

The organism in the environment

Draw a line to match the following words to the correct definition:

- Population The place or type of site where an organism or population naturally occurs
- Community A community of living things and the environment in which they live
- Habitat Group of species living in a particular local area
- Ecosystem A group of organisms of the same species populating a given area

Plan an experiment to investigate the population size of dandelions (Taraxacum officinale) in 2 different grassland areas.

C } COMPARE THE ABUNDANCE OF DANDELIONS
 O } IN TWO AREAS BY SELECTING A
 R } SITE IN EACH AREA AND PLACING
 M } QUADRAT RANDOMLY 10 (OR MORE) TIMES
 S } IN EACH SITE. COUNT NUMBER OF DANDELIONS
 AND AVERAGE. KEEP TIME OF YEAR, COUNTER, QUADRAT
 SIZE SAME

Many interactions occur in an ecosystem such as:

- i) Interaction between organisms – e.g. competition for
 FOOD, LIGHT, MATES, SPACE
- ii) Interactions between the organism and the environment, e.g.
 O₂ FOR RESPIRATION, CO₂ FOR PHOTOSYNTHESIS
 LIGHT

Feeding relationships

A food chain represents a FLOW of energy, from one organism to another. The different stages in a food chain are often called TROPHIC levels. The first trophic level are the organisms which transfer the sun's energy into chemical energy (food) and are collectively known as PRODUCERS. These are consumed by primary consumers (HERBIVORES) which in turn are consumed by SECONDARY consumers and so on.

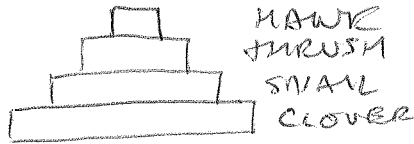
The original energy input from the sun is considerably smaller than that used by the plants. Reasons for this include:

- i) REFLECTION OFF OF LEAF SURFACE
- ii) WRONG WAVELENGTH / MISSES PLANT

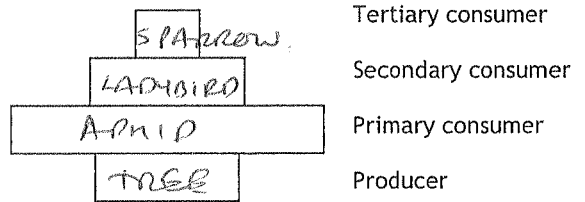
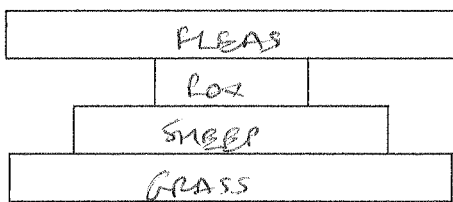
Indeed from one trophic level to the next only 10 % of the energy is passed on. The remaining 90 % is:

USED BY THE ORGANISM*; RELEASED AS
 HEAT ENERGY, FOUND IN INDIGESTIBLE
 MATERIAL * FOR LIFE PROCESSES (GIVE EXAMPLE)

Therefore food chains are usually limited to a maximum of 5 stages as the energy become insufficient to support another level. As a consequence the size of the population of organisms at each trophic levels REDUCES..... The following Pyramid of numbers represents this:



However, in some food chains this typical pyramid of numbers does not happen. Under the following two pyramids draw a food chain which would show the pattern:

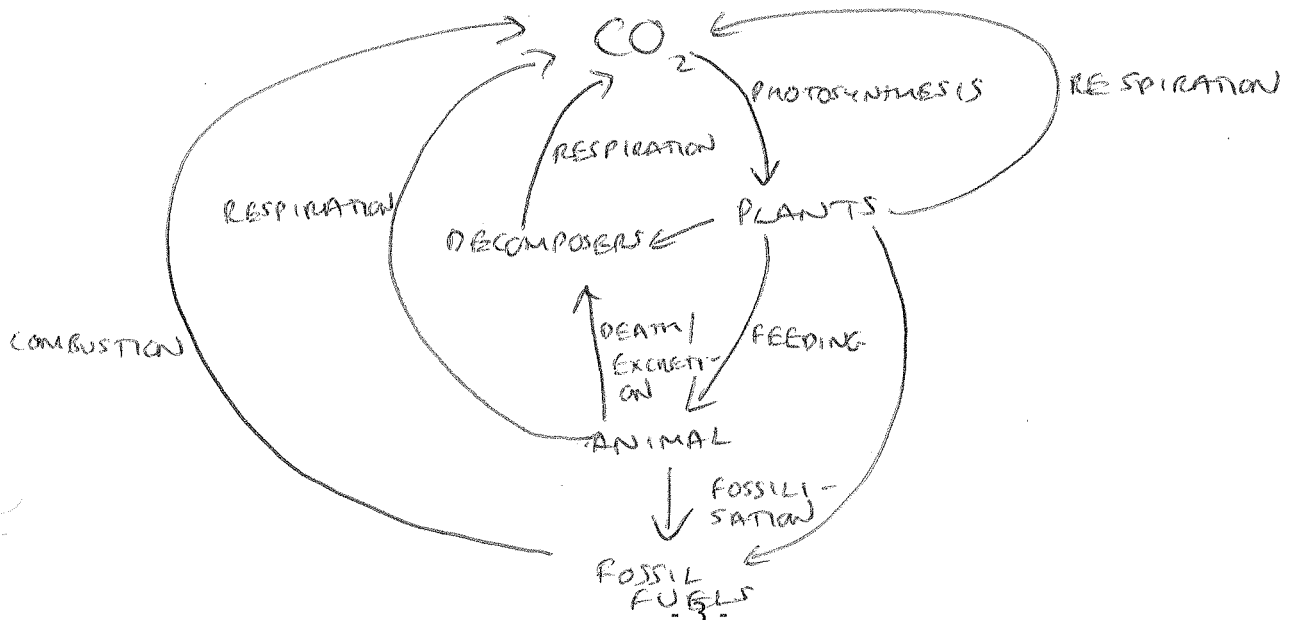


Tertiary consumer
Secondary consumer
Primary consumer
Producer

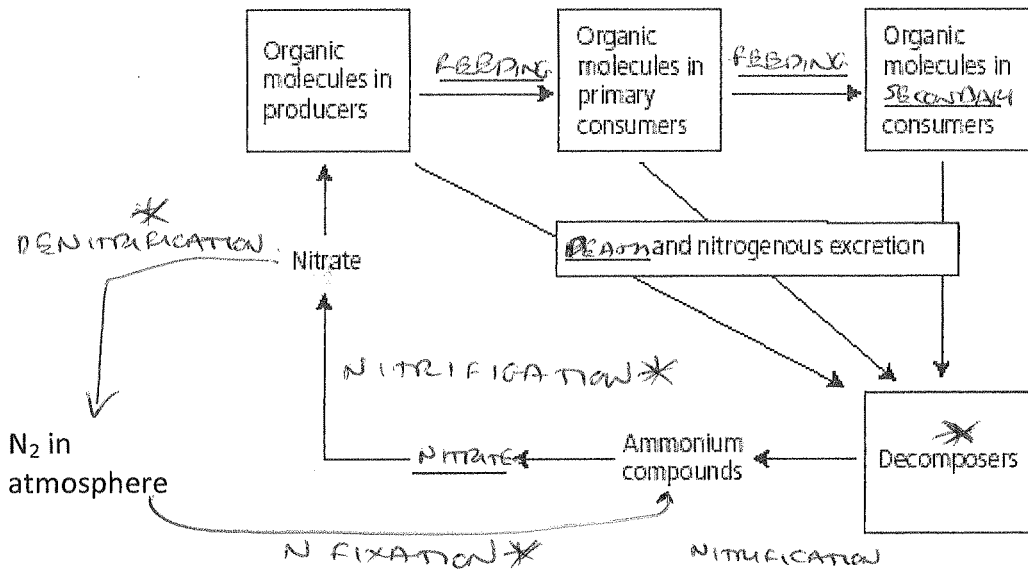
To overcome this problem Scientists often convert pyramids of number into pyramids of BIOMASS. In this case the bar width represents both the number and MASS..... of the organism at that trophic level. This measure is only made once a year and the value obtained is called the STANDING CROP. If the organism has a very fast REPRODUCING rate they can sometimes appear to support a population with a seemingly larger BIOMASS..... To overcome this final hurdle the most accurate representation is to measure the ENERGY..... at a particular trophic level (the units would be: KJ/m²/yr.....) and to construct a pyramid of ENERGY..... This is quite difficult to do.

Nutrient cycling

Draw and label a diagram of the carbon cycle below:



Label the following diagram of the Nitrogen cycle; in addition draw an arrow from N₂ into the cycle representing the process of nitrogen fixation:



The conversion of ammonium ions to nitrate is known as Denitrification converts NO₃⁻ into N₂. Put an asterisk by the stages in which bacteria are involved.

Use the space below to describe the cycling of water:

EVAPORATION FROM SEA/LAKES → CLOUD FORMATION
RESPIRATION/TRANSPIRATION/COMBUSTION → " "
CLOUDS → PRECIPITATION

Human influences on the environment

Air pollution:

The burning of fossil fuels releases many substances which can damage the environment. These include CO₂, SO₂, OXIDES OF NITROGEN which will combine with water to form acid rain. The effects of this include:

- I. ACIDIFICATION OF LAKES
- II. LEACHING OF SOIL NUTRIENTS → DAMAGE PLANTS
- III. DAMAGE TO BUILDINGS

In addition the gas CO₂ is also released this along with CH₄, WATER VAPOR NITROUS OXIDES and CFC's are known as GREENHOUSE gases. Sources of these gases include:

- BURNING FOSSIL FUELS
- RICE FIELDS
- CATTLE FARMING (MEAT + DAIRY)

The additional release of these gases over the last century has contributed to an ENHANCED greenhouse effect, potentially leading to GLOBAL warming. In the following space describe 5 possible consequences of this:

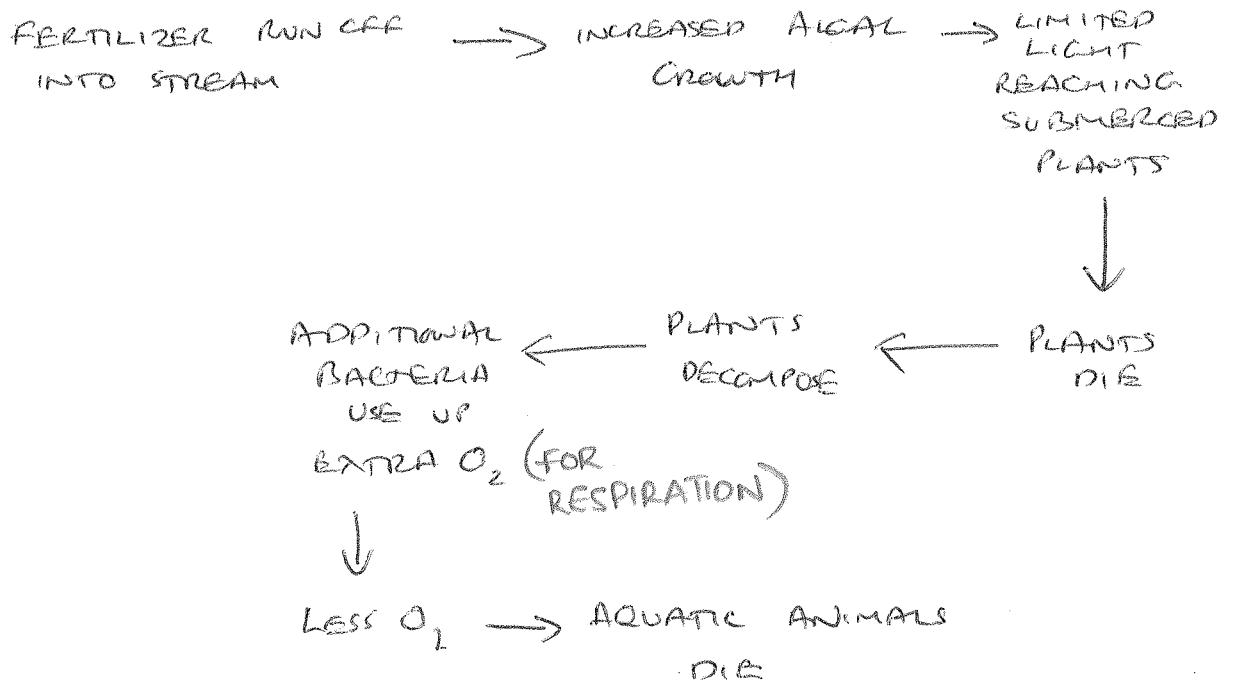
- MELTING OF POLAR ICE CAPS, - LEADING TO FLOODING
- ALTERING GLOBAL RAINFALL - DESERTIFICATION OF SOME AREAS
- EXTINCTIONS
- CHANGES IN SPECIES DISTRIBUTIONS
- CHANGING OCEAN CURRENTS
- INCREASED PESTS

Another air pollutant from the INCOMPLETE combustion of fossil fuels is CO. This is potentially very dangerous as it is POISONOUS and combines with haemoglobin preferentially to oxygen. The person will therefore be unable to carry sufficient O₂ which can lead to death.

Water pollution:

The release of sewage into waterways is dangerous as it will increase the level of BACTERIA in the water which will lead to a much REDUCED oxygen demand, thus REDUCING the amount of oxygen in the water.

EUTROPHICATION is a consequence of fertiliser entering water ways. In the space below draw a flow chart of the process.



Deforestation:

The removal of forested areas, particularly in the TROPICS, is due to a demand for:

WOOD (TIMBER); LAND

This has huge consequences including:

- I. soil erosion
- II. loss of soil nutrient content (LEACHING)
- III. HIGHER CO₂ → LESS PLANTS PHOTOSYNTHESIZING
- IV. FLOODING

Overfishing and overgrazing:

List three consequences of the above human impacts:

Overfishing:

- LOSS OF SPECIES (EXTINCTION)
- DAMAGE TO SEA ECOSYSTEM
- " " " BED

Overgrazing:

- SOIL EROSION
- DESERTIFICATION

IGCSE Questions

1. A river is polluted by some raw sewage. This causes changes in the number of microorganisms in the river. This in turn has an effect on the number of large fish in the river. Describe and explain these changes.

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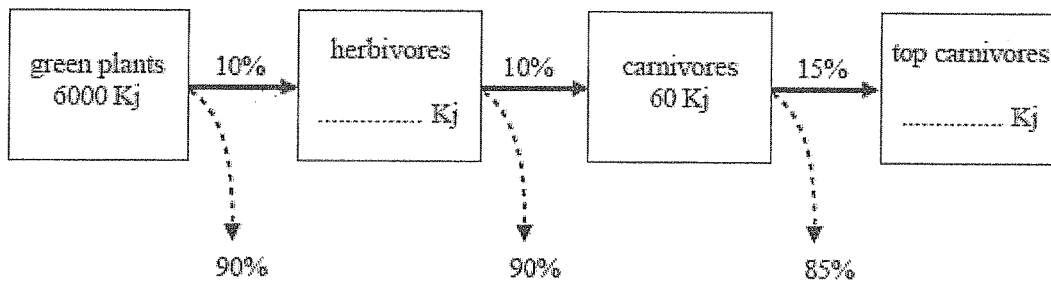
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Total 5 marks

2. The boxes in the diagram show the amount of energy in different trophic levels of a food chain. The numbers on the solid arrows show the percentage of energy transferred between the organisms in the different trophic levels. The numbers on the dotted arrows show the percentage of energy not transferred from one trophic level to the next.



(a) Complete the diagram by showing the amount of energy in the box for the herbivores and in the box for the top carnivores. (2)

(b) All organisms respire. One reason why 90% of the energy is not transferred from the herbivores to the carnivores is because of respiration by the herbivores.

(i) Give the balanced chemical symbol equation for respiration.

.....(3)

(ii) Give two reasons, other than respiration, why 90% of the energy in herbivores is not transferred to the carnivores.

1

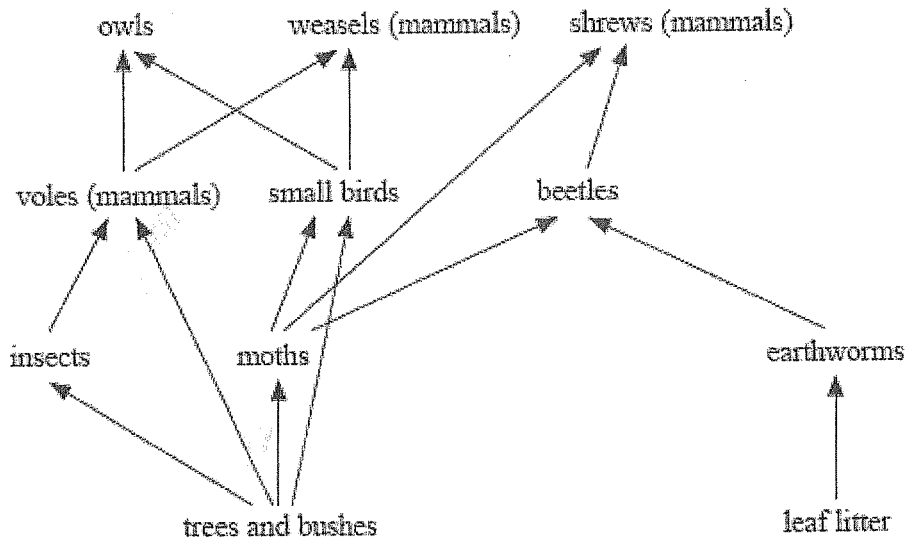
2.....(2)

Which group of organisms shown in this food chain are secondary consumers?

.....(1)

Total 8 Marks

3. The diagram shows a food web for a wood.



(a) Give a food chain that contains four organisms and includes shrews. (2)

(b) Explain what would happen to the populations of voles and of owls if a farmer catches a lot of weasels.

Voles

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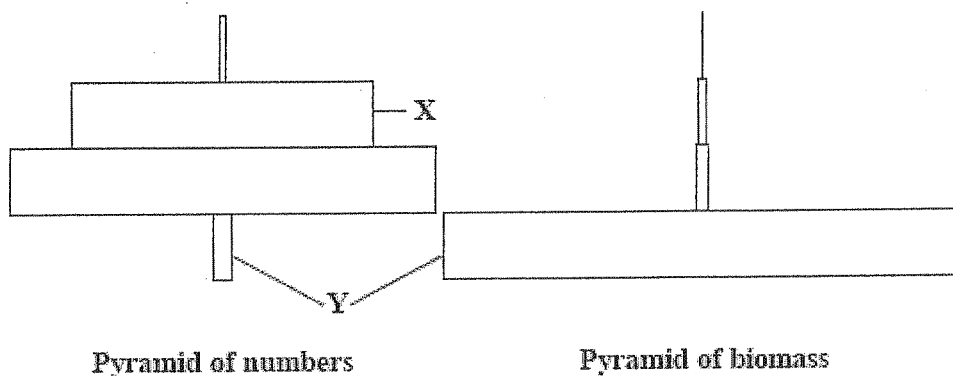
.....

Owls

.....

..... (4)

(c) The diagrams show a pyramid of numbers and a pyramid of biomass for the same area in this wood.



Pyramid of numbers Pyramid of biomass

(i) Name **one** organism from the food web that is in trophic level X.

..... (1)

(ii) The organisms in trophic level X are described as secondary consumers. What term describes the organisms in trophic level Y?

.....(1)

(iii) Explain why trophic level Y is narrow in the pyramid of numbers but is the widest trophic level in the pyramid of biomass.

.....
.....(2)

Total 10 marks

4. A habitat is a place where organisms live. The food chains below are from different habitats.

From a seashore

seaweed → periwinkle → oystercatcher
(a mollusc) (a bird)

From the edge of a field

blackberry → bank vole → tawny owl
(a fruit) (a mammal) (a bird)

(a) (i) Name **one** primary consumer in these food chains.

.....(1)

(ii) What is the original energy source for these food chains?

.....(1)

(b) The following food chains come from a woodland environment.

leaf litter → earthworm → blackbird → sparrow hawk
dead mouse → blowfly larvae → common frog → grass snake

Other than the names of the organisms, give **two** ways in which these food chains differ from the examples in part (a).

1.....
2.....(2)

(c) (i) Name **two** groups of organisms that can act as decomposers in food chains.

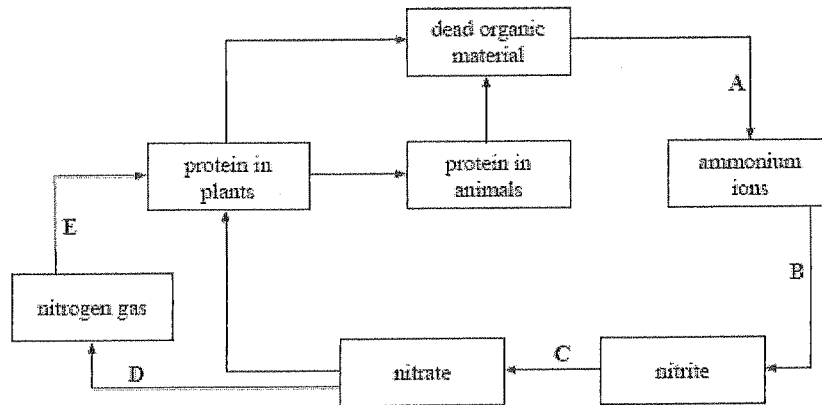
1.....
2.....(2)

(ii) Describe the role of decomposers in the carbon cycle.

.....
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.....(3)

Total 9 marks

5. The diagram shows some of the processes in the nitrogen cycle.



Bacteria are involved in the stages labelled A, B, C, D and E.

(a) Give the letter of **one** stage that involves each of the following.

- nitrifying bacteria
- denitrifying bacteria
- nitrogen-fixing bacteria(3)

(b) Fungi are also involved in the nitrogen cycle. Describe how fungi feed.

.....

(2)

(c) Explain how the use of nitrate fertiliser on a farmer's field can affect algal growth in rivers.

.....

(4)

Total 9 marks

6. The sentence below was said in a speech about how human activities can affect the environment.



Use your knowledge to explain how human activities contribute to global warming, and to suggest why it might be seen as a danger.

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Total 5 marks



REVISION BOOKLET & ANSWERS

1.

increase in number of microorganisms / eq;
breakdown / decompose / decomposition;
bacteria / fungi;
oxygen reduced;
respiration;
fish die;
decrease in number of fish;
maximum of 5

(5)

Total 5 marks

2.

(a) 600;
9;

(2)

(b) (i) LHS; RHS; balanced;
(ii) not eaten / inedible;
not digested / indigestible / egested;
excreted / urine / sweating;
movement;
heat loss;
death / decomposers;
maximum of 2

(3)

(2)

(c) carnivores;

(1)

Total 8 marks

3.

(a) correct chain;
chain in the correct direction (arrows);

(2)

(b) voles increase;
fewer weasels eating them / less eaten fewer predators / eq;
owls increase;
more voles / more small birds / more food / less competition;

(4)

(c) (i) voles, small birds or beetles;
(ii) producers;
(iii) producers are few / trees are few / one tree;
producers are heavy / trees are heavy / have lots of
mass / bigger / larger;

(1)

(1)

(2)

Total 10 marks

4.

Question Number	Question		
	(a)		
	Acceptable Answers	Reject	Mark
	(i) periwinkle / (bank) vole;		1
	(ii) sun / light;		1
			(2)

Question Number	Question		
	(b)		
	Acceptable Answers	Reject	Mark
	4 links / eq, e.g. longer/more organisms/more consumers/ref tertiary consumer; they do not start with a producer / start with dead organisms;		(2)

Question Number	Question		
	(c)		
	Acceptable Answers	Reject	Mark
	(i) bacteria; fungi;		2
	(ii) rot / decay / digest / breakdown; dead organisms; release carbon dioxide; respiration; carbon dioxide absorbed by plants / used in photosynthesis;		3
			(5)

Total 9 marks

5.

Question Number	Question		
	(a)		
	Acceptable Answers	Reject	Mark
	B or C; D; E;		(3)

Question Number	Question		
	(b)		
	Acceptable Answers	Reject	Mark
	secrete enzymes; external digestion / on to food; product absorbed;		(2)

Question Number	Question		
	(c)		
	Acceptable Answers	Reject	Mark
	leaching / run off / idea of fertiliser getting into river; increase in algal growth; amino acids / proteins; eutrophication;		
	Notes		(4)

Total 9 marks

6. (a) (i) 1st week / 2nd week;
(ii) oestrogen;
(iii) ovary;
- (b) progesterone;
- (c) ovulation / egg release;

1
1
1
1
1

Total 5 marks

- greenhouse gas
• CO₂ / methane /; Greenhouse effect; / Global warming;
- Example: combustion of fossil fuels.
car emissions
deforestation
- melting polar ice
flooding
climate change
extinction of species.

