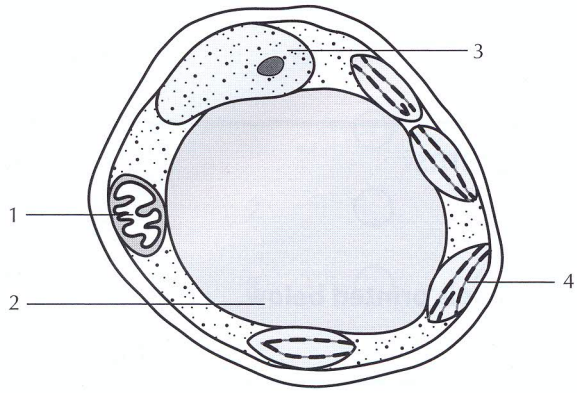
SECTION 1 ANSWER GRID

Mark the correct answer as shown ✓

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○

SECTION 1

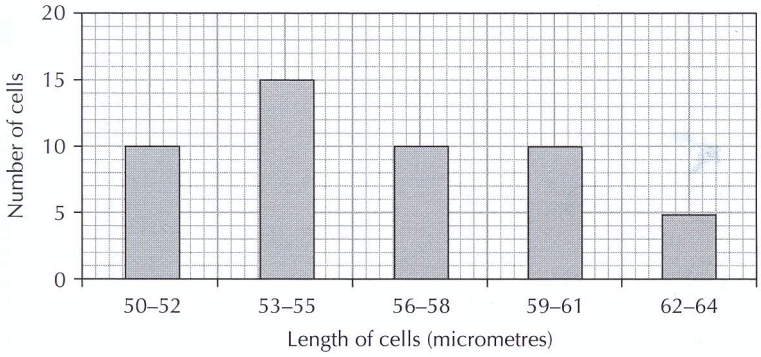
1. The diagram below shows some structures present in a mesophyll cell from a green plant.



Which line in the table below identifies correctly the structures in the cell that carry out photosynthesis and contain genetic information?

	Carry out photosynthesis	***Contain genetic information***
A	1	2
B	4	3
C	1	3
D	4	2

2. The histogram below shows the number of cells of different lengths in a sample of onion epidermis.



What percentage of the cells in the sample have a length greater than 58 micrometres?

A 15%

B 25%

C 30%

D 50%.

3. 50 mm strips of potato tissue were placed into each of three sucrose solutions P, Q and R of different concentrations and left at room temperature. After 1 hour the strips of tissue were re-measured and the results are shown in the table below.

Sucrose solution	***Length of potato tissue strip after 1 hour* (mm)**
P	50
Q	47
R	52

Which of the following conclusions based on these results is valid?

A Solution P had a lower concentration of sucrose than the potato cell sap

B Solution Q had a higher concentration of sucrose than the potato cell sap

C Solution R had a higher concentration of sucrose than the potato cell sap

D Solutions P, Q and R had the same concentration as the potato cell sap.

4. In active transport, molecules are moved by membrane

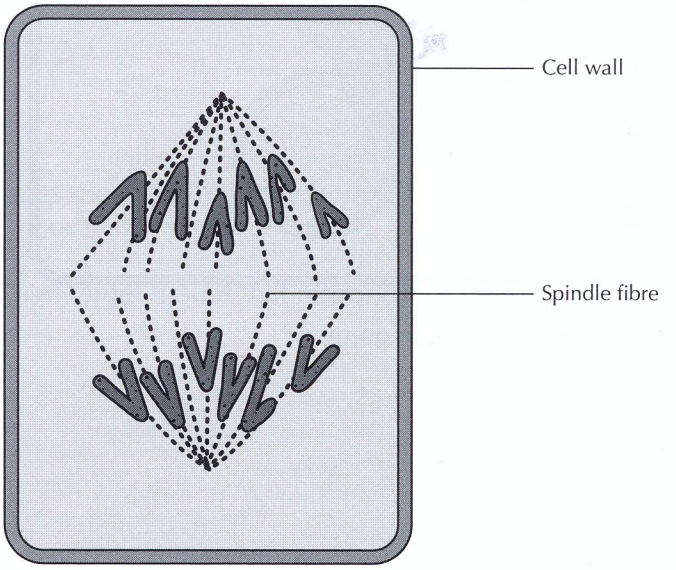
A proteins against the concentration gradient

B lipids down the concentration gradient

C lipids against the concentration gradient

D proteins down the concentration gradient.

5. The diagram below shows a stage in mitosis in a plant cell.



Which of the following best describes the chromosomes at the stage of mitosis shown?
The chromosomes have

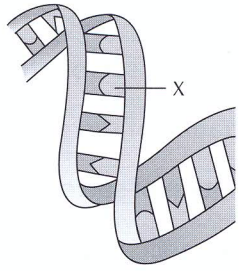
A become visible as pairs of identical chromatids

B aligned at the equator of the spindle

C gathered at opposite poles of the spindle

D been pulled apart by spindle fibres.

6. The diagram below represents a short piece of a DNA molecule.



Which part of the DNA molecule is shown at X?

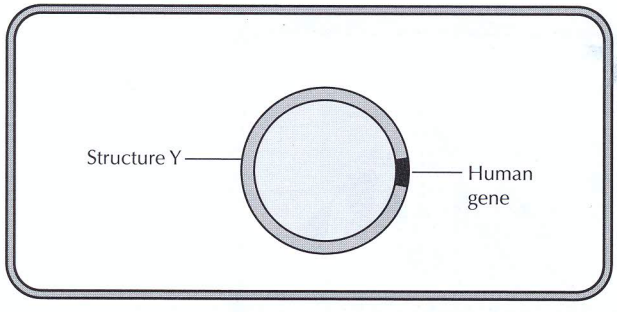
A Sugar

B Base

C Gene

D Amino acid.

7. The diagram below shows a genetically modified bacterial cell that contains a human gene.



Structure Y, which contains the human gene, is

A the nucleus

B a chromosome

C a ribosome

D a plasmid.

8. A group of similar cells working together to perform the same function is called

A an organism

B a system

C an organ

D a tissue.

9. Which of the following statements is **false** in relation to stem cells?

Stem cells

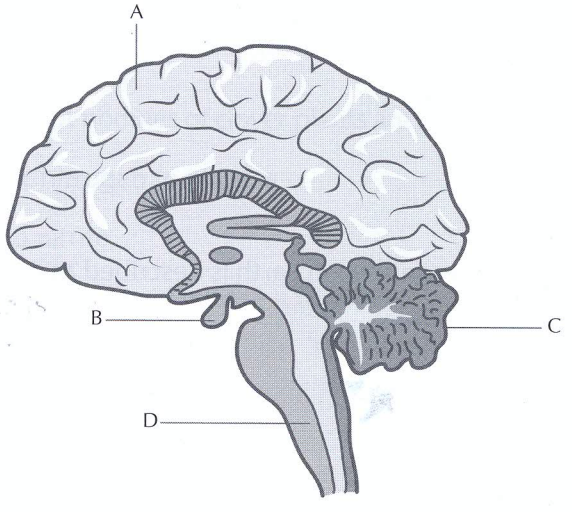
A are found in animal embryos

B can undergo cell division

C develop into gametes

D can produce new stem cells.

10. The diagram below shows a vertical section through the human brain.



Which letter indicates the site of memory storage and reasoning?

11. Which organ contains target tissues that respond to insulin?

A Small intestine

B Pancreas

C Liver

D Brain.

12. Which line in the table below shows correctly the chromosome complements of the mammalian cells listed?

	Mammalian cell		
	muscle cell	***gamete***	***zygote***
A	diploid	haploid	haploid
B	diploid	haploid	diploid
C	haploid	diploid	diploid
D	haploid	diploid	haploid

13. The cardiac output from the heart is calculated using the equation shown below.

cardiac output (litres per min) = volume of blood pumped per beat (cm^3) × heart rate (beats per minute)

A hospital patient had a heart rate of 80 beats per minute and a cardiac output of 4 litres per minute.

What is the volume of blood pumped per beat?

A 5 cm^3

B 20 cm^3

C 50 cm^3

D 320 cm^3.

14. The total variety of all living organisms on Earth is described as its

A biome

B biodiversity

C ecosystem

D population.

15. Which of the following statements is **true**?

A Scottish moorland community consists of all of the

A plant species present

B plants species present and the non-living environment

C plant and animal species present and the non-living environment

D plant and animal species present.

16. Which of the following factors are **both** biotic?

A Predation and temperature

B Temperature and pH

C pH and grazing

D Grazing and predation.

17. Between each level in a food chain 90% of energy is lost.

In the food chain below, the plant plankton contains 100 000 units of energy gained by photosynthesis.

plant plankton → **animal plankton** → **small fish** → **predatory fish**

How many energy units would be found in the predatory fish?

A 10 000

B 1 000

C 100

D 10.

18. Bacteria present in the root nodules of clover plants are beneficial to the plants because they

A convert atmospheric nitrogen to nitrates

B convert ammonia to nitrite

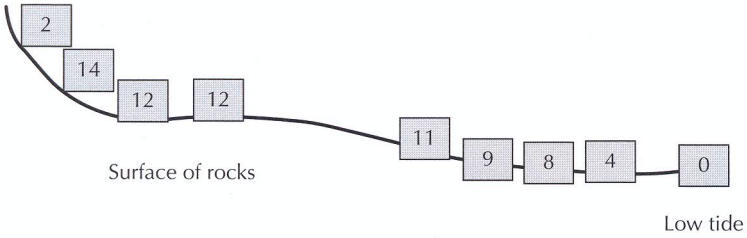
C remove nitrogen from roots and release it to soil

D synthesise protein for plant cells.

Questions 19 and 20 refer to the following information.

A survey of the number of limpets on rocky areas of a seashore was carried out using quadrats.

The squares in the diagram below indicate the number of limpets recorded in each quadrat.



19. What is the average number of limpets per quadrat?

A 8

B 9

C 11

D 12.

20. Which of the following is a precaution needed to make the results of the survey more valid?

A Place quadrats randomly

B Use exactly ten quadrats

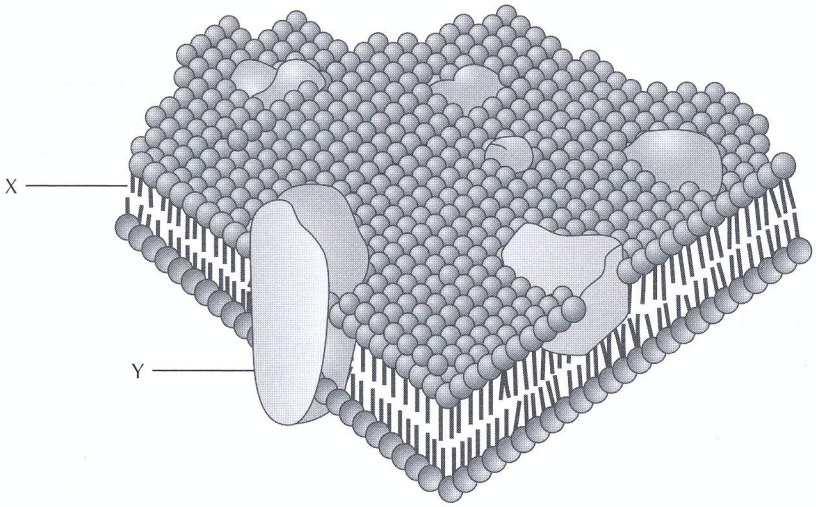
C Place quadrats where limpets occurred

D Repeat the quadrat sampling several times.

MARKS
Do not write in this margin

SECTION 2

1. The diagram below represents molecules present in a magnified fragment of cell membrane.



(a) Name molecules X and Y.

X _____

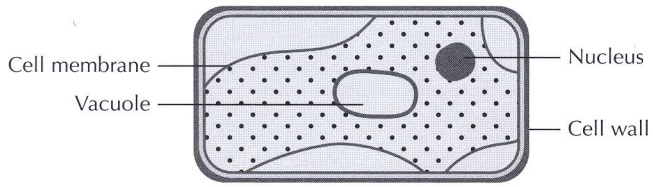
Y _____ 2

(b) Complete the following sentences by underlining the correct options in each choice bracket.

The cell membrane is {selectively / fully} permeable and transports water in and out of the cell by osmosis.

Osmotic movement occurs {down / against} the concentration gradient and and {requires / does not require} energy. 2

(c) The diagram below shows a cell from a piece of plant tissue.



(i) Describe how a piece of plant tissue could be treated so that its cells appeared as shown in the diagram.

_____

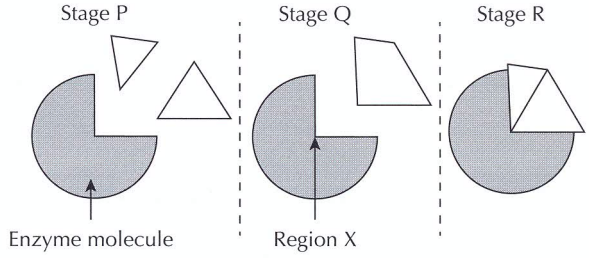
_____ 1

(ii) Give the term applied to cells that appear as shown in the diagram.

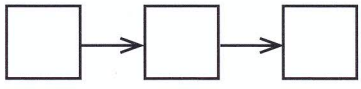
_____ 1

Total marks 6

2. The diagrams below represent stages in a synthesis (building up) reaction catalysed by a human enzyme molecule at 37 °C.



(a) Complete the flow chart below by adding letters to show the correct order of these stages as they would occur during the reaction.

 1

(b) Identify the part of the enzyme molecule labelled region X in the diagram.

_____ 1

(c) Explain why the cellular reaction above would **not** occur if the temperature were increased to 60 °C

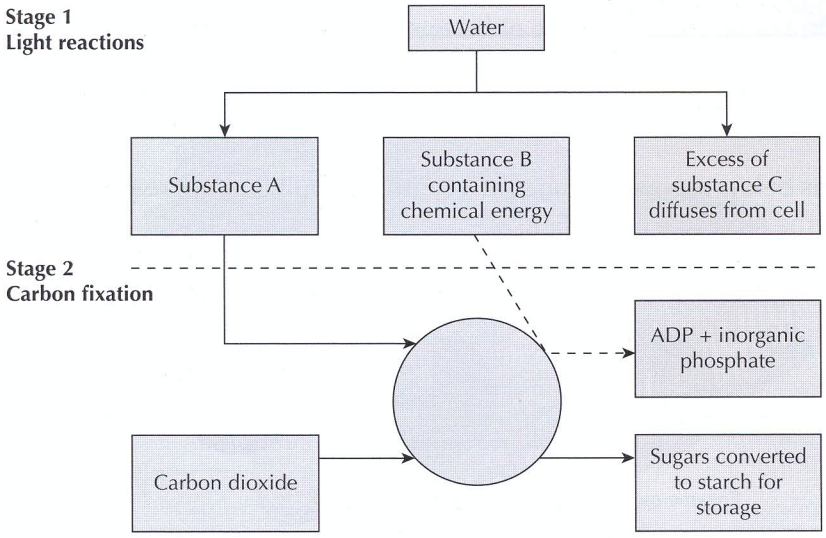
_____

_____ 2

Total marks 4

MARKS
Do not write in this margin

3. (a) The diagram below shows parts of two stages of photosynthesis in a green plant.



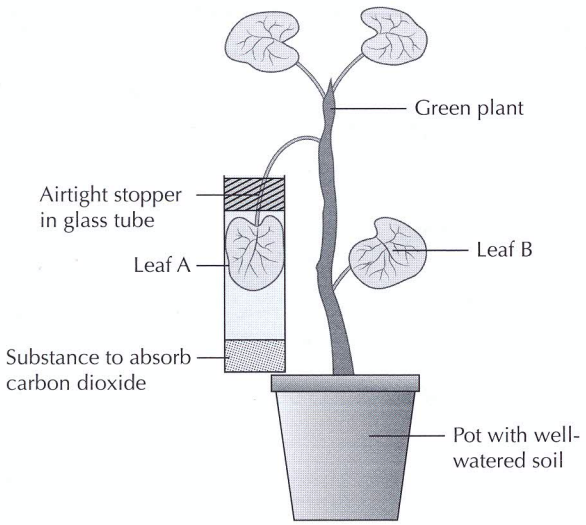
Complete the table below by naming substances A, B and C produced during Stage 1.

Substance	*Name*
A	
B	
C	

2

(b) The apparatus in the diagram below was used to investigate the requirements for photosynthesis in a green plant.

The plant was kept in darkness for 24 hours before being placed in bright light for 5 hours.



MARKS
Do not write in this margin

(i) After the apparatus had been in bright light for 5 hours, a test for starch was carried out on **leaf A**.

Predict the result of this test and give a valid conclusion about the requirements for photosynthesis that can be drawn from it.

Result _____ 1

Conclusion _____

_____ 1

(ii) Describe how **leaf B** would be treated so that it could act as a control in this experiment.

_____

_____ 1

(iii) Describe how the apparatus could be altered to show that light is needed for photosynthesis.

_____

_____ 1

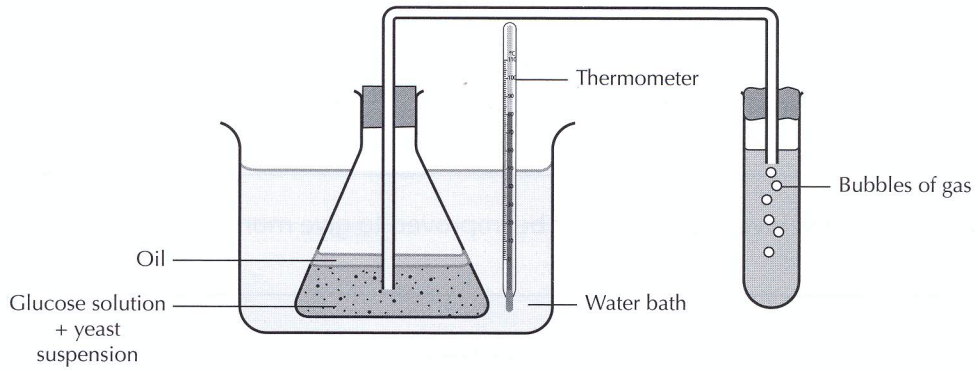
_____

Total marks 6

4. An investigation was carried out on the effect of temperature on the rate of fermentation in yeast.

Apparatus as shown in the diagram below was set up, and the number of bubbles of gas produced by the yeast per minute was counted at various temperatures, as shown in the table.

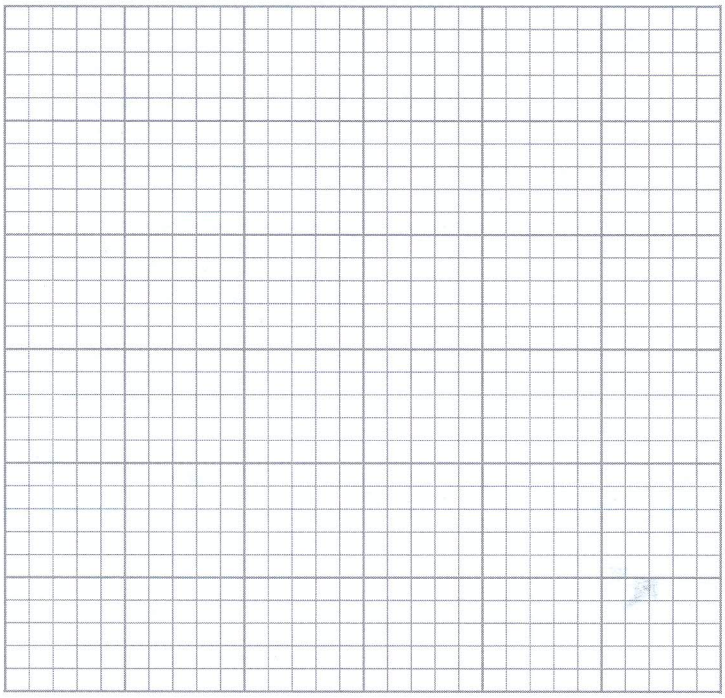
Apparatus



Temperature (°C)	*Bubbles of gas produced per minute*
10	30
15	50
20	80
25	110
30	120

(a) On the grid provided below, draw a line graph of temperature against number of bubbles of gas produced per minute.

(A spare grid, if required, can be found on page 31.)



2

(b) Identify the gas produced during fermentation.

_____ 1

(c) Suggest how the investigation could be improved to give more accurate results.

_____

_____ 1

(d) Predict how the results would be different if the investigation were repeated at 5 °C. Explain your answer.

Prediction _____ 1

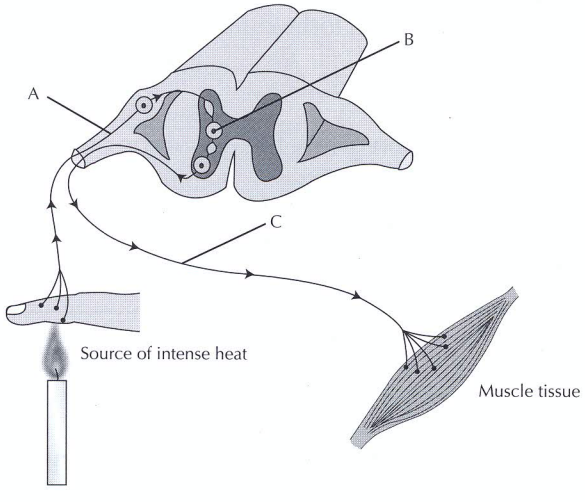
Explanation

_____

_____ 1

Total marks 6

5. The diagram below shows a reflex arc in a human and the neurons involved.



(a) Identify the type of neuron shown at A.

_____ 1

(b) Name the gap at B and describe the role of chemicals that enter this gap.

Name _____

Role _____ 2

(c) Explain the advantage of this reflex to the human involved.

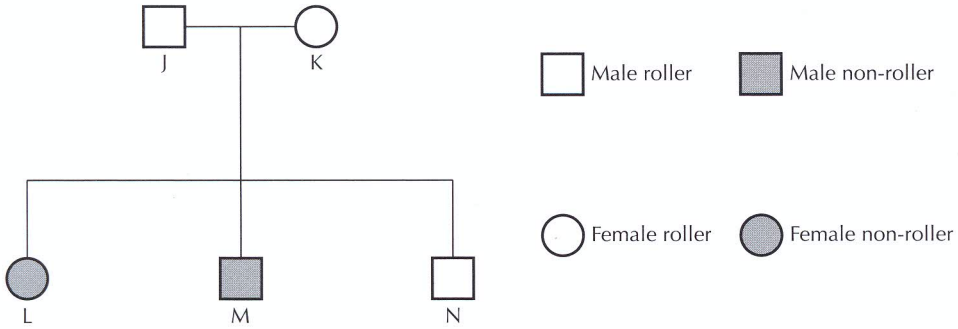
_____

_____ 2

Total marks 5

6. Tongue rolling in humans is controlled by a single gene.
The dominant allele is tongue-rolling (**R**) and the recessive allele is non-rolling (**r**).

The diagram below shows the inheritance of tongue-rolling in part of a family.



(a) Give the genotypes of the following individuals.

J _____ K _____ L _____ 2

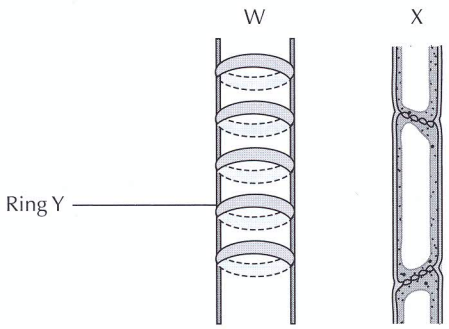
(b) Explain why, from the information given, the genotype of individual N cannot be known for certain.

_____

_____ 2

Total marks 4

7. The diagram below shows cells from tissues involved in the transport of substances in a plant stem.



(a) Complete the table below to name tissues W and X and give **one** substance transported by each.

Tissue	*Name*	*Substance transported*
W		
X		

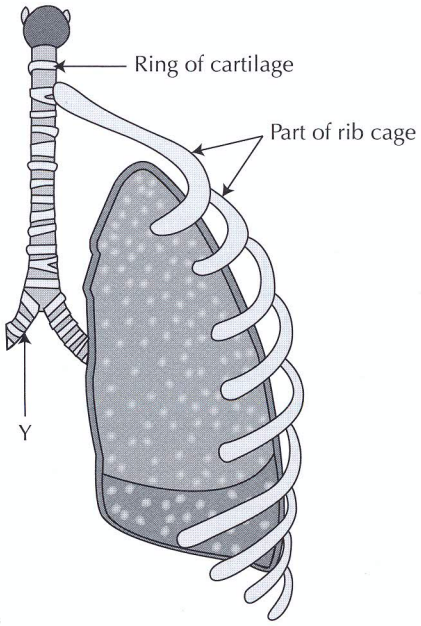
3

(b) Name the substance of which ring Y is composed.

_____ 1

Total marks 4

8. The diagram below shows part of the human breathing system.



(a) Describe the function of the rings of cartilage in the breathing system.

_____

_____ 1

(b) Some cells inside part Y secrete mucus and others have cilia.
Describe how these features ensure the maintenance of healthy lungs.

_____

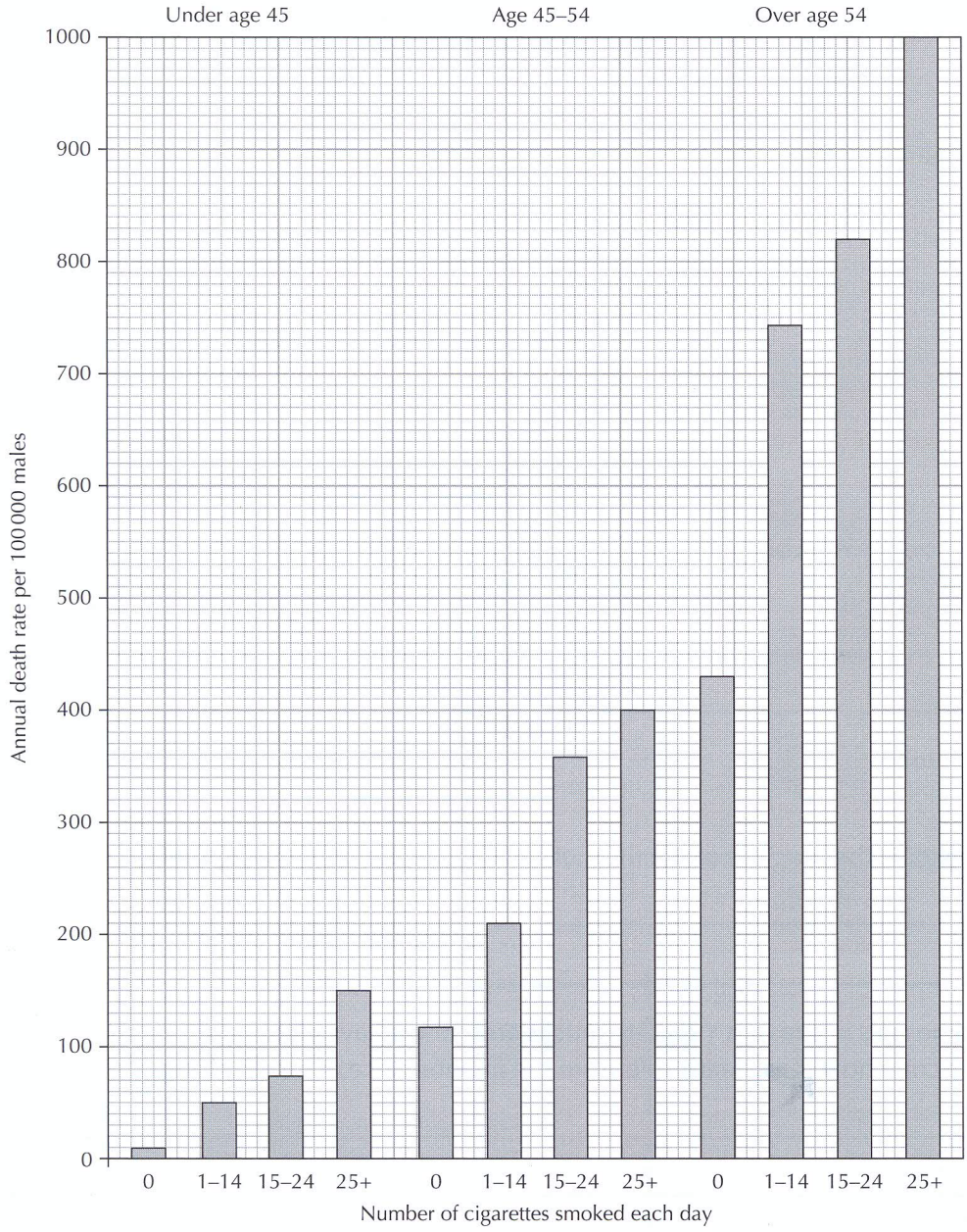
_____

_____

_____ 3

MARKS
Do not write in this margin

(c) The chart below shows some information relating to the annual death rate of males in an area of the UK from coronary heart disease over the course of one year.



(i) From the data, identify **two** factors that affect the death rate from coronary heart disease.

1 _____

2 _____ **1**

MARKS
Do not write in this margin

(ii) Calculate the percentage increase in death rate in males under 45 years when the number of cigarettes smoked per day is increased from 1–14 to 25+.

Space for calculations

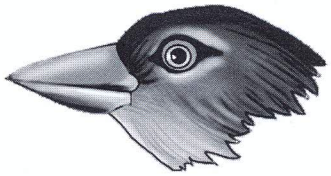
_____% 1

Total marks 6

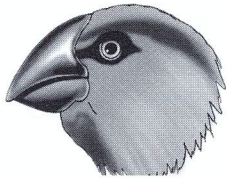
9. The table and diagrams below give information about the beaks of two species of finch and a description of the habitats they occupy on the Galapagos Islands.

Size and shape of beak	***Description of habitat***
wide, deep and blunt	woodland with flowering shrubs providing large seeds and nuts
long, narrow and pointed	woodland with rotting logs providing food for insects

Finch species P



Finch species Q



(a) Identify the finch species that eats large seeds and give a reason for your choice.

Species _____

Reason _____

_____ 1

(b) Suggest **two** ways in which competition between the two species is reduced.

1 _____

2 _____ 2

(c) These two species may have arisen by evolution from a common ancestor.
The processes below are involved in the formation of new species.

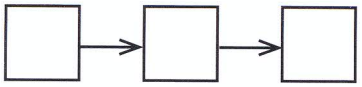
P mutation

Q natural selection

R isolation

MARKS
Do not write in this margin

Complete the flow chart below by adding the letters to show the order in which these processes would have occurred to produce the two species of finch.

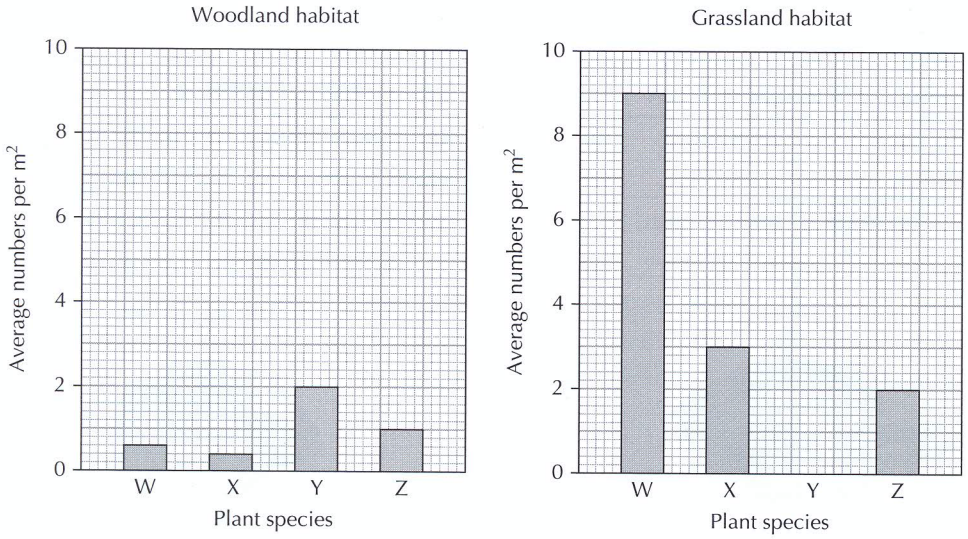


1

Total marks 4

10. The bar charts below show the results of an investigation carried out to compare the numbers of four different species of ground layer plants in a hectare of woodland with the numbers found in a hectare of grassland nearby.

(1 hectare = 10 000 m²)



(a) Name a technique that could be used to estimate the number of plants of each species present and describe its use.

Name _____

Description _____ 1

(b) Calculate the simplest whole number ratio of perennial rye grass to clover in the grassland habitat.

_____ : _____
perennial rye grass clover 1

MARKS
Do not write in this margin

(c) Estimate the total number of wood sorrel plants that would be present in the entire hectare of woodland.

Space for calculations

_____ plants 1

(d) **Choose** an abiotic factor that might be involved in the different abundance of perennial rye grass in these two habitats and explain its role.

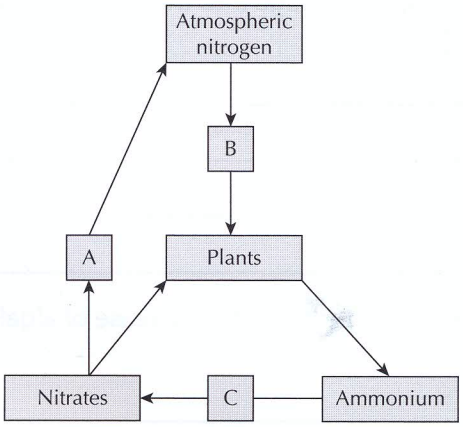
Abiotic factor _____

Explanation _____

_____ 2

Total marks 5

11. The diagram below shows part of the nitrogen cycle.



(a) Complete the table by inserting **one** letter from the diagram into each box to show the type of bacteria involved at each of the stages shown in the diagram.

Type of bacteria involved	***Letter***
nitrogen-fixing bacteria	
nitrifying bacteria	
denitrifying bacteria	

2

(b) Name **one** type of substance found in plants that is produced using nitrates taken up from the soil.

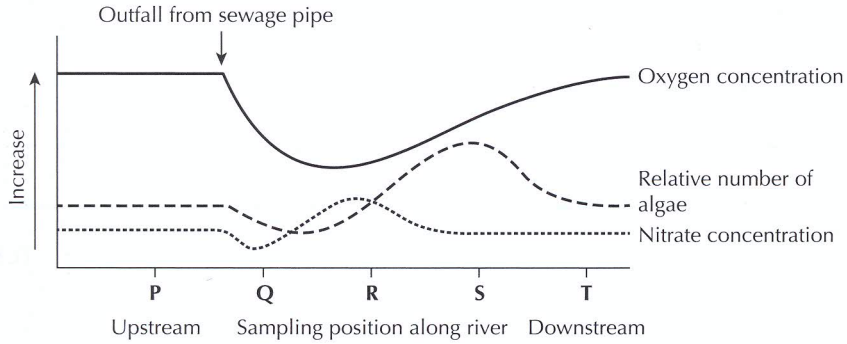
_____ 1

(c) Give the general name for organisms that can produce ammonium from plant remains.

_____ 1

Total marks 4

12. The graph below shows the concentration of dissolved oxygen and nitrate together with the numbers of algal cells present at various sampling positions along a river near the outfall from a sewage pipe.



(a) Explain why the introduction of sewage into the river leads to the reduction in oxygen levels shown in the graph.

_____

_____

_____

_____ 3

(b) Suggest **one** factor that may have led to the increase of algal cells **between Q and R** on the graph.

_____ 1

(c) Explain how the presence of algae can lead to increases in the oxygen concentration of the water.

_____ 1

(d) Describe a piece of evidence from the graph that suggests that this river recovers from the polluting effects of sewage.

_____ 1

Total marks 6

[END OF QUESTION PAPER]