# GCE AS Level Biology

S21-B400U10-1

## Assessment Resource 6

Basic Biochemistry and Cell Organisation Resource F

1. Some bacteria produce a protease which breaks down milk protein. When the enzyme is added to milk the milk gradually becomes clear as the protein in milk is broken down.
A student investigated the effect of temperature on this protease using the following method.

- Set up five water baths in beakers using ice, hot and cold water at the following approximate temperatures; 10 °C, 20 °C, 30 °C, 40 °C, 50 °C.
- Record the actual temperature of the water baths.
- Add 10 $cm^3$ of milk to one test tube.
- Add 1 $cm^3$ of protease at pH 7 to a separate test tube.
- Place both test tubes in the first water bath for five minutes.
- Pour the milk into the protease.
- Record the time taken for the milk to become clear.
- Repeat for the other temperatures.

The results the student obtained are shown in **table 1.1**.

**Table 1.1**

| Actual temperature of water bath / °C | Time taken for the milk to become clear / seconds | | | |
|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | Mean |
| 8 | 56 | 49 | 54 | 53 |
| 18 | 31 | 34 | 28 | 31 |
| 32 | 28 | 34 | 27 | 30 |
| 42 | 21 | 17 | 21 | 20 |
| 54 | 45 | 36 | 34 | 38 |

*(a)* (i) State two *other* variables that should have been controlled during this investigation. [2]

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(ii) Identify two sources of inaccuracy in this experimental method **and** describe how accuracy could be improved in each case. [4]

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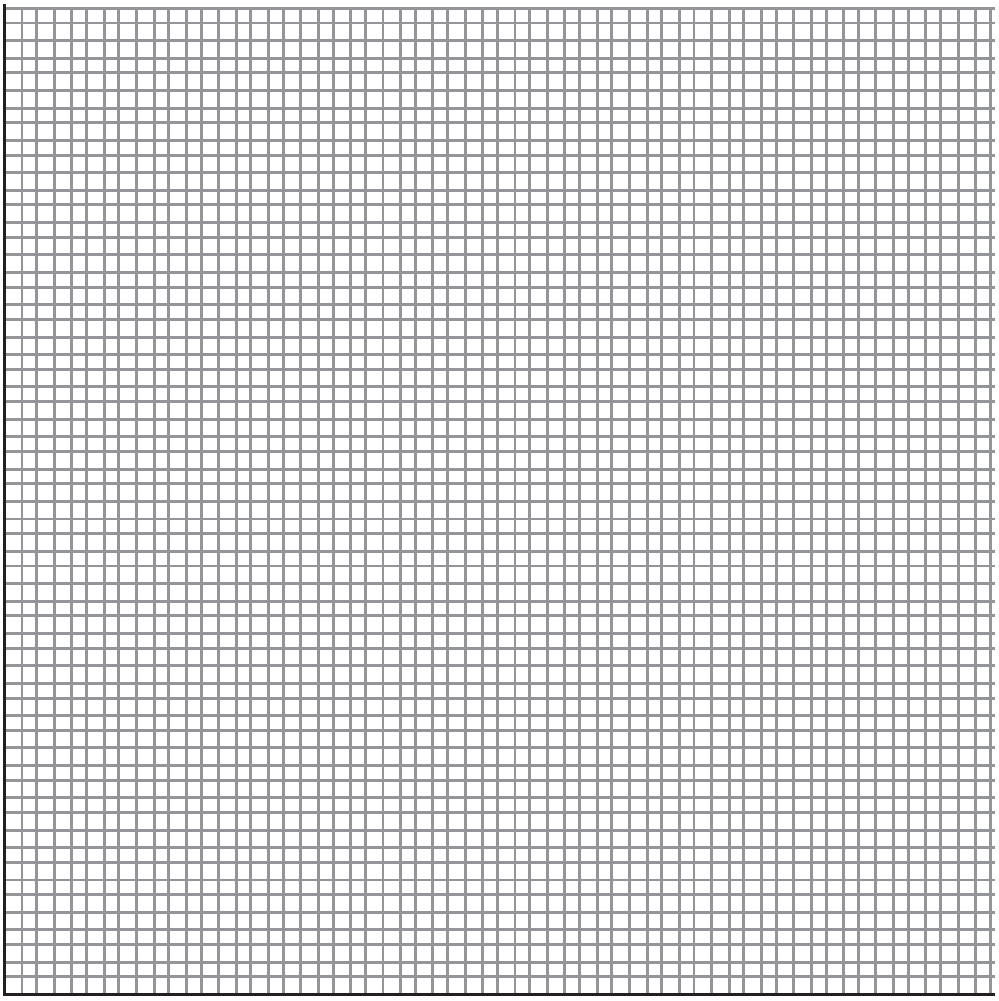
*(b)* (i) Plot the mean results of the investigation on the graph paper provided. [4]



(ii) Describe and explain the results of the experiment. [4]

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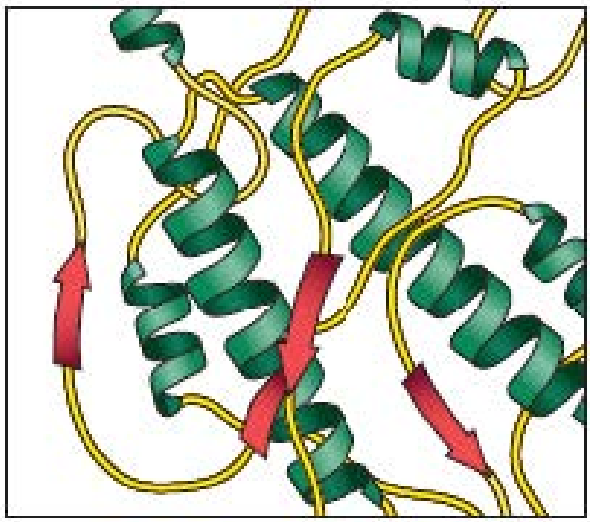
(c) Image 1.2 shows part of the structure of the protease used in the experiment on page 1.

**Image 1.2**



(i) State the highest level of protein structure shown in image 1.2 and identify the bonds that maintain the structure. [2]

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(ii) Explain how the shape of the molecule is related to its function. [2]

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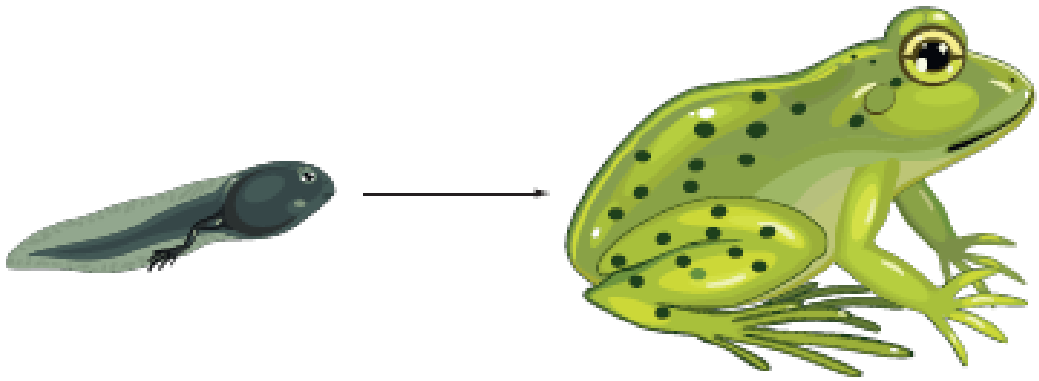
2. Programmed cell death, also known as apoptosis, is an important part of embryonic development. For example, in tadpoles, the cells of the tail undergo apoptosis as the tadpole develops into an adult frog. This is shown in image 2.1.

**Image 2.1**



During apoptosis, the cells in the tail break down into fragments surrounded by membranes. These membranes have signal molecules which are recognised by the tadpole's white blood cells. The cell fragments are then engulfed and destroyed.

*(a)* (i) Suggest the class of biological molecules to which the signal molecules belong. [1]

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(ii) Name the process by which white blood cells engulf and destroy the cell fragments. [1]

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*(b)* During apoptosis enzymes hydrolyse the cell's DNA into different lengths. The length of DNA molecules is measured in base pairs (bp).

(i) Name the complementary base pairs found in DNA and state the bond that joins them. [2]

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(ii) Each complete 360° turn of the double helix of DNA is 34 nm long and contains 10 base pairs. The length of a DNA fragment is 6800 nm.
Calculate the number of base pairs in this fragment. [2]

Number of base pairs = ..... bp

(iii) With reference to the hydrolysis of DNA, explain why the process of apoptosis would prevent the formation of functional proteins. [4]

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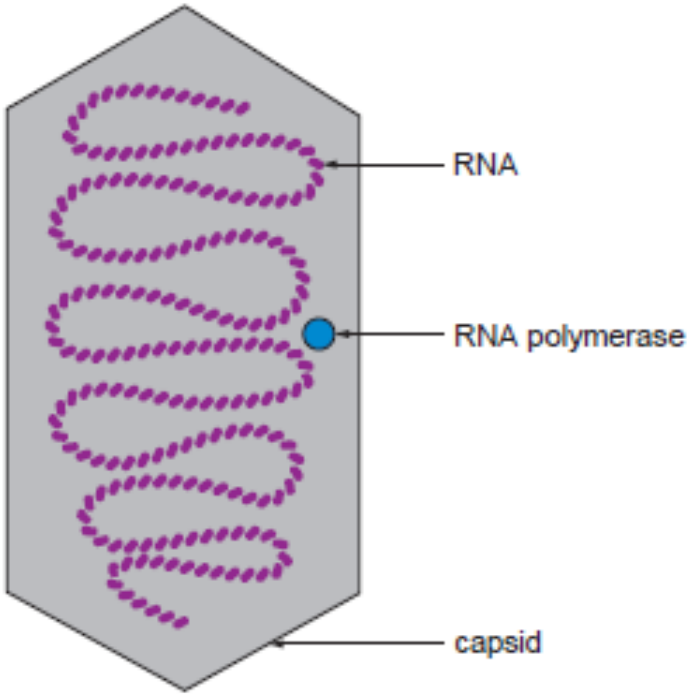
3. Viruses cause infections in many mammals including humans. The basic structure of a virus is shown in **image 3.1**.

**Image 3.1**




The virus must enter a host cell in order to reproduce. Once inside, the viral RNA is replicated using viral RNA polymerase enzyme. Viral RNA then acts as a code to synthesise the capsid protein using the host cell's organelles.

Compare the structure of the virus shown in **image 3.1** with the structure of a human cell. Describe and explain how the viral RNA is replicated and then used to make viral protein molecules. [9 QER]

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