Physics 11 Answers to Questions pages 371 - f.

(1) period $= \frac{15\,s}{20\text{ swings}} = \frac{.75\,s}{1\text{ swing}}$; frequency $= \frac{20\text{ swings}}{15\,s} = \frac{1.3\text{ swings}}{1\,s}$

(2) period $= \frac{60\,s}{30\text{ waves}} = \frac{2\,s}{1\text{ wave}}$

(3) a) $\frac{36\text{ points}}{24\text{ min}} = \frac{1.5\text{ points}}{1\text{ min}}$ (3) b) $\frac{27\text{ Times}}{9\text{ min}} = \frac{3\text{ Times}}{1\text{ min}}$ (3) c) $\frac{170\text{ Times}}{15.0\,s} = \frac{11.3\text{ Times}}{\text{sec}}$

(4) a) $\frac{12\,s}{30\text{ times heartbeat}} = \frac{.4\,s}{\text{heartbeat}}$ (4) b) $\frac{8.0\,s}{2048\text{ vibration}} = \frac{3.9\times10^{-3}\,s}{1\text{ vibration}}$ (4) c) $\frac{163.8\text{ d}}{6\text{ rev}} = \frac{27.3\text{ d}}{1\text{ rev}}$

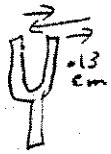
(5) a) $\frac{1}{5\,s} = .2\text{ Hz}$ (5) b) $\frac{1}{.01\,s} = 100\text{ Hz}$ (5) c) $\frac{1}{2.5\times10^{-2}\,s} = 4\times10^{1}\text{ Hz}$ (5) d) $\frac{1}{.8\,s} = 1.25\text{ Hz}$

(5) e) $\frac{1}{6.0\,s} = .17\text{ Hz}$ (5) f) $\frac{1}{.40}\text{ min} = \frac{1}{24\,s} = .042\text{ Hz}$

(6) a) $\frac{1}{10\text{ Hz}} = .1\,s$ (6) b) $\frac{1}{.25\text{ Hz}} = 4\,s$ (6) c) $\frac{1}{500\text{ kHz}} = \frac{1}{500000\text{ Hz}} = 2\times10^{-6}\,s$

(6) d) $\frac{1}{.10\text{ Hz}} = 10\,s$ (6) e) $\frac{1}{2.5\text{ Hz}} = .4\,s$ (6) f) $\frac{1}{3.5\text{ Hz}} = .29\,s$

(8)



distance travelled per 1 cycle = .52 cm

200 Hz = $\frac{200\text{ cycles}}{\text{sec}}$

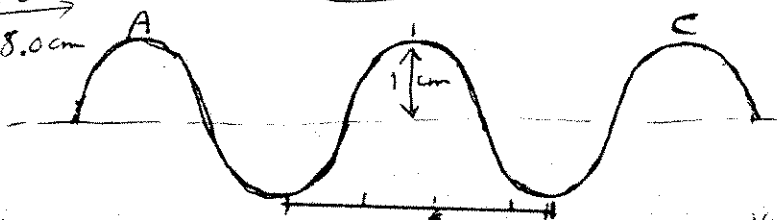
distance per sec = $\frac{.52\text{ cm}}{\text{cycle}} \times \frac{200\text{ cycles}}{\text{sec}} = \frac{104\text{ cm}}{\text{sec}}$

distance per minute = $\frac{104\text{ cm}}{\text{sec}} \cdot \frac{60\text{ sec}}{1\text{ min}} = \frac{6240\text{ cm}}{\text{min}} = 6.2\text{ m}$

(7)

amplitude $= \frac{1}{2} = 4.0\text{ cm}$

(9) a)



wavelength = 3.5 cm
amplitude = 1.0 cm

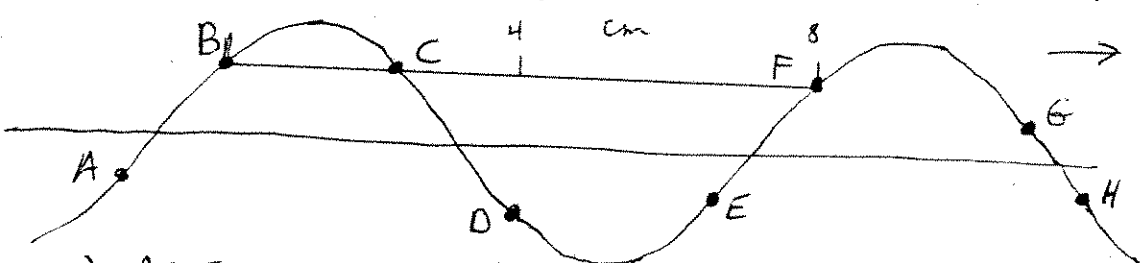
b)(i) $V = \frac{\text{distance}}{\text{Time}} = \frac{7.2\text{ cm}}{2.0\,s} = \frac{3.6\text{ cm}}{\text{sec}}$

b)(ii) $V = f\lambda$ $f = \frac{V}{\lambda} = \frac{3.6\text{ cm/s}}{3.6\text{ cm}} = 1.0\text{ Hz}$

b)(iii) ~~$f = \frac{V}{\lambda}$~~ = 1.0 Hz ← Same as the waves frequency.

(10) $V = f\cdot\lambda$ $F = \frac{V}{\lambda} = \frac{2.0\text{ m/s}}{8.0\text{ m}} = .25\text{ Hz}$ (waves/sec) $\frac{\text{waves}}{1\text{ min}} = \frac{.25\text{ waves}}{\text{sec}} \times \frac{60\,s}{1\text{ min}} = \frac{15\text{ waves}}{\text{min}}$

(11)



a) A & E in phase
A & H "
~~E & H~~
B & F "

b) 7.9 cm

c) $T = .5\,s$
d = 1½ wavelengths = 11.85 cm.
$V = \frac{d}{t} = \frac{11.85\text{ cm}}{.5\,s} = \frac{23.7\text{ cm}}{\text{sec}} = \frac{24\text{ cm}}{\text{sec}}$

(12) $\lambda = 6.0\text{ m}$ $V = 5.6\text{ m/s}$

a) $f = \frac{V}{\lambda} = \frac{5.6\text{ m/s}}{6.0\text{ m}} = .93\text{ Hz}$ (12) b) $\frac{1}{.93} = 1.0714\,s$ $1.1\,s$

(13) $V = f\cdot\lambda$, $V = 5.0\text{ Hz} \cdot .4\text{ m} = 2\text{ m/s}$ (200 cm/s)

(14) $\lambda = 5.0\,m$ $V = \frac{8.6m}{5.0s} = 1.72\,m/s$ $f = \frac{V}{\lambda}$

$f = \frac{V}{\lambda} = \frac{1.72\,m/s}{5.0\,m} = .34\,Hz$

(15) a) $\lambda = 3.7m$ Period $= 1.5s$ $f = \frac{1}{1.5s} = .67\,Hz$

$V = f \cdot \lambda = .67 \times 3.7 = 2.5\,m/s$ (2.46)

b) $V = \frac{d}{t}$; $t = \frac{d}{V}$ $t = \frac{100\,m}{2.46\,m/s} = 40.54 = 41s$

c) $d = V \cdot t$ $d = 2.46 \times 60s$ (1 min) $= 148\,m = 150\,m$

(16) $V = \frac{60\,cm}{2.0\,s} = \frac{30\,cm}{s}$ $f = \frac{V}{\lambda} = \frac{30\,cm/s}{5.0\,cm} = 6.0\,Hz$

$\lambda = 5.0\,cm$

(17) $\lambda = 30\,m$ $V = 8.0\,m/s$ period $= ? = \frac{1}{f}$

$f = \frac{V}{\lambda} = \frac{8.0\,m/s}{30\,m} = .2\dot{6}$ ~~Hz~~ period $= 3.75\,s = 3.8\,s$

(18) $V = f \cdot \lambda$; $V = 100\,Hz \cdot 3.4\,m = 340\,m/s$

(19) $p = 3.0 \times 10^{-3}\,s$; $V = 360\,m/s$; $\lambda = \frac{V}{f} = \frac{360\,m/s}{3.\dot{3} \times 10^{2}\,Hz} = 1.08$

$f = \frac{1}{3.0 \times 10^{-3}} = 3.\dot{3} \times 10^{2}\,Hz$ $= 1.1\,m$

(20) $f = 90\,MHz = 90 \times 10^{6}\,Hz$; $V = 3.0 \times 10^{8}\,m/s$

$\lambda = \frac{V}{f} = \frac{3.0 \times 10^{8}\,m/s}{90 \times 10^{6}\,Hz} = 3.3\,m$

(21) $f = 102\,MHz = 102 \times 10^{6}\,Hz$; $V = 3.0 \times 10^{8}\,m/s$

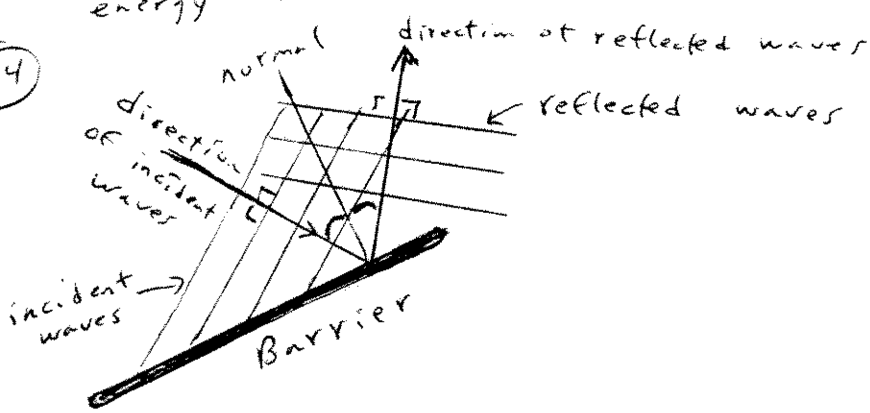
$\lambda = \frac{V}{f} = \frac{3.0 \times 10^{8}\,m/s}{102 \times 10^{6}\,Hz} = 2.94\,m = 2.9m$

(22) $f = 5.5 \times 10^{4}\,Hz$, $V = 350\,m/s$, $\lambda = \frac{V}{f} = \frac{350\,m/s}{5.5 \times 10^{4}\,Hz} = 6.363 \times 10\,m$

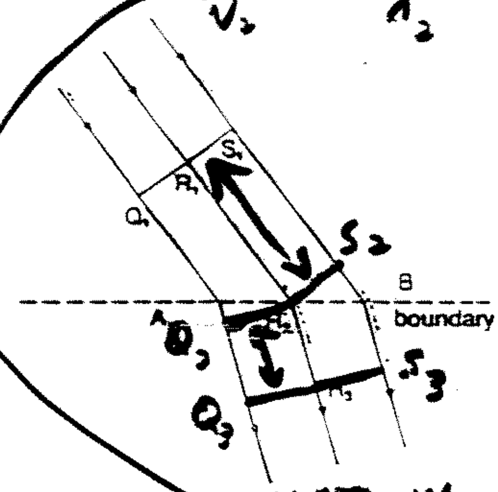
$= 6.4 \times 10^{-3}\,m$

(23) As the waves lose energy, their amplitude decreases. The waves lose energy because the particles of the medium absorb some energy because there is friction in the medium (becomes heat).

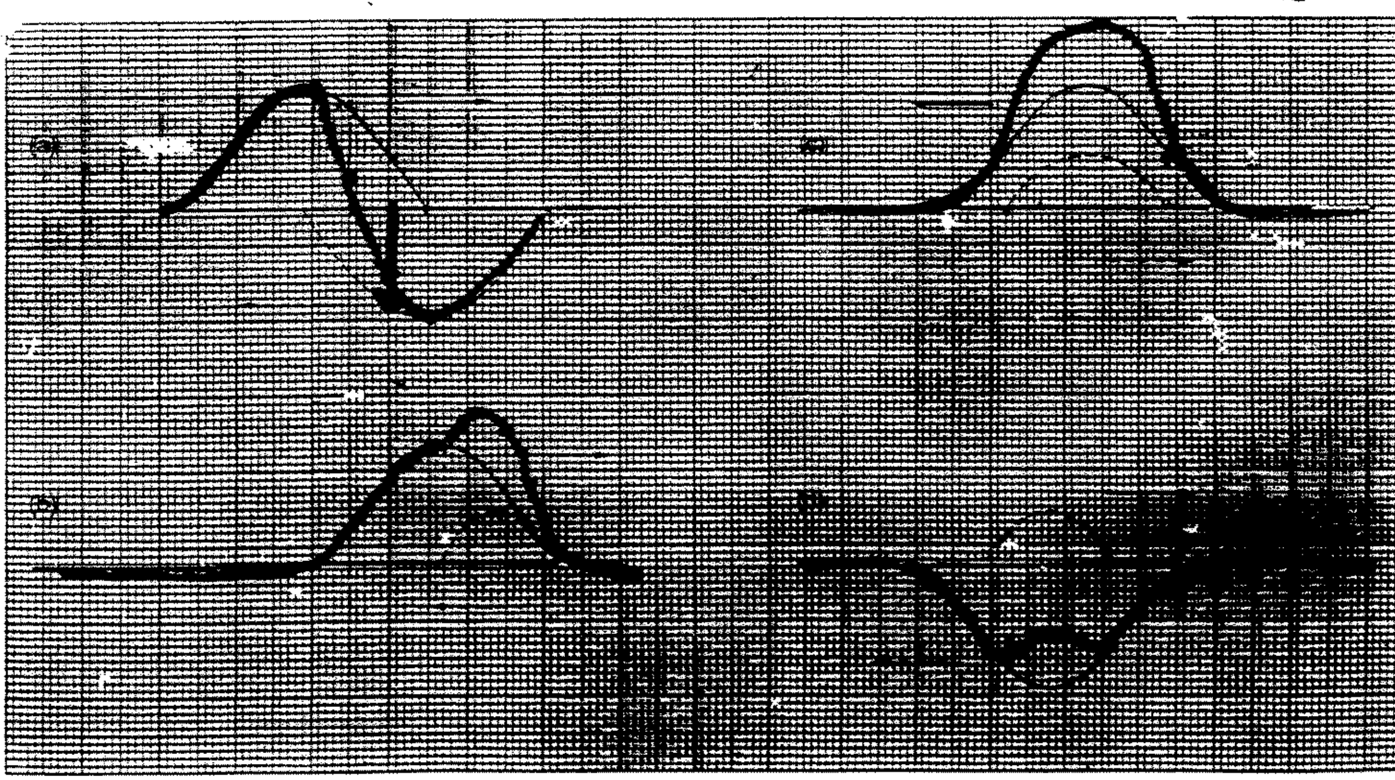
(24)



25. In this diagram, QRS is a straight wave, and the wave rays indicate the direction of its motion towards a refracting surface, AB. Copy the diagram into your notebook and draw the wavefront $Q_1 R_1 S_1$ when it has reached R_1 and R_2. Label the corresponding wavefronts at these points $Q_2 R_2 S_2$ and $Q_3 R_3 S_3$.
26. The speed of water waves is 30 cm/s in deep water and 15 cm/s in shallow water. If the wavelength in deep water is 1.0 cm, what is the wavelength in shallow water?
27. The velocity of sound waves in cold air is 320 m/s, and in warm air it is 384 m/s. If the wavelength of the sound waves was 3.0 m in cold air, what would it be in warm air?
28. As water waves approach a beach, their wavelengths become shorter. Why?
29. What happens when two billiard balls, rolling towards one another, collide head on? How does this differ from two waves or pulses that collide head on?
30. Trace the pulses illustrated into your notebook, and determine the resultant displacement of the particles of the medium at each instant, using the Principle of Superposition.



Question 25



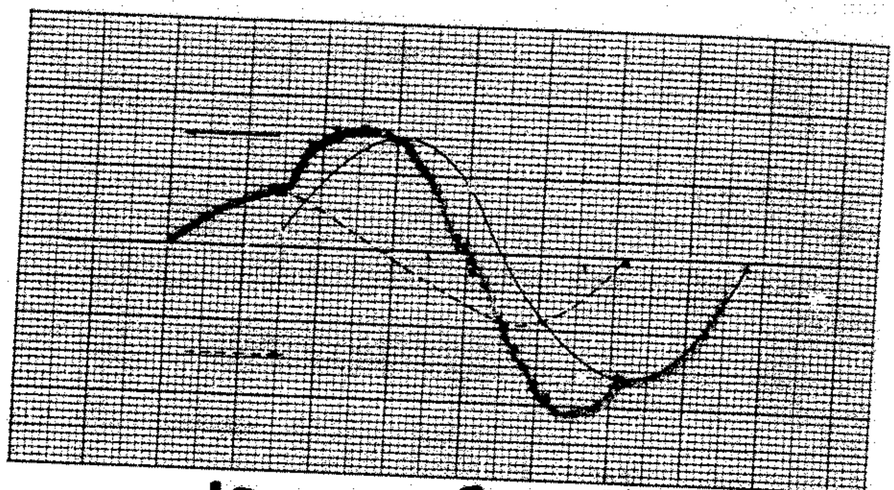
Numerical Answers to Review Questions

1. 1.3 Hz, 0.75 s
2. 2.00 s
3. (a) 1.5 points/min (b) 3 escapes/min (c) 11.3 r/s
4. (a) 0.40 s (b) 3.9×10^{-3}s (c) 27.30 d
5. (a) 0.20 Hz (b) 1.0×10^{2} Hz (c) 40 Hz (d) 1.2 Hz (e) 0.17 Hz (f) 4.2×10^{-2} Hz
6. (a) 0.10 s (b) 4.0 s (c) 2.00×10^{-6} s (d) 10 s (e) 0.40 s (f) 0.20 s
7. 4.0 cm
8. 62 m
9. (a) 3.6 cm, 1.0 cm (b) (i) 3.6 cm/s (ii) 1.0 Hz (iii) 1.0 Hz
10. 15 waves
11. (b) 8.0 cm (c) 24 cm/s

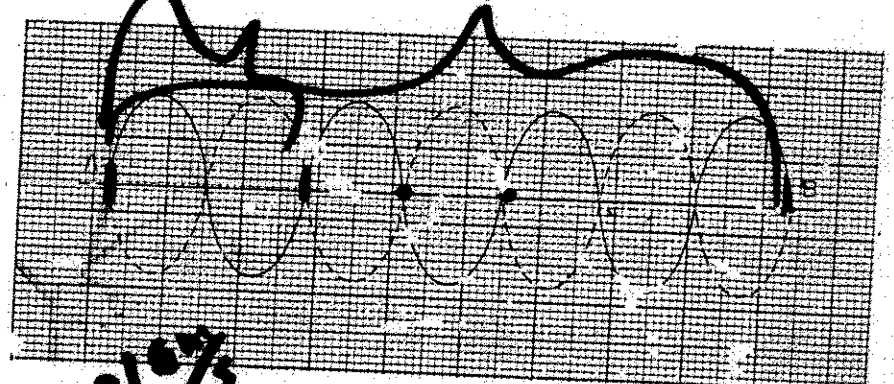
1 . (a) 0.93 Hz (b) 1.1 s

13. 2.0×10^{2} cm/s
14. 0.34 Hz
15. (a) 2.5 m/s (b) 41 s (c) 1.5×10^{2} m
16. 6.0 Hz
17. 3.S ;
18. 3.4×10^{2} m/s
19. 1.1 m
20. 3.3 m
21. 2.9 m
22. 6.4×10^{-3} m
26. 0.50 cm
27. 3.6 m
32. (a) 2.6 cm (b) 3.1 cm/s (c) 1.2 Hz
33. (a) 3.0 m (b) 8.0 cm (c) 96 mm
34. (a) 50 cm (b) 1.0×10^{4} cm/s
35. (a) 36 cm (b) 3.6×10^{2} cm/s
36. 40 cm, 15 Hz

31. Trace the waves illustrated into your notebook and determine their resultant displacement.



32.



Using measurements taken directly from this diagram of a standing wave pattern, determine each of the following.

(a) the wavelength of the waves

(b) the speed of the waves, if they move between points A and B in 3.0 s

(c) the frequency of the waves

33. Calculate the wavelength if the distance between adjacent nodes in a vibrating medium is

(a) 1.5 m (b) 4.0 cm (c) 48 mm