Question Number	Answer		Mark
2(a)(i)	• Normal drawn and critical angle indicated	(1)	**1**
2(a)(ii)	• Use of $\sin C = \frac{1}{n}$ with their measured value of C • Refractive index = 1.58 to 1.70	(1) (1)	**2**

C / °	n
36	1.70
37	1.66
38	1.62
39	1.59

MP1 accept correct use of $n_1 \sin\theta_1 = n_2 \sin\theta_2$, with $n_2 = 1$ and $\theta_2 = 90^\circ$

Example calculation
$C = 38^\circ$
$\sin 38^\circ = \frac{1}{n}$
$n = 1.62$

2(b)	• Use of $\sin C = \frac{1}{n}$ with either 40.5° or 41.5° • Range of refractive index calculated	(1) (1)	**2**

Example calculation
$\sin 40.5^\circ = \frac{1}{n}$
$n = 1.54$
$\sin 41.5^\circ = \frac{1}{n}$
$n = 1.51$
$1.51 \leq n \leq 1.54$

2(c)	• Use of $n_1 \sin\theta_1 = n_2 \sin\theta_2$ • Refractive index = 1.53 • Comparative statement consistent with the range from (b)	(1) (1) (1)	**3**

Example calculation
$\sin 64 = n \sin 36$
$n = 1.53$

2(d)	• The monochromatic light has a single wavelength/frequency **Or** White light is a mixture/range of wavelengths/frequencies • The different wavelengths/colours would refract by different angles **Or** different wavelengths/colours would have different refractive indexes • Monochromatic light would give less uncertainty in the angle (incident/refraction/critical) **Or** monochromatic light allows for a more accurate measurement of angle	(1) (1) (1)	**3**
2(e)	• Angle resolution of 0.1° compared to protractor resolution of 1° • Beam from the collimator is narrower (than the ray from a ray box) • So, uncertainty in angle (of refraction) is smaller	(1) (1) (1)	**3**

For MP1 – accept descriptions of protractor with resolution 0.5°
For MP3 – must be clear the uncertainty is for the angle measurement

	Total for question 2		**14**