Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

The harp is a musical instrument with many strings, as shown.



(Source: © Peter Voronov/Shutterstock)

All the strings are under tension.

The strings on one type of harp are made from nylon of density 1070 kg m^{-3}. One string has a diameter of 1.14 mm.

(i) Show that the mass per unit length μ of the string is about 1.1×10^{-3} kg m^{-1}.

(2)

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(ii) When the middle of the string is plucked, a note of frequency 440 Hz is produced.

Calculate the tension in the string.
length of string = 41.0 cm

(4)

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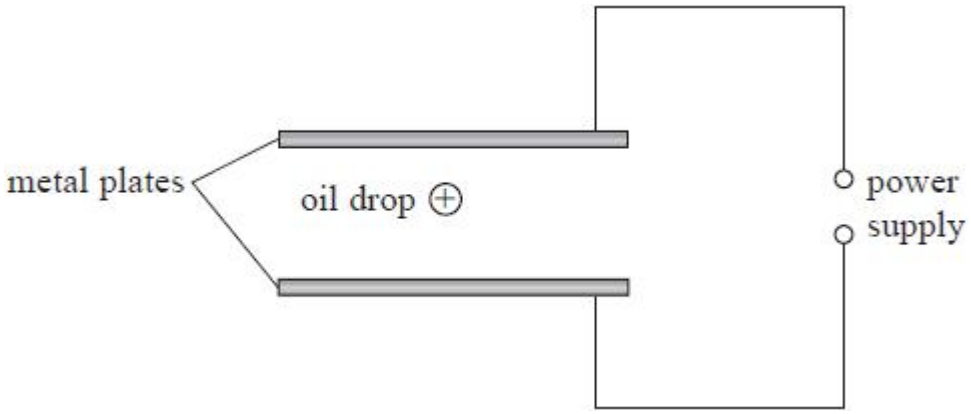
Tension in string = ...

(Total for question = 6 marks)

Q2.

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)

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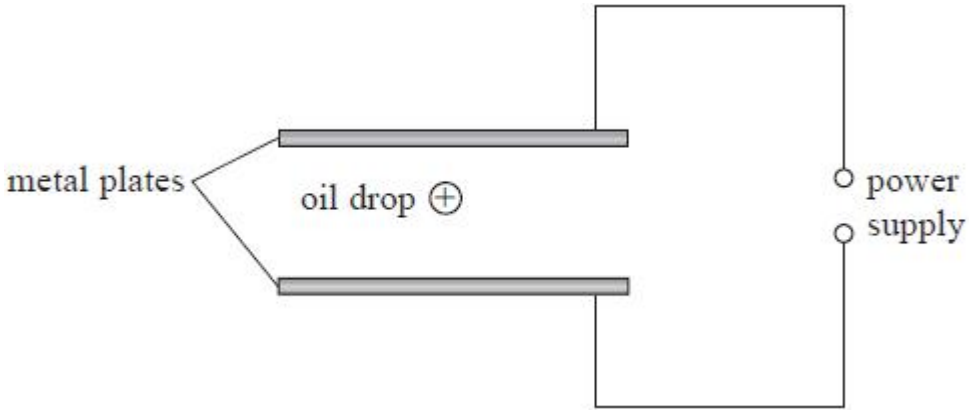
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(Total for question = 7 marks)

Q3.

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.



The student determined the terminal velocity of the oil drop in order to obtain a value for the weight of the oil drop.

He disconnected the power supply and the oil drop fell downwards. He viewed the oil drop through a microscope.

(i) Explain why the student should wait a short while before starting to take measurements.

(2)

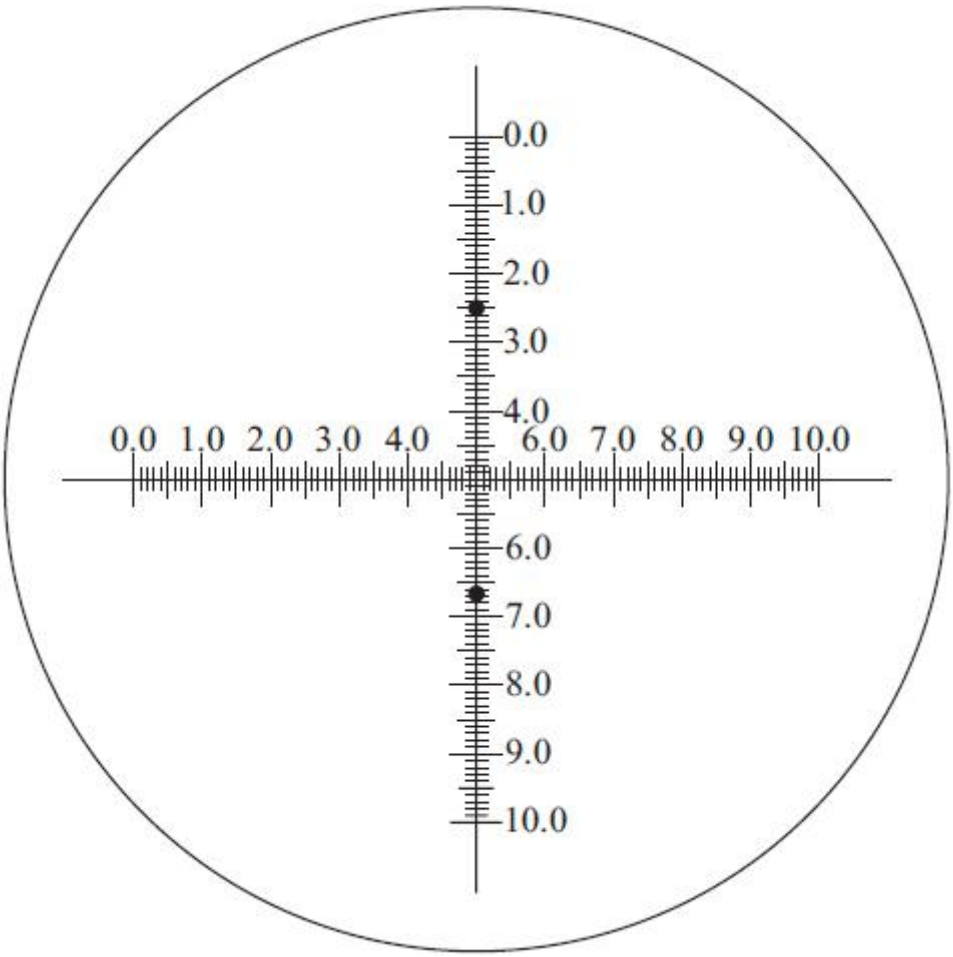
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(ii) The view through the microscope is shown below. The scale is in millimetres.

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The position of the oil drop at the start and end of a 120s time interval is indicated by the black dots.
Determine the terminal velocity of the oil drop.

(3)

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Terminal velocity = ...

(Total for question = 5 marks)

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