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Answer ALL questions in the spaces provided.

1. The table below refers to plant growth substances and their functions. Complete the table by inserting the correct word or words in the spaces provided.

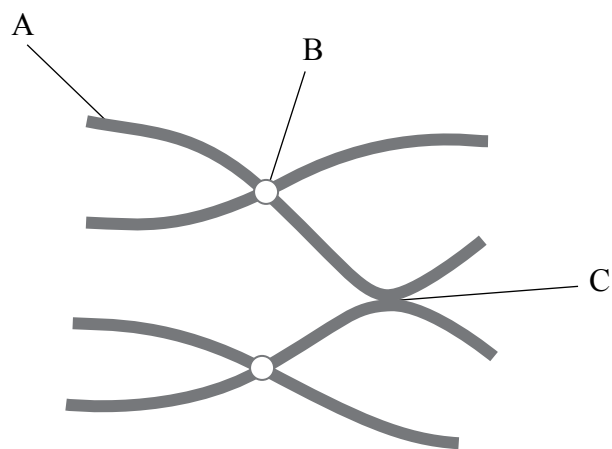
Plant growth substance	One function
	Used in weed killers
Gibberellin	
Cytokinin	
	Involved in leaf fall
Ethene	

Q1

(Total 5 marks)



2. The diagram below shows a pair of homologous chromosomes (a bivalent) during meiosis.



(a) (i) Name **one** stage of meiosis during which homologous chromosomes might look like the ones shown in the diagram.

..... (1)

(ii) Name the structures labelled **A**, **B** and **C** on the diagram.

A

B

C

(2)



- (b) Guinea pigs are popular pets that have variations in both the colour and texture of their fur. The allele for black fur (**B**) is dominant to the allele for white fur (**b**). The allele for rough fur (**R**) is dominant to the allele for smooth fur (**r**).

In a breeding experiment, a homozygous black, rough-furred guinea pig was crossed with a homozygous white, smooth-furred guinea pig. This cross was repeated several times to give offspring in the F₁ generation.

- (i) State the genotype and the phenotype of the F₁ generation.

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(1)

- (ii) Several of the offspring in the F₁ generation were interbred to produce an F₂ generation.

The phenotypes present in the F₂ generation are shown below. Give the expected ratio of the different phenotypes in the F₂ generation by writing appropriate numbers in the spaces below.

Black with rough fur =

Black with smooth fur =

White with rough fur =

White with smooth fur =

(1)



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3. (a) (i) In the space below, draw a low power plan of a cross-section through a typical dicotyledonous leaf, to show the distribution of the tissues. On your plan label the palisade mesophyll, the spongy mesophyll and the lower epidermis. Do not include any cells.

(5)

(ii) Explain the role, in the process of photosynthesis, of each of the tissues you have labelled in (a)(i).

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(3)



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(b) Plants that live in shady areas have leaves that are adapted to growing in low light intensity. Suggest how the structure of one of these leaves might differ from the leaf that you have drawn in (a)(i).

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(2)

(Total 10 marks)

Q3

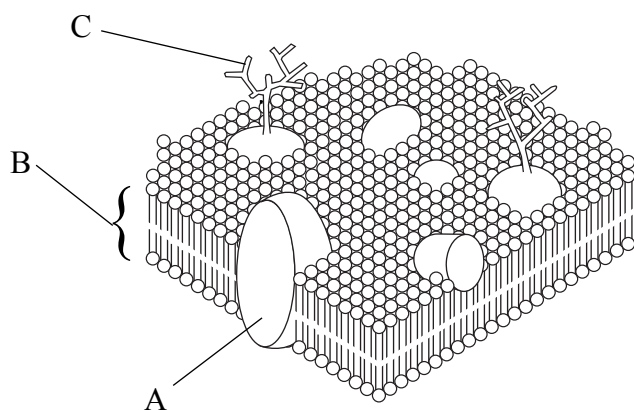
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Synoptic Section

The questions in this section are designed to give you the opportunity to make connections between different areas of biology and to use skills and ideas developed throughout the course in new contexts. You should include in your answers any relevant information from the whole of your course.

4. The diagram below shows part of a cell surface membrane.



(a) (i) Name the parts labelled **A** and **B**.

A

B

(1)

(ii) Name the molecule labelled **C** and state its role.

Molecule C:

Role.....

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(2)



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(ii) The loop of Henlé is part of a renal (kidney) nephron. Explain the role of sodium and chloride ion transport in the loop of Henlé.

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(4)

Q4

(Total 11 marks)



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N 2 4 7 3 6 A 0 1 1 2 0

5. The water flea, *Daphnia*, is a type of aquatic invertebrate found in fresh water. An investigation was carried out to determine the effect of different concentrations of caffeine on the heart rate of *Daphnia*. After being kept at a temperature of 25 °C, individual *Daphnia* were placed on microscope slides in a few drops of caffeine solution. After one minute, the heart rate of each *Daphnia* was counted. This procedure was repeated ten times for each concentration of caffeine to obtain a mean heart rate. The results are shown in the table below.

Concentration of caffeine / parts per million	Mean heart rate / beats per second
1000	5.6
100	4.9
10	4.4
1	4.1
0.1	4.0
0.01	3.9
0.001	3.8
0.0001	3.7
0.00001	3.7
0.0 (control)	3.7

Data adapted from R. Foster JBE 4,31

(a) (i) Describe the relationship between mean heart rate and caffeine concentration.

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(3)



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(ii) Calculate the percentage increase in the mean heart rate between the control and the solution containing 1000 parts per million of caffeine. Show your working.

Answer %
(2)

(b) Explain the purpose of the control in this investigation.

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(1)

(c) Explain why *Daphnia* were kept at a constant temperature throughout the investigation.

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(d) Nicotine is another drug that will change the heart rate. Describe the effect of nicotine on a synapse.

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(2)

(Total 11 marks)

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Q5



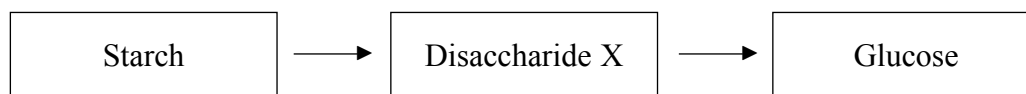
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N 2 4 7 3 6 A 0 1 5 2 0

6. The diagram below shows a summary of the breakdown of starch in the human digestive system.



(a) Identify disaccharide **X** and explain how it is converted into glucose in the ileum.

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(3)

(b) Describe **three** features of the ileum which enable it to absorb glucose efficiently.

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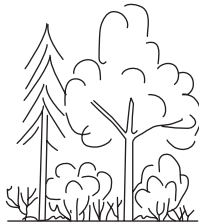
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(3)



7. An area of abandoned grassland was studied over a period of more than 100 years. During that time, there were changes to the plant communities which resulted in changes to the number of species and population density of small birds. The table below shows the changes.

Time since abandoned / years	1–10	10–25	25–100	100+
Plant community	Grass	Shrubs	Pine trees	Mixed woodland
				
Number of species of small birds	2	8	15	19
Population density of small birds / number of birds per 40 hectares	54	246	226	466

- (a) State the name that is given to the process by which communities change over time.

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(1)



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- (c) The population density of birds drops when shrubs are replaced by pine trees, but then increases with the change to mixed woodland. Suggest reasons for these changes in population density.

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(2)

- (d) The mixed woodland is the final climax community. Describe and explain **two** ways in which woodland can be damaged by human activities.

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(Total 12 marks)

Q7

TOTAL FOR PAPER: 70 MARKS

END

