

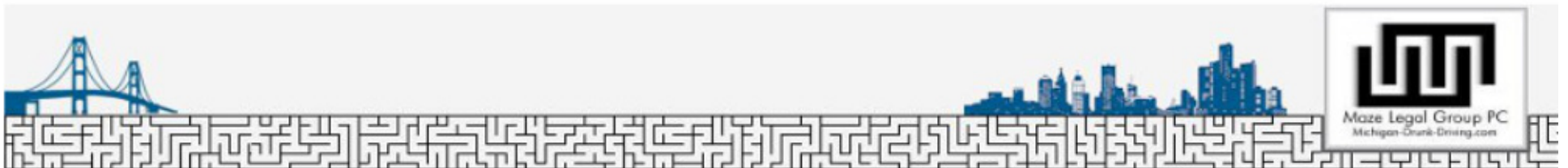
Introduction to Breath Testing

Breath testing primer, procedures,
and practical issues in Michigan
drunk driving cases

By William J. Maze

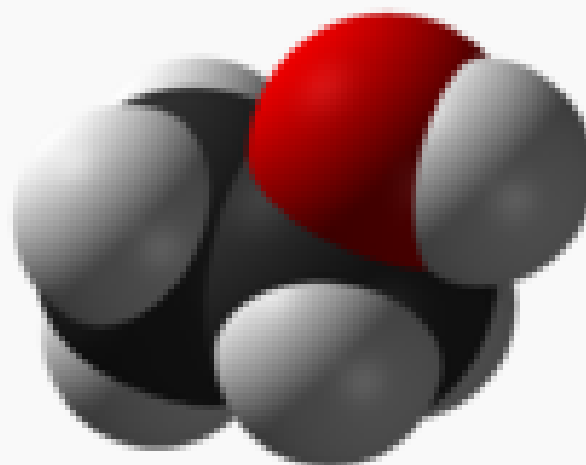
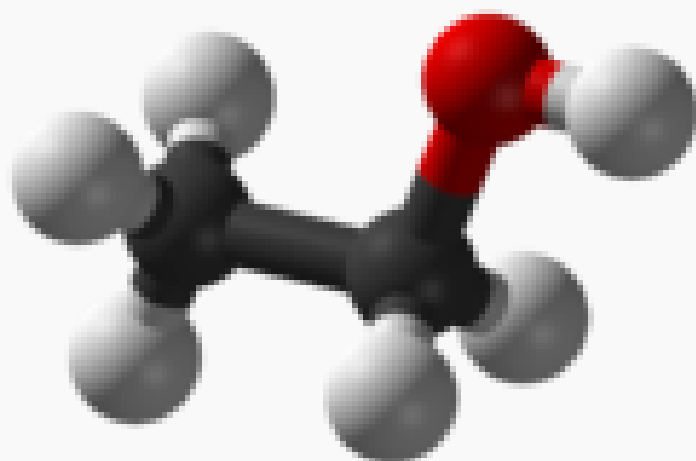
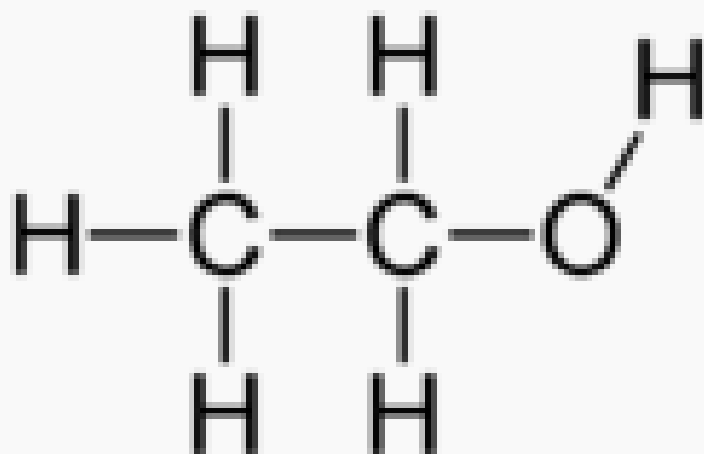
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Ethanol







Digging yucca to make Cauim / Masato

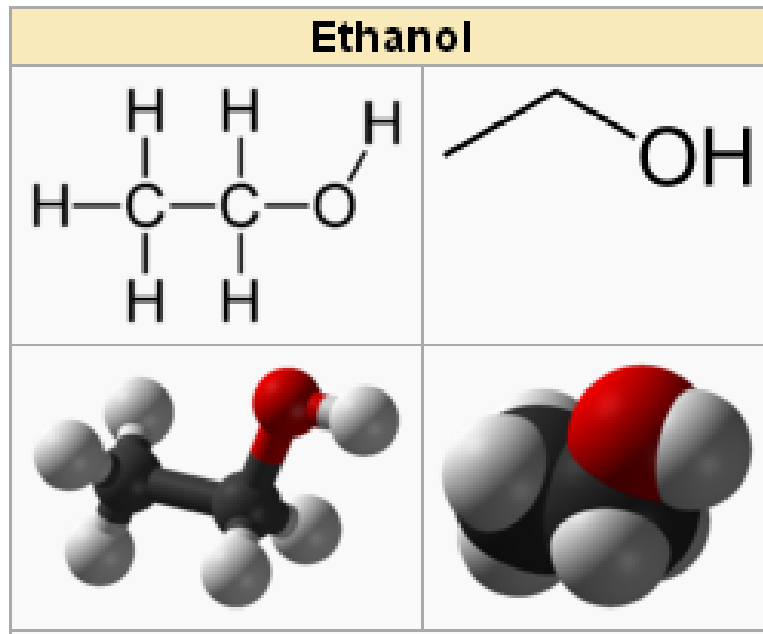
Fermentation and Distillation

- Beers and Wines: 3% to 12% alcohol concentration and up
- Liquor: 80 to 90 proof – up to 200 proof



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Ethanol



- 78.5C boiling point
- Specific Gravity of .7939 g/ml (.8 of water)
- Others in the alcohol group: methanol, isopropanol
- OH requires C for alcohol group (water)



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Blood Testing vs. Other Tests

- Breath and urine tests require a conversion formula.
- For breath: .08 g/210L breath
- For urine: .08 g/67 mL urine
- Breath & urine tests are circumstantial measurements based upon average comparisons of blood alcohol readings with simultaneous breath/urine tests.



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MICHIGAN LEGISLATIVE WEBSITE

Michigan Compiled Laws Complete Through PA 300 of 2012
House: Adjourned until Thursday, September 27, 2012 12:00:00 PM
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- Section 257.625

Section 257.625

[friendly link](#) [Printer Friendly](#)

MICHIGAN VEHICLE CODE (EXCERPT) Act 300 of 1949

257.625 Operating motor vehicle while intoxicated; operating motor vehicle when visibly impaired; penalties for causing death or serious impairment of a body function; operation of motor vehicle by person less than 21 years of age; requirements; controlled substances; costs; enhanced sentence; guilty plea or nolo contendere; establishment of prior conviction; special verdict; public record; burden of proving religious service or ceremony; ignition interlock device; "prior conviction" defined.

Sec. 625.

(1) A person, whether licensed or not, shall not operate a vehicle upon a highway or other place open to the general public or generally accessible to motor vehicles, including an area designated for the parking of vehicles, within this state if the person is operating while intoxicated. As used in this section, "operating while intoxicated" means any of the following:

- (a) The person is under the influence of alcoholic liquor, a controlled substance, or a combination of alcoholic liquor and a controlled substance.
- (b) The person has an alcohol content of 0.08 grams or more per 100 milliliters of blood, per 210 liters of breath, or per 67 milliliters of urine, or, beginning October 1, 2013, the person has an alcohol content of 0.10 grams or more per 100 milliliters of blood, per 210 liters of breath, or per 67 milliliters of urine.
- (c) The person has an alcohol content of 0.17 grams or more per 100 milliliters of blood, per 210 liters of breath, or per 67 milliliters of urine.

(2) The owner of a vehicle or a person in charge or in control of a vehicle shall not authorize or knowingly permit the vehicle to be operated upon a highway or other place open to the general public

- legislature
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Historical Perspectives

- Breath testing was rejected in *P v Morse*, 325 Mich. 270 (1949)
- Urine was the best thing since sliced bread in *P v Miller*, 357 Mich. 400 (1959) [.25 adjusted down to .20]



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Iowa Urine Tests

- Two results (grams/57mL) (grams/67mL) are reported when the urine sample is a first or random void. One result (grams/67mL) is reported when the urine sample is a 2nd void.
- Due to potential for production of alcohol post collections, urine sample storage (1% NaF) is critical.



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ETOH Lifecycle

- Absorption
- Distribution
- Elimination



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Absorption

- 20% Stomach / 80% Small Intestine – Duodenum
- Food and the ETOH content matters
- Up to 3 hrs. to reach post-absorptive phase
- AW Jones (1991) while 77% had reached peak BEC on empty stomach within 45 minutes, 3% had not reached peak BEC in over 75 minutes on an empty stomach



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Distribution

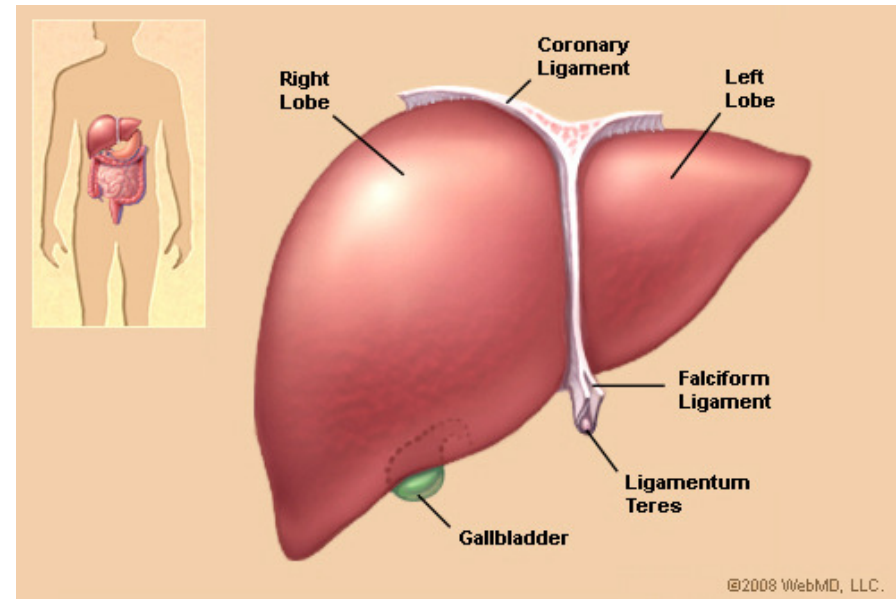
- Women are generally 55% water weight
- Men are generally 68% water weight
- Alcohol has an affinity for water
- But BAC will not distribute equally in all areas of the body in the capillaries, as well as the arteries, and the veins... and this could be important to breath testing.



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Elimination

- As soon as alcohol is absorbed, elimination begins (First pass metabolism)
- Alcohol dehydrogenase (ADH) breaks down ETOH into acetaldehyde and then to acetic acid = CO₂/water/heat



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Elimination Rates

- .015 per hour is a BIG FAT LIE
- Widmark's Beta ranges from .005 to .030 per hour
- Elimination rate, ie, your liver's ability to produce ADH, is based largely on ancestry, national origin, drinking experience, and gender.



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Henry's Law

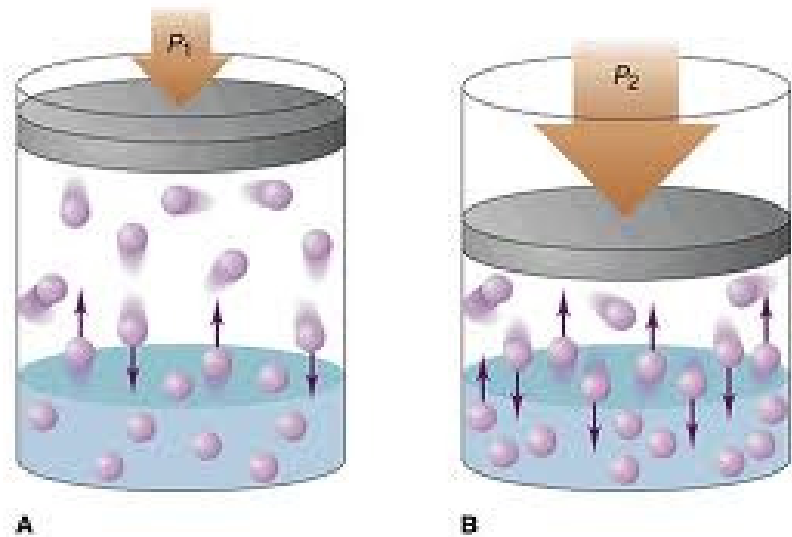
1803 British chemist, William Henry, developed a principle concerning the actions of volatile substances when placed in water and brought into contact with air. “At a constant temperature, the amount of a given gas that dissolves in a given type and volume of liquid is directly proportional to the partial pressure of that gas in equilibrium with that liquid.”



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Henry's Law

- Requires a closed system
- Requires constant temperature
- Soda Pop
- Headspace Gas Chromatography



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Does Henry's Law Apply?



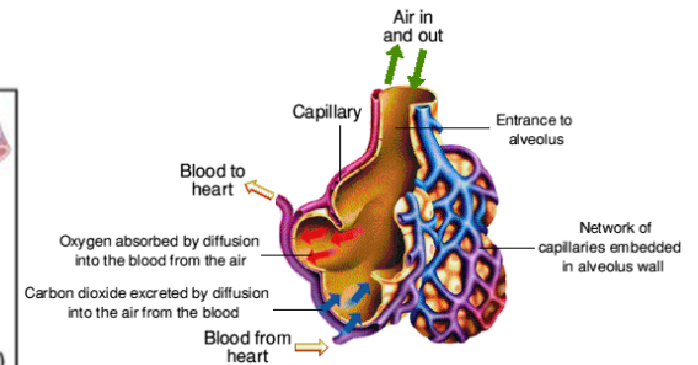
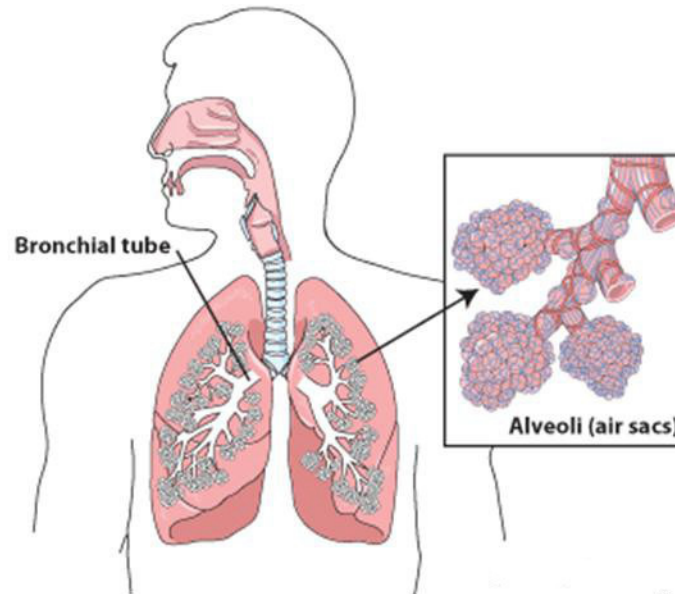
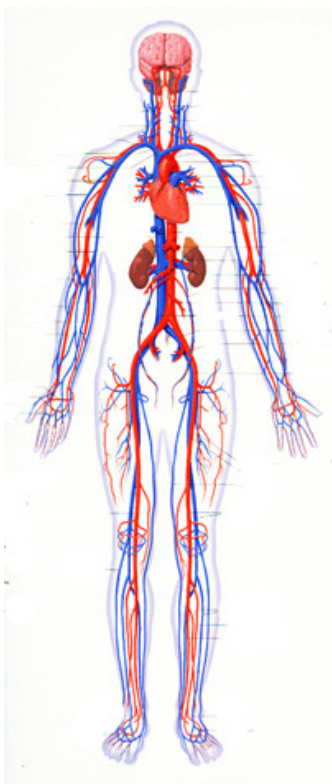
- Dr. Rollo Harger, inventor of the Drunkometer, attempted to use Henry's Law.
- Determined “average” 2,100:1 partition ratio



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Breath vs. Blood Testing

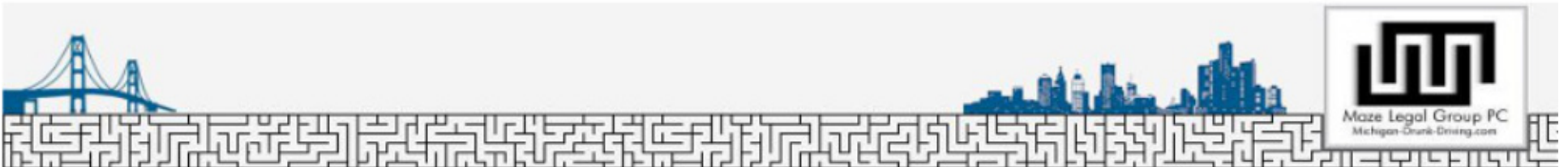
2100:1 (or 2,100 times smaller)



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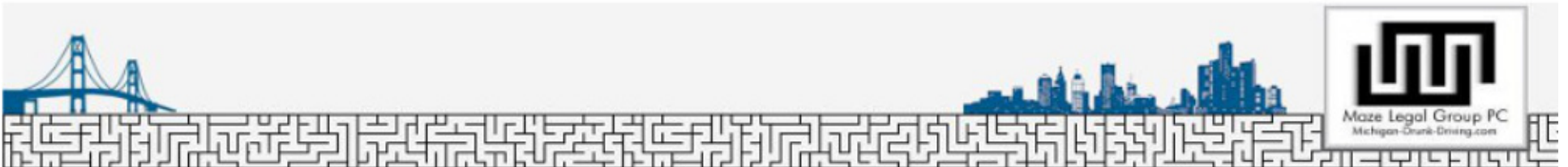
Important concept

- Tidal Breath vs Deep Lung Air
- Alveolar air cannot actually be tested
- Notion is that the deeper you get, the closer you are to true alveolar air



2,100 Debate

- What does the 2,100:1 conversation factor mean?
- AW Jones – (2000 to 2452), Mean: 2226
- Kurt Dubowski – (1900 to 2500), Mean: 2300
(Dubowski had extreme numbers down near 500 that did not impact the statistical majority.)
- SCLE 1633-2560 (68 subjects)
- Dominick Labianca has suggested 1700:1



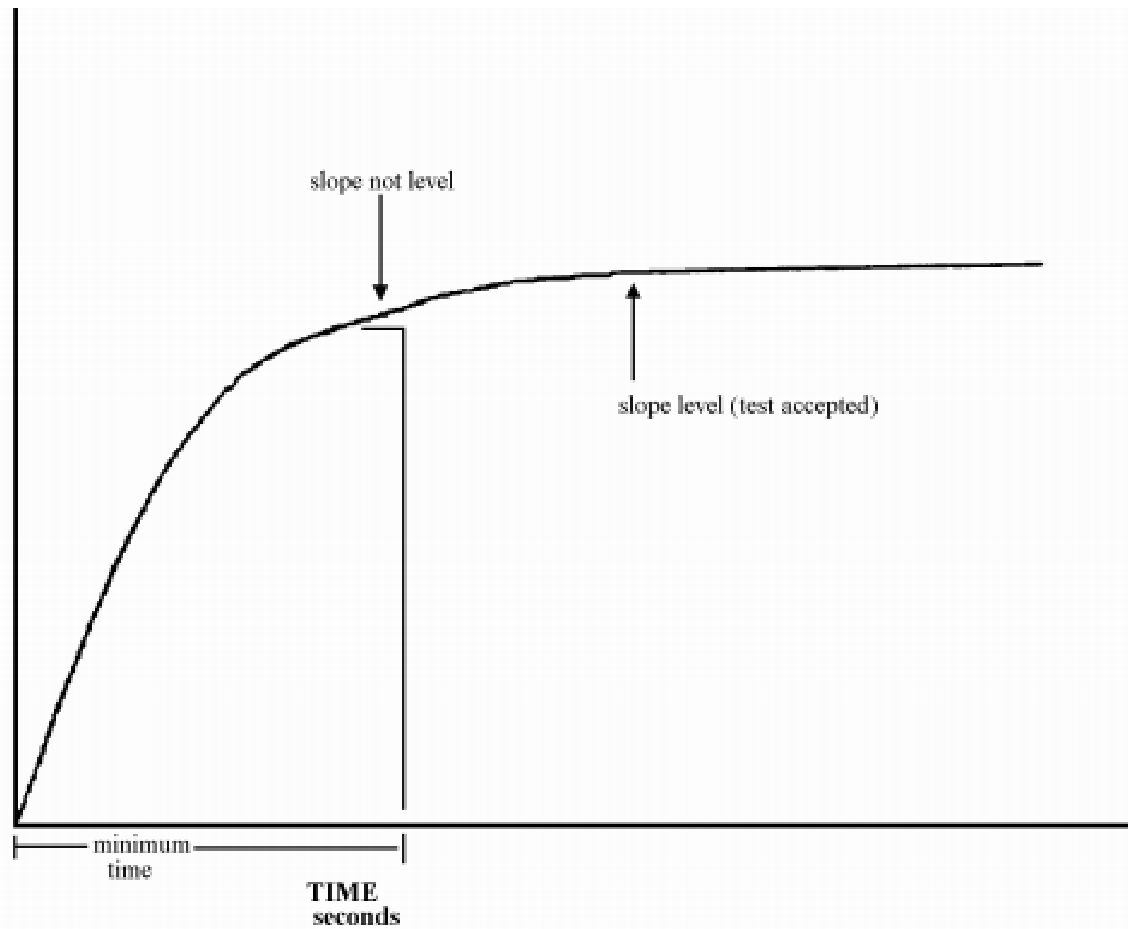
Hlastala Paradigm Shift

- Is Alveolar Alcohol Exchange a Myth?
- Exchange between the breath and the blood in the alveoli assumes that ethanol exchanges same as O₂ and CO₂.
- ETOH has higher solubility - exchanges higher in the airway while those with lower solubility exchange lower in the airway, such as in the alveolar sacs.



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**ALCOHOL
CONCENTRATION**



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The Drunkometer collected a motorist's breath sample directly into a balloon inside the machine. The breath sample was then pumped through a reagent. If there was alcohol in the breath sample, the solution changed color. The greater the color change, the more alcohol there was present in the breath.



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Henry's Assumption

- Temperature and Pressure are also important
- Dry gas simulators
- Wet bath simulators
- Expired breath temperature



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Dr. Robert F. Borkenstein



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Preliminary Breath Test Units



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Limitations of PBTs

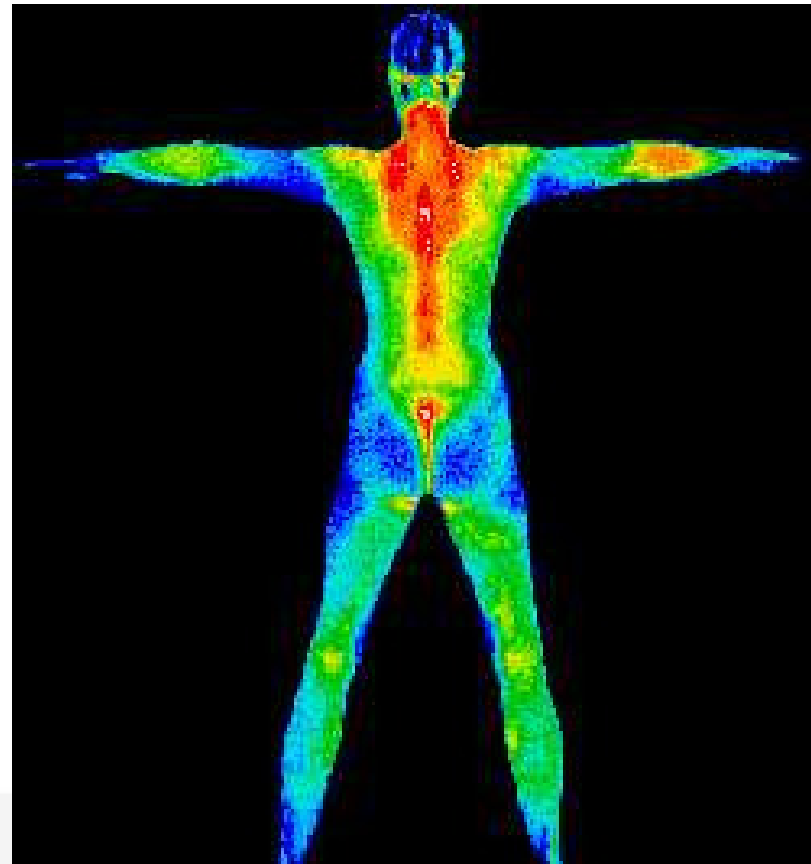
- Temperature
- Cannot be used repeatedly
- Claims of alcohol specificity are exaggerated
- Accuracy claims are wildly exaggerated
- No slope detection

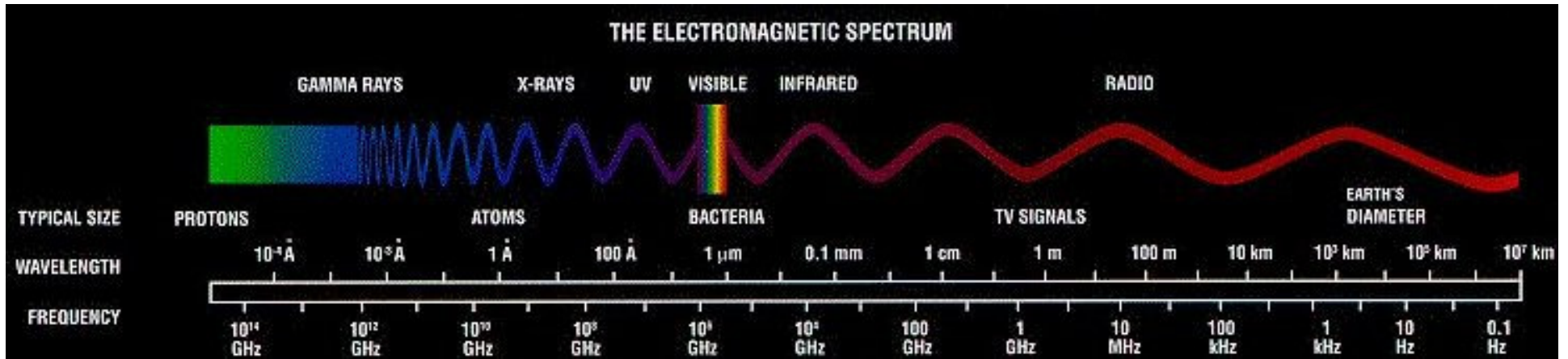


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Infrared Devices

- Think of infrared as heat, just like in the movie Predator
- Infrared light is just above visible spectrum





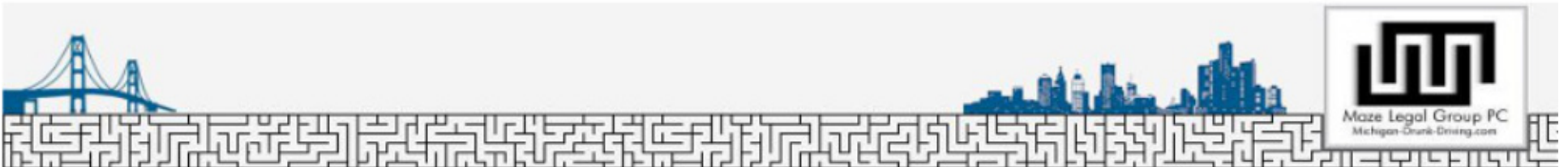
Portion of the Spectrum	Wavelength in Microns
Radio Waves	Greater than 10^3
Microwaves	25 to 10^3
Far Infrared	15 to 50
Mid Infrared	2.5 to 15
Near Infrared	0.7 to 2.5
Visible Light	0.4 (blue) to 0.7 (red)
Ultraviolet	10^{-3} to 4×10^{-1}

A micron is one-millionth of a meter. The wavelength of the light that we see is from 0.4 microns (blue light) to 0.7 microns (red light).

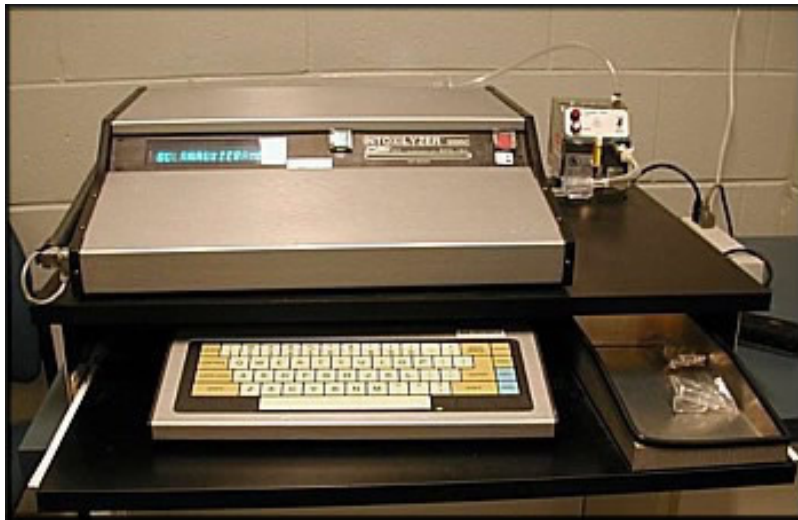


Omicron Intoxilyzer

- First IR breath testing device
- Developed in 1970s and used in modified form today
- Single micron measurement at 3.39
- Measurement was changed to 3.42



Intoxilyzer 5000



- Updated version of Omicron Intoxilyzer
- Refusals to turn over source code has plagued the device



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Intoxilyzer 8000



- Intoxilyzer 5000 replacement
- Rejected in many states
- Measures in the 9.36 um levels (C-O bonds as opposed to C-H bonds)



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EC/IR



- Utilizes both electrochemical sensor and infrared sensor (IR) technology.
- The Infrared system is capable of measuring both alcohol and carbon dioxide concentrations in the breath.
- The instrument also contains “advanced radio frequency interference immunity”
- Centralized data collection using optional IntoxNet software.



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Alcotest 7110 MKIII-C



- Measures expired breath temperature and automatically adjusts
- Fuel cell and IR
- Uses higher wavelength in 9.5um range
- Less interference from acetone and hydrocarbons (AW Jones cited)



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