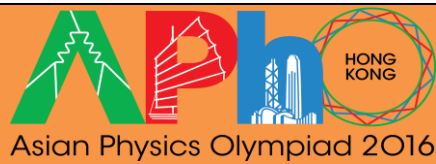




Task	Summary Table	Mark (for marker's use only)															
A1	<table border="1"> <tr> <td>h</td> <td></td> </tr> <tr> <td>θ</td> <td></td> </tr> </table>	h		θ													
	h																
θ																	
D1	<table border="1"> <tr> <td>A</td> <td></td> </tr> <tr> <td>B</td> <td></td> </tr> <tr> <td>C</td> <td></td> </tr> </table>	A		B		C											
	A																
	B																
C																	
D2	<table border="1"> <thead> <tr> <th>Order m</th> <th>Grating constant a (meters)</th> </tr> </thead> <tbody> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>5</td><td></td></tr> <tr><td>6</td><td></td></tr> </tbody> </table>	Order m	Grating constant a (meters)	1		2		3		4		5		6			
	Order m	Grating constant a (meters)															
	1																
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	3																
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	5																
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Task	Summary Table	Mark (for marker's use only)																							
E1	<table border="1"> <thead> <tr> <th data-bbox="282 528 759 584">x co-ordinates (cm)</th> <th data-bbox="759 528 1236 584">y co-ordinates (cm)</th> </tr> </thead> <tbody> <tr><td data-bbox="282 584 759 647">-1.0</td><td data-bbox="759 584 1236 647"></td></tr> <tr><td data-bbox="282 647 759 710">-0.5</td><td data-bbox="759 647 1236 710"></td></tr> <tr><td data-bbox="282 710 759 772">0.0</td><td data-bbox="759 710 1236 772"></td></tr> <tr><td data-bbox="282 772 759 835">0.5</td><td data-bbox="759 772 1236 835"></td></tr> <tr><td data-bbox="282 835 759 898">1.0</td><td data-bbox="759 835 1236 898"></td></tr> <tr><td data-bbox="282 898 759 960">1.5</td><td data-bbox="759 898 1236 960"></td></tr> <tr><td data-bbox="282 960 759 1023">2.0</td><td data-bbox="759 960 1236 1023"></td></tr> <tr><td data-bbox="282 1023 759 1086">2.5</td><td data-bbox="759 1023 1236 1086"></td></tr> <tr><td data-bbox="282 1086 759 1149">3.0</td><td data-bbox="759 1086 1236 1149"></td></tr> <tr><td data-bbox="282 1149 759 1211">3.5</td><td data-bbox="759 1149 1236 1211"></td></tr> </tbody> </table>	x co-ordinates (cm)	y co-ordinates (cm)	-1.0		-0.5		0.0		0.5		1.0		1.5		2.0		2.5		3.0		3.5			
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E2	<table border="1"> <tbody> <tr> <td data-bbox="253 1288 469 1438">$M(y, x, D, \theta)$</td> <td data-bbox="469 1288 1267 1438"></td> </tr> <tr> <td data-bbox="253 1438 469 1590">I</td> <td data-bbox="469 1438 1267 1590"></td> </tr> <tr> <td data-bbox="253 1590 469 1742">S</td> <td data-bbox="469 1590 1267 1742"></td> </tr> <tr> <td data-bbox="253 1742 469 1805">ϕ^*</td> <td data-bbox="469 1742 1267 1805"></td> </tr> </tbody> </table>	$M(y, x, D, \theta)$		I		S		ϕ^*																	
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F2	<table border="1"> <tbody> <tr> <td data-bbox="285 1883 437 1957">b (meters)</td> <td data-bbox="437 1883 1235 1957"></td> </tr> </tbody> </table>	b (meters)																							
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G1	<table border="1"> <tbody> <tr> <td data-bbox="285 2029 437 2103">a^* (meters)</td> <td data-bbox="437 2029 1235 2103"></td> </tr> </tbody> </table>	a^* (meters)																							
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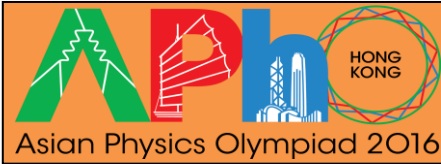


Answer Sheet – E1



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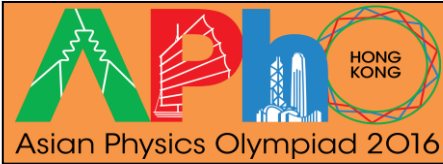
Task	Answer	Marks (for marker's use only)
A1	<p>Measure the height of the “zero-order spot” h, from the origin of the x-axis.</p> <p>Determine the incident angle θ of the laser beam from D and h. Write down the values of h in cm and θ in degrees to three significant figures in the corresponding table in the answer sheet.</p>	0.6



Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
<p>B1</p>	<p>Record the diffraction patterns on the graph paper for $\phi = 0^\circ, 30^\circ, 60^\circ$ and 90° of the rotary disk and write down the corresponding angle of rotation ϕ next to each pattern. Write down “# 2” at the top of this graph paper.</p> <p style="text-align: center;">PLEASE USE THE GRAPH PAPER PROVIDED FOR THIS TASK.</p>	<p>0.8</p>



Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
<p>C1</p>	<p>Mark the centers of the diffraction spots from Sample 3 for $\phi = 0^\circ, 30^\circ, 60^\circ$ and 90° on the graph paper and write down the corresponding angle of rotation ϕ next to each pattern. Write down “# 3” at the top of this graph paper.</p> <p style="text-align: center;">PLEASE USE THE GRAPH PAPER PROVIDED FOR THIS TASK.</p>	<p>0.8</p>

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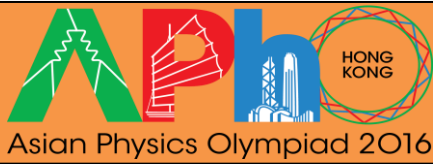
Task	Answer	Marks (for marker's use only)
D1	<p>Equation (3) can be rearranged to obtain a quadratic equation for the grating constant a of Sample 3, as</p> $Aa^2 + Ba + C = 0. \quad (4)$ <p>Derive the expressions for A, B and C. Enter your results in the corresponding table in the answer sheet.</p>	0.9

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Task	Answer	Marks (for marker's use only)
D2	<p>By solving this quadratic equation and using the measured y values of the diffraction spots for Sample 3 at $\phi = 90^\circ$ (See Task C1), together with the known values of D, θ and λ, determine the grating constant a of Sample 3 in meters to three significant figures for each diffraction order from the 1st order ($m = 1$) up to the 6th order ($m = 6$) [<i>Hints: These orders correspond to the six spots above the zero-order spot</i>]. Enter your results in the corresponding table in the answer sheet.</p>	1.6

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Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
D2 Cont.		

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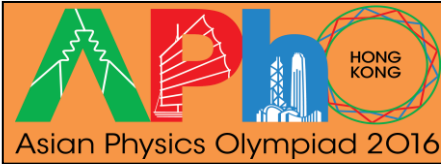


Answer Sheet – E1



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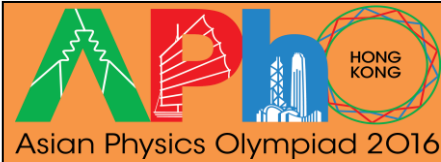
Task	Answer	Marks (for marker's use only)
D3	Calculate the mean for the grating constant a in meters to three significant figures and the standard error of the mean. Enter your results in the corresponding table in the answer sheet.	0.8



Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
E1	<p>Along the continuous diffracted curve of Sample 4 projected on the graph paper, measure the y-coordinates in cm for ten points starting from $x = - 1.0$ cm to 3.5 cm with a step of 0.5 cm. Enter your results in the corresponding table in the answer sheet.</p> <p>PLEASE PLACE YOUR RESULTS IN THE SUMMARY TABLE FOR THIS TASK.</p>	0.6

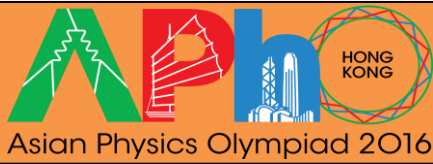


Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
E2	<p>Based on Eq. (1) given in Task D, construct a linear equation in the form of</p> $M(y, x, D, \theta) = I(D) + S(\phi^*)x . \quad (5)$ <p>Determine the functional forms for $M(y, x, D, \theta)$, $I(D)$ and $S(\phi^*)$. Plot M against x, using the data recorded in Task (E1). Determine the unknown angle ϕ^* in degrees from this graph. Write down all the functional forms and the value of ϕ^* in the corresponding table in the answer sheet.</p>	1.6

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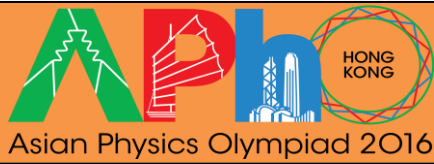


Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
E2 Cont.		

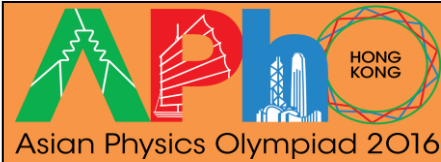
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Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
E2 Cont.		



Answer Sheet – E1



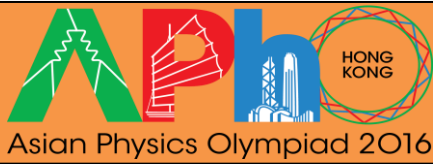
Task	Answer	Marks (for marker's use only)
F1	<p>Record the diffraction patterns you observed for $\phi = 0^\circ, 30^\circ, 60^\circ$ and 90° on separate graph papers for each value of ϕ. At the top of each graph paper, put down '#5' and the corresponding ϕ value. It is expected that you could observe more than 10 diffraction orders. However, you are required to record only three relatively brighter orders on each graph paper.</p> <p style="text-align: center;">PLEASE USE THE GRAPH PAPERS PROVIDED FOR THIS TASK.</p>	0.8

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Task	Answer	Marks (for marker's use only)
F2	<p>With this understanding, estimate the spacing b in meters of the uniformly spaced pre-made grooves of Sample 5 using the recorded diffraction pattern for $\phi = 0^\circ$ from Task F1.</p> <p>Enter the value of b in the answer sheet.</p> <p><i>[Note that in estimating the value of b, you are only required to take the measured data of the first diffraction order and the estimated b should be rounded up to three significant figures.]</i></p>	1.6

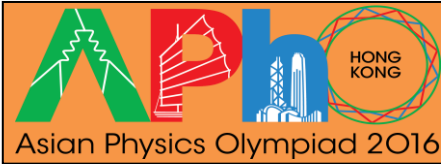
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Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
F2 Cont.		

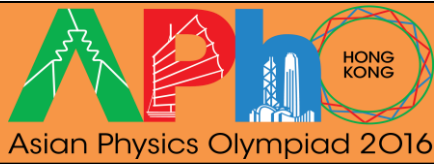


Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
<p>G1</p>	<p>For the ZnSe sample, based on Figure 16 and the experimental conditions given above, determine the lattice-plane spacing a^* of the periodic atomic lattice planes that are perpendicular to the nano-grooves with non-uniform spacing, in meters. Enter your result in the corresponding table in the answer sheet.</p>	<p>1.7</p>

STUDENT CODE:



Answer Sheet – E1



Task	Answer	Marks (for marker's use only)
G1 Cont.		