Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

(a) s from $\frac{R_2 - R_1}{3} = 1.43\,\text{mm}$ ✔ (accept bald answer for 1 mark)

1

(b) 0.01 mm (condone 0.005 mm) ✔

1

(c) uncertainty in 3s [in s] = 0.02 ✔ [2 × answer for **(b)**] or 0/2

percentage uncertainty in $3s = \frac{0.02}{4.29} \times 100 = 0.47\%$ ✔ (use of R_2 (use of R_1 is required; accept 1 sf 0.5%)

[for precision = 0.005 mm, % uncertainty in $3s = \frac{0.01}{4.29} \times 100 = 0.23\%$ ✔

(use of R_2 and R_1 is required; accept 1 sf 0.2% but reject 0.3%)

2

(d) evidence of suitable working, e.g. d from 2s - (R_3 - R_2) or from

5s - (R_3 - R_1) or from $\frac{2(R_3 - R_1) - 5(R_2 - R_1)}{3}$ ✔

d = 0.84 mm ✔

[allow ecf for incorrect s: the candidate in **(a)** who evaluates the distance between the edges of adjacent holes will get s = 0.59 mm; they get the correct result for d using $\frac{R_2 - R_1}{3} - 0.59$]

2

[6]

Q2.

(a)

***h*/mm**	**ln(*h*/mm)**
381	5.943
336	5.817 or 5.818

✔

Exact answers only.

1

(b) Both points plotted within 1 mm ✔
An accurate best fit straight line drawn with an even scatter of points on either side of the line ✔

2

(c) Triangle drawn with smallest side at least 8 cm in length (or 8 grid squares) **and** correct values read from the line of best fit ✔
Correct answer for gradient in the range -0.0140 to -0.0138 ✔✔

Note: correct answer marks:

One mark for the minus sign plus one mark for a value in the range 0.0136 to 0.0140 <u>expressed to 2 or 3 sf</u>

3

(d) H = 665 or a correctly calculated value from the intercept on the graph **and** the unit quoted for H quoted as mm ✔
λ = candidate's answer to part **(c) without the minus sign** ✔
Unit for $\lambda = s^{-1}$ ✔

No sf penalty

3

(e) There could be a systematic error in the measurement of h ✔
Consideration of the effect of this on the natural log values that are being plotted ✔
An explanation involving recognition that a (small) change in gradient is likely and this would result in a change in λ ✔

*Alternative (simplistic) answer for **2 marks max***

There could be a systematic error in the measurement of h ✔

This would be unlikely to affect the gradient of the line since h is numerically large and so the value found for λ would not be affected. ✔

3

(f) There could be random errors associated with the use of a stopclock for measuring time ✔
By taking repeat readings these should have been minimised so the value found for λ would not be affected. ✔

2

[14]