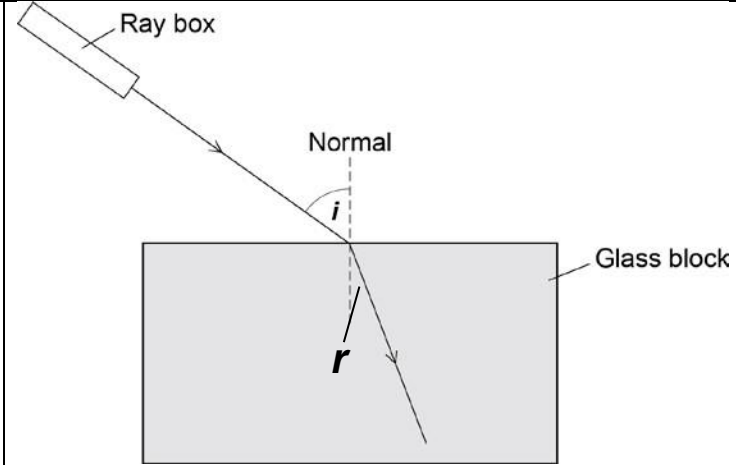
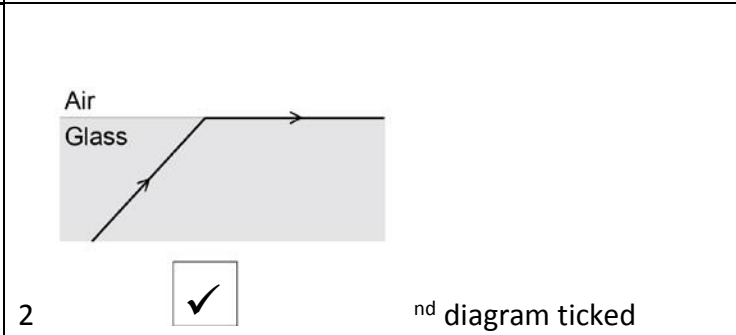


Refraction MS

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
QUESTION 1			
(a)(i)	(angle of) refraction	take care not to credit angle of reflection	1
(a)(ii)	normal	do not credit horizontal	1
Question 2			
(a)	the <u>normal</u>		1
(b)	v		1
(c)	<p>any one from:</p> <ul style="list-style-type: none"> light has moved from glass to air / from air to glass speed of light has changed angle of incidence is less than the critical angle change in density (of medium) 	<p>accept light has changed medium</p> <p>beware of contradictions for this marking point eg light has moved from glass to air and slowed down gets zero</p> <p>or (angle) $i < (\text{angle}) c$</p> <p>or (angle) y is less than the critical angle</p> <p>eg glass is more (optically) dense than air</p>	1

<p>(d)(i)</p>	<p>ratio of v to y does not give the same answer (in every case)</p> <p>or</p> <p>value of v doubles value of y does not double</p> <p>or</p> <p>increments for v are the same but increments for y are not the same</p>	<p>allow for 1 mark a calculation but no conclusion eg $30 \rightarrow 60$ $19 \rightarrow 35$ (38)</p>	<p>2</p>
<p>(d)(ii)</p>	<p>as (angle) v increases, angle y increases</p>	<p>accept as the angle of incidence increases, the angle of refraction increases</p> <p>or</p> <p>there is a (strong) positive(non-linear) relationship between the variables</p> <p>or ratio of sines is constant</p> <p>do not accept angle y is not directly proportional to angle v</p>	<p>1</p>
<p>(d)(iii)</p>	<p>no evidence outside this range</p> <p>or</p> <p>when angle y is greater than the critical angle total internal reflection occurs</p>	<p>OWTTE</p>	<p>1</p>
<p>Total</p>			<p>7</p>
<p>Question 3</p>			

(a)(i)	 <p>Ray box</p> <p>Normal</p> <p>i</p> <p>r</p> <p>Glass block</p>		1
a)(ii)	1 degree		1
(a)(iii)	1.6	<p>allow 1 mark for correct substitution, ie 0.80 / 0.5 provided no subsequent step shown</p> <p>working showing 1.59(9.....) scores zero</p>	2
(b)	 <p>Air</p> <p>Glass</p> <p>2</p> <p><input checked="" type="checkbox"/></p> <p>nd diagram ticked</p>		1
Total			5