Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:_____

Max. **Marks : 20 Marks**　　　　　　　　　　　　　　　　　　**Time : 20 Minutes**

Mark Schemes

Q1.

(a)　Max one from: ✔
　　internal ray is a <u>radius</u> (of the block)
　　OR
　　internal ray travels along a <u>normal</u>
　　OR
　　ray meets (glass-air) boundary at 90°
　　OR
　　angle of incidence is zero
　　(so angle of emergence/refraction is zero)

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　1

(b)　Straight line ruled from centre of protractor through **ABC** ✔

　　　　*for $_1$✔ line must be reasonable and must pass through intersection of
　　　　the cross-wires and must not pass above the centre of **A** or below the
　　　　centre of **B***

　　Takes a pair of readings: 24 or 66; and angle consistent with their line ✔
　　　　Must be between 0° and 90°

　　Use of Snell's Law with their angles ✔

　　1.48 or 1.52 ✔
　　　　Must be a positive value to 3 sf.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　4

(c)　1.47 or 1.471 ✔
　　　　Reject 1.5 or >4 sf; ignore any unit written

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　1

(d)　0.08 (mm) ✔
　　　　Only acceptable answer

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　1

(e)　Calculates one percentage uncertainty
　　　　*For $_1$✔ allow ecf from **(d)**; expected answers are*
　　　　% uncertainty in $(R_2 - R_0) =$

$$100 \times \frac{0.08}{14.28} = 0.56(0)\%$$

　　　　% uncertainty in $(R_2 - R_1) =$

$$100 \times \frac{0.08}{9.71} = 0.82(4)\%$$

OR

Calculates max or min value ✔

$$n_{min} = \frac{14.28 - 0.08}{9.71 + 0.08} = 1.45(0);$$

$$n_{max} = \frac{14.28 + 0.08}{9.71 - 0.08} = 1.49(1);$$

Adds their percentage uncertainties
OR

attempt to use percentage $n = \dfrac{0.5(max - min)}{1.47} \times 100$ ✔

> *Ecf for $_2$✔ from wrong percentage uncertainties or wrong max or min values*

1.4(%) ✔

> *Condone 3 or 4 sf*

3

[10]

Q2.

(a) to limit (maximum) current (when variable resistor is set to zero) ✔

> *Accept 'so cell is not short-circuited' for $_1$✔*

to prevent overheating (of cell)
OR
to prevent damage to <u>cell</u>
OR
otherwise cell would discharge quickly ✔

> *'to avoid damaging components' is not enough for $_2$✔*

2

(b) Line ruled through bottom of second error bar and top of ninth (3rd from right) error bar ✔

> *Ignore unit if given. Allow tolerance of 2 mm inside either error bar.*

Determines their gradient, with $\Delta x \geq 0.2$ (A) ✔

$(-)1.0 \pm 0.1$ (/ V A^{-1}) ✔

> *Expect to see 2 sf in any answer*

3

(c) Attempt to calculate mean of their G_{min} and -1.3 ✔

> *Allow positive G values*

1.1 (Ω) ✔

> *Ecf from (b). 1 mark max if r given as negative*

2

(d) States that $\varepsilon = V + Ir$ **OR** calculates $R = 0.39$ (Ω) ✔

> *Allow ruled line drawn through (0.94, 0.37) and (0.70, 0.65)* ✔

Use of $\varepsilon = V + Ir$ **OR** $\varepsilon = I(R + r)$ ✔

Adds their gradient to read off at I = 1.0 A ✔ ✔

OR

Use of y=mx+c with their gradient ✔

Intercept (c) determined ✔

1.4 (V) ✔

*Ecf from **(c)**. 3 sf max*

3

[10]