Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

In 2010, Andre Geim and Konstantin Novoselov were awarded the Nobel Prize in Physics for producing, identifying and studying graphene.

Graphene is a form of carbon which exists only as a single atomic layer of graphite. It has a breaking stress of 130 GPa compared to 0.5 GPa for steel. Some scientists claim that graphene is the strongest material ever measured.

(a) Explain why graphene, despite its greater strength, is unlikely to replace steel in many applications.

(2)

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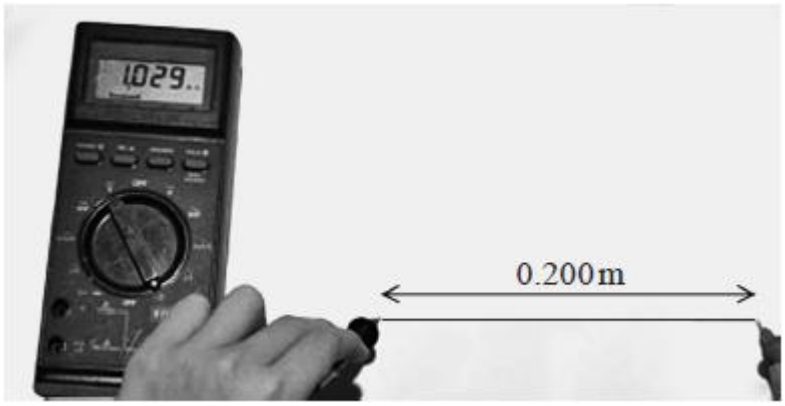
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(b) Graphite used in pencils consists of many layers of carbon. It can be assumed that a pencil deposits approximately 100 layers of carbon atoms when drawn across a piece of paper.

A student carried out an experiment to determine the resistivity of the graphite in a pencil.
A line of length 0.200m and width 0.50mm was drawn on a piece of paper. An ohmmeter was then used to measure the resistance of the graphite line.



Calculate the resistivity of graphite.
resistance = $1.029 \times 10^{6}\ \Omega$
diameter of carbon atom = 1.4×10^{-10} m

(4)

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Resistivity of graphite = ...

(c) Photocells traditionally use silicon to generate electricity using visible light. Research demonstrates that unlike silicon, graphene is able to respond at all wavelengths and releases multiple electrons as it absorbs one photon.

Deduce why it would be an advantage to use graphene in photocells to generate electricity.

(3)

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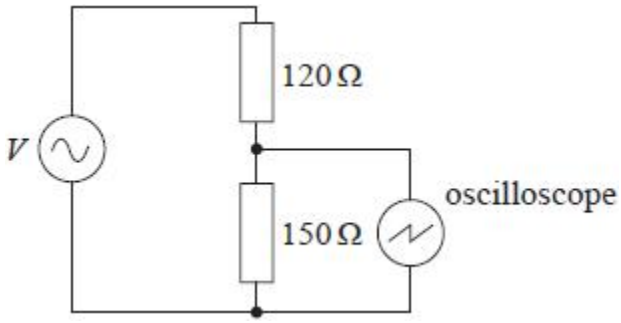
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(Total for question = 9 marks)

Q2.

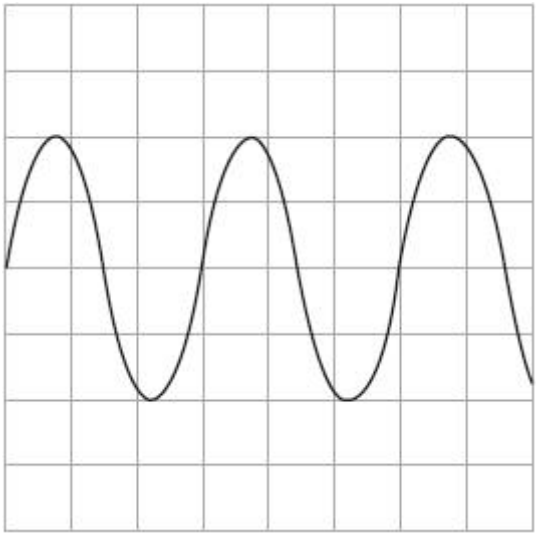
A student connected the output from a source of alternating potential difference (p.d.) to a series resistor combination.

She connected an oscilloscope across the 150 Ω resistor as shown.



The trace obtained on the oscilloscope is shown below.

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(i) Determine the peak p.d. across the 150 Ω resistor.

y-sensitivity of oscilloscope = 2.0 V per division

(2)

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Peak p.d. across 150 Ω resistor = ...

(ii) Calculate the root mean square (r.m.s.) value of the current in the circuit.

(3)

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r.m.s. value of current = ...

(iii) Calculate the power dissipated in the circuit.

(3)

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Power dissipated in circuit = ...

(Total for question = 8 marks)

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