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

Mark Schemes

Q1.

(a) Use of $\rho = RA / l$)
cross sectional area= × $(3.7 \times 10^{-3})^2 = 4.3 \times 10^{-5}$ (m^2)✓

$\rho = \frac{3.3 \times 4.3 \times 10^{-5}}{1000}$ ✓ $= 1.4(2) \times 10^{-7}$✓ Ω m✓

area : lose first mark if use diameter as radius or fail to convert to m^2 (if both errors still only lose 1 mark)
CE area for next two marks but if uses diameter in place of area then lose first two marks
if leave length in km lose 2nd mark but CE for answer
UNIT stand-alone 4th mark

4

(b) (current in) steel wire (is less than the current in an) aluminium wire as it has a higher resistivity / resistance OR aluminium is better conductor✓
the six aluminium wires are in parallel OR total cross-sectional area of aluminium is 6 times greater than steel wire✓
each aluminium wire carries three times as much current as the (single) steel wire✓

3

(c) resistance of 1 km of 6 Al cables in parallel = $\frac{1.1}{6}$ = 0.183 Ω✓

if ignored the steel wire then can score first and third mark

total resistance of the cable = 0.174 Ω✓
power loss per km = 32.3 kW (or 30.7 kW if they ignore the steel)✓
OR
power loss in 1 km of steel = 1.70kW✓
power loss in 1 km each of Al cable = 5.11 kW✓
total power loss per km = 32.4 kW (or 30.7 kW if they ignore the steel)✓
OR
calculate current in steel wire and aluminium wire (22.7 and 68.2) ✓
calculate power loss in aluminium wire and steel wire (1700 and 5115) ✓
calculate total power loss (1700 + 6 × 5115 = 32,4 kW) ✓

accept range 32 kW to 33 kW
if ignored steel wire
range for third mark is 30 kW to 31 kW

if wires treated as series resistors then zero

3

[10]

Q2.

(a) (i) 5.1 and 7.1 ✓

Exact answers only

1

(ii) Both plotted points to nearest mm ✓

Best line of fit to points ✓

The line should be a straight line with approximately an equal number of points on either side of the line

2

(iii) Large triangle drawn at least 8 cm × 8 cm ✓

Correct values read from graph ✓

Gradient value in range 0.190 to 0.210 to 2 or 3 sf ✓

3

(iv) ($R = \frac{1}{\text{gradient}}$) = 5.0 Ω Must have unit ✓

Allow ecf from gradient value

No sf penalty

1

(b) (i) 5.04 (Ω) or 5.0 (Ω) S

(Allow also 5.06 Ω or 5.1 Ω, obtained by intermediate rounding up of 3.50^2)

From $R = \frac{V^2}{P}$

1

(ii) (Uncertainty in V = 0.29%)

Uncertainty in V^2 = 0.57%, 0.58% or 0.6% ✓

From uncertainty in V = 0.01 / 3.50 × 100%

Uncertainty in P = 2.1% ✓

From uncertainty in P = 0.05 / 2.43 × 100% = 2.1%

Uncertainty in R =2.6%, 2.7% or 3%

Answer to 1 or 2 sf only ✓

2.1 % + uncty in V^2 (0.6%) = 2.7%

Allow ecf from incorrect uncertainty for V^2 or P

3

(iii) (Absolute) uncertainty in R is (±) 0.14 or just 0.1 Ω (using 2.6%)

(or 0.15 or 0.2 Ω using 3%) ✓

Must have unit (Ω)

Must be to 1 or 2 sf and must be consistent with sf used from (ii)

No penalty for omitting ± sign

1

(iv) Works out possible range of values of *R* based on uncertainty in (iii), e.g. *R* is in range 5.0 to 5.2 Ω using uncertainty of ± 0.1 Ω ✓

No credit for statement to effect that the values are or are not consistent, without any reference to uncertainty

Allow ecf from (iii)

Value from (a)(iv) is within the calculated range (or not depending on figures, allowing ecf) ✓

Allow ecf from (a)(iv)

2

[14]