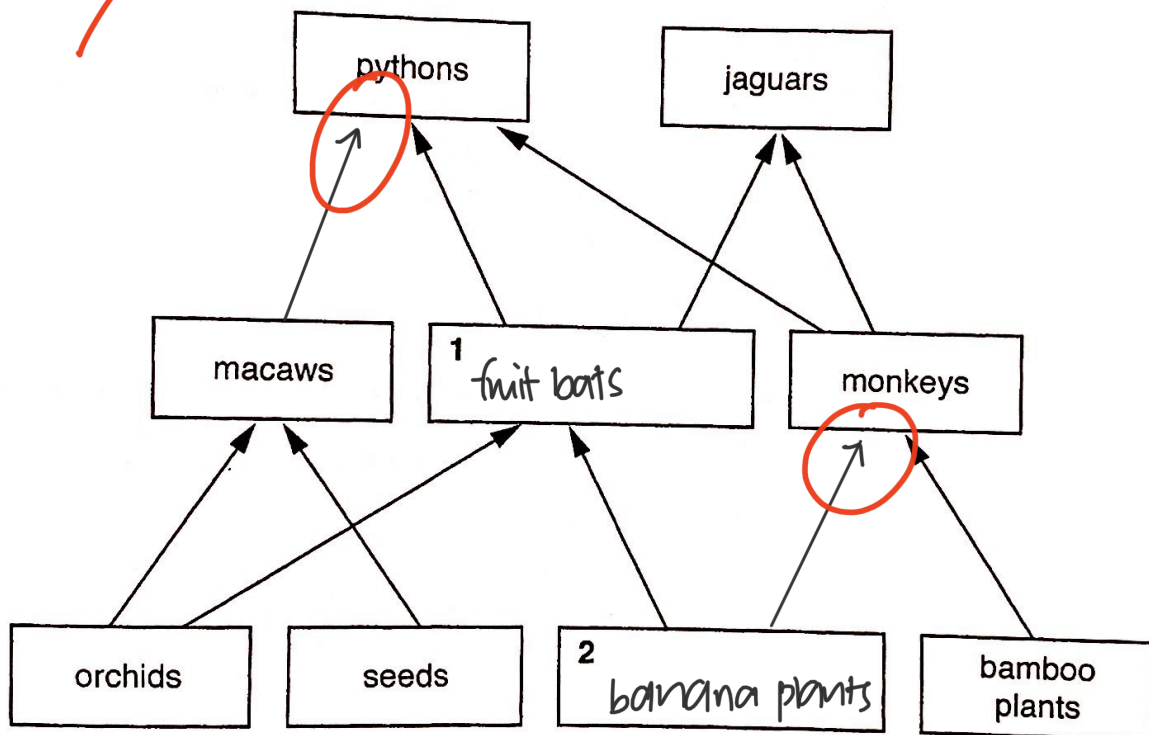


Fig. 6.2

- (b) With reference to Fig. 6.2 explain what is meant by the term *trophic level*.

Trophic level refers to each stage in a food chain. It is the feeding position of an organism in a food chain.

For instance, orchids, seeds, banana plants and bamboo plants are producers and belong to the first trophic level. Macaws, fruit bats and monkeys are herbivores and belong to the second trophic level and pythons and jaguars are in the third trophic level and are known as secondary consumers. [2]

* when answering qns related to trophic levels, imp't to make reference to mode of nutrition.

1st Trophic level = producers
2nd TL = herbivores / 1st con-
3rd TL = 2^o consumers.

7 (a) State what is meant by the following terms:

(i) consumer

Organisms that are not able to make their own food. They obtain energy and nutrients by feeding on other organisms. (there are 3 types of consumers, 1^o, 2^o, 3^o) [1]

(ii) trophic level.

Refers to each stage or feeding position in a food chain. The first trophic level are producers, 2nd trophic level are herbivores. (for eg. [1]

(b) A food chain in the ocean may be affected by pollutants such as mercury, as shown in Fig. 7.1.

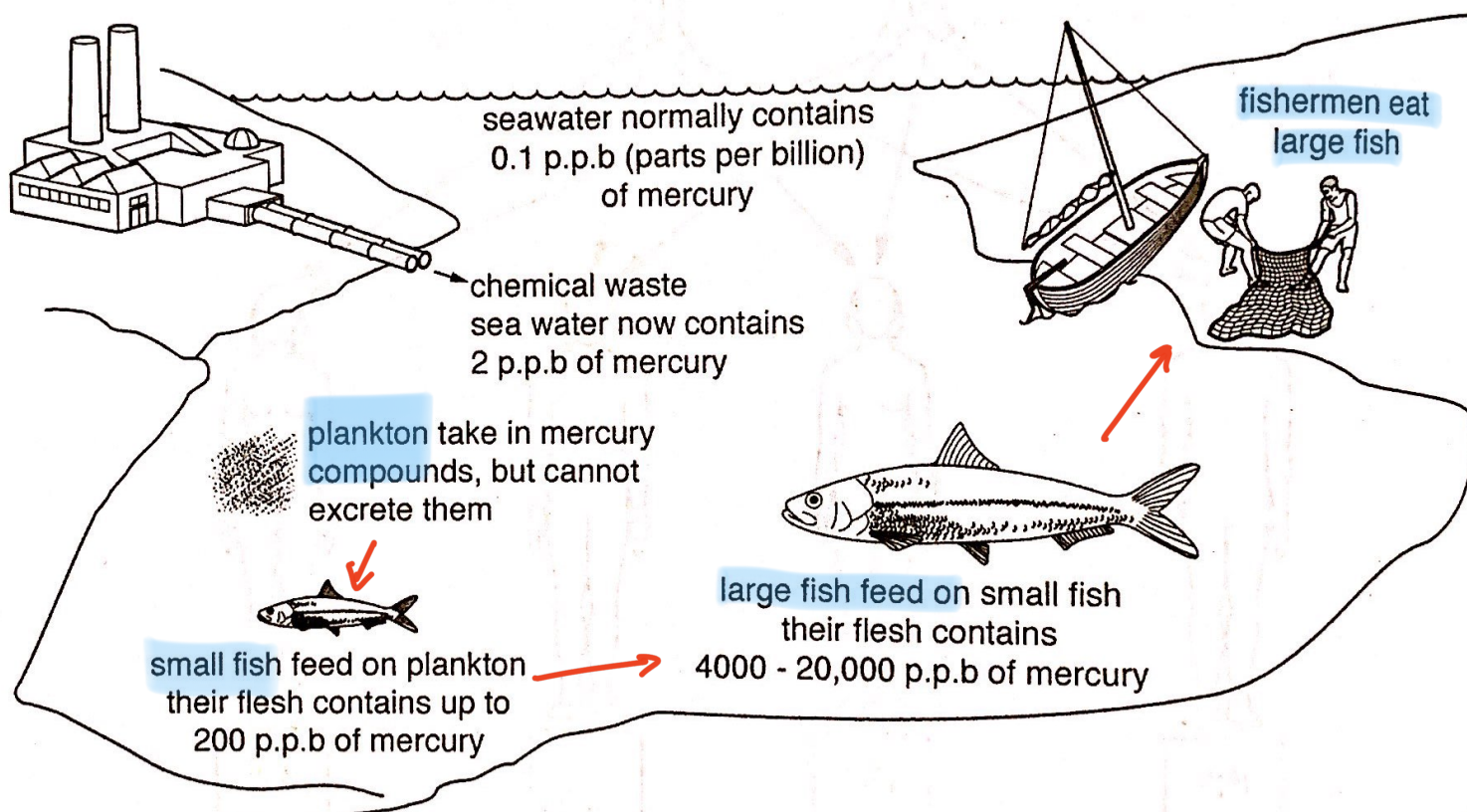


Fig. 7.1

(i) Draw the food chain shown in Fig. 7.1.

Plankton → small fish → large fish → fishermen/human beings

[2]

- (ii) The food chain in Fig. 7.1 illustrates the process of bioaccumulation. With reference to the plankton and the small fish suggest how this process takes place.

Bio accumulation is the accumulation of harmful chemicals in an organism over time, as the organism consumes food containing these harmful chemicals. In this example, bioaccumulation occurs in the plankton that take up mercury from the ocean water, as well as for the small fishes that feed on the planktons, as the planktons are not able to excrete them. [3]

[Total: 7]

Bioaccumulation

- The accumulation of substances in a single organism over time;
- resulting in a higher conc. in older individuals.

Bio magnification / Bioamplification

- The transfer of substances from lower trophic levels to higher trophic levels,
- resulting in a higher conc. in organisms at higher trophic levels.

4 (a) State what is meant by the term *carbon sink*.

A carbon sink is an area that stores carbon compounds for an indefinite period. It helps to remove carbon dioxide from the atmosphere, reducing the rate of global warming.

Examples are forests and oceans. *savannah (forest, sparse)* [2]

(b) Fig. 4.1 shows part of the carbon cycle.

The numbers represent the changes in the flow of carbon in gigatons of carbon per year between parts of the cycle.

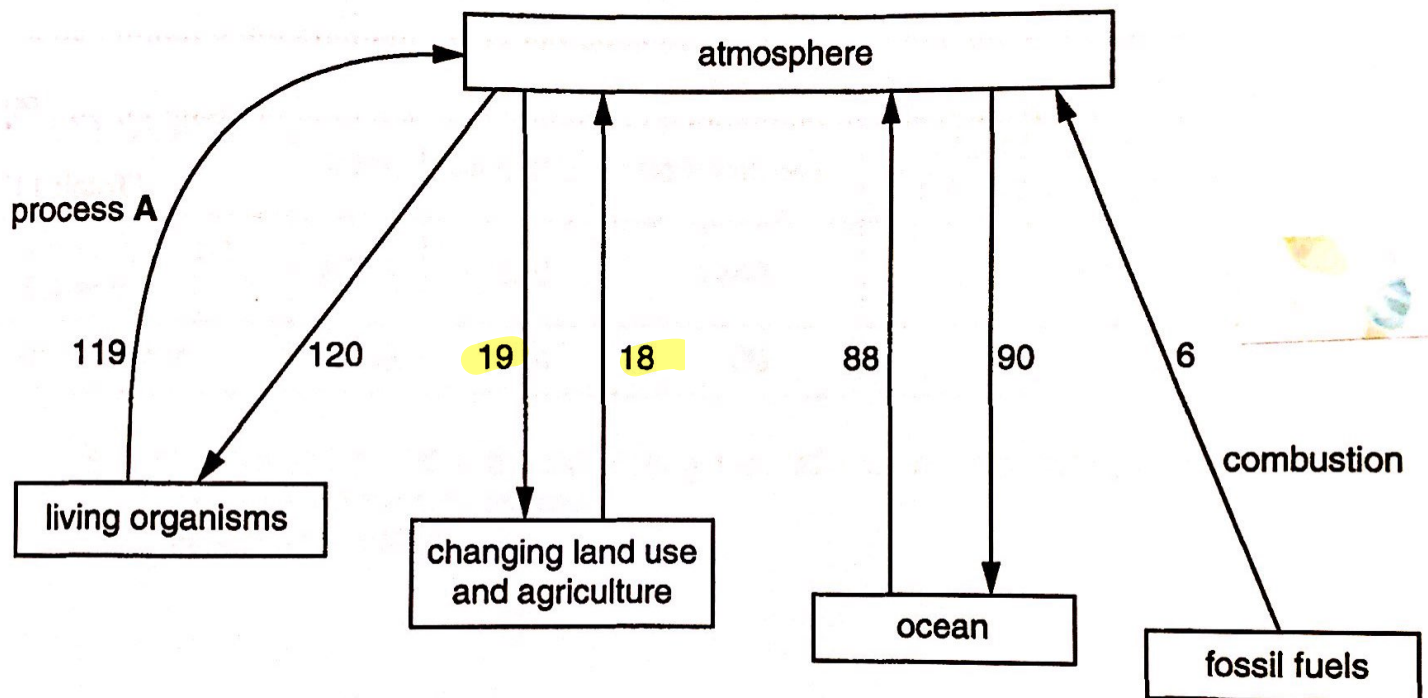


Fig. 4.1

(i) Name process A.

Respiration

(ii) State the effect that changing land use and agriculture has on the quantity of carbon dioxide in the atmosphere.

changing land use and agriculture removed 19 gigatons and released 18 gigatons of carbon per year, resulting in a net 1 gigaton of carbon removed from the atmosphere per year. [1]

(iii) Calculate the total change in the amount of carbon in the atmosphere each year. Show your working.

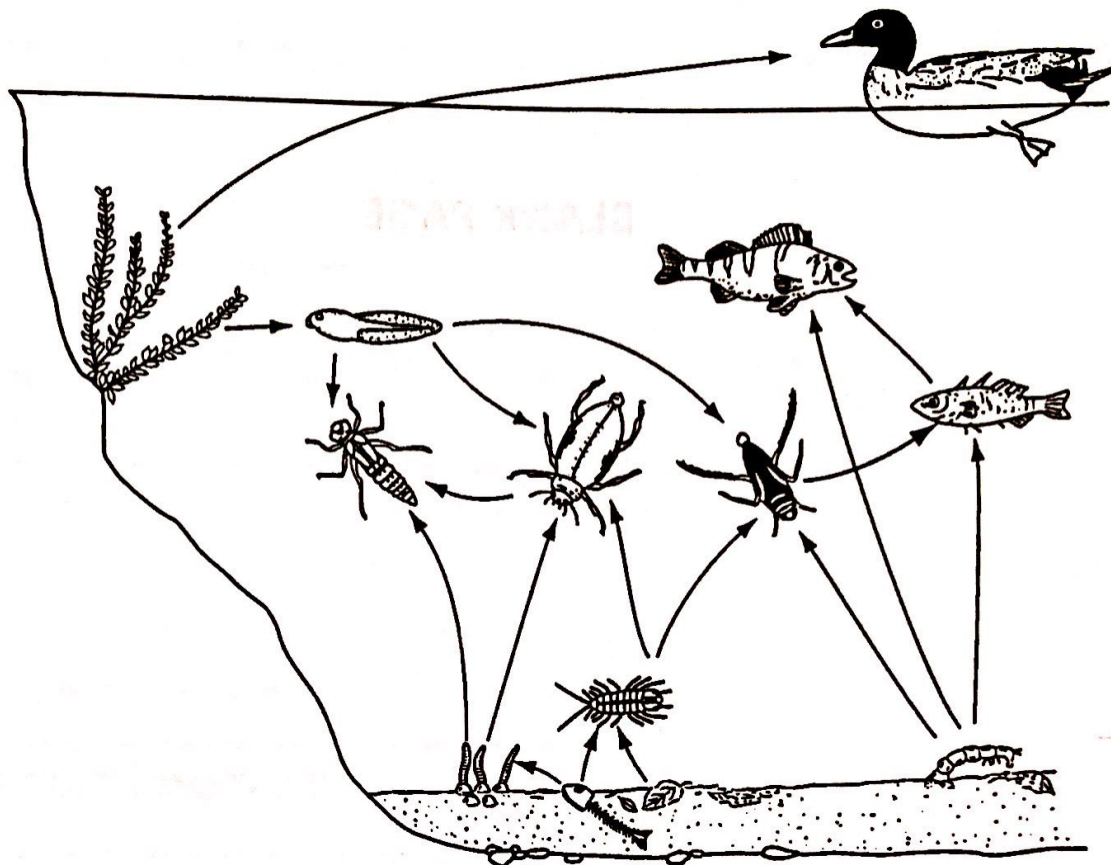
$$119 + 18 + 88 + 6 - 120 - 19 - 90 = 2$$

+ 2 gigatons

* Indicate increase by using the term or adding '+' before value [2]

39 The diagram shows part of a food web in a freshwater pond.

[2013 P1 Q39]

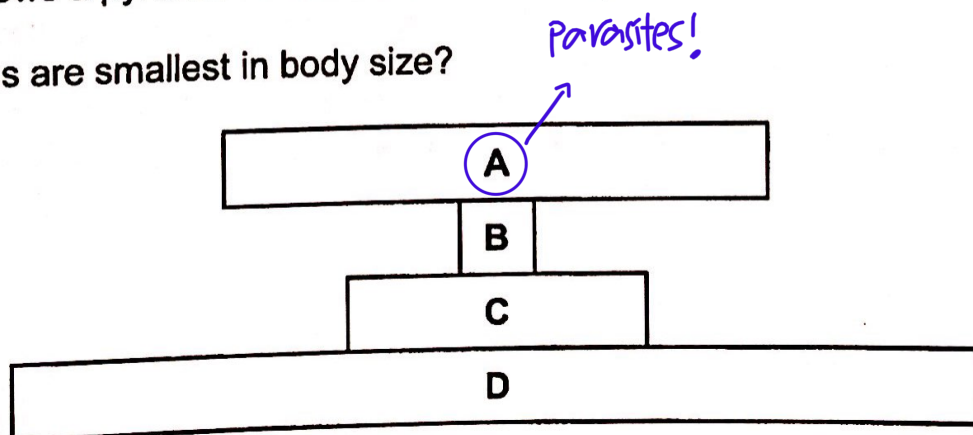


In this web, which is **not** correct?

- A One trophic level is herbivorous.
- ☒ B Two trophic levels are producers.
- C Three trophic levels are carnivorous.
- D Four trophic levels are consumers.

40 The diagram shows a pyramid of numbers in an ecosystem on land.

Which organisms are smallest in body size?



5 Fig. 5.1 shows a food web in a river.

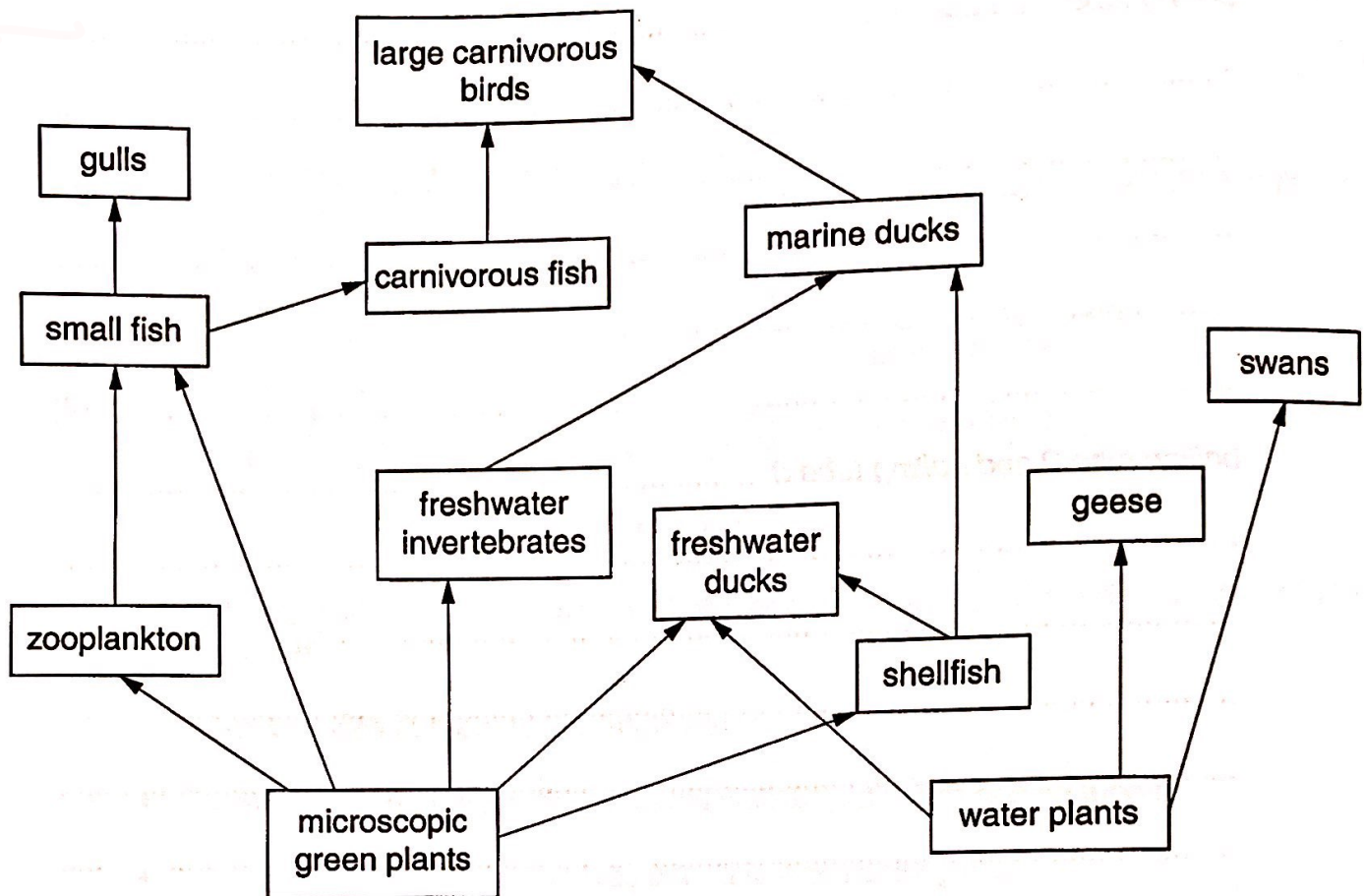


Fig. 5.1

- (a) From Fig. 5.1 select a food chain of five organisms. Draw the food chain in the space below.

[2]

microscopic green plants → zooplankton → small fish → carnivorous fish → large carnivorous birds

- (b) (i) Name the producers in the food web in Fig. 5.1.

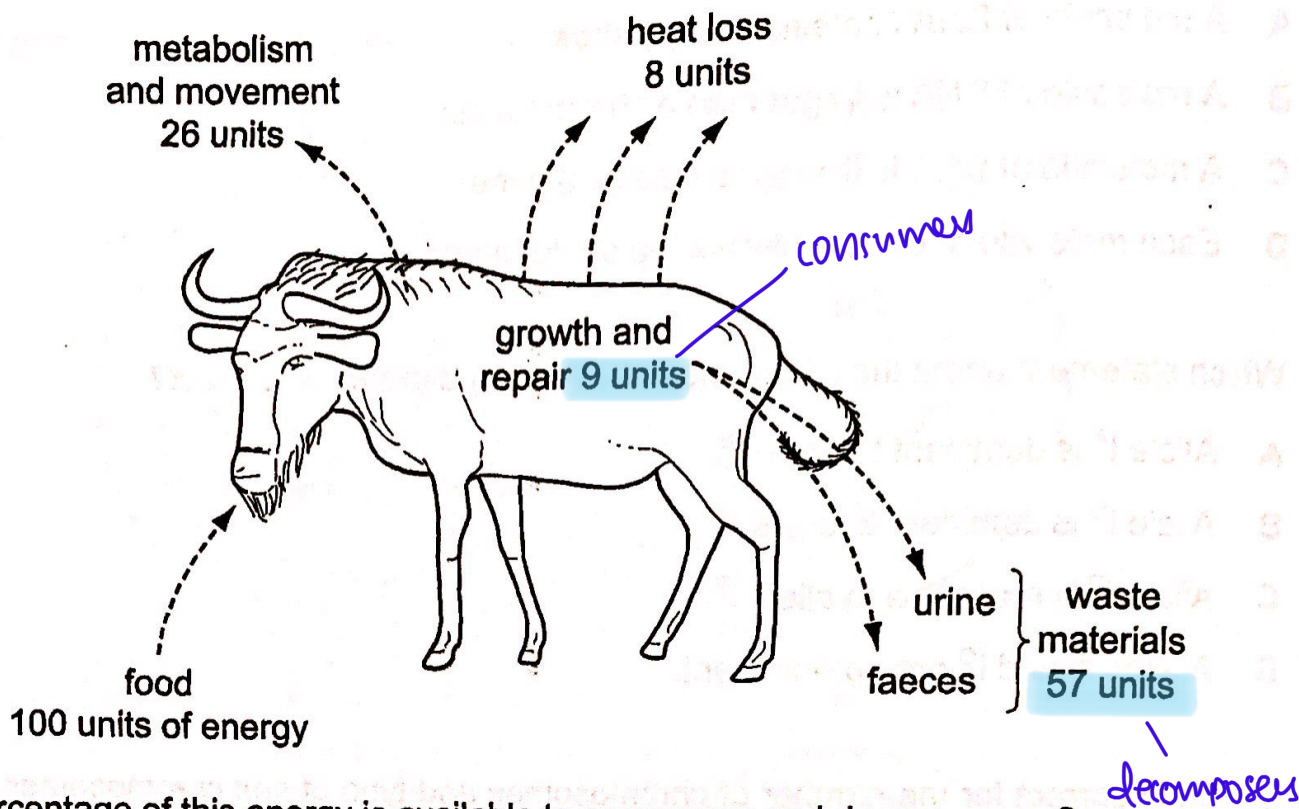
microscopic green plants and water plants [1]

- (ii) With reference to Fig. 5.1, explain the term producer.

- Producers are organisms that make food by photosynthesis, which converts light energy to chemical energy.
- They are the first organisms in the food chain or food web. In this case, they are the microscopic green plants and water plants. They are consumed by primary consumers, which in this case, are shellfish, zooplankton, ducks, geese, swan. [3]

* MR gave clear direction for answers this qn.

39 The diagram shows how energy from food is used by an animal.



What percentage of this energy is available to consumers and decomposers?

A 91

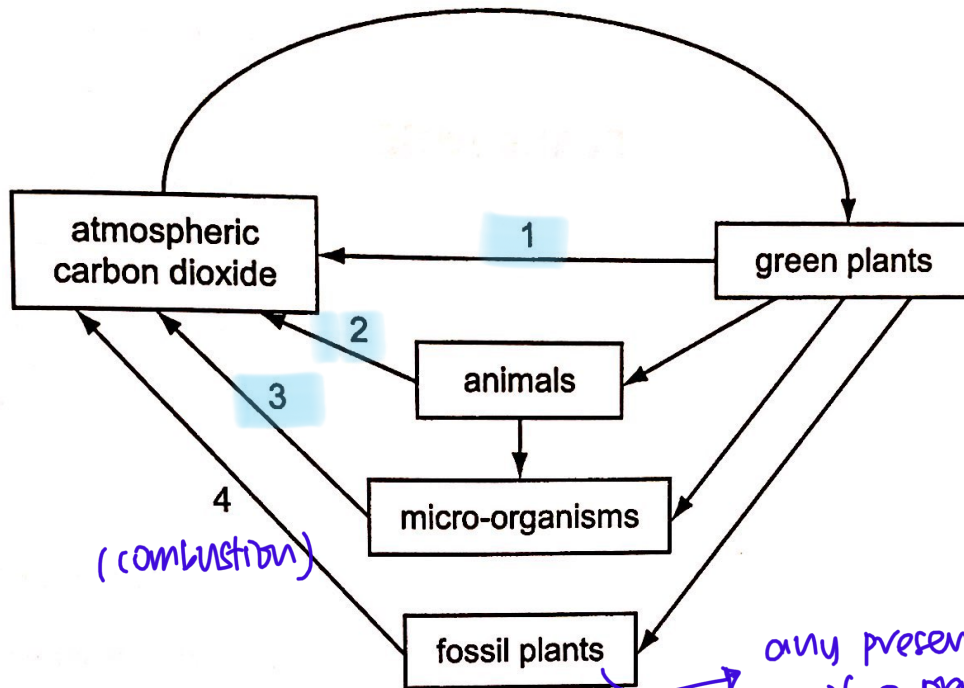
B 66

C 34

D 9

$$9 + 57 = \underline{66}$$

- 40 The diagram represents the carbon cycle. The arrows represent different processes that occur in the carbon cycle.



Which of the numbered arrows show where respiration takes place?

- A 1, 2, 3 and 4
- B 1, 2 and 3 only**
- C 1 and 4 only
- D 2 and 3 only

any preserved part
of a plant that
has died for
a long time.

10 Or

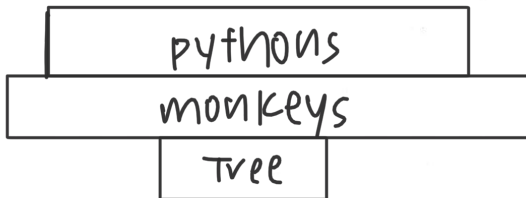
four will not be accepted!

do not start with parts of a plant eg leaves or stem.

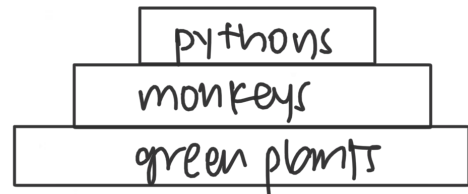
- (a) Draw a food chain made up of three organisms.

tree → monkey → python

Draw a **labelled** diagram of a pyramid of numbers for your food chain.



or



excretion and egestion
uneaten parts of organisms
heat loss via respiration
metabolism and movement

- (b) Explain how energy losses occur along food chains.

[3]

Energy is lost from one trophic level to the next in the form of heat through respiration, metabolism and movement, excretory products and faeces. They are also trapped in the uneaten parts of organisms. About 90% of energy is lost and only 10% of energy is passed on during feeding from one trophic level to the next.

[4]

For Examiner's Use

ECF allowed in 0' level marking. But no full credit for the next part.

Note: Energy is not used for respiration! Rather, energy is released by respiration.

(c) Explain the term *bioaccumulation*.

MR: Name eg. of toxins eg DDT/mercury.

don't use "chemicals", but "toxins".

(or "harmful chemicals")

Certain harmful chemicals such as the insecticide, DDT, cannot be broken down by organisms and cannot be excreted. As such if consumers keep on consuming food that contains these harmful chemicals, the concentration will increase in their bodies. This is known as bioaccumulation.

[3]

[Total: 10]