Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICAL SCIENCE
0652/51
Paper 5 Practical Test
October/November 2018
1 hour 30 minutes

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 12.

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
Total

This document consists of 9 printed pages and 3 blank pages.
Solid H is a mixture of two substances, element J and compound K.

Compound K is soluble in water whereas element J is not soluble in water.

You are going to separate the mixture and identify the two substances.

(a) separating the mixture

• Place the solid H in a beaker and add 20 cm$^3$ of distilled water.
• Stir well for 30 seconds.
• Filter the mixture into a large test-tube.
• Keep the filtrate and residue for testing in (b) and (c).

(i) Draw and label the apparatus you have used to filter the mixture.

(ii) Describe the appearance of the filtrate and residue.

filtrate ................................................................................................................................
residue ..............................................................................................................................

[2]

[1]
(b) testing the liquid

- Place 1 cm depth of the liquid from (a) in another large test-tube.
- Slowly add sodium hydroxide solution until there is no further change.

(i) Record your observations and any conclusion you can make about the soluble compound K.

observations ......................................................................................................................
...........................................................................................................................................
...........................................................................................................................................

conclusion ........................................................................................................................ [3]

(ii) On the answer lines below, plan which three tests you need to carry out to determine whether the liquid contains the carbonate, chloride or sulfate anion.

You also need to plan the order in which you will carry out these tests.

The following reagents are available:

- barium nitrate solution,
- dilute nitric acid,
- silver nitrate solution.

For each test, state the observation which would confirm the presence of the anion.

**first test** ........................................................................................................................
...........................................................................................................................................
anion tested for ..................................................................................................................
observation for a positive result ........................................................................................
...........................................................................................................................................

**second test** ................................................................................................................... 
...........................................................................................................................................
anion tested for ..................................................................................................................
observation for a positive result ........................................................................................
...........................................................................................................................................
(iii) Carry out your plan in (b)(ii).

Record the reagent, observation and conclusion for the test which identifies the anion.

reagent ...........................................................................................................................................
observation ....................................................................................................................................... 
anion present in filtrate ...................................................................................................................

(c) testing the solid

• Scrape the solid from the filter paper in (a) into a test-tube.
• Add dilute hydrochloric acid until the test-tube is half-full.
• Loosely hold a bung in the test-tube.
• After 3 minutes take the bung away from the test-tube and test the gas produced with a lighted splint.

(i) Record the test result and the colour of the liquid.


test result ....................................................................................................................................... 
colour of liquid ...............................................................................................................................[2]

(ii) Name the gas produced in this test.

gas ...............................................................................................................................................[1]

(iii) Use your answers to (c)(i) and (c)(ii) to deduce the type of element which is in the solid from (a).

type of element ............................................................................................................................[1]

(iv) Suggest one test which could be carried out on the solution produced in the test-tube to identify the element J.

You should not carry out this test.

test ...............................................................................................................................................[1]
2 You are going to investigate the resistance and the power output of two lamps, L and M, connected in series and in parallel.

The circuit shown in Fig. 2.1 has been set up for you. The lamps are connected in series.

![Fig. 2.1](image)

(a) • Close the switch.
• Measure the current $I$ flowing through lamps L and M.
• Measure the potential difference $V$ across the lamps.
Record your readings in Table 2.1.
• Open the switch.

<table>
<thead>
<tr>
<th>$I$/A</th>
<th>$V$/V</th>
<th>resistance $R_S$/Ω</th>
<th>power $P_S$/W</th>
</tr>
</thead>
<tbody>
<tr>
<td>lamps L and M in series</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) State why it is important to open the switch after taking readings.

...............................................................................................................................................[1]

(c) (i) Calculate the combined resistance $R_S$ of lamps L and M when connected in series. Use the equation shown.

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

Record your answer in Table 2.1. [1]

(ii) Calculate the combined power output $P_S$ of lamps L and M when connected in series. Use the equation shown.

$$P = V \times I$$

Record your answer in Table 2.1. [1]
(d) Rearrange the circuit and set it up as shown in Fig. 2.2.

Lamps L and M are now connected in parallel with the power supply.

![Circuit Diagram]

Fig. 2.2

(i) • Close the switch.
• Measure the current $I$ flowing through lamp L.
• Measure the potential difference $V$ across lamp L.

Record your readings in Table 2.2.
• Open the switch.

Table 2.2

<table>
<thead>
<tr>
<th></th>
<th>$I$/A</th>
<th>$V$/V</th>
<th>resistance $R$/Ω</th>
<th>power $P$/W</th>
</tr>
</thead>
<tbody>
<tr>
<td>lamp L in parallel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lamp M in parallel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(ii) • Disconnect the ammeter from the circuit shown in Fig. 2.2.
• Reconnect the ammeter so that it is now in series with lamp M as shown in Fig 2.3.

![Circuit Diagram]

Fig. 2.3

• Close the switch.
• Measure the current $I$ flowing through lamp M.
• Measure the potential difference $V$ across lamp M.

Record your readings in Table 2.2.
• Open the switch. [2]

(e) (i) Calculate the resistance of each lamp. Use the equation shown.

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

Record your answers in Table 2.2. [1]

(ii) Calculate $R_p$, the sum of the resistances of lamps L and M.

$$R_p = \text{.................................} \ \Omega \ [2]$$

(f) (i) Calculate the power output of each lamp. Use the equation shown.

$$P = V \times I$$

Record your answers in Table 2.2. [1]

(ii) Calculate the total power output, $P_p$, of lamps L and M in parallel.

$$P_p = \text{.................................} \ \text{W} \ [1]$$
(g) A student says that the combined resistance $R_S$ of the lamps in the series circuit should be equal to the sum of the resistances $R_P$ in the parallel circuit.

State whether your values of $R_S$ and $R_P$ from (c)(i) and (e)(ii) support the suggestion made by the student. Justify your statement by referring to the values you have calculated.

...................................................................................................................................................
...................................................................................................................................................
...............................................................................................................................................[1]

(h) The power output $P_S$ of the lamps connected in series is less than the power output $P_P$ of the lamps connected in parallel.

Without referring to your results, state one observation you made while carrying out the experiment that supports the conclusion that $P_S$ is less than $P_P$.

...................................................................................................................................................
...................................................................................................................................................
...............................................................................................................................................[1]
NOTES FOR USE IN QUALITATIVE ANALYSIS

**Tests for anions**

<table>
<thead>
<tr>
<th>anion</th>
<th>test</th>
<th>test result</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbonate (CO$_3^{2-}$)</td>
<td>add dilute acid</td>
<td>effervescence, carbon dioxide produced</td>
</tr>
<tr>
<td>chloride (Cl$^-$) [in solution]</td>
<td>acidify with dilute nitric acid, then add aqueous silver nitrate</td>
<td>white ppt.</td>
</tr>
<tr>
<td>nitrate (NO$_3^-$) [in solution]</td>
<td>add aqueous sodium hydroxide, then aluminium foil; warm carefully</td>
<td>ammonia produced</td>
</tr>
<tr>
<td>sulfate (SO$_4^{2-}$) [in solution]</td>
<td>acidify with dilute nitric acid, then add aqueous barium nitrate</td>
<td>white ppt.</td>
</tr>
</tbody>
</table>

**Tests for aqueous cations**

<table>
<thead>
<tr>
<th>cation</th>
<th>effect of aqueous sodium hydroxide</th>
<th>effect of aqueous ammonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>ammonium (NH$_4^+$)</td>
<td>ammonia produced on warming</td>
<td>–</td>
</tr>
<tr>
<td>copper(II) (Cu$^{2+}$)</td>
<td>light blue ppt., insoluble in excess</td>
<td>light blue ppt., soluble in excess, giving a dark blue solution</td>
</tr>
<tr>
<td>iron(II) (Fe$^{2+}$)</td>
<td>green ppt., insoluble in excess</td>
<td>green ppt., insoluble in excess</td>
</tr>
<tr>
<td>iron(III) (Fe$^{3+}$)</td>
<td>red-brown ppt., insoluble in excess</td>
<td>red-brown ppt., insoluble in excess</td>
</tr>
<tr>
<td>zinc (Zn$^{2+}$)</td>
<td>white ppt., soluble in excess, giving a colourless solution</td>
<td>white ppt., soluble in excess, giving a colourless solution</td>
</tr>
</tbody>
</table>

**Tests for gases**

<table>
<thead>
<tr>
<th>gas</th>
<th>test and test result</th>
</tr>
</thead>
<tbody>
<tr>
<td>ammonia (NH$_3$)</td>
<td>turns damp, red litmus paper blue</td>
</tr>
<tr>
<td>carbon dioxide (CO$_2$)</td>
<td>turns limewater milky</td>
</tr>
<tr>
<td>chlorine (Cl$_2$)</td>
<td>bleaches damp litmus paper</td>
</tr>
<tr>
<td>hydrogen (H$_2$)</td>
<td>'pops' with a lighted splint</td>
</tr>
<tr>
<td>oxygen (O$_2$)</td>
<td>relights a glowing splint</td>
</tr>
</tbody>
</table>