Determination of % citric acid

Molar masses

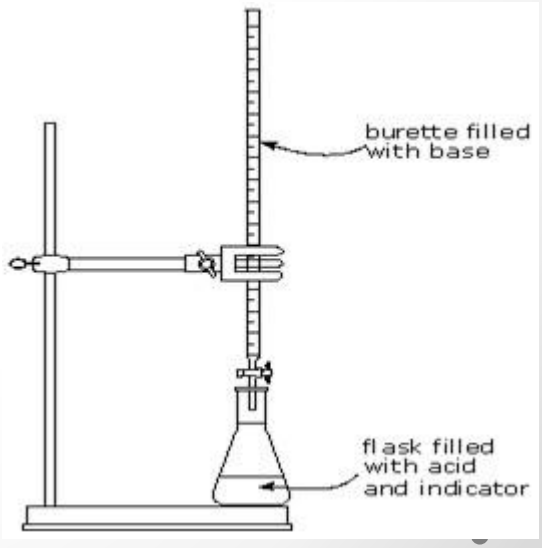
- **KHF = 204.23 g/mol**
- **Dehydrated citric acid = 192.14 g/mol**
- **Citric acid monohydrate = 210.14 g/mol**

Titration

- What is the purpose of a titration?
- Which apparatus are used for a titration?
- How does a burette work?
- How does a pipette work?
- Which information is known and which information is unknown in a titration?
- What is very important in a titration?

$$n_a / n_b = (C_a V_a / C_b V_b)$$

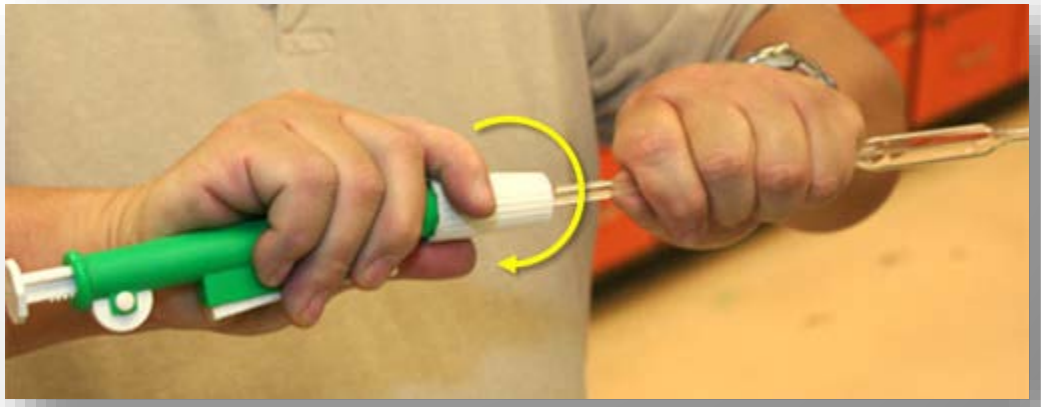
$$n_{KHF} / n_{NaOH} = (CV)_{KHF} / C_{NaOH} V_{titrasie\ syfer})$$



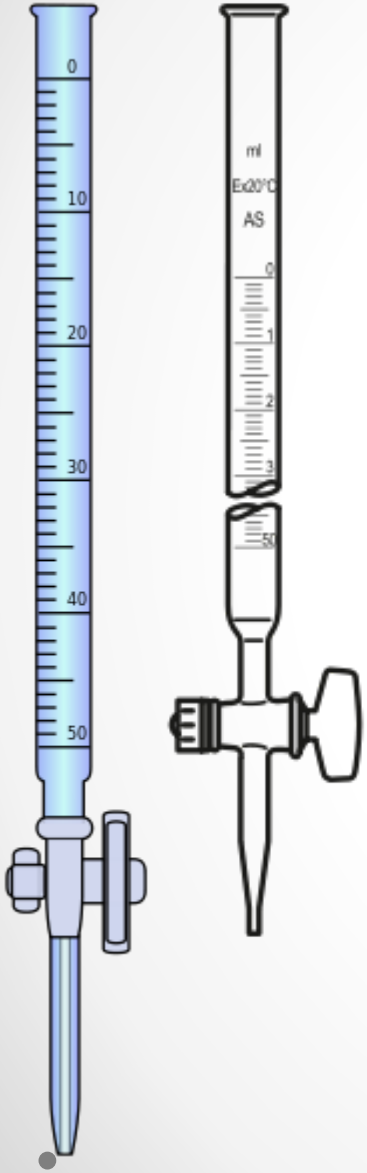
Concentration of Hydrogen ions compared to distilled water		Examples of solutions at this pH
10,000,000	pH= 0	Battery acid, Strong Hydrofluoric Acid
1,000,000	pH = 1	Hydrochloric acid secreted by stomach lining
100,000	pH = 2	Lemon Juice, Gastric Acid Vineger
10,000	pH = 3	Grapefruit, Orange Juice, Soda
1,000	pH = 4	Acid rain Tomato Juice
100	pH = 5	Soft drinking water Black Coffee
10	pH = 6	Urine Saliva
1	pH = 7	"Pure" water
1/10	pH = 8	Sea water
1/100	pH = 9	Baking soda
1/1,000	pH = 10	Great Salt Lake Milk of Magnesia
1/10,000	pH = 11	Ammonia solution
1/100,000	pH = 12	Soapy water
1/1,000,000	pH =13	Bleaches Oven cleaner
1/10,000,000	pH = 14	Liquid drain cleaner

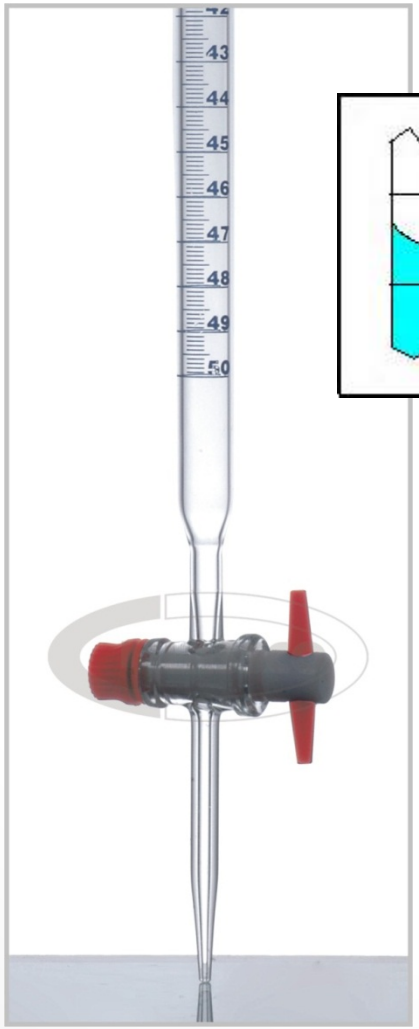
Titration apparatus

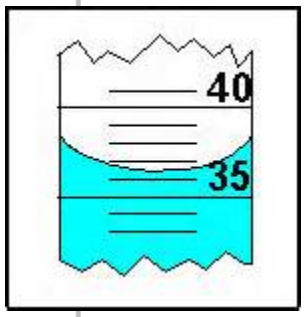
How to use a pipette pump.

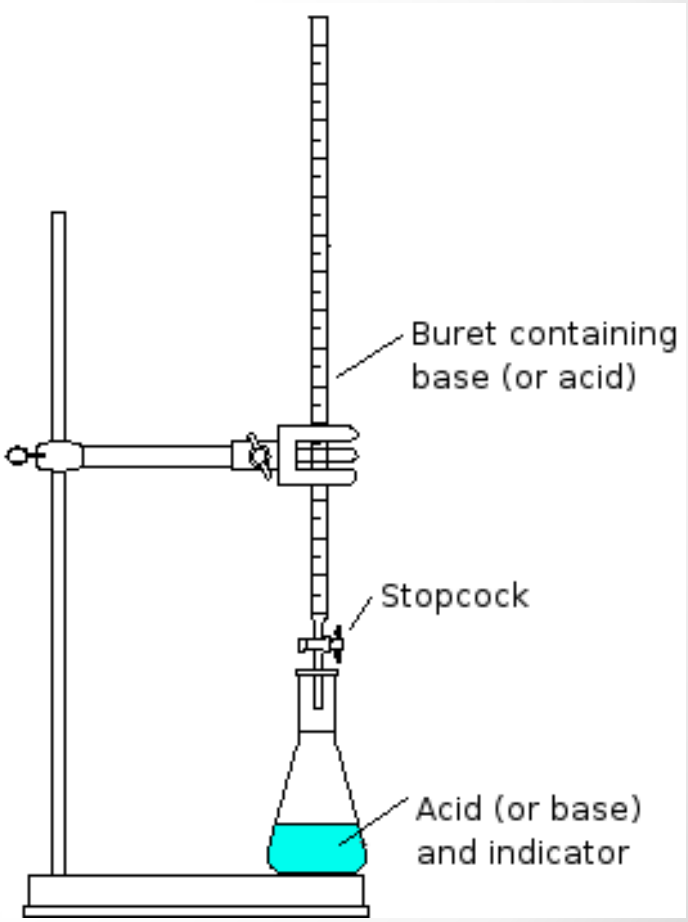


How to test burette taps.



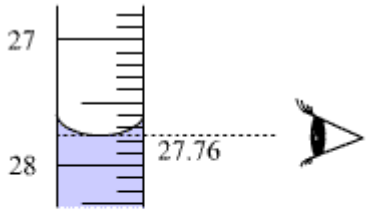






Funnels on top of burette and burette readings

Remove the funnel before taking a reading on the burette.



Move your eyes to the level of the liquid surface and read the value of the bottom of the meniscus with 1/10 of the smallest scale marked on the burette.

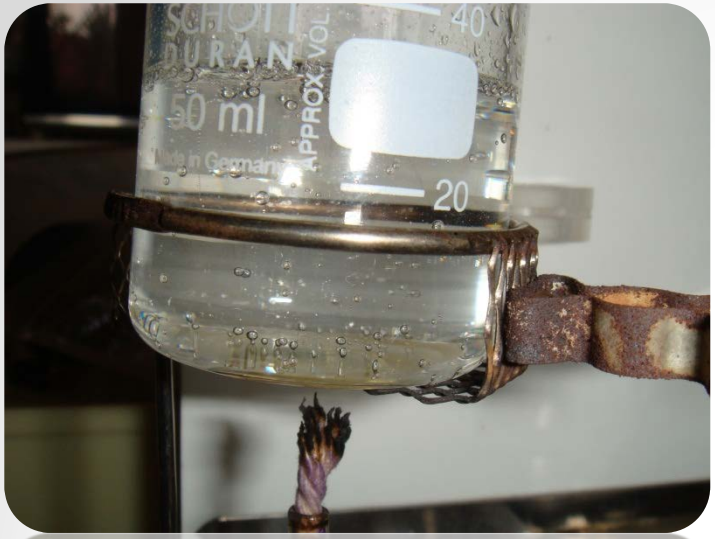
Determine the % citric acid in fizzy drinks

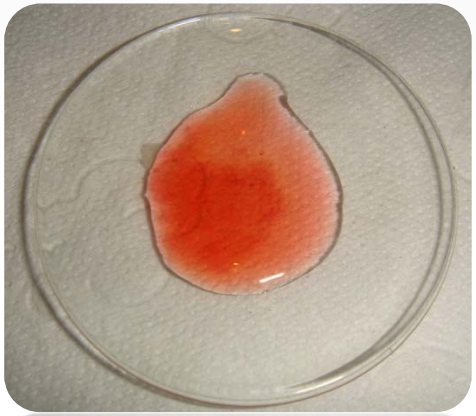
- Each student works individually.
- Three titrations are done.
- Time management is very important.

- **Standardization of NaOH solution** (titration 1)
- $NaOH(aq) + KHC_8H_4O_4(aq) \rightarrow KNaC_8H_4O_4(aq) + H_2O(l)$
- **Titration of pure citric acid** (titration 2)
- $C_6H_8O_7 + 3NaOH \rightarrow C_6H_5O_7Na_3 + 3H_2O$
- **Titration of citric acid in fizzy drink** (titration 3)
- Indicator for all three titrations is phenolphthalein

Standardization of NaOH solution (titration 1)

- Boil 150 mL fizzy drink and let it stand to cool down.
- NaOH is hygroscopic.
- KHF primary standard
- Weigh 0,15g KHF (weigh twice in two conical flasks)
- Dissolve KHF in approximately 50 mL distilled water
- Titrate against given NaOH
- Repeat the titration
- Record the titration numbers of the TWO titrations.
- Standardize the NaOH

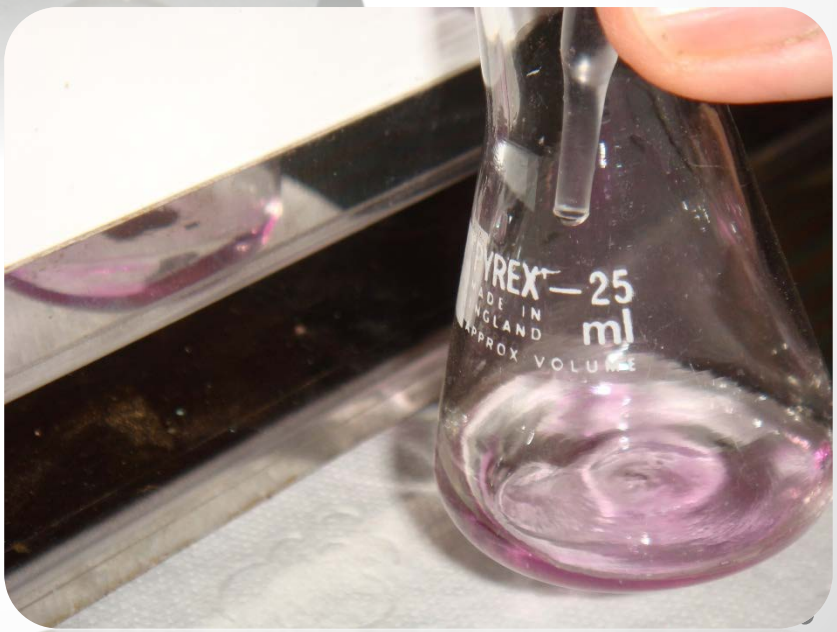

DURAN
50 ml
APPROX. VOL.
40
20




Fanta
PINEAPPLE FLAVOURED DRINK
a product of The Coca-Cola Company
TWIST
Lemon Flavoured Sparkling Drink


PYREX
MADE IN ENGLAND


1.8
PYREX
25
ml
APPROX VOLUME


PYREX
25
ml
APPROX VOLUME

Titration of pure citric acid (titration 2)

- Wash glassware and rinse with distilled water
- Weigh 0.04g citric acid (twice in TWO flasks)
- Dissolve acid in approximately 50 mL distilled water
- Titrate against standardized NaOH
- Repeat the titration
- Record the titration numbers of TWO titrations.
- Determine the concentration of citric acid.
- Determine the mass of citric acid.
- Determine the percentage citric acid in pure citric acid.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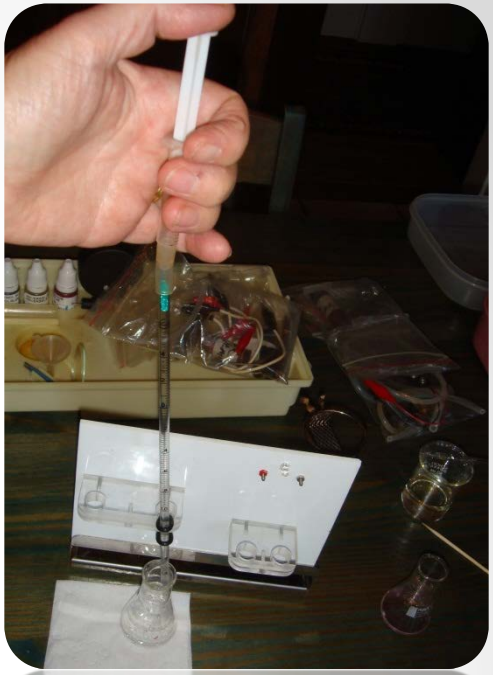


PHTHALATE
601.3
PLATINUM LINE (AR)
500g


WATER (dist.)
WATER (gedis.)

Titration of citric acid in fizzy drinks (titration 3)

- Transfer 25 mL fizzy drink with pipette to conical flask.
- Three drops phenolphthalein in conical flask.
- Titrate fizzy drink against standardized NaOH.
- Repeat the titration.
- Determine average titration number of TWO titrations.
- Determine the concentration of citric acid in fizzy drink.
- Determine the mass of citric acid.
- Determine % citric acid in fizzy drink.

- Wash all apparatus.
- COMPLETE questions and calculations on answersheet.

Calculations (1) and (2)

$$n_a / n_b = (C_a V_a / C_b V_b)$$

$$n_{KHF} / n_{NaOH} = (CV)_{KHF} / C_{NaOH} V_{titration\ number})$$

$n_{KHF} = (CV)_{KHF}$ and $n_{KHF} = m/M_{KHF}$

Calculate C_{NaOH} the unknown

$$n_a / n_b = (C_a V_a / C_b V_b)$$

$$n_{citric} / n_{NaOH} = (CV)_{citric} / C_{NaOH} V_{titration\ number})$$

$n_{citric} = (CV)_{citric}$ and $n_{citric} = m/M_{citric}$

Calculate $mass_{citric}$ the unknown

$(Mass_{citric} / mass_{weighed}) \times 100 =$ % purity

Calculations (3)

$n_a / n_b = (C_a V_a / C_b V_b)$

$n_{citric} / n_{NaOH} = C_{citric}\ V_{citric} / C_{NaOH} V_{titration\ number})$

Calculate C_{citric} the unknown

Meaning of the concentration of citric acid:

A mol citric acid in 1000 ml

Therefore X mol citric acid in 100 ml is

$X = (A \times 100)/1000$ mol

% acid in fizzy drink

Mass in gram per 100 ml

Change mol in 100 ml to (mass in 100 g) by multiplication with M_{citric}

$Massa = X\ mol \times M_{citric}$

% citric acid in the fizzy drink = answer received from mass