OCR
Oxford Cambridge and RSA

Accredited

A Level Biology B (Advancing Biology)

H422/03 Practical skills in biology

Sample Question Paper

Date – Morning/Afternoon

Version 2.0

Time allowed: 1 hour 30 minutes

You may use:
• a scientific or graphical calculator

First name	
Last name	
Centre number	**Candidate number**

INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

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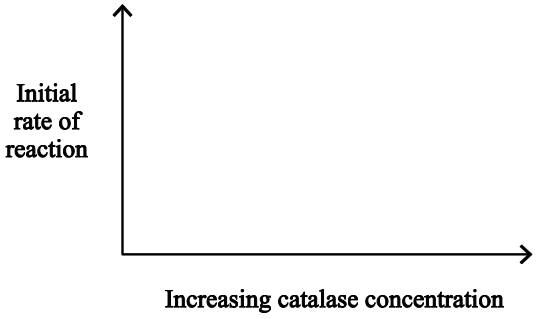
Answer **all** the questions.

1 Catalase is an enzyme that is often used in school laboratories. Catalase acts on hydrogen peroxide.

(a) On the axes below, sketch the curve you would expect if a reaction was carried out in optimum conditions with catalase and hydrogen peroxide.

Excess substrate is available.



[1]

(b) A student wanted to investigate the effect of substrate concentration on the rate of hydrogen peroxide breakdown.

There are many different sources of catalase, including ground liver and blended celery stalk. Both of these tissues could be used but each has advantages and disadvantages.

Evaluate the suitability of each of the tissues and justify which tissue is best for the student to use.

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…… **[3]**

(c) The student set up the investigation using a source of catalase as shown in **Fig. 1.1**.

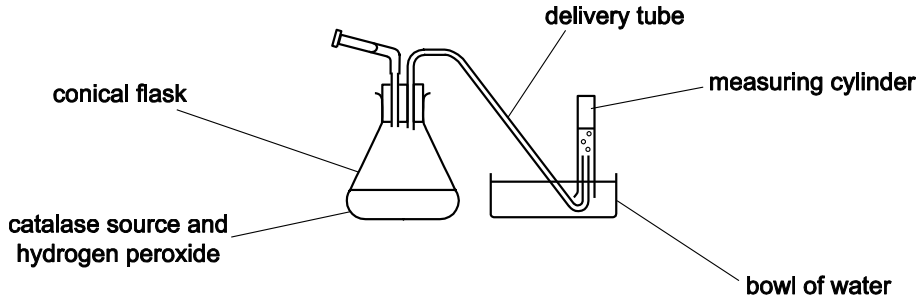

Fig. 1.1

The oxygen gas produced is collected in a 100 cm^3 measuring cylinder. The gas produced was measured at two minute intervals.

The student collected data for two different concentrations of hydrogen peroxide (H_2O_2):

- 2 arbitrary units H_2O_2
- 4 arbitrary units H_2O_2.

At the start of each test, 5.0 cm^3 of air was already present in the measuring cylinder.

Fig. 1.2 shows the results seen by the student.

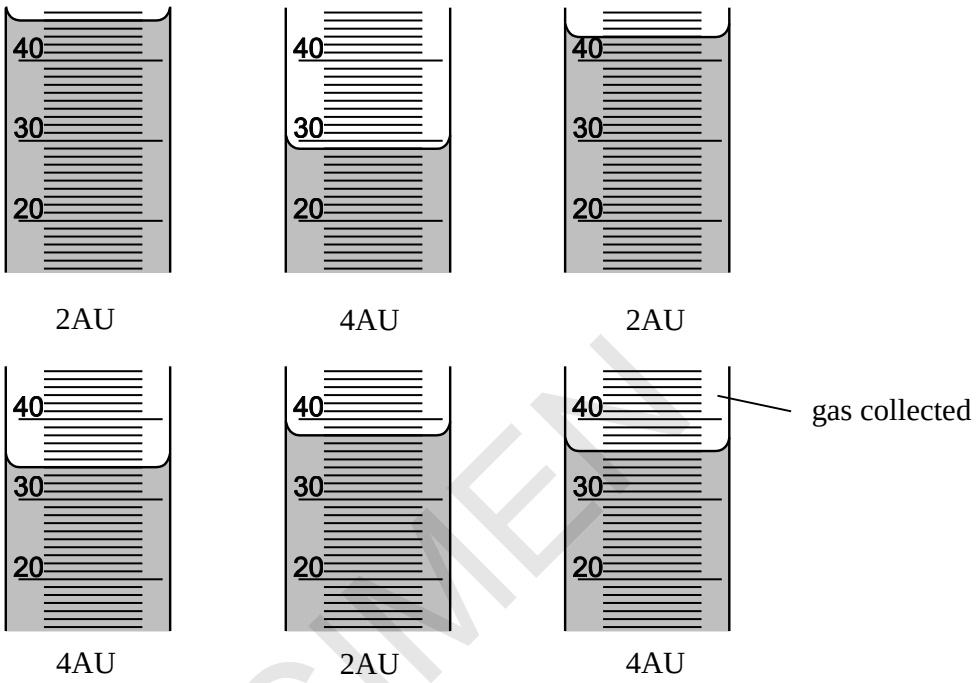

Fig. 1.2

Construct an appropriate table and enter:

- the **raw** data to the most appropriate level of precision for this apparatus
- the **mean values.**

[3]

(d) Catalase activity can vary between different tissues within the same organism. A second student carried out an investigation using catalase from different muscle tissues. All the samples were taken from the same individual organism.

The results are shown in **Table 1.1** below.

	Time for muscle tissue to produce 2 cm^3 oxygen from hydrogen peroxide (s)	
	Chicken leg muscle	**Chicken wing muscle**
1	76	98
2	78	96
3	84	85
4	86	78
5	94	102
6	79	104
7	83	116
8	85	94
9	78	89
10	86	112
Mean ($\overline{x}$)	82.9	97.4
SD (s)	5.4	11.7
Variance (s^2)		

Table 1.1

(i) Complete **Table 1.1**, by calculating the variance for each set of data.

[1]

(ii) The student decided to carry out a t-test to determine if the two sets of data were significantly different from each other.

Calculate the t value for the data in **Table 1.1**. Use the formula.

$$t = \frac{| \overline{x_1} - \overline{x_2} |}{\sqrt{\frac{S_1^{\,2}}{N_1} + \frac{S_2^{\,2}}{N_2}}}$$

t =…… **[3]**

(iii) The student stated that "there is no significant difference in the time it took to collect 2 cm^3 oxygen so the activity of the catalase in both types of tissue was the same".

Use **Table 1.2** below to decide if the student is correct. Explain your answer.

Degrees of freedom	**Level of probability**		
	0.05	**0.01**	**0.001**
1	12.71	63.66	636.6
2	4.303	9.925	31.60
18	2.101	2.878	3.922
20	2.086	2.845	3.850

Table 1.2

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…… **[3]**

(iv) Comment on the precision of the data obtained for the two types of muscle in **Table 1.1**.

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…… **[1]**

(v) Hydrogen peroxide is produced in cells as an intermediate compound when oxygen is converted to water. It can interact with and destroy other molecules in the cell. The enzyme catalase is present in cells to reduce the damage.

Muscles consist of bundles of muscle cells (fibres).

Suggest which muscle, chicken leg or chicken wing, contains cells with a high number of mitochondria.

Explain your suggestion.

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…… **[1]**

2 (a) Deaths from hypothermia in the UK have greatly increased.

(i) Give **two** visible symptoms that would suggest a patient has hypothermia?

…… **[1]**

(ii) What evidence would confirm hypothermia?

…… **[1]**

(iii) Between 2007 and 2011 the number of recorded cases of hypothermia were as follows:

Year	Number of patients treated in hospital	Number of patients over-60 years of age	Number of patients who died within 30 days of being admitted
2007	950	633	
2011	1876	1396	260

Table 2.1

In 2007, 14% of people with hypothermia treated in hospital died within 30 days of being admitted. Calculate how many people died as result of hypothermia in 2007.

Number of people who died …… **[2]**

(iv) What can be concluded about the susceptibility to hypothermia of people who are over the age of 60 years?

In your answer you should:

- analyse the data from **Table 2.1**
- suggest possible explanations for your conclusion.

You may use the space below if needed for any calculations.

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…… **[4]**

(b) Body temperatures vary between different organisms. One method of measuring body temperature uses fibre optic thermometers.

A fibre optic thermometer has a resolution of 0.1°C and a precision: ±0.8°C.

Calculate the percentage error of this thermometer for a temperature change of 5°C.

Show your measuring. Give your answer to one decimal place.

percentage error **……..%** **[2]**

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3* Aspirin (2-O-acetylsalicylic acid) is a drug commonly used in medicine.

Ingestion of more than 500 mg kg^{-1} of aspirin causes severe and possibly fatal toxicity.

Once in the body aspirin is gradually broken down in the liver into salicylic acid.

Salicylic acid is excreted through the kidney and leaves the body in the urine.

Estimates of the amount of aspirin remaining in the body can be made by determining the amount of salicylic acid in the urine. Salicylic acid reacts with a solution of iron (III) chloride to give a purple-coloured substance.

Write a <u>method</u> to determine the concentration of salicylic acid in a sample of urine.

Your method must be based on the assumption that you are provided with the following:

- a solution of 100 mg dm^{-3} salicylic acid
- a 1% solution of iron(III) chloride
- a colorimeter
- school or college laboratory resources. **[9]**

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Additional answer space if required.

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4 As the human population continues to grow there is an ever increasing need to increase food production.

(a) Alfalfa is grown mainly for animal feed as it is rich in protein, minerals and vitamins. The leaves can also be used as a dietary supplement in human nutrition.

Fig. 4.1 below shows the transverse section of an alfalfa leaf.

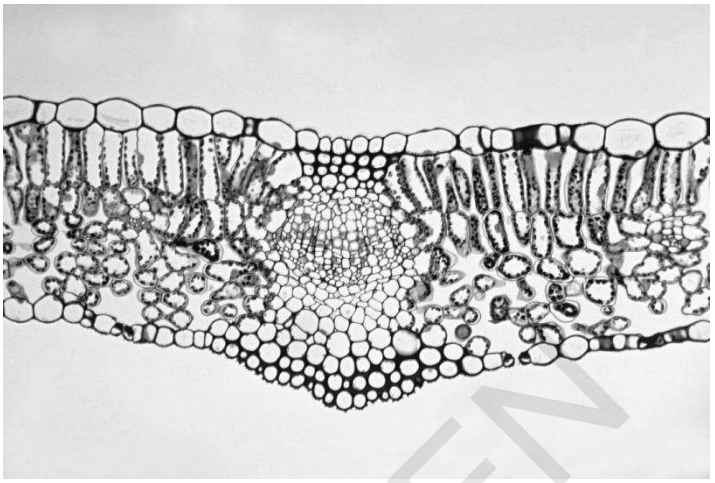


Fig 4.1

In the space below draw a labelled and annotated low power plan of the transverse section of the alfalfa leaf shown in **Fig. 4.1**.

[4]

(b) Other important crops within the UK include potatoes, sugar beet, oilseed rape, wheat and fresh fruits.

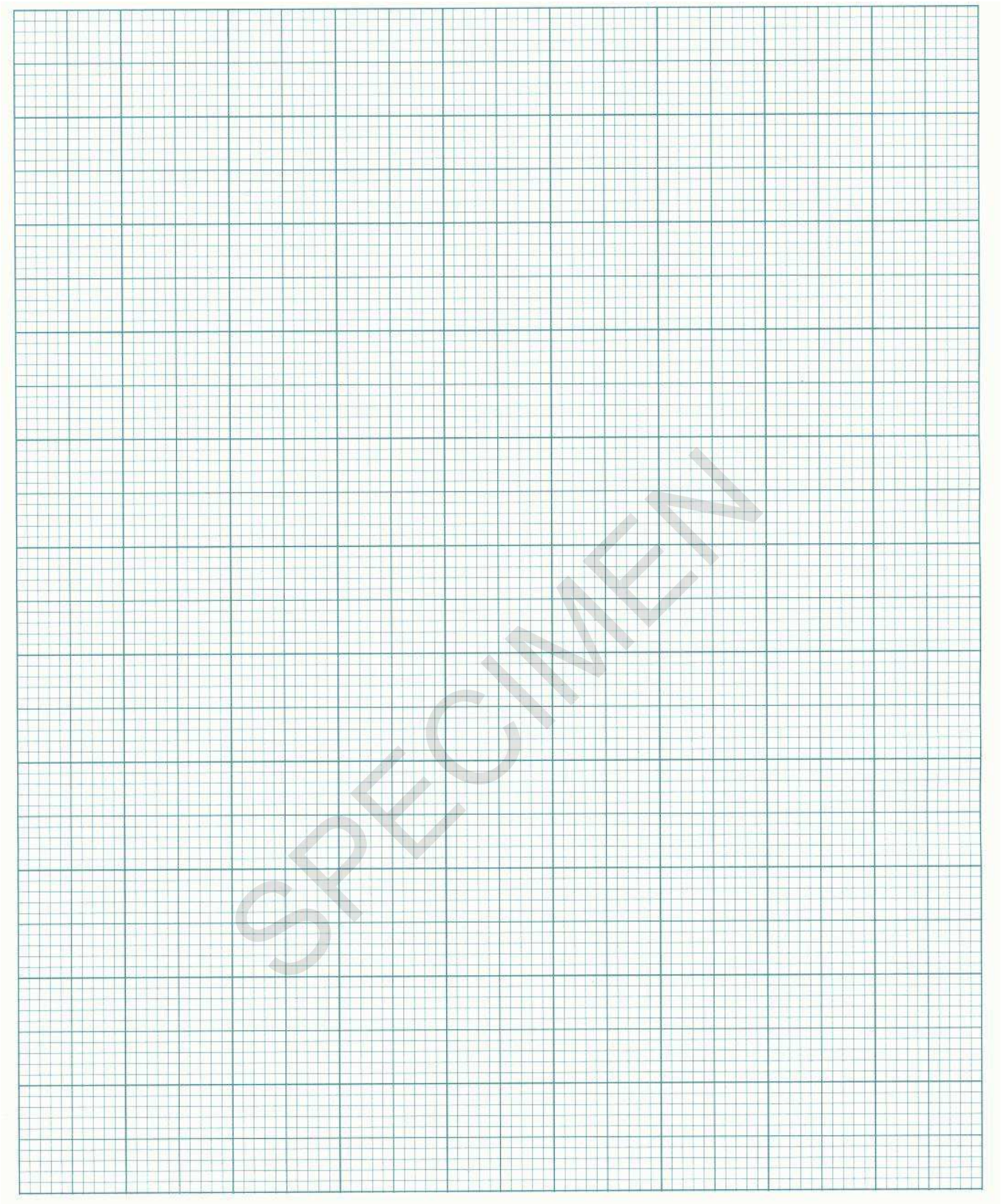
Table 4.1 below shows the UK production in tonnes per hectare for each of these crops in 2012.

Crop	Total production (thousand tonnes per hectare)
Potatoes	4553
Sugar beet	1144
Oilseed rape	2557
Wheat	13261
Fresh fruits	358

Table 4.1

Plot a graph on the grid provided to show this data in the most appropriate way.

[4]


SPECIMEN

(c) Plant cells can be studied using microscopy.

Fig. 4.2

Using a light microscope and a suitably calibrated graticule it is possible to calculate the field of view for each eyepiece lens. Each of the smallest divisions on the graticule shown at this magnification is 0.1 mm.

(i) For **Fig. 4.2**, calculate the diameter of the field of view.

diameter of field of view**……** µm **[2]**

(ii) For **Fig. 4.2**, estimate the number of cells shown in the field of view.

number of cells **…… [1]**

(iii) Using 3.14 as the value for π, calculate the density of the cells in the area shown in **Fig. 4.2**.

density of cells **…… [3]**

5 Dairy farmers need the land used for grazing by their cows to be as free of weeds as possible.

In the UK, dock plants are the most common perennial weed in grassland grazed by dairy cows.

Dock seeds are able to **pass through** the digestive tract of **cattle** unharmed. Cattle do not graze near cowpats so dock plants survive and grow in abundance.

Nettles can be found in plant material fed to cattle and these also survive passage through a cow's digestive system. The plant chickweed grows well in soils with high nitrogen. Other plants commonly found in grassland are rye grass and white clover as these are present in the grass seed mix sown by farmers.

(a) (i)* A student plans to collect valid data to investigate the distribution of plants in a grazed grassland field.

Describe the limitations of using systematic sampling as a technique. **[6]**

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Additional answer space if required.

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(ii) Explain how using a point quadrat could affect the accuracy of data collected.

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(b) Patches of docks, nettles, thistles and other weeds develop over time in the grassland reducing the grazing area and the yield of plant material for use as cattle feed.

Evaluate the use of weed control in this grassland.

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END OF QUESTION PAPER

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