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CANDIDATE NAME

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2957497803

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.

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[Turn over

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

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*.

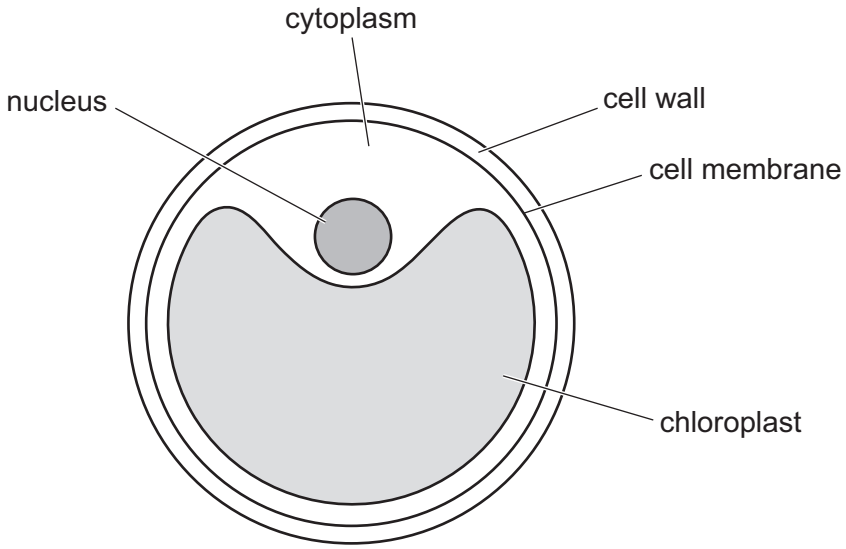


Fig. 1.1

(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 protoctists.

1 .....

2 .....
[2]

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

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(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 100 g of supplement		average recommended daily intake in adults / mg per day
	Chlorella supplement	*Spirulina* 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 5 g 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.

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..... [4]

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(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.

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..... [2]

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

..... [1]

[Total: 17]

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

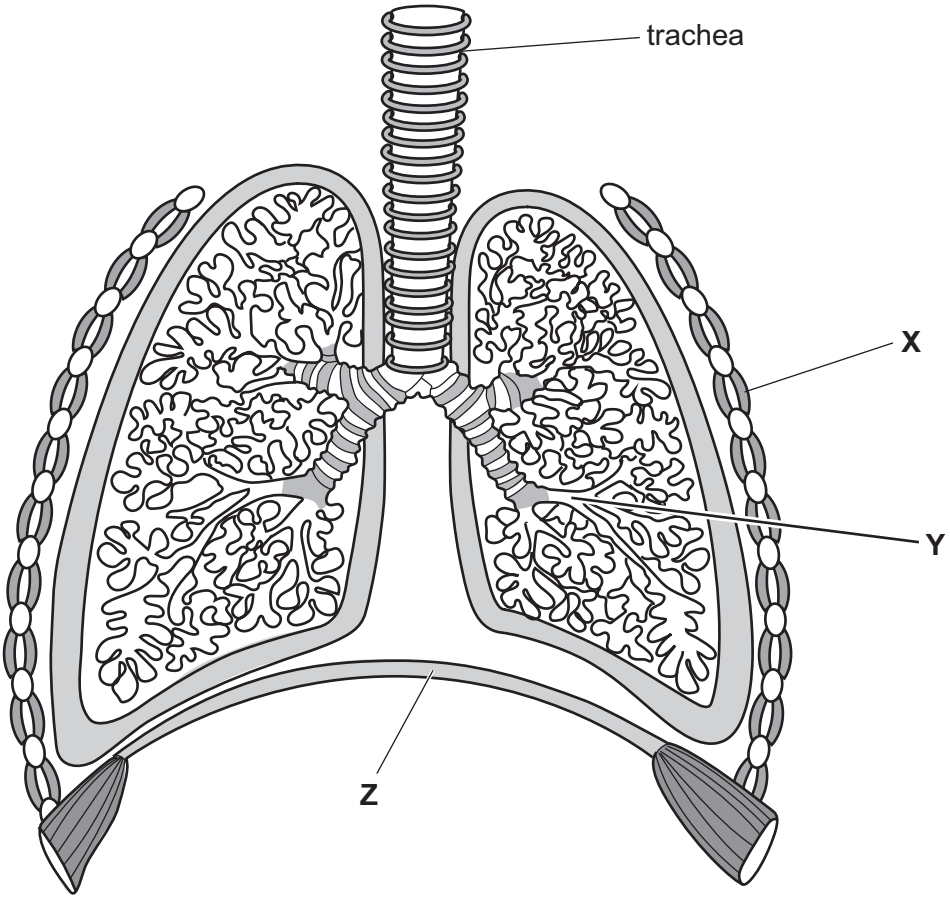


Fig. 2.1

(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]

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

Fig. 2.2 shows a graph of the results.

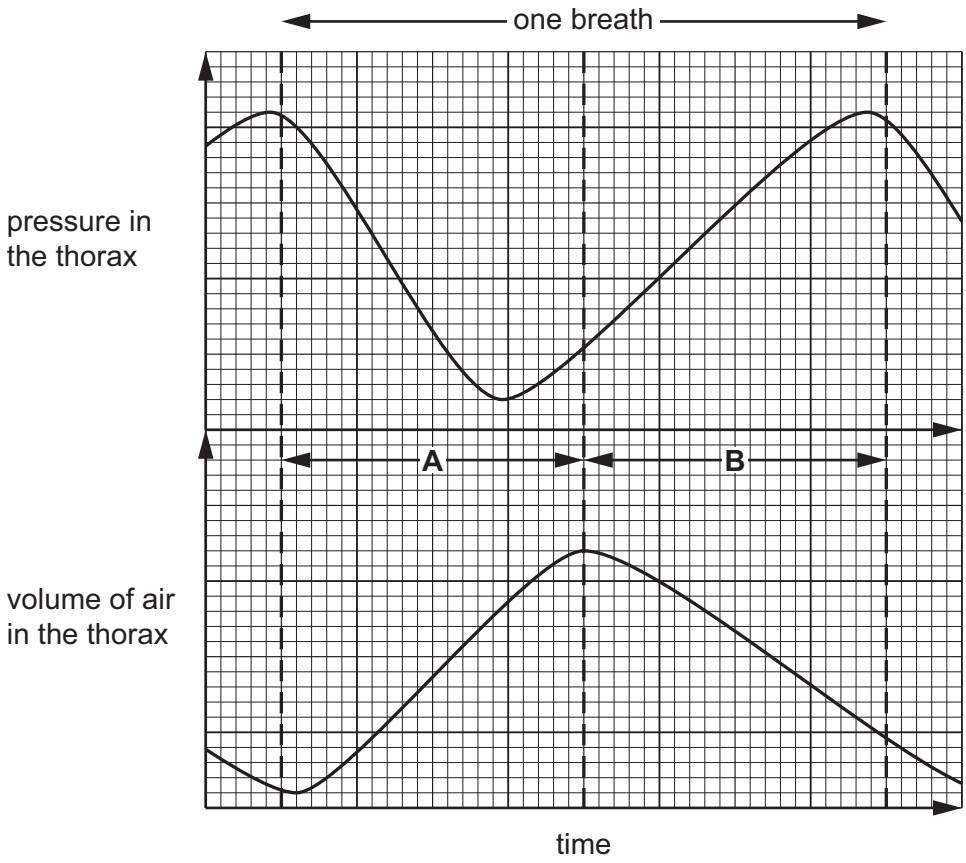


Fig. 2.2

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

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

During physical activity, the carbon dioxide concentration of the blood

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This is detected by the ..... .

This results in an increased rate and greater ..... of breathing.

[3]

[Total: 15]

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

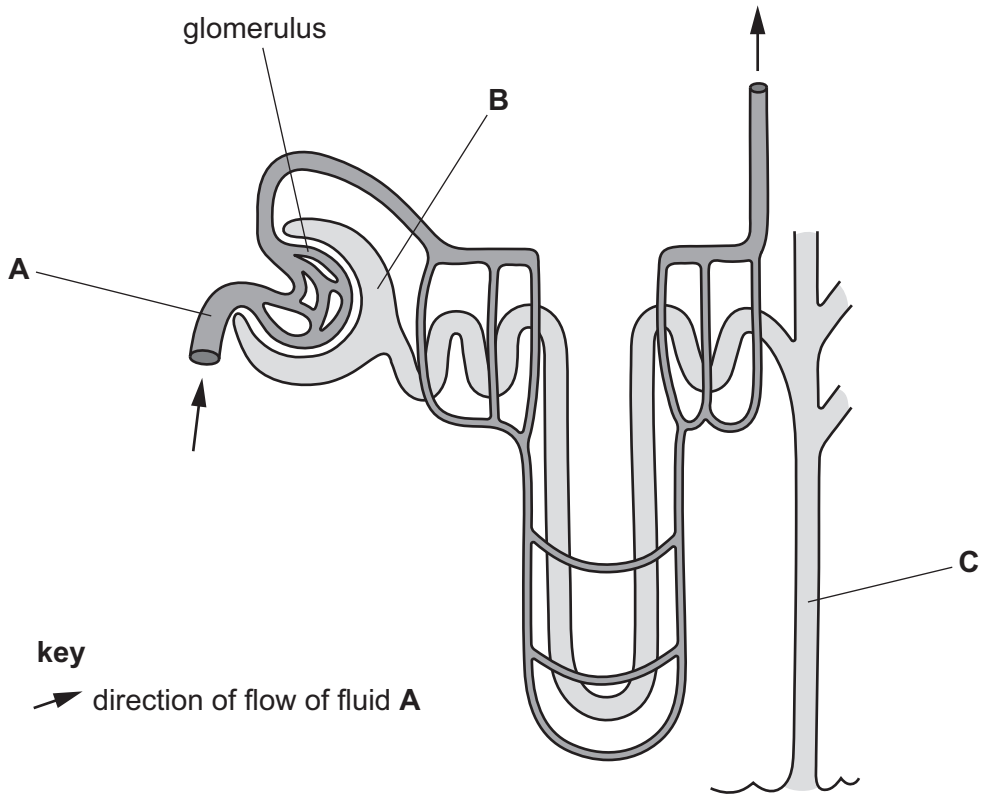


Fig. 3.1

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]

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(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**.

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..... [5]

(b) Outline how blood glucose concentration is controlled.

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..... [6]

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

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

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..... [2]

(ii) Outline the treatment of type 1 diabetes.

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..... [3]

[Total: 18]

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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.

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..... [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.

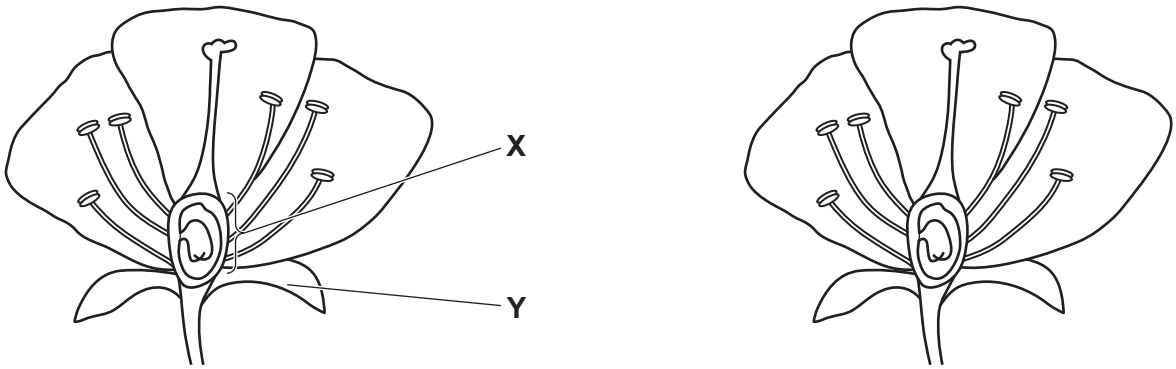


Fig. 4.1

[3]

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

X .....

.....

Y .....

.....

[2]

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

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..... [3]

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

..... [1]

[Total: 11]

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

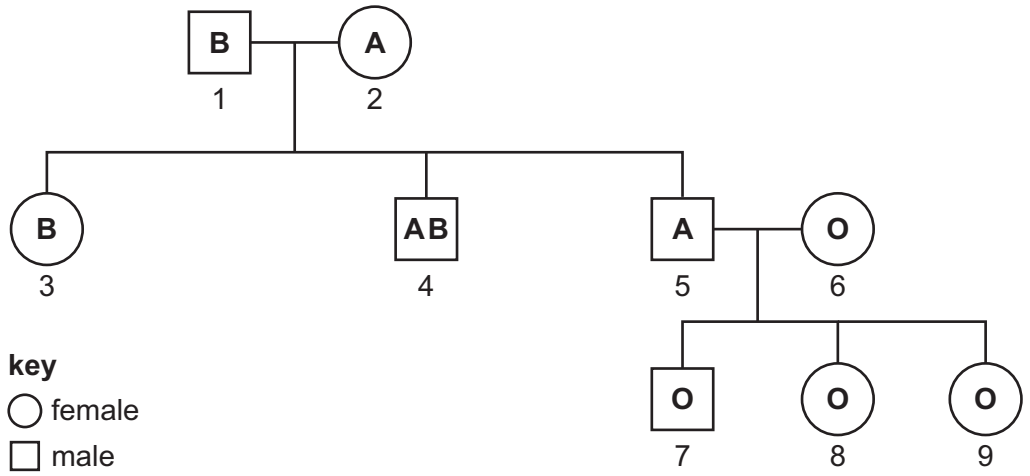


Fig. 5.1

(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.

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..... [2]

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

..... [1]

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

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..... [2]

(e) A person with the genotype I^AI^o has a child with a person with the genotype I^BI^o.

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

	parent 1		parent 2
parental phenotypes	blood group **A**	+	blood group **B**
parental genotypes	I^AI^o	+	I^BI^o
gametes	◯ ◯	+	◯ ◯

offspring genotypes				
offspring phenotypes				

probability of the offspring having the blood group **AB** .....
[4]

[Total: 11]

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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.

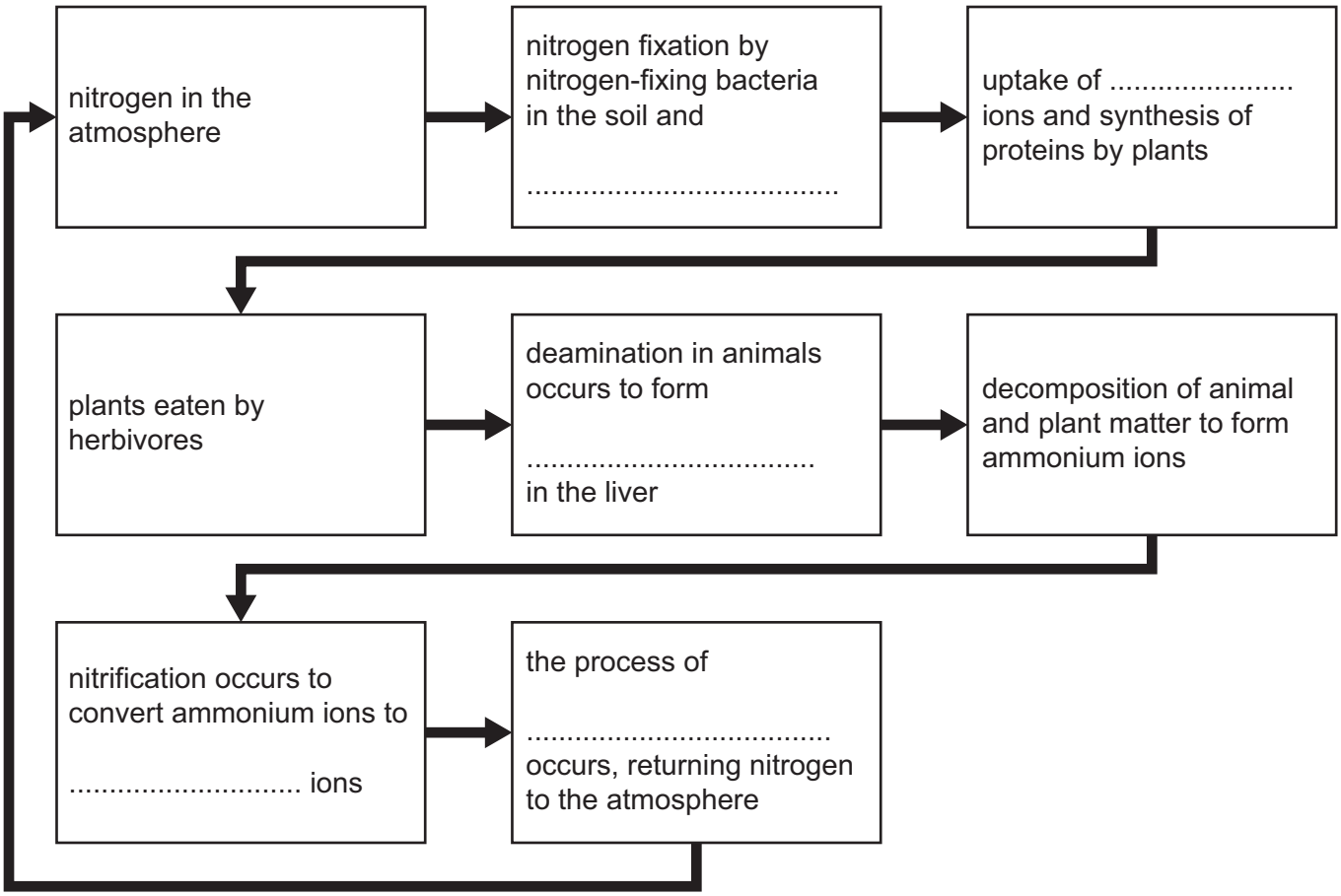


Fig. 6.1

[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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