Waves Refraction and Reflection Past Paper Answers Edexcel Physics IGCSE Higher

1.

Question number	Answer	Notes	Marks
(a)	change in direction of waves at a boundary	ALLOW change in speed ALLOW idea of 'boundary' such as changing medium, or examples such as 'going from air into a glass block'	1
(b)	correct label for ***i*** correct label for ***r***	ALLOW labels written out in full as "incidence" or "angle of incidence" etc REJECT if angles are the wrong way around	2
(c) (i)	refractive index = sin ***i*** / sin ***r***	ALLOW 'n' for refractive index REJECT speed in 1/speed in 2	1
(ii)	Method max 4 marks: draw around block; mark positions of incident and emergent rays; (remove block and) draw refracted ray; measure i; measure r; measure angle(s) to the normal; range of values; Data max 2 marks: (graph of) sin i against sin r; graph is straight line; DOP gradient gives refractive index; DOP	 Accept pin or pencil method Ignore mention of protractor i.e. different values of i not just repeating	MAX 6

2.

Question Number	Answer	Notes	Marks
(a)	D;		1
(b)	Any four of - MP1. mention of ray box/pins; MP2. Use of protractor; MP3. (vary ***i*** to) obtain a range of values; MP4. statement of equation; $n = \frac{\sin i}{\sin r}$ MP5. plot a graph of sin ***i*** against sin ***r***; OR calculate/work out/ find ***n***; MP6. find gradient of graph; OR calculate average of n; MP7. sensible experimental precaution; OR improvement to a basic method;	ignore reference to critical angle allow Snell's Law equation in words allow correct use of A and D from diagram including – • draw lines with a ruler, • use a thinner beam/slit, • use a monochromatic beam, e.g. red, • fix block firmly in position, • set any anomalous readings aside, • use a sharp pencil, • use a more precise protractor e.g. to ½°	4

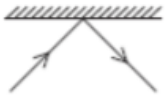
Total 5 marks

3.

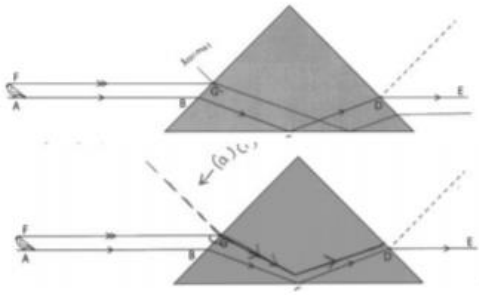
Question number	Answer	Notes	Marks
(a) (i)	Equal to		1
(ii)	Any TWO of - Rays continued and reflected correctly from mirror; Projected back behind mirror (to reasonably the right place) Line perpendicular to the mirror joining object and image positions (roughly equal distances in front and behind);	Judged by eye to be i = r rays should diverge after reflection Judged by eye ACCEPT (for the second mark) projection back to image even if reflected rays not drawn in front of the mirror Rays do not need to have arrows Dotted lines no required behind mirror Image does not have to be labelled Accept dotted lines in front of mirror if meaning is clear Use of ruler not essential, but candidates will find it difficult to draw a convincing diagram freehand	2
(iii)	'rays do not actually meet at the image'		1

Question Number	Answer	Notes	Marks
(b) (i)	Added to diagram - Reflection inside fibre; At least three (with reasonable angles);	Continuous path shown inside fibre	1 1
(ii)	Must be more (optically) dense to less (optically) dense change; Angle of incidence > critical angle;	IGNORE angle of incidence = critical angle DO NOT ALLOW angle of incidence greater than 42^0	1 1
(iii)	Any ONE sensible point – e.g. Less prone to noise; less prone to heating; send more information (per second); more data (per second);	IGNORE references to cost IGNORE references to speed	1
		Total	**9**

4.

Question number	Answer	Notes	Marks
(a)	 ☒ D		(1)
(b) (i)	normal drawn correctly;	judge by eye	(1)
(ii)	correct angle marked to their normal;	judge by eye	(1)
(iii)	correct angle chosen within ± 3°;	27°, no ECF from bi or bii	(1)
(vi)	$\frac{\sin i}{\sin r} = n$;	accept rearrangements	(1)
(v)	substitution; evaluation; e.g. $\frac{\sin 43}{\sin 27} = n$ 1.5	allow ECF from biii	(2)
(c) (i)	Total Internal Reflection;	accept TIR	(1)
(ii)	MP1. light reflects (inside (surface) of fibre); MP2. with angle i> critical angle; MP3. (because) light travels slower in glass;	condone light hits/bounces off the fibre wall	(3)

5.

Question number	Answer	Notes	Marks
(a) i	normal drawn at G ;	by eye	1
ii	value for G ; (45) value for D; (45)	tolerance ±2°	2
b	ray has been reflected; totally internally; because angle of incidence > critical angle;	allow 42 or 43°	3
c	correct refraction at G downwards; TIR on bottom surface; emergent ray parallel to and below DE;  =3 = MP1 only		3

Total 10 marks