Mark scheme for Support Worksheet – Topic 4, Worksheet 4

1 Travelling waves transfer energy, standing waves do not; travelling waves have a constant amplitude standing waves do not. [2]

2 A standing wave is formed when two identical travelling waves travelling in opposite directions; meet and superpose. [2]

3 It is twice the string length, i.e. 3.0 m. [1]

4 The fundamental wave has wavelength $2L$ and the second harmonic wavelength L; so

$$\frac{f_2}{f_2} = \frac{\frac{v}{L}}{\frac{v}{2L}} = 2$$ [2]

5 The wavelength is $4L$, i.e. 3.0 m. [1]

6 The Doppler effect is the phenomenon in which there is a change in observed frequency; when there is relative motion between the observer and the source. [2]

7 See Figure 5.2 on page 245 of *Physics for the IB Diploma*. From the diagram, the wavefronts in front of the source are closer together; which means that the observer receives the wavefronts more frequently, i.e. with higher frequency. [2]

8 **a** ***c*** [1]

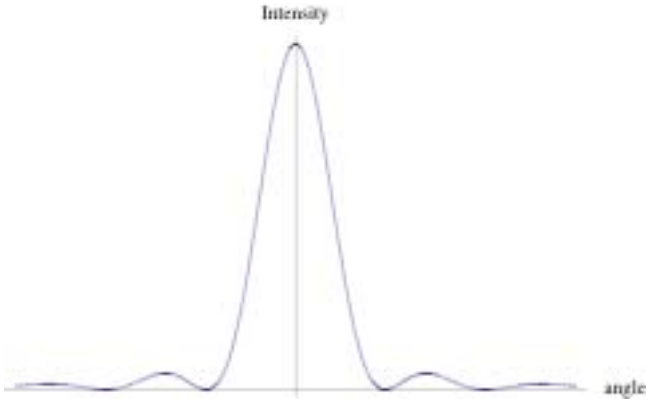
b $\lambda = \frac{c}{f'} = \frac{c}{\frac{cf}{c-v}} = \frac{c-v}{c} f$ [1]

9 $f' = \frac{cf}{c+v} = \frac{c \times 4200}{c + \frac{c}{10}}$; $f' = \frac{4200}{1.1} = 3818 \approx 3800$ Hz [2]

10 $f' = \frac{(c+v)f}{c} = \frac{(340+12) \times 680}{340}$; $f' = 704$ Hz [2]

11 Measuring the speed of cars on highways; measuring the speed of blood in arteries. [2]

12 See diagram below: you must show the central maximum; maxima at an intensity that is greatly reduced; and finally minima with zero intensity. [3]



13 From $b\sin\theta = \lambda$ we have that $\sin\theta = \frac{\lambda}{b} = \frac{2.4}{4.0} \Rightarrow \theta \approx 37^{o}$ [1]

14 Two sources are just resolved if the central maximum in the diffraction pattern of one source coincides with the first minimum of the other. [1]

15 From the Rayleigh criterion the angular separation θ_A of the two sources is equal to $\frac{\lambda_{blue}}{b}$; Since $\lambda_{blue} < \lambda_{red}$ we have that $\theta_A < \frac{\lambda_{red}}{b}$ and so the sources will not be resolved. [2]