Fluids

Pressure = $\frac{\text{Force}}{\text{Area}}$ $P = \frac{F}{A}$

Units of Pressure = $\frac{N}{m^2}$, $1\frac{N}{m^2} = 1\,Pa$ = 1 Pascal

Air Pressure at sea level is approximately $1\times10^5\,P_a = 1\times10^5\frac{N}{m^2}$

Pressure at a depth d in a fluid of density ρ

is $P = \frac{F}{A} = \frac{mg}{A} = \frac{(\rho V)g}{A} = \rho g\frac{V}{A} = \rho g d$

ρ is density

Buoyancy

The apparent weight of an object which is under water is $mg - (\text{density of water} \times \text{Volume} \times g)$

or $(\rho_{obj} \times V_{obj} - \rho_{water} \times V_{obj}) \times g$

Gas and Temperature

For a fixed amount of gas at a fixed temperature

$PV = \text{const.}$ if P increases then V decreases

if V increases then P decreases

Ideal Gas Law $PV = NkT$

← Boltzman's constant

T measures kinetic energy of molecules

Sound

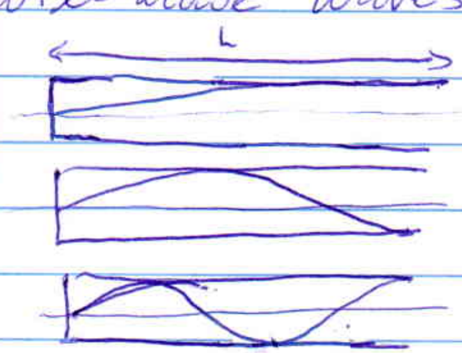
Doppler Effect

A plane flying towards you might emit a sound of a particular frequency. If you are at rest, then the sound you hear has a frequency

$$f_{heard} = \left(\frac{1}{1 - \frac{V_{plane}}{V_{sound}}} \right) f_{emit}$$

If the plane is flying towards you then just change the - sign to a + sign.

The sound from a pipe, open at one end, will have waves which are represented by



$L = \frac{1}{4}\lambda$ $(n=0)$

$L = \frac{3}{4}\lambda$ $(n=1)$

$L = \frac{5}{4}\lambda$ $(n=2)$

⋮

$$\lambda = \frac{4L}{2n+1}$$

A pipe open at both ends has waves represented by

$n=1$: $L = \frac{1}{2}\lambda$

$n=2$: $L = \lambda$

$n=3$: $L = \frac{3}{2}\lambda$

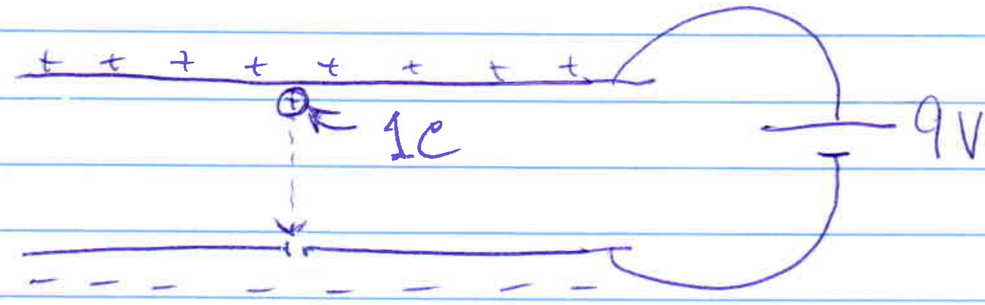
$$\lambda = \frac{2L}{n}$$

For all λ the corresponding frequency is $f = \frac{V_{sound}}{\lambda}$

Electricity

$F = k \frac{q_1 q_2}{d^2}$ coulomb's law

two plates



Assume that the positive charge is 1C
a positive charge very near the top plate is attracted to the bottom plate. When the positive charge goes through the hole in the lower plate its $K.E. = \frac{1}{2}mv^2 = 1C \times 9V = 9J$