Cambridge Assessment International Education

Cambridge Pre-U

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

3296456285

BIOLOGY **9790/04**

Paper 4 Practical **October/November 2020**

2 hours 30 minutes

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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 [ ].

For Examiner's Use	
Section A	
Section B	
Total	

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document has **20** pages. Blank pages are indicated.

DC (RW) 208020

Section A

Answer **all** the questions.

You are advised to spend no more than **90 minutes** on Question 1.

1 You are advised to read the whole of the question before starting the practical work, as you will need to make decisions about how to obtain high quality results using the apparatus and materials provided.

You are going to investigate the clotting of milk.

Young mammals are fed on milk. To enable efficient digestion of milk it is clotted in the stomach using the protease enzyme chymosin.

Chymosin converts the soluble protein caseinogen in the milk to an insoluble form called casein.

The manufacture of cheese also requires the clotting of milk. This can be done in two ways by:

- acidifying the milk
- using the enzyme chymosin.

In **Part 1** you will observe the clotting of cows' milk using two methods: **Method 1** with acid and **Method 2** with chymosin.

In **Part 2** you will investigate the effect of chymosin concentration on the rate of clotting of cows' milk.

You are provided with:

- cows' milk
- 10% chymosin solution
- 1 mol dm^{-3} hydrochloric acid
- distilled water.

Part 1 – observing clotting

Method 1 – using acid

1. Add 5 cm^3 of milk to a test-tube.

2. Add 1 cm^3 of 1 mol dm^{-3} hydrochloric acid to the milk in the same test-tube.

3. Put a bung into the test-tube and mix the contents by inverting the test-tube three times.

4. Tilt the tube and rotate it slowly as shown in Fig. 1.1. Do **not** shake the tube.

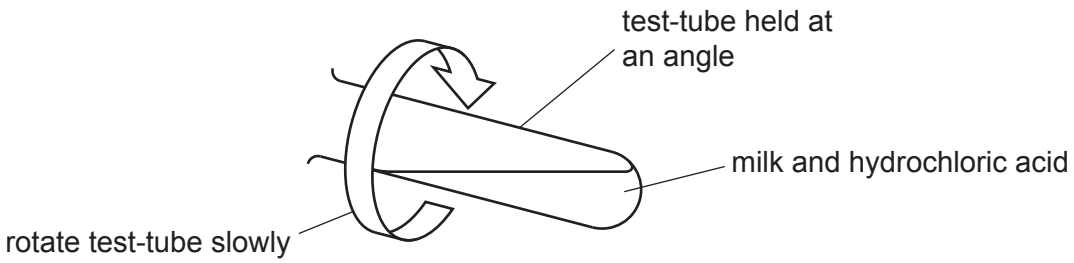

Fig. 1.1

(a) Record your observations.

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..... [2]

5. Keep the test-tube for later reference.

Method 2 – using chymosin

1. Prepare and maintain a water-bath at 40 °C ±2 °C.
2. Put 5 cm^3 of milk into a test-tube.
3. Put 1 cm^3 of chymosin solution into a separate test-tube.
4. Allow the milk and chymosin solution to equilibrate to 40 °C ±2 °C.
5. Add the milk to the chymosin solution and immediately start a timer. Mix by inverting as in Method 1 step 3.

(b) Record the time taken for the milk to clot.

..... [1]

6. Keep the test-tube for later reference.

(c) Suggest the advantage of adding the milk to the chymosin solution rather than adding the chymosin solution to the milk.

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..... [1]

7. Use the universal indicator paper to test the pH of:

- milk
- milk with acid (use the test-tube from Method 1 step 5)
- milk with chymosin solution (use the test-tube from Method 2 step 6)
- chymosin solution.

(d) Record your results in the space below and explain the advantage of carrying out this test before investigating the effect of concentration of chymosin on the clotting of milk.

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..... [2]

(e) Caseinogen molecules are hydrophilic and therefore soluble in water. When formed, they are incorporated, along with certain other molecules and ions, into spherical structures called micelles. Each micelle has a hydrophobic core and a stabilising outer layer of hydrophilic caseinogen molecules.

During clotting the micelles are broken open and their contents clump together to form clots.

Suggest why the contents tend to clump together.

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..... [1]

(f) Suggest why the time taken for clotting was different in the two methods.

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..... [3]

Part 2 – investigating the effect of chymosin concentration on the rate of clotting

You will need to decide:

- the range of concentrations of chymosin solution to use
- a suitable end-point.

To help you decide, you should carry out some preliminary practical work. You should spend no longer than about 10 minutes on this preliminary work.

Space for results from preliminary work

(g) Explain how the results of your preliminary practical work have influenced your decisions about the range of concentrations of chymosin solution to use and the end-point.

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(h) Use the space below to draw a dilution table showing how you will prepare the chymosin concentrations for your investigation.

[4]

- Prepare the concentrations of chymosin according to your dilution table.
- Use the chymosin solutions to determine the effect of chymosin concentration on the rate of clotting of milk.

(i) Record all your results in a suitable table in the space on the next page.

If there is no clotting within 10 minutes record the result as no change.

Space for results

[6]

(j) On the grid draw a graph to show the effect of concentration of chymosin on the **rate** of clotting of milk.

[5]

(k) Describe and explain the pattern of results shown by your graph.

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(l) Describe and explain the precautions that you took to ensure high quality results.

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..... [4]

(m) Complete Table 1.1 by stating:

- **three** possible sources of error that may have affected your results
- an improvement to reduce the effect of each error.

Table 1.1

error	improvement
1	
2	
3	

[6]

(n) A student was told that the optimum pH of chymosin is pH 6.0. The student investigated the effect of pH on the activity of chymosin to confirm this value.

Fig. 1.2 shows the student's results.

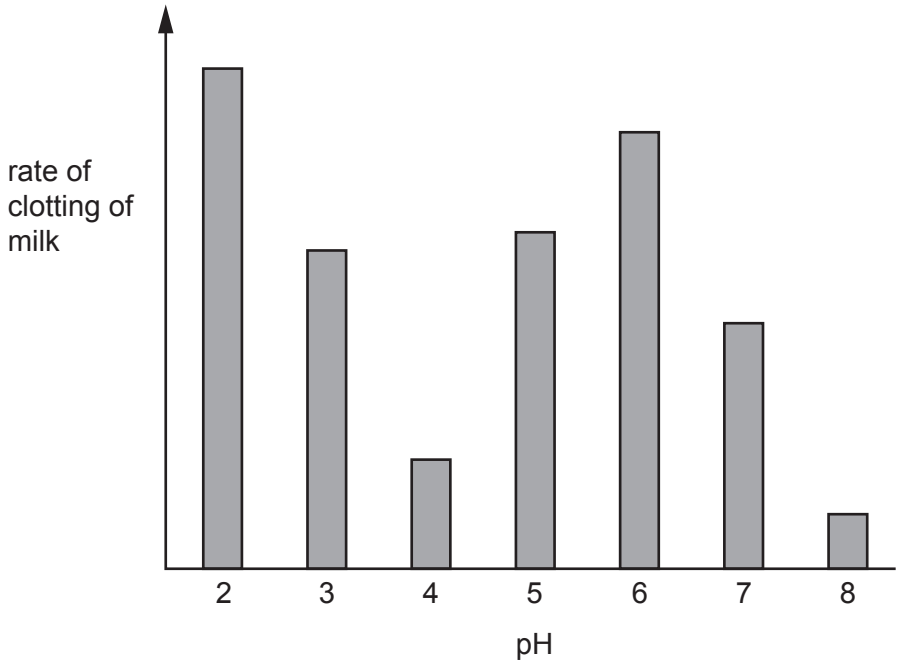

Fig. 1.2

Comment on the results shown in Fig. 1.2.

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[Total: 45]

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Section B

Answer **all** the questions.

You are advised to spend no more than **60 minutes** on Section B.

2 You should read through the whole of Question 2 carefully and then plan your use of the time to make sure that you finish all the work that you would like to do.

Slide **F1** is a transverse section through the ileum of an adult small mammal.

Look carefully at the section with the low power of your microscope.

(a) (i) Make a large, low-power plan diagram of a representative region through the wall of the ileum in the space provided on the page opposite.

Before you start your drawing you should look at the whole section and choose a small representative region through the wall.

Label your plan diagram.

[12]

(ii) Indicate the magnification of your drawing and show how you have calculated it. [3]

Space for drawing

(b) Look carefully at the section on slide **F1** with the high power of your microscope.

The alimentary canal is lined by an epithelium. The cells that form the epithelium in the different regions of the alimentary canal are adapted for a variety of functions.

(i) Make a high-power drawing of a representative part of the epithelium of the ileum in slide **F1** in the space below. [5]

(ii) Identify and label the types of cells present in the epithelium of the ileum in slide **F1**. [2]

(iii) Annotate your drawing to:

- describe the appearance of the cells that you have labelled
- state the functions of these cells.

[4]

Space for drawing

(c) Fig. 2.1 is a photomicrograph of a transverse section of a group of gastric glands from the mammalian stomach.

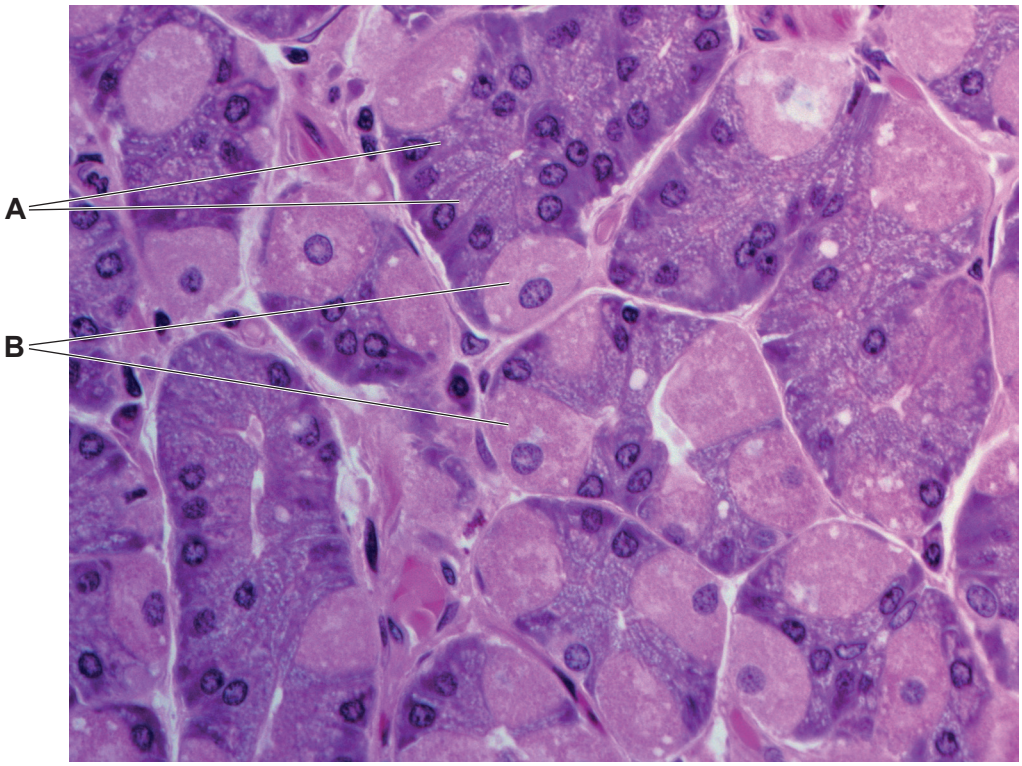

Fig. 2.1

(i) Name the types of cells labelled **A** and **B** in Fig. 2.1.

A .....

B .....
[2]

(ii) Describe how the appearance of the cells in the epithelium of the gastric glands shown in Fig. 2.1 differs from the appearance of the cells in the epithelium of the ileum on slide **F1**.

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(iii) Explain the reasons for the differences that you have described in part **(c)(ii)**.

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[Total: 35]

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