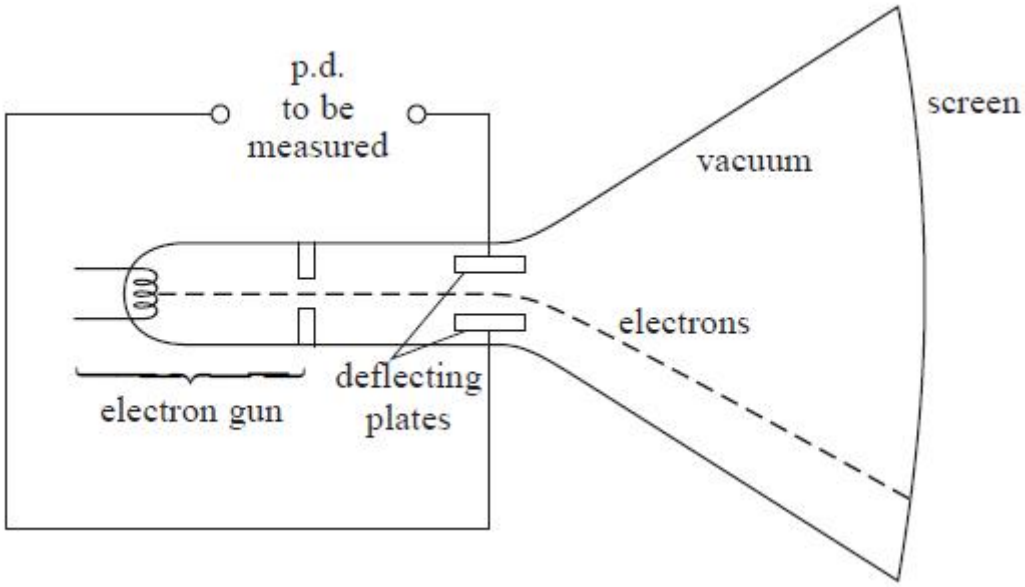
Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Q1.

Cathode ray tubes are used in oscilloscopes.

The diagram shows a simplified cathode ray tube that can be used to determine the magnitude and polarity of a potential difference (p.d.).

The cathode ray tube consists of an electron gun, a pair of deflecting plates and a fluorescent screen.



(a) The electron gun includes a filament. When this filament is heated, electrons are released and are accelerated by a p.d. of 1.5 kV to form an electron beam.

(i) Name the process by which electrons are released from the heated filament.

(1)

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(ii) Show that the maximum velocity of the electrons is about 2×10^7 m s^{-1}.

(2)

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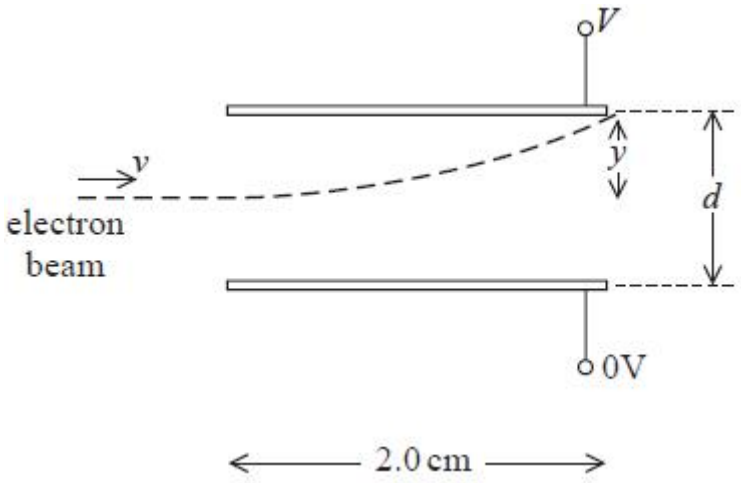
(b) The electron beam then enters a uniform electric field between the two parallel horizontal deflecting plates. The magnitude and direction of the deflection is determined by the p.d. *V* that is applied across the plates.

The diagram shows one possible path of the electron beam as it passes between the plates.



(i) Show that the acceleration of an electron, of mass *m* and charge *Q*, is given by

$$\frac{VQ}{dm}$$

(2)

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(ii) Calculate the magnitude of the vertical deflection y of the beam as it leaves the plates.
V = 50 V
d = 0.01 m

(5)

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y = ...

(c) A laboratory oscilloscope with the time base turned off operates in the same way as this simplified cathode

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ray tube. A student uses an oscilloscope in this way to monitor an alternating p.d. of 53 V_{rms}

On the grid, draw the trace that would be seen on the screen.

(4)

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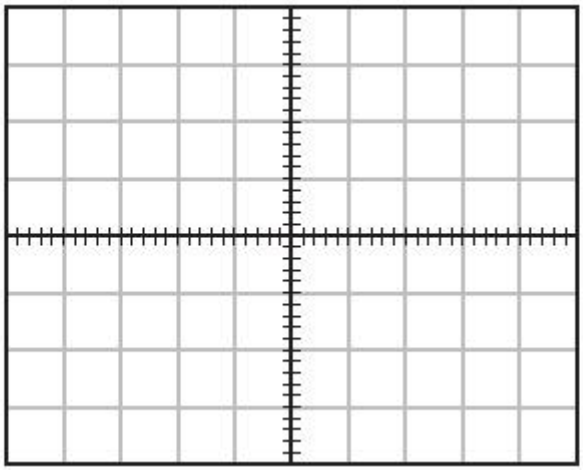


1 square = 25 V

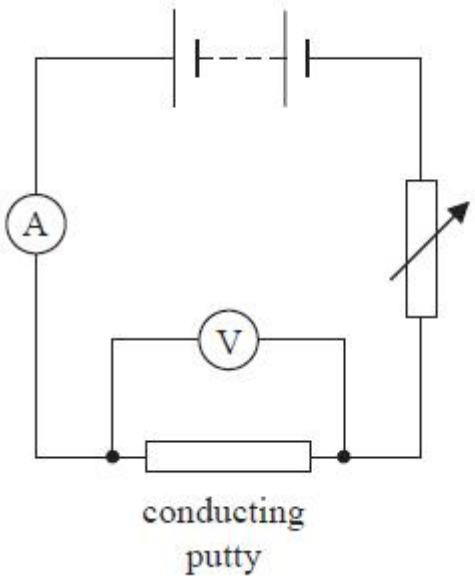
(Total for question = 14 marks)

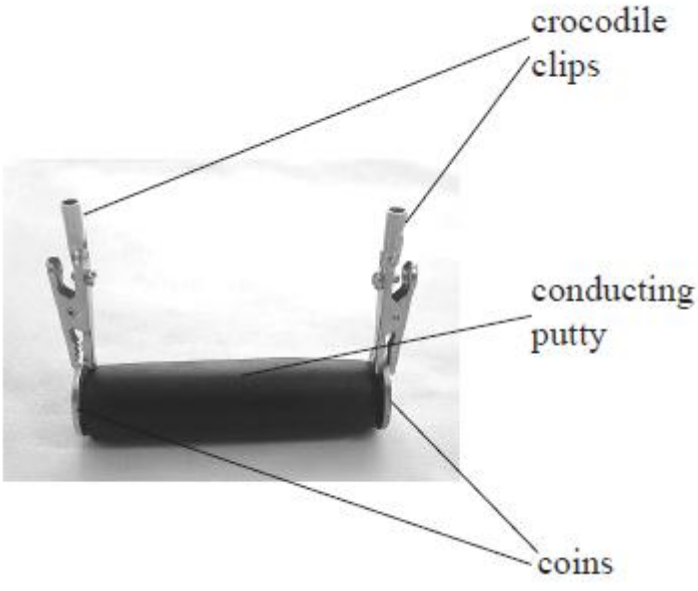
Q11.

Conducting putty is a material that is a relatively good conductor and can be easily moulded into different shapes.

A student decides to investigate how the resistance *R* of a cylinder of conducting putty depends upon the cross-sectional area *A* of the cylinder.

(a) She sets up the circuit shown and keeps the length *l* of the cylinder constant at 7.5 cm.
She uses the ammeter and voltmeter readings to determine the resistance of cylinders of different cross-sectional areas.





The student's results are shown in the table.

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Diameter / cm	Resistance / Ω	(l / A) / m^{-1}
0.4	56.0	1490
1.0	37.5	968
1.5	16.7	430
2.0	9.44	242
2.5	6.00	155

(i) Plot a graph of *R* against *l*/*A*.

(4)

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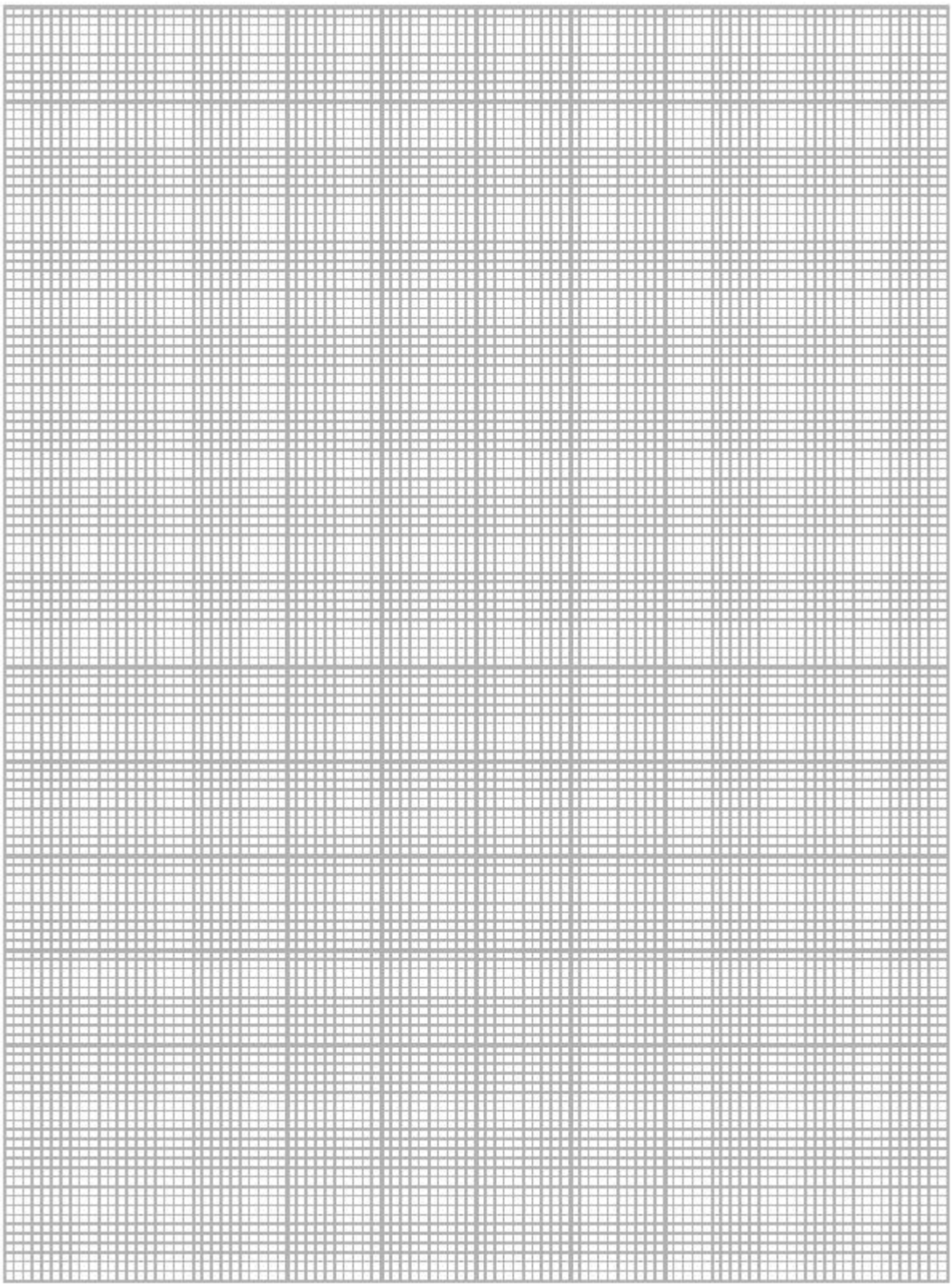

(ii) Use your graph to determine a value for the resistivity of the putty.

(2)

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Resistivity = ...

(b) The photographs show how the student obtained measurements for the length and diameter of a cylinder.

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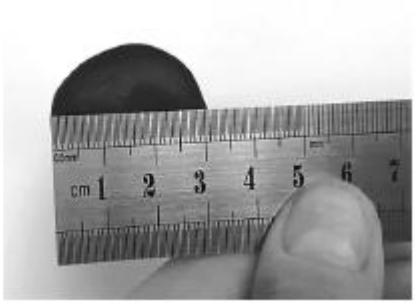

The student records the following readings:

length = 90 mm; diameter = 31 mm

Identify two problems with this method of determining the dimensions of the cylinder and for each problem identify a solution.

(4)

1

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2

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(Total for question = 10 marks)

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