

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

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

**Q1.**

- (a) (i) change in (apparent) frequency [or wavelength] **(1)**  
 due to relative motion between source and observer **(1)**
- (ii) from spectrum obtain change in wavelength,  $\Delta\lambda$ , for a spectral line **(1)**  
 using known wavelength measured on Earth **(1)**

$$\frac{\Delta\lambda}{\lambda} = (-) \frac{v}{c}$$

calculate  $v$  from **(1)**

- (iii) radar or rotation of star **(1)**  
 double Doppler effect because body acts as source for return signal **(1)**  
 [for rotation, one limb moves towards Earth, one away]

**(max 6)**

- (b) (i) use of  $v = Hd$  **(1)**

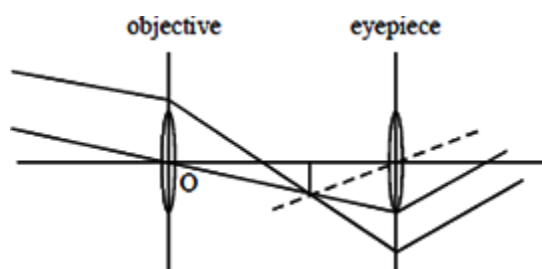
$$v = \frac{5 \times 10^4 \times 4.9 \times 10^7}{3.26 \times 10^6} = 7.5 \times 10^5 \text{ m s}^{-1}$$

- (ii)  $\Delta\lambda \left( = \frac{\lambda v}{c} \right) = \frac{7.5 \times 10^5 \times 6.5647 \times 10^{-7}}{3 \times 10^8} = 1.64 \times 10^{-9} \text{ (m)} \text{ **(1)**}$

$$\lambda_{\text{obs}} = (6.5647 + 0.0164) \times 10^{-7} = 6.58 \times 10^{-7} \text{ m} \text{ **(1)**}$$

**(4)****[10]****Q2.**

- (a) (i)

correct rays through objective **(1)**first image at  $f_o$  **(1)**

$f_o$  and  $f_e$  coincide **(1)**

correct construction line(s) **(1)**

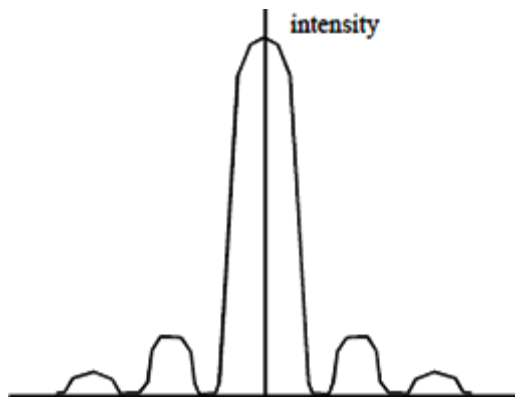
rays emerge parallel **(1)**

(ii)  $\left( M = \frac{\alpha'}{\alpha} \text{ gives } \right) 24 = \frac{120}{\alpha} \text{ (1)}$

$\alpha = 5$  sec (of arc) **(1)**

(7)

(b) (i)



central maximum **(1)**

decreasing maxima **(1)**

approximate equal spacing between

minima either side of central axis **(1)**

(ii) two intensity curves [or two Airy discs] **(1)**  
central maximum of first coincides with  
first minimum of second curve **(1)**

(5)

(c) (i)  $\left( \theta = \frac{\lambda}{d} \text{ gives } \right) \theta = \frac{6.0 \times 10^{-7}}{15 \times 10^{-2}} = 4.0 \times 10^{-6} \text{ rad (1)}$

angular separation of Mizar  $7.0 \times 10^{-5}$  rad, can be resolved **(1)**

(ii) resolving power controlled by diffraction effects [ or by  $\frac{\lambda}{d}$  ] **(1)**

hence increasing angular magnification does not increase resolution **(1)**

(4)

[16]