

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Mark Schemes

Q1.

- (a) uniform width peaks ✓ (accurate to within
- $\pm$
- one division)

*peaks need to be rounded ie not triangular**the minima do not need to be exactly zero*

a collection of peaks of constant amplitude or amplitude decreasing away from central peak ✓

*pattern must look symmetrical by eye**condone errors towards the edge of the pattern**double width centre peak total mark = 0*

2

- (b) (i) constant / fixed / same phase relationship / difference (and same frequency / wavelength) ✓

in phase is not enough for the mark

1

- (ii) single slit acts as a point / single source diffracting / spreading light to
- both slits
- ✓
-
- OR

the path lengths between the single slit and the double slits are constant / the same / fixed ✓

1

- (iii)
- superposition
- of waves from two slits ✓

phrase 'constructive superposition' = 2 marks

diffraction (patterns) from both slits overlap (and interfere constructively) ✓ (this mark may come from a diagram)

constructive interference / reinforcement (at bright fringe)

peaks meet peaks / troughs meet troughs ✓ (any reference to antinode will lose this mark)

waves from each slit meet in phase

OR path difference = $n\lambda$ ✓

4 max 3

- (c) (i) $D = \frac{ws}{\lambda} = \frac{0.004 \times 5.0 \times 10^{-5}}{405 \times 10^{-9}}$ ✓ do not penalise any incorrect powers of ten for this mark
= 0.5 (m) ✓ (0.4938 m)

numbers can be substituted into the equation using any form
 note 0.50 m is wrong because of a rounding error
 full marks available for answer only

2

- (ii) fringes further apart or fringe / pattern has a greater width / is wider ✓
 ignore any incorrect reasoning
 changes to green is not enough for mark

1

- (iii) increase D ✓
 measure across more than 2 maxima ✓
 several / few implies more than two

added detail which includes ✓
 explaining that when D is increased then w increases
 Or
 repeat the reading with a changed distance D or using different numbers of fringes
 or measuring across different pairs of (adjacent) fringes
 Or
 explaining how either of the first two points improves / reduces the percentage error.
 no mark for darkened room

3

[13]

Q2.

- (a) (i) $\sin 60 = 1.47 \sin \theta$ OR $\sin \theta = \sin 60 / 1.47$ ✓
 $(\sin^{-1} 0.5891) = 36 (^{\circ})$ ✓ (36.0955°) (allow 36.2)
 Allow 36.0

2

- (ii) $\sin \theta_c = 1.33 / 1.47$ OR $\sin \theta_c = 0.9(048)$ ✓
 $(\sin^{-1} 0.9048) = 65 (^{\circ})$ ✓ (64.79)
 Allow 64 for use of 0.9 and 66 for use of 0.91

2

- (iii) answer consistent with previous answers, e.g.
 if $a_{ii} > a_i$:
 ray refracts at the boundary AND goes to the right of the normal ✓
 Angle of refraction > angle of incidence ✓ **this mark depends on the first**
 if a_{ii}
 TIR ✓
 angle of reflection = angle of incidence ✓
 ignore the path of the ray beyond water / glass boundary
 Approx. equal angles (continuation of the line must touch 'Figure 1' label)

2

- (b) for Reason or Explanation:
 the angle of refraction should be > angle of incidence when entering the water ✓
 water has a lower refractive index than glass \ light is faster in water than in glass ✓

TIR could not happen \ there is no critical angle, when ray travels from water to oil ✓
TIR only occurs when ray travels from higher to lower refractive index \ water has a lower refractive index than oil ✓

Allow 'ray doesn't bend towards normal' (at glass / water)

Allow optical density

Boundary in question must be clearly implied

4

[10]