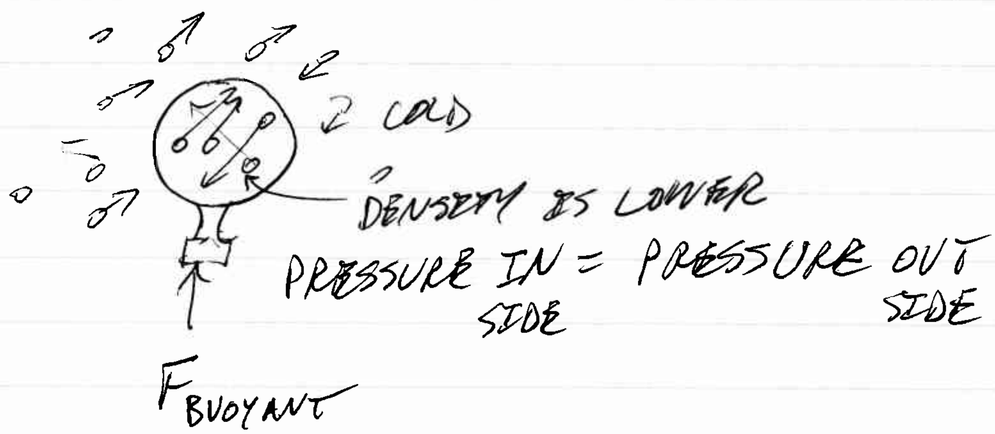
3-18

HOT AIR BALLOON

HOT AIR IS LESS DENSE THAN COLD AIR AT THE SAME PRESSURE



MEASURING PRESSURE IN A FLUID

LIQUID:

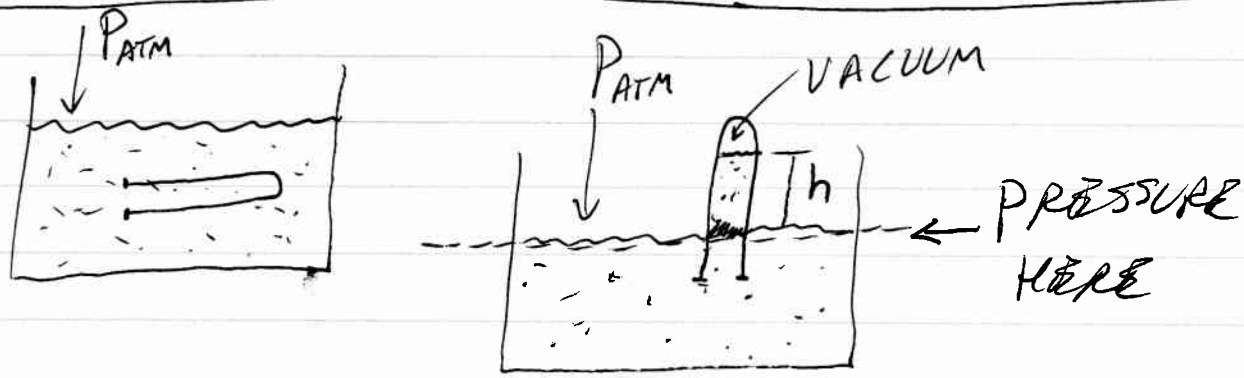
$$P = \rho \cdot g \cdot h$$

$$N \quad \frac{kg}{m^3} \cdot \frac{m}{s^2} \, m = \frac{N}{m^2}$$

h = HEIGHT OF THE COLUMN OF LIQUID ABOVE THE POINT OF INTEREST

GAS: WEIGHT OF THE COLUMN OF GAS ABOVE PER UNIT MASS

A WAY TO MEASURE ATMOSPHERIC PRESSURE

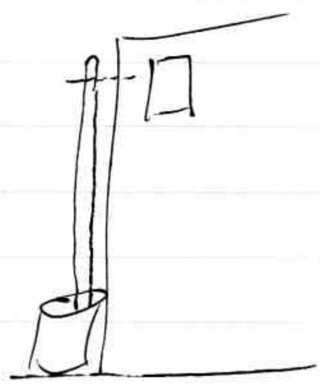


$$P_{ATM} = \rho g h$$

TORRICELLI BAROMETER: TORRICELLI USED WATER $\rho = \frac{1000\,kg}{m^3}$

$= \frac{1\,g}{cm^3}$

$h_{H_2O} = 32\ ft$



$h_{MERCURY} = 0.76\ m$

$= 760\ mm$

$\rho = 13600\ \frac{kg}{cm^3}$

$\frac{13.6\,g}{cm^3}$

$= 101\ kPa$

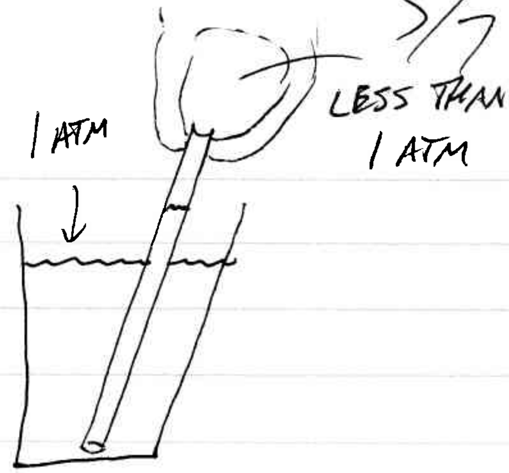
$P_{ATM} = 101{,}000\ Pa$ $\frac{N}{m^2}$

$= 760\ mmHg$

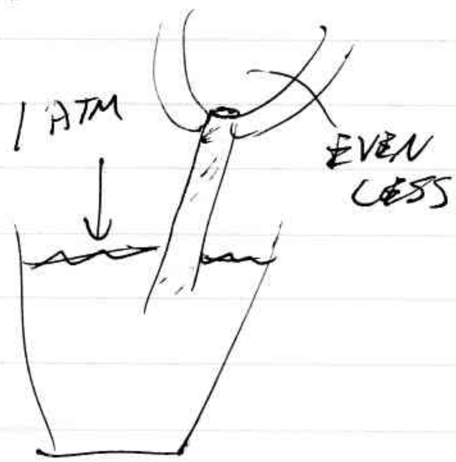
$= 100{,}000$ TORR ~~TORR~~

$= 14.7\ psi$

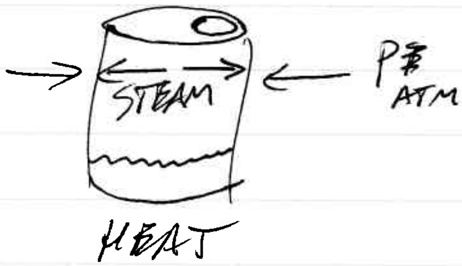
STRAWS



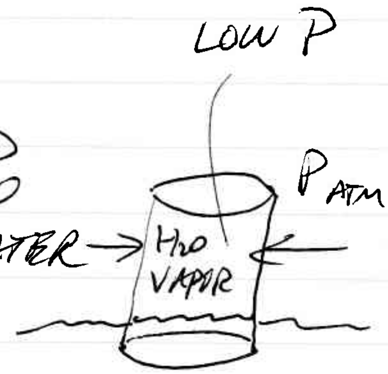
TALLEST
POSSIBLE STRAW?
32 ft



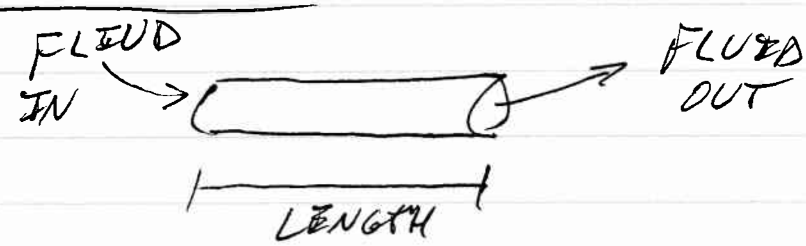
CRUSHING A CAN USING THE ATMOSPHERE



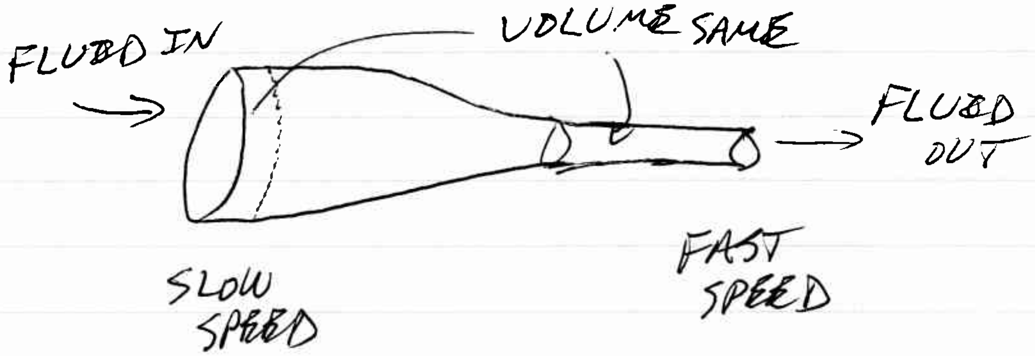
FLIP ~~AB~~ AND
PUT INTO
COLD WATER



FLUIDS IN MOTION

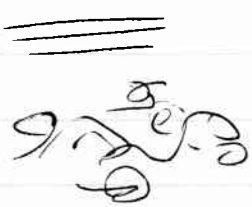


FLOW RATE = $\dfrac{\text{VOLUME IN}}{\text{UNIT TIME}}$ $\qquad \dfrac{gal}{min} \quad \dfrac{l}{s} \quad \dfrac{m^3}{s}$



AS AREA DECREASES,
FLUID SPEED INCREASES

UNCONTAINED FLUID



— LAMINAR FLOW (LAYERS)

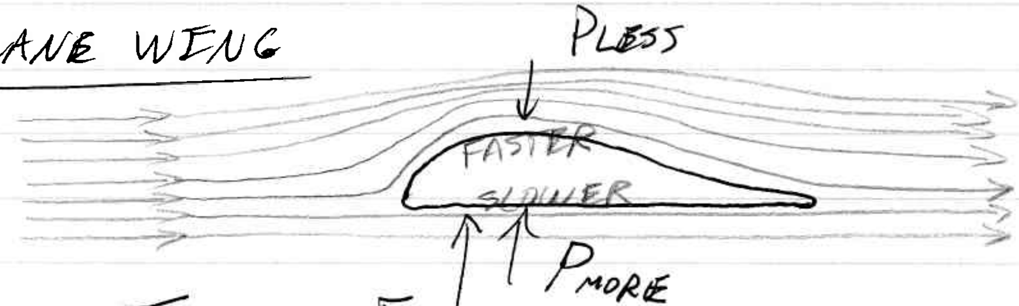
— TURBULENT FLOW

FOR LAMINAR FLOW,

BERNOULLI'S PRINCIPLE: "THE SUM OF PRESSURE AND KINETIC ENERGY PER UNIT VOLUME (AT A GIVEN HEIGHT) IS CONSTANT."

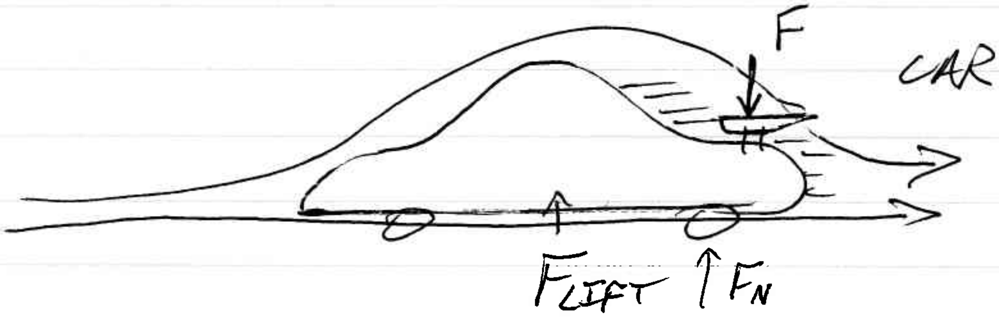
IN OTHER WORDS, FAST-MOVING FLUIDS EXERT LESS PRESSURE ON THE LAYERS AROUND THEM.

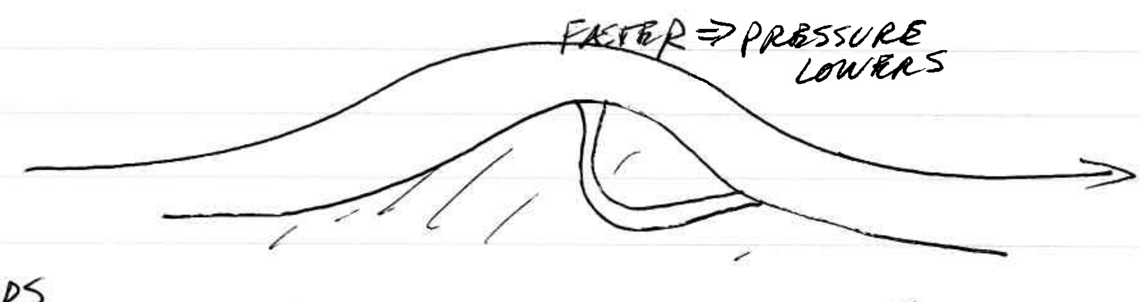
AIRPLANE WING

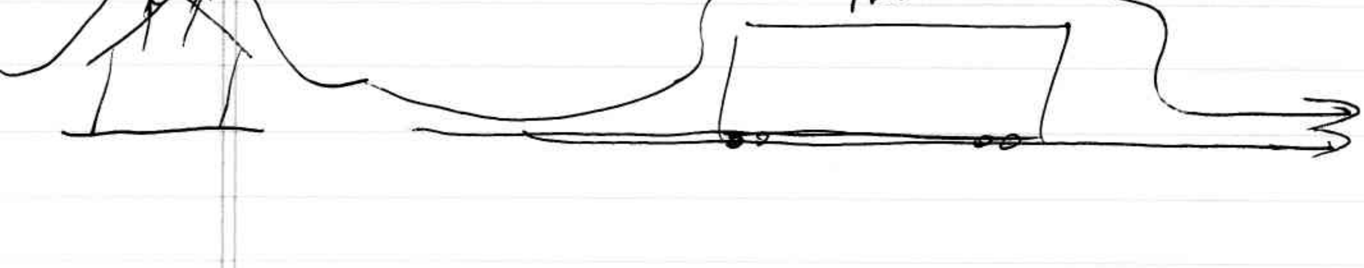


$F_{LIFT} = F_{NET}$

$F = P \cdot AREA$







RELATIONSHIPS OF P, V, T FOR GASES

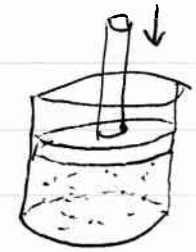
PRESSURE VOLUME TEMPERATURE

Boot

__BOYLE'S LAW__ (TEMPERURE CONSTANT)

AS P INCREASES, WHAT HAPPENS TO V ?

$$P_1 \cdot V_1 = P_2 \cdot V_2 \ (= \text{CONSTANT})$$



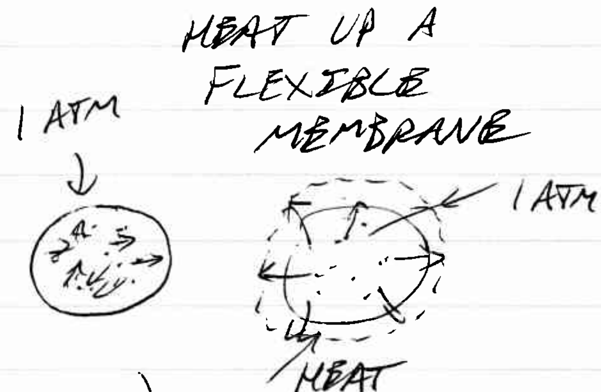
$$P \uparrow \quad V \downarrow$$

CuP

__CHARLES' LAW__ (PRESSURE CONST.)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \ (= \text{CONST.})$$

$$T \uparrow \quad V \uparrow$$



GLoVe

__GAY-LUSSAC'S LAW (VOLUME CONST.)__

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \ (= \text{CONST.})$$

$$T \uparrow \quad P \uparrow$$

__IDEAL GAS LAW__

$$\frac{P \cdot V}{T} = \text{CONSTANT}$$

DEPENDS ON THE GAS SAMPLE

HEAT & TEMPERATURE

HEAT = TOTAL KINETIC ENERGY OF ALL PARTICLES IN A BODY

TEMPERATURE = AVERAGE KINETIC ENERGY PER PARTICLE