

Name of the Student: _____

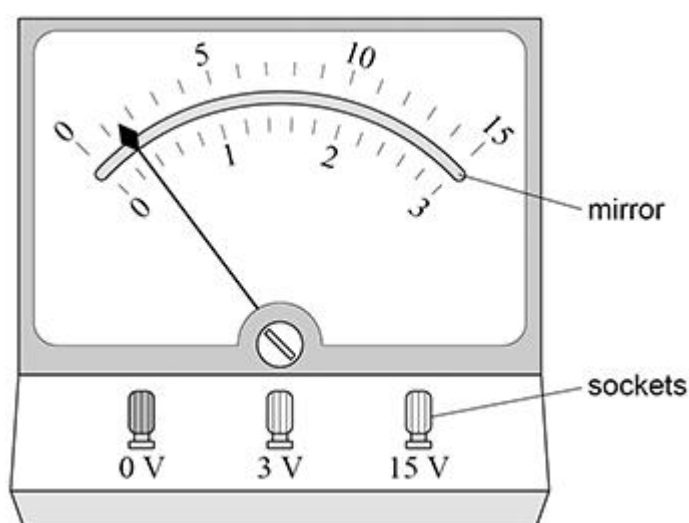
Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

An analogue voltmeter has a resistance that is much less than that of a modern digital voltmeter. Analogue meters can be damaged if the full-scale reading is exceeded.

Figure 1 shows a dual-range analogue voltmeter with a zero error.

Figure 1

- (a) The voltmeter is set to the **more sensitive** range and then used in a circuit.

What is the potential difference (pd) between the terminals of the voltmeter when a full-scale reading is indicated?

Tick (✓) **one** box.

2.7 V

☐

3.3 V

☐

13.5 V

☐

16.5 V

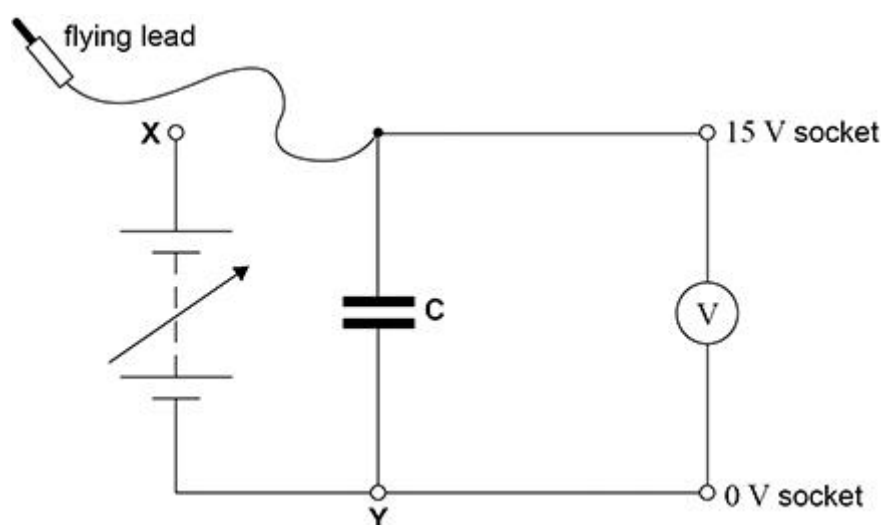
☐
(1)

(b) Explain the use of the mirror when reading the meter.

(2)

A student corrects the zero error on the meter and then assembles the circuit shown in **Figure 2**. The capacitance of the capacitor **C** is not known.

Figure 2



The output pd of the power supply is set to zero.

The student connects the flying lead to socket **X** and adjusts the output pd until the voltmeter reading is full scale (15 V).

She disconnects the flying lead from socket **X** so that **C** discharges through the voltmeter.

She measures the time $T_{\frac{1}{2}}$ for the voltmeter reading **V** to fall from 10 V to 5 V.

She repeats this process several times.

Table 1 shows the student's results, **none** of which is anomalous.

Table 1

$T_{\frac{1}{2}} / \text{s}$	12.00	11.94	12.06	12.04	12.16
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(c) Determine the percentage uncertainty in $T_{\frac{1}{2}}$.

(2)

(1)

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(4)

V/V	14	11	8	6	4	3	2
t/s	0.0	3.1	7.2	11.0	16.2	19.9	25.2

- (f) Suggest **two** reasons why the student selected the values of V shown in **Table 2**. Explain each of your answers.

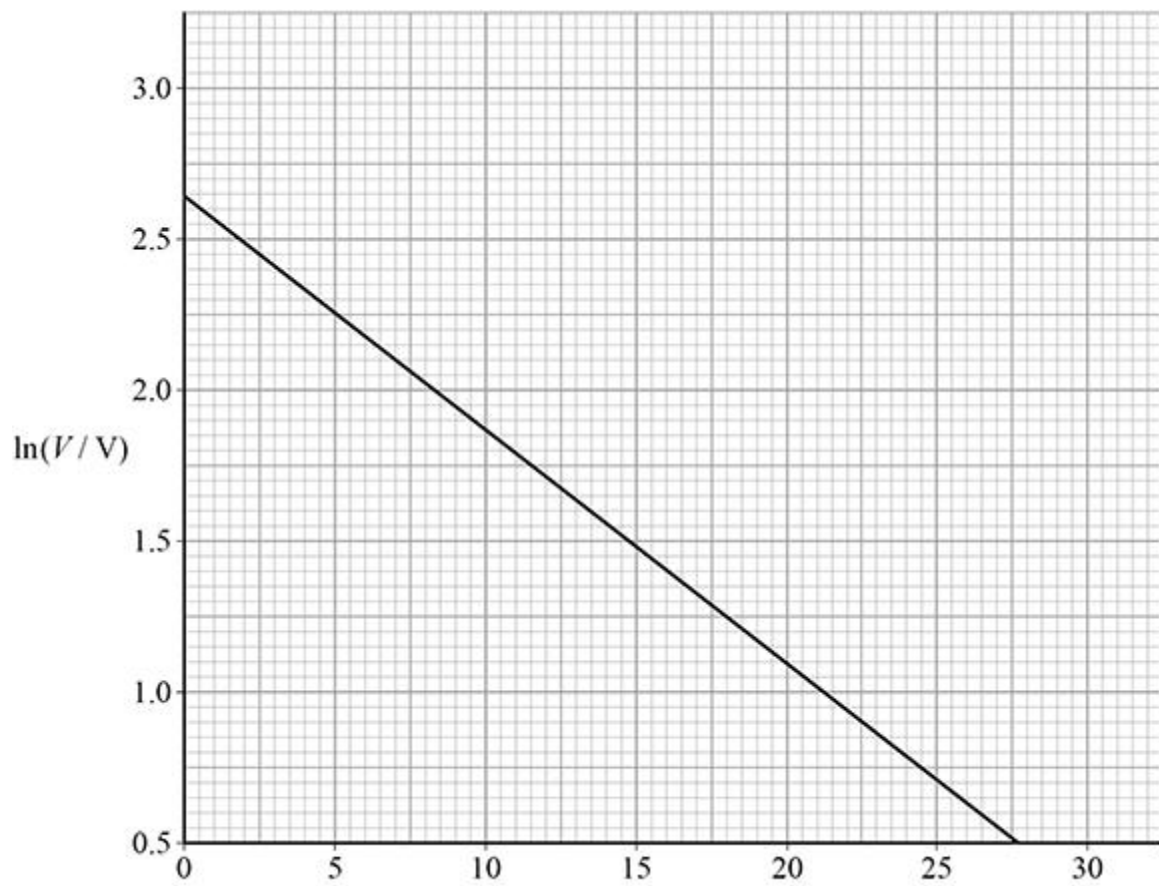
1 _____

2 _____

(4)

Figure 3 shows a graph of the experimental data.

Figure 3



(g) Show, using **Figure 3**, that the resistance of the voltmeter is about $16 \text{ k}\Omega$.

(3)

(h) Determine the current in the voltmeter at $t = 10 \text{ s}$.

current = _____ A
(2)
(Total 19 marks)