



General Certificate of Education  
Advanced Subsidiary Examination  
June 2014

**Biology**

**BIO3X/TN**

**Unit 3X AS Externally Marked Practical Assignment**

**Teachers' Notes**

**Confidential**

The Exams Officer should make two copies of these Teachers' Notes; one copy for the Head of A-level Biology and one for the technician.

These copies can be released to the Head of A-level Biology and the technician at any point following publication but must be kept under secure conditions at all times.

Teachers can have sight of the Teachers' Notes but no further copies should be made.

Estimated entries must be submitted to AQA in order for centres to receive hard copies of the materials to be used by candidates.

**BIO3X/TN**

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**Teachers' Notes****Confidential**

These notes must be read in conjunction with **Instructions for the Administration of the EMPA: A-level Biology** published on the AQA Website. Please note that these have been revised for 2014.

**Investigating water movement by capillary action**

Candidates will investigate capillary action through absorbent paper and capillary tubes. They will also make a simple temporary mount of celery to observe vascular bundles. They are **not** expected to have any prior knowledge of capillary action.

**Materials**

In addition to access to general laboratory equipment, each candidate needs the following:

**Task 1**

- piece of celery leaf petiole
- 10 cm<sup>3</sup> coloured water
- scalpel/knife
- cutting board
- shallow dish
- timer
- magnifying lens
- microscope slide
- 3 different types of absorbent paper labelled **A**, **B** and **C**
- ruler with millimetre measurements
- scissors.

**Task 2**

In addition to access to general laboratory equipment, each candidate needs the following:

- 15 capillary tubes
- 5 cm<sup>3</sup> coloured water
- 5 cm<sup>3</sup> coloured solutions of sodium chloride of concentrations 0.3 mol dm<sup>-3</sup>, 0.5 mol dm<sup>-3</sup>, 0.8 mol dm<sup>-3</sup> and 1.0 mol dm<sup>-3</sup>
- 5 cm<sup>3</sup> or 10 cm<sup>3</sup> syringe or measuring cylinder
- 100 cm<sup>3</sup> beaker
- timer
- pot to dispose of used capillary tubes.

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## Managing the investigation

If you have any queries about the practical work for the EMPA, please contact your Assessment Adviser. Contact details can be obtained by emailing your centre name and number to [science-gce@aqa.org.uk](mailto:science-gce@aqa.org.uk)

### Task 1

In the first part of Task 1, each candidate will place a 2 cm piece of celery in coloured water in order to stain the vascular bundles. They will then make a temporary mount of a slice of this celery and observe where the colour is, using a magnifying lens.

In the second part of Task 1, each candidate will observe and measure movement of coloured water up pieces of absorbent paper.

Any suitable clear container, such as a Petri dish, can be used as the shallow dish as long as the 2 cm length of celery can easily be placed in, and removed from, a shallow layer of coloured water.

The magnifying lens could be a hand lens, specimen viewer or low power of a microscope. Each candidate will only need access to this for a short period during the task, so it could be shared.

### Task 2

It does not matter if candidates find that there is little or no difference in the effect of the different sodium chloride solutions.

A 100 cm<sup>3</sup> beaker is not essential; any suitable container can be used to support the capillary tube safely in approximately a 2–3 mm depth of solution (the volume of solution may need to be changed to ensure this depth).

### Trialling

The tasks **must** be trialled before use.

### Technical information

#### Task 1

Standard bunches of celery usually contain approximately eight usable petioles. So as not to confuse candidates, they will be referred to as 'stems' throughout. Each candidate needs a 2 cm length of stem for Task 1. Centres can get candidates to cut this or provide each candidate with a ready-cut 2 cm piece. It does not matter which way up the candidates place the celery in the coloured water as enough dye moves by capillary action into the xylem tissue for it to be observed, even if placed 'upside down'.

The investigation was trialled with 2% red food colouring in the water and sodium chloride solutions. Any suitable, safe dye could be used. Red was found to be the clearest to see when staining the xylem tissue in the celery. Centres concerned about colour-blind students could trial the tasks with black dye.

Three different types of absorbent paper are needed in Task 1. The task was trialled with toilet paper, kitchen roll and face tissue.

Turn over ►

## Task 2

In Task 2, dye of any colour can be used.

Task 2 was successfully trialled with 10 cm long melting point tubes and with 7 cm long 1 mm bore capillary tubes. Other capillary tubes could be used as long as the coloured water moves at least 1 cm up the tubing when trialled. Melting point tubes are available from laboratory supply companies.

### Additional Information

AQA might publish Additional Information about an ISA/EMPA practical. This will be placed on e-AQA in Secure Key Materials. We will email Exams Officers who have downloaded the particular Teachers' Notes so they can print a copy for the Head of Biology. Additional Information will cover issues such as suitable suppliers or tips on getting a practical to work.

### Information to be given to candidates

Candidates must **not** be given information about an EMPA until one week before Task 1. One week before Task 1, teachers should give their candidates the following information.

You will investigate water movement through plants. In addition, you will need to understand the following topics:

- effect of lifestyle on health
- the biological basis of heart disease
- mitosis
- mass transport.

There **must** be no further discussion and candidates must **not** be given any further resources to prepare for the assessment.

In this investigation, teachers **must not** give candidates the following information:

- the tissue that is stained by the coloured dye and its position in the celery.

## Task 1

### Introduction

Capillary action causes some of the movement of water up plant stems. Capillary action is the movement of water through narrow spaces.

In this task, you will stain the plant tissue where capillary action occurs and demonstrate capillary action in paper.

### Materials

You are provided with:

- piece of celery stem
- coloured water
- scalpel/knife
- cutting board
- shallow dish
- timer
- magnifying lens
- microscope slide
- 3 different types of absorbent paper **A**, **B** and **C**
- ruler with millimetre measurements
- scissors.

You may ask your teacher for any other apparatus you require.

Teacher Use Only

Turn over ►

## Method

**Read these instructions carefully before you start your investigation.**

Staining the tissue that transports water in a plant stem

1. Add coloured water to the shallow dish to a depth of 3–4 mm.
2. Take a 2 cm piece of celery stem.
3. Place one cut end of the celery in the coloured water in the dish. Start the timer.
4. After 5 minutes, remove the celery stem and rinse with water to remove the coloured water on the outside of the stem.
5. Cut as thin a slice as you can from the end of the celery stem that has been in the coloured water. Lay this section flat onto the microscope slide. Look at the section using the magnifying lens, making note of where the coloured dye is.

**Figure 1** (page 4) shows a section through a celery stem.

Use a label line and the letter **X** to show **one** area that corresponds to where you can see the most intense colour in your section.

Observing capillary action in paper

6. Cut a strip of absorbent paper **A** 2 cm wide and at least 10 cm long.
7. Hold one end of the strip and lower the other end into the coloured water in the dish until the end is just under the surface. Keep the strip upright in this position for 30 seconds.
8. Remove the strip of paper and, immediately, measure how far the coloured water has moved up the paper. Record your result in **Table 1** on page 4.
9. Repeat steps 6 to 8 with paper types **B** and **C**.

**You will need to decide for yourself:**

- the position of the most intense colour in your section of celery stem.

## Task 2

### Introduction

Capillary action causes some of the movement of water up plant stems. Water moving up stems carries mineral ions that have been absorbed by the roots.

In Task 2, you will investigate whether the concentration of sodium chloride (salt) in solution has any effect on capillary action. You will use a capillary tube as a model for water movement in the xylem in a plant stem.

### Materials

You are provided with:

- capillary tubes
- coloured water
- coloured salt solutions of concentrations  $0.3 \text{ mol dm}^{-3}$ ,  $0.5 \text{ mol dm}^{-3}$ ,  $0.8 \text{ mol dm}^{-3}$  and  $1.0 \text{ mol dm}^{-3}$
- syringe or measuring cylinder
- beaker
- timer
- ruler with millimetre measurements
- pot to dispose of used capillary tubes.

You may ask your teacher for any other apparatus you require.

### Method

**Read these instructions carefully before you start your investigation.**

1. Place  $5 \text{ cm}^3$  coloured water into the beaker.
2. Stand one capillary tube in the beaker.
3. Start the timer and observe the coloured water as it moves up the tubing.
4. After 30 seconds, gently remove the capillary tube and measure, in millimetres, how far up the tube the coloured water has moved.
5. Repeat steps 1 to 4 two more times. Use a new capillary tube for each trial.
6. Empty your beaker, rinse and dry.
7. Repeat steps 1 to 6 with each of the coloured salt solutions.