

Question number	Answer	Notes	Marks
11 (a) (i)	any two from: MP1. optical fibres for communication; MP2. endoscopes; MP3. optical fibres in decorative lamps etc.; MP4. safety reflector; MP5. prism in {binoculars / camera / periscope / rangefinder};	allow 1 mark for unqualified "optical fibres" in the absence of any other marks e.g. bicycle/car reflector, cat's eye	2
(ii)	idea that light travels from more (optically) dense medium to less (optically) dense medium; incident angle greater than critical angle;	allow if expressed in terms of refractive index allow "has to go from glass to air" / eq.	2
(b) (i)	normal line drawn correctly by eye where light ray meets flat surface at A;		1
(ii)	angle measured in the range 24-30°;	allow ecf from incorrect normal	1
(iii)	ray emerges from block at position A; refracting correctly away from normal;		2
(iv)	$\sin(c) = 1 \div n$;	allow rearrangements and word equations	1
(v)	substitution AND rearrangement; evaluation; e.g. $n = 1 \div \sin(40^\circ)$ (n =) 1.6	allow 1.557...	2

Total for question 11 = 11 marks