Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

8346658419

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **February/March 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

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.

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.

This document consists of **18** printed pages and **2** blank pages.

CAMBRIDGE International Examinations

1 A student investigates the nutrient content of two solutions, **A** and **B**.

- He pours some of solution **A** into each of three test-tubes.
- He adds Benedict's solution to one test-tube, mixes well and places it in a hot water-bath for a few minutes.
- He adds biuret solution to another test-tube and mixes well.
- He adds a few drops of iodine solution to the other test-tube and mixes well.

He repeats the procedure above for solution **B**.

(a) Complete the second row of Table 1.1 to show which nutrient each test identifies. [3]

(b) Solution **A** gives a positive result with Benedict's solution and iodine solution.

Solution **B** gives a positive result with biuret solution and iodine solution.

All other observations are negative.

Complete the third and fourth rows of Table 1.1 to show the student's observations for solutions **A** and **B**. [3]

Table 1.1

reagent	Benedict's solution	biuret solution	iodine solution
nutrient tested for			
colour obtained with solution **A**			
colour obtained with solution **B**			

(c) State and explain a safety precaution the student should have taken when carrying out his experiment.

.....[1]

(d) Describe how you would test for the presence of fat in cooking oil.

You should include the following in your answer:

- what you would do
- the reagents you would use
- any safety precautions you would take
- the observations you would make that indicate the presence of fat.

.....

.....

.....

.....

.....

.....[3]

2 Solid **H** is a mixture of a black metal oxide and a white salt. The metal oxide is insoluble in water. The salt is soluble in water.

A student carries out tests to identify the metal oxide and the salt in **H**.

(a) Describe how the student separates the metal oxide and the salt.

Include a labelled diagram in your answer.

.....

.....

.....

.....[3]

(b) **(i)** The student places some of the salt solution from **(a)** in a test-tube and adds dilute hydrochloric acid.

The test shows that the anion of the salt is **not** a carbonate.

State the observation that allows the student to conclude this.

.....[1]

(ii) He then places another sample of the salt solution from **(a)** in a clean test-tube and adds a few drops of dilute nitric acid followed by silver nitrate solution.

He observes a white precipitate.

State the conclusion that he is able to make about the anion of the salt.

.....[1]

(iii) Using the remainder of the salt solution from **(a)** he adds only one reagent and is able to identify the cation in the filtrate after carrying out the tests in Table 2.1.

Table 2.1 has been partially completed to show the tests and one of the conclusions.

Complete Table 2.1.

Table 2.1

	test	observations	conclusion about cation
1	add sodium hydroxide solution	....	not Cu^{2+}, Fe^{2+}, Fe^{3+}, Zn^{2+}.
2	heat the mixture from test **1** and test any gases with damp litmus papers	....	.....

[3]

(c) The student pours hot nitric acid onto the metal oxide from **(a)**, stirs well and collects the resulting liquid.

He slowly adds ammonia solution to this liquid until there is no further change.

(i) Suggest why hot nitric acid is used rather than cold nitric acid.

.....

.....[1]

(ii) From his observations he concludes that the metal oxide is copper oxide.

Describe the appearance of the liquid after excess ammonia solution has been added.

.....

.....[1]

3 A student investigates the resistance of lamps connected in series and in parallel.

She begins by using the circuit shown in Fig. 3.1.

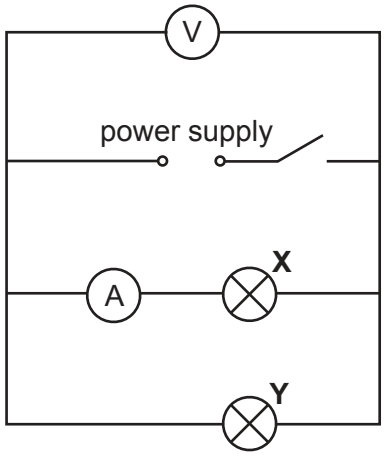


Fig. 3.1

She switches on the circuit and records in Table 3.1 the potential difference V across the lamps and the current I flowing through lamp **X**. She switches off the circuit.

(a) She moves the ammeter so that it is now connected to measure the current flowing through lamp **Y**.

The scales of the voltmeter and the ammeter are shown in Fig. 3.2. Read the scales and record the values in Table 3.1. [2]

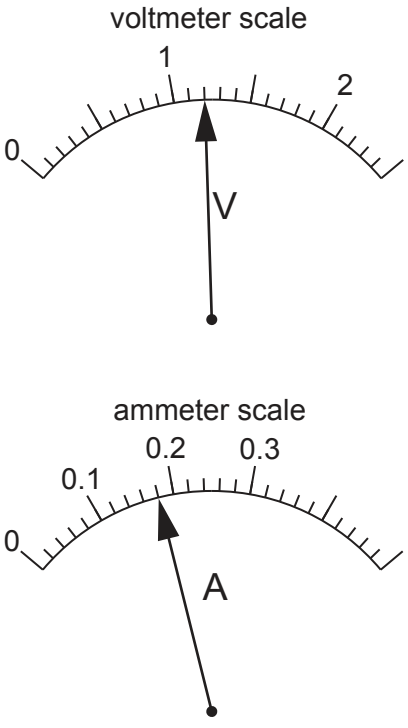


Fig. 3.2

Table 3.1

	potential difference V/V	current I/A	resistance R/Ω
X	1.1	0.21	
Y			

(b) (i) Use the equation below to calculate the resistance R of each lamp.

$$R = \frac{V}{I}$$

Record your values of R in Table 3.1.

[2]

(ii) Calculate the sum of the resistances of lamps **X** and **Y**, R_P, by adding your two values together.

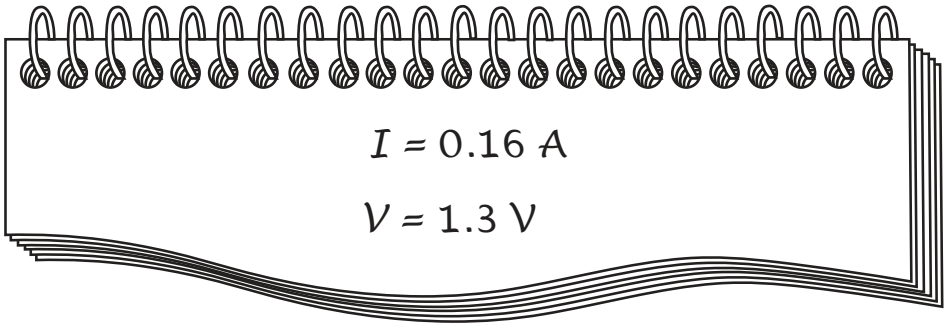
R_P = ...[1]

(c) She rearranges the circuit so that both lamps are now connected together in series with the ammeter and leaves the position of the voltmeter unchanged.

(i) Draw the complete circuit diagram with the lamps connected in series.

[2]

She records the current I through the lamps and the potential difference V across them.



(ii) Calculate the combined resistance R_S of the two lamps in series.

R_S = ...[1]

(d) The student thinks that the value of R_P should be the same as the value of R_S.

State whether her results support this suggestion and justify your statement with reference to the student's results.

statement .....

justification .....

.....

[1]

(e) Explain why it is important for the student to switch off the circuit between taking readings.

.....

.....[1]

Please turn over for Question 4.

4 A student investigates the effect of exercise on pulse rate.

(a) Read through the rest of the question and then complete the headings for the results in Table 4.1. [2]

Table 4.1

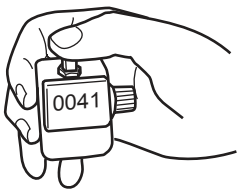
...../.....	...../.....	pulse rate / beats per minute
0	17	68
2	23	92
4	31	124
6	37	
8		
10		176

- The student takes his pulse rate at rest.
- He then begins running.
- While running he records his pulse rate for 15 seconds every 2 minutes.
- He does this for 10 minutes.

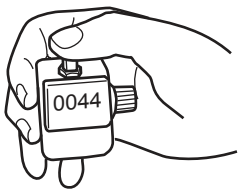
He uses a clicker counter to count his pulse. Every time he feels a beat he clicks the counter and the number of clicks are shown on the display.

(b) **(i)** Read the clicker counter displays in Fig. 4.1.

Record these values to complete the second column of Table 4.1. [1]



8 minutes



10 minutes

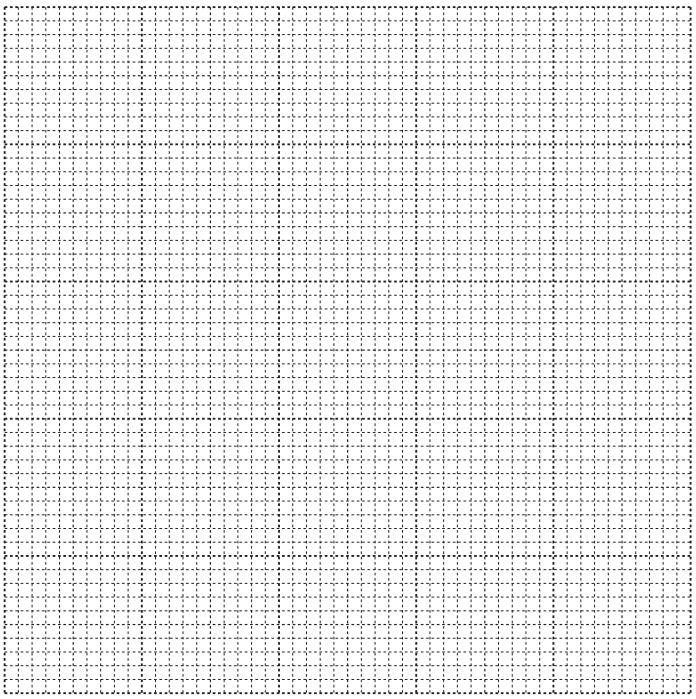
Fig. 4.1

(ii) Calculate the pulse rates per minute for 6 and 8 minutes. Record these in the third column of Table 4.1.

[1]

(c) On the grid below, plot a graph of pulse rate per minute (vertical axis) against time.

Draw the best-fit curve.



[4]

(d) State the effect of exercise on the student's pulse rate.

.....[1]

(e) Use the graph to estimate the student's pulse rate after 9 minutes of exercise. Show on your graph how you arrived at your answer.

pulse rate = ... beats per minute [1]

[Turn over

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5 A student is going to investigate the rate of reaction between a metal and an acid.

She is going to measure the volume of hydrogen gas produced every minute.

She sets up the apparatus shown in Fig. 5.1.

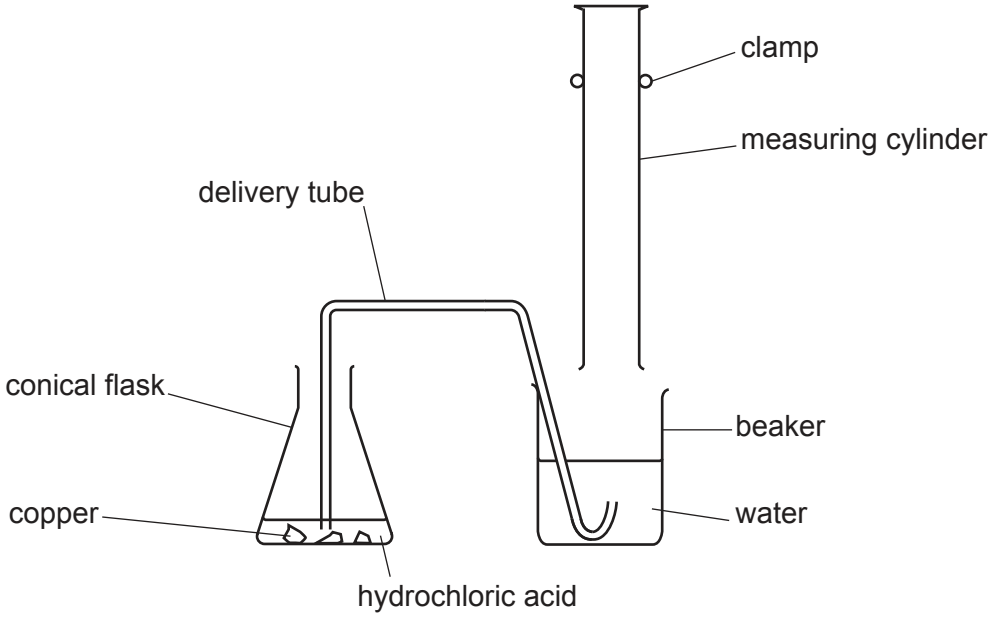

Fig. 5.1

(a) Describe **three** mistakes she has made in the setting up of this experiment.

1. .....

.....

2. .....

.....

3. .....

.....

[3]

(b) The teacher corrects the apparatus so that the student can measure the volume of hydrogen produced.

- The student adds an excess of metal into the acid and measures the volume of hydrogen gas produced every minute.
- She draws a graph of her results. This is shown as line **3** on Fig. 5.2.

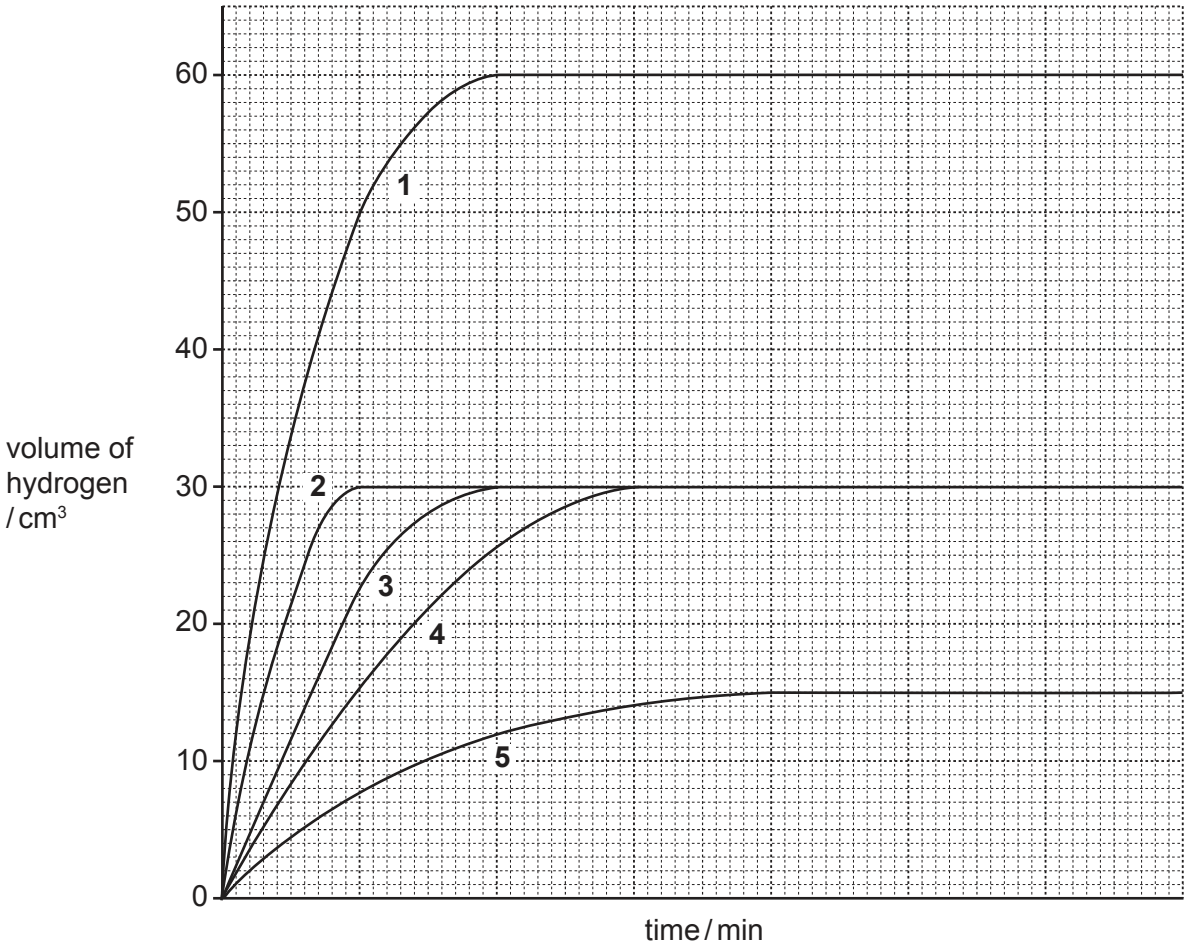

Fig. 5.2

(i)
- She repeats the experiment keeping everything the same except the temperature, which she decreases.
- She plots a graph of these results on the same grid.

State which line is obtained when the temperature of the reaction is decreased. Explain your choice.

line .....

explanation .....

.....

[2]

(ii) She repeats the experiment again but this time doubles the concentration of the acid while keeping everything else the same as the original experiment.

She plots a graph of these results on the same grid.

State which line is obtained when the concentration of the acid is doubled. Explain your choice.

line .....

explanation .....

.....

[2]

(c) She repeats the experiment again but this time the metal is ground into a fine powder while keeping everything else the same as the original experiment.

Suggest what happens to the total volume of hydrogen gas produced.

Explain your answer.

volume of gas produced .....

explanation .....

.....

[1]

(d) At the end of the experiment a solution remains in the conical flask.

The solution contains a dissolved salt.

Describe how she can obtain a sample of the salt from the solution. You may include a labelled diagram in your answer.

.....

.....

.....[1]

(e) Describe how she can test the gas to show it is hydrogen. Remember to include the result of the test in your answer.

.....

.....[1]

6 A student performs an experiment to find out the density of the metal used to make a coin.

(a) She lines up 10 new coins using straight blocks of wood as shown in Fig. 6.1.

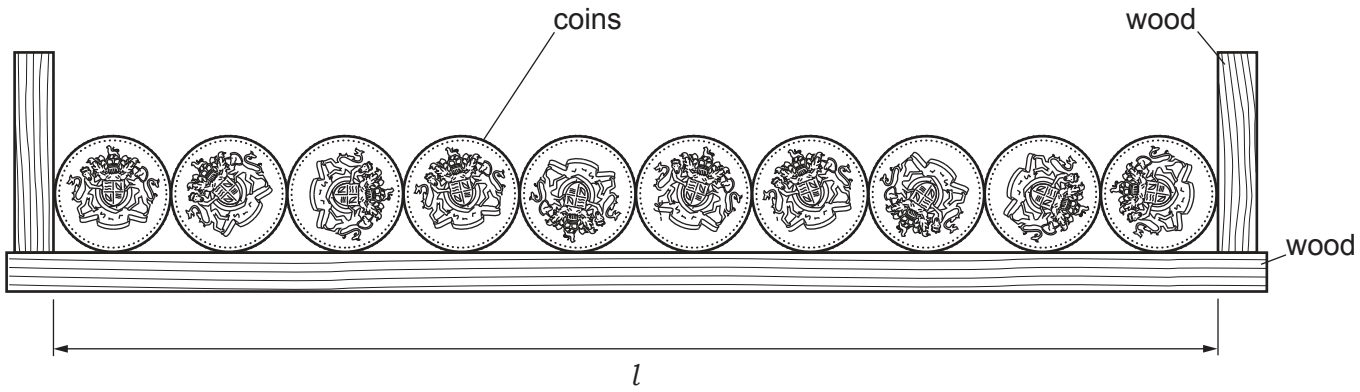

Fig. 6.1

(i) Measure the length l, shown in Fig. 6.1, to the nearest 0.1 cm.

length l = ... cm [1]

(ii) Use your answer to **(a)(i)** to **calculate** the average (mean) diameter d of **one** coin.

diameter d = ... cm [1]

(iii) Calculate the average area A of one coin face using the equation shown below.

$$A = \frac{\pi d^2}{4}$$

A = ... cm^2 [1]

(b) She then makes a vertical stack of the ten coins and measures the height h, as shown in Fig. 6.2.

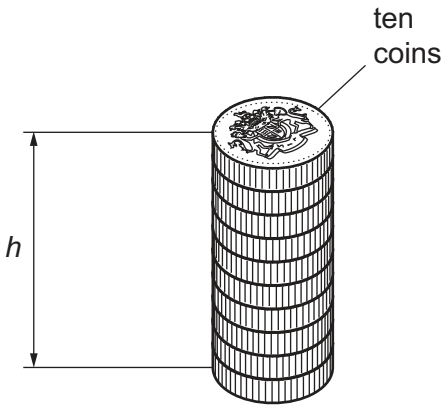

Fig. 6.2

(i) Measure the height h, shown in Fig. 6.2, to the nearest 0.1 cm.

h = ... cm [1]

(ii) Use your values from **(a)(iii)** and **(b)(i)** to **calculate** the volume V of the ten coins using the equation

$$V = Ah.$$

V = ... cm^3 [1]

(c) She measures the mass m of the ten coins using a balance, as shown in Fig. 6.3.

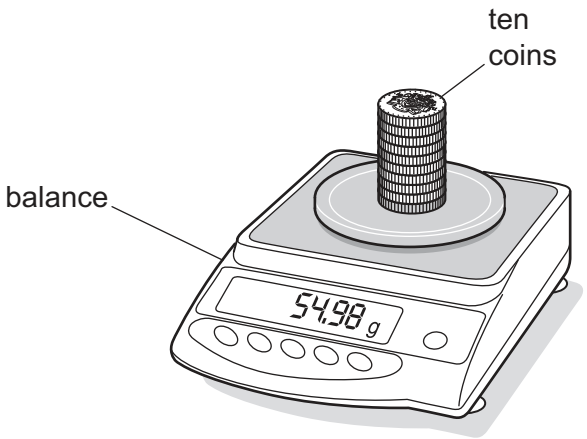

Fig. 6.3

Read the balance and record the value of the mass to the nearest 0.1 g.

m = ... g [1]

(d) Calculate the density of the metal used to make the coins using the equation

$$\text{density} = \frac{m}{V}.$$

density of the metal = ... g / cm^3 [1]

(e) Explain the advantage of using ten coins instead of one.

.....

.....

.....[1]

(f) Another student says that the value of the density will be inaccurate because the coins are not smooth discs of metal as they have ridges and patterns on them.

State and explain what effect these ridges and patterns will have on the value of the density you have calculated in **(d)**.

.....

.....

.....

.....[2]

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