WJEC 2014 Online Exam Review

GCE Physics PH3 1302-01

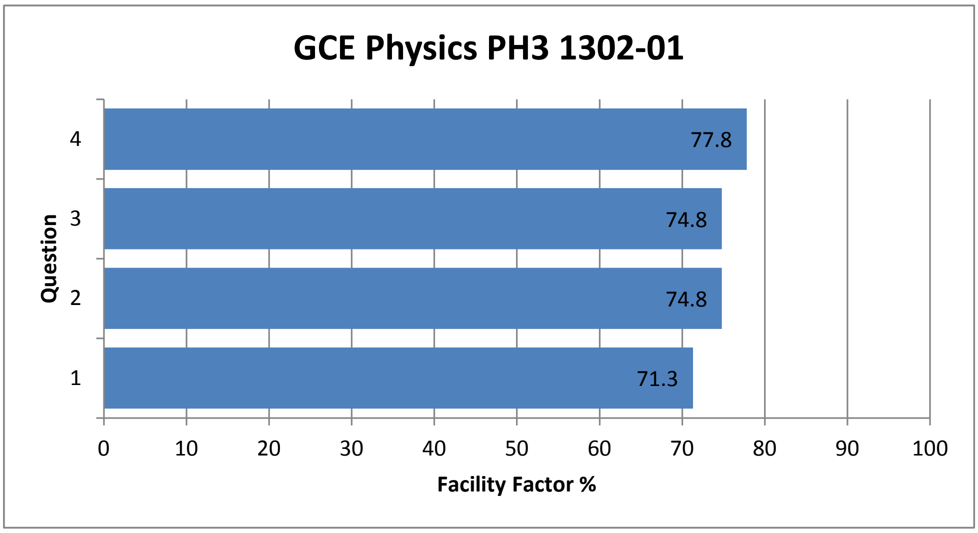
All Candidates' performance across questions

Question Title	N	Mean	S D	Max Mark	F F	Attempt %
1	3094	5.7	1.9	8	71.3	100
2	3094	6	1.7	8	74.8	100
3	3094	6	1.7	8	74.8	100
4	3094	18.7	3.9	24	77.8	100

A1

B4a

B4eii



Examiner only

SECTION A

Task A1 (15 minutes)
In this task you will determine the volume of a glass block. **Repeat readings are not required for this task.**

(a) By taking appropriate measurements, determine the volume of the block. [2]

....

....

....

....

(b) Calculate the **percentage** uncertainty in the volume. [3]

....

....

....

....

....

(c) (i) Calculate the **absolute** uncertainty in the volume. [1]

....

....

(ii) Quote both the volume along with its absolute uncertainty to an appropriate number of significant figures. [1]

....

....

(d) State clearly how you could reduce the absolute uncertainty in the volume. [1]

....

....

1323 01A005

Examiner only

SECTION A

Task A1 (15 minutes)
In this task you will determine the volume of a glass block. **Repeat readings are not required for this task.**

(a) By taking appropriate measurements, determine the volume of the block. [2]

length = 11.6 cm
width = 6.5 cm
height = 1.9 cm
Volume = length × width × height = 11.6 × 6.5 × 1.9 = 143.26 cm^3
= ~~143.26 cm~~ = 140 cm^3 (2sf)

(b) Calculate the **percentage** uncertainty in the volume. [3]

absolute uncertainty for all measurements = 1 mm = 0.1 cm
% uncertainty of length = $\frac{0.1}{11.6}$ × 100 = 0.862 % (3sf)
% uncertainty of width = $\frac{0.1}{6.5}$ × 100 = ~~1.538~~ 1.54% (3sf)
% uncertainty of height = $\frac{0.1}{1.9}$ × 100 = 5.26 % (3sf)
uncertainty of volume = 0.862 + 1.54 + 5.26 = 7.663688399...
= 7.66% (3sf)

(c) (i) Calculate the **absolute** uncertainty in the volume. [1]

absolute uncertainty = $\frac{7.66}{100}$ × 143.26
= 10.979 cm^3 = 10 cm^3 (1sf)

(ii) Quote both the volume along with its absolute uncertainty to an appropriate number of significant figures. [1]

Volume = ~~140 cm~~ 140 ± 10 cm^3

(d) State clearly how you could reduce the absolute uncertainty in the volume. [1]

Use more than one block to take measurements of length, width and height, so the ~~absolute~~ percentage uncertainty of each measurement is lower, so the percentage uncertainty of the volume is lower and therefore the ~~absolute~~ absolute uncertainty will be reduced. You could also use a measuring device with a ~~smaller absolute uncertainty~~ ~~greater precision~~ smaller resolution e.g. a Vernier Calliper.

1323
01A005

Examiner only

SECTION A

Task A1 (15 minutes)
In this task you will determine the volume of a glass block. **Repeat readings are not required for this task.**

(a) By taking appropriate measurements, determine the volume of the block. [2]

length = 11.6 cm
width = 6.5 cm
height = 1.9 cm
Volume = length × width × height = 11.6 × 6.5 × 1.9 = 143.26 cm³
= 140 cm³ (2sf)

(b) Calculate the **percentage** uncertainty in the volume. [3]

absolute uncertainty for all measurements = 1 mm = 0.1 cm
% uncertainty of length = $\frac{0.1}{11.6} \times 100$ = 0.862 % (3sf)
% uncertainty of width = $\frac{0.1}{6.5} \times 100$ = ~~1.538~~ 1.54% (3sf)
% uncertainty of height = $\frac{0.1}{1.9} \times 100$ = 5.26 % (3sf)
uncertainty of volume = 0.862 + 1.54 + 5.26 = 7.663688399...
= 7.66% (3sf)

(c) (i) Calculate the **absolute** uncertainty in the volume. [1]

absolute uncertainty = $\frac{7.66}{100} \times 143.26$
= 10.979 cm³ = 10 cm³ (1sf)

(ii) Quote both the volume along with its absolute uncertainty to an appropriate number of significant figures. [1]

Volume = ~~140 cm~~ 140 ± 10 cm³

(d) State clearly how you could reduce the absolute uncertainty in the volume. [1]

Use more than one block to take measurements of length, width and height, so the ~~absolute~~ percentage uncertainty of each measurement is lower, so the percentage uncertainty of the volume is lower and therefore the ~~absolut~~ absolute uncertainty will be reduced. You could also use a measuring device with a ~~smaller absolute uncertainty~~ ~~greater precision~~ smaller resolution e.g. a Vernier Calliper.

1323 01A005

Examiner only

SECTION A

Task A1 (15 minutes)
In this task you will determine the volume of a glass block. **Repeat readings are not required for this task.**

(a) By taking appropriate measurements, determine the volume of the block. [2]

Width 115 mm

Length 74 mm

Height 15 mm

115 × 74 × 15 = 127650 mm³ = 127.65 cm³

(b) Calculate the **percentage** uncertainty in the volume. [3]

$\frac{1}{115}$ + $\frac{1}{74}$ + $\frac{1}{15}$ = 8.89 % (2.dp)

Percentage uncertainty in width

Percentage uncertainty in length

Percentage uncertainty in height.

(c) (i) Calculate the **absolute** uncertainty in the volume. [1]

8.89% × 127.65 = ±11.345 cm³

(ii) Quote both the volume along with its absolute uncertainty to an appropriate number of significant figures. [1]

127.65 cm³ ± 11.35 cm³ (2.d.p)

(d) State clearly how you could reduce the absolute uncertainty in the volume. [1]

By using rule scales of ± 1mm rather than ± 0.5 cm.

1323
01A005

Examiner only

SECTION A

Task A1 (15 minutes)
In this task you will determine the volume of a glass block. **Repeat readings are not required for this task.**

(a) By taking appropriate measurements, determine the volume of the block. [2]

Width 115 mm

Length 74 mm

Height 15 mm

115 × 74 × 15 = 127650 mm³ = 127.65 cm³

(b) Calculate the **percentage** uncertainty in the volume. [3]

$\frac{1}{115} + \frac{1}{74} + \frac{1}{15} = 8.89\%$ (2.dp)

Percentage uncertainty in width
Percentage uncertainty in length
Percentage uncertainty in height.

(c) (i) Calculate the **absolute** uncertainty in the volume. [1]

8.89% × 127.65 = ±11.345 cm³

(ii) Quote both the volume along with its absolute uncertainty to an appropriate number of significant figures. [1]

127.65 cm³ ± 11.35 cm³ (2.d.p)

(d) State clearly how you could reduce the absolute uncertainty in the volume. [1]

By using rule scales of ± 1mm rather than ± 0.5 cm.

2 3 1 0 0 6

1323
01A005

SECTION A

Task A1 (15 minutes)
In this task you will determine the volume of a glass block. **Repeat readings are not required for this task.**

(a) By taking appropriate measurements, determine the volume of the block. [2]

Volume = l × b × h Length = 11.5 cm

= 11.5 × 6.6 × 1.8 Bredth = 6.6 cm

= 136.62 cm³ (to 2dp) height = 1.8 cm

(b) Calculate the **percentage** uncertainty in the volume. [3]

$P = \frac{u}{x} \times 100\%$

$= \frac{0.1}{11.5+6.6+1.8} \times 100\%$

$= 0.5\%$

(c) (i) Calculate the **absolute** uncertainty in the volume. [1]

$u = \frac{0.1}{2} = 0.05\,cm \pm 0.1\,cm$

(ii) Quote both the volume along with its absolute uncertainty to an appropriate number of significant figures. [1]

Volume = 136.62 cm³ 136.00 cm³ (to 3SF)

absolute uncertainty = 0.05 cm 0.05 cm (to 3SF)

(d) State clearly how you could reduce the absolute uncertainty in the volume. [1]

By measuring the blocks dimensions using a digital Caliper. ~~Therefore the resolution is ...~~ Rather than a ruler, as there is a different resolution.

Examiner only

SECTION A

Task A1 (15 minutes)
In this task you will determine the volume of a glass block. **Repeat readings are not required for this task.**

(a) By taking appropriate measurements, determine the volume of the block. [2]

Volume = l × b × h
= 11.5 × 6.6 × 1.8
= 136.62 cm³ (to 2dp) ✓✓

Length = 11.5 cm
Breadth = 6.6 cm
height = 1.8 cm

2

(b) Calculate the **percentage** uncertainty in the volume. [3]

$p = \frac{u}{x} \times 100\%$ ✓

$= \frac{0.1}{11.5+6.6+1.8} \times 100\%$

= 0.5%

Ø 1

(c) (i) Calculate the **absolute** uncertainty in the volume. [1]

$u = \frac{0.1}{2}$ = 0.05 cm ± 0.1 cm ✗

0

(ii) Quote both the volume along with its absolute uncertainty to an appropriate number of significant figures. [1]

Volume = 136.62 cm³   136.00 cm³ (to 3SF)
absolute uncertainty = 0.05 cm   0.05 cm (to 3SF)

0

(d) State clearly how you could reduce the absolute uncertainty in the volume. [1]

By measuring the blocks dimensions using a digital Caliper. ~~Therefore the resolution is often~~ Rather than a ruler, as there is a different resolution. ✓

1

4

Examiner only

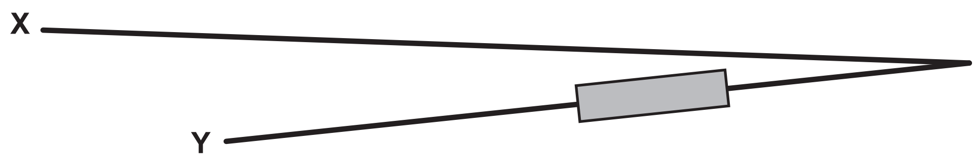
SECTION B

Task B4 (45 minutes)

Two wires of different materials are joined together. You are going to carry out an investigation to determine the position of the join.

Repeat readings are not required for this task. An additional measurement is required for part *(e)*(ii).

(a) (i) Complete the following diagram to show the circuit that has been set up for you. [2]



(ii) Write a plan to describe how you would use your circuit to investigate how resistance varies with length starting from point **X**. [3]

....

....

....

....

....

....

Examiner only

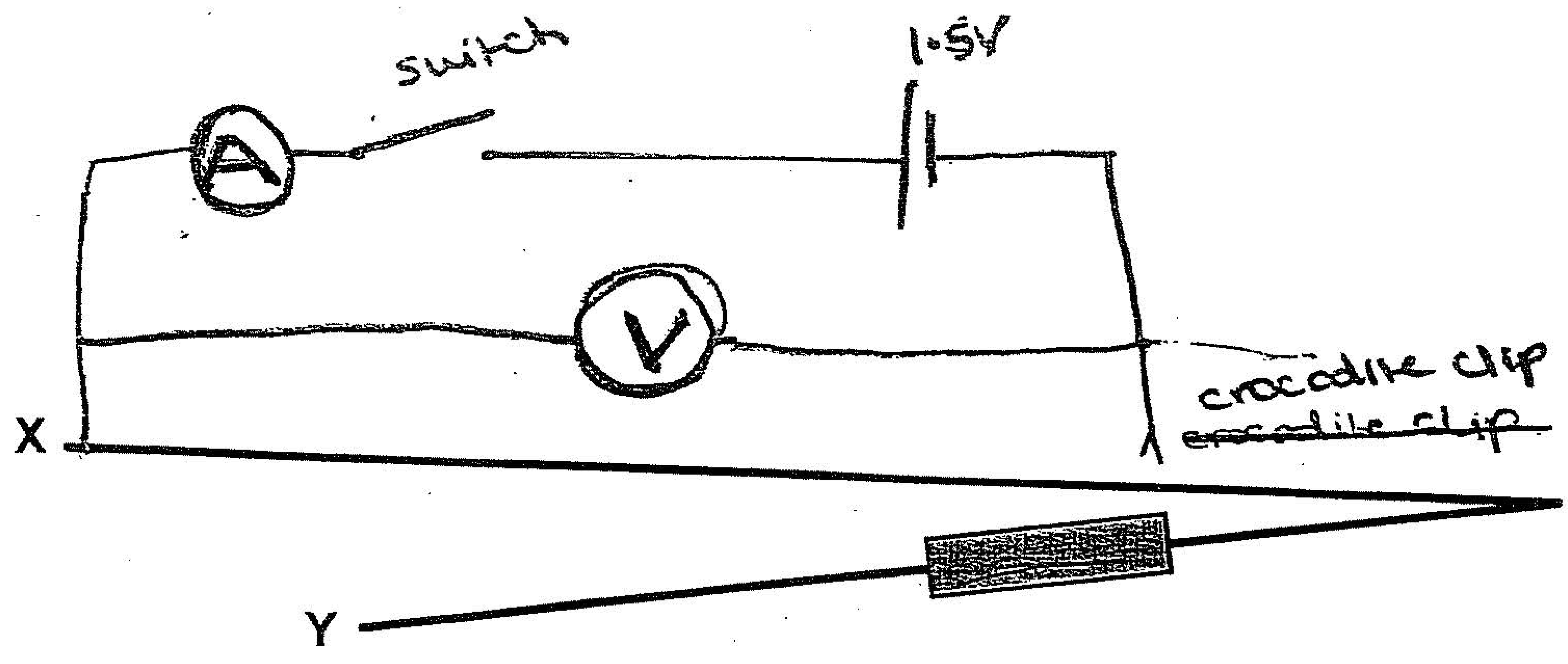
SECTION B

Task B4 (45 minutes)

Two wires of different materials are joined together. You are going to carry out an investigation to determine the position of the join.

Repeat readings are not required for this task. An additional measurement is required for part *(e)*(ii).

(a) (i) Complete the following diagram to show the circuit that has been set up for you. [2]



(ii) Write a plan to describe how you would use your circuit to investigate how resistance varies with length starting from point X. [3]

I will clip the crocodile ~~cord~~ clip at ~~pretty~~ equal distances (16 cm) from x to y. At each clip I will flick the switch to connect the full circuit and measure the ~~voltage~~ p.d voltage and current using the voltmeter and ammeter. from this I can calculate the resistance using $R=\frac{V}{I}$. then plot a graph of distance against resistance. ~~I will do one time~~

Examiner only

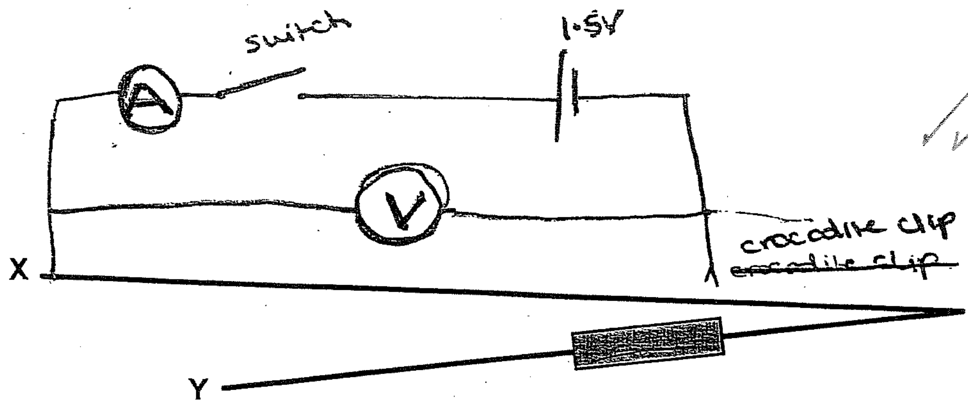
SECTION B

Task B4 (45 minutes)

Two wires of different materials are joined together. You are going to carry out an investigation to determine the position of the join.

Repeat readings are not required for this task. An additional measurement is required for part *(e)*(ii).

(a) (i) Complete the following diagram to show the circuit that has been set up for you. [2] 2



(ii) Write a plan to describe how you would use your circuit to investigate how resistance varies with length starting from point **X**. [3] 3

I will clip the crocodile clip ~~cord~~ at ~~pretty~~ equal distances (16 cm) from x to y. At each clip I will flick the switch to connect the full circuit and measure the ~~voltage~~ pd voltage and current using the voltmeter and ammeter. From this I can calculate the resistance using $R = \frac{V}{I}$. Then plot a graph of distance against resistance. ~~I will do one time~~

Examiner only

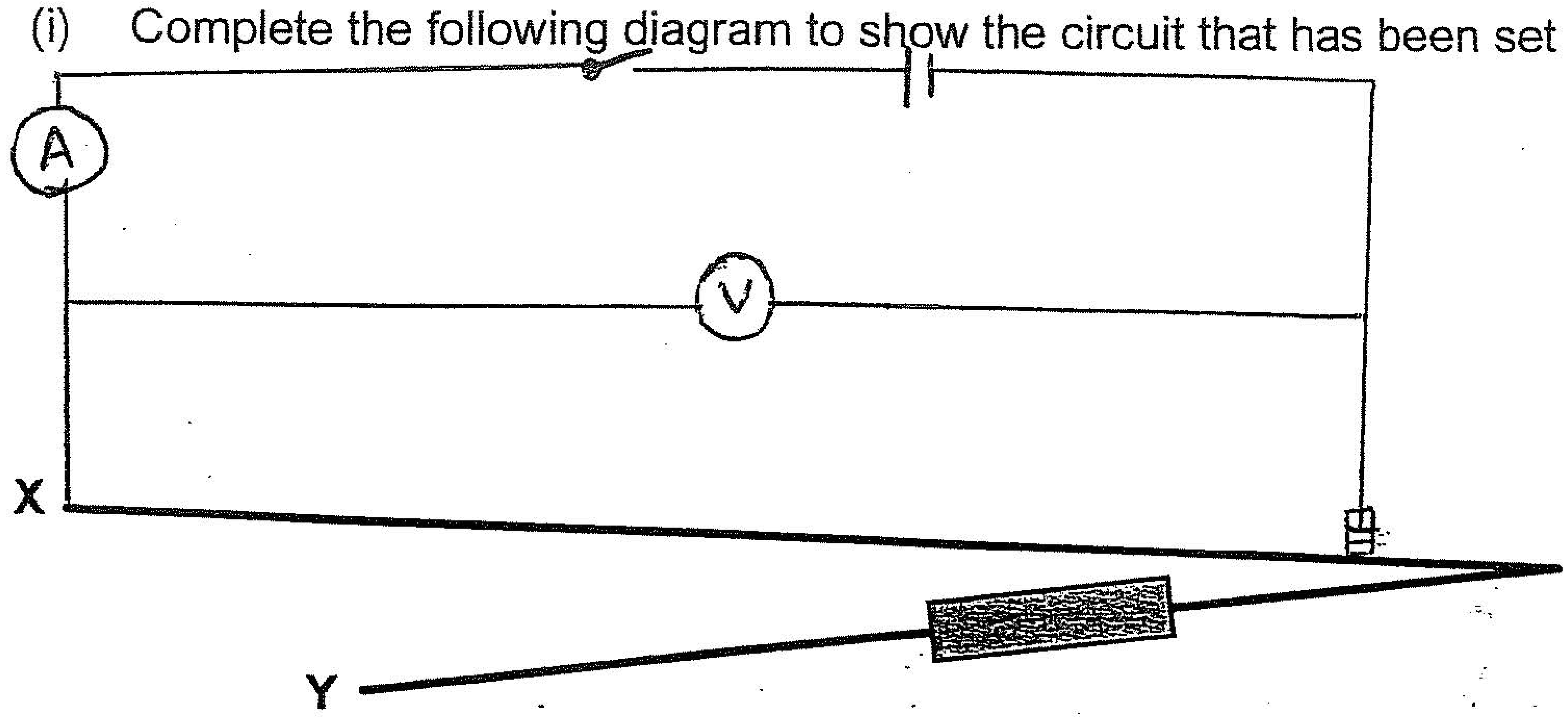
SECTION B

Task B4 (45 minutes)

Two wires of different materials are joined together. You are going to carry out an investigation to determine the position of the join.

Repeat readings are not required for this task. An additional measurement is required for part *(e)*(ii).

(a) (i) Complete the following diagram to show the circuit that has been set up for you. [2]



(ii) Write a plan to describe how you would use your circuit to investigate how resistance varies with length starting from point **X**. [3]

I am going to attach the crocidile clip to different parts of the wire and record the voltage and current. I am going to use the full set of wire to get good results. ~~I am going to find the resistance of each point by using R = V/I I am going to plot records on a graph and draw a line of best fit and find gradient to get the relationship with resistance.~~
I am going to find the resistance by using dividing voltage by current. I am going to plot records on graph (resistance against length) to find relationship

Examiner only

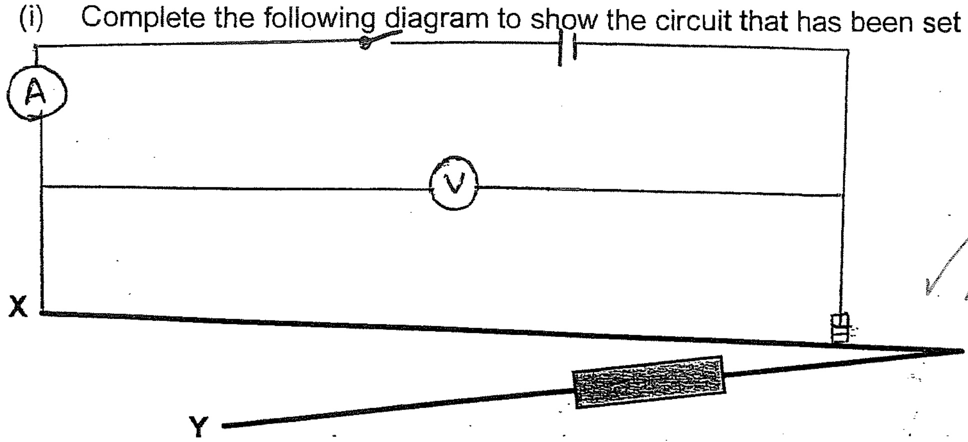
SECTION B

Task B4 (45 minutes)

Two wires of different materials are joined together. You are going to carry out an investigation to determine the position of the join.

Repeat readings are not required for this task. An additional measurement is required for part *(e)*(ii).

(a) (i) Complete the following diagram to show the circuit that has been set up for you. [2]



2

(ii) Write a plan to describe how you would use your circuit to investigate how resistance varies with length starting from point **X**. [3]

I am going to attach the crocidile clip to different parts of the wire and record the voltage and current. I am going to use the full set of wire to get good results. ~~I am going to find the resistance of each point by using R = V/I I am going to plot records on a graph and draw a line of best fit and find gradient to get the relationship with resistance.~~
I am going to find the resistance by using dividing voltage by current. I am going to plot records on graph (resistance against length) to find relationship

2

Examiner only

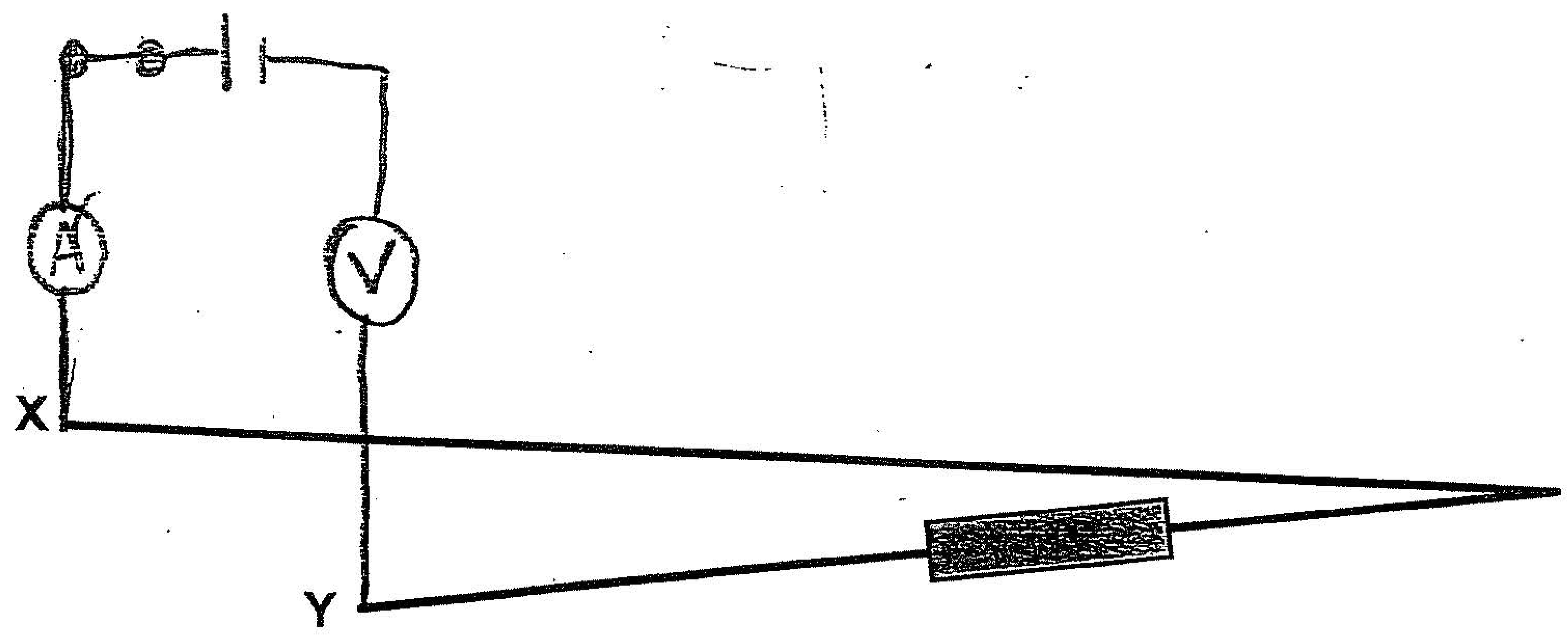
SECTION B

Task B4 (45 minutes)

Two wires of different materials are joined together. You are going to carry out an investigation to determine the position of the join.

Repeat readings are not required for this task. An additional measurement is required for part *(e)*(ii).

(a) (i) Complete the following diagram to show the circuit that has been set up for you. [2]



(ii) Write a plan to describe how you would use your circuit to investigate how resistance varies with length starting from point **X**. [3]

I would first turn on the ammeter and voltmeter. Then Connect the wire from the voltmeter to the wire ~~X~~. I would then move the wire at different distances down wire ~~Y~~X and therefore resulting in a Change of Current and voltage.

Examiner only

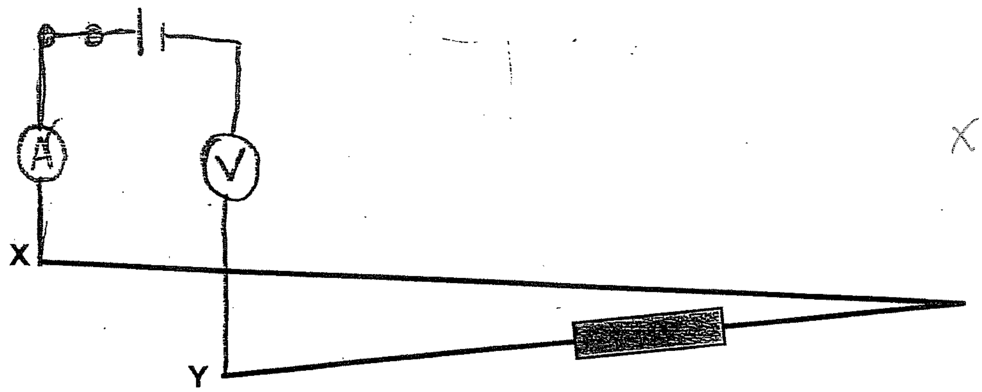
SECTION B

Task B4 (45 minutes)

Two wires of different materials are joined together. You are going to carry out an investigation to determine the position of the join.

Repeat readings are not required for this task. An additional measurement is required for part *(e)*(ii).

(a) (i) Complete the following diagram to show the circuit that has been set up for you. [2]



X

(ii) Write a plan to describe how you would use your circuit to investigate how resistance varies with length starting from point **X**. [3]

0

I would first turn on the ammeter and voltmeter. Then connect the wire from the voltmeter to the wire X. I would then move the wire at different distances down wire X and therefore resulting in a change of current and voltage.

Examiner only

4 e (ii) The value of resistivity for different materials is given in the following table.

Material	Resistivity (Ωm) (at 20°C)
Platinum	1.06×10^{-7}
Nichrome	1.10×10^{-6}
Tin	1.09×10^{-7}
Constantan	4.90×10^{-7}
Zinc	5.90×10^{-8}

Resistivity, ρ, is given by the equation:

$$\rho = \frac{RA}{l}$$

where R is the resistance, l is the length and A is the cross-sectional area of the wire.

Using the equation above and by measuring the diameter of the wire, determine the material of the wire starting at **X**. [5]

....

....

....

....

....

....

....

....

....

....

....

END OF PAPER

1m = 100 cm = 1000 mm

1mm = 1 × 10^-3 m   0·1mm = 1 × 10^-4 m

0·01 mm = 1 × 10^-5 m   0·31 = 3·1 × 10^-4 m

(ii) The value of resistivity for different materials is given in the following table.

Material	Resistivity (Ω m) (at 20°C)
Platinum	1.06×10^{-7}
Nichrome	1.10×10^{-6}
Tin	1.09×10^{-7}
Constantan	4.90×10^{-7}
Zinc	5.90×10^{-8}

Resistivity, ρ, is given by the equation:

$$\rho = \frac{RA}{l}$$

where R is the resistance, l is the length and A is the cross-sectional area of the wire.

Using the equation above and by measuring the diameter of the wire, determine the material of the wire starting at **X**. [5]

Our gradient represents R/L for the wire starting at X. Hence ρ can be calculated because from the diameter we use $A = \pi\left(\frac{d}{2}\right)^2$.

Measurement 1 of Diameter = 0·32 mm

Measurement 2 of Diameter = 0·30 mm

Mean value for Diameter = $\frac{0\cdot32 + 0\cdot30}{2}$ = 0·31 mm ± 0·01 mm

$A = \pi\left(\frac{d}{2}\right)^2$

$= \pi \times \left(\frac{3\cdot1\times10^{-4}}{2}\right)^2$

$= 7\cdot5476\ldots \times 10^{-8}\ m^2 = 7\cdot5 \times 10^{-8}\ m^2$

$\rho = \frac{RA}{L} = \left(\frac{R}{L}\right) \times A = (6\cdot4) \times (7\cdot5\times10^{-8})$

$\rho = 4\cdot8 \times 10^{-7}\ \Omega m$ (1.d.p.)

Thus, ~~due~~ to experimental error it is suitable to determine that the material of the wire starting at X is Constanstan.

END OF PAPER

Examiner only

Turn over.

1m = 100 cm = 1000 mm

1mm = 1 × 10^{-3} m

0·01 mm = 1 × 10^{-5} m

0·1 mm = 1 × 10^{-4} m

0·31 = 3·1 × 10^{-4} m

Examiner only

(ii) The value of resistivity for different materials is given in the following table.

Material	Resistivity (Ωm) (at 20°C)
Platinum	1.06×10^{-7}
Nichrome	1.10×10^{-6}
Tin	1.09×10^{-7}
Constantan	4.90×10^{-7}
Zinc	5.90×10^{-8}

Resistivity, ρ, is given by the equation:

$$\rho = \frac{RA}{l}$$

where R is the resistance, l is the length and A is the cross-sectional area of the wire.

Using the equation above and by measuring the diameter of the wire, determine the material of the wire starting at **X**. [5]

Our gradient represents R/L for the wire starting at X. Hence ρ can be calculated because from the diameter we use $A = \pi\left(\frac{d}{2}\right)^2$.

Measurement 1 of Diameter = 0·32 mm

Measurement 2 of Diameter = 0·30 mm

Mean value for Diameter = $\frac{0.32 + 0.30}{2}$ = 0·31 mm ± 0·01 mm

$A = \pi\left(\frac{d}{2}\right)^2$

$= \pi \times \left(\frac{3.1 \times 10^{-4}}{2}\right)^2$

$= 7.5476... \times 10^{-8}$ m² = 7.5×10^{-8} m²

$\rho = \frac{RA}{L} = \left(\frac{R}{L}\right) \times A = (6.4) \times (7.5 \times 10^{-8})$

$\rho = 4.8 \times 10^{-7}$ Ωm (1 d.p.)

Thus, to experimental error it is suitable to determine that the material of the wire starting at X is Constanstan.

5

22

END OF PAPER

Turn over.

Examiner only

(ii) The value of resistivity for different materials is given in the following table.

Material	Resistivity (Ωm) (at 20°C)
Platinum	1.06×10^{-7}
Nichrome	1.10×10^{-6}
Tin	1.09×10^{-7}
Constantan	4.90×10^{-7}
Zinc	5.90×10^{-8}

Resistivity, ρ, is given by the equation:

$$\rho = \frac{RA}{l}$$

where R is the resistance, l is the length and A is the cross-sectional area of the wire.

Using the equation above and by measuring the diameter of the wire, determine the material of the wire starting at **X**. [5]

Diameter of wire = 0.27mm → 2.7×10^{-4} m

Area of wire = πr^2

Radius = 1.35×10^{-4} m 5.73×10^{-8} m^2

Area of wire = $\pi (1.35 \times 10^{-4})^2$ = ~~5.73×10^{-8} m^2~~

Resistance = ~~1.29~~ ~~0.29Ω~~ 1.29mΩ

Length = ~~0.20m~~ ~~4.20m~~ 0.20m

~~$\rho = \frac{0.29 \times (5.73 \times 10^{-8})}{1.00}$~~

~~ρ = 3.60... 3.6×10^{-7} Ωm~~

~~Material of wire starting at x =~~

$\rho = \frac{1.29 \times (5.73 \times 10^{-8})}{0.2}$ $\rho = 3.7 \times 10^{-7}$ Ωm

The material of the wire is ~~[illegible]~~ Tin.

END OF PAPER

~~Material of wire is [illegible]~~

Examiner only

(ii) The value of resistivity for different materials is given in the following table.

Material	Resistivity (Ωm) (at 20°C)
Platinum	1.06×10^{-7}
Nichrome	1.10×10^{-6}
Tin	1.09×10^{-7}
Constantan	4.90×10^{-7}
Zinc	5.90×10^{-8}

Resistivity, ρ, is given by the equation:

$$\rho = \frac{RA}{l}$$

where R is the resistance, l is the length and A is the cross-sectional area of the wire.

Using the equation above and by measuring the diameter of the wire, determine the material of the wire starting at **X**. [5]

Diameter of wire = 0.27mm → 2.7×10^{-4} m

Area of wire = πr^2

Radius = 1.35×10^{-4} m 5.73×10^{-8} m²

Area of wire = $\pi(1.35 \times 10^{-4})^2$ = ~~5.02×10^{-8} m²~~

Resistance = ~~1.29Ω~~ ~~0.29Ω~~ 1.29mΩ

Length = ~~0.20m~~ ~~4.200m~~ 0.20m

~~$\rho = \frac{0.29 \times (5.73 \times 10^{-8})}{1.00}$~~

~~$\rho = 3.60 \ldots \times 10^{-2}$ 3.6×10^{-7} Ωm~~

~~Material of wire starting at x =~~

$\rho = \frac{1.29 \times (5.73 \times 10^{-8})}{0.2}$ $\rho = 3.7 \times 10^{-7}$ Ωm

The material of the wire is ~~nichrome~~ Tin.

END OF PAPER

~~Material of wire is ...~~

3.

X ✓ ✓ ✓ X

19

Examiner only

[illegible] The value of resistivity for different materials is given in the following table.

Material	Resistivity (Ωm) (at 20°C)
Platinum	1.06×10^{-7}
Nichrome	1.10×10^{-6}
Tin	1.09×10^{-7}
Constantan	4.90×10^{-7}
Zinc	5.90×10^{-8}

Resistivity, ρ, is given by the equation:

$$\rho = \frac{RA}{l}$$

where R is the resistance, l is the length and A is the cross-sectional area of the wire.

Using the equation above and by measuring the diameter of the wire, determine the material of the wire starting at **X**. [5]

Diameter of wire = 0.31mm

$\rho = \frac{RA}{l}$

$A = \pi r^2$

$= \pi(0.155)^2$

$= 0.075\ mm^2$

$\bar{R} = \frac{0.76 + 1.37 + 2.00 + \ldots}{10}$

$= 3.63\ \Omega$

$l = 1m$

$0.075\ mm^2 = 0.000075\ m^2$

$\rho = \frac{(3.63)(0.000075)}{1000}$

$= 2.7 \times 10^{-7}\ \Omega m$

∴ As the resistivity is closest to Tin, material X must be Tin.

END OF PAPER

Examiner only

(e) The value of resistivity for different materials is given in the following table.

Material	Resistivity (Ωm) (at 20°C)
Platinum	1.06×10^{-7}
Nichrome	1.10×10^{-6}
Tin	1.09×10^{-7}
Constantan	4.90×10^{-7}
Zinc	5.90×10^{-8}

Resistivity, ρ, is given by the equation:

$$\rho = \frac{RA}{l}$$

where R is the resistance, l is the length and A is the cross-sectional area of the wire.

Using the equation above and by measuring the diameter of the wire, determine the material of the wire starting at **X**. [5]

Diameter of wire = 0.31mm

$\rho = \frac{RA}{l}$

$A = \pi r^2$

$= \pi(0.155)^2$

$= 0.075\ mm^2$

$\bar{R} = \frac{0.76 + 1.37 + 2.00 + \cdots}{10}$

$= 3.63\ \Omega$

$l = 1m$

$0.075 mm^2 \times 10^{-6} = 0.000075\ m^2$

$\rho = \frac{(3.63)(0.000075)}{1000}$

$= 2.7 \times 10^{-7}\ \Omega m$

∴ As the resistivity is closest to Tin, material X must be Tin.

END OF PAPER