## Mark Scheme Diffraction Past Paper Questions

### Jan 2002 to Jan 2009

1

(a)(i) $0, 2\pi$ or $4\pi$ [or $0, 360^\circ$ or $720^\circ$] ✓

(ii) $4\lambda$ ✓

(iii) $\sin \theta = \frac{CE}{AC}$ ✓

[or $\sin \theta = \frac{BD}{AB}$ ]

$CE = 4\lambda$ and $AC = 2d$ ✓ (hence result)
[or $BD = 2\lambda$ and $AB = d$] ✓

(b) (limiting case is when $\theta = 90^\circ$ or $\sin \theta = 1$)

$\frac{d \sin \theta}{\lambda} = \frac{2.22 \times 10^{-6} (\times 1)}{486 \times 10^{-9}}$ ✓ ($= 4.6$)

highest order is 4th ✓

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### Question 2

| (a) | light waves diffract on passing through slits ✓
|     | narrow slits (or $d = \lambda$) give wide diffraction ✓
|     | diffracted waves meet or overlap or interfere ✓
|     | maxima when waves are in phase or when path difference is $n \lambda$ ✓ | max 3 |

(b) (i) $n_1 \lambda_1 = n_2 \lambda_2$ (or $3 \times 420 = 2 \lambda$) ✓ (gives $\lambda = 630 \text{ nm}$)

(ii) $d \left( \frac{n\lambda}{\sin \theta} \right) = \frac{3 \times 420 \times 10^{-9}}{\sin 44^\circ}$ ✓

\[ (= 1.81 \times 10^{-6} \text{ m}) \]

no of lines $m^{-1} = 1/1.81 \times 10^{-6} = 5.5 \times 10^5 (5.51 \times 10^5)$ ✓

(iii) when $\sin \theta = 1$, $n \left( \frac{d}{\lambda} \right) = \frac{1.81 \times 10^{-6}}{420 \times 10^{-9}}$ ✓ ($= 4.31$)

$\therefore$ highest order maximum is $4^{th}$ ✓

| Total | 8 |  |
Section A

This component is an objective test for which the following list indicates the correct answers used in marking the candidates’ responses.

<table>
<thead>
<tr>
<th>Keys to Objective Test Questions</th>
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<tbody>
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<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15</td>
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Section A

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Section A

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Section A: Objective test keys

Q6 Jan 2002

1-D; 2-C; 3-B; 4-C; 5-B; 6-D; 7-B; 8-A; 9-D; 10-C; 11-B; 12-B; 13-A; 14-D; 15-B.

Section A

Key to Objective Test Questions

Q6 Jun 2002

1-B; 2-B; 3-D; 4- C; 5-A; 6-C; 7-B; 8-B; 9-D; 10-A; 11-C; 12-C; 13-D; 14-A; 15-C.
Key to Objective Test Questions

Q7 Jun 2003

1-A; 2-B; 3-A; 4-B; 5-A; 6-B; 7-A; 8-A; 9-D; 10-C; 11-C; 12-D; 13-A; 14-C; 15-D.

Unit 4: Section A

Q5 Jan 2004

Key to Objective Test Questions

1-C; 2-A; 3-D; 4-D; 5-B; 6-A; 7-C; 8-D; 9-C; 10-C; 11-A; 12-C; 13-C; 14-B; 15-B.

PA04 Section A Waves, Fields and Nuclear Energy

Q6 Jun 2005

Key to Objective Test Questions

1-B; 2-A; 3-D; 4-B; 5-C; 6-C; 7-C; 8-D; 9-D; 10-A; 11-A; 12-B; 13-A; 14-B; 15-C.

PA04 Section A: Waves, Fields and Nuclear Energy

Q6 Jun 2006

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