

Name of the Student: \_\_\_\_\_

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

**Q1.**

- (a) App magnitude is how bright object appears in sky  
Abs magnitude is how bright object would appear if 10 parsecs away  
*Magnitude must be related to brightness or max 1* 2

- (b) Use of  $I = P / 4\pi r^2$   
 $9.8 \times 10^{27}$   
W 3

- (c) Sirius (is closer)  
Sirius is 10 pc from Earth or apparent magnitude = absolute magnitude  
Explains that data shows that Regal would appear ( much) brighter if at 10 pc but is seen to be much dimmer (so must be further away)  
**OR**  
Appears brighter  
Even though it has a lower luminosity / even though it has a lower surface temperature 2

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**Q2.**

- (a) uniform width peaks ✓ (accurate to within ± 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)  $D = \frac{w\lambda}{\lambda} = \frac{0.004 \times 5.0 \times 10^{-5}}{405 \times 10^{-9}}$  ✓ **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*

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