UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/35**

Advanced Practical Skills 1 **October/November 2013**

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 ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, staples, paper clips, highlighters, 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 **15** printed pages and **1** blank page.

You are reminded that you have **only one hour** for each question in the practical examination.

For Examiner's Use

You should:

- read carefully through **the whole** of Question 1 and Question 2
- then plan your use of **the time** to make sure that you finish all the work that you would like to do.

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

1 Plant cells contain enzymes which catalyse some of their metabolic reactions. Some of these enzymes catalyse the release of oxygen from hydrogen peroxide solution. A plant extract solution can be produced which will contain these enzymes.

You are required to investigate the effect of hydrogen peroxide (independent variable) when mixed with a plant extract solution.

You are provided with:

labelled	contents	hazard	volume / cm^3
P	plant extract solution	none	15
H	6% hydrogen peroxide solution	irritant harmful	50
W	distilled water	none	100
D	liquid detergent	none	15

Proceed as follows:

You are required to change the concentration of the hydrogen peroxide solution (the independent variable).

(a) (i) Decide which concentrations of hydrogen peroxide to make:

- using **serial dilution**,
- using 40 cm^3 6% hydrogen peroxide solution, **H**, to start the **serial dilution**,
- reducing the concentration by **half** between each concentration.

Complete Fig. 1.1 to show how you will make **three** further concentrations.

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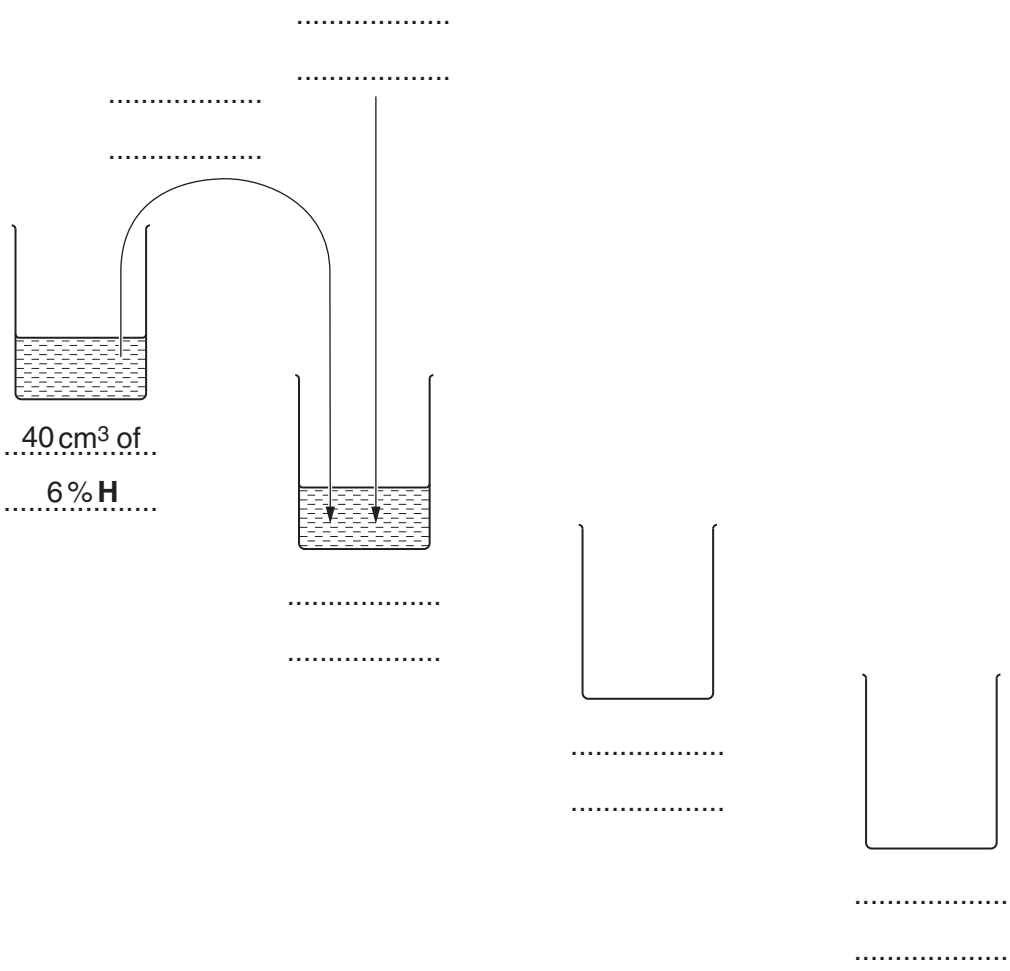

Fig. 1.1

[3]

1. Prepare all the concentrations of hydrogen peroxide, as in **Fig. 1.1**, in the containers provided.

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When detergent is mixed with **H** and then **P** (containing the enzyme), oxygen is released and the bubbles form a foam on top of the mixture.

You are required to measure the release of oxygen by measuring the total height of the mixture and the foam **and** the height to where the mixture meets the foam, as shown in Fig. 1.2.

You are provided with a graph paper scale on a piece of card. Fig. 1.2 shows how to use the graph paper scale to measure the total height of the mixture and foam **and** the height to where the mixture meets the foam.

2. Fold the graph paper scale along one of the thicker lines and label this line 0 as shown in Fig. 1.2.
You may find it useful to label each 10 mm as shown on Fig. 1.2.

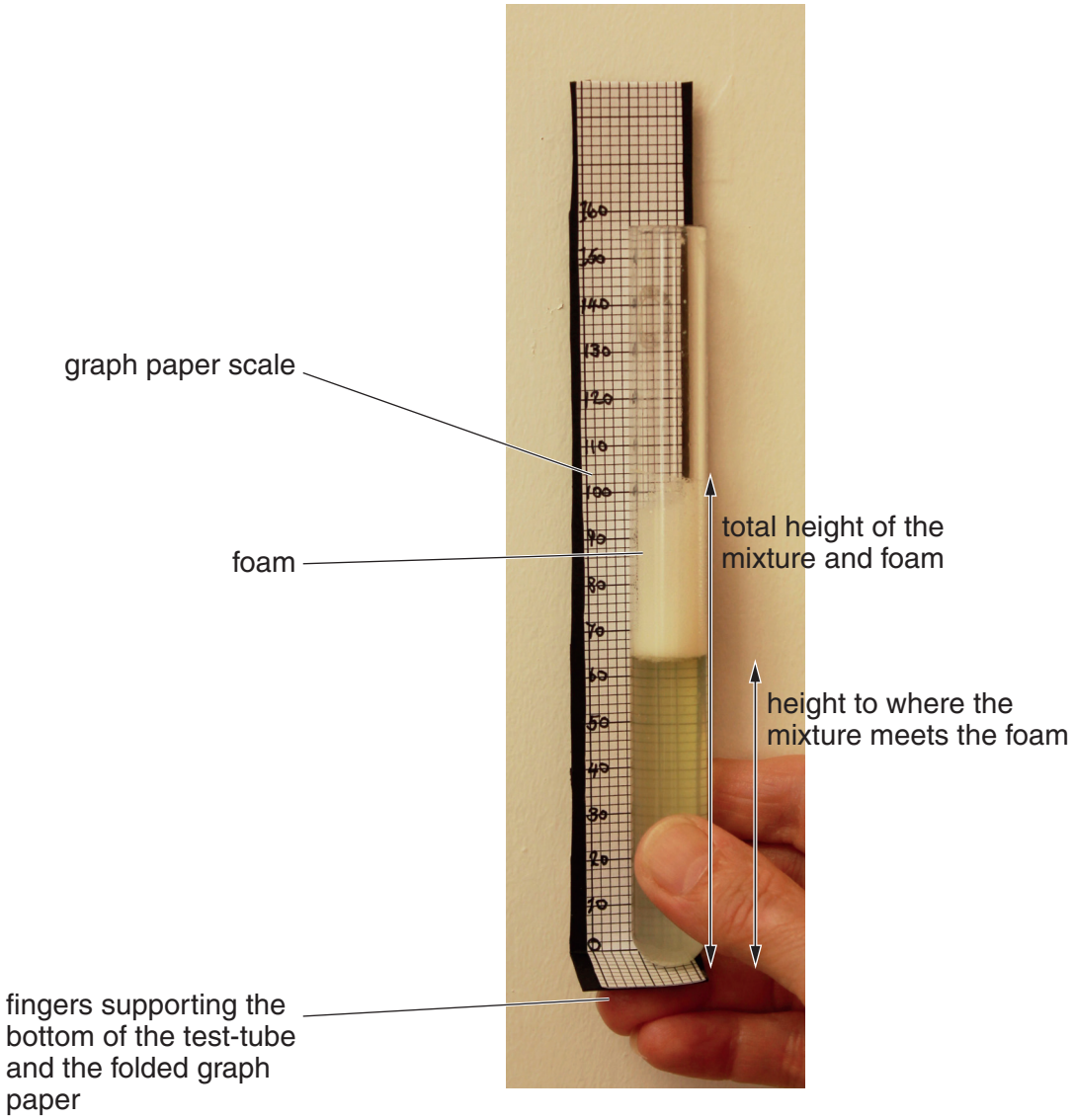

Fig. 1.2

For Examiner's Use

3. Put 5 cm^3 of the 6% concentration of **H** into a test-tube.

4. Put 4 or 5 drops of **D** into the same test-tube.
So that **D** does not come into contact with the wall of the test-tube, you should release the drops close to the top of **H**.

5. As shown in Fig. 1.3, stir **H** and **D** until mixed together.

The reaction will start as soon as you put **P** into the mixture of **H** and **D**.

Read steps 6 to 9, before proceeding.

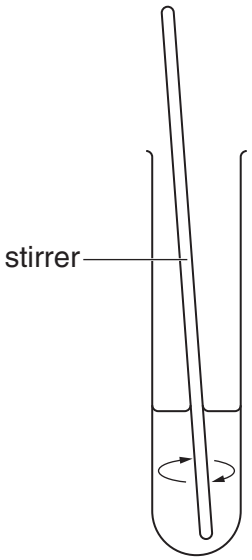

Fig. 1.3

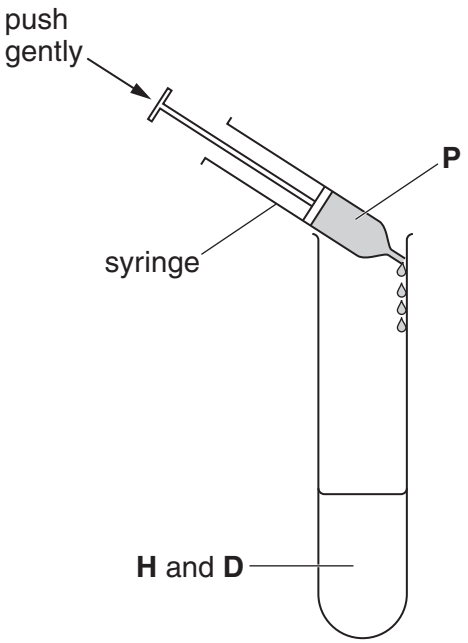

Fig. 1.4

6. As shown in Fig. 1.4, put 1 cm^3 of **P** into the same test-tube and stir as before. Immediately start timing.

7. Hold the test-tube as shown in Fig. 1.2.

   Every 60 seconds until 180 seconds, record the:

   - total height of the mixture and foam
   - height of the mixture where it meets the foam.

If the foam reaches the top of the test-tube before 180 seconds:

- stop timing
- record 'total height to the top of test-tube'
- record the height of the mixture where it meets the foam.

To process your results you may find it helpful to record your raw measurements on Fig. 1.5.

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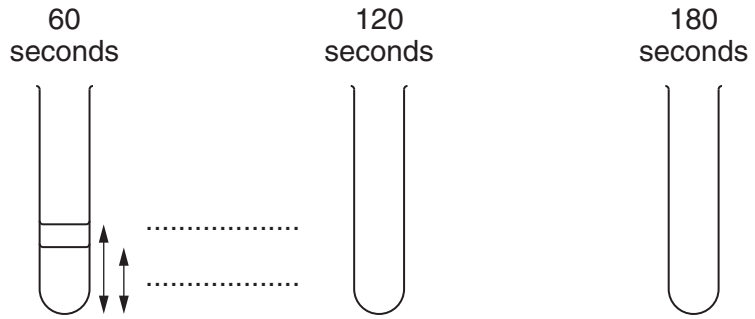

Fig. 1.5

8. Repeat steps 3 to 7 with each of the remaining concentrations.

9. Process your raw results to find the height of the foam. If you have time, check your results.

   You may use the space below to record your raw measurements.

(ii) Prepare the space below to record, for **each** concentration, the **processed** results **only** for the maximum height of foam.

For Examiner's Use

[5]

(iii) Identify **two** significant sources of error in this investigation.

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(iv) Describe **how** you would modify this procedure to investigate the effect of copper sulfate concentrations on the enzyme in the plant extract solution.

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(b) Some scientists investigated the effect of copper sulfate solution on the release of oxygen from hydrogen peroxide solution, in the presence of a plant extract.

All the variables were standardised.

They set up two test-tubes:

- one with 1 cm^3 of distilled water, hydrogen peroxide and plant extract
- one with 1 cm^3 of copper sulfate solution, hydrogen peroxide and plant extract.

The number of bubbles of oxygen released in each 60 seconds for 300 seconds were recorded.

The results are shown in Table 1.1.

Table 1.1

time / s	number of bubbles of oxygen released	
	with 1 cm^3 of distilled water	with 1 cm^3 of copper sulfate solution
60	99	69
120	96	4
180	65	0
240	34	0
300	4	0

(i) Plot a graph of the data in Table 1.1.

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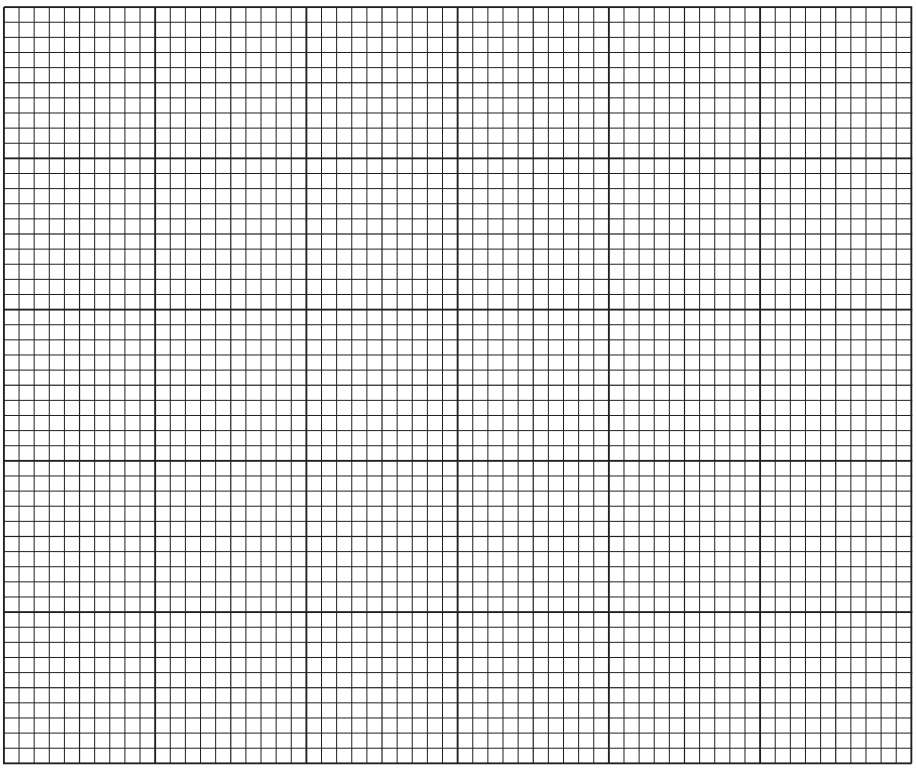

[4]

(ii) Explain the effect of the copper sulfate solution on the enzymes in the plant extract.

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[Total: 20]

Question 2 starts on page 11

2 **L1** is a slide of a transverse section through a plant leaf. This plant species grows widely including tropical, sub-tropical and temperate regions.

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(a) (i) Draw a large plan diagram of the part of the leaf on **L1** indicated by the shaded sector in Fig. 2.1.

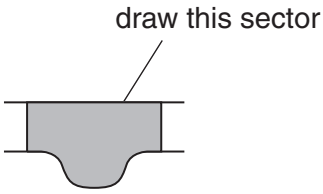

Fig. 2.1

On your diagram, use a ruled label line and label to show the vascular bundle.

[5]

[Turn over

(ii) Make a drawing of **one** group of adjacent (touching) cells, as observed on the specimen on **L1**, made up of:

For Examiner's Use

- three epidermal cells
- three of the palisade cells touching these epidermal cells.

On your drawing use a label line and label to show one palisade cell.

[5]

Fig. 2.2 shows a stage micrometer viewed through a microscope with an eyepiece graticule scale.

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The smallest measurement on this stage micrometer is 0.1 mm.

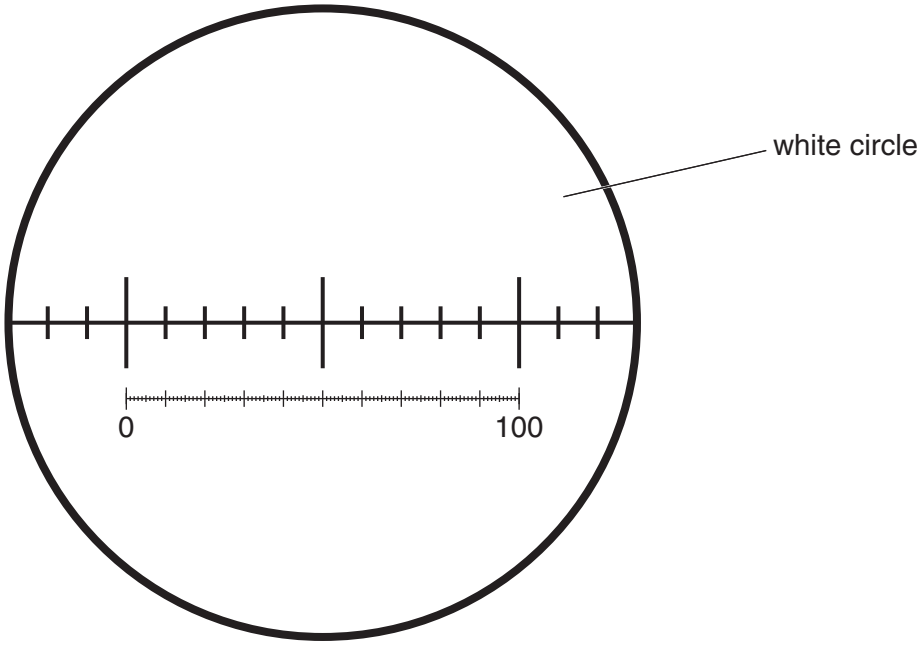

Fig. 2.2

You are required to:

- find the area of the field of view, using Fig. 2.2
- count the number of stomata in a quarter of the field of view, using Fig. 2.3 (on page 14)
- calculate the number of stomata per mm^2.

(b) (i) Calculate the area of the field of view, using:

- the formula for the area of a circle πr^2
- $\pi = 3.14$
- r = radius of the field of view.

You will lose marks if you do not show your working or if you do not use appropriate units.

area of field of view ..... mm^2 [2]

Fig. 2.3 is a photomicrograph of the lower surface of a leaf, with the same field of view as in Fig. 2.2.

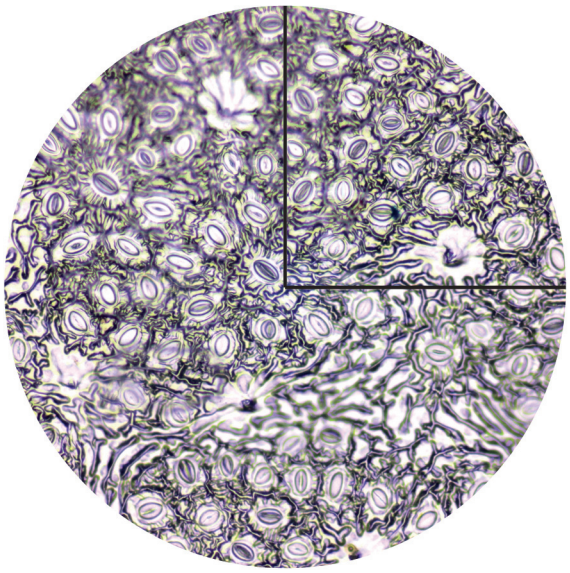

Fig. 2.3

Fig. 2.3 shows stomata on a leaf surface. There are too many stomata to count so the technique of sampling may be used to estimate the number of stomata in the field of view.

A sample should be counted in a known smaller portion and then the result multiplied to obtain an estimate of the number of stomata in the whole field of view.

For example, if the number of stomata is counted in a quarter of the field of view then this number would be multiplied by 4 to obtain the estimate of the total number in the field of view.

(ii) Count and record the **sample number** of stomata in the quarter of the field of view shown in Fig. 2.3.

- Mark clearly **on Fig. 2.3** each of the stomata counted.
- Estimate the total number in the whole field of view.

Calculate the number of stomata per mm^2.

You will lose marks if you do not show your working.

number of stomata ..... mm^{-2} [4]

Fig. 2.4 is a photomicrograph of the lower surface of a different leaf, with the same field of view (using the same lenses) as Fig. 2.3.

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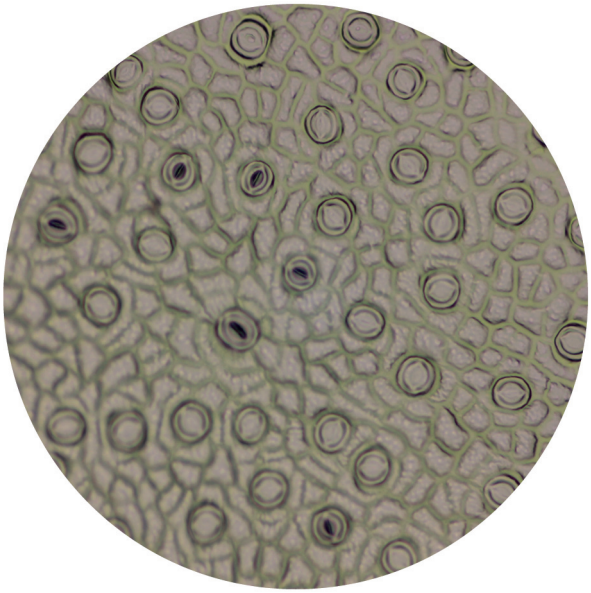

Fig. 2.4

(c) Prepare the space below so that it is suitable for you to record the observable differences between the surface of each leaf shown in Fig. 2.3 and Fig. 2.4.

Record your observations in the space you have prepared.

[4]

[Total: 20]

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