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Cambridge Assessment International Education

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CANDIDATE NAME Solved by Anubha Roberts.

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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 [ ].

NOTE - The keywords of answer are underlined.

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

[Turn over

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

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

Species name ..... [1]

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

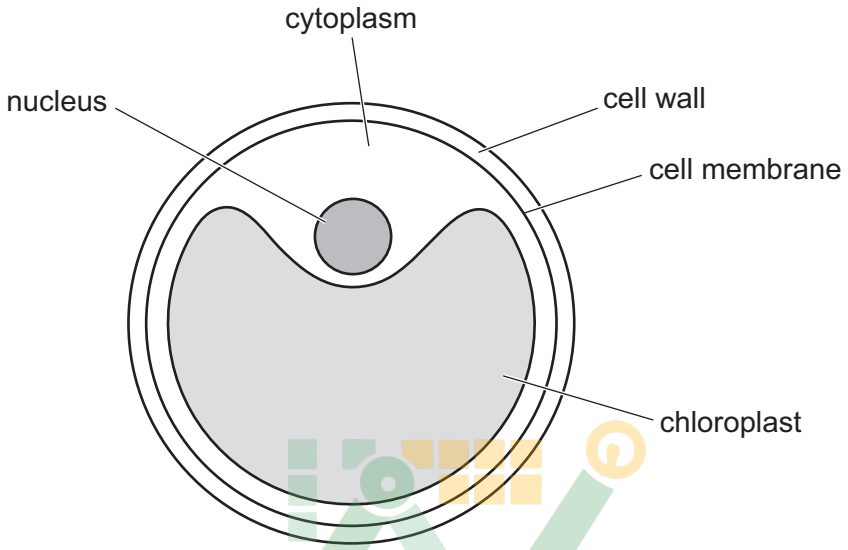

Fig. 1.1

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

1 Has nucleus. .....

2 Has chloroplast .....

[2]

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

1 Cell membrane .....

2 cytoplasm. .....

[2]

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

animal ..... and ..... plant ..... [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 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.

Iron in 5g

$\frac{37 \times 5}{100} = 1.85g$

Daily intake

$\frac{12}{1.85} = 6.48$

6.5 ..... 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.

Chorella has vitamin C which is 0.74g per 100g and none in Spirulina. Vitamin C prevents scurvy.

Chlorella has more calcium than spirulina. Calcium is required for strong bones and teeth.

..... [4]

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

Citrus fruits ..... [1]

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

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

- Active transport uses carrier proteins
- Carrier proteins transport molecules from low concentration to high concentration. ..... [2]

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

amino acids. ..... [1]

[Total: 17]

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

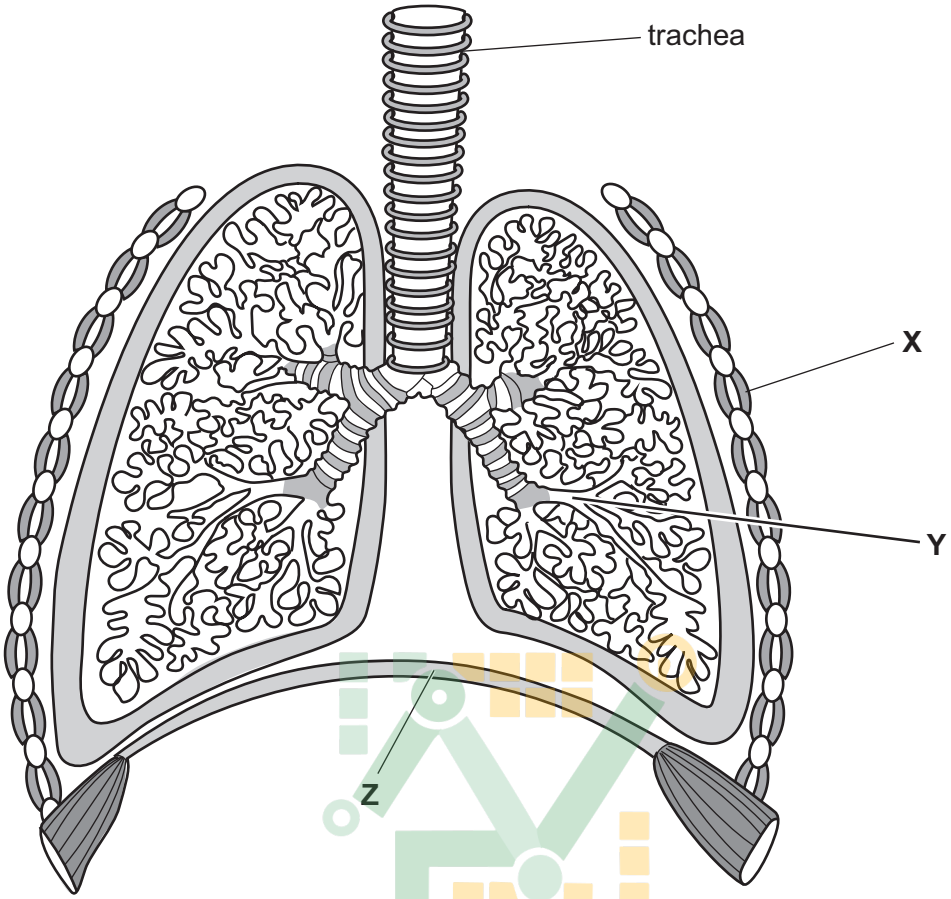

Fig. 2.1

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

X External intercostal muscles

Y Bronchioles

Z Diaphragm

[3]

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

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

name cartilage

function to keep trachea open for gas exchange

[2]

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

1 Ciliated cells

2 Goblet cells

[2]

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

Fig. 2.2 shows a graph of the results.

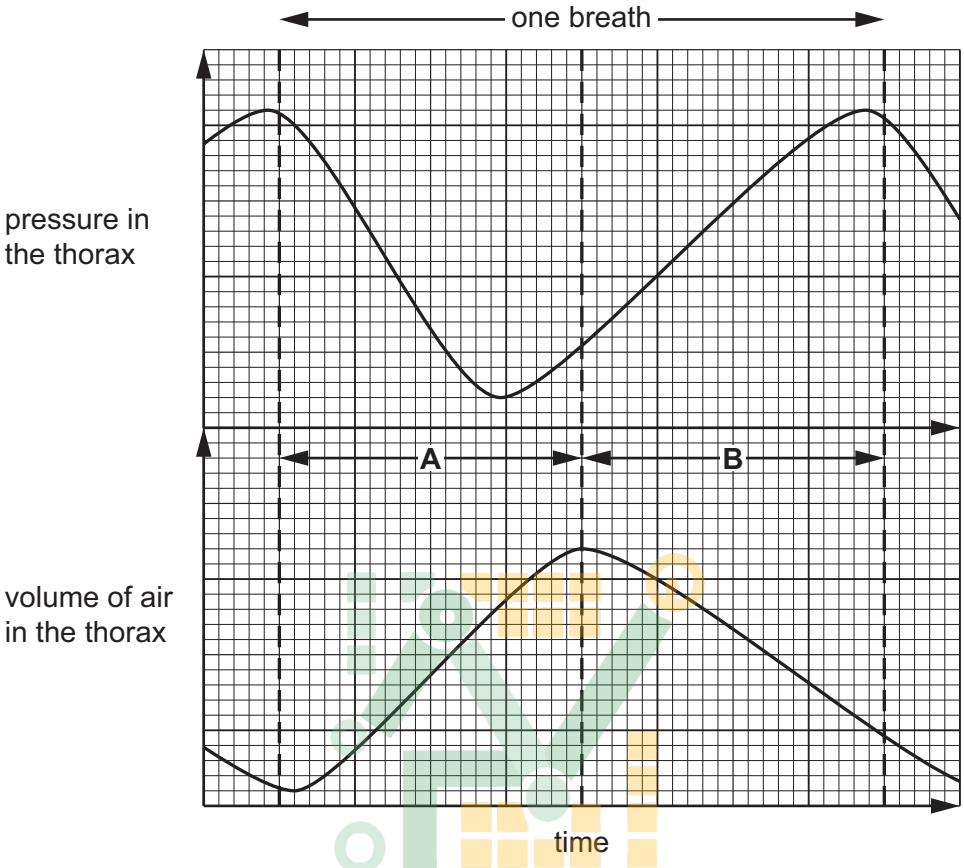

Fig. 2.2

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

In section A, there is decrease in pressure and also increase in volume of air in thorax.
This due to contraction of External Intercostal muscle and contraction of diaphragm.
Air moves inside for inspiration.

..... [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

increases .

This is detected by the brain .

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

[3]

[Total: 15]

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

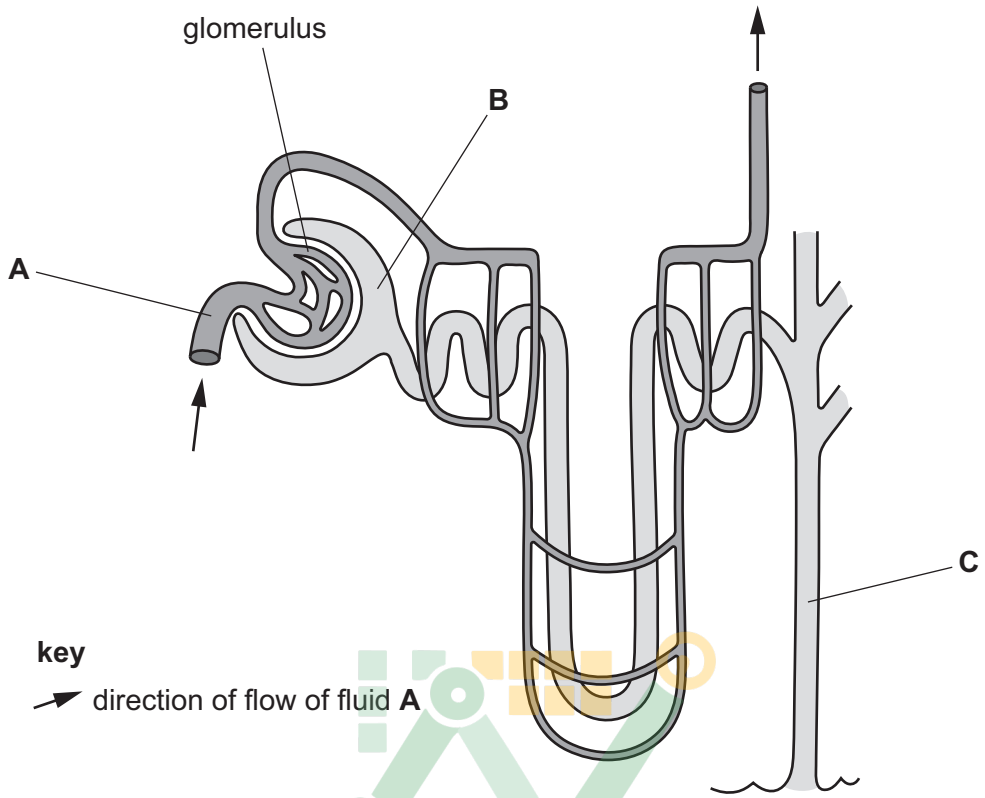

Fig. 3.1

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 Blood plasma

C Urine

[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**.

All of the water, glucose, urea and ions get filtered from fluid A to fluid B.
None of proteins get filtered due to large size.
All of the glucose is absorbed from fluid B by active transport so no glucose in fluid C.
Some of water is reabsorbed by osmosis and salts by active transport.
Fluid C contains excess salts, water and all of urea. [5]

(b) Outline how blood glucose concentration is controlled.

Blood glucose concentration is controlled by negative feedback.
An increase in blood glucose after the meal will be detected by Pancreas which releases insulin. Insulin acts on liver cells to convert excess glucose to glycogen and store it.
A decrease in blood glucose causes the Pancreas to release glucagon.
Glucagon acts on liver cells to breakdown glycogen to glucose.

[6]

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

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

Random change in the base sequence of DNA.

..... [2]

(ii) Outline the treatment of type 1 diabetes.

Injection of insulin.
Carbohydrate controlled diet.
Regular exercise.

..... [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.

A group of organisms which can reproduce to produce fertile offsprings.

[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.

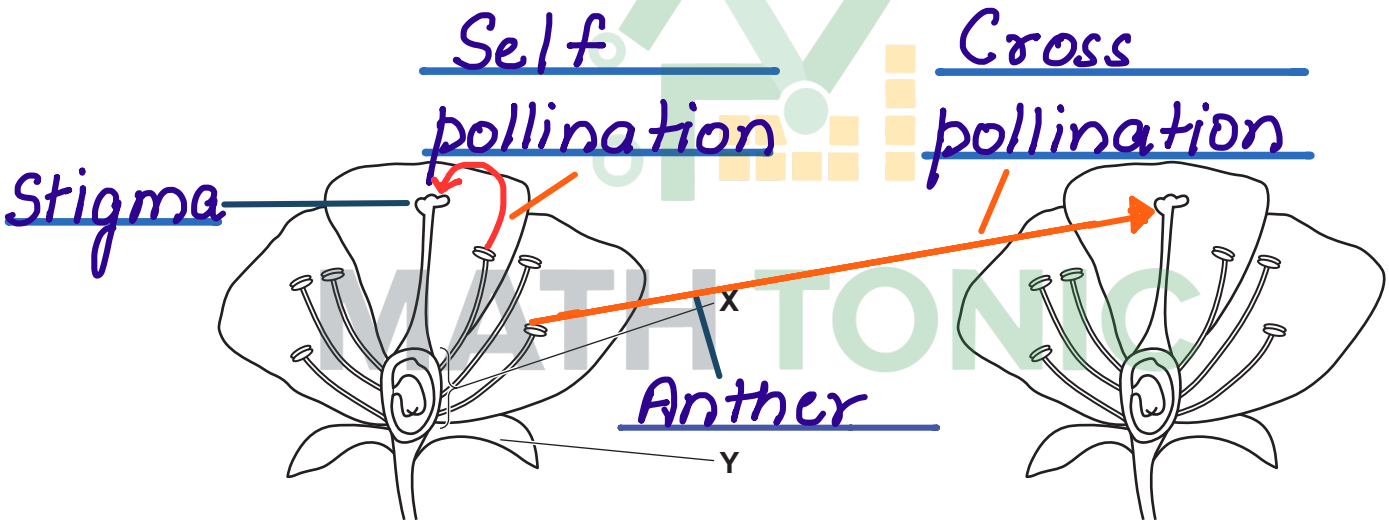

Fig. 4.1

[3]

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

X contains ovules

Y protect the flower in bud stage

[2]

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

In self pollination, meiosis produces haploid gamete which on fertilization produce diploid zygote.
There is no meiosis, gamete or zygote in asexual reproduction.

..... [3]

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

water ..... [1]

[Total: 11]

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

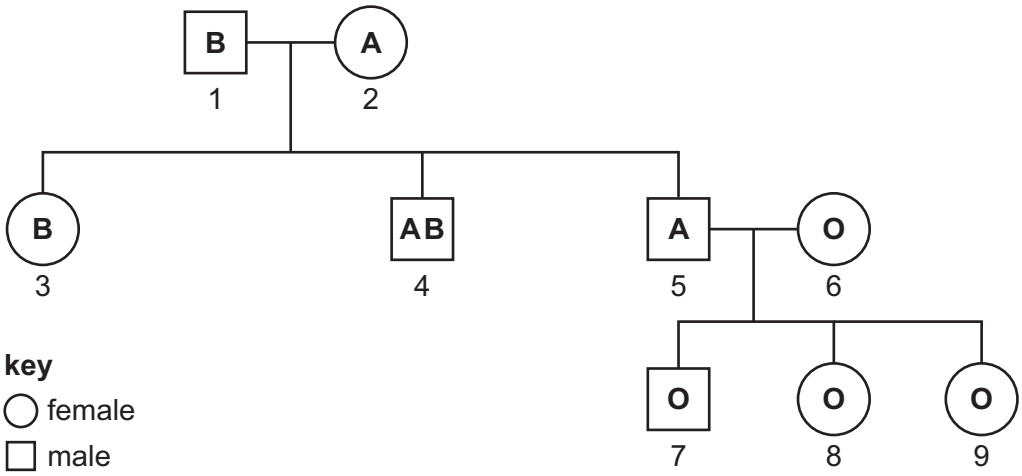

Fig. 5.1

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

XY chromosomes ..... 3 .....

only **one** I^A allele. ..... 3 .....

[2]

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

It does not involve a range of phenotype.

No intermediate phenotype.

..... [2]

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

Seed shape ..... [1]

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

Allele I^A and I^B express equally in the phenotype. and form a different blood group AB.

[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	I^A I^o	+	I^B I^o

	I^A	I^o
I^B	I^AI^B	I^BI^o
I^o	I^AI^o	I^oI^o

offspring genotypes	I^AI^B	I^BI^o	I^AI^o	I^oI^o
offspring phenotypes	AB	B	A	O

probability of the offspring having the blood group **AB** 25 %

[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.

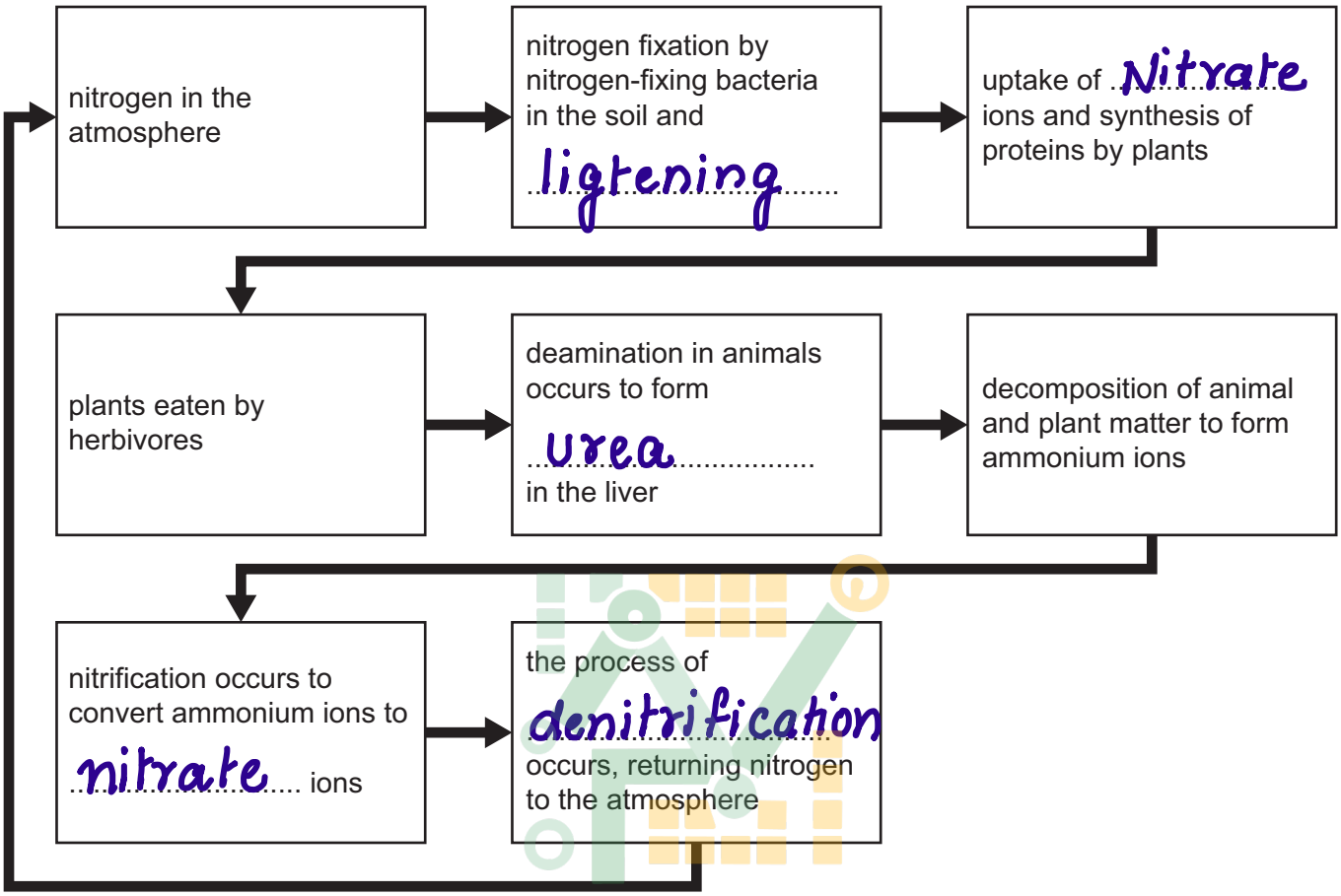

Fig. 6.1

[5]

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

1 Decomposition

2 Excretion

[2]

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

Sun [1]

[Total: 8]