Thermodynamics Week 1 Notes

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- The first Law of thermodynamics – the conservation of energy

initial KE + PE = KE + PE final

- The second Law of thermodynamics – energy has a quality as well as a quantity
- Classical thermodynamics – A macroscopic approach to the study of thermodynamics that doesn't require knowledge of the behavior of individual particles

- Statistical thermodynamics – A microscopic approach to thermodynamics

Unit Conversion

$N = kg \frac{m}{s^2}$ $\quad 1bf = 32.174\ lbm \frac{ft}{s^2}$

$\frac{N}{kg \cdot m/s^2} = 1$ and $\frac{lbf}{32.174\ lbm \cdot ft/s^2} = 1$

Energy unit = Joules or J

Work: $W = F \cdot d$ $\quad N \cdot M$

Joule = total energy $\quad$ Watt = Energy rate

Watt is Joule/sec $\quad$ 700W = 700 Joules/sec

Watt also kW/h

Ex 100W x 24hr x 30 days

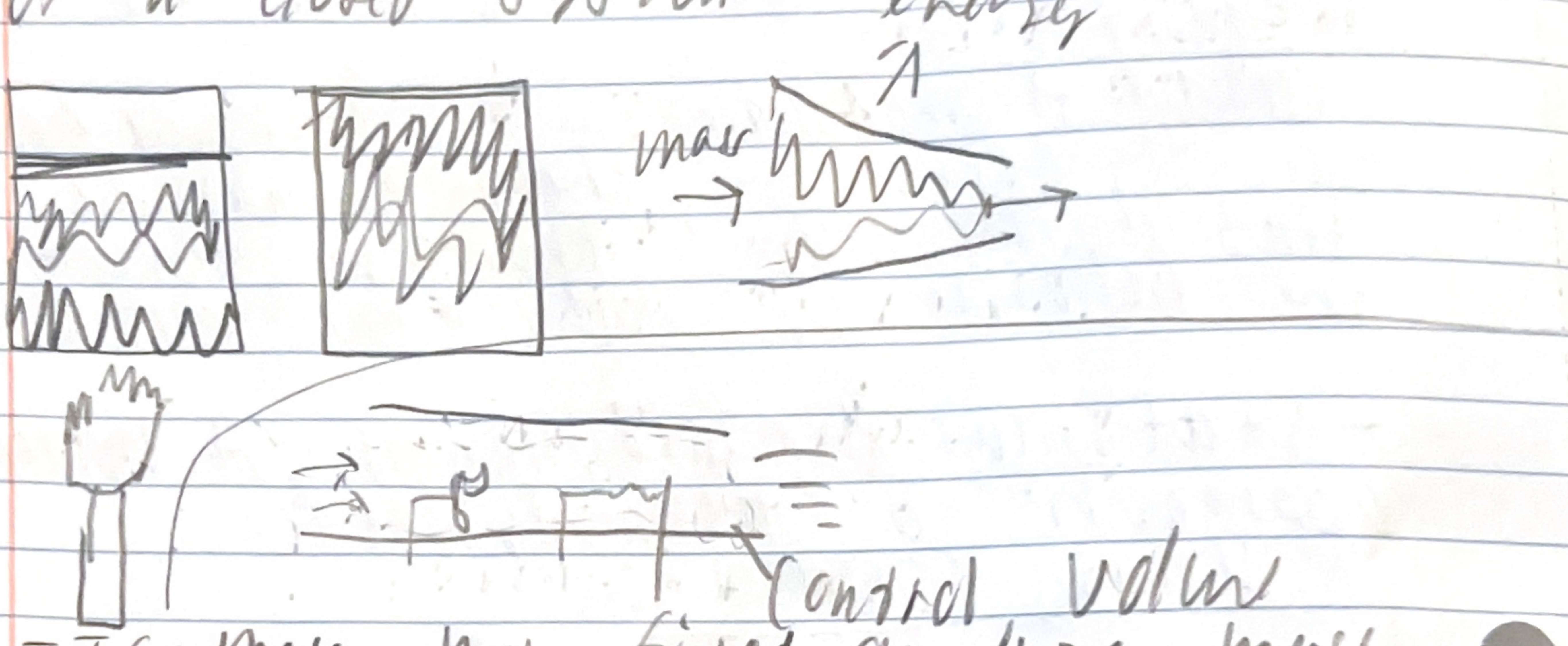
= 72000 whr $\quad$ 72, 10.83

$2.58

Ch1 P2

- System – A quantity of matter or a region in space
- Boundary – The line or surface that seperates
- Surroundings – The mass or region outside

closed system - no mass or objects may leave
open system
-Energy can transfer in and out of a closed system



-If mass not fixed analyze mass flow rate
mass flow rate = kg/sec
v = volumetric flow rate

Ch1 P3

To analyze a system you need to know mass, volume, Temperature, pressure, and density.
-Intensive properties - Those that are Independent of the mass of the system. Such as temperature

-Extensive properties - depend on the size ~~and~~ extent of a system
Total mass, total volume, total momentum

-Specific properties - Extensive properties per unit mass $v = V/m$ $e = E/m$

$m = \rho V$

$\frac{V}{m}$ = the specific volume

$\rho = \frac{m}{V}$ $m = \rho V$ m = mass ρ = density
V = volume

$\frac{1}{\rho} = \frac{V}{m} = \nu$ or specific volume

$\nu = \frac{kg}{m^3}$

Specific weight

$\gamma = \rho g$ $\frac{\text{weight}}{V} = \frac{mg}{V}$, $\frac{N}{m^3}$

Specific gravity (S.G)

Specific gravity of water = 1

Water density = 1000 kg/m3

S.G = 2 means its twice the density

S.G = .5 → 500 kg/m3

Eg) $S.G. = \frac{\rho}{\rho_{H_2O}}$ S.G. mercury = $\frac{\rho_{mercury}}{\rho_{H_2O}}$

Ch1 p4

Pressure 101325 Pa

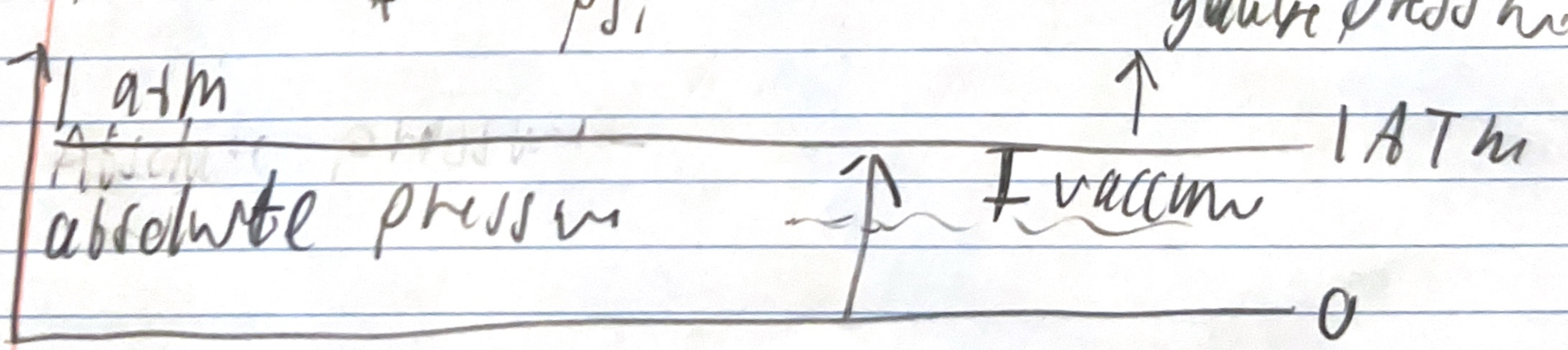
1 Pa = 1 N/m²

101325 Pascales at sea level

Units: Pa, KPa, bar bar = 105 pa

pressure = $\frac{F}{A}$

Psi



$P_{abs} = P_{atm} + P_{gauge}$

$P_{abs} = P_{atm} - P_{vac}$

Problem 1.45

Patm P = 92 KPa

35 KPa

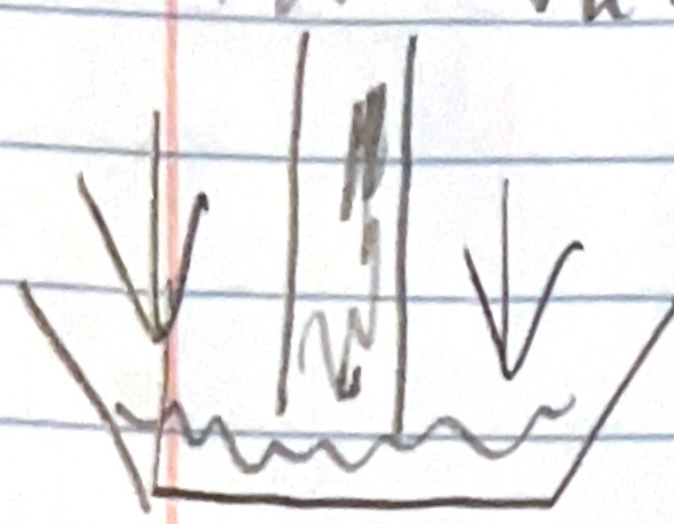
$P_{abs} = P_{atm} - P_{vac}$

$P_{abs} = 92 - 35 =$

Barometer

- Atmospheric pressure is measured by a device called a barometer
- atmospheric pressure is sometimes refferred to as barometric pressure.

standard pressure is defined as a coloumn of murcury 760 mm in height at 0C. $h = 744$ mm



$P_A = \rho g h$

$= 13600 \cdot 9.81 \cdot .744$

- diameter does not effect height of barometer