Waves Review

(1) transverse wave - disturbance is perpendicular to the direction the wave travels

a) Shake the spring side to side

b) 1. Rate at which you shake

ii. Tension in the spring (medium)

iii. Both i + ii - wavelength is proportional to velocity (medium) + inversley proportional to frequency (rate)

iv. Force used to shake/displacement during shake

(2) longitudinal wave - disturbance is parallel to the direction the wave travels

- Pull some of the coils in and release

(3) a) $T = 0.2\ s$

b) $f = \frac{1}{T} = \frac{1}{.2}$ $\boxed{f = 5\ Hz}$

c) $\lambda = \frac{v}{f} = \frac{40\ m/s}{5\ Hz}$ $\boxed{\lambda = 8\ m}$

d) $A = 4\ m$

e) distance $= 16\ m$

f) speed $= \frac{16\ m}{.2\ s} = 80\ m/s$

g) a would be $\frac{1}{2}$

b would double

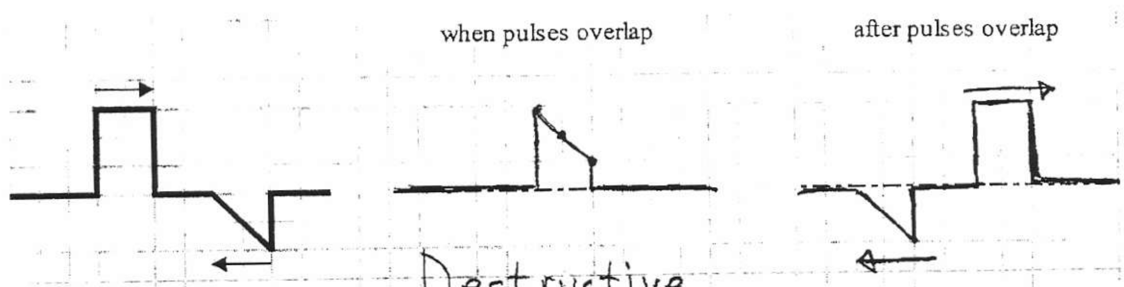
c would be $\frac{1}{2}$

d wouldn't change

e wouldn't change

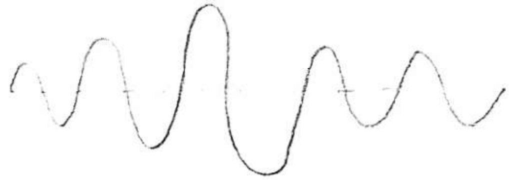
f would double

(4)



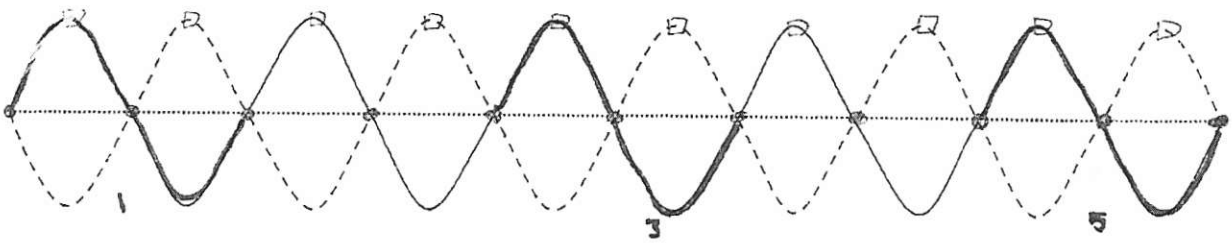
Destructive Interference

(5)

a) 

b) The two tuning forks interfere w/ each other - since their frequencies are close they quickly oscillate between constructive + destructive interference

(6)



a) Draw a dot at each node. Count how many nodes there are. 11 nodes

5 Waves.

b) Draw a square at each anti-node. Count how many anti-nodes there are. 10 anti-nodes

c) $L = 5\lambda$

$\lambda = \frac{L}{5} = \frac{.5m}{5}$

$\boxed{\lambda = .1m}$

d) $f = 88Hz$

$V = f\lambda$

$V = 88Hz(.1m)$

$\boxed{V = 8.8 m/s}$

e) The shortened string would still produce a wave - there would be 9 nodes instead of 11.

f) There would no longer be a standing wave; the length is no longer $= \frac{n}{2}\lambda$.

d) original: $n = 10$ $(\frac{10}{2} = 5)$

next: $n = 11$

$L = \frac{11}{2}\lambda$

$\lambda = \frac{2L}{11} = \frac{2(.5m)}{11}$

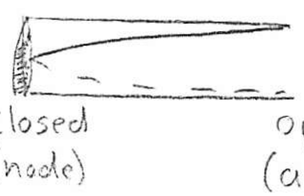
$\lambda = .09m$

$f = \frac{V}{\lambda}$

$f = \frac{8.8 m/s}{.09m}$

$\boxed{f = 98 Hz}$

(7)

a) 

b) $L = \frac{n}{4}\lambda = \frac{1}{4}\lambda$

$\lambda = 4L = 4(.2m)$

$\lambda = .8m$

$f = \frac{V}{\lambda} = \frac{340 m/s}{.8m}$

$\boxed{f = 425 Hz}$

c) 

$L = \frac{3}{4}\lambda$

$\lambda = \frac{4L}{3} = \frac{4(.2m)}{3}$

$\lambda = .267m$

$f = \frac{340 m/s}{.267m}$

$f = 1275 Hz$

(3x higher than original)

d) 

$L = 3/4\lambda$

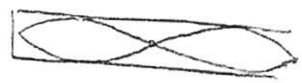
$L = 3/4(.8m)$

$\boxed{L = .6m}$

(8)

a) the length of the pipe must be an odd quarter of the wavelength in order to resonate ($L = \frac{n}{4}\lambda$, n = odd)

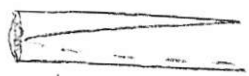
- Resonates



- Doesn't Resonate

b) Yes - both lengths must be an odd quarter of the wavelength

ex: $\lambda = 1m$

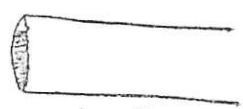


$L = .25m$

$L = .75m$

c) Yes - the wavelengths of the tuning forks must be such that the length of the pipe is still an odd quarter of the wavelength

ex:



$L = 3m$

$n = 1: \lambda = 4L : \lambda = 12m$
$n = 3: \lambda = \frac{4}{3}L : \lambda = 4m$
} Both will resonate

REVIEW

1) E FREQUENCY DECREASES AS THE SOURCE MOVES AWAY & IS INCREASED AS IT MOVES TOWARD.

⇒ THE SHIFT IN FREQUENCY DEPENDS ON VELOCITY (HOW FAST) & NOT PROXIMITY (HOW CLOSE).

2.) B IT COULD BE 336 OR 444 → EACH IS 4 Hz FROM ~~THE~~ 440. INCREASING TENSION RAISES FREQUENCY WHICH INCREASES BEATS.

3.) C IT GOES FROM HIGH TO LOW THE INSTANT IT PASSES. THE SHIFT IS CONSTANT UNTIL THAT TIME.

4.) C $V = F\lambda$

$= 120\text{Hz}\,(0.5\text{ m}) = \underline{60\text{ m/s}}$

5.) D

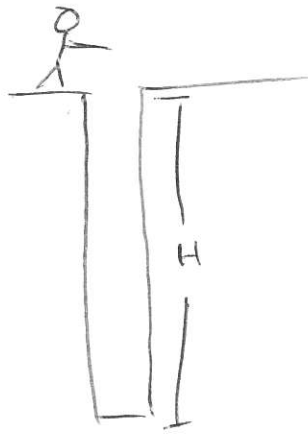
6.) C $f = \dfrac{12\text{ WAVES}}{6\text{ s}} = 2\text{Hz}$

$V = F\lambda = 2\text{Hz}(.75\text{ m}) = 1.5\text{ m/s}$

7.) B $\lambda = 4\text{ cm} \Rightarrow 3\text{ WAVES IN } 12\text{ cm}$

$f = \dfrac{V}{\lambda} = \dfrac{320\text{ cm/s}}{4\text{ cm}} = 80\text{Hz}$

8.) A



$V_{SOUND} = 340 m/s$

SOUND GOES DOWN & BACK - TRAVELS 2H

$d = vt$

$d = 340 m/s (.437s)$

$d = 148.5 m$

$H = \frac{d}{2} = 74.3 m$

9.) C

FREQUENCY IS CONSTANT WHEN A WAVE CHANGES MEDIUM.

10.) C

$F_B = |f_1 - f_2|$

$\pm 7 = |400 - f|$

$f = 400 \pm 7$ → 393, → 407

11.)

$\lambda = \frac{V}{f} = \frac{340}{350} = 0.97 m$

$\lambda_7 = \frac{4L}{7}$

$L = \frac{7\lambda_7}{4} = \frac{7(.97)}{4} = 1.7 m$

12.) a. $\lambda_5 = \frac{2(.685)}{5} = 0.274 m$

$F = \frac{V}{\lambda} = \frac{338}{.274} = 1233 Hz$

b. $\lambda_5 = \frac{2(.685)}{5} = .274 \Rightarrow F = 1233 Hz$

c. $\lambda_5 = \frac{4(.685)}{5} = 0.548 m \quad F = \frac{338}{.548} = 617.8 Hz$