Additional Assessment Materials

Summer 2021

Pearson Edexcel GCE A Level Physics

Topic 3: Electric Circuits

Test 1

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1

11 A "metre bridge" is a circuit which can be used to measure an unknown resistance accurately. The metre bridge includes a metre length of nichrome wire.

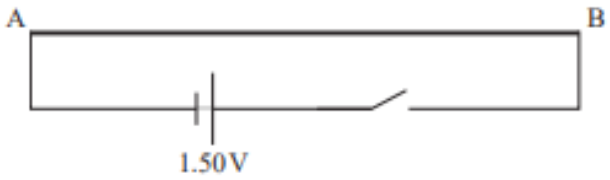
(a) Calculate the resistance of a 1.00 m length of the nichrome wire.

(3)

resistivity of nichrome = 1.12×10^{-6} Ωm
diameter of wire = 4.00×10^{-4} m

Resistance = ...

(b) This metre length of wire, labelled AB, is connected to a 1.50 V cell of negligible internal resistance and a switch as shown.



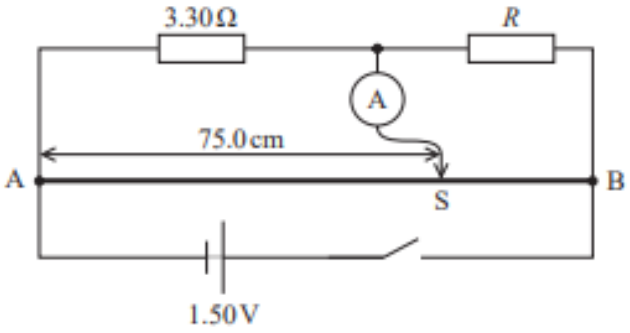
(i) Explain how the potential along this wire varies with distance from A when the switch is closed.

(2)

(ii) Show that the potential difference between A and a point 75.0 cm along the wire from A is about 1.1 V.

(2)

(c) The metre bridge circuit is shown. The circuit includes a resistor of resistance 3.30 Ω, a very sensitive ammeter and a resistor of unknown resistance R.



A metal slider S can be moved along the nichrome wire and pressed firmly against it to make an electrical connection.

When the switch is closed and S is 75.0 cm along the nichrome wire, the ammeter reads 0 A because the potential difference across the ammeter is zero.

Calculate R.

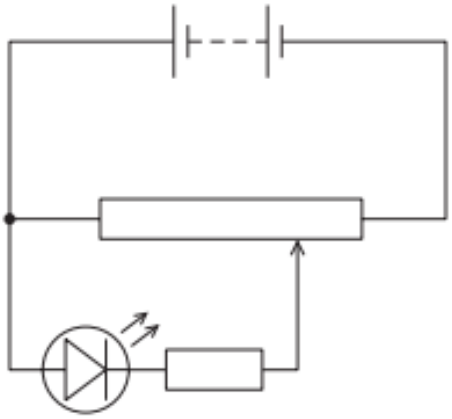
(2)

$R =$ .....

(Total for Question 11 = 9 marks)

2

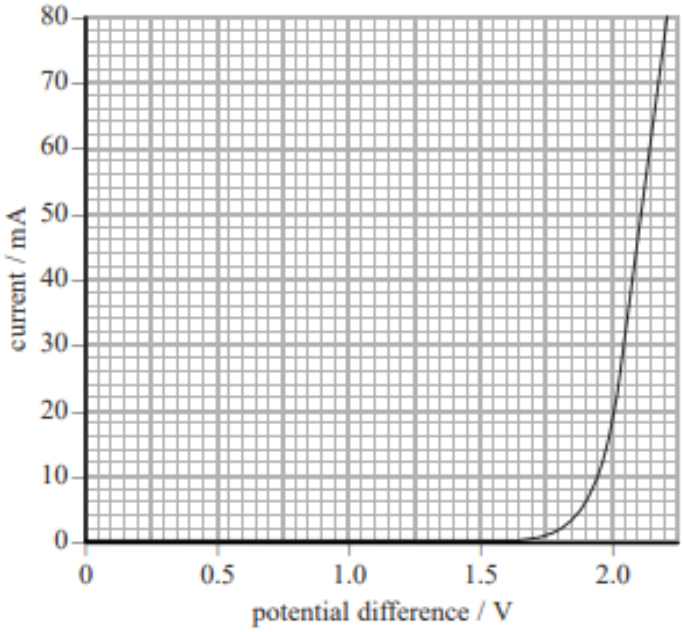
8 A student wanted to plot a graph of current against potential difference for a light emitting diode (LED). He used the circuit shown.



(a) Add an ammeter and a voltmeter to the circuit diagram that would enable the data to be collected.

(1)

(b) The graph of current against potential difference obtained by the student is shown.



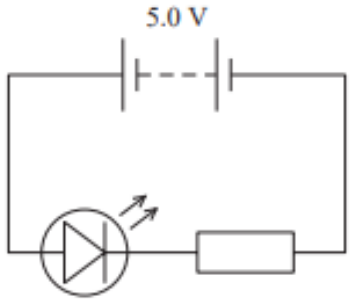
(i) The student wrote the following conclusion.

"The graph shows that in general the LED is not an ohmic conductor. However, for potential differences greater than +2 V, Ohm's law is obeyed since the graph is linear in this region."

Criticise the student's conclusion.

(2)

(ii) The student used the LED with a 5.0 V power supply as shown in the circuit.



To be lit to normal brightness the current through the LED must be 18 mA.

Calculate the resistance of the resistor needed in the circuit.

(4)

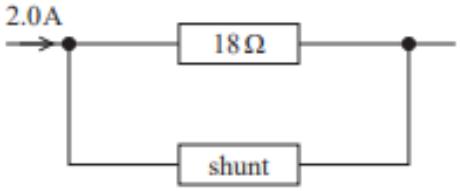
Resistance = ...

(Total for Question 8 = 7 marks)

12 Analogue ammeters were used before digital meters became widely available.
The analogue ammeter shown will measure a maximum current of 1.0 mA and has a resistance of 18 Ω.

(Source: © David J. Green/Alamy Stock Photo)

The analogue ammeter can be adapted to measure a larger current by adding a resistor, known as a shunt, in parallel with the ammeter. The arrangement is shown below.
The analogue ammeter is represented by the 18 Ω resistor.



The maximum current through the 18 Ω resistor remains as 1.0 mA.

(a) Show that the shunt would need to have a resistance of about 0.01 Ω to adapt this ammeter to read up to a maximum current of 2.0 A.

(3)

(b) A shunt of this resistance was usually made from Manganin wire.

Calculate the length of Manganin wire of radius 0.95 mm required to make this shunt.

resistivity of Manganin = $4.55 \times 10^{-7}\,\Omega\,m$

(3)

Length = ...

(Total for Question 12 = 6 marks)

TOTAL FOR PAPER IS 22 MARKS