Reflected and transmitted pulses

http://www.kettering.edu/~drussell/Demos/reflect/reflect.html

bottom

http://physics.usask.ca/~hirose/ep225/animation/reflection/anim-reflection.htm

Velocity

$$v=\sqrt{E/\rho}$$

$$v=\sqrt{\beta/\rho}$$

$$v=\sqrt{T/\mu}$$

$$v= f\lambda$$

$$v= d/t$$

$$E = 2\pi^2 m f^2 x_0^2$$

$$\rho = m/V$$

$$m = \rho V$$

$$V = A\ell$$

$$v = \ell/t$$

$$\ell = vt$$

$$m = \rho A v t$$

$$E = 2\pi^2 (\rho A v t) f^2 x_0^2$$

Ratios

$$E = 2\pi^2 \rho A v t f^2 x_0^2$$

and $P = E/t$

$$\therefore P = 2\pi^2 \rho A v f^2 x_0^2$$

"t's" cancel

Ratios:

$$P = 2\pi^2 \rho A v f^2 x_0^2$$

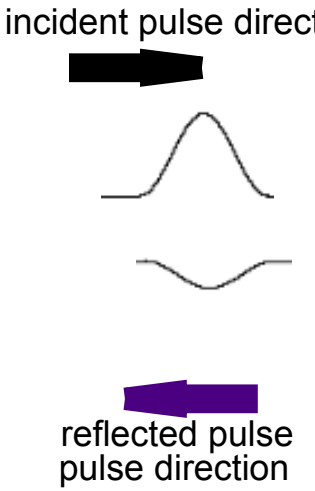
and $I = \frac{P}{A}$

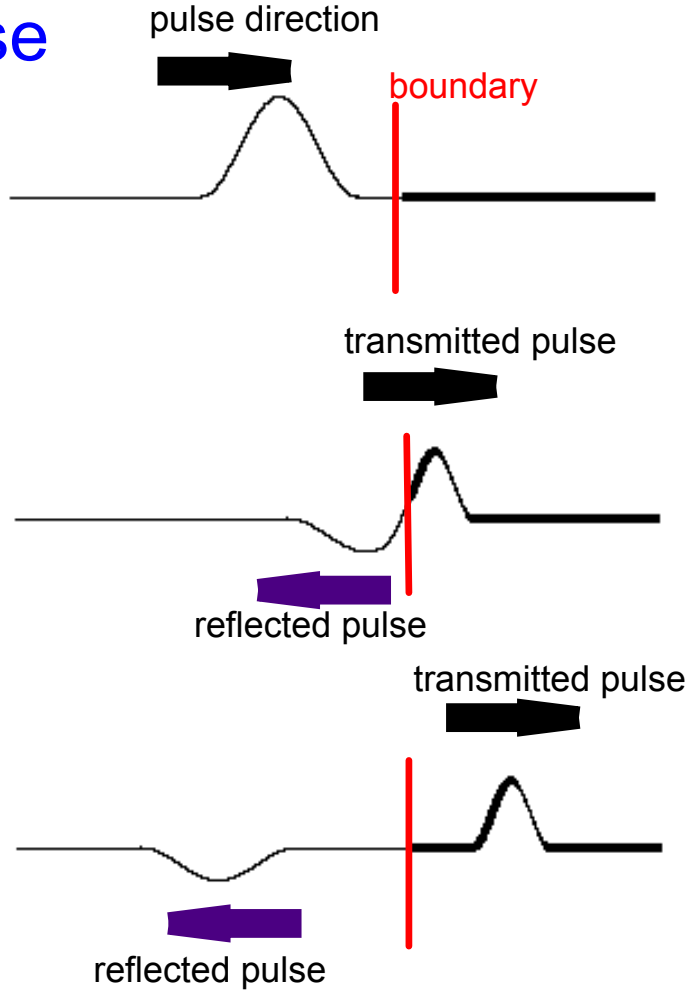
$$\therefore I = 2\pi^2 \rho v f^2 x_0^2$$

Ratio:

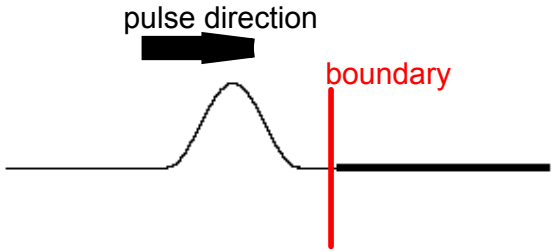
When a wave strikes a boundary between two mediums it is always *partially transmitted and partially reflected.*

Fixed boundary- reflected pulse



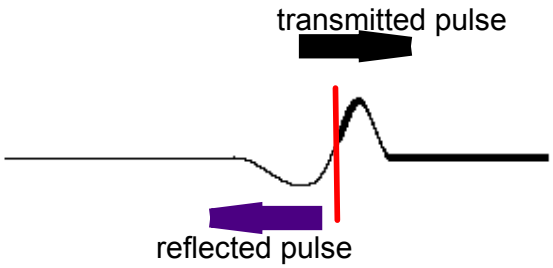


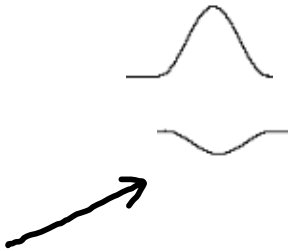
Fixed boundary- reflected pulse



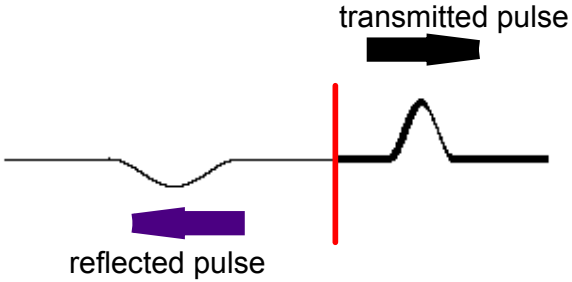
1) Note, reflected pulse is inverted.

2) Note, the size of the reflected pulse is diminished





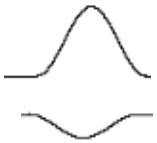
less amplitude in reflected pulse



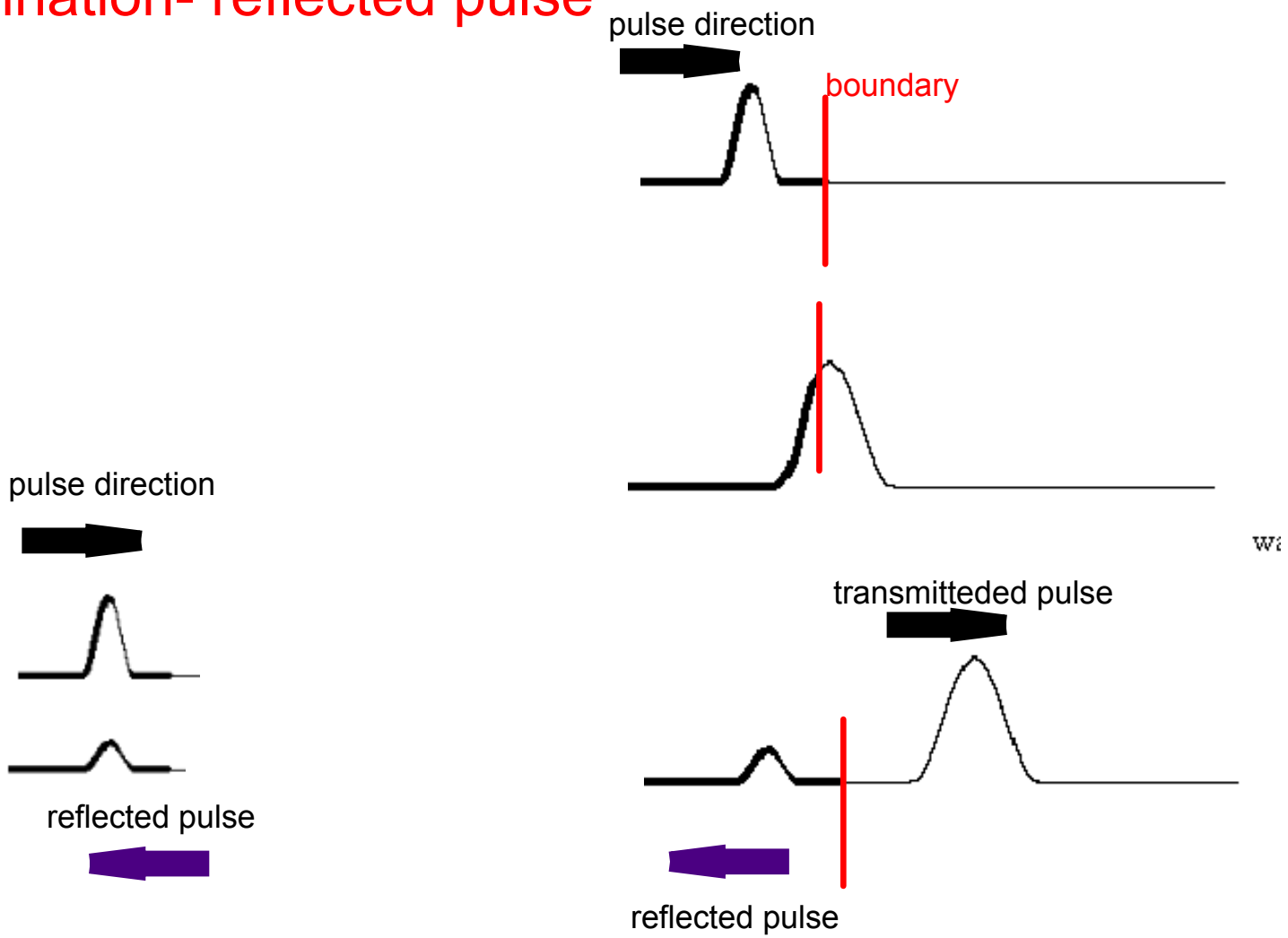
1) Less particle displacement

2) Less energy (some goes into second medium)

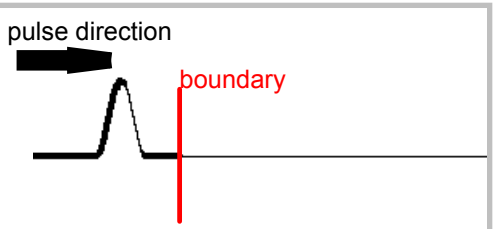
same "v", "freq.", and "λ", because same medium



Open Termination- reflected pulse

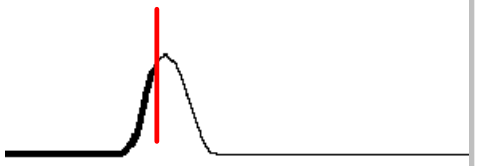


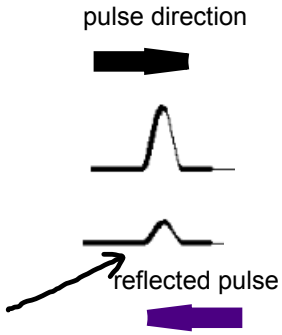
Open Termination- reflected pulse

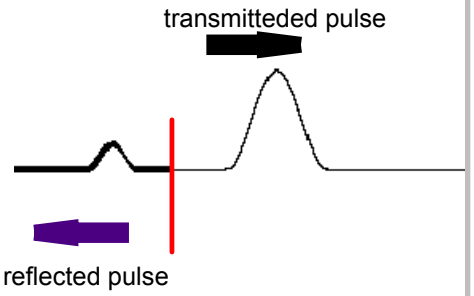


1) Note, reflected pulse is erect.

2) Note, the size of the reflected pulse is diminished







less amplitude in reflected pulse

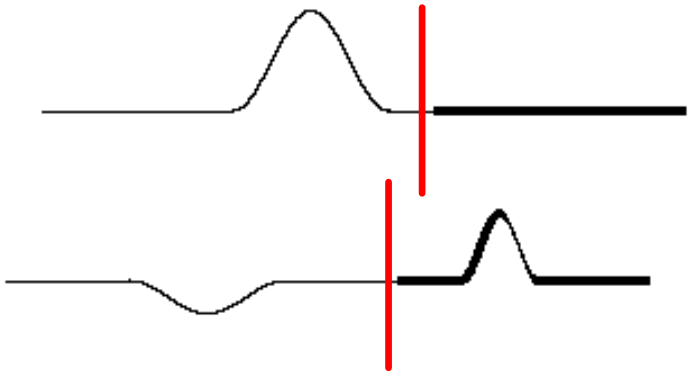
1) Less particle displacement

2) Less energy (some goes into second medium)

same "v", "freq.", and "λ"

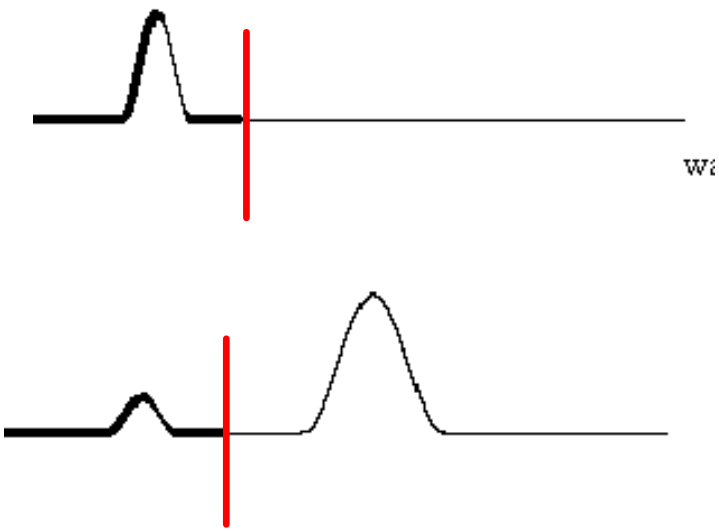
Transmitted Pulse

Fixed boundary
-transmitted pulse



or

Open termination
-transmitted pulse



Transmitted Pulse

No change in "frequency"

No change in "phase"

(some reflected back into first medium)

-less energy

Change in "amplitude"

-less particle displacement

(medium is more dense so the particles are displaced less-fixed)

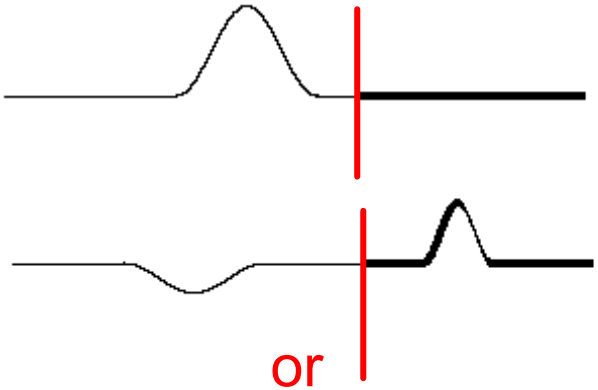
-more particle displacement

(medium is less dense so the particles are displaced more-open

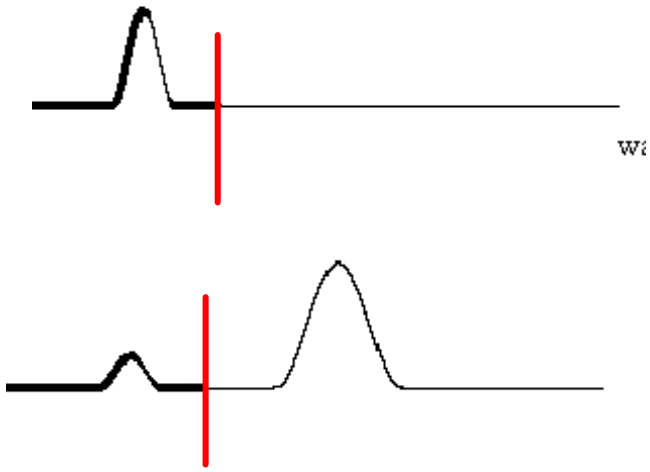
Change in "velocity"

therefore, change in "λ"

Fixed boundary-transmitted pulse



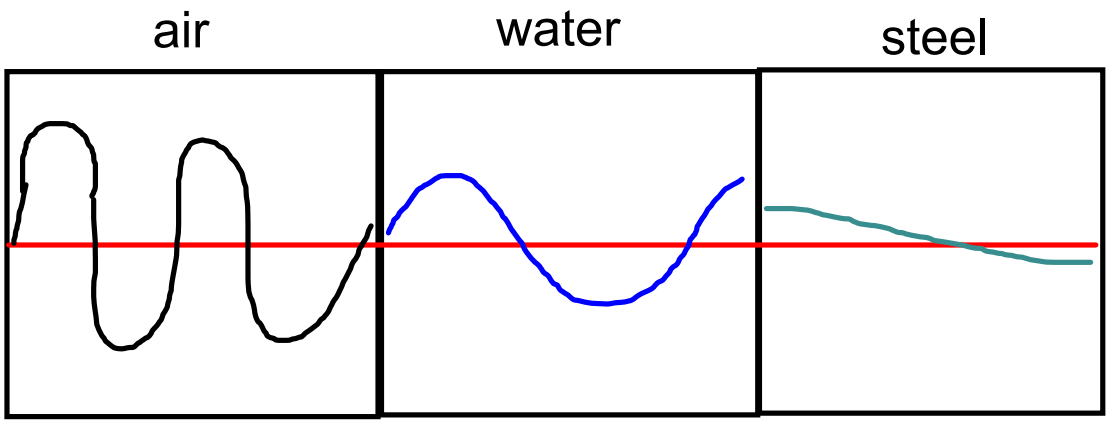
Open termination-transmitted pulse



Ratios: Energy

340Hz sound wave travels in air, water, and steel

transmitted pulses only



air	water	steel
v = 340 m/s	v = 1500 m/s	v = 5100 m/s
$\lambda = 1.0$ m	$\lambda = 4.4$ m	$\lambda = 15$ m

Note: 1) The wavelength is shortest in air and longest in steel!
(shorter λ in air because slower velocity)
2) The amplitude is greatest in air and least in steel!
(less amplitude in steel because denser medium)