Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER ☐☐☐☐☐ CANDIDATE NUMBER ☐☐☐☐

PHYSICS **9702/03**

Paper 3 Advanced Practical Skills **For Examination from 2016**

SPECIMEN PAPER

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 **both** questions.
You will be allowed to work with the apparatus for a maximum of one hour for each question.
You are expected to record all your observations as soon as these observations are made, and to plan the presentation of the records so that it is not necessary to make a fair copy of them.
You are reminded of the need for good English and clear presentation in your answers.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

Additional answer paper and graph paper should be used only if it becomes necessary to do so.

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 **10** printed pages and **2** blank pages.

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You may not need to use all the materials provided.

1 In this experiment, you will measure the e.m.f. E and internal resistance r of a dry cell by changing the resistance R in the circuit and measuring the current I.

Connect the circuit shown in Fig. 1.1 using one of the 10 Ω resistors as resistance R.

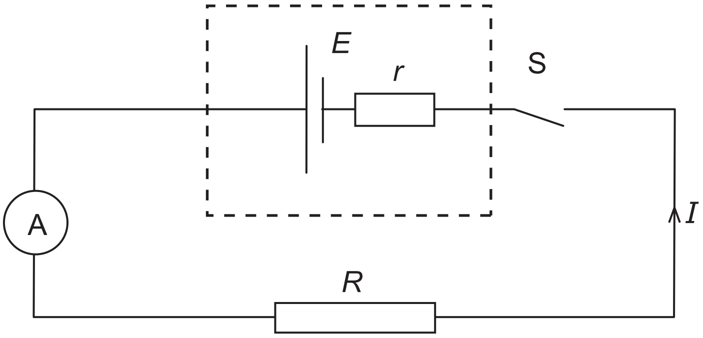

Fig. 1.1

(a) Close switch S.

Record the value of the current I and the resistance R.

I = ...

R = ...

[1]

Open switch S.

(b) The combined resistance of resistors in series is given by $R = R_1 + R_2 + \ldots$

The combined resistance of resistors in parallel is given by $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$

Change the value of R by using different combinations of the $10\,\Omega$ resistors and repeat **(a)** until you have six sets of readings for I and R. You may need to twist the ends of the resistors together when joining them.

Include values of $\frac{1}{I}$ in your table.

[10]

(c) **(i)** Plot a graph of $\frac{1}{I}$ on the y-axis against R on the x-axis. [3]

(ii) Draw the straight line of best fit. [1]

(iii) Determine the gradient and the y-intercept of this line.

gradient = ...

y-intercept = ...
[2]

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(d) The quantities I and R are related by the equation

$$\frac{1}{I}=\frac{1}{E}R+\frac{r}{E}.$$

Using your answers from **(c)(iii)**, determine values of E and r.
Give appropriate units.

E = ...

r = ...
[2]

(e) On the graph grid on page 5, sketch a second line to show your prediction of the results if **two** dry cells are used in series instead of one dry cell as the power source.

Label this line Z. [1]

[Total: 20]

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You may not need to use all the materials provided.

2 In this question, you will investigate how the mass flow rate of salt passing through the hole in a funnel depends on the mass of salt in the funnel.

You are supplied with two small containers holding salt and an empty container. The mass of salt in container A is m_A and the mass of salt in container B is m_B.

(a) Use a top pan balance to determine m_A and m_B.

m_A = ...

m_B = ...
[4]

Mount the funnel in a stand and clamp and place the empty container underneath, as shown in Fig. 2.1.

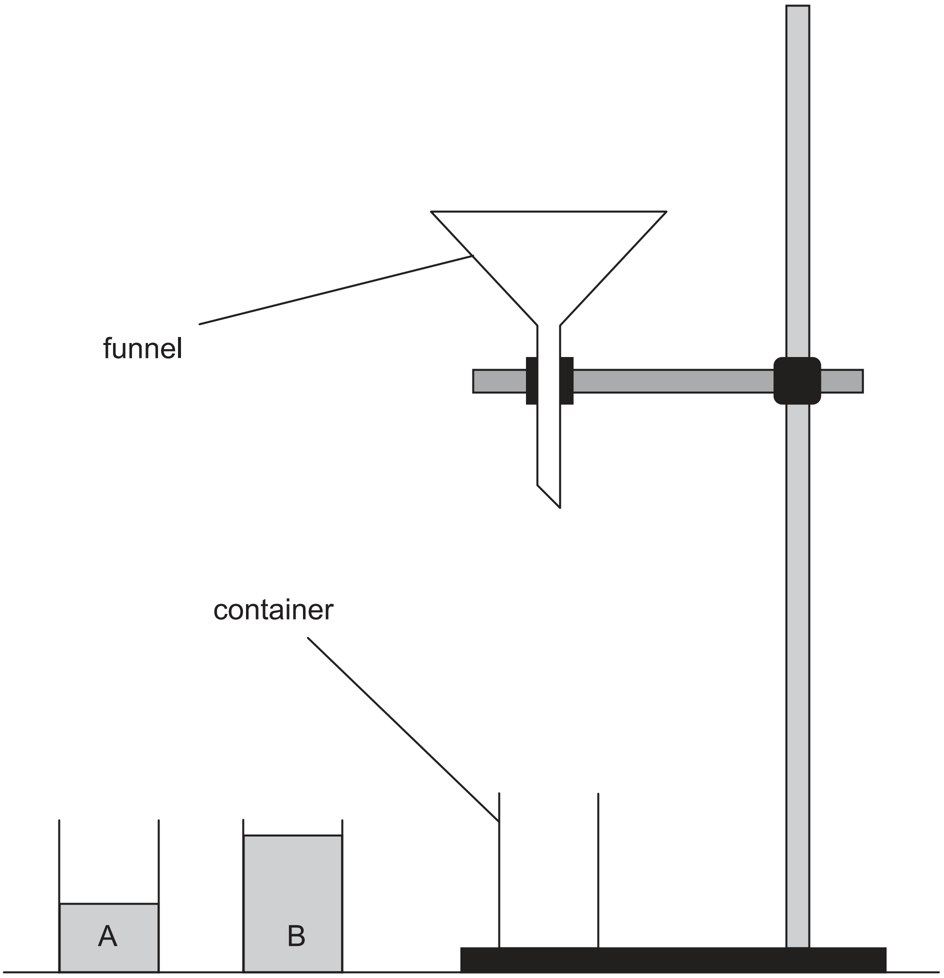

Fig. 2.1

(b) **(i)** Place your finger over the hole at the bottom of the funnel and pour the salt from container A into the funnel.

Move your finger away from the hole and at the same time start the stopwatch. Make and record measurements to find the time t_A for all the salt to leave the funnel.

t_A = ... s [1]

(ii) Repeat the procedure for the salt in container B.

t_B = ... s [3]

(c) Estimate the percentage uncertainly in t_B. Show your working.

percentage uncertainly in t_B = ... [1]

(d) **(i)** Calculate the mass flow rate in each case by dividing the mass of salt by the time taken for it to pass through the hole in the funnel.

mass flow rate_A = ...

mass flow rate_B = ...
[2]

(ii) Use your answer in **(i)** to comment on whether the mass of salt in the funnel affects the rate at which salt passes out of the funnel.

....

....

....

.... [1]

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(e) **(i)** Describe four sources of uncertainty or limitations of the procedure in this experiment.

1. ....

....

2. ....

....

3. ....

....

4. ....

....

[4]

(ii) Describe four improvements that could be made to the experiment. You may suggest the use of other apparatus or different procedures.

1. ....

....

2. ....

....

3. ....

....

4. ....

....

[4]

[Total: 20]

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