



Cambridge O Level

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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BIOLOGY

5090/02

Paper 2 Theory

For examination from 2023

SPECIMEN PAPER

1 hour 45 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 **14** pages.

1 Digestion in the human digestive system is carried out by the action of enzymes.

(a) The diagrams each represent the action of a specific enzyme to break down a substrate into one or more end products.

Fig. 1.1 has been completed for you.

Complete Fig. 1.2 and Fig. 1.3.

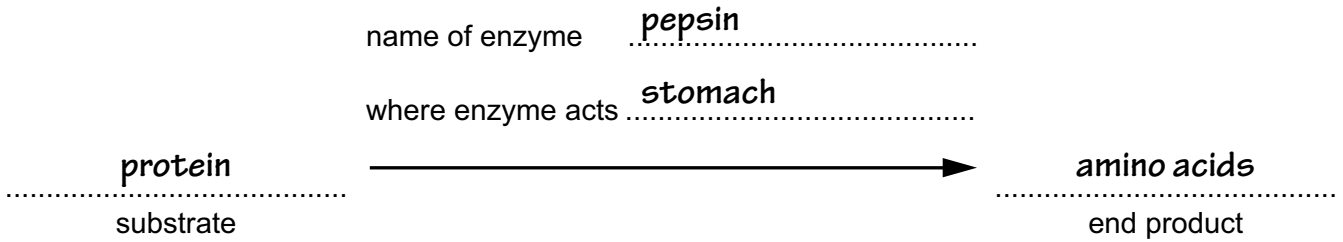


Fig. 1.1

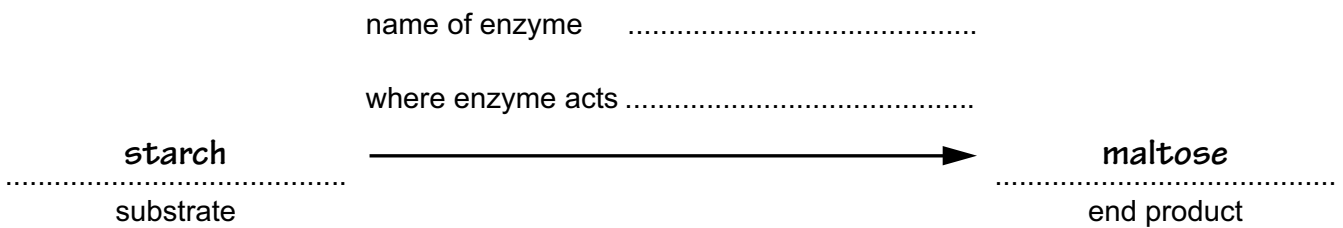


Fig. 1.2

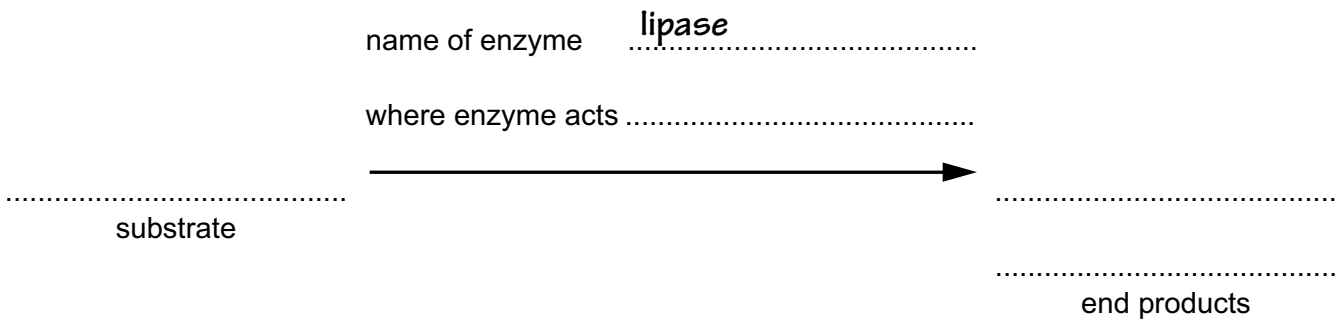


Fig. 1.3

[6]

2 Fig. 2.1 shows the effect on crop yield (amount harvested) of using nitrogen-containing fertilisers.

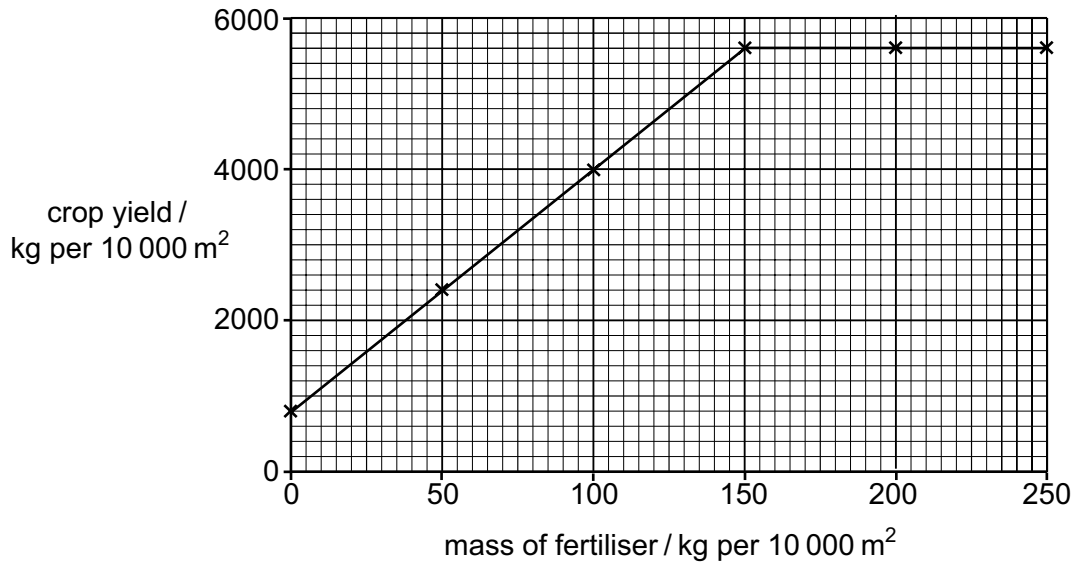


Fig. 2.1

(a) (i) Using the information in Fig. 2.1, describe the effect on crop yield of using an increasing mass of fertiliser.

.....

.....

.....

.....

..... [3]

(ii) The nitrogen in the fertiliser is in the form of nitrate ions.

Describe how the nitrogen in the fertiliser is absorbed by crop plants and used to give an increased crop yield.

.....

.....

.....

.....

..... [3]

(iii) Explain why a farmer may decide to use a mass of fertiliser per 10 000 m² which is less than that needed for a maximum crop yield.

.....
.....
.....
.....
..... [3]

(b) State **one** type of mineral ion, other than nitrate, that is required by a plant and explain its importance to the plant.

type of mineral ion
importance to plant
..... [2]

[Total: 11]

3 DNA controls cell function by controlling the production of proteins.

These proteins determine the phenotype of an organism, including blood group in humans.

(a) Describe the structure of a DNA molecule.

.....

 [4]

(b) One parent of a child has blood group B and the other parent has blood group A. The child has blood group O.

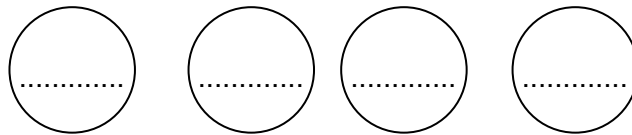
The parents decide to have another child.

(i) Complete the genetic diagram in Fig. 3.1 to show the possible blood groups for the second child of these parents.

genotypes of parents

..... x

gametes



possible genotypes of child

possible blood groups of child

Fig. 3.1

[4]

(ii) State the probability that the second child of these parents:

has the same sex as the first child

has the same blood group as the first child

[2]

[Total: 10]

- 4 Fig. 4.1 shows a photomicrograph of a pollen grain with a pollen tube growing from it.



Fig. 4.1

A student placed pollen grains from the same type of plant in sucrose solutions of different concentrations for a fixed amount of time. After this time, the student used a microscope to examine the grains and tubes.

Table 4.1 shows the results of the investigation.

Table 4.1

% sucrose concentration	% of pollen grains germinated	mean pollen tube length / mm
1	6	0.005
2	13	0.008
4	25	0.015
8	56	0.040
10	31	0.030
20	25	0.018
40	13	0.006

- (a) (i) A total of 12 pollen grains were placed in the 20% sucrose solution.

Using the information in Table 4.1, calculate the number of pollen grains that germinated to produce a pollen tube in the 20% sucrose solution.

..... [1]

- (ii) Suggest why the **mean** pollen tube length was calculated for each sucrose concentration.

.....

..... [1]

(iii) Using the information in Table 4.1, identify the optimum (best) concentration of sucrose solution for pollen grain germination and pollen tube growth.

..... % [1]

(iv) Explain how you used the information in Table 4.1 to answer (a)(iii).

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

(v) The germination of a pollen grain requires the movement of water into the pollen grain to form a pollen tube.

Suggest why placing a pollen grain in a solution with a higher sucrose concentration than in your answer to (a)(iii) may result in a lower percentage of germination.

.....
.....
.....
.....
.....
..... [3]

(b) Describe the route taken by a growing pollen tube in a plant **and** explain the importance of this route in plant reproduction.

.....
.....
.....
.....
.....
.....
.....
..... [4]

[Total: 12]

5 Compare each of the following processes:

(a) aerobic respiration and anaerobic respiration

.....
.....
.....
.....
..... [3]

(b) anaerobic respiration in muscles and anaerobic respiration in yeast

.....
.....
.....
.....
..... [3]

(c) photosynthesis and phototropism.

.....
.....
.....
.....
..... [4]

[Total: 10]

6 The statements **E** to **K** relate to the process of reproduction.

- E** produces genetically identical offspring
- F** produces more individuals of the same species
- G** always involves only one parent
- H** involves fusion of nuclei
- I** requires gametes
- J** forms a diploid zygote
- K** involves only cell division by mitosis

Table 6.1 shows a comparison of sexual and asexual reproduction.

Complete Table 6.1 by writing each letter in the correct box to match it to sexual reproduction only, asexual reproduction only, or to both.

The first letter has been written in the correct box for you. Use each letter **once** only.

Table 6.1

sexual reproduction only	asexual reproduction only	both sexual and asexual reproduction
	E	

[6]

7 Organisms can be classified into groups by the features they share.

(a) State **two** features used to classify humans as mammals.

1

2

[2]

(b) The scientific name for humans is *Homo sapiens*.

State the level of classification referred to by each part of the scientific name:

Homo

sapiens

[2]

(c) Humans may be infected with pathogens such as viruses.

State the **two** main features of a virus.

1

2

[2]

(d) Fig. 7.1 shows a sample of human blood as seen under a microscope.

In Fig. 7.1 one cell is labelled **X**. Cells of this type produce antibodies.

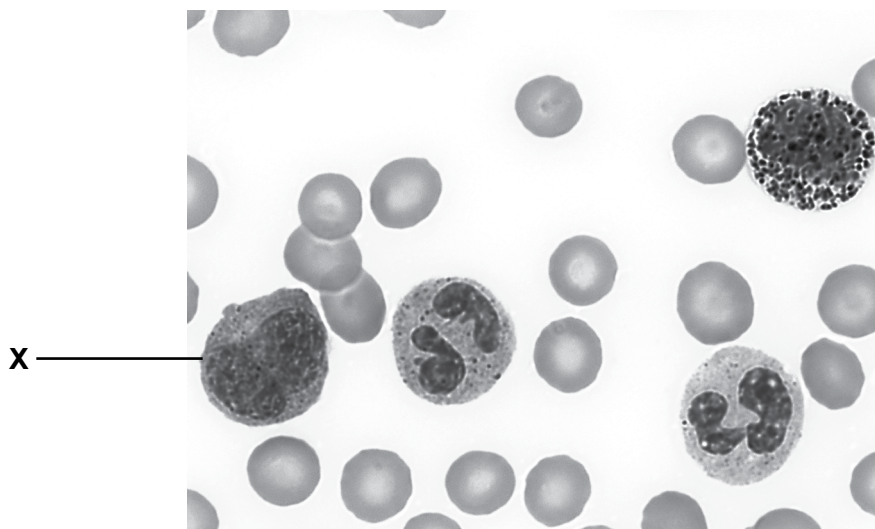


Fig. 7.1

(i) Outline how the type of cell labelled **X** defends the body against infection by a pathogen.

.....
.....
.....
.....
.....
..... [4]

(ii) Infection causes the type of cell labelled **X** to produce antibodies.

State **one** other cause of antibody production.

..... [1]

[Total: 11]

