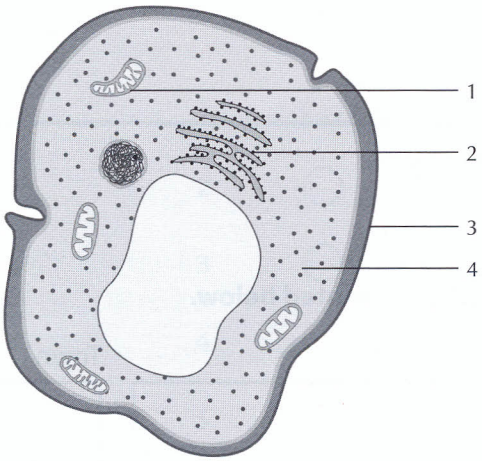
SECTION 1 ANSWER GRID

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

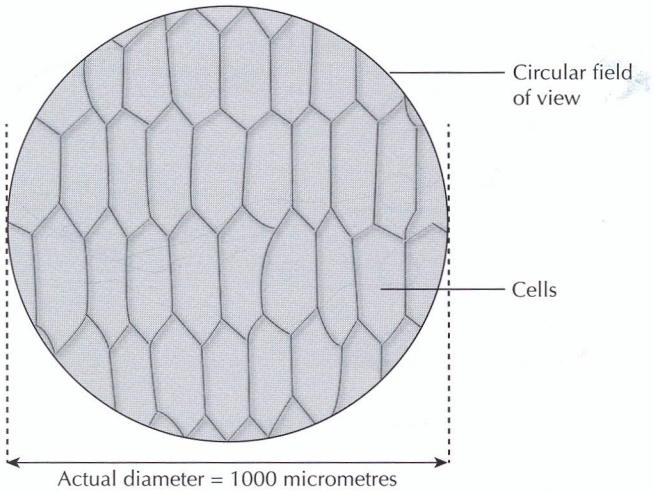
1. The diagram below shows some structures present in a fungal cell.



Which line in the table below identifies correctly the site of aerobic respiration and the structure that provides support for the cell?

	Site of aerobic respiration	***Provides support for cell***
A	1	4
B	2	3
C	2	4
D	1	3

2. The diagram below shows cells in a piece of onion epidermal tissue as seen under a microscope.



The best estimate of the average **length** of the cells shown is

A 10 micrometres

B 25 micrometres

C 100 micrometres

D 250 micrometres.

3. Which line in the table below shows correctly the terms that apply to the descriptions of enzyme action given?

	Description of enzyme action	
	best conditions for enzyme action	***effect of reaction on enzyme molecules***
A	optimum	denatured
B	specific	unchanged
C	optimum	unchanged
D	specific	denatured

4. The following are stages in the genetic engineering of bacteria.

1 Insert plasmid into host cell

2 Extract required gene from chromosome

3 Insert required gene into plasmid

4 Remove plasmid from host cell.

Which is the correct sequence of stages that would be carried out during the process of genetic modification of the bacteria?

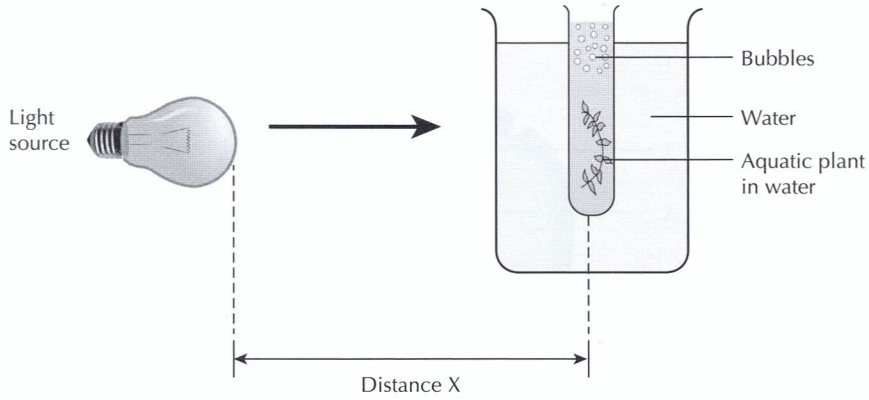
A 2→4→1→3

B 2→4→3→1

C 3→4→1→2

D 3→1→4→2.

5. The apparatus below was set up to investigate photosynthesis in an aquatic plant.



The list below shows variables related to photosynthesis that could be measured.

1 Light intensity

2 Rate of carbon fixation

3 Rate of bubble production

If distance X was increased, which variable(s) on the list would **decrease**?

A 1 only

B 2 only

C 1 and 3 only

D 1, 2 and 3.

6. The role of chlorophyll in photosynthesis is to trap

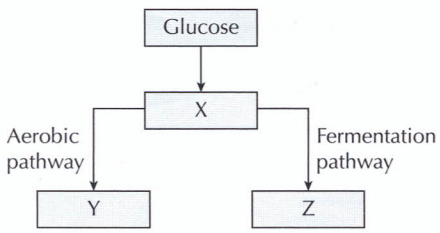
A light energy for ATP production

B light energy for carbon dioxide absorption

C chemical energy for carbon dioxide absorption

D chemical energy for ATP production.

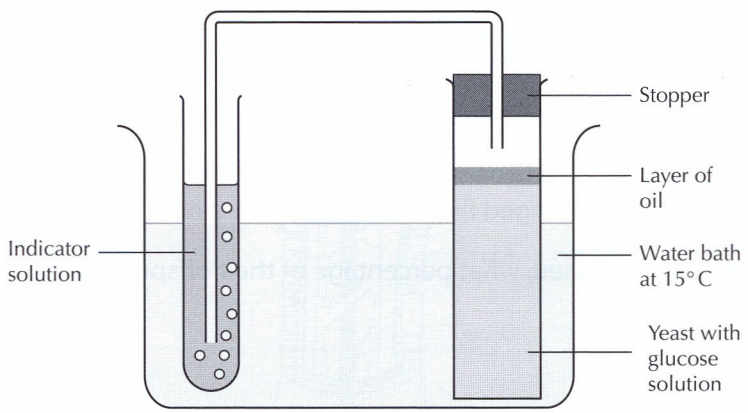
7. The diagram below shows respiratory pathways in a mammalian muscle cell.



Which line in the table below identifies correctly substance(s) in boxes X, Y and Z?

	X	*Y*	*Z*
A	pyruvate	carbon dioxide and water	lactic acid
B	pyruvate	lactic acid	carbon dioxide and water
C	lactic acid	pyruvate	carbon dioxide and water
D	carbon dioxide and water	pyruvate	lactic acid

8. The apparatus shown below was used in an investigation of respiration in yeast.



Which change to the apparatus would cause a **decrease** in the respiration rate of yeast?

A Leaving out the oil layer

B Diluting the glucose solution

C Increasing the water bath temperature to 20 °C

D Using cotton wool instead of a rubber stopper.

9. Which of the following is **not true** of meristem cells?

Meristem cells

A can undergo cell division

B have a specialised structure

C contribute to the growth of plants

D have potential to become any type of plant cell.

10. A homozygous black-coated male mouse was crossed with a homozygous brown-coated female.

All the F_1 mice were black.

The F_1 mice were allowed to mate, and the F_2 generation contained both black and brown mice.

What evidence is there that the allele for black coat is dominant to the allele for brown coat?

A Only one of the original parents was black

B The original male parent was black

C All of the F_1 were black

D Some of the F_2 were black.

11. In a breeding experiment with *Drosophila*, homozygous normal winged flies were crossed with homozygous vestigial winged flies. All of the F_1 were normal winged.

If flies from the F_1 were crossed, what percentage of their offspring would be expected to have normal wings?

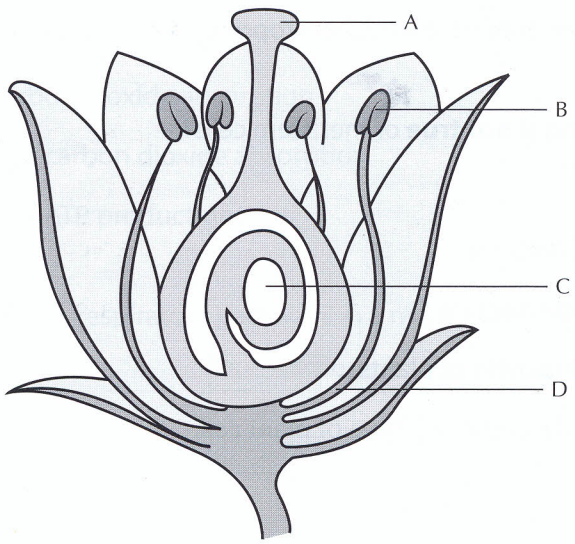
A 25%

B 50%

C 75%

D 100%.

12. The diagram below shows a vertical section through a flower.



Which part produces male gametes?

13. The plant tissue that carries sugar from the leaves to the roots is the

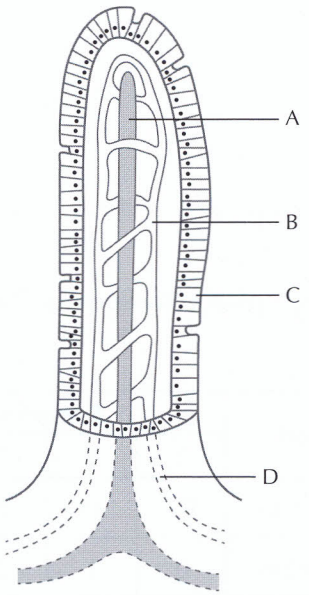
A mesophyll

B xylem

C phloem

D epidermis.

14. The diagram below shows a single villus from the small intestine of a mammal.

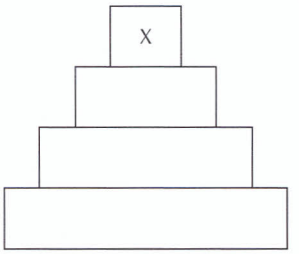


Which part is the lacteal?

15. Which line in the table below identifies correctly examples of biotic and abiotic factors affecting biodiversity?

	Biotic	***Abiotic***
A	temperature	grazing
B	pH	temperature
C	grazing	predation
D	predation	pH

16. The diagram below represents a pyramid of biomass.



The block at X best represents the total biomass of

A producers

B decomposers

C predators

D prey.

17. Various aspects of a river were sampled at five points. The results are shown in the table below.

Aspect sampled	***Sampling points***				
	1	2	3	4	5
Mayfly nymph number	89	15	0	0	0
Midge larvae numbers	0	1	2	175	24
Oxygen concentration (% of maximum)	85	85	75	30	63
pH level	5.5	6.0	6.4	7.3	8.0

Based on the results in the table, which of the following conclusions is valid?

A High oxygen concentration limits the numbers of midge larvae

B pH level is proportional to oxygen concentration

C Midge larvae do not survive in water with low oxygen concentration

D Mayfly numbers depend on oxygen concentration alone.

18. The following stages are involved in speciation.

1 Natural selection

2 Isolation

3 Mutation

In which order do these occur?

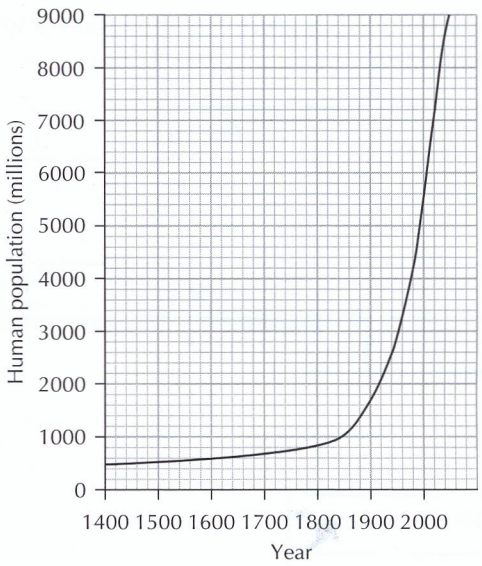
A 2→3→1

B 1→2→3

C 2→1→3

D 3→2→1.

19. The graph below shows the increase in the human population between the years 1400 and 2000.



What was the percentage increase in the population between 1850 and 1950?

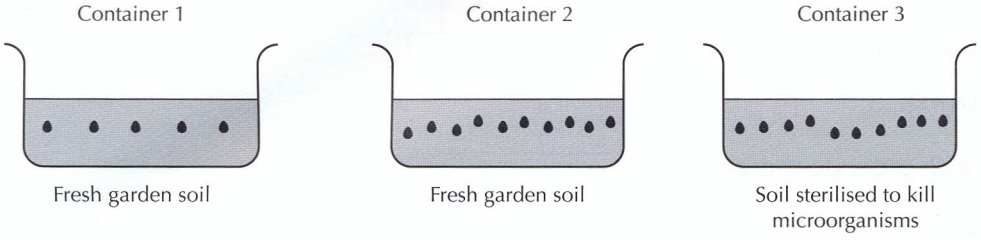
A 60%

B 200%

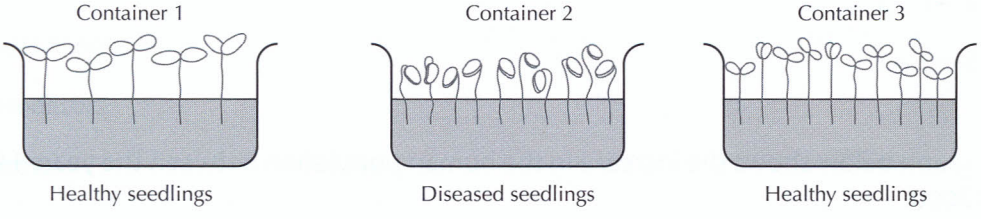
C 250%

D 50%.

20. A batch of cress seeds of the same variety were planted out into three containers, as shown below. The containers were well watered then placed together in a bright evenly-lit room.



The diagrams below show the appearance of the containers after three days.



Which line in the table below correctly identifies the factor(s) involved in the diseased state of the seedlings in container 2?

	Factors		
	sowing density	***microorganisms in soil***	***light intensity***
A	✔	✔	✔
B	✔	×	×
C	×	✔	×
D	✔	✔	×

Key

✔ Factor involved
× Factor not involved

MARKS
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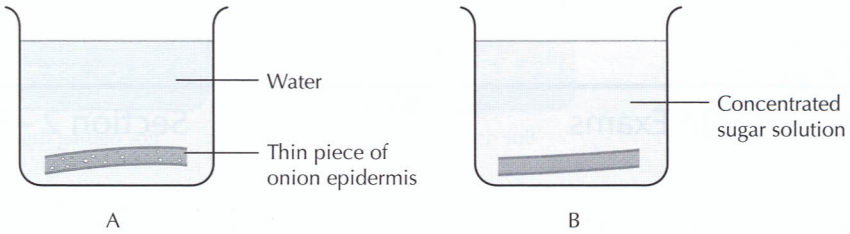
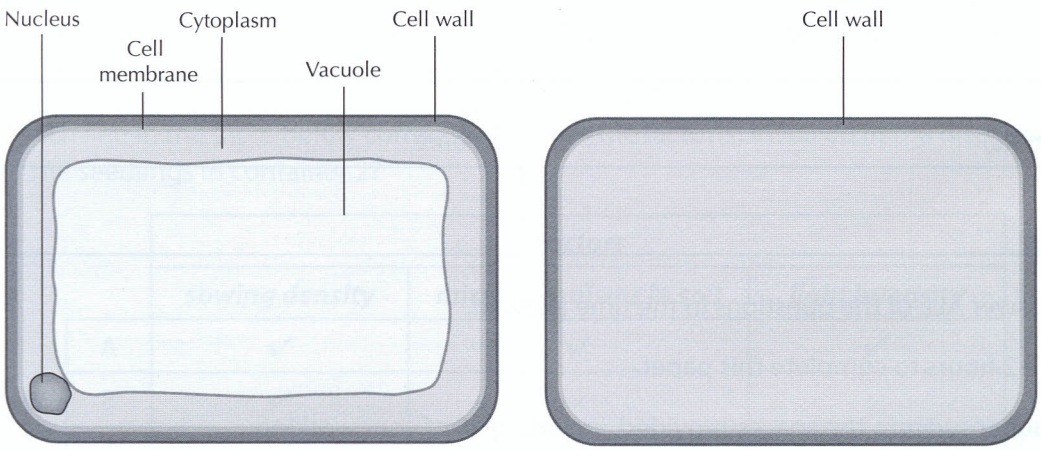
SECTION 2

1. Thin pieces of onion epidermis were immersed in solutions, as shown in the diagram below, and left for one hour.



(a) The diagram below shows the appearance of an onion cell from dish A after one hour.

Complete the diagram to show the predicted appearance of a cell from dish B after this time.



Cell from dish A Cell from dish B 2

(b) Give the term used to describe the state of a cell, such as that from dish A, which has been immersed in pure water for one hour.

_____ 1

(c) (i) Name the process that has led to the different appearances of the onion cells in dishes A and B.

_____ 1

(ii) The process responsible for these changes is described as being passive. Give the meaning of the term passive in this example.

_____

_____ 1

MARKS
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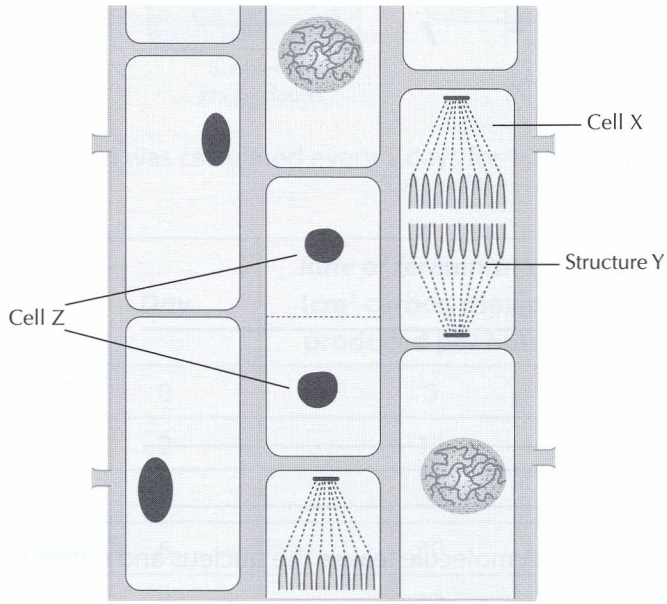
(d) Complete the following sentence by underlining the correct option in each choice bracket.

Onion epidermis is a(n) { organ / tissue } which is made up of cells carrying out a { similar / different } function. 1

Total marks 6

2. The diagram below represents cells from a region of cell division in a young plant root.



(a) Describe the stage of mitosis shown in cell **X**.

_____

_____ 1

(b) Name the structure labelled **Y**.

_____ 1

(c) Complete the sentences below by underlining the correct option in each of the choice brackets.

The two nuclei in cell **Z** are genetically { different / identical } to each other, and each has the { haploid / diploid } number of chromosomes. The two cells that are forming will be { specialised / unspecialised }. 2

Total marks 4

MARKS
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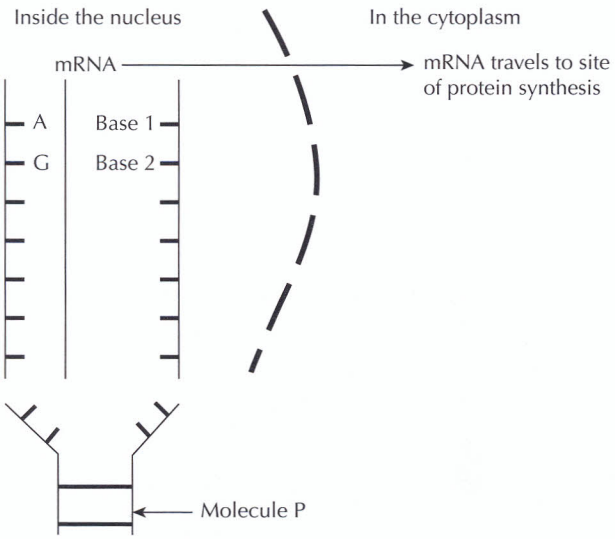
3. The diagram below shows a stage of protein synthesis in which messenger RNA (mRNA) is formed in the nucleus of a cell.



(a) Name molecule P.

_____ 1

(b) Identify the bases 1, 2.

Base 1 _____

Base 2 _____ 2

(c) Once complete, the mRNA molecule leaves the nucleus and enters the cytoplasm.

Identify the cell structures to which the mRNA travels and where protein synthesis takes place.

_____ 1

(d) Describe the feature of the mRNA molecule that ensures that the correct protein is synthesised.

_____

_____ 1

(e) Give **one** function of proteins in cells.

_____ 1

Total marks 6

MARKS
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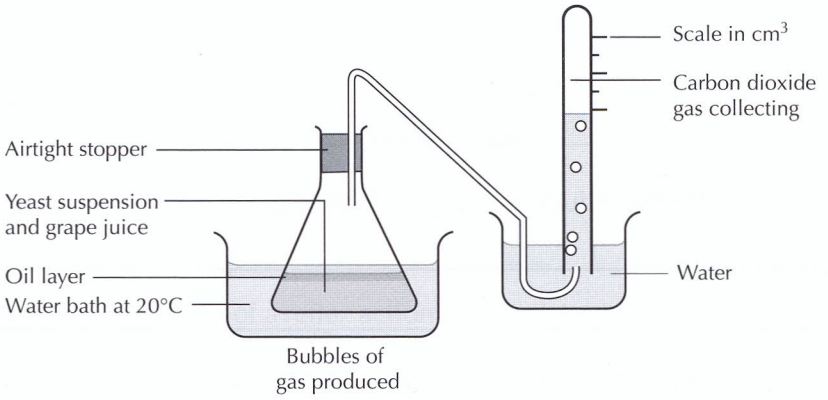
4. In an investigation of fermentation, 20 cm^3 of a yeast suspension was added to 50 cm^3 of grape juice and the carbon dioxide gas produced was collected and measured, as shown in the diagram below.

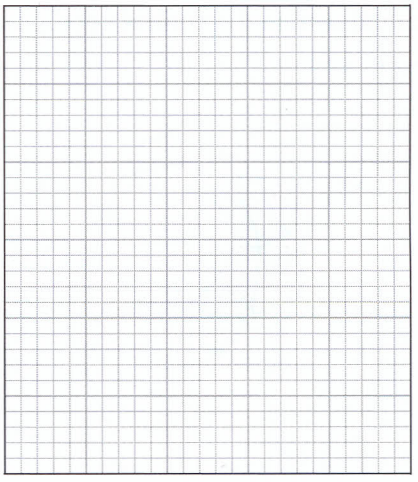


The rate of fermentation was calculated every 2 days for 10 days. The results are shown in the table below.

Day	***Rate of fermentation* (cm^3 carbon dioxide produced per hour)**
0	0
2	15
4	25
6	30
8	12
10	2

(a) On the grid below plot a line graph to show the rate of fermentation against time.

(A spare grid, if required, can be found on page 56.)



2

MARKS
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(b) Calculate the simplest whole number ratio of volume of carbon dioxide produced per hour after 2 days to that produced after 8 days.
Space for calculations

_____ : _____
2 days 8 days

1

(c) Suggest a reason for the reduction in rate of fermentation after day 6.

_____

_____ 1

(d) Suggest an improvement to the method described that would allow the investigation to be repeated more accurately.

_____

_____ 1

(e) The list shows various factors that could affect the rate of respiration.

temperature **concentration of grape juice** **concentration of yeast suspension**

Choose a factor and describe how the apparatus could be used to investigate its effect on the rate of fermentation.

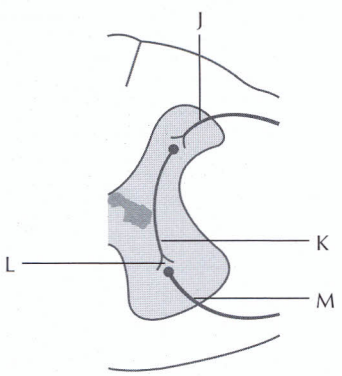
Factor chosen _____

Description _____

_____ 1

Total marks 6

5. The diagram below shows the ends of two neurons J and M, the gaps between them and a relay neuron K within the spinal cord in the central nervous system of a mammal.



(a) Describe how a nervous message is passed along a neuron such as J.

_____ 1

(b) Describe how a nervous message arriving at the end of neuron K is able to cross the gap L.

_____

_____ 1

(c) Name gap L.

_____ 1

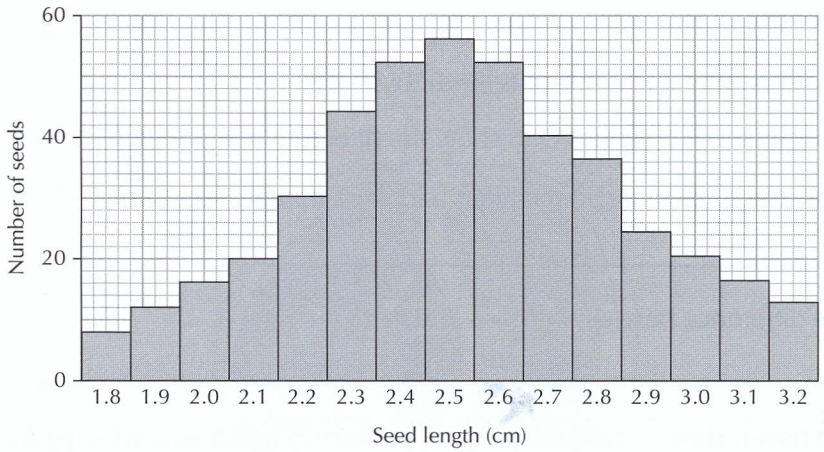
(d) Give **one** characteristic of a reflex action and explain the advantage it provides for mammals.

Characteristic _____ 1

Advantage _____ 1

Total marks 5

6. The bar chart below shows variation in the length of seeds harvested from a broad bean plant.



(a) Calculate the difference between the shortest and longest seeds in the sample.

Space for calculations

_____ cm 1

(b) Give evidence to support the statement that the seed length shows continuous variation.

_____

_____ 1

MARKS
Do not write in this margin

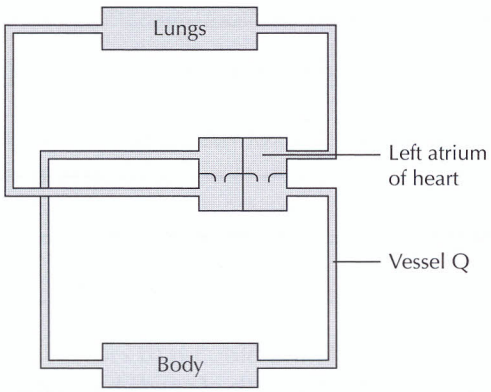
(c) Give **one** example of a characteristic from a **named** animal or plant species that shows discrete variation.

Named species _____

Characteristic _____ 1

Total marks 3

7. The diagram below shows the heart and an outline of the circulatory system of a human.



(a) **On the diagram**:

(i) Use the letter P to label the pulmonary artery. 1

(ii) Draw an arrow on vessel Q to show the direction of blood flow. 1

(b) Name the structures found in the heart and veins that prevent the backflow of blood.

_____ 1

(c) Give **one** difference between arteries and veins.

_____ 1

(d) Describe how red blood cells are adapted to take up and transport oxygen.

_____

_____

_____

_____

_____ 2

Total marks 6

MARKS
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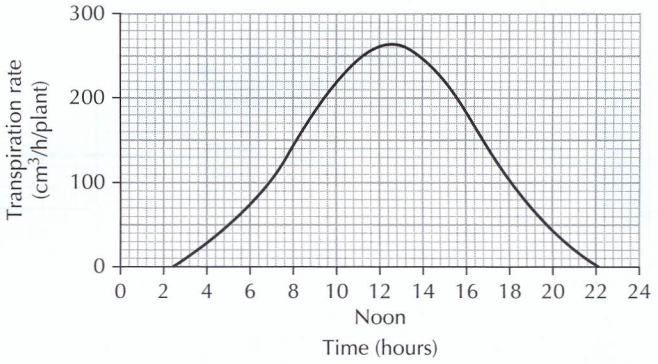
8. The graph below shows the average transpiration rate of barley plants in an open field over a 24-hour period during summer in Scotland.



(a) Give the period during which the average transpiration rate is greater than 100 cm^3 per hour per plant.

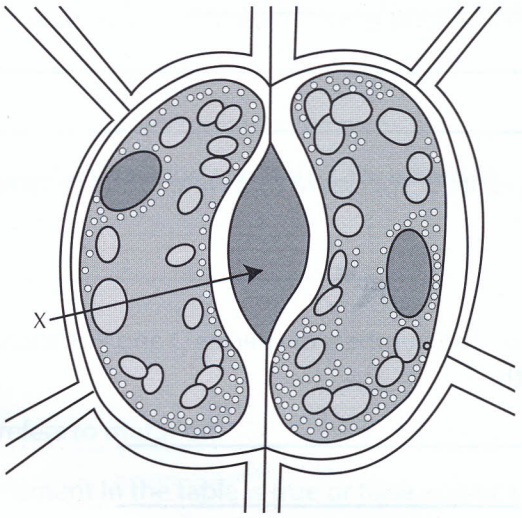
From _____ hours until _____ hours **1**

(b) Name **two** environmental factors that might be involved in the changing rates of transpiration over the period.

1 _____

2 _____ **2**

(c) The diagram below shows cells in the lower epidermis of a barley leaf.



Name structure X, through which water vapour leaves the plant during transpiration.

_____ **1**

(d) Suggest a possible benefit of transpiration to a barley plant.

_____ **1**

Total marks **5**

MARKS
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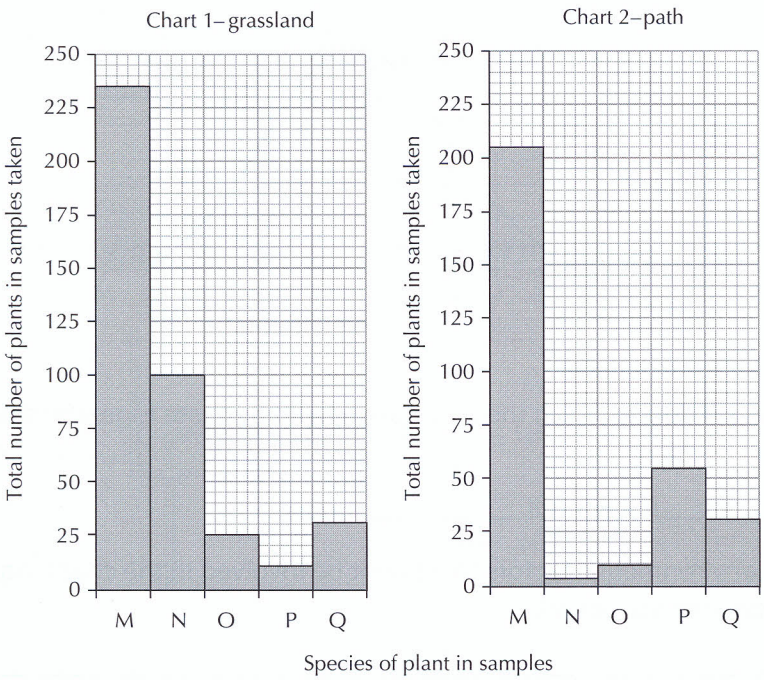
9. The charts below show the occurrence of five species of plants in samples taken from an area of grassland and from a path passing through it.



(a) Name **one** method that could be used to sample plants in grassland and describe its use.

Name _____ **1**

Description of use _____

_____ **1**

(b) Give the number of plants of species M that were found in samples taken from the path.

_____ plants **1**

(c) Describe the effects on the numbers of species O and P of being walked over by people using the path.

Species O _____ **1**

Species P _____ **1**

(d) Give the species that is least affected by being walked over.

Species _____ **1**

Total marks **6**

MARKS
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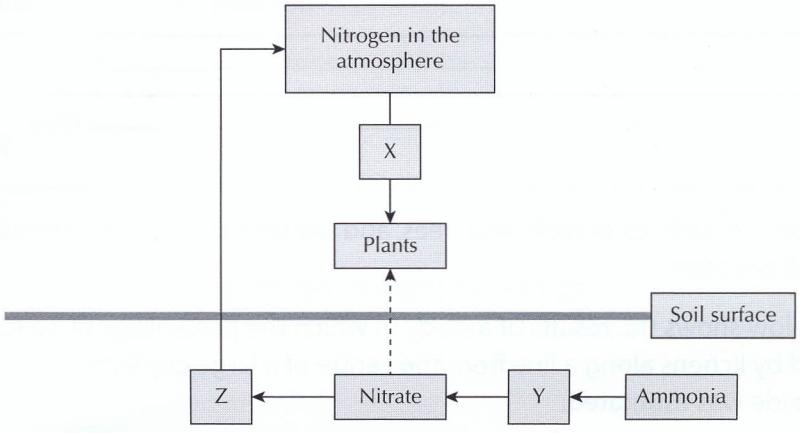
10. The diagram below shows part of the nitrogen cycle.

The letters X, Y and Z represent different types of bacteria involved in the cycle.



(a) Choose **one** letter, name the type of bacteria present and describe their role in the nitrogen cycle.

Letter _____

Name _____ 1

Role in nitrogen cycle _____

_____ 1

(b) Name **one** type of substance that is produced by plants using nitrate absorbed in the nitrogen cycle.

_____ 1

(c) Name the nitrate-containing substances that are added to soil by farmers to increase the yield of their crops.

_____ 1

Total marks 4

11. (a) The table below refers to mutation.

Decide if each statement in the table is true or false and tick (✔) the appropriate box.

Statement	*True*	*False*
Mutation is a non-random event.		
Mutation can confer an advantage to an organism.		
Mutation is the only source of new alleles.		

2

(b) Describe how natural selection is involved in the evolution of new species.

_____

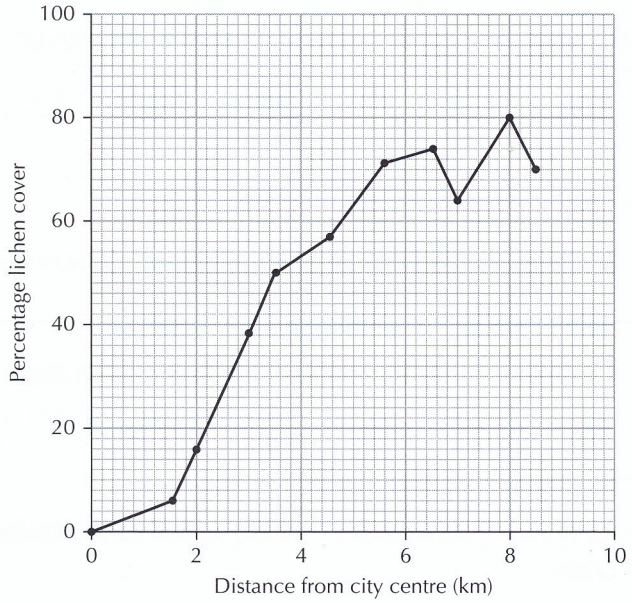
_____

_____ 3

Total marks 5

12. Lichens live on the surfaces of walls and trees, and are sensitive to sulfur dioxide, a gas linked with air pollution.

The graph below shows the results of a study in which the percentage of surfaces that were covered by lichens along a line from the centre of a large city that had air polluted by sulfur dioxide was estimated.



(a) Lichens can be used as indicators of air pollution.

Describe how this statement is supported by the data shown in the graph.

_____

_____ 1

(b) At what distance from the city centre was the air pollution the lowest as indicated by percentage lichen cover?

_____ km 1

MARKS
Do not write in this margin

(c) As well as sulfur dioxide, polluted air often contains tiny black soot particles.

Predict how these particles would affect the rate of photosynthesis in plants growing in polluted air. Explain your answer.

Prediction _____ 1

Explanation _____

_____ 1

Total marks 4

[END OF QUESTION PAPER]