4 copies

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PHYSICS 9188/4

PAPER 4 Practical Test

NOVEMBER 2010 SESSION 2 hours 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors
Electronic calculator
Graph paper

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on any separate answer paper used.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
In Questions 1 and 2, 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. The working of the answers is to be handed in. Marks are mainly given for a clear record of the observations actually made, for their suitability and accuracy, and for the use made of them. **Routine** precautions and theory are **not** wanted in Questions 1 and 2. You should, however, record any **special** precautions you have taken so as to aid accuracy. At the end of the examination, fasten any separate answer paper used securely to the question paper.

INFORMATION FOR CANDIDATES

Questions 1 and 2 carry 18 marks each and question 3 carries 14 marks.
Squared paper and Mathematical tables are available.
Additional paper and graphs should be submitted **only** if it becomes **necessary** to do so.
You are advised to spend approximately one hour on each of Questions 1 and 2 and 30 minutes on Question 3
You are reminded of the need for good English and clear presentation in your answers.

FOR EXAMINER'S USE	
1	
2	
3	
TOTAL	

This question paper consists of 10 printed pages and 2 lined pages.

It is recommended that you spend about 60 minutes on this question.

1 In this experiment you will investigate the rate of rise of water in a graduated measuring cylinder.

Set up the apparatus shown in **Fig. 1.1** ensuring the burette is vertical.

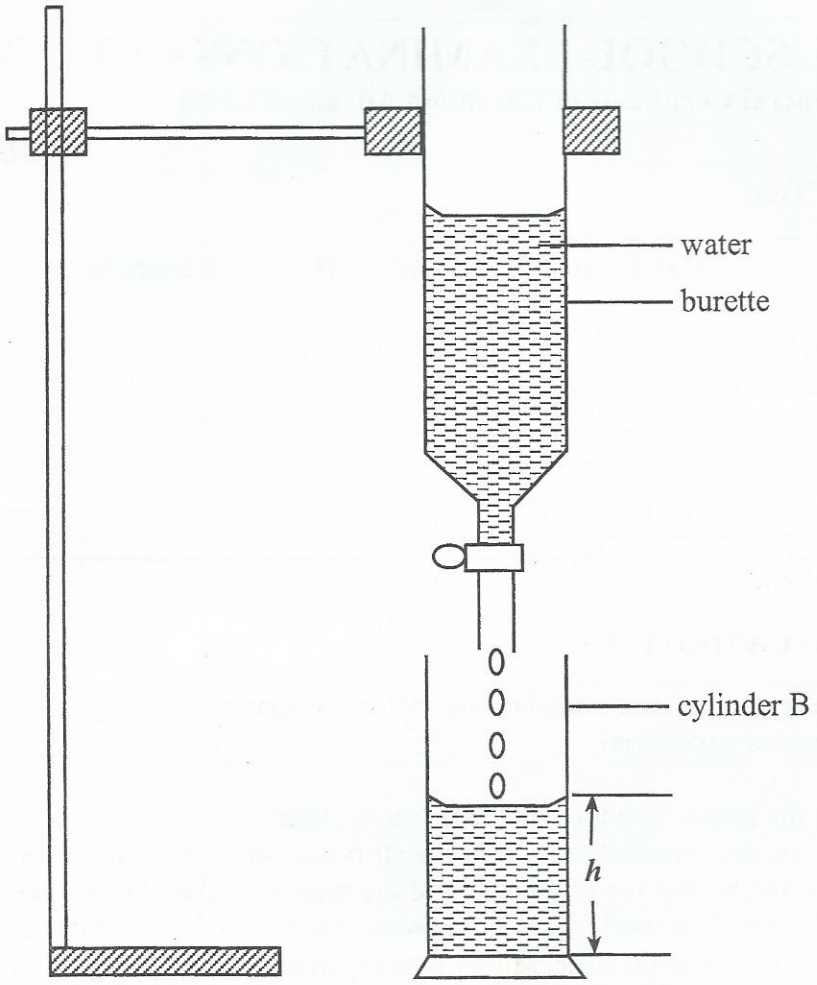

Fig. 1.1

(a) **(i)** Fill up the burette with water and open its tap briefly to allow some water to completely fill the lower part of the burette. Make further adjustments to ensure the burette level is at the 0 cm^3 mark.

(ii) Start the stopwatch as you open the burette tap **completely**.

(iii) Measure and record the time, t, it takes for the water to rise to height, h, in cylinder B (*which must initially be empty*).

(iv) repeat **a(iii)** for seven further sets of values of t and h.
[$2.0 \leq h \leq 13.0$ cm].

(b) **(i)** Plot a graph of h against t.

(ii) Determine the gradients of the tangents at the points where $t = \frac{T}{5}$ and $t = \frac{T}{2}$ where T is the greatest value of t recorded in the table.

(c) **(i)** Theory suggests that the rate of rise, $\frac{dh}{dt}$, is related to t by the equation $\frac{dh}{dt} = \frac{53k}{c} e^{-kt}$ where k and c are constants.

(ii) Use this equation and the two values of gradients determined in **(b)(ii)** to get values of k and c.

DO NOT WRITE ON THIS SPACE

Measurements and calculations

For Examiner's Use

M

R

A

It is recommended that you spend about 60 minutes on this question.

2 In this experiment you will investigate the variation of potential difference with resistance.

A, **B** and **C** are resistors. The variable resistor, **R**, is formed by connecting the 100 Ω resistors provided. One or more of these can be used to obtain different values of **R**.

Set up the circuit as shown in **Fig. 2.1**.

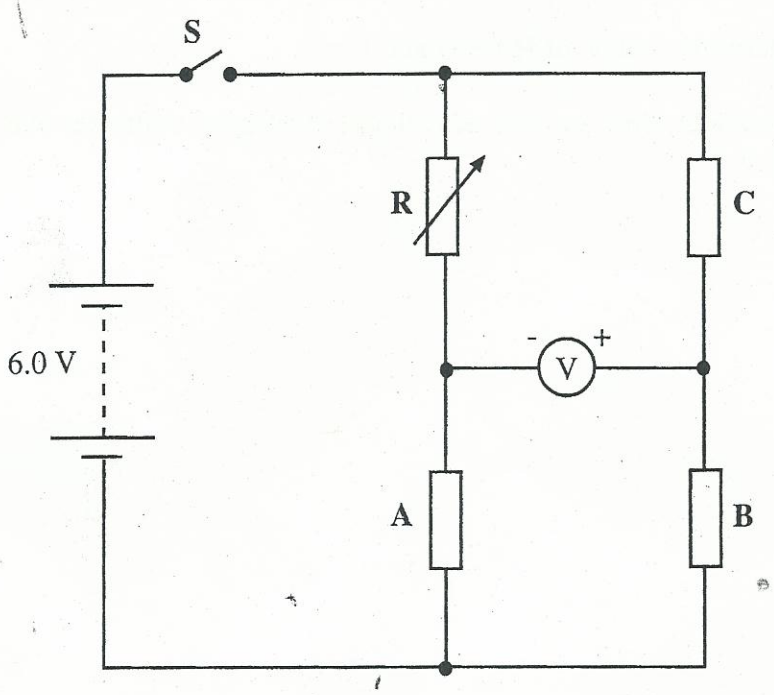

Fig. 2.1

(a) **(i)** Using one value of **R**, close the switch, record **R**, and record V.

(ii) Change the value of **R** and repeat **a(i)** for five further sets of values of **R** and V.

N.B. For series resistors $\mathbf{R = R_1 + R_2 + \ldots}$

For parallel resistors $\dfrac{\mathbf{1}}{\mathbf{R}} = \dfrac{\mathbf{1}}{\mathbf{R_1}} + \dfrac{\mathbf{1}}{\mathbf{R_2}} + \ldots$

(iii) Include in your table of results, values of $\dfrac{100}{100 + \mathbf{R}}$.

(b) **(i)** The voltmeter reading, V, and **R** are related by the equation

$$V = K - \frac{100M}{100 + \mathbf{R}},$$

where K and M are constants.

(ii) Plot a graph of V(y-axis) against $\frac{100}{100 + \mathbf{R}}$.

(iii) Use your graph to determine values of K and M.

(iv) Determine a value of **R** for which V = 0.

(c) In this experiment, state any **two** advantages of a digital voltmeter over an analogue one.

DO NOT WRITE ON THIS SPACE