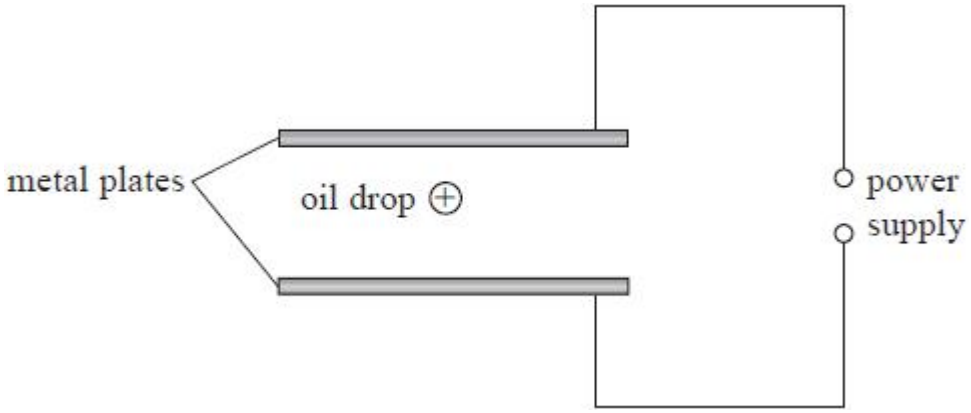
Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

A student investigated the behaviour of small, positively charged oil drops in an electric field.

He introduced an oil drop between two horizontal metal plates. A potential difference *V* was applied to bring the oil drop to rest as shown.



(i) Add to the diagram to show the polarity of the power supply when the oil drop is at rest.

(1)

(ii) The oil drop was at rest when *V* = 4870 V.

The student expected the charge on the oil drop to be a whole number multiple of the charge on an electron. Deduce whether this is confirmed by the experimental data.
distance between top plate and bottom plate = 1.55 cm
density of oil = 920 kg m^{-3}
radius of the oil drop = 1.78×10^{-6} m

(6)

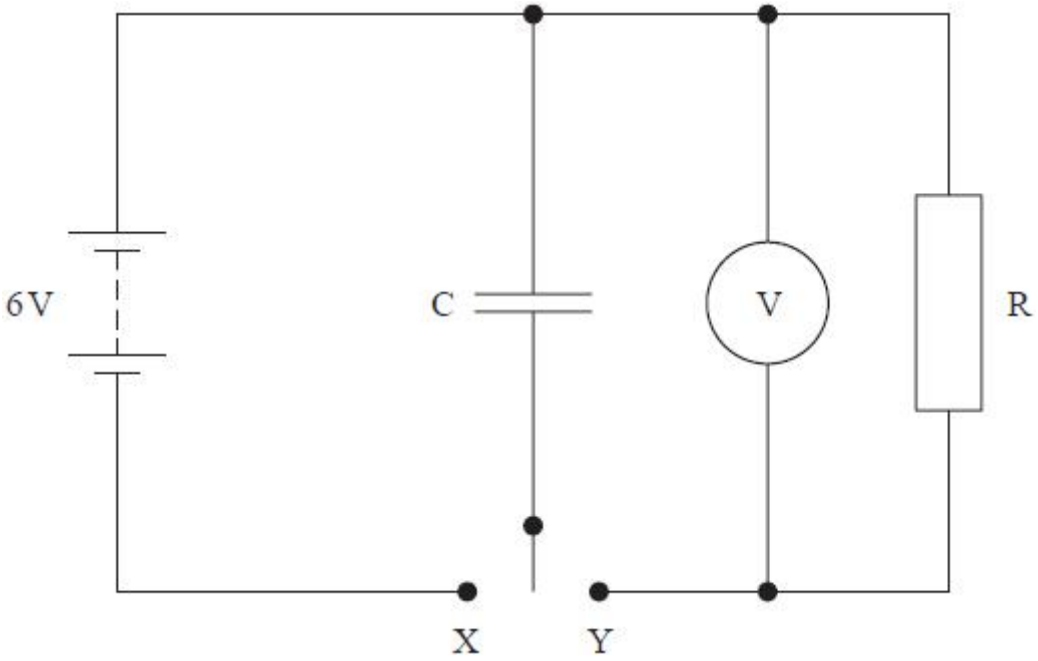
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

Downloaded from www.merit-minds.com

(Total for question = 7 marks)

Q2.

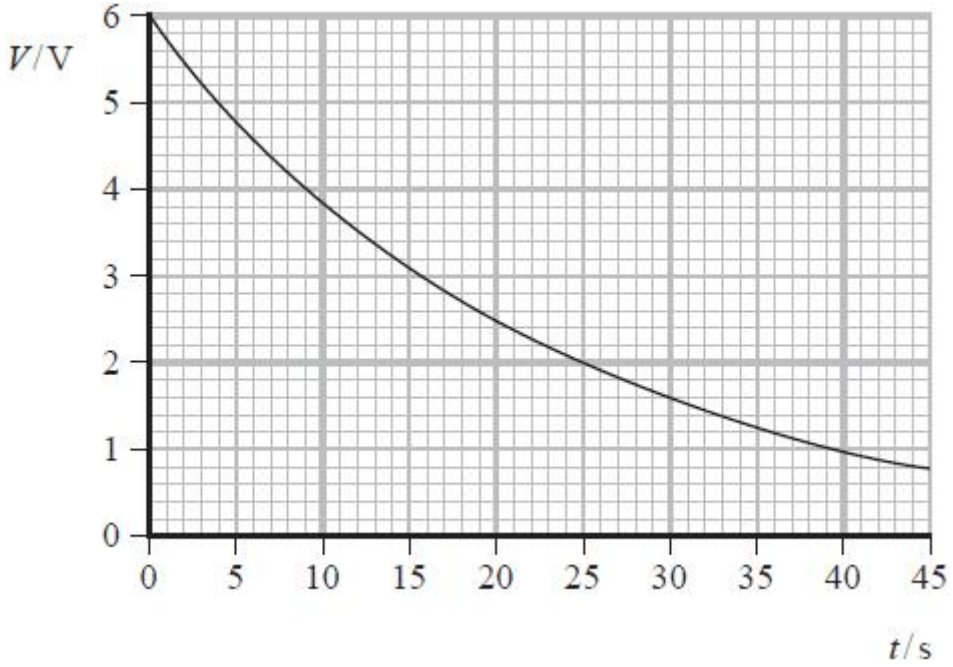
A student investigated the discharge of a capacitor C through a resistor R using the circuit shown.



The student used the switch to connect C to X to charge the capacitor. She then connected C to Y to discharge the capacitor through R.

As the capacitor discharged, she recorded values of the potential difference *V* across *C* and corresponding values of time *t*. She used a stopwatch to measure *t*.

The student used her results to plot the following graph.



The capacitor was marked 220 μF ± 20%.

Deduce whether the student's data give a value of capacitance within the stated range.

Downloaded from www.merit-minds.com

R = 82 kΩ

(5)

.....

.....

.....

.....

.....

.....

.....

.....

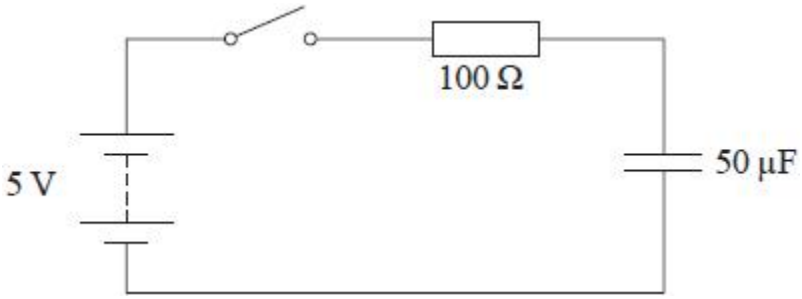
.....

.....

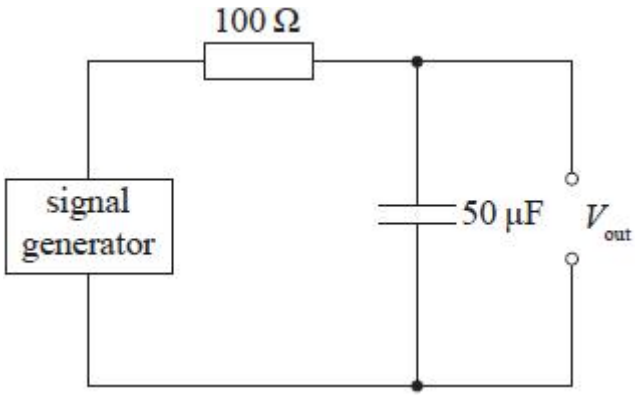
(Total for question = 5 marks)

Q3.

A circuit consists of a battery of e.m.f. 5 V and negligible internal resistance, a switch, a 100 Ω resistor and an uncharged 50 μF capacitor.

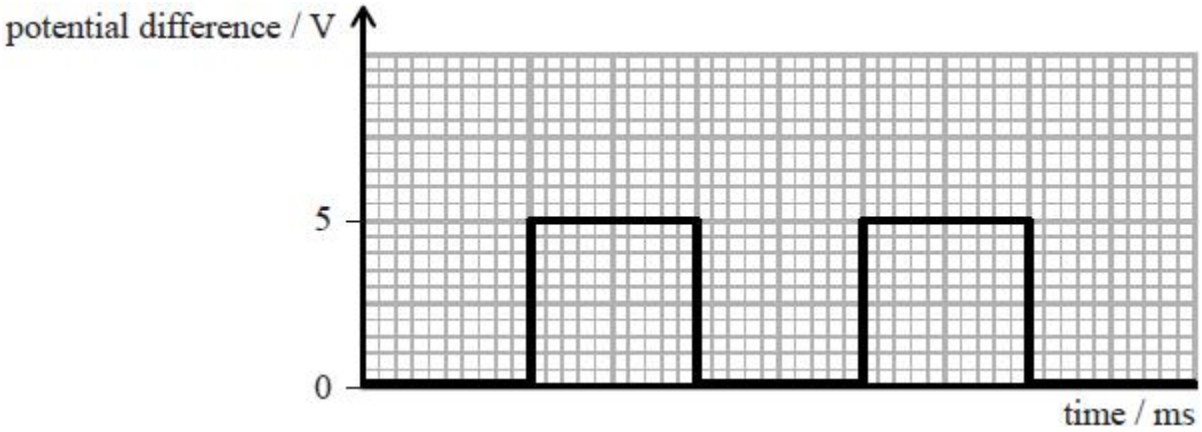


The battery and switch are replaced by a signal generator providing a square wave output of peak potential difference 5 V. The signal generator has negligible internal resistance.



The graph shows the square wave output of the signal generator. The frequency of the square wave is 20 Hz.

Downloaded from www.merit-minds.com



On the graph add values to the time axis and sketch a graph of the potential difference, V_{out}, across the capacitor for two cycles of the square wave. Assume the capacitor is initially uncharged.

(5)

.....

.....

.....

.....

.....

(Total for question = 5 marks)

Downloaded from www.merit-minds.com