AS Physics - Experiment Questions for Unit 2

1. Explain what is meant by the term **polarisation** when referring to light.

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(2)

Sugar is produced from plants such as sugar cane. The stems are crushed and the juice extracted. The concentration of sugar in the juice is used to value the crop.

The concentration can be determined using polarised light.

Explain how to measure the angle of rotation of polarised light when it passes through a sugar solution.

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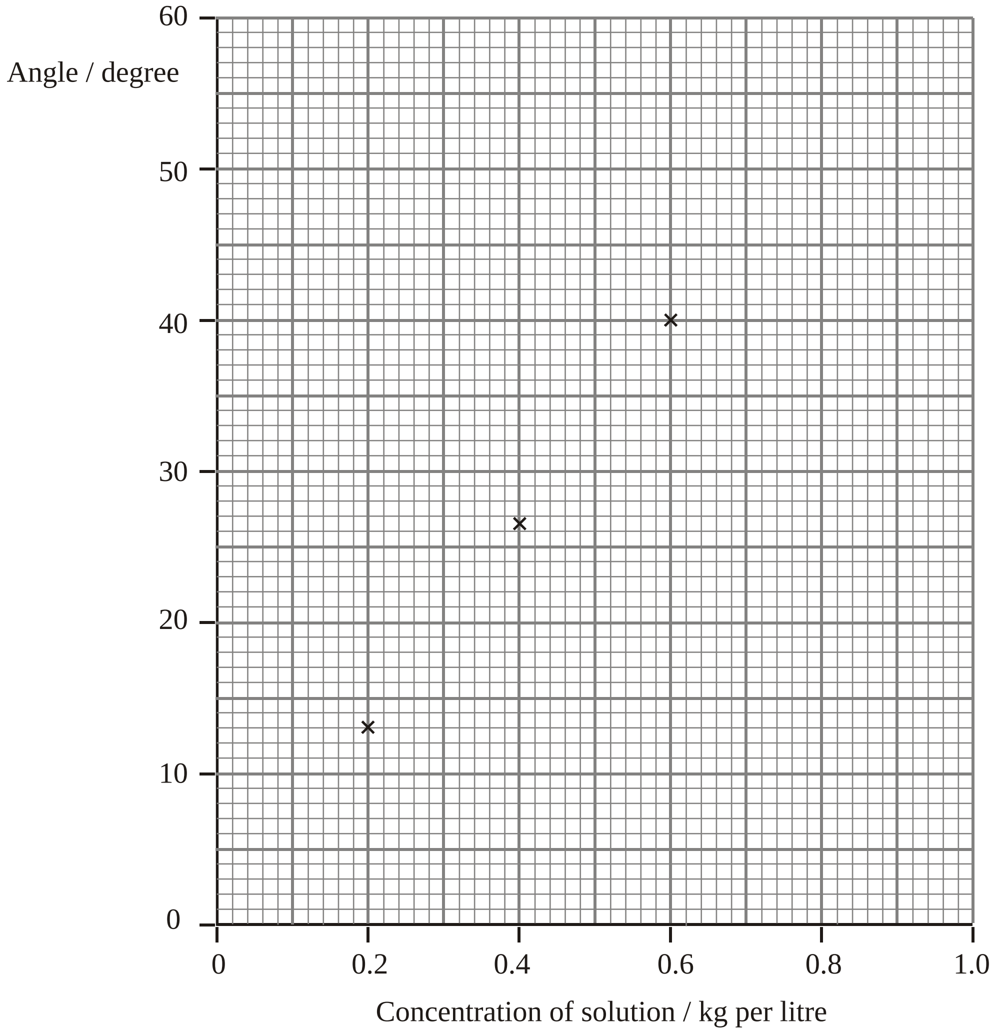
(4)

A student has carried out this experiment and obtains three results. He has plotted them on the graph below. He takes three more results and tabulates them.

Angle of rotation/degrees	Concentration of solution/ kg per litre
17	0.25
33	0.50
50	0.75

Add these results to the graph.

(3)



Use your graph to determine the concentration of an unknown sample which gives a rotation of 38°.

Concentration: .... kg per litre

(1)

The sugar produced is dissolved in water and then heated. It turns brown and becomes thick and viscous. If it is heated for a long time and then cooled it becomes hard and brittle.

What is meant by the terms viscous and brittle?

Viscous ....

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Brittle ....

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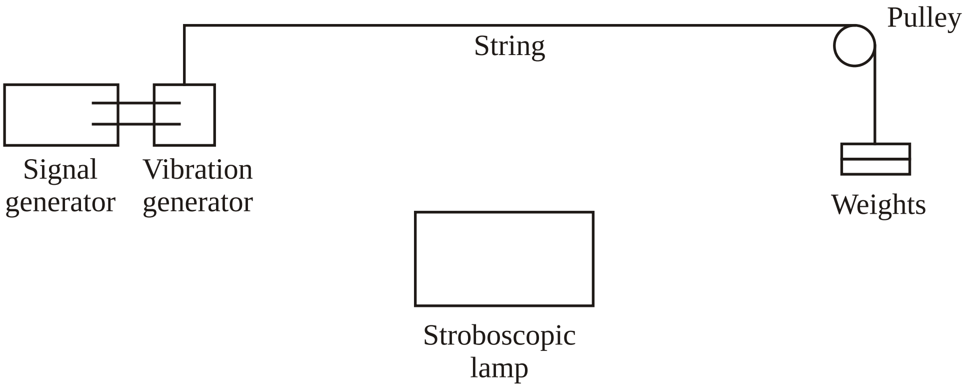
(2)
(Total 12 marks)

2. Some Physics students studying standing waves decide to play a trick on visitors to their Open Evening.

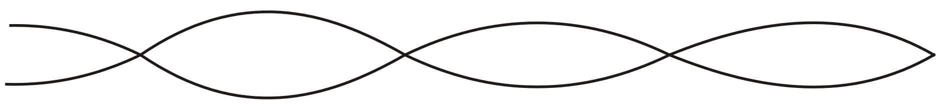
They set up the apparatus shown in Figure 1 in a dark corner of their laboratory.

Figure 1



They switch on the vibration generator and the stroboscopic lamp, which flashes on and off. The frequency of the flashing is adjusted until the illuminated portion of the string appears as in Figure 2.

Figure 2



The visitors are invited to put their fingers between the two 'strings' they think they see and are taken by surprise when it is impossible.

Explain how standing waves have been produced on the string.

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(3)

Mark one node with N and one antinode with A on Figure 2.

(1)

Add a labelled line to Figure 2 to show the wavelength.

(1)

The string vibrates at a frequency of 170 Hz. The stroboscopic lamp is flashing on and off at a frequency of 340 Hz. Explain why the string appears to be in two different positions at the same time as shown in Figure 2.

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(2)

Calculate the speed of the waves in the string.

Tension in string = 1.96 N

Mass per unit length of string = 6.00×10^{-4} kg m^{-1}

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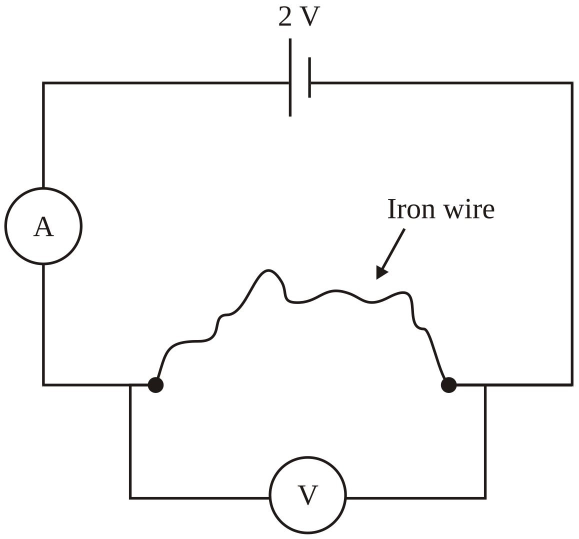
Speed = ...

(2)
(Total 9 marks)

3. A student carries out an experiment to determine the resistivity of iron using the circuit shown below.



He uses iron wire with a diameter of 0.50 mm.

Show that the cross-sectional area of this wire is about 2×10^{-7} m^2.

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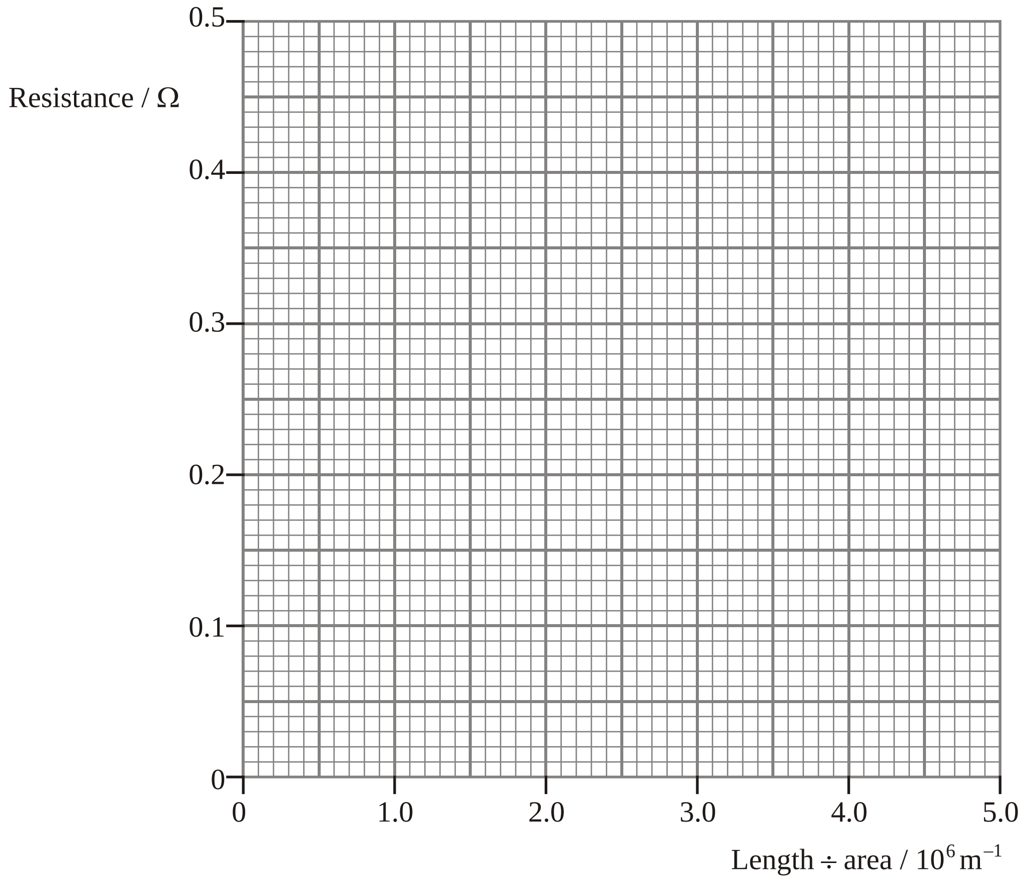
(2)

The table shows the results he obtained.

Resistance / Ω	Length / m	Length ÷ area /10^6 m^{-1}
0.00	0.00	
0.10	0.10	
0.14	0.20	
0.18	0.30	
0.24	0.40	
0.30	0.50	
0.36	0.60	
0.42	0.70	
0.48	0.80	

Complete the third column and use the data to plot a graph of resistance against length ÷ area on the grid below.



(3)

Draw the line of best fit and use this to calculate the resistivity of iron.

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Resistivity = ...

(4)

Suggest an explanation for the anomalous results obtained in this experiment.

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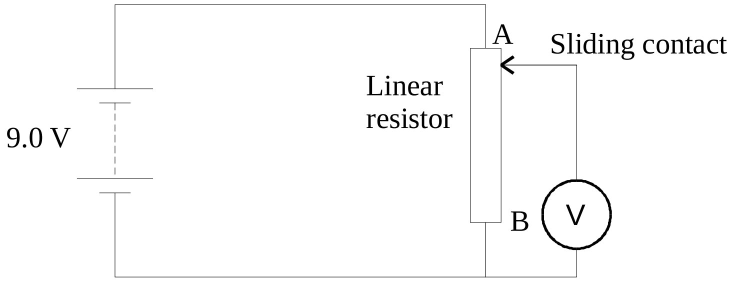
(2)
(Total 11 marks)

4. A student wants to provide lighting for a model house which she has made. She needs 3.0 V for her lamps but only has a 9.0 V battery, so uses a linear resistor AB in the circuit below. The linear resistor is made from a high resistance uniform conductor.



What is the name of the device AB when it is used in this manner?

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(1)

State the voltmeter reading when the sliding contact is at:

A .... B ....

(2)

The student moves the sliding contact until the voltmeter reads 3.0 V.

Add an arrow labelled X to the diagram to show where the sliding contact must be placed.

(1)

The student replaces the voltmeter with a 3.0 V lamp but the lamp does not light. Explain why the lamp does not light.

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(3)

(Total *7* marks)

5. The table gives the resistivities of five different materials:

Material	Resistivity/ Ω m
Copper	1.8×10^{-8}
Iron	1.2×10^{-7}
Carbon	1.4×10^{-5}
Silicon	2.3×10^{3}
Glass	1.0×10^{12}

Explain what type of scale you would need to use to plot these values of resistivity on a graph.

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(2)

A student needs to make a 0.12 Ω resistor. She has some copper wire of diameter 0.80 mm.

(i) Show that the cross-sectional area of the wire is about 5×10^{-7} m^2

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(2)

(ii) Calculate the length of wire she needs for the 0.12 Ω resistor.

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(3)

What would be the advantage of making the resistor from iron wire of the same diameter?

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(1)

(Total 8 marks)

6. The following notes are taken from some laboratory instructions for using an ohmmeter to measure resistance.

- Ohmmeters should be zeroed. To do this, touch the leads together and adjust the meter to read zero ohms.
- The ohmmeter works by placing a small voltage across the resistor. The current that flows in response to this voltage determines the ohmmeter reading.
- Do not measure the resistance of a resistor while it is in a circuit.

Explain why touching the leads together allows the meter to be zeroed.

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(1)

An ohmmeter is connected across a resistor. The ohmmeter applies a voltage of 0.54 V. The current through the meter is 0.0081 A. Show that the resistance being measured is about 70 Ω.

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(2)

Explain why, when using an ohmmeter, the resistance of the resistor should not be measured while it is in a circuit.

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(2)

By connecting the ohmmeter across a coil of thin copper wire, temperature changes can be detected.

Explain how, as the temperature rises, changes in the copper lead to changes in the meter reading.

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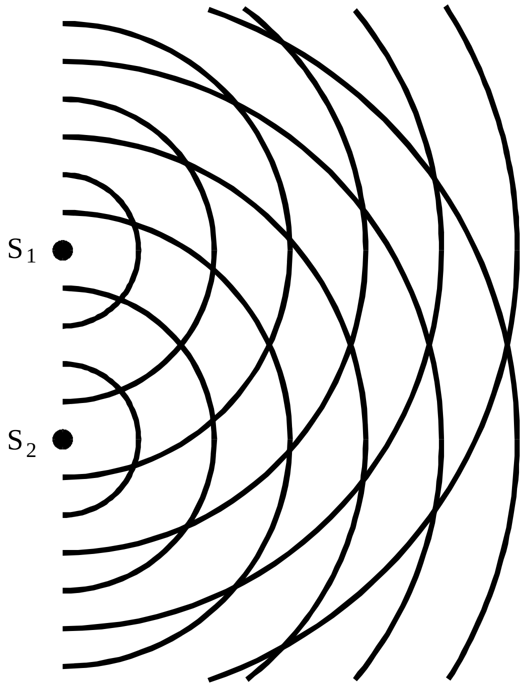
(3)
(Total 8 marks)

7. The diagram shows wavefronts spreading out from two identical sources, S_1 and S_2.



Describe how such a pattern could be produced and observed using a ripple tank.

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(5)

On the diagram draw the following:

(i) a line labelled A joining points where the waves from S_1 and S_2 have travelled equal distances,

(ii) a line labelled B joining points where the waves from S_1 have travelled one wavelength further than the waves from S_2,

(iii) a line labelled C joining points where the waves from S_2 have travelled half a wavelength further than the waves from S_1.

(4)

Complete each of the sentences below by selecting an appropriate term from the following:

increase
decrease
stay the same

If only the separation of the sources were increased, the angle between lines A

and B would..

If only the wavelength of the waves were increased, the angle between lines A

and B would..

If only the depth of the water in the ripple tank were increased, the angle between lines A

and B would..

(3)
(Total 12 marks)

8. (a) The shaded square in the diagrams represents a piece of resistance paper. The surface of the paper is coated with a conducting material. In the figure below two metal electrodes E_1 and E_2 are placed on the resistance paper and connected to a battery.

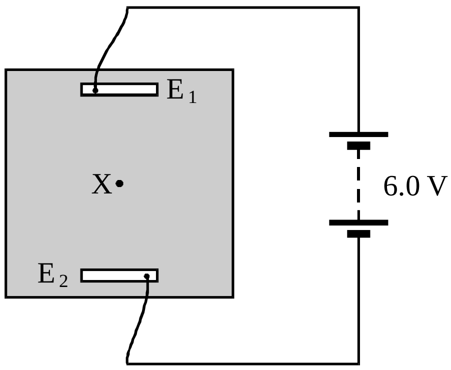


Figure 1

(i) Sketch the electric field in the region between E_1 and E_2.

(ii) E_1 and E_2 are 15 cm apart. What is the strength of the electric field at X, a point half-way between them?

(iii) Add and label three equipotential lines in the region between E_1 and E_2.

(7)

(b) Figure 2 shows two 470 Ω resistors and a milliammeter connected to the initial arrangement. The other side of the milliammeter is connected to a metal probe which makes contact with the surface of the resistance paper.

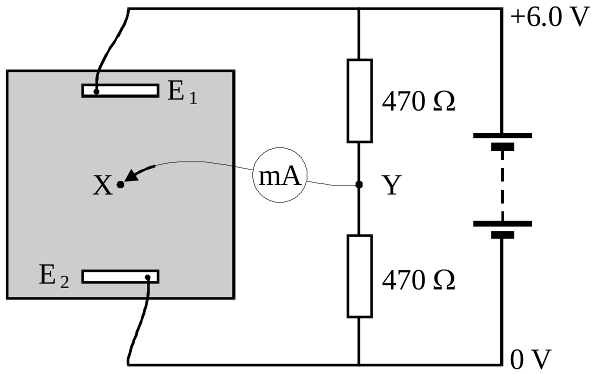


Figure 2

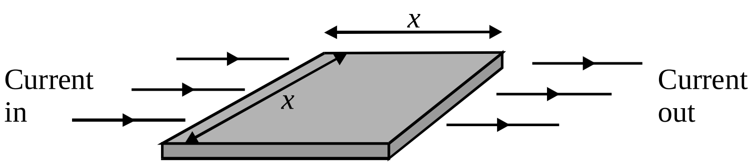
(i) The metal probe is moved over the resistance paper surface. When the probe is at X the milliammeter registers zero. State the potential at X and explain why the milliammeter registers zero.

(ii) Describe how you would adapt the apparatus to find the potentials at other points on the resistance paper.

(5)

(c) The resistance of a square piece - a tile - of the resistance paper is given by $R = \rho/t$, where ρ is the resistivity and t the thickness of the material forming the conducting layer.

(i) By considering a square of side x as shown, prove that $R = \rho/t$, i.e. that the resistance of the tile is independent of the size of the square.



(ii) Calculate the resistivity of a material of thickness 0. 14 mm which has a resistance of 1000 ohms for a square of any size.

(4)
(Total 16 marks)

9. Define the term **e.m.f. of a cell**.

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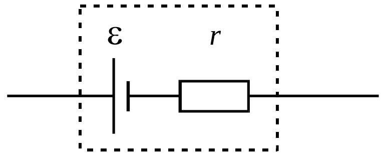
(2)

A student wants to use a graphical method to determine the internal resistance r of a cell of known e.m.f. ε.

Complete the diagram below showing how the cell should be connected in a circuit to allow the student to do this.



(2)

Sketch the graph the student should plot and state how she could determine r from the graph.

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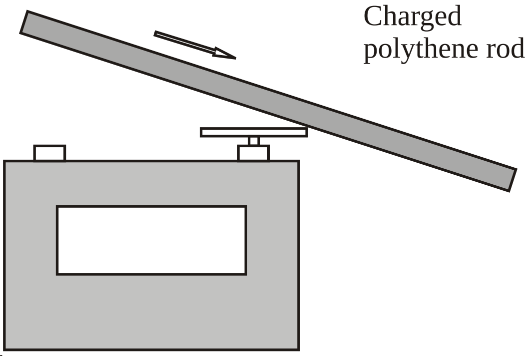
(2)

(Total 6 marks)

10. A polythene rod was negatively charged by rubbing it with a cloth. The rod was then stroked several times across the metal cap of a meter used for measuring charge.



The initial reading on the meter was zero.

After 3.8 s the final reading was -6.4×10^{-8} C.

Calculate the number of electrons that were transferred to the metal cap.

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Number of electrons = …………………………

(3)

Calculate the average rate in C s^{-1} at which charge was transferred to the metal cap.

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Rate = …………………………………… C s^{-1}

(2)

State the base unit for the rate of flow of charge.

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(1)

(Total 6 marks)