Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

6806494257

CO-ORDINATED SCIENCES **0654/53**

Paper 5 Practical Test **October/November 2014**

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 8.

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 **8** printed pages.

CAMBRIDGE International Examinations

1 You are provided with three liquids, **A**, **B** and **C**. You will carry out three tests on these liquids to identify nutrients important in the human diet. Each liquid contains only one type of nutrient.

(a) Test 1

- Label three test-tubes **A**, **B** and **C**.
- Place a quarter to a third of a test-tube (about 5 cm^3) of liquid **A** in test-tube **A**. Add the same amount of Benedict's solution and gently shake the tube.
- Place the tube in a hot water-bath at about 80 °C.
- Repeat the above procedure using liquids **B** and **C** in test-tubes **B** and **C**.
- After 5 to 7 minutes, record, in Table 1.1, the colour of the mixture in each tube. [2]

While you are waiting the five minutes for this test to finish, you can start Tests 2 and 3 below.

Test 2

- Label another set of test-tubes **A**, **B** and **C**.
- Place a quarter to a third of a test-tube (about 5 cm^3) of liquid **A** in test-tube **A**. Add the same amount of biuret solution and gently shake the tube.
- Repeat, using liquids **B** and **C** in test-tubes **B** and **C**.
- Record, in Table 1.1, the colour of the mixture in each tube. [2]

Test 3

- Label another set of test-tubes **A**, **B** and **C** (or rinse out the test-tubes used in Test 2 and reuse them).
- Place a quarter to a third of a test-tube (about 5 cm^3) of liquid **A** in test-tube **A**. Add a few drops of iodine solution and gently shake the tube.
- Repeat using liquids **B** and **C** in test-tubes **B** and **C**.
- Record, in Table 1.1, the colour of the mixture in each tube. [2]

Table 1.1

liquid	**Test 1**	**Test 2**	**Test 3**
A			
B			
C			

(b) Use the results of **Tests 1**, **2** and **3** to name the nutrient in

liquid **A**, ...

liquid **B**, ...

liquid **C**. ....

[3]

(c) A student has two different solutions that test positive with Benedict's solution.

Describe an experiment that uses Benedict's solution to find out which of the two solutions is more concentrated.

....

....

....

....

....

.... [4]

(d) The teacher says that two of the nutrients identified in the tests above must be broken down before they can be absorbed into the bloodstream.

Name these nutrients and explain why they must be broken down before absorption.

names .... and ....

explanation ....

.... [2]

2 You are going to investigate some of the reactions of magnesium compounds. Solid **P** is a magnesium compound.

(a) Some solid **P** is provided in a hard glass test-tube. Heat this solid for at least two minutes. During this time identify the gas given off.

Record the test and observation which identifies the gas. Also record any changes in the appearance of the solid.

Allow the contents of the test-tube to cool for use in **(c)**. This solid is compound **Q**.

observation (solid) ....

....

test which identifies the gas ....

....

observation (gas test) ....

....

name of gas given off .... [4]

(b) **(i)** Add 15 cm^3 hydrochloric acid to the sample of solid **P** provided in a beaker. Stir well until there is no solid remaining.

Record your observations and retain the mixture for **(b)(ii)**.

....

.... [2]

(ii) To the mixture from **(b)(i)** add dilute sodium hydroxide with stirring until the mixture is alkaline as shown by litmus paper.

Record your observations.

.... [1]

(iii) Use your observations in **(a)** and **(b)(i)** to name the compound in solid **P**.

name of compound in solid **P** .... [1]

(c) Empty the beaker and wash it thoroughly with water. Transfer the cooled contents of the hard glass test-tube from **(a)**, compound **Q**, to the beaker and add 25 cm^3 of water. Stir well and filter the mixture into three test-tubes. This filtrate is solution **R**.

(i) To the first test-tube of solution **R**, add an equal volume of copper(II) sulfate solution. Leave for a few minutes while you carry out the tests below in part **(ii)** and **(iii)**, then record your observations.

....

.... [1]

(ii) Test the second test-tube of solution **R** with red litmus paper and blue litmus paper.

Record any colour changes to the papers.

red litmus ....

blue litmus .... [1]

(iii) To the third test-tube of solution **R** add a few drops of Universal Indicator solution (full range indicator).

Record the colour and suggest the pH of the solution.

colour ....

pH .... [2]

(iv) State what you can conclude about solution **R** from the pH suggested in **(iii)**.

....

.... [1]

(v) Use your observations and conclusions in **(c)(i)**, **(ii)**, **(iii)** and **(iv)** to name solution **R**.

name of solution **R** .... [1]

(d) Use your observations and conclusions in **(a)**, **(b)** and **(c)** to identify the compound **Q** formed by heating solid **P** in **(a)**.

compound **Q** is .... [1]

3 In this experiment you are going to find a value for the specific heat capacity of glass by investigating the thermal energy changes that occur when hot and cold water are mixed.

The specific heat capacity of glass, c, is the amount of thermal energy required to raise the temperature of 1 g of glass by 1 °C.

You are provided with hot water and cold water. The cold water is at room temperature.

(a) **(i)** Use the balance provided to find the mass m of beaker **X** to **the nearest gram**.

m = ... g [1]

(ii) Pour 100 cm^3 of cold water into the beaker labelled **X**. Measure and record the temperature T_1 of the cold water to the nearest 0.5 °C.

T_1 = ... [1]

(iii) Pour hot water into the beaker labelled **Y** up to the line marked on the side of the beaker. Measure and record the temperature T_2 of the hot water to the nearest 0.5 °C.

T_2 = ... [1]

(iv) As soon as you have recorded the temperature of the hot water, pour the hot water from beaker **Y** into beaker **X** and stir the mixture. Measure and record the highest temperature T_3 of the mixture.

T_3 = ... [3]

(b) **(i)** Calculate the rise in temperature ($T_3 - T_1$) of the cold water.

($T_3 - T_1$) = ... [1]

(ii) Calculate the fall in temperature ($T_2 - T_3$) of the hot water.

($T_2 - T_3$) = ... [1]

(c) **(i)** Calculate the gain in thermal energy E_c of the cold water using the equation

$$E_c = k\,(T_3 - T_1)$$

where k = 420 J / °C.

E_c = ... J [1]

(ii) Calculate the loss in thermal energy E_h of the hot water using the equation

$$E_h = k(T_2 - T_3)$$

where k = 420 J / °C.

E_h = ... J [1]

The difference between E_h and E_c is approximately equal to the thermal energy E_g gained by the glass beaker **X**.

(d) **(i)** Use your answers **to (c)(i)** and **(c)(ii)** to calculate the thermal energy gained by the glass.

$E_g = E_h - E_c$ = ... J [1]

(ii) Use your answers **to (a)(i)**, **(b)(i)** and **(d)(i)** to calculate c, the specific heat capacity of glass, using the equation

$$E_g = m \times c \times (T_3 - T_1)$$

Show your working.

c = ... J / g °C [2]

(e) Suggest **two** practical reasons why your value for the specific heat capacity of glass may be inaccurate.

....

....

.... [2]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Test for anions

anion	*test*	*test result*
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 *or* aqueous barium nitrate	white ppt.

Test for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
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

gas	*test and test results*
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