# A level Biology A

**H420/03** Unified biology

# Question Set 16

**1** Icefish live in very cold water.

Icefish contain biological molecules that allow them to tolerate cold temperatures.

**(a)** Adaptations can be grouped into three general categories.

Which category of adaptation is represented by cold-tolerant molecules? **[1]**

physiological

**(b)** One example of a cold-tolerant molecule present in icefish is a modified form of the proteaseenzyme trypsin.

Fig. 3 shows how trypsin is converted from a molecule called trypsinogen. This conversionoccurs in the lumen of the small intestine

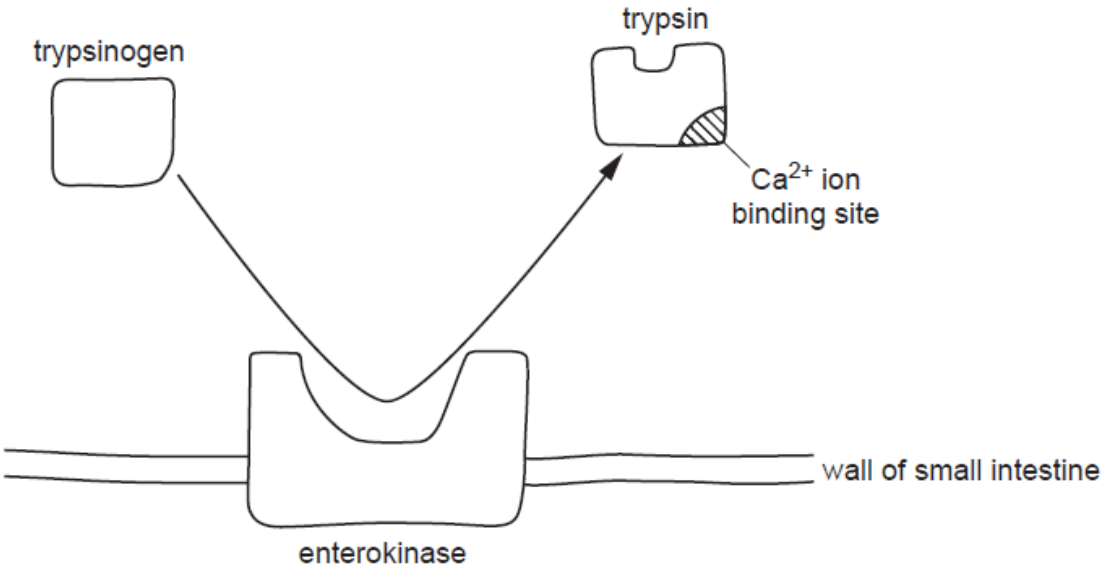


**Fig. 3**

State **two** conclusions that can be drawn from Fig. 3 about the roles of the molecules andions that affect how trypsin functions.

1 enterokinase is an enzyme

2 $Ca^{2+}$ ion is a cofactor

**[2]**

**(c)** A group of students investigated the effect of temperature on the activity of two forms oftrypsin: human trypsin and icefish trypsin.

Part of their method is shown below:

- use 10 $cm^3$ of 5% trypsin solution for all trials
- measure enzyme activity at 10, 20, 30, 40 and 50 °C for both enzymes
- carry out each trial in the same pH buffer
- repeat the experiment 5 times at each temperature
- measure enzyme activity by recording the area of gelatine on a photographic filmthat is broken down over a set time period
- calculate the rate of enzyme activity at each temperature.

**(i)** Suggest **and** explain two improvements that would increase the validity of the students'investigation.

Improvement.....control group without trypsin.....

Explanation.....to see if gelatine breaks down without trypsin.....

Improvement.....closer temperature intervals.....

Explanation.....more accurate estimate of optimum temperature

**[4]**

**(ii)** Suggest appropriate units to use to represent the rate of enzyme activity in this investigation. **[1]**

$mm^2\ min^{-1}$

**(iii)** The students recorded the temperature that produced the fastest reaction rate in each ofthe five replicates. These results are shown in Table 3.

| Replicate | Temperature that produced the fastest reaction rate (°C) | |
|---|---|---|
| | Human trypsin | Icefish trypsin |
| 1 | 40 | 20 |
| 2 | 10 | 10 |
| 3 | 30 | 20 |
| 4 | 40 | 30 |
| 5 | 40 | 30 |
| Mean = | 32.0 | 22.0 |
| Mode = | 40 | 20 and 30 |
| Median = | 40 | 20 |

**Table 3**

One of the students made the following statement:

I think the mean is a more accurate measure than the median or mode for these results.

Evaluate the student's statement. **[2]**

AGREE - 2 mode values exist for icefish trypsin
DISAGREE - outlier included in mean for human trypsin but median / mode isn't affected

**(iv)** The students wanted to know whether there was a difference between the reaction ratesof the two forms of trypsin at 30 °C.

They performed a statistical test on the mean of the five replicates for human trypsin and the five replicates for icefish trypsin.

Suggest the most appropriate statistical test for the students to use **and** explain why this test is appropriate. **[2]**

- t-test
- for comparing means

## Total Marks for Questions Set 16: 12