Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/34**

Advanced Practical Skills 2 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do **not** use staples, paperclips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **12** printed pages.

CAMBRIDGE International Examinations

Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of the two hours to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining and recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Plant cells contain an enzyme, catalase, which catalyses the hydrolysis (breakdown) of hydrogen peroxide into oxygen and water. An extract of plant tissue contains catalase.

You are required to investigate the effect of solution **X** on the activity of the catalase in a plant extract **P** by:

- preparing different concentrations of solution **X**
- investigating the effect of different concentrations of solution **X** by counting the number of bubbles of oxygen released in two minutes
- finding the rate of activity of the catalase by measuring the time taken to collect 2 cm^3 of the oxygen.

You are provided with:

labelled	contents	hazard	volume / cm^3
X	0.3% solution of **X**	harmful	20
W	distilled water	none	100
P	plant extract solution	none	90
H	hydrogen peroxide solution	harmful irritant	90
T	tap water	none	–

When carrying out a practical procedure, the hazards of the use of all the apparatus and all of the reagents need to be considered, then the **level** of risk needs to be assessed as low or medium or high.

(a) State the hazard with the greatest level of risk when using the apparatus and reagents in step 1 on page 4.
State the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....

[1]

(b) (i) You are required to make a **serial** dilution of the 0.3% solution of **X** which reduces the concentration of **X** by a **factor of 10** between each successive dilution.

You will need to prepare 10 cm^3 of each concentration of solution **X**.

You should use the beakers shown in Fig. 1.1 to show how you will prepare the **serial** dilutions.

You will need to use 9 cm^3 of each different concentration of **X** in the investigation.

For **each** beaker, complete Fig. 1.1 to show how you will dilute the solution by:

- stating, under the beaker, the **concentration** and **volume** of the solution available for use in the investigation
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of the solution **X** added to prepare the concentration
- using another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.

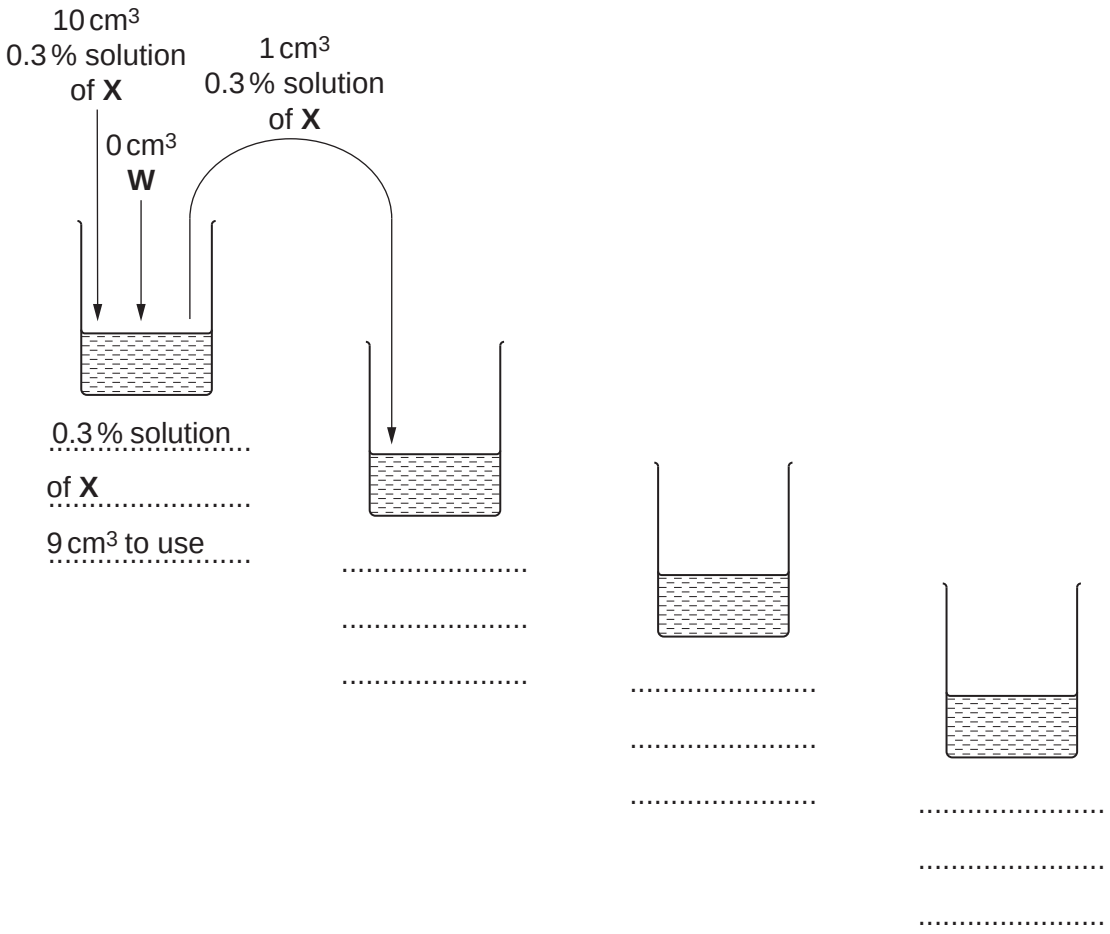


Fig. 1.1

[3]

You are required to investigate the effect of different concentrations of **X** on the activity of catalase by finding the number of bubbles of oxygen released in two minutes.

Proceed as follows:

1. Prepare the concentrations of **X** as shown in **(b)(i)**. *Note: syringe labelled **X** should be used for solution **X only**.*

2. Put 10 cm^3 of **P** into each of the concentrations of **X**, including 0.3% **X**. Shake gently to mix.

3. Put 20 cm^3 of **P** and 18 cm^3 of **W** into a separate beaker.

4. Leave for at least three minutes.

Read step 5 to step 13 before proceeding.

5. Put 10 cm^3 of **H** into each of five test-tubes.

6. Put 10 cm^3 of the mixture of **P** and **W** into one of the test-tubes.

7. Put the bung (with the delivery tube attached) into this test-tube.

8. Put the end of the delivery tube into the large beaker containing water labelled **T**.

9. Start timing and count the number of bubbles of oxygen released in 2 minutes.

10. Record the result in **(b)(ii)**.

Note: if no bubbles are released then make sure the bung is securely fitted into the test-tube. You may ask for petroleum jelly if necessary.

11. Put 10 cm^3 of the mixture of **P** with the **lowest** concentration of **X** into another test-tube containing **H**.

12. Repeat steps 7 to 10.

13. Repeat steps 11 and 12 with each of the other concentrations of **X**, including 0.3% **X**.

Consider how you will obtain results which are as accurate as possible.

(ii) Prepare the space below and record your results.

[5]

You are required to find the rate of activity of the catalase by measuring the time taken to collect 2 cm^3 of oxygen produced by the hydrolysis of **H**.

You are going to collect the oxygen released by displacement of water as shown in Fig. 1.2.

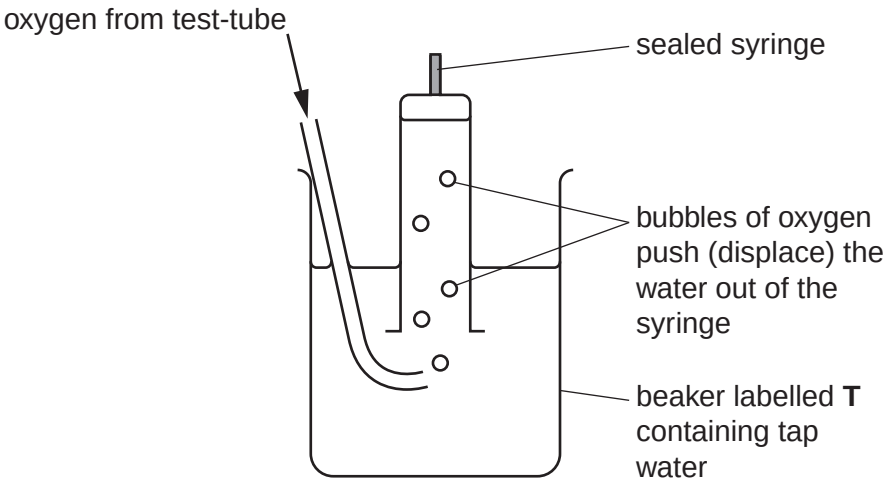


Fig. 1.2

The sealed syringe is full of water and is upside down over the end of the delivery tube.

You need to time how long it takes for the bubbles of oxygen to push (displace) 2 cm^3 of the water out of the syringe.

14. Put 5 cm^3 of **H** into a clean test-tube.

15. Put 10 cm^3 of the mixture of **P** and **W** into this test-tube.

16. Put the bung (with the delivery tube attached) into this test-tube.

17. Fill the sealed syringe with water from the beaker and turn it upside down keeping the open end of the syringe under the water as shown in Fig. 1.2.

18. Immediately put the end of the delivery tube into the beaker of water so that the bubbles of oxygen pass into the syringe.

19. Start timing.

(iii) Record the time for 2 cm^3 of oxygen to be collected.

time .....

Using your recorded time, calculate the rate of activity of the catalase in $cm^3\ s^{-1}$.

You may lose marks if you do not show your working and do not use the appropriate units.

rate of activity ..... $cm^3\ s^{-1}$ [2]

(iv) Using your knowledge of enzymes, suggest how solution **X** may be changing the activity of the catalase.

.....

.....

.....

.....

.....[2]

(v) Identify **one** significant source of error when using each of the two methods to measure the dependent variable.

one significant error in counting the number of bubbles

.....

.....

one significant error in measuring the displacement of water

.....

.....
[2]

(vi) This first procedure investigated the effect of the concentration of **X** on the activity of catalase in the plant extract.

To modify this procedure for investigating another variable, the independent variable (concentration of **X**) would need to be standardised.

Describe how the independent variable (concentration of **X**) will be standardised.

.....

.....

Consider how you would modify this procedure to investigate the effect of temperature on the activity of the catalase in the plant extract.

Describe how the independent variable, temperature, will be investigated.

.....

.....

.....

.....
[3]

[Total: 18]

2 In an investigation into the circulation of blood in giraffes, it has been found that as the length of the neck increases the thickness of the muscle wall of the left ventricle increases.

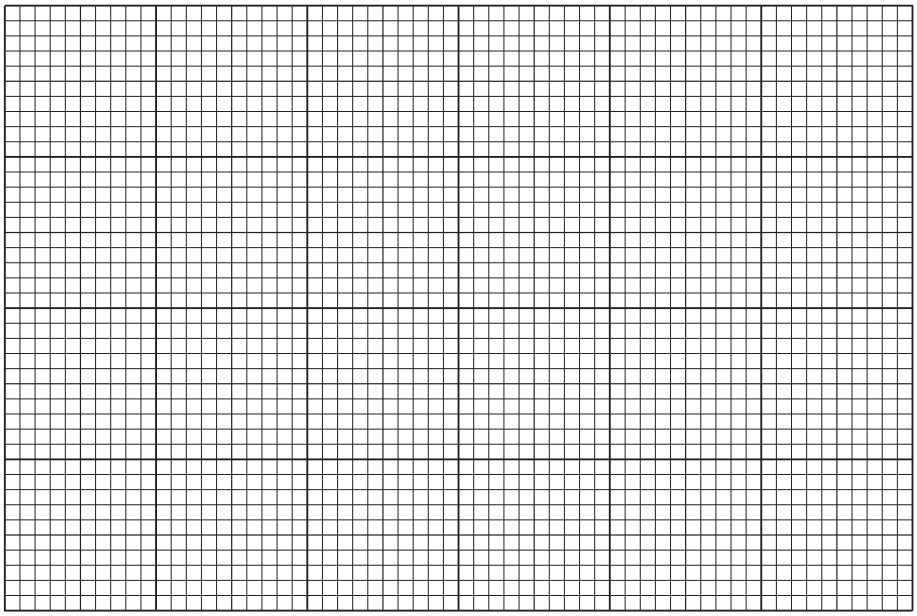
The results for five giraffes are shown in Table 2.1.

Table 2.1

length of neck / cm	**thickness of muscle wall in left ventricle / mm**
53.0	22.00
73.5	28.75
82.5	31.75
92.0	35.00
106.5	39.75

You are required to use a sharp pencil for graphs.

(a) (i) Plot a graph of the data in Table 2.1.



[4]

(ii) A giraffe was found to have a neck length of 95.0 cm.

Using the graph, estimate the thickness of the muscle wall in the left ventricle.

..... mm [1]

(iii) Suggest **one** reason for the relationship shown in the graph.

.....

.....[1]

(b) Fig. 2.1 shows four photomicrographs of stained transverse sections through blood vessels, **Q**, **R**, **S** and **T**.

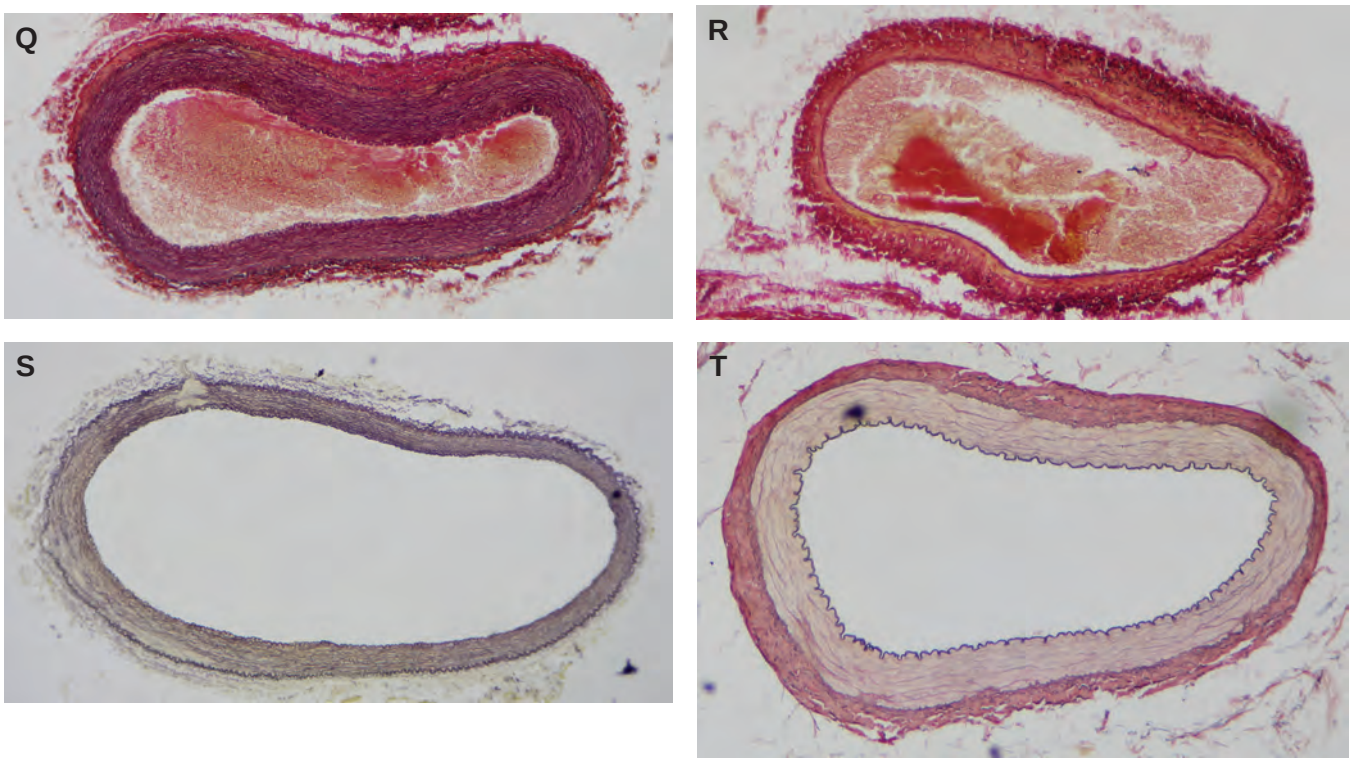


Fig. 2.1

(i) Choose **one** of the blood vessels shown in Fig. 2.1 which carries blood away from the heart.

State the blood vessel, **Q**, **R**, **S** or **T**, which you have chosen .....

Draw a large plan diagram of this blood vessel.

[5]

A student observed a blood vessel from a **different** specimen. The student determined the ratio of the widest diameter of the blood vessel to the thickness of the blood vessel wall, using the actual measurements shown below.

widest diameter of the blood vessel = 1460 μm

thickness of the blood vessel wall = 75 μm

Ratio is 1460:75

However, a ratio may be simplified by dividing each side by the same number to give the smallest possible whole number on each side.

In this example, both sides of the ratio 1460:75 are divisible by 5, so the simplest ratio is 292:15.

(ii) Determine the simplest ratio of the **mean** diameter of the blood vessel **S** to the **mean** thickness of the wall of the blood vessel in Fig. 2.1.

On Fig. 2.1 show where you take your measurements.

You may lose marks if you do not show all the steps in your working.

ratio .....[4]

(c) **M1** is a slide of a stained transverse section through a plant stem.
This plant species grows throughout the world.

You are not expected to be familiar with this specimen.

(i) Observe one large vascular bundle. Select one group of **four** adjacent xylem vessel elements with at least two of the vessel elements touching.

Make a large drawing of this group of **four** xylem vessel elements.

Use **one** ruled label line and label to identify **one** lumen.

[5]

(ii) Describe **one** observable difference between the structure of the xylem vessel elements drawn in **(c)(i)** and the structure of the blood vessels in Fig. 2.1.

.....

.....[1]

(iii) Suggest **one** observable feature, shown by **both** the specimen on **M1** and Fig. 2.1, which supports the conclusion that these structures transport materials.

Explain how this feature may help the transport of materials in the vessel elements in **M1**.

feature .....

explanation .....

.....
[1]

[Total: 22]