

1. A group of organisms, recently discovered in hot springs, may be classified into a new kingdom. Their cells have no nuclei and no membrane-bound organelles.

(a) (i) Name the existing kingdom to which this group of organisms is most closely related.

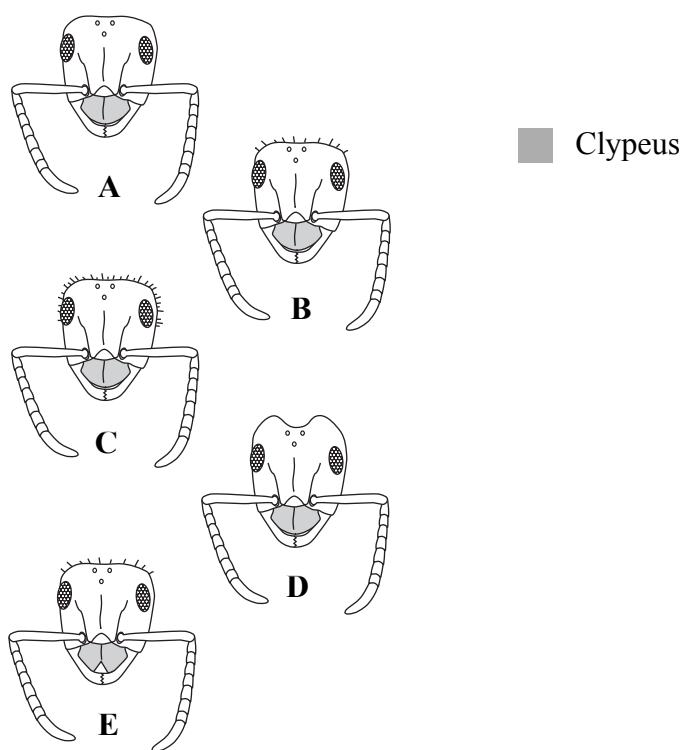
.....
(1)

(ii) Complete the table by naming the other four kingdoms of the Five Kingdom classification system. Give **one** feature for each kingdom.

| Kingdom | Feature |
|---------|---------|
| | |
| | |
| | |
| | |

(4)

(b) The drawings below show the front view of the heads of ants from five different species of British wood ant.



Leave
blank

(i) Use the key below to identify ants **B**, **D** and **E**.

- | | | | |
|---|---|--|--------------------------|
| 1 | a | Large notch on top of head | <i>Formica exsecta</i> |
| | b | No such notch | 2 |
| 2 | a | Clypeus notched | <i>Formica sanguinea</i> |
| | b | No notch in clypeus | 3 |
| 3 | a | Hairs on top and sides of head extend down to lower part of eyes | <i>Formica lugubris</i> |
| | b | Hairs do not extend this far | 4 |
| 4 | a | No hairs on top or sides of head | <i>Formica rufa</i> |
| | b | Some hairs on top of head | <i>Formica aquilonia</i> |

B

D

E

(2)

(ii) State the genus to which all of these species of ant belong.

.....

(1)

Q1

(Total 8 marks)



2. In guinea pigs, the colour of the hair in the coat is determined by a gene, where the allele for black hair (**B**) is dominant to the allele for white hair (**b**). Another gene determines whether the hair is short or long, with the allele for short hair (**H**) being dominant to the allele for long hair (**h**).

A guinea pig with the genotype **BBhh** was crossed with another guinea pig with the genotype **bbHH**.

(a) (i) Give the phenotypes of these two guinea pigs.

BBhh

bbHH

(1)

(ii) Give the genotype of the offspring of this cross.

Genotype

(1)

(b) One of these offspring was crossed with a guinea pig with white long hair.

(i) Construct a genetic diagram, using the same symbols, to show the expected genotypes and phenotypes of the offspring of this cross.

(4)

(ii) Suggest how the results of the cross in (b)(i) demonstrate that independent assortment has been involved in the production of the gametes.

.....
.....
.....

(2)



Leave
blank

(c) Compare how mutation and independent assortment can increase genetic diversity.

.....
.....
.....
.....
.....

(2)

(d) Explain **one** reason for conserving genetic diversity in captive breeding programmes.

.....
.....
.....
.....
.....

(2)

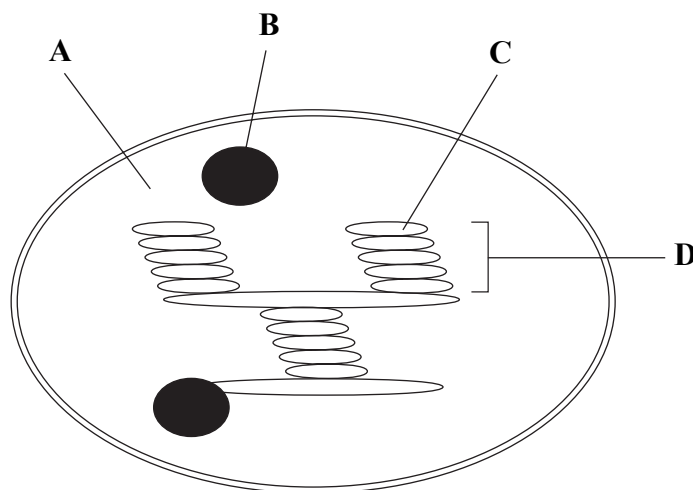
Q2

(Total 12 marks)

| | |
|--|--|
| | |
|--|--|



3. The diagram below shows a chloroplast.



(a) (i) Name the parts labelled A, B, C and D.

A

B

C

D

(2)

(ii) State the part of the chloroplast, shown on the diagram, where oxygen is produced.

.....

(1)

(iii) Explain how oxygen is produced in chloroplasts during photosynthesis.

.....
.....
.....
.....
.....
.....
.....
.....
.....

(3)



Leave
blank

(b) Oxygen inhibits the enzyme that catalyses the fixing of carbon dioxide. High concentrations of oxygen, within a chloroplast, can reduce the rate of photosynthesis.

Describe and explain the effect of high concentrations of oxygen on the rate of carbohydrate production in a chloroplast.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(3)

(c) Suggest **two** environmental conditions which could increase the rate of oxygen production by plants.

1

2

(2)

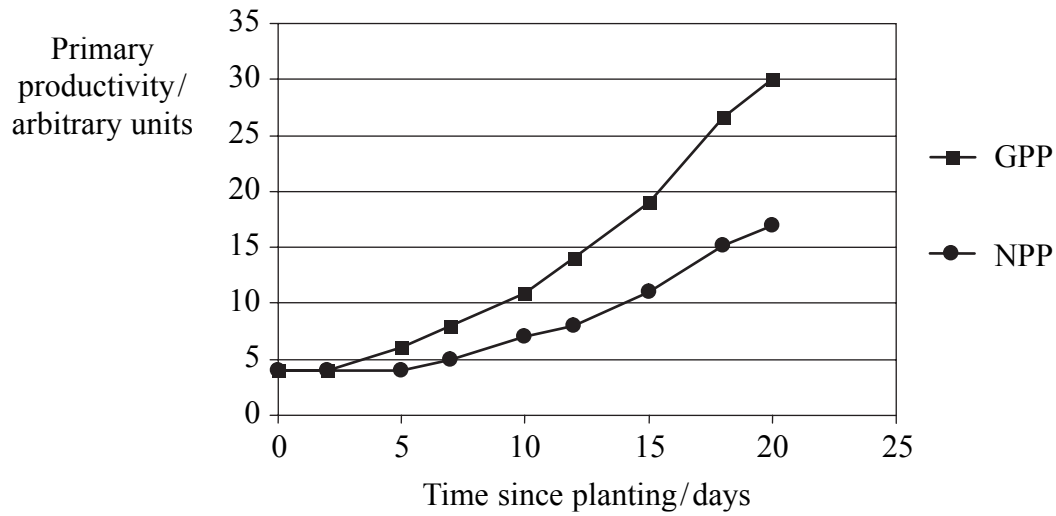
Q3

(Total 11 marks)

| | |
|--|--|
| | |
|--|--|



4. Sunflower seedlings were planted and kept under controlled conditions for 20 days. The gross primary productivity (GPP) and the net primary productivity (NPP) were measured each day. The results are shown in the graph below.



(a) (i) Compare the changes in GPP and NPP during the time period shown on the graph.

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

(ii) Suggest an explanation for the changes you have described in (a)(i).

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

(b) Explain the relationship between GPP, NPP and respiration.

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

(Total 6 marks)

Q4



Leave
blank

5. Many people infected with the bacterium that causes tuberculosis (TB) do not develop the disease for a number of years.

(a) Suggest how some TB bacteria avoid being destroyed by the immune system for a number of years.

.....
.....

(1)

(b) Describe the role of B-cells and T-cells in preventing the development of the symptoms of TB in an infected person.

.....
.....
.....
.....
.....
.....
.....
.....

(3)

(c) (i) Suggest why a patient infected with TB is more likely to develop symptoms of the disease if they are also infected by HIV.

.....
.....
.....
.....
.....

(2)

(ii) Give **two** symptoms which are likely to occur in a person with TB.

1

2

(2)

(Total 8 marks)

Q5



7. The tolerance of plants to copper ions in the soil is under genetic control. The frequency of an allele, which causes a plant to be more tolerant of copper, was measured at two different sites A and B.

The table below shows the percentage frequencies of the tolerance and non-tolerance alleles in plant populations at the two sites.

| Site | Percentage frequencies of | |
|------|---------------------------|----------------------|
| | Tolerance allele | Non-tolerance allele |
| A | 30 | 70 |
| B | 80 | 20 |

- (a) Explain what is meant by the frequency of an allele in a population.

.....
.....
.....

(2)

- (b) Describe how natural selection could have brought about the different allele frequencies at the two sites.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(4)



(c) Suggest why bacteria often adapt to changing conditions much more quickly than plants.

.....

.....

.....

.....

.....

(2)

(Total 8 marks)

Leave blank

Q7

TOTAL FOR PAPER: 60 MARKS

END

