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BIOLOGY

0610/42

Paper 4 Theory (Extended)

October/November 2024

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.



1 (a) Organisms from the genus *Chlorella* are protists.

State the additional information required to name *Chlorella* according to the binomial system.

..... [1]

(b) Fig. 1.1 shows the structure of an organism from the genus *Chlorella*.

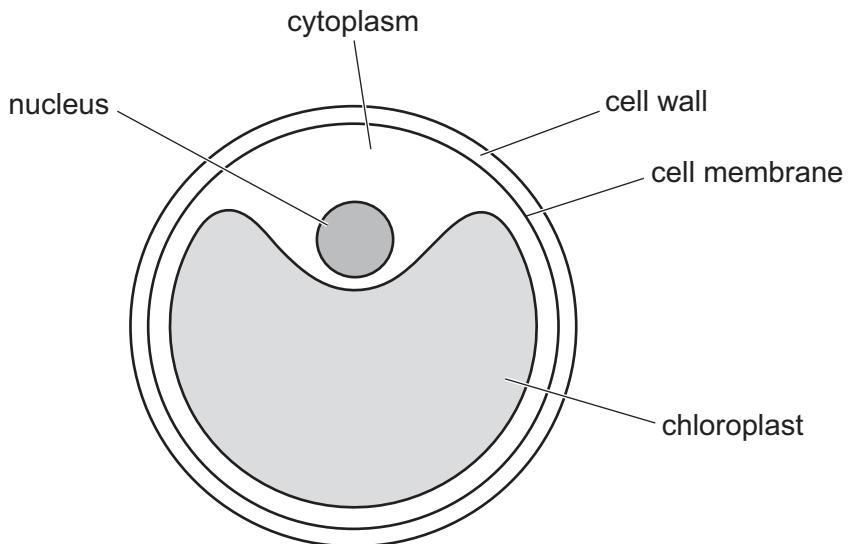


Fig. 1.1

(i) Identify **two** cell structures in Fig. 1.1 that indicate that *Chlorella* is **not** a prokaryote.

1

2

[2]

(ii) Identify **two** cell structures in Fig. 1.1 that are found in both fungi and protists.

1

2

[2]

(iii) State the names of **two other** kingdoms, apart from fungus, prokaryote and protist.

..... and

[1]





(c) *Chlorella* is sold as a nutritional supplement.

Spirulina is another nutritional supplement.

Table 1.1 shows some nutritional information for *Chlorella* and *Spirulina* supplements and the recommended daily intake for some nutrients.

Table 1.1

nutrient	mass of nutrient /mg per 100g of supplement		average recommended daily intake in adults /mg per day
	<i>Chlorella</i> supplement	<i>Spirulina</i> supplement	
vitamin C	0.74	0.00	80.00
calcium	120.00	5.10	1000.00
iron	37.00	75.50	12.00

(i) One tablet contains 5g of *Chlorella* supplement.

Using the information in Table 1.1, calculate the number of tablets of *Chlorella* supplement a person needs to take to provide the recommended daily intake of iron.

Give your answer to **one** decimal place.

Space for working.

..... tablets [3]

(ii) Explain the advantages of taking *Chlorella* as a dietary supplement rather than *Spirulina*.

Use the data in Table 1.1 to justify your answer.





(iii) State the name of **one** food that is a principal dietary source of vitamin C.

..... [1]

(d) *Chlorella* is also a good source of protein.

(i) State the importance of proteins in active transport.

.....
.....
.....
.....
..... [2]

(ii) State the name of the smaller molecules that proteins are made from.

..... [1]

[Total: 17]





2 (a) Fig. 2.1 is a diagram of the gas exchange system in humans.

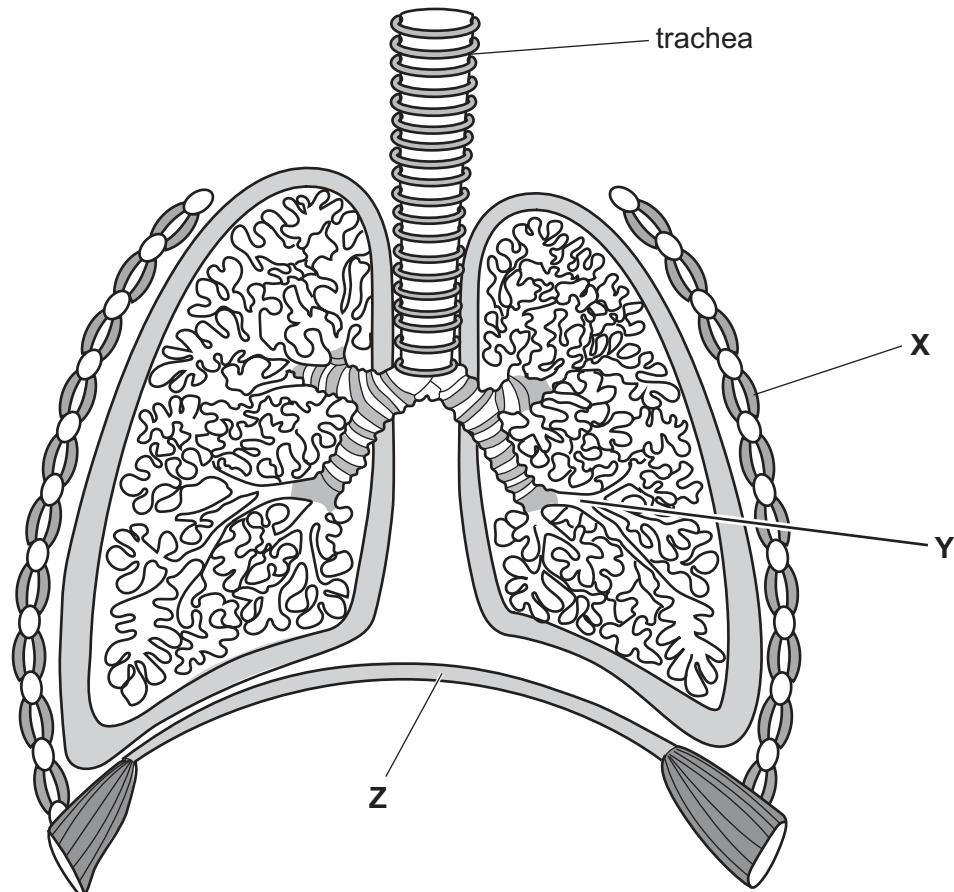


Fig. 2.1

(i) State the names of the parts labelled **X**, **Y** and **Z** in Fig. 2.1.

X

Y

Z

[3]

(ii) The wall of the trachea contains rings of tissue.

State the name of this tissue **and** describe its function.

name

function

[2]

(iii) State the names of **two** types of cells responsible for protecting the breathing system from particles.

1

2

[2]

[Turn over]





(b) A scientist estimated the pressure and volume in the thorax during one breath.

Fig. 2.2 shows a graph of the results.

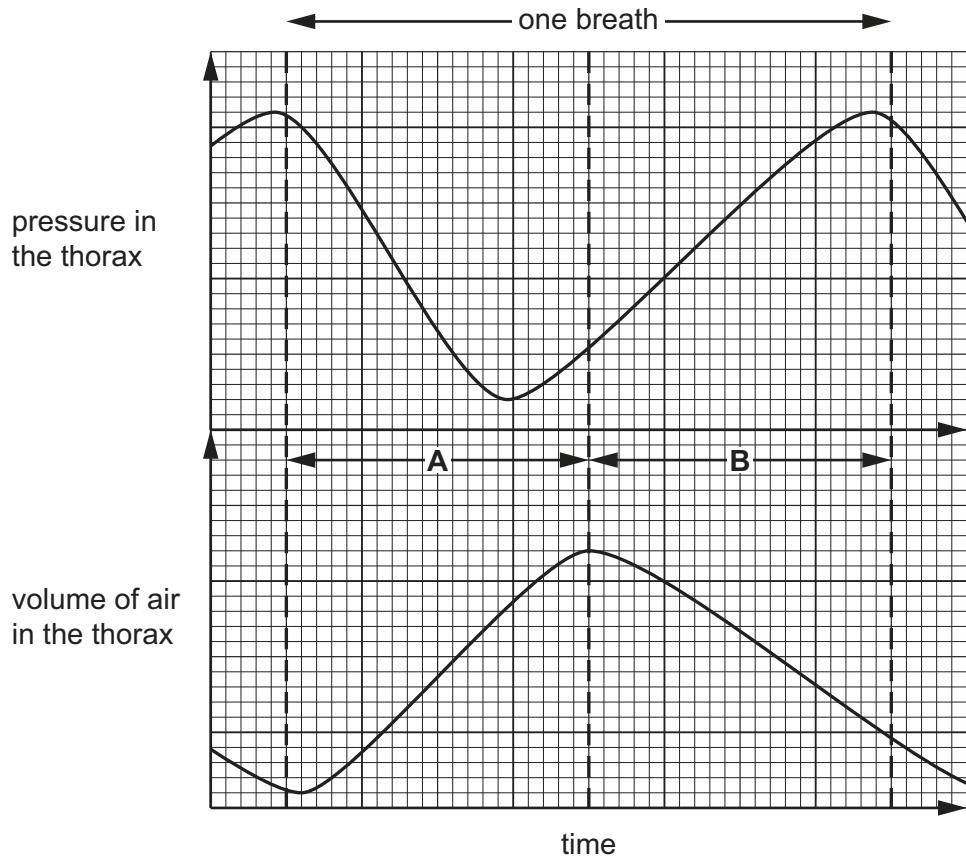


Fig. 2.2

Describe **and** explain the changes in the thorax that occur during section **A only** in Fig. 2.2.

[5]





(c) Complete the sentences to describe the effect of carbon dioxide concentration on breathing.

During physical activity, the carbon dioxide concentration of the blood

.....

This is detected by the

This results in an increased rate and greater of breathing.

[3]

[Total: 15]





3 (a) Fig. 3.1 shows a kidney nephron and its associated blood vessels.

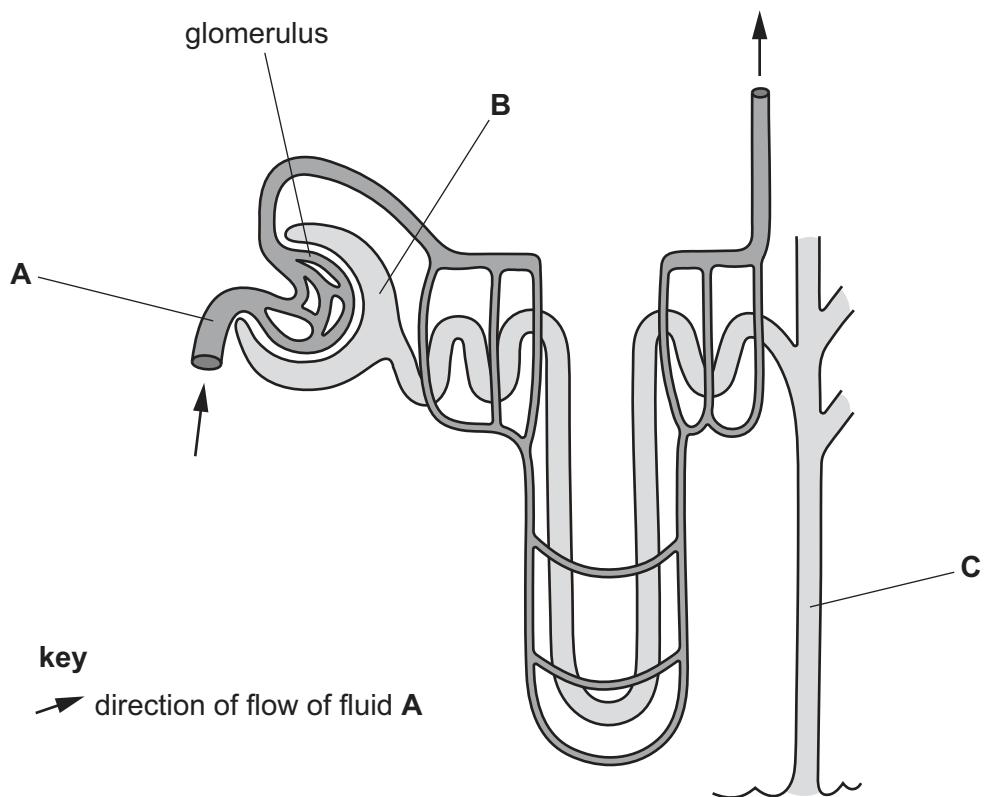


Fig. 3.1

The compositions of fluids **A**, **B** and **C** were analysed.

Table 3.1 shows the results for five components of the fluids.

Table 3.1

component	percentage concentration in fluid A	percentage concentration in fluid B	percentage concentration in fluid C
water	90.00	90.00	94.00
glucose	0.10	0.10	0.00
protein	8.00	0.00	0.00
urea	0.03	0.03	2.00
ions	0.72	0.72	1.50

(i) State the names of fluid **A** and fluid **C** in Fig. 3.1.

A

C

[2]





(ii) Using the information in Fig. 3.1 and Table 3.1, describe **and** explain the differences in the compositions of fluids **A**, **B** and **C**.

[5]

(b) Outline how blood glucose concentration is controlled.

[6]





(c) A gene mutation may be involved in the development of type 1 diabetes.

(i) Describe what is meant by a gene mutation.

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

[2]

(ii) Outline the treatment of type 1 diabetes.

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

[3]

[Total: 18]

DO NOT WRITE IN THIS MARGIN





DO NOT WRITE IN THIS MARGIN





4 (a) Fig. 4.1 shows a diagram of two flowers from different plants of the same species.

(i) Describe what is meant by the term species.

.....

 [2]

(ii) Complete the diagram in Fig. 4.1 to show self-pollination and cross-pollination by:

- drawing **one** arrow to show the pathway of pollen during self-pollination **and** labelling this arrow self-pollination
- drawing **one** arrow to show the pathway of pollen during cross-pollination **and** labelling this arrow cross-pollination
- labelling the names of the structures involved in pollination.

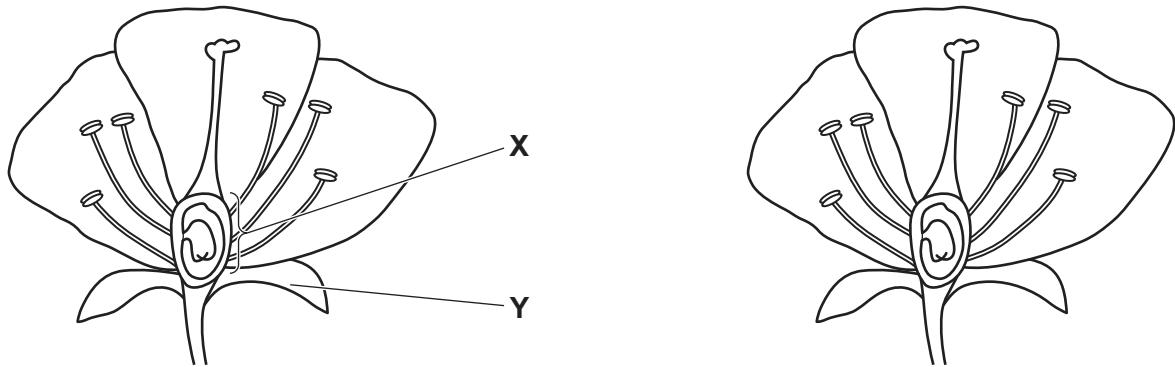


Fig. 4.1

[3]

(iii) State the function of the parts labelled X and Y in Fig. 4.1.

X

 Y

 [2]





(b) Explain why self-pollination that results in production of offspring is a form of sexual reproduction and **not** asexual reproduction.

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

[3]

(c) State the type of environmental conditions that hydrophytes are adapted to live in.

.....

[Total: 11]





5 Fig. 5.1 is a pedigree diagram showing the inheritance of blood group in one family.

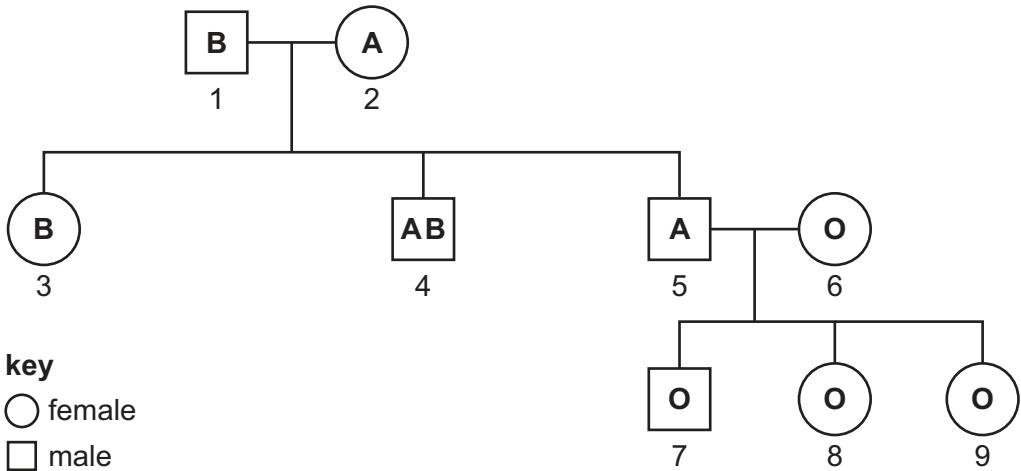


Fig. 5.1

(a) State the number of people in Fig. 5.1 with:

XY chromosomes

only one I^A allele.

[2]

(b) Explain how Fig. 5.1 shows that blood group is an example of discontinuous variation.

.....
.....
.....
..... [2]

(c) State **one** example of discontinuous variation in **plants**.

..... [1]





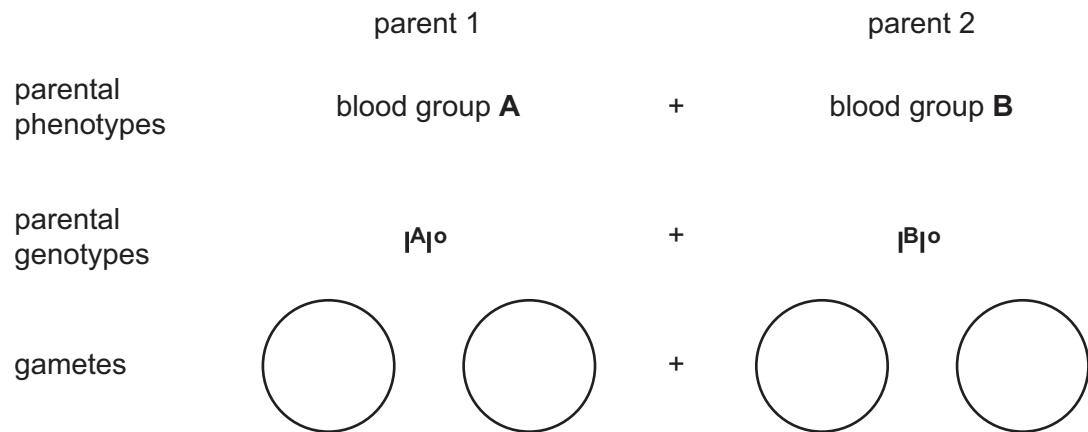
(d) Explain why the inheritance of blood group is an example of codominance.

.....

 [2]

(e) A person with the genotype $I^A I^0$ has a child with a person with the genotype $I^B I^0$.

Complete the genetic diagram to determine the probability of the offspring having the blood group **AB**.



offspring genotypes				
offspring phenotypes				

probability of the offspring having the blood group **AB**

[4]

[Total: 11]





6 (a) The flow chart in Fig. 6.1 shows one pathway of nitrogen as it travels through the nitrogen cycle.

Complete the flow chart in Fig. 6.1.

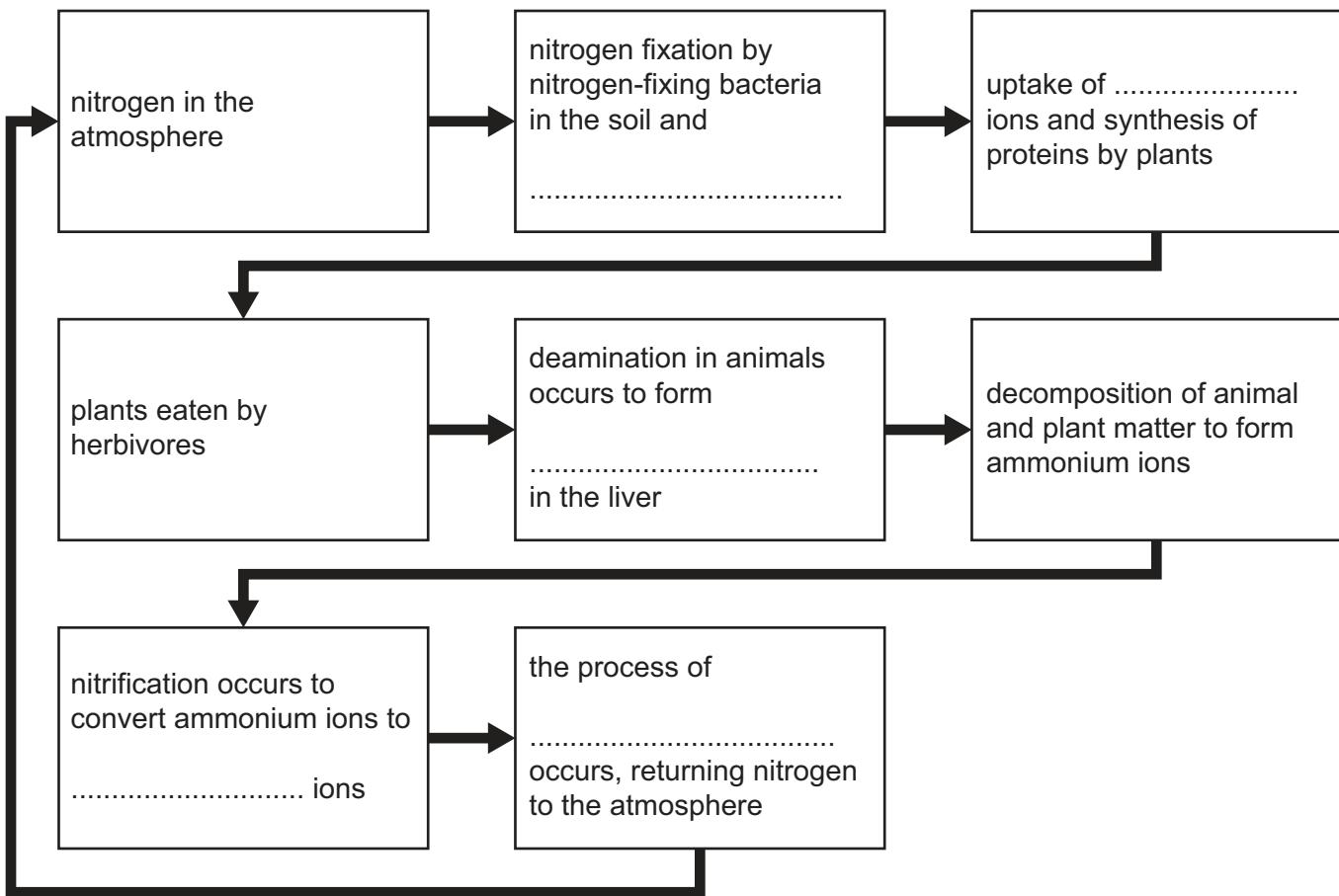


Fig. 6.1

[5]

(b) State the names of **two** processes that occur in both the carbon and nitrogen cycles.

1

2

[2]

(c) State the principal source of energy input to biological systems.

..... [1]

[Total: 8]

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