Molar mass of butane

Schweitzer

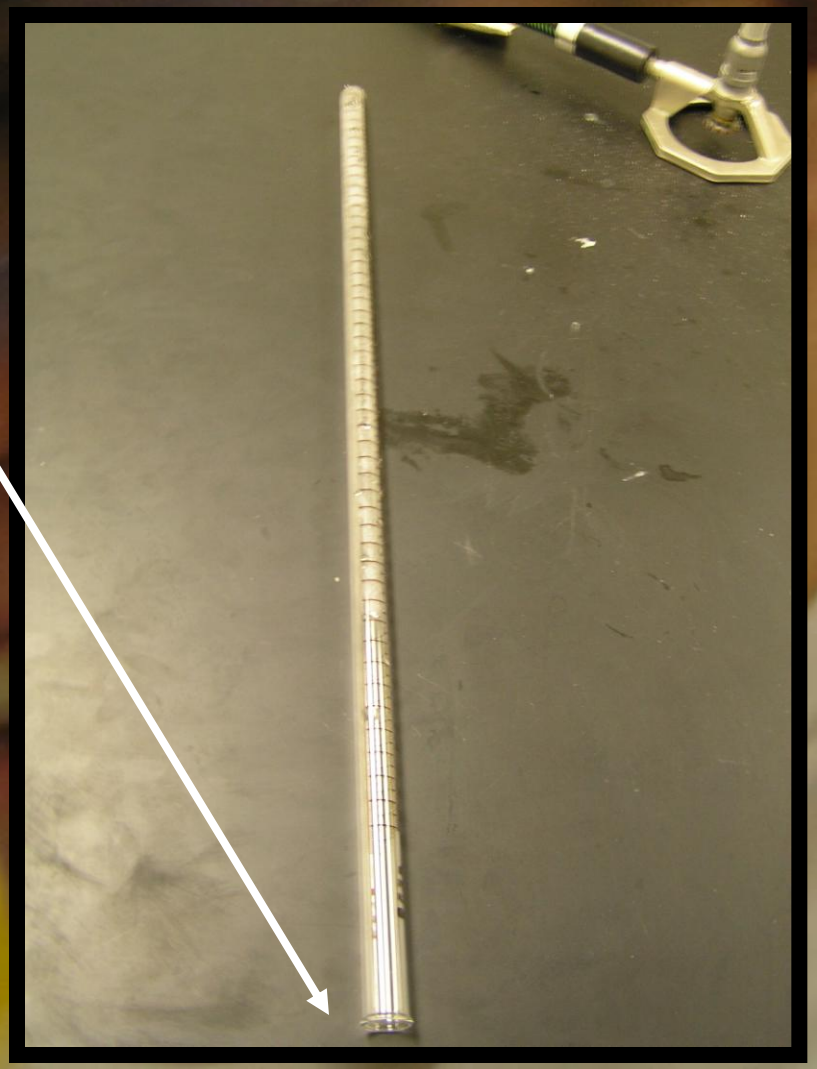
Background: Ryan Van Asten

Materials

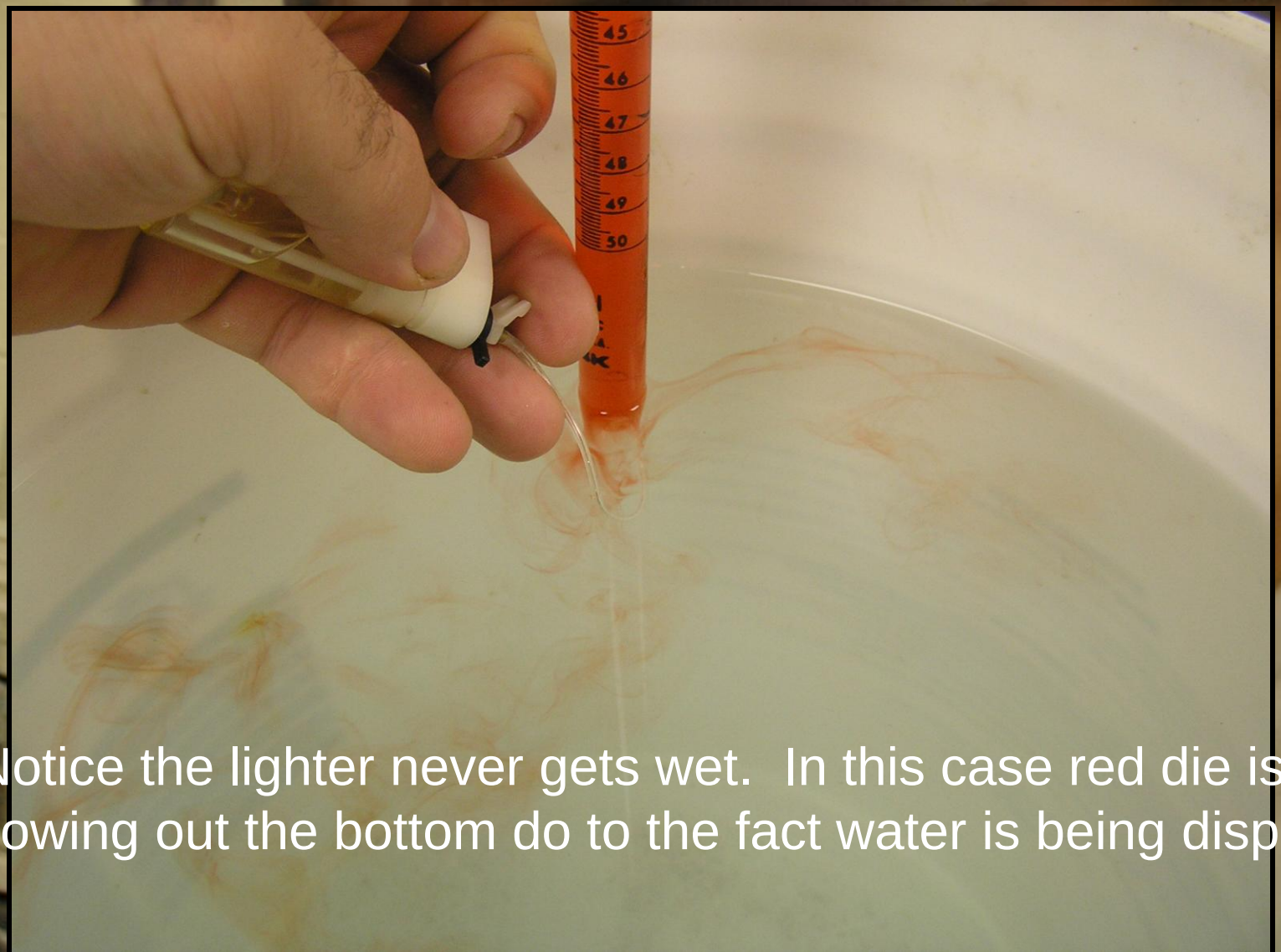
- 5 gallon bucket
- Thermometer
- Lighter or at least part of it.
- Water
- Fruit coloring (I used for sake of pictures)

Eudiometer or gas collection tube

- One end is open. ☺



Gas Delivery technique



Notice the lighter never gets wet. In this case red die is flowing out the bottom do to the fact water is being displaced.

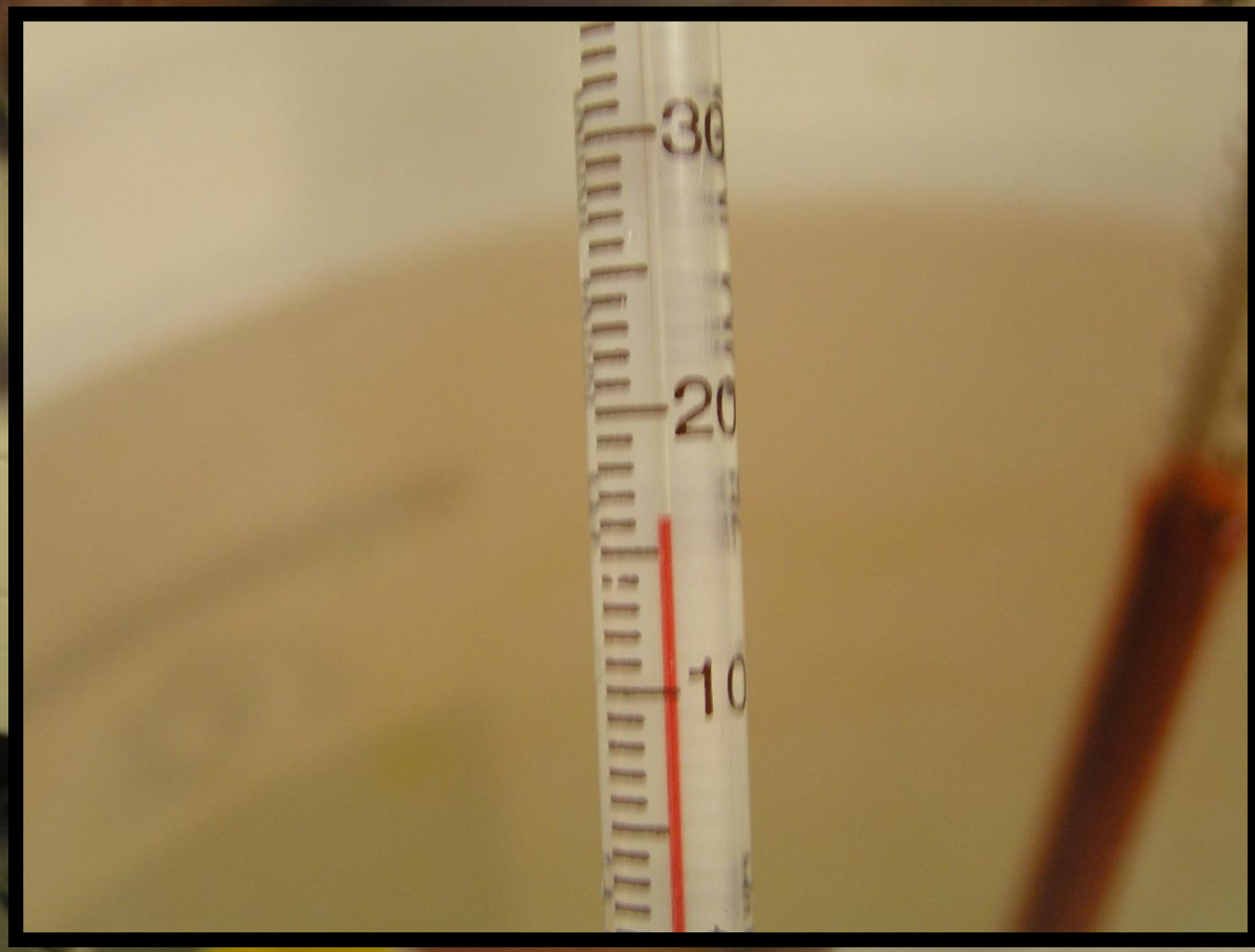
Objective: Determine molar mass a gas. In this case, butane.

- Molar mass = grams/mole
- What is the mass?
  - Subtract weight of the lighter before and after.

15.013 – 14.940 = .073g

Temperature

- 16.1C
- 289.1K



Pressure

- 29.93inHg * (25.4mm/1in) = 760.22mmHg
- Vpressure = 13.1 mmHg
- $P_{atm} = P_{gas} + Vp_{water}$
- $760.22 = p_{gas} + 13.1$ mmHg
- $P_{gas} = 747.12$ mmHg
- 747.12 mmHg (1 atm/760.0 mmHg) = .9830 atm

volume

- 32.8mL

Need moles

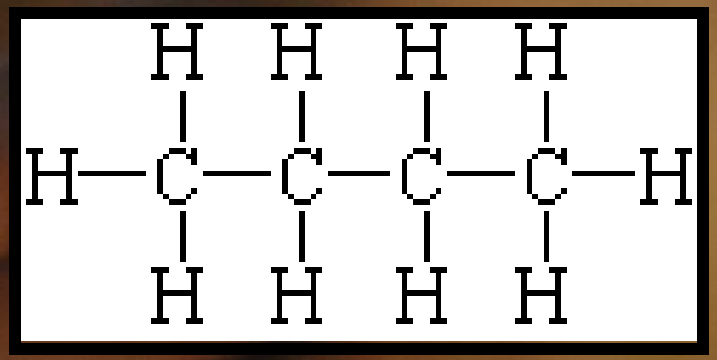
- PV = nRT
- PV/RT = n
  - P = .9830 atm
  - V = .0328 L
  - R = .0821
  - T = 289.1K
  - .001358 moles

Molar mass

- Grams/ mole = Molar mass
- .073g/ .001358 moles = 53.7g/mol

Error analysis
Percent error

- Butane
- C_4H_{10}
- 58.04g/mol



- What is the percent error?

$$\% \text{ error} = \frac{\text{your result - accepted value}}{\text{accepted value}} * 100\ \%$$

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- % error = 53.7 – 58.04/58.04 * 100 = -7.47%

In some cases I have seen percent error as an absolute value In that case the value is always positive.