Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

(a) D could not be measured with enough **precision**; [can only resolve to 1 sf / 2 dp (and 3 sf / 4 dp needed) / needs to measure to 0.0001 mm] ✓
example given to correctly illustrate this point, eg 0.0855 mm would be read as 0.09 mm ✓

same D would be produced for different α ✓
example given to correctly illustrate this point, eg when α = 12° / 14° / 16° ✓

there would be a large **percentage** uncertainty [**percentage** error] in D ✓
example given to correctly illustrate this point, eg when α = 8° percentage uncertainty is 47% ✓ (tolerate answers using ΔD = 0.01 mm or 0.02 mm)

α / °	D / mm		% uncertainty (ΔD = 0.01 mm)
	spreadsheet	to 0.01 mm	
2	0.0855	0.09	11.7%
4	0.0428	0.04	23.4%
6	0.0285	0.03	35.1%
8	0.0214	0.02	46.8%
10	0.0171	0.02	58.5%
12	0.0143	0.01	70.2%
14	0.0122	0.01	81.9%
16	0.0107	0.01	93.6%

max 4

(b) argument is not sensible because (larger value of D leads to) very small values of α ✓
(hence) α cannot be measured accurately [uncertainty would be very large] ✓

2

(c) $\frac{0.0859 - 0.0855}{0.0859}$ × 100 ✓ (working must show 0.0859 in denominator, or 0 / 2)

= 0.466% or 0.47% **only** ✓ (ie 0.5% is worth 1 max)

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[8]

Q2.

(a) 3 parallel off-axis rays through objective lens correct **(1)**

rays continued through to the eyepiece emerging parallel to construction line **(1)**

correct position of labelled foci **(1)**

3

(b) (i) use of $f_o + f_e = 3.7$

and $f_o/f_e = 50$

(to give $51f_e = 3.7$) **(1)**

$f_o = 3.6$ (m) and $f_e = 0.074$ (m) **(1)**

2

(ii) use of $s = r\theta$

to give $\theta = 23/380000 = 6(.053) \times 10^{-5}$ rad **(1)**

use of $M = \theta_2/\theta_1$

to give $\theta_2 = 50 \times \theta_1 = 3(.026) \times 10^{-3}$ (rad) **(1)**

2

(c) diagram to show dispersion of different colours in the correct order **(1)**
rays crossing each other or principal axis correctly **(1)**

2

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