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

Mark Schemes

Q1.

(a) (i) circuit diagram to show:
wire, ammeter, battery, (variable resistor) and switch in series **(1)**
[or potentiometer with ammeter in correct position]
voltmeter across the wire **(1)**

(ii) (method: constant length of wire)
measure length (of wire) **(1)**
measure diameter (of wire) **(1)**
measure voltage (across) and current (through wire) **(1)**
vary resistor to obtain different voltage and current **(1)**
alternative
[(method: variable length of wire)
measure length (each time) **(1)**
measure diameter **(1)**
(for full length of wire) measure voltage and current **(1)**
voltmeter to shorter lengths, measure voltage (and current) **(1)**]

(iii) (use of) $\rho = \frac{RA}{l}$ (to calculate ρ) **(1)** (for either method)
calculate A from (πr^2) **(1)** (for either method)
(method: constant length of wire)
determine $R\left(=\frac{V}{I}\right)$ for (one) length **(1)**
repeat readings (for same length and) take mean of ρ or R **(1)**
[or plot graph of V vs I to give mean R **(1)**
or gradien = $\frac{\rho}{A}$ **(1)**]
alternative
[(method: variable length of wire)
determine $R\left(=\frac{V}{I}\right)$ for each length **(1)**
calculate ρ for each length and take mean **(1)**
[or graph of R vs l **(1)** with correct gradient **(1)**]

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(b) (use of $R = \frac{\rho l}{A}$ gives) $\frac{2.0}{4.0} = \frac{1.1\times10^{-7} l}{7.8\times10^{-9}}$ **(1)**

l = 0.035 m **(1)**

2

[12]

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Q2.

(a) (i) at 25 (°C), total resistance = 300 + 200 = 500 (Ω) **(1)**

$I = \frac{12}{500}$ = 24 mA **(1)**

(allow C.E. for value of total resistance)

(ii) pd across thermistor = $24 \times 10^{-3} \times 300 = 7.2$ V **(1)**

(allow C.E. for value of current from (i) and R_{th} from graph)

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(b) as temperature increases, resistance (of thermistor) decreases **(1)**
total resistance decreases **(1)**
current in circuit increases **(1)**
pd across resistor increases **(1)**
(since battery remains at 12 V) pd across thermistor decreases **(1)**
[or R_{th} decreases **(1)**
potential divider situation **(1)**

$V_{th} = 12 \times \frac{R_{th}}{R_{th} + R}$ **(1)**

denominator decreases less slowly than numerator **(1)**
V_{th} decreases **(1)**
or for last two marks, thermistor gets smaller share of voltage
explanation of this]

(max 3)
QWC 1

(c) (i) (use of $P = \frac{V^2}{R}$ gives) at 25°C $P = \frac{144}{300}$ = 0.48 W **(1)**

at 45°C correct reading of R = 30 (Ω) **(1)**

$P = \frac{144}{300}$ = 4.8 (W) **(1)**

(ii) $E = Pt = 2.64 \times 10 \times 60$ **(1)**
$= 1.6 \times 10^3$ J **(1)**
(allow C.E. from part (i)

(iii) rate of decrease of resistance is not linear
[or resistance not directly proportional to temperature] **(1)**

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[12]

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