Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
TOTAL	

General Certificate of Education
Advanced Level Examination
June 2014

Physics
(Specifications A and B)

PHA6/B6/XPM1

Unit 6 Investigative and Practical Skills in A2 Physics
Route X Externally Marked Practical Assignment (EMPA)

Section A Task 1

For this paper you must have:
- a calculator
- a pencil
- a ruler.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for Section A Task 1 is 14.

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Section A Task 1

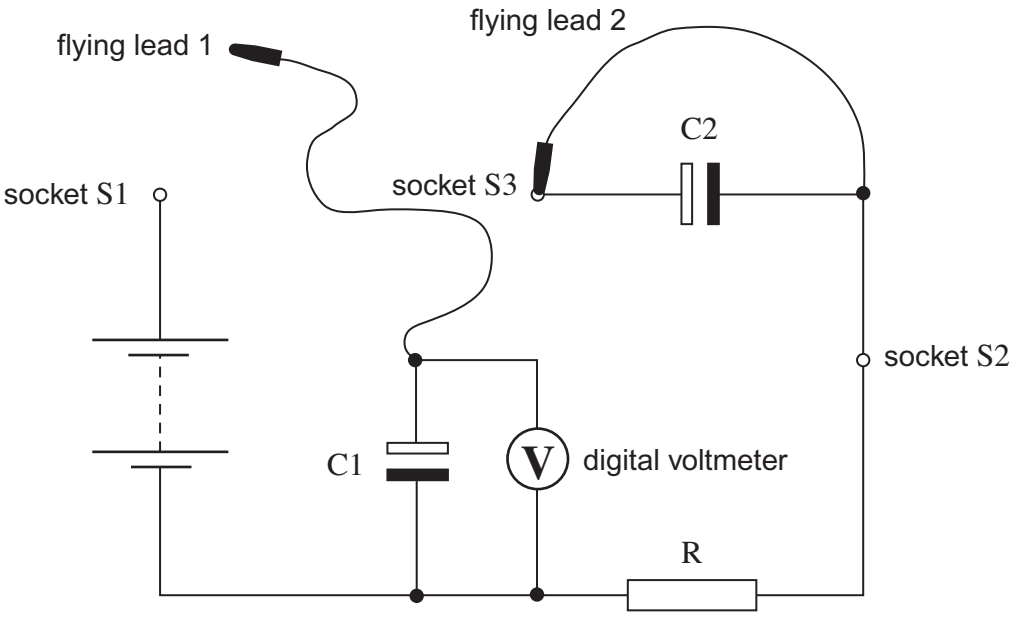
Follow the instructions given below.

Give the information required in the spaces provided.

No descriptions of the experiments are required.

1 You are to determine the resistance of a resistor R of unknown resistance using the circuit shown in **Figure 1**.

Figure 1



This circuit is used for both Question 1 and Question 2 in Section A Task 1.
Connect flying lead 2 to socket S3 as shown in **Figure 1**; **Keep this lead connected to S3 whilst making the measurements in Question 1**.

1 (a) Connect flying lead 1 to socket S1 so that capacitor C1 is fully charged.

1 (a) (i) Read and record the voltmeter reading, ε.

ε = ...

Turn over ▶

1 (a) (ii) Remove flying lead 1 from socket S1 and connect this **without delay** to socket S2 so the voltmeter reading decreases as C1 discharges through resistor R.

Start the stopwatch when the voltmeter reads 80% of ε.
Measure and record in **Table 1**, the times at which the voltmeter reads 40% and 20% of ε.

[2 marks]

Table 1

Voltmeter reading	**Time/s**
40% of ε	
20% of ε	

1 (b) Explain whether the results in part (a) show that the voltmeter reading is decreasing exponentially.

[1 mark]

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1 (c) Use your results to calculate the resistance of resistor R.
The capacitance of capacitor C1 is provided for your use; you may assume that the voltmeter has infinite resistance.

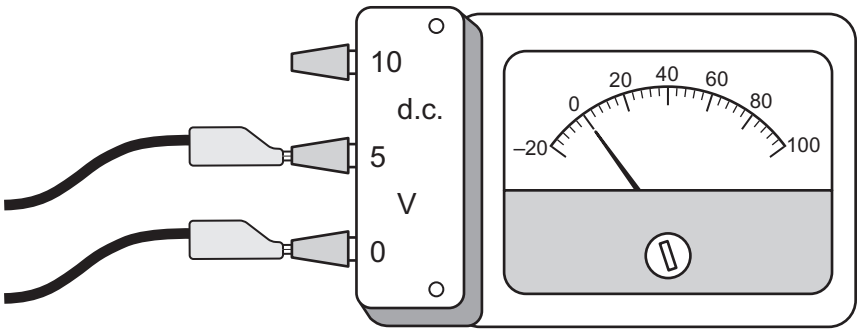
You may wish to use the equation $V = V_0 e^{-\frac{t}{RC}}$

[2 marks]

resistance of resistor R = ...

1 (d) Most analogue voltmeters, such as that shown in **Figure 2**, have a finite resistance.

Figure 2



A student carries out the experiment using an analogue voltmeter that has the same resistance as resistor R.
State and explain how the result for resistance of R obtained by the student will compare with **your** result.

[3 marks]

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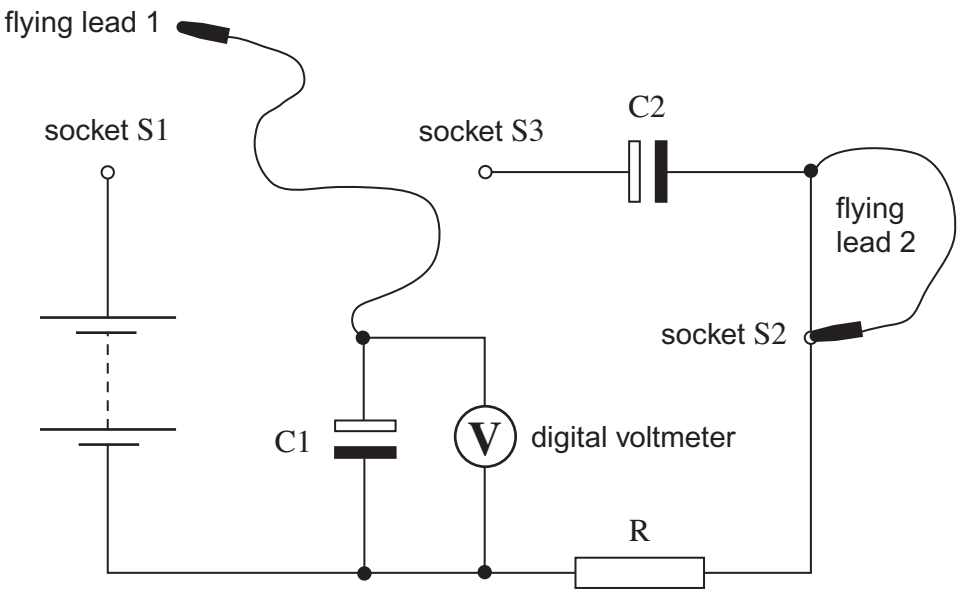
Turn over for the next question

2 (a) **Disconnect flying lead 1 from S2.**

Connect flying lead 2 to S2 as shown in **Figure 3; keep this lead connected to S2 whilst making the measurements in Question 2** (unless you wish to discharge C2 in order to repeat the question).
You are not required to take any repeat readings in Question 2(a).

Figure 3



2 (a) (i) Charge C1 by connecting flying lead 1 to S1.
Record the voltmeter reading, V_A, **in the top row** of **Table 2**.

2 (a) (ii) Disconnect the lead from S1 and **without delay** connect it **to S3**, starting the stopwatch **as you do this**.
Read and record further values of V_A at 10 second intervals to complete **Table 2**.

Table 2

***t*/s**	**V_A/V**
0	
10	
20	
30	
40	
50	
60	

2 (a) (iii) Remove flying lead 1 from S3 and connect it to S1 to recharge C1.
Record the voltmeter reading, V_B, in the top row of **Table 3**.

2 (a) (iv) Disconnect the lead from S1 and without delay connect it to S3, starting the stopwatch as you do this.
Read and record further values of V_B at 10 second intervals to complete **Table 3**.
[1 mark]

Table 3

t/s	V_B/V
0	
10	
20	
30	
40	
50	
60	

You are not required to repeat the experiment but should you need to do so, disconnect flying lead 1 from S3 and flying lead 2 from S2.
Briefly connect flying lead 2 to S3 to discharge C2 before reconnecting this lead to S2. You may now recommence the procedure starting at part 2 (a)(i).

2 (b) Evaluate $\frac{2\varepsilon - V_A}{V_B}$ using your values of V_A and V_B at $t = 60$ s.
[1 mark]

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$\frac{2\varepsilon - V_A}{V_B}$ = ...

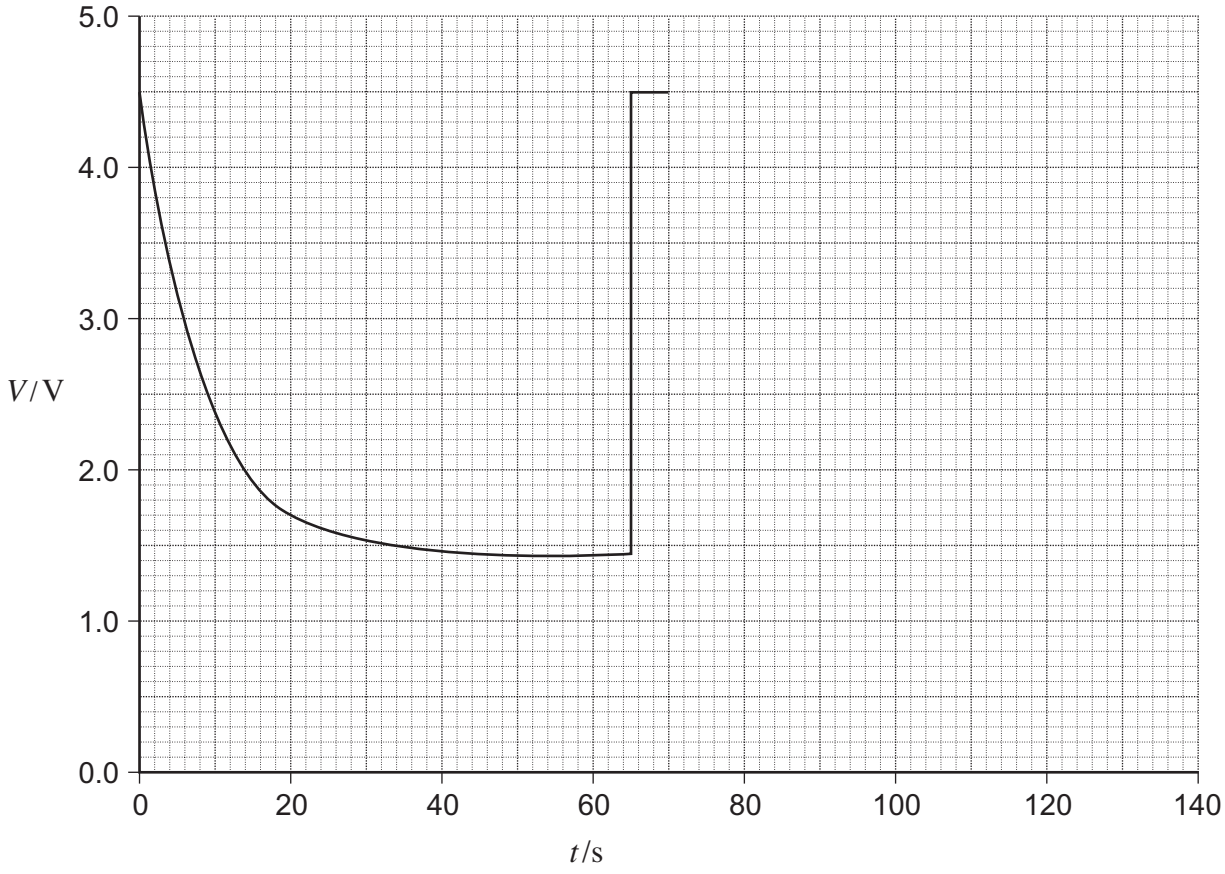
2 (c) A student performed the experiment you carried out in part 2 (a).
The student did not stop the watch at the end of part 2 (a)(ii). He connected flying lead 1 to S1 at $t = 65\,\text{s}$ then reconnected this lead to socket S3 at $t = 70\,\text{s}$.

2 (c) (i) Complete the sketch graph in **Figure 4** to show how the pd across C1 varied between $t = 70\,\text{s}$ and $t = 130\,\text{s}$.

2 (c) (ii) Add a second line to **Figure 4** to show how the pd across C2 varied between $t = 0\,\text{s}$ and $t = 130\,\text{s}$.

[4 marks]

Figure 4



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END OF QUESTIONS