
BIOLOGY

9700/33

Paper 3 Advanced Practical Skills 1

October/November 2017

CONFIDENTIAL INSTRUCTIONS

Great care should be taken to ensure that any confidential information given, including the identity of material on microscope slides where appropriate, does not reach the candidates either directly or indirectly.



If you have any queries regarding these Confidential Instructions, please contact Cambridge stating the Centre number, the nature of the query and the syllabus number quoted above.

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This document consists of **11** printed pages and **1** blank page.

Instructions for preparing apparatus

These instructions give details of the apparatus required by each candidate for each experiment in this paper. A summary of the questions that will be presented to the candidates is included, where appropriate, to allow the biology teacher to test the apparatus appropriately.

No access to the Question Paper is permitted in advance of the examination.

Candidates must be provided with a microscope with:

- eyepiece lens, $\times 10$ (equal to 16 mm or $\frac{2}{3}$ ")
- low-power objective lens, $\times 10$ (equal to 16 mm or $\frac{2}{3}$ ")
- high-power objective lens, $\times 40$ (equal to 4 mm or $\frac{1}{6}$ ")
- eyepiece graticule fitted within the eyepiece and visible in focus at the same time as the specimen.

To avoid confusion, only the lenses specified above should be fitted in the microscopes to be used in the examination. Any lenses which are **not** $\times 10$ or $\times 40$ should be removed or replaced.

Each candidate must have uninterrupted use of the microscope for at least one hour.

Supervisors are advised to remind candidates that **all** substances in the examination should be treated with caution. Pipette fillers and suitable eye protection should be used where necessary.

In accordance with the COSHH (Control of Substances Hazardous to Health) Regulations, operative in the UK, a hazard appraisal of the examination has been carried out.

The following codes are used where relevant.

C corrosive

HH health hazard

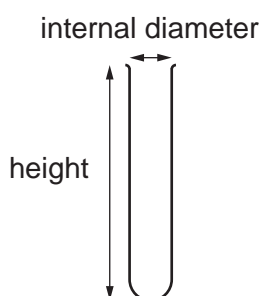
F flammable

N hazardous to the aquatic environment

MH moderate hazard

T acutely toxic

O oxidising



When small test-tubes are provided, it is expected that these are approximately 150 mm in height.

If other dimensions of apparatus are required, these will be specified.

Confidential Instructions**For both Questions**

Each candidate will require:

- ruler, marked in mm
- clean and dry apparatus, e.g. glassware and syringes (without a needle)
- solutions supplied in suitable beakers or containers for removal of the solutions using syringes
- fresh solutions, materials and rinsing water where appropriate.

More of the solutions should be available if requested by candidates.

If a candidate breaks any of the apparatus or loses any of the materials supplied, the matter should be rectified and a note made in the Supervisor's Report.

Solutions should be disposed of in accordance with local safety regulations.

Question 1

Each candidate will require:

materials and apparatus for each candidate	quantity	✓
[HH] plant extract solution in a beaker or container, labelled E , provided at room temperature (see Preparation of materials)	at least 40 cm ³	
[C] 6% (20 vols) hydrogen peroxide solution in a beaker or container, labelled H , provided at room temperature	at least 70 cm ³	
pH4 buffer in a beaker or container, labelled B4 , provided at room temperature (see Preparation of materials)	at least 10 cm ³	
pH5 buffer in a beaker or container, labelled B5 , provided at room temperature (see Preparation of materials)	at least 10 cm ³	
pH7 buffer in a beaker or container, labelled B7 , provided at room temperature (see Preparation of materials)	at least 10 cm ³	
pH9 buffer in a beaker or container, labelled B9 , provided at room temperature (see Preparation of materials)	at least 10 cm ³	
pH10 buffer in a beaker or container, labelled B10 , provided at room temperature (see Preparation of materials)	at least 10 cm ³	
pH5 buffer in a beaker or container, labelled U , provided at room temperature (see Preparation of materials)	at least 10 cm ³	
Liquid detergent in a beaker or container, labelled D , with a pipette with a teat (see Preparation of materials)	at least 10 cm ³	
5 cm ³ syringe, with the means to wash it out	1	
2 cm ³ or 3 cm ³ syringes, with the means to wash them out	2	
Test-tubes – small (capacity 20 cm ³ to 30 cm ³) (test-tubes provided to a candidate should have the same dimensions)	6	
Test-tube rack(s) to hold 6 small test-tubes	1	
Glass rod	1	
Strip of graph paper, with 2 mm divisions and at least 2 cm wide and at least 2 cm longer than the test-tube provided (see Preparation of materials)	1	
Thermometer, –10 °C to 110 °C	1	
Container with tap water (capacity approximately 200 cm ³), labelled For washing	1	
Container (capacity approximately 400 cm ³), labelled For waste	1	
Paper towels	8	
Glass marker pen	1	
Stop-clock or timer showing seconds	1	
Suitable eye protection	1	

It is advisable to wear suitable eye protection when handling chemicals.

Preparation of materials

In advance of the examination test the plant extract as described in (i) to make sure it will be active (produces foam on the top).

If the plant extract is frozen, defrost before the examination and re-test to check it is still active. The buffers may be prepared the day before the examination and kept in covered containers.

[HH] (i) E, plant extract solution

The plant extract solution can be prepared using approximately 45g of peeled sweet potato or peeled white potato (for example Irish, *Solanum tuberosum*).

Cut the plant material into small pieces and, with approximately 75 cm³ of water, grind using a pestle and mortar, or liquidise.

Strain the mixture through a fine sieve or muslin and retain the liquid plant extract solution. This may contain small pieces of plant material.

This should produce approximately 60 cm³ of plant extract solution.

Test the activity of the extract

Put 2 cm³ of plant extract solution into a small test-tube.

Add 1 drop of detergent, do **not** mix.

Add 5 cm³ of hydrogen peroxide solution.

Within 30 seconds, the mixture should actively produce bubbles and a foam.

If the foam does not form then more plant material should be used to produce the extract.

If the foam reaches the top of the test-tube within 1 minute, either dilute the plant extract solution or dilute the hydrogen peroxide solution and re-test.

The plant extract may be prepared the day before the examination and kept in a refrigerator in a covered container **or** the plant extract may be prepared at any time before the examination and then frozen.

The extract should be defrosted before the examination.

Before the examination, the extract should be tested to make sure it is still active.

The extract **must** be at room temperature for the examination.

(ii) **B4, B5** and **B7**, buffers at pH4, pH5 and pH7

Phosphate-citrate buffer to make pH4, pH5 and pH7

You will need to prepare stock solutions of 0.2 mol dm^{-3} disodium hydrogen phosphate and 0.1 mol dm^{-3} citric acid.

0.2 mol dm^{-3} disodium hydrogen phosphate (Na_2HPO_4) is prepared using **one** of the following:

types of disodium hydrogen phosphate	mass/g
$\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$ MW = 178.05	35.6
$\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$ MW = 268.07	53.7
$\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$ MW = 358.14	71.6

This is prepared by dissolving the appropriate mass of disodium hydrogen phosphate in 500 cm^3 of distilled water and making up to 1 dm^3 with distilled water.

0.1 mol dm^{-3} citric acid is prepared by dissolving 19.2 g of citric acid in 500 cm^3 of distilled water in a beaker and making up to 1 dm^3 with distilled water.

To prepare 100 cm^3 of **B4, B5** and **B7** buffers, use the table below to mix the stock solutions.

pH	0.2 mol dm^{-3} disodium hydrogen phosphate $/\text{cm}^3$	0.1 mol dm^{-3} citric acid $/\text{cm}^3$	distilled water $/\text{cm}^3$
4	19.3	30.7	50
5	25.7	24.3	50
7	43.6	6.4	50

(iii) B9 and B10, buffers at pH9 and pH10Glycine-sodium hydroxide (NaOH) buffer to make pH9 and pH10

You will need to prepare stock solutions of 0.2 mol dm^{-3} glycine solution and 0.2 mol dm^{-3} sodium hydroxide solution.

0.2 mol dm^{-3} glycine is prepared by dissolving 15.0g in 500 cm^3 of distilled water and making up to 1 dm^3 .

0.2 mol dm^{-3} NaOH **[MH]** is prepared by dissolving 8.0g of sodium hydroxide **[C]** in 500 cm^3 of distilled water and making up to 1 dm^3 .

To prepare 100 cm^3 of **B9** and **B10** buffers, use the table below to mix the stock solutions.

pH	0.2 mol dm^{-3} glycine $/\text{cm}^3$	0.2 mol dm^{-3} sodium hydroxide $/\text{cm}^3$	distilled water $/\text{cm}^3$
9	25	4.4	70.6
10	25	13.6	61.4

(iv) D, liquid detergent

This should be of a type which is used for hand washing apparatus and **not** that used in a dishwasher. Using a pipette, it should be easy to release the detergent as separate drops.

(v) Graph paper

This may be prepared by gluing an A4 sheet of 2 mm grid graph paper onto a piece of card. The strip should be cut approximately 1 mm each side of the thicker vertical lines showing the 2 cm width and can be provided the width of the A4 sheet.

Question 2

Each candidate will require:

- (i) Microscope with an eyepiece graticule fitted into the eyepiece lens (as described on page 2)

For each candidate:

- the microscope **must** be set up on low power
- the slide must **not** be left on the stage of the microscope.

- (ii) Slide J1

On receipt of the slides, please check that they are labelled **J1** and that no slides are broken. The material is **confidential** (so **must not** be disclosed to candidates) and the slides should **not** be viewed in advance of the examination.

The number of slides supplied by Cambridge will be equal to half the candidate entry.

Therefore, half the candidates should start on **Question 2** and the other candidates should start on **Question 1**.

SUPERVISOR'S REPORT

The Supervisors' Report is essential in order to allow the Examiners to assess all candidates as fairly as possible and should always be completed by every Centre.

During the examination, the Supervisor or a competent biologist (not the Invigilator), should follow the steps in **Question 1**, in order to obtain results for **1(b)(i)** and **1(b)(iv)**.

The Supervisor should use the same solutions as those provided to the candidates and work **out of the sight of the candidates**.

These results should be written in the Supervisor's Report, **not** on a spare Question Paper.

SEATING PLAN

Provide a **seating plan** of work benches, on separate paper, giving details of the places occupied by the candidates for **each question** using each candidate's number.

The Supervisor's Report and the candidates' seating plan should be enclosed with each packet of scripts.

MATERIALS TO BE SUPPLIED BY CAMBRIDGE

- Slide J1

RETURN OF EXAMINATION MATERIALS TO CAMBRIDGE

Immediately after the examination the microscope slides **must** be:

- returned to Cambridge in the containers in which they were received, using the self-adhesive label. The slides must **not** be included in the packet of scripts.

or

- purchased using the order form enclosed with the slides, which should be completed and returned to Cambridge. The order form must **not** be included in the packet of scripts.

Slides and boxes will be charged at the rate of £3 per slide plus £1 per box.

If the items are not returned or purchased by the deadline stated on the order form, they will be charged at £3.50 per slide plus £1 per box.

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This form should be completed and sent with the scripts.

SUPERVISOR'S REPORT

October/November 2017

The Supervisor or Teacher responsible for the subject should provide the following information.

- 1 Was any difficulty experienced in providing the necessary materials? If so, give brief details.

- 2 Give details of any difficulties experienced by particular candidates, giving names and candidate numbers. Reference should be made to:
 - (a) difficulties arising from faulty specimens or microscopes;
 - (b) accidents to apparatus or materials;
 - (c) assistance provided in case of colour blindness;
 - (d) any other information that is likely to assist the Examiner, especially if this cannot be discovered from the scripts.

All other cases of individual hardship, e.g. illness or disability, should be reported direct to Cambridge on the normal 'Special Consideration Form' as detailed in the Handbook for Centres.

- 3 During the examination the Supervisor or competent biologist should follow the steps in **Question 1** in order to obtain results for **1(b)(i)** and **1(b)(iv)**. The Supervisor should use the same solutions as those provided to the candidates, and work **out of the sight of the candidates**. These results should be written on page 12, which should be enclosed with the candidates' scripts. If the scripts are in several packets, please ensure that a copy of the Supervisor's Report is enclosed with each packet of scripts.

- 4 Enclosed a **seating plan** of work benches with the scripts, giving details of the candidate numbers for the places occupied by the candidates for **each question**.

Declaration (to be signed by the Supervisor)

The preparation of this practical examination has been carried out so as to maintain the security of the examination.

Signed

Name (in block capitals)

Centre number (of enclosed scripts)

Centre name

If scripts are despatched in more than one envelope, it is essential that **each envelope** includes a copy of the:

- relevant Supervisor's Report
- appropriate seating plan(s).

Temperature of examination room °C

Results for Question **1(b)(i)** and **1(b)(iv)**.