Practical Skills in Biology – 2021/20 GCE AS Biology A

1. Nov/2021/Paper_H020/2/No.3

Students carried out a practical investigation into the effect of enzyme concentration on the rate of reaction.

They were provided with:

- a 1% solution of the enzyme trypsin
- a supply of distilled water
- test tubes labelled 1–4
- 10 cm^3 syringes.

(a) **(i)** Describe how they would create **four** different enzyme concentrations using **tenfold serial dilutions**. They started by using a syringe to transfer 1 cm^3 of the 1% trypsin solution into tube 1. With a clean syringe, they then added 9 cm^3 of distilled water to tube 1.

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

(ii) State the concentration of trypsin in tube 4 once the **tenfold serial dilutions** had been completed.

Concentration = ... % **[1]**

(b) Trypsin is an example of a protease enzyme found in the small intestine of mammals. Explain why trypsin is described as an extracellular enzyme.

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..... **[1]**

(c) **Fig. 3.1** shows how the rate of reaction of trypsin changes with pH.

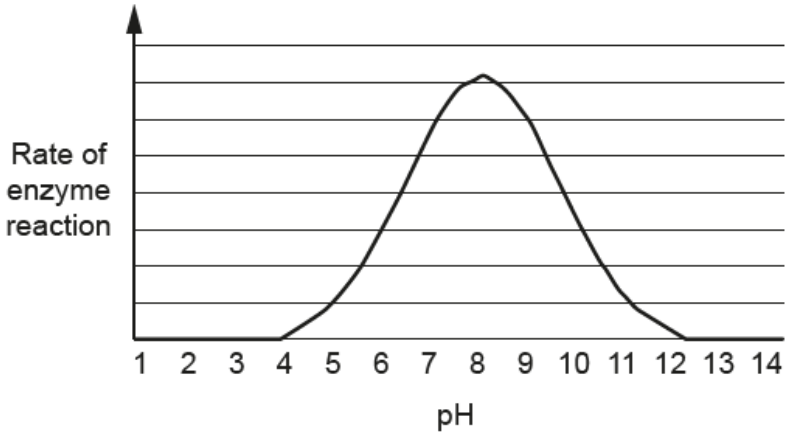

Fig. 3.1

With reference to **Fig. 3.1**, explain the change in the rate of reaction between pH 8 and pH 11.

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(d) Catalase is an enzyme found in a wide range of tissues. It catalyses the breakdown of hydrogen peroxide into water and oxygen. A group of students used liver tissue to investigate the effect of temperature on the rate of reaction of catalase.

A diagram of the apparatus is shown in **Fig. 3.2**.

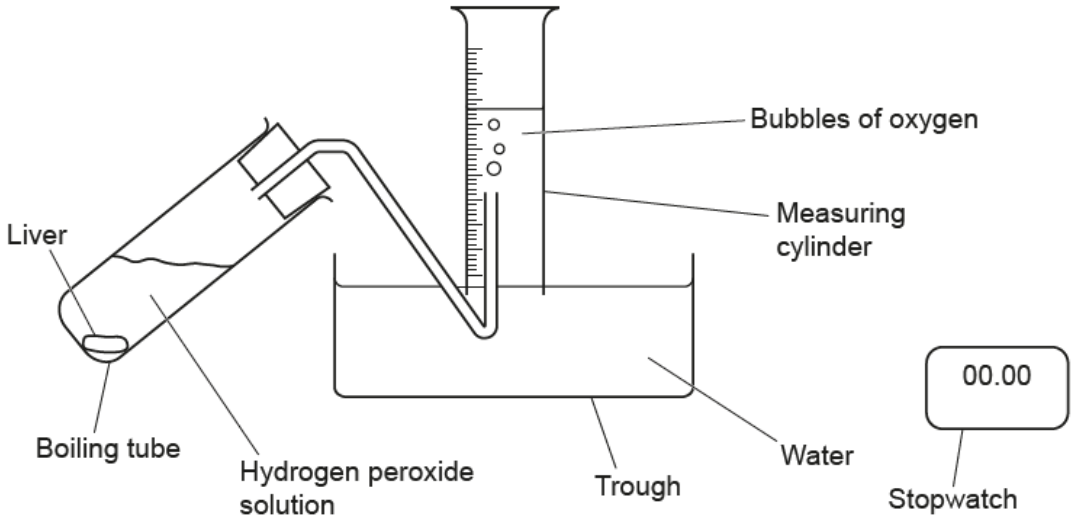

Fig. 3.2

Table 3 shows the results from the experiment carried out at 20 °C.

Time (s)	Volume of oxygen collected (cm^3)
30	6.0
60	12.0
90	15.0
120	18.0
150	21.0
180	22.0
210	23.5
240	24.0
270	24.5
300	25.0

Table 3

(i) Other factors may affect the rate of the reaction.

Name **one** other factor they would need to control **and** describe how they would control this.

Factor

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How they would control this

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[2]

(ii) Describe how you would use the apparatus shown in **Fig. 3.2** to obtain the results shown in **Table 3**.

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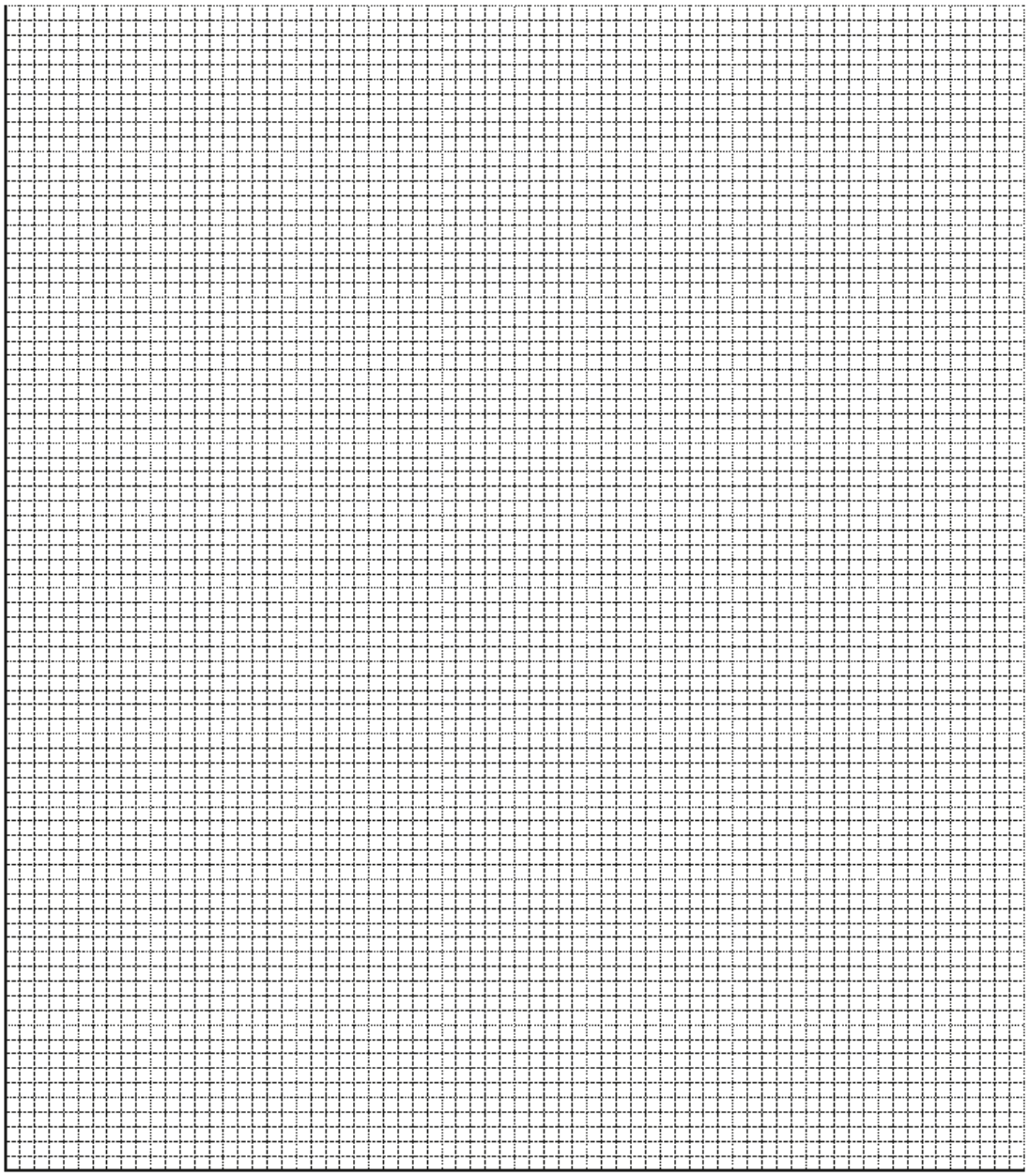
(iii) Plot a graph of the results shown in **Table 3** on the grid below.



[3]

(iv) Use your graph to calculate the **initial** rate of reaction.

Give your answer to **2** significant figures.

Rate of reaction = ... $cm^3 s^{-1}$ **[3]**

(e)* Temperature and enzyme concentration are two factors that affect the activity of enzymes.

Describe how variations in these two factors affect enzyme activity.

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..... **[6]**

2. Nov/2021/Paper_H020/2/No.(b)

(b) A study was carried out on moorland vegetation in the North of England. A number of 10-metre interrupted belt transects were carried out in this area.

Here are some instructions for carrying out an interrupted belt transect:

1. Mark a line with a string.
2. Make an observation at varying points along the string.
3. Count how many different species of plants are found at each point.
4. Note down what you think the names of each of these species are.
5. Record your results as a table.

(i) Suggest **two** improvements you could make to these instructions.

Improvement 1

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Improvement 2

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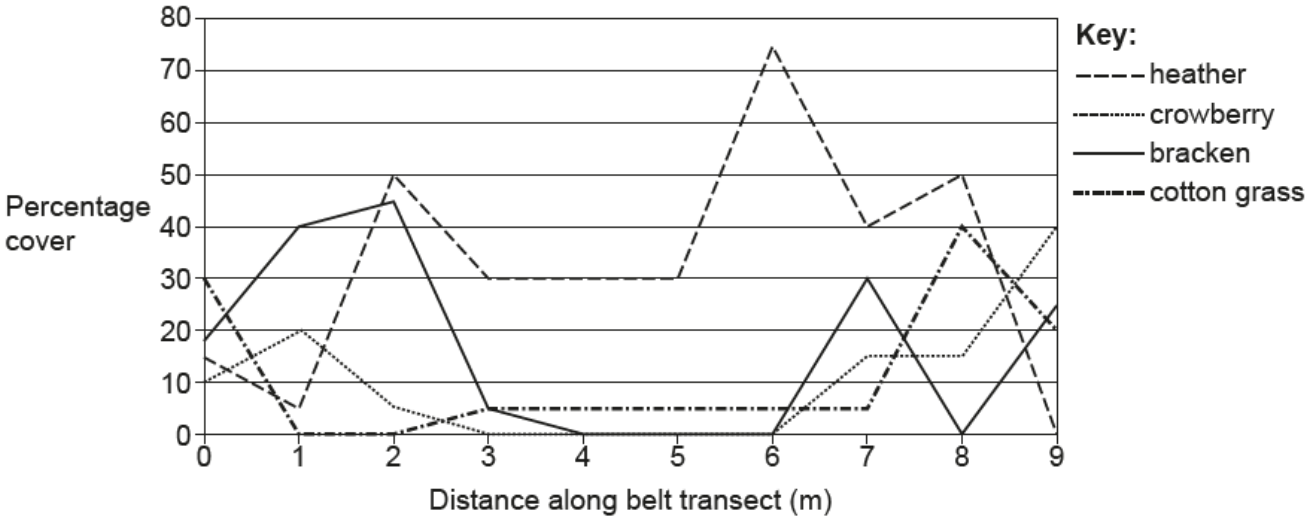
[2]

(ii) Results of the four most abundant species from the study are shown in the graph below.



When presented with an aerial photograph of the moorland community being studied, a student stated that bracken and heather are not found growing in the same area.

Using the data in the graph, evaluate the student's statement.

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

3. Nov/2020/Paper_H020/2/No.1

(a) A student was observing onion epithelial cells using a light microscope. They photographed these cells and the image obtained is shown in Fig. 1.1. The student then made a drawing of a few cells from this image. The drawing is shown in Fig. 1.2.

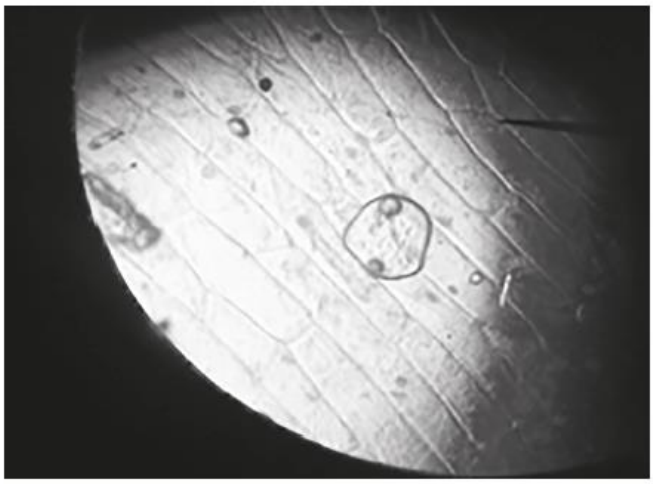

Fig. 1.1

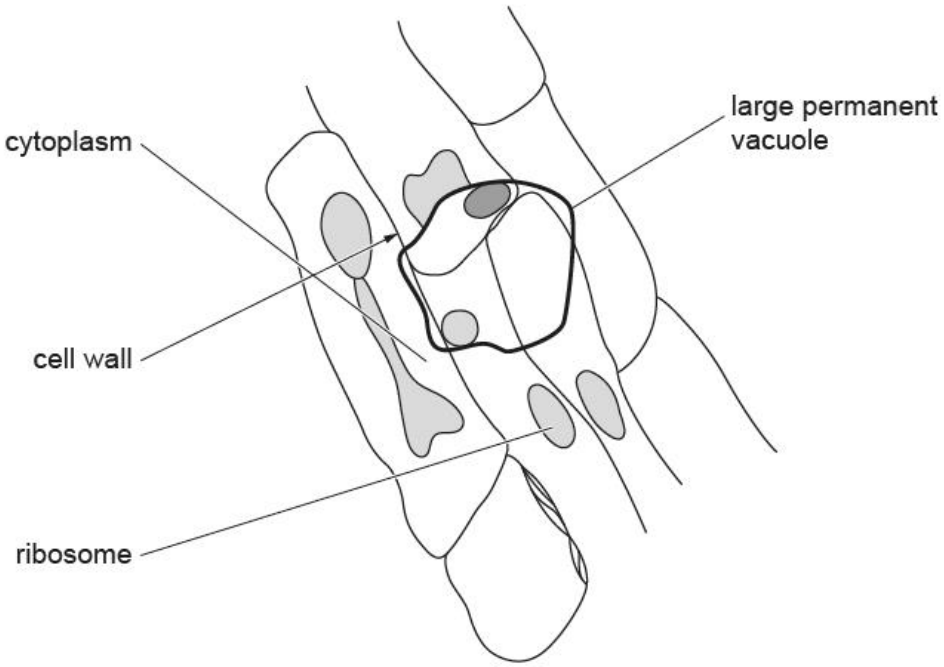

Fig. 1.2

The teacher stated that two of the labels on the drawing Fig. 1.2 were incorrect, and also that it was a poor quality biological drawing.

(i) Identify **one** incorrect label and explain your answer.

Incorrect label .....

Explanation .....

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[3]

(ii) State **three** changes, other than to the labels, to Fig. 1.2 that the student would need to make to improve the biological drawing.

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2 .....

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3 .....

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[3]

(b) Both a transmission electron microscope (TEM) and a scanning electron microscope (SEM) can be used to view the same cell. However, the images formed will be different.

Compare the resolutions of these microscopes **and** the images formed by them.

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(c) (i) A student wrote the following passage about cells:

'Erythrocytes and neutrophils are formed in the spleen. One of the places ciliated epithelial cells are found is in blood vessels. Sperm cells are the male gametes and contain the haploid number of chromosomes. The cell wall of the guard cell is thicker on the side furthest away from the stoma, so the cell does not change shape symmetrically as its volume changes. Root hair cells increase the surface area for absorption of water and mineral ions from the soil.'

Identify **and** correct the errors in the passage.

Error 1 .....

Correction .....

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Error 2 .....

Correction .....

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Error 3 .....

Correction .....

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[3]

(ii) A man with a body mass of 73 kg was admitted to hospital with an infection. His neutrophil production was measured at approximately 3804 billion cells in a 24h period.

When healthy, the man was producing approximately 1.6 billion neutrophils $kg^{-1}\,h^{-1}$.

Calculate the percentage increase in neutrophil production due to the infection.

percentage increase = ... % **[2]**

(iii)* Erythrocytes and neutrophils are both examples of specialised blood cells.

Squamous and ciliated epithelial cells are also examples of specialised cells.

Describe how each of these **four** cells is specialised for its function.

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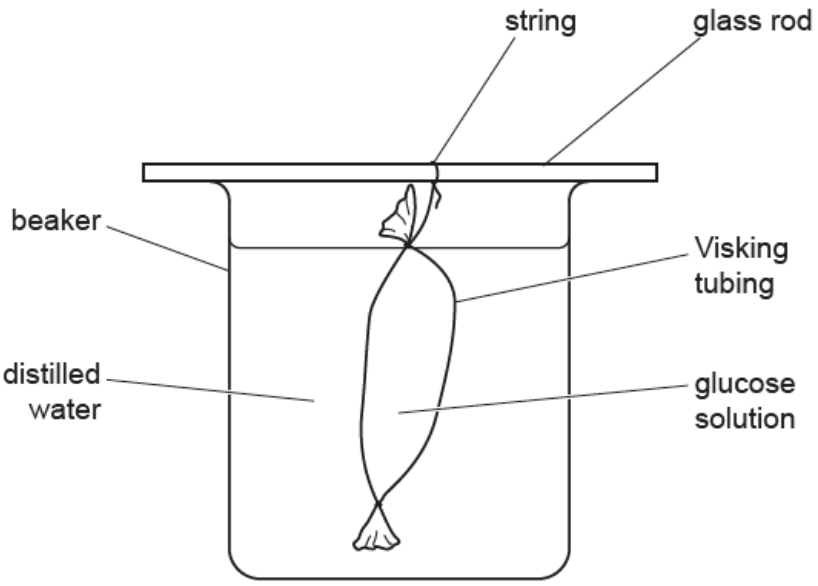
4. Nov/2020/Paper_H020/2/No.5

(a) A group of students set up the apparatus shown below to test the effect of temperature on the rate of diffusion of glucose molecules in model cells.

They determined the concentration of glucose in the distilled water by taking samples at 30s intervals. They carried out the Benedict's test on each sample and used a calibrated colorimeter to determine the absorbance of each sample. Previously they had produced a calibration curve of colorimeter readings against glucose concentration. They used the calibration curve to determine the glucose concentrations of their samples.

They carried out the investigation at three different temperatures.



A table of the results from the students' investigation is shown below.

	Concentration of glucose found in the distilled water samples taken at 30s intervals (mmol dm^{-3})				
Temperature of water bath (°C)	**0s**	**30s**	**60s**	**90s**	**120s**
10	0.00	0.33	0.65	0.98	1.30
20	0.00	0.80	3.21	2.40	3.20
30	0.00	1.23	2.45	3.68	4.90

(i) Suggest an improvement to the method that would allow the students to obtain more precise results.

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..... **[1]**

(ii) State **one** variable that should have been controlled during this experiment.

..... **[1]**

(b) (i) Before the students began their investigation they made a hypothesis.

State the hypothesis the students would have made **and** state the scientific process that supports your choice.

Hypothesis .....

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Scientific process .....

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[2]

(ii) Justify whether the results from the investigation support your hypothesis given in part **(b)(i)**.

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(c) Describe how you would use the same equipment to test if the thickness of the exchange surface affects the diffusion rate.

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