

MARKING SCHEME FOR ANSWERS TO THE THEORETICAL QUESTION III - OPTICS

Part	MARKING SCHEME - THE THEORETICAL QUESTION III - PRISMS	Total Scores
III. a.	<p>For:</p> $n_1(\lambda_0) = n_2(\lambda_0)$ $\lambda_0 = \sqrt{\frac{b_1 - b_2}{a_2 - a_1}}$ <p>final result: $\lambda_0 = 500 \text{ nm}$</p> $n_1(\lambda_0) = n_2(\lambda_0) = 1,5$	<p>1.25 points</p> <p>0.50p</p> <p>0.25p</p> <p>0.25p</p> <p>0.25p</p>
III. b.	<p>For the rays with different wavelength (λ_{red}, λ_0, λ_{violet}) having the same incidence angle on first prism, the paths are illustrated in the figure III.1</p> <p style="text-align: center;">Figure III.1</p>	2.00 points
III. c.	<p>For:</p> $n_1(\lambda_0) = n_2(\lambda_0) = \frac{\sin \frac{\delta_{\min} + A'}{2}}{\sin \frac{A'}{2}}$ $m(\hat{A}') = 30^\circ$ $\delta_{\min} = 2 \arcsin \left(\frac{3}{2} \cdot \sin \frac{A'}{2} \right) - \frac{A'}{2}$ <p>final result: $\delta_{\min} \cong 30,7^\circ$</p>	<p>1.00 point</p> <p>0.25p</p> <p>0.25p</p> <p>0.25p</p> <p>0.25p</p>

III. d.	<p>For: the refraction law on the AD face $\sin i_1 = n_1 \cdot \sin r_1$</p> <p>0.25p</p>	2.75 points
	<p>Figure III.2</p> <p>the refraction law on the AC face $n_1 \cdot \sin r_1' = n_2 \cdot \sin r_2$</p> <p>$r_1 + r_1' = A_1$</p> <p>$r_2 = A_2$</p> <p>$i_1 = 30^\circ$</p> <p>$\sqrt{4n_1^2 - 1} = \frac{2n_2 \cdot \sin A_2 + \cos A_1}{\sin A_1}$</p> <p>$3 \cdot n_1^2 = 1 + n_2 + n_2^2$</p> <p>$\lambda^4 \cdot (3a_1^2 - a_2^2 - a_2 - 1) + (6a_1b_1 - b_2 - 2a_2b_2) \cdot \lambda^2 + 3b_1^2 - b_2^2 = 0$</p> <p>final result: $\lambda \cong 1,2 \mu m$</p>	<p>0.25p</p> <p>0.25p</p> <p>0.25p</p> <p>0.25p</p> <p>0.50p</p> <p>0.25p</p> <p>0.50p</p> <p>0.25p</p>
Total score theoretical question III		7.00 points

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