



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE
NAME

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CO-ORDINATED SCIENCES

0654/51

Paper 5 Practical Test

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, paper clips, 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.

Notes for Use in Qualitative Analysis for this paper are printed on page 16.

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	
3	
Total	

This document consists of **15** printed pages and **1** blank page.

1 You are going to investigate plant transport systems using a celery stalk and coloured water.

- Take the piece of celery and cut it approximately in half as shown in Fig. 1.1. Place one half on the white tile with the cut face upwards.

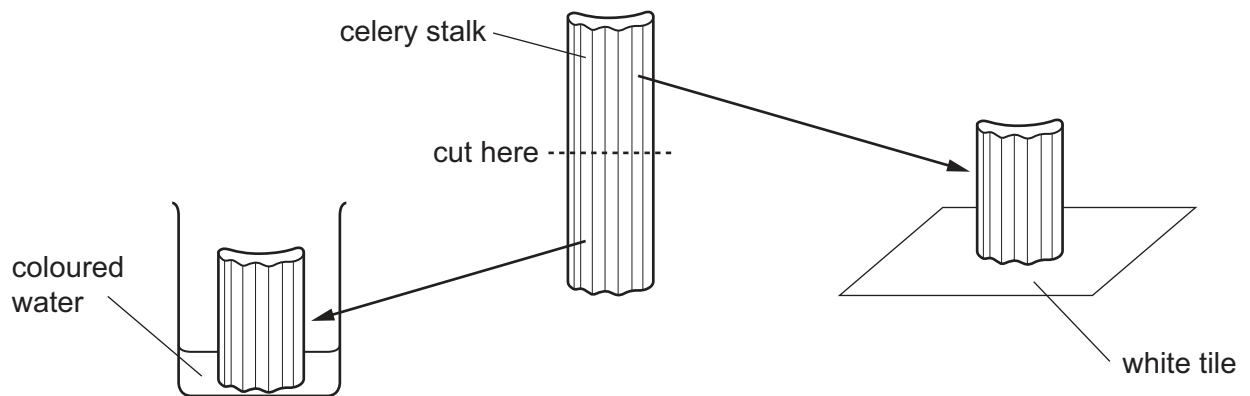


Fig. 1.1

- Place the other half with the freshly cut end in the coloured water. Leave it for at least five minutes. Continue with the rest of the question while you are waiting.
- (a) Make a large pencil drawing as accurately as possible in the space below of the cross-section (cut end) of the celery from the white tile. **Only** show outline. Leave the centre of your drawing blank.



[2]

- (b) • Using the knife, cut three slices of about 2 mm across the width of the stalk from the piece you have just drawn as shown in Fig. 1.2.

Treat the first slice as follows:

- Cut the slice into very small pieces (less than 0.5 mm square) and then place the cut pieces in a mortar with approximately 1 cm³ distilled water.
- Grind the pieces up with the pestle and then place the mixture into a clean test-tube in a test-tube rack.

Repeat the procedure with the other two slices using two more test-tubes.

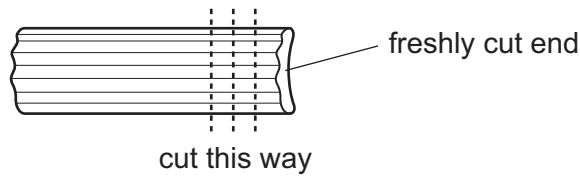


Fig. 1.2

- To one test-tube add an equal amount of Benedict’s solution, shake well and place in the hot water-bath provided for about 5 minutes. Continue below with the other test-tubes whilst you are waiting.
- To the second test-tube add an equal amount of biuret solution.
- To the third test-tube add a few drops of iodine solution.

(i) Record your observations in Table 1.1.

Table 1.1

test	observation
Benedict’s solution	
biuret solution	
iodine solution	

[3]

(ii) Using your observations, name the food group or groups present in the celery stalk.

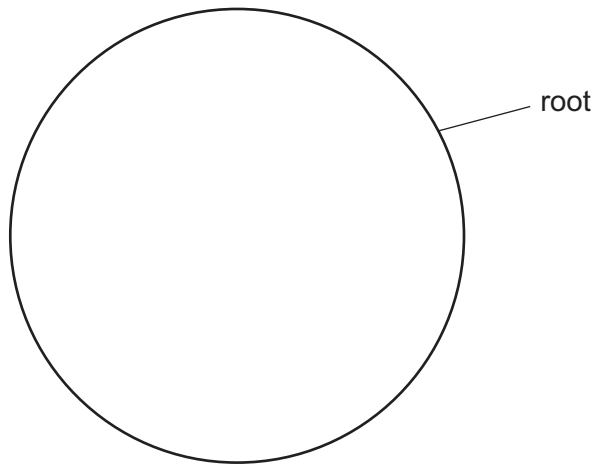
..... [1]

- (c) • Remove the piece of celery from the coloured water and cut a 2mm slice from the end that was in the coloured water.
- Place this slice on the white tile with the newly cut surface exposed.
- Examine this upper surface using the hand lens.
- (i) On your drawing in (a) on page 2, draw and label the positions of the stained areas. [2]
- (ii) Name the tissue that has taken up the coloured water and state what can be concluded about its function.

name

function [2]

- (d) The piece of celery you have used in (c) is from the leaf stalk. In the outline below, show what you would expect to see if the piece of celery had been a section from the **root**. Draw and label the transport tissue you have named in (c)(ii). You may include other tissues if this helps you.



[2]

- (e) Plan an experiment based on the method you have just used, to investigate the effect of temperature on the speed of movement of the coloured water in pieces of celery stalk.

.....

.....

.....

.....

.....

.....

..... [3]

Please turn over for Question 2.

- 2 Solid **X** is a mixture of three metal oxides, compounds **A**, **B** and **C**. You are going to carry out a series of experiments and suggest the identities of the metal oxides.

(a) Experiment to identify compound A

Place two large spatula loads of solid **X** into a small beaker and add approximately 25 cm³ distilled water. Stir well for 30 seconds. Filter the mixture to collect two test-tubes half full of filtrate for use in **(i)** and **(ii)** below.

The remainder of the liquid may be discarded but the residue in the filter paper should be placed in the second beaker. Add 25 cm³ dilute nitric acid and stir the mixture. Keep this for use in part **(b)**.

- (i)** To the marble chips in the test-tube provided, add hydrochloric acid until the test-tube is one third full. Attach the delivery tube to this test-tube and pass the gas produced into one of the test-tubes containing the filtrate.

Record your observations of the filtrate.

observations

..... [1]

- (ii)** To the second test-tube containing filtrate, add a few drops of full range Universal Indicator.

Record the colour of the resulting mixture and its pH.

colour

pH [1]

- (iii)** Using your observations in **(i)** and **(ii)**, suggest the identity of compound **A**.

compound **A** is

..... [1]

- (iv)** Using your observations in **(ii)**, classify the oxide in compound **A** which is present in the filtrate.

classification of oxide in compound **A** [1]

(b) Experiment to identify compound B

If the residue from part (a) has not all dissolved in the dilute nitric acid, gently warm the beaker and carefully stir the mixture.

Do NOT boil the mixture.

If not all of the solid has dissolved after warming then filter or decant the mixture into two large test-tubes so that they are each one quarter full.

- (i) In one of the test-tubes, add sodium hydroxide solution slowly until the test-tube is nearly full.

Use red litmus paper to check that the mixture is alkaline. If not, add more sodium hydroxide solution until the mixture is alkaline. Stir the mixture carefully.

Keep this mixture for part (c).

Record your observations.

observations

..... [1]

- (ii) To the liquid in the other large test-tube **slowly add** ammonia solution until there is no further change.

Record your observations. Looking down through the test-tube from the top will help you.

observations

.....

.....

.....

.....

..... [3]

- (iii) Use your observations in (i) and (ii) to identify the cation present in compound **B** and hence name compound **B** present in solid **X**.

cation present

compound **B** is [2]

(c) Experiment to identify compound C

- (i) Wash out one of the beakers from part (a) with distilled water. The contents of the large test-tube from (b)(i) should now have settled. Decant about 20 cm³ of the liquid into the beaker. Describe the appearance of the liquid and keep this liquid for (ii).

appearance of liquid [1]

- (ii) To the liquid in the beaker from (i) add dilute hydrochloric acid **very slowly**, with stirring, until you have added an equal volume of acid.

Record your observations.

observations

.....

..... [2]

- (iii) The scheme below shows the other compounds that compound C changed into during your experiment. Complete the missing compound.

oxide (C) → nitrate (in (a)) → hydroxide (during (b)(i))

└─→ (at end of (c)(ii)) [1]

- (iv) Look at what you have done and your observations in parts (b) and (c). Using the Notes for Qualitative Analysis, on page 16, suggest the **formula** of the cation which is in compound C.

formula of cation [1]

Please turn over for Question 3.

- 3 You are going to find the spring constant k of a spring by two different methods. The spring constant k of a spring is a measure of the spring's stiffness.

Method 1

- (a) Measure the unstretched length l_1 of the spring to the nearest millimetre. Do not include the loops at the end of the spring in your measurement.

$l_1 = \dots\dots\dots$ mm [1]

- (b) Attach the spring to the clamp as shown in Fig. 3.1.

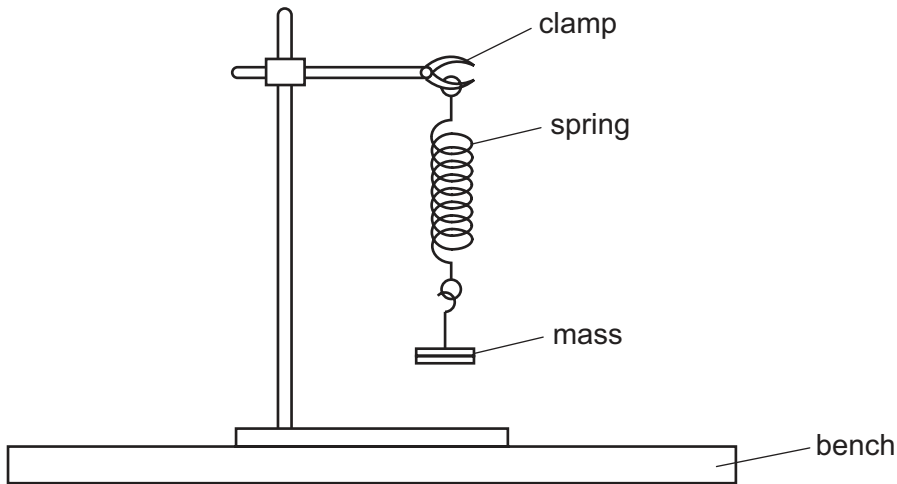


Fig. 3.1

Hang a 0.2 kg mass (200 g) on the spring.

- (i) Measure the new length l_2 of the spring.

$l_2 = \dots\dots\dots$ mm

Calculate the extension, e of the spring produced by the mass.

Use the equation

$$e = l_2 - l_1$$

$e = \dots\dots\dots$ mm [1]

(ii) Calculate the spring constant k of the spring.

Use the equation

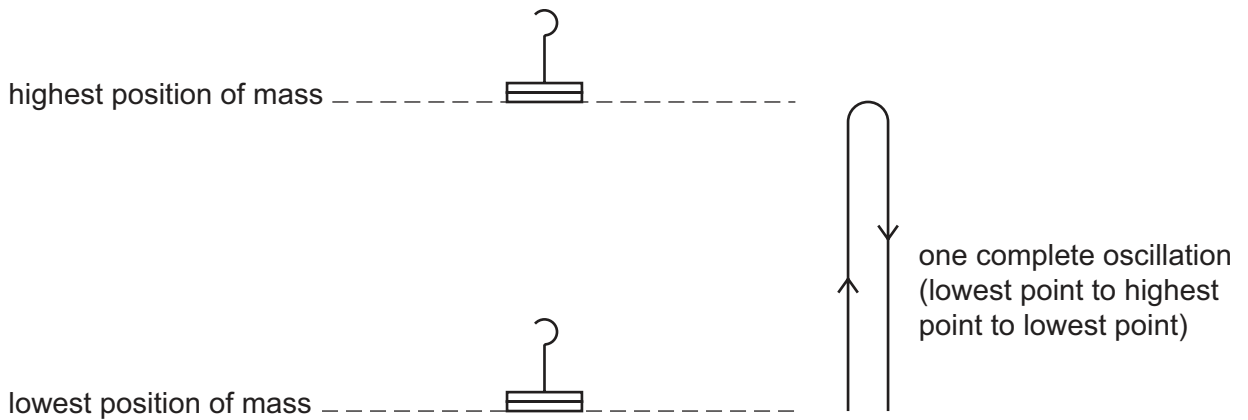
$$k = \frac{F}{e}$$

where the weight of the mass F is 2 N.

$k =$ N/mm [1]

Method 2

- (c) Pull the mass down a **small** distance and release it. The mass oscillates up and down. The period T of the oscillations is the time taken for **one** oscillation. One complete oscillation of the mass is shown in Fig. 3.2.

**Fig. 3.2**

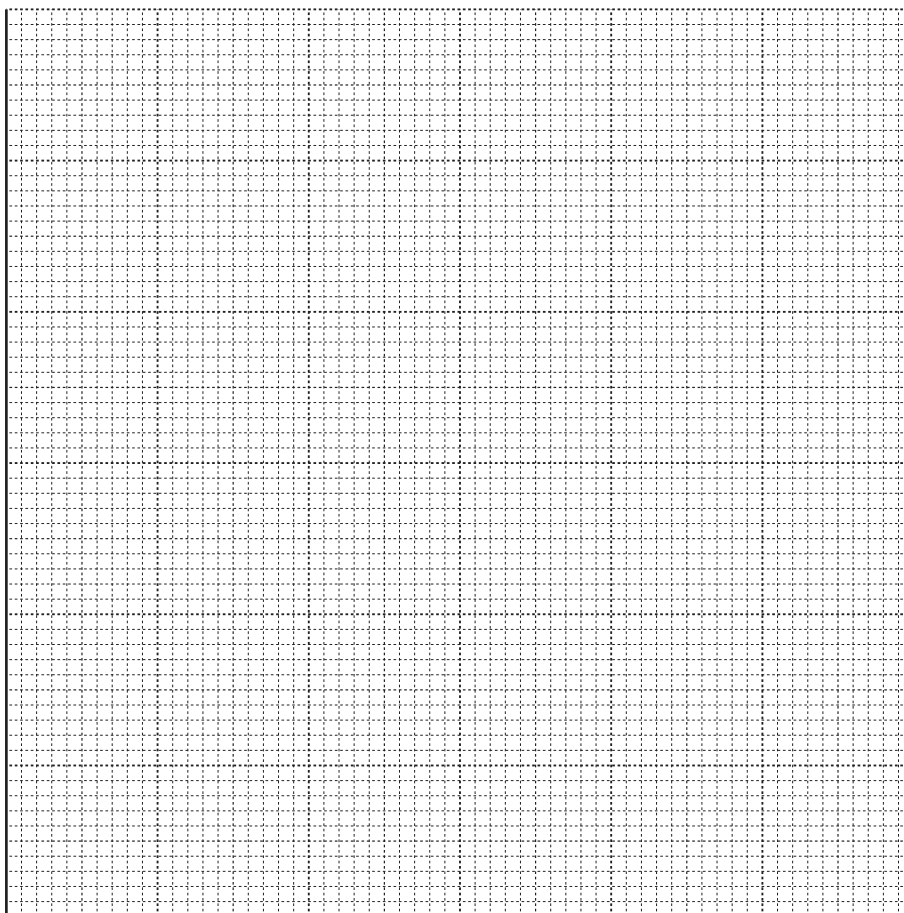
- Measure t , the time taken for 20 oscillations. Record this time in Table 3.1. Repeat this for masses of 0.3 kg, 0.4 kg and 0.5 kg.
- Use your times for 20 oscillations to calculate T , the period (the time for one oscillation) for each of the masses. Record these values in Table 3.1.
- Calculate the values of T^2 . Record your answers in Table 3.1 to **two significant figures**.

Table 3.1

mass m /kg	time for 20 oscillations t /s	period T /s	T^2 /s ²
0.2			
0.3			
0.4			
0.5			

[3]

- (d) (i) On the grid provided, plot a graph of T^2 (vertical axis) against m . Start your graph at (0,0). Draw the best fit straight line.



[4]

- (ii) Calculate the gradient of your line. **Show all working** and **indicate on your graph** the values you chose to enable an accurate value of the gradient to be calculated.

gradient = [2]

- (iii) The gradient of the line is related to the spring constant k of the spring by the equation

$$k = \frac{0.0395}{\text{gradient}}$$

Determine the value of k .

$k = \dots\dots\dots$ N/mm [1]

- (e) In both methods it is important to avoid line of sight (parallax) errors when measuring the length of the spring and timing the oscillations.

Describe how you avoided this error in each method.

Method 1

.....
.....

Method 2

.....
.....

[2]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify then add aqueous barium chloride <i>or</i> aqueous barium nitrate	white ppt.

Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
ammonium (NH_4^+)	ammonia produced on warming	-
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Test for gases

<i>gas</i>	<i>test and test results</i>
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	"pops" with a lighted splint
oxygen (O_2)	relights a glowing splint

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