

Question Number	Answer	Mark																																
18a	<p>Use of $n\lambda = d \sin \theta$ (1) $\theta_2 = 29^\circ$ (1)</p> <p>(For MP1, allow calculation of $d/\lambda = 4.13$ or $\lambda/d = 0.242$)</p> <p><u>Example of calculation</u> $\sin 14.0^\circ = 0.242$ (when $n = 1$) $n = \frac{d}{\lambda} \sin \theta$, so if d and λ are the same, when $n = 2$, $\sin \theta$ is doubled so $\sin \theta_2 = 0.242 \times 2 = 0.484$ $\sin^{-1} 0.484 = 28.9^\circ$</p>	2																																
18b	<p>Suitable graph suggested (see table below) (1) Calculate/determine gradient (1) Correct method for determining λ from gradient of graph (1)</p> <p>(MP2 do not award without any suggestion of the graph to be plotted) (MP2 do not award if either of the axes involves λ)</p> <table><tr><th colspan="2">MP1</th><th colspan="2">MP3</th></tr><tr><th>y-axis</th><th>x-axis</th><th>gradient =</th><th>or $\lambda =$</th></tr><tr><td>n</td><td>$d \sin \theta$</td><td>$1/\lambda$</td><td>$1/\text{gradient}$</td></tr><tr><td>$d \sin \theta$</td><td>n</td><td>λ</td><td>gradient</td></tr><tr><td>n</td><td>$\sin \theta$</td><td>d/λ</td><td>$d/\text{gradient}$</td></tr><tr><td>$\sin \theta$</td><td>n</td><td>λ/d</td><td>gradient $\times d$</td></tr><tr><td>$\sin \theta$</td><td>n/d</td><td>λ</td><td>gradient</td></tr><tr><td>n/d</td><td>$\sin \theta$</td><td>$1/\lambda$</td><td>$1/\text{gradient}$</td></tr></table>	MP1		MP3		y-axis	x-axis	gradient =	or $\lambda =$	n	$d \sin \theta$	$1/\lambda$	$1/\text{gradient}$	$d \sin \theta$	n	λ	gradient	n	$\sin \theta$	d/λ	$d/\text{gradient}$	$\sin \theta$	n	λ/d	gradient $\times d$	$\sin \theta$	n/d	λ	gradient	n/d	$\sin \theta$	$1/\lambda$	$1/\text{gradient}$	3
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18c	<p>Use of tan to calculate θ_2 (allow Pythagoras to find hypotenuse and then using sin or cos) (1)</p> <p>Use of $n\lambda = d\sin\theta$ with $n = 2$ (1)</p> <p>Use number of lines per m(m) = $1 / d$ (1)</p> <p>Number of lines per mm = 149, so labelling incorrect Or $d = 3.33 \times 10^{-6}$ m, not 6.69×10^{-6} m, so labelling incorrect (1)</p> <p><u>Example of calculation</u> $\tan \theta = 0.397 \text{ m} / 2.00 \text{ m} = 0.199$, $\theta = 11.2^\circ$ $n\lambda = d\sin\theta$, so $d = n\lambda / \sin \theta = 2 \times 650 \times 10^{-9} \text{ m} / \sin (11.2^\circ)$ $d = 6.69 \times 10^{-6} \text{ m}$ number of lines per metre = $1/d = 1 / 6.69 \times 10^{-6} \text{ m} = 149,000 \text{ m}^{-1}$ $= 149 \text{ mm}^{-1}$</p>	4																																
Total for question 18		9																																