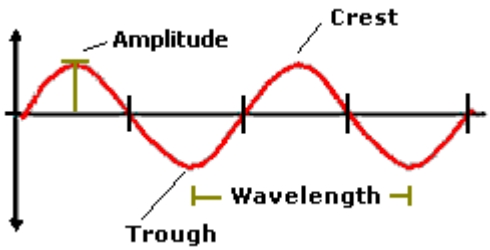
Waves and Light Assignment SOLUTIONS

1. a) The *time* of swing (back to where it started) /1
   b) Seconds /1

2.



/2

3. a) The *number* of vibrations (cycles) per time /1
   b) Hz (hertz) /1

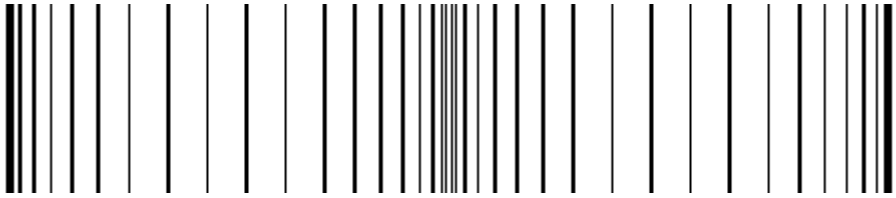
4. a)

/1

b) (the low frequency one) /1

c) Increase /1

5. a)



(a wave depicted by closely drawn dots (compressions) and sparse dots (rarefactions) is also acceptable) /1

b) From compression to compression or rarefaction to rarefaction /1

c) Back and forth along the direction of propogation /1

6. f = 76 hb/min = 76/60 cycles/second = 1.3 Hz (2 s.f.)
   T = 1/f = 0.79 seconds (2 s.f.) /3

7.

$\lambda = 0.4\text{m} \quad f = 2\text{Hz}$

$v = f\lambda = 0.4 \times 2 = 0.8\text{ms}^{-1}$ (1 s.f.)

/2

8. a) They cancel out or add together (completely or partially) depending on whether a crest overlaps a trough, a compression overlaps a rarefaction, etc. /2

b) They must be travelling in opposite directions, have equal amplitude, and have equal frequency.

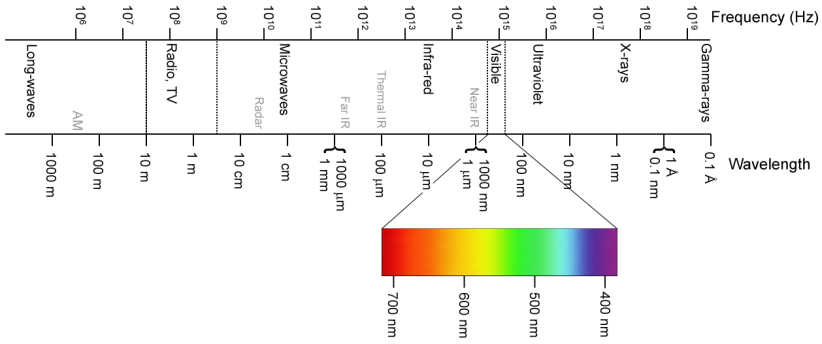
/2

c) Draw a standing wave which has 4 nodes.

/2

9. Moving towards you the waves are being created close behind each other and therefore the frequency is higher. Moving away, the waves are being produced further apart, therefore lower frequency. /3

10. a)



/4

b) (i) and (ii) shown above

(iii) Gamma (high frequency end) has more energy /4

11. No effect. Opacity is a property of the atoms, not just the particle layout. /2

12. Paper exhibits diffuse reflection /1

13. $n\sin\theta = n'\sin\theta'$ so $\theta' = \sin^{-1}(n\sin\theta \,/\, n')$

so $\theta' = \sin^{-1}(1.00 \times \sin(28.0°) \,/\, 1.33) = 20.7°$ (3 s.f.) /2

14. a) The pigment in the train's paint absorbs blue light but reflects orange light. /2

b) Possibly black if only orange wavelengths are reflected, but more likely a dark green since orange pigment is likely to be reflecting red and green light

(since red + green = yellow and red + yellow = orange) /1

TOTAL /40