Enzymes

Question Paper 1

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Enzymes
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 1

Time Allowed: **63 minutes**

Score: **/52**

Percentage: **/100**

1 Dairy cattle are kept for milk production. Approximately half of all the calves born are male.

(a) Sex is determined in cattle in exactly the same way as it is in humans.

Explain why 50% of all cattle are born male.

You may draw a genetic diagram to help your explanation.

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(b) Dairy farmers only need a very small number of male calves. They limit the number by using sex selection. Sperm cells are identified and sorted before they are used in artificial insemination (AI).

Explain how artificial insemination is carried out.

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(c) Table 2.1 shows the composition of 100 g of cow's milk compared with the same quantities of commercial formula milk and human milk.

Table 2.1

nutrient	cow's milk	formula milk	human milk
carbohydrate / g	6.5	7.3	7.5
protein / g	3.3	1.3	1.3 – 1.6
fat / g	3.9	3.6	4.1
calcium / mg	120	42	34
iron / mg	0.02	0.64	0.07
vitamin D / µg	0.05	1.20	0.06
vitamin A / µg	19	66	58

Some women do not breast-feed their babies but bottle-feed them using formula milk. Health authorities advise against the use of cow's milk until babies are about 9 months old.

Use the information in Table 2.1 to explain the advantages of using formula milk rather than cow's milk.

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One of the components of human milk is the enzyme lysozyme that is present in many body fluids and is responsible for breaking down the cell walls of bacteria.

(d) Define the term *enzyme*.

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(e) The effect of human lysozyme on two common species of bacteria, **A** and **B**, was investigated at two different values of pH.

The investigation was set up as shown in Fig. 2.1.

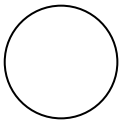
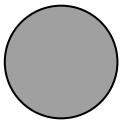
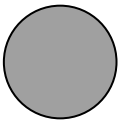
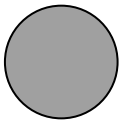
The test-tubes were kept at 37 °C for 24 hours.

tube number	1	2	3	
species of bacteria	A	A	A	B
pH of medium	4.0	4.0	9.0	4.0
fresh lysozyme	✓		✓	✓
boiled lysozyme		✓		

Fig. 2.1

After 24 hours, samples were taken from each test-tube. Each sample was placed onto nutrient agar in Petri dishes. The dishes were incubated at 28 °C for a further 24 hours to allow any bacteria to grow.

The results are shown in Fig. 2.2.

sample from test-tube	1	2	3	
result after incubation for 24 hours				

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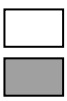

no growth of bacteria

growth of bacteria

Fig. 2.2

Explain the results shown in Fig. 2.2 by comparing the following pairs:

1 and **3** .....

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1 and **4** .....

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1 and **2** .....

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(f) Human milk also contains antibodies. Explain the benefits of antibodies to a newborn child.

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[Total: 20]

2 Microorganisms in the soil release enzymes to digest dead leaves.

(a) Explain how enzymes catalyse chemical reactions.

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(b) Protease and cellulase are two enzymes secreted by soil microorganisms. Protease digests protein.

Suggest what part of the dead leaf cells are digested by the enzyme cellulase.

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(c) Table 6.1 shows the results of a study comparing the decomposition of dead leaves at two locations **A** and **B**.

Table 6.1

	location **A**	location **B**
protease activity / μmol min^{-1}	2750	2670
cellulase activity / μmol min^{-1}	4790	2500
soil pH	6.0	3.5
soil water content / %	10	77

(i) Compare the enzyme activity at location **A** with the enzyme activity at location **B**.

You will gain credit for using the data from Table 6.1 to support your answer.

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(ii) Suggest possible reasons for any differences in the enzyme activity at location **A** and location **B**.

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(d) Describe how nitrogen in proteins in dead leaves is recycled to be absorbed by plants.

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(e) Microorganisms also process and convert atmospheric nitrogen to form a nitrogen compound that can be absorbed by plants.

(i) Name this process of converting atmospheric nitrogen.

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(ii) Explain how this process happens.

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[Total: 17]

3 Enzymes are necessary for many biological processes, such as the digestion of fat.

$$\text{fat} + \text{water} \xrightarrow{\text{lipase}} \text{fatty acids} + \text{glycerol}$$

(a) (i) Explain why enzymes are necessary for biological processes.

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(ii) Lipase, protease and amylase are enzymes secreted into the alimentary canal.

Name **one** organ that secretes each enzyme. Choose your answers from this list.

colon gall bladder liver

pancreas rectum salivary glands

You can use each organ **only once**.

lipase .....

protease .....

amylase ..... [3]

(b) A group of students investigated the digestion of fat in milk.

- They added an alkaline solution to the milk.
- They divided the milk into four test-tubes.
- They added lipase and bile salts to some of the test-tubes, as shown in Table 5.1. They did this at the same time for each test-tube.
- They kept all test-tubes at 40 °C.
- After 5 minutes, they added Universal Indicator solution to each test-tube.

Table 5.1

test-tube		colour of pH indicator after 5 minutes at 40 °C
A	milk, alkaline solution, lipase and bile salts	orange
B	milk, alkaline solution, bile salts and water	blue
C	milk, alkaline solution, lipase and water	yellow
D	milk, alkaline solution and water	blue

Fig. 5.1 shows the colour of the indicator at different pH values.

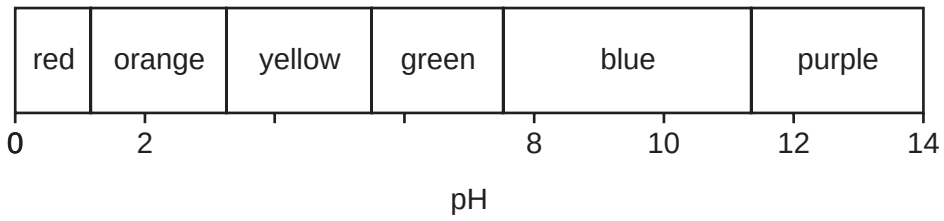

Fig. 5.1

(i) Explain why test-tube **D** was included in the investigation.

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(ii) Explain why the colour in test-tube **A** was orange.

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(iii) Explain the results for test-tubes **B** and **C**.

test-tube **B** .....

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test-tube **C** .....

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[Total: 15]