

Question	Marking details	Marks available				Maths	Prac
		AO1	AO2	AO3	Total		
8	(a) [Constant] velocity horizontal (1) Accelerating / force downwards [b.o.d. motion under gravity] (1) Projectile motion → 1 mark		2		2		
	(b) $\phi = \sin^{-1}\left(\frac{1.55}{1.58}\right)$ (1) 78.82°, 78.8° or 79° etc. seen (not just 80) (1) 1.38 [rad] → 1st mark	1	1		2	2	
	(c) Maximum angle for propagation with TIR (1) Rotational symmetry (about central axis) (1)		2		2		
	(d) $\theta_2 = 90 - 80 = 10$ degree or similar (11.2 degree etc.) (1) $n_1 \sin \theta_1 = n_2 \sin \theta_2$ used (1) Rearrangement $\theta_1 = \sin^{-1}\left(\frac{n_2}{n_1} \sin \theta_2\right)$ (1) Answer = 17.9° or 15.9° if 10° used (1)	1	1 1 1		4	3	
	(e) Dispersion increases with length of fibre (1) [Maximum] bit rate and distance proportional [however stated, eg. Accept distance × 10 → bit-rate down by factor of 10] (1) Conclusion consistent with argument (1)			3	3		
	(f) 20 × 0.8 dB or 16 dB seen (1) Correct comparison with table e.g. 15 dB too much (0.03) (1) Correct conclusion: no, signal drops too much / distance too large (1) [NB Either distance for 6% = 15.3 km or 20 km → 2.5 % gives the first two marks].			3	3	2	
	(g) Wavelength is decreased by factor n or $v=c/n$ (1) Wavelength is 820 nm (1) So thickness of around 8.2 μm is required (1) 13 μm student is wrong (1) [Allow Aled correct because 1.3 μm × 10 = 13 μm for 1 mark]			4	4	2	
	Question 8 total	2	8	10	20	9	0