



In The Name of GOD



# IYNT 2016

## Iran-Shiraz

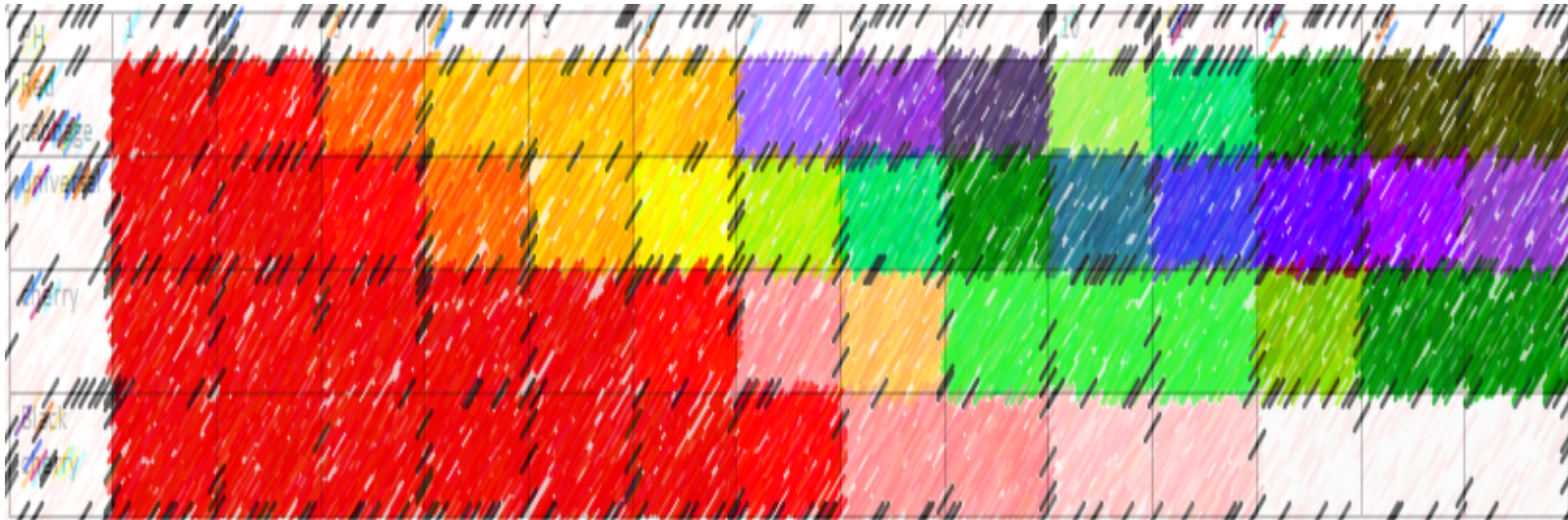


# International Young Naturalist's Tournament



# Problem No.10.

- \* Reporter: Zeinab Ammari Allahyari
- \* Maple group



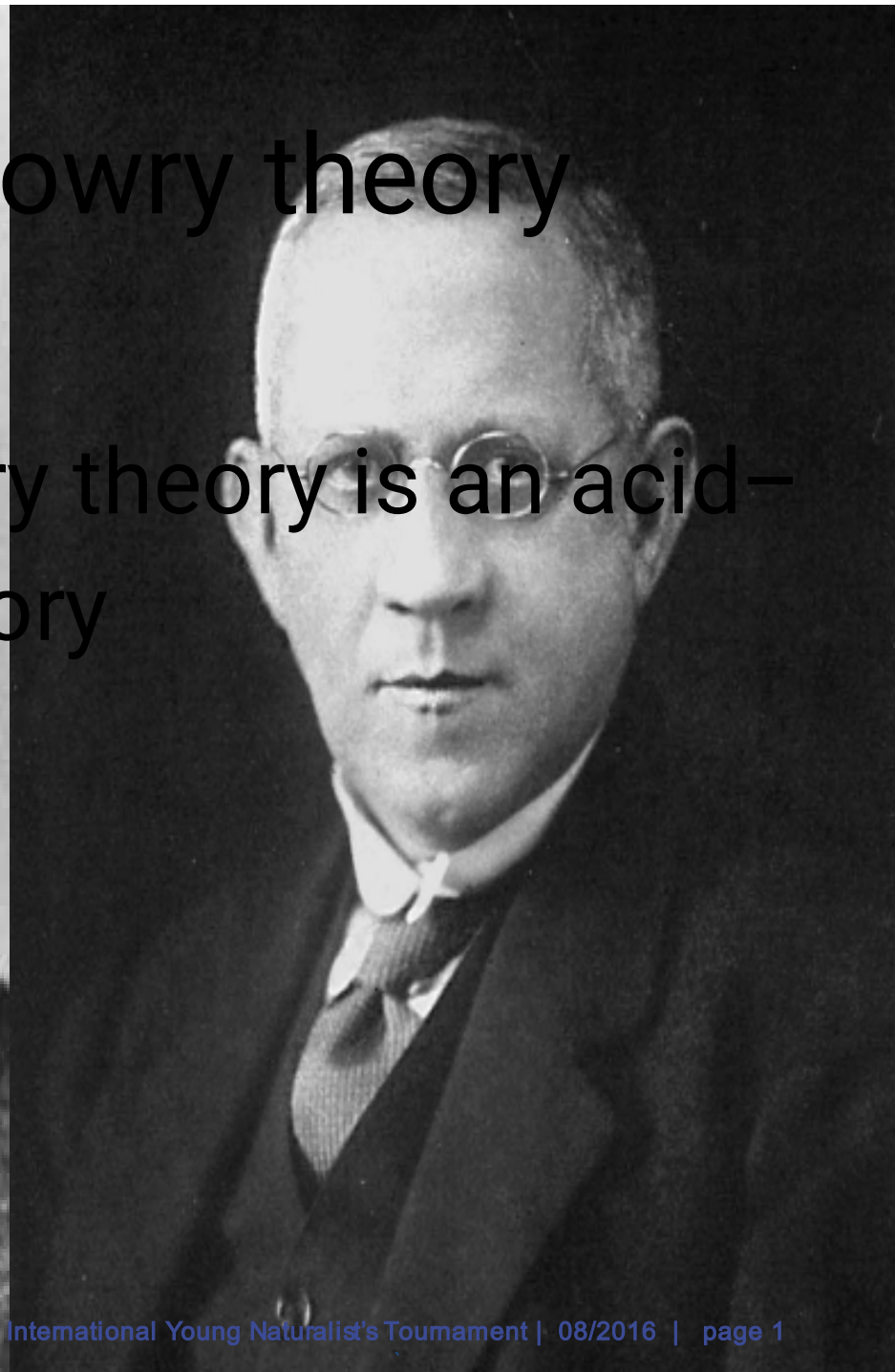
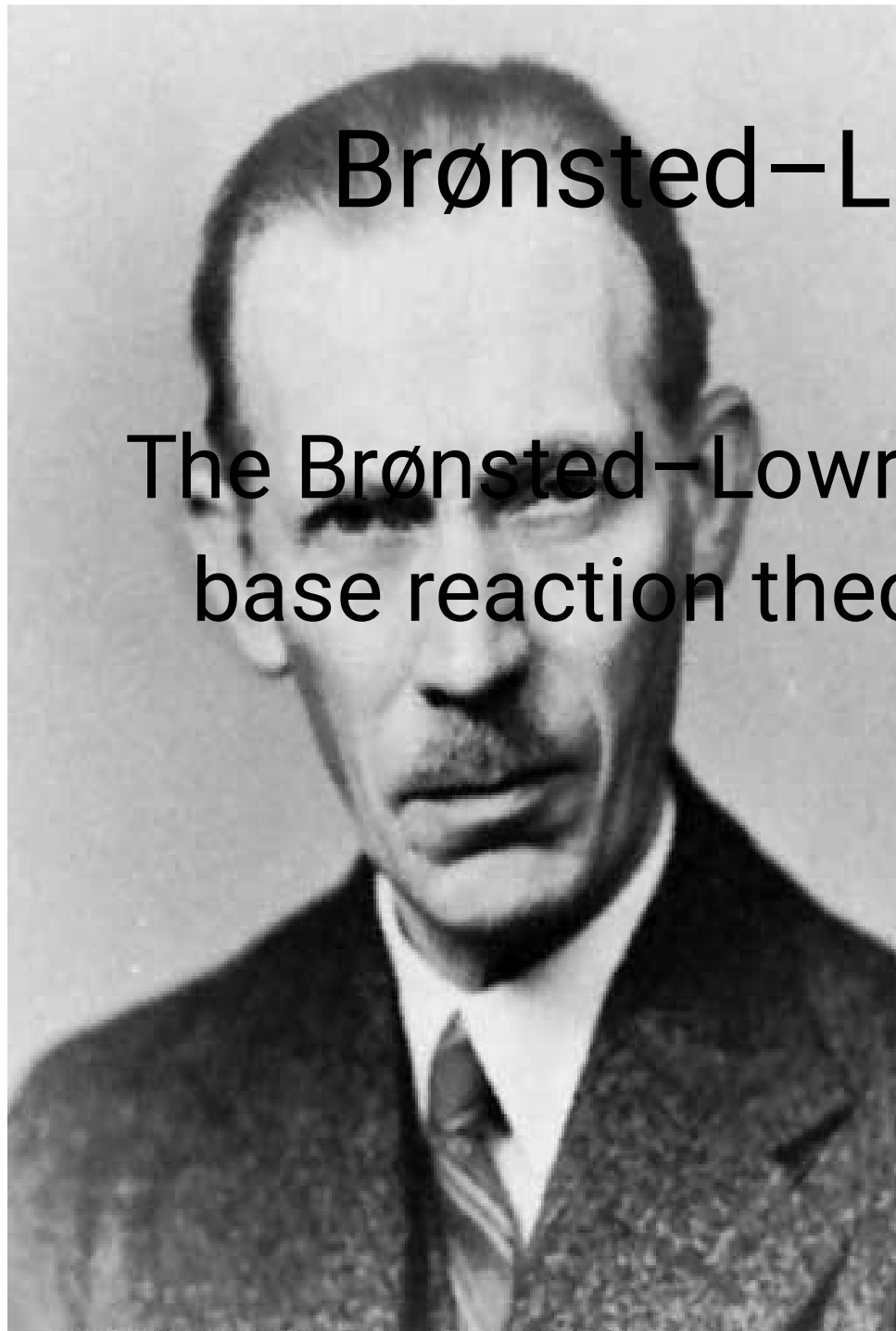
# 10. pH Indicator

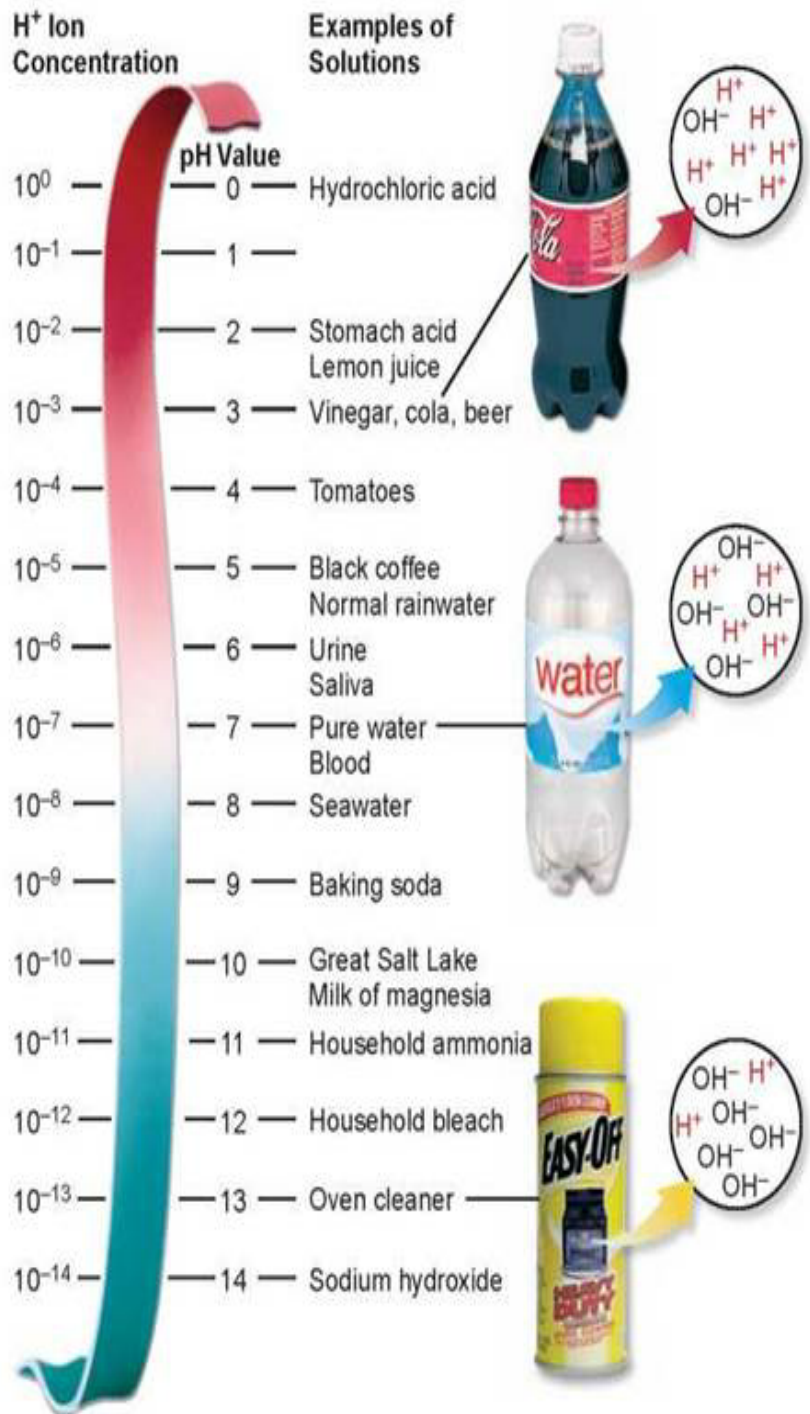
The juice of many fruits or vegetable crops contains a natural pH indicator that changes colors according to the acidity or basicity of the solution. Investigate such pH indicator juices and their mixes. Propose the most precise and effective composition and compare its properties with those of common indicator paper.



# Brønsted–Lowry theory
















The Brønsted–Lowry theory is an acid–base reaction theory





# ACIDS, ALKALIS, AND THE pH SCALE

The pH scale is a way of gauging the acidity or alkalinity of a solution. It is calculated using:  $\text{pH} = -\log_{10}[\text{H}^+]$ . Adding an acid to water increases the  $\text{H}^+$  ( $\text{H}_3\text{O}^+$ ) concentration, and decreases the  $\text{OH}^-$  concentration. An alkali does the opposite.

	pH	$\text{H}^+$ CONCENTRATION <small>(in moles per litre)</small>	$\text{OH}^-$ CONCENTRATION <small>(in moles per litre)</small>	EVERYDAY EXAMPLE
<b>ALKALINE</b> Turquoise → Blue → Purple	14	$1 \times 10^{-14}$	1	Drain Cleaner 
	13	$1 \times 10^{-13}$	0.1	Bleach 
	12	$1 \times 10^{-12}$	0.01	Ammonia 
	11	$1 \times 10^{-11}$	0.001	Soap 
	10	$1 \times 10^{-10}$	$1 \times 10^{-4}$	Antacid Tablets 
	9	$1 \times 10^{-9}$	$1 \times 10^{-5}$	Baking Soda 
	8	$1 \times 10^{-8}$	$1 \times 10^{-6}$	Seawater 
<b>NEUTRAL</b> Green	7	$1 \times 10^{-7}$	$1 \times 10^{-7}$	Pure Water 
<b>ACIDIC</b> Red → Orange → Yellow	6	$1 \times 10^{-6}$	$1 \times 10^{-8}$	Urine (average) 
	5	$1 \times 10^{-5}$	$1 \times 10^{-9}$	Black Coffee 
	4	$1 \times 10^{-4}$	$1 \times 10^{-10}$	Tomato Juice 
	3	0.001	$1 \times 10^{-11}$	Soda 
	2	0.01	$1 \times 10^{-12}$	Lemon Juice 
	1	0.1	$1 \times 10^{-13}$	Stomach Acid 
	0	1	$1 \times 10^{-14}$	Battery Acid 



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# pH indicators:

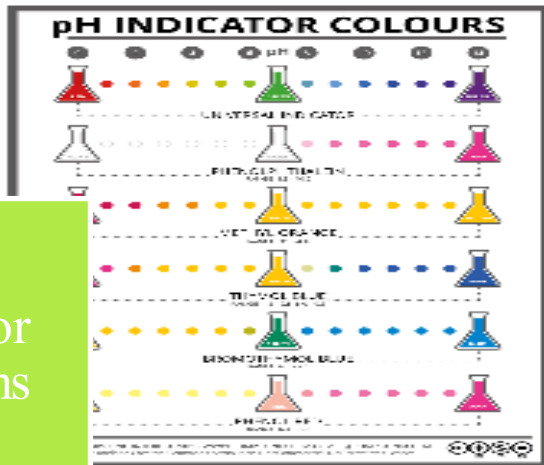
Universal paper



Litmus papers



Indicator solutions



Naturally pH indicators:

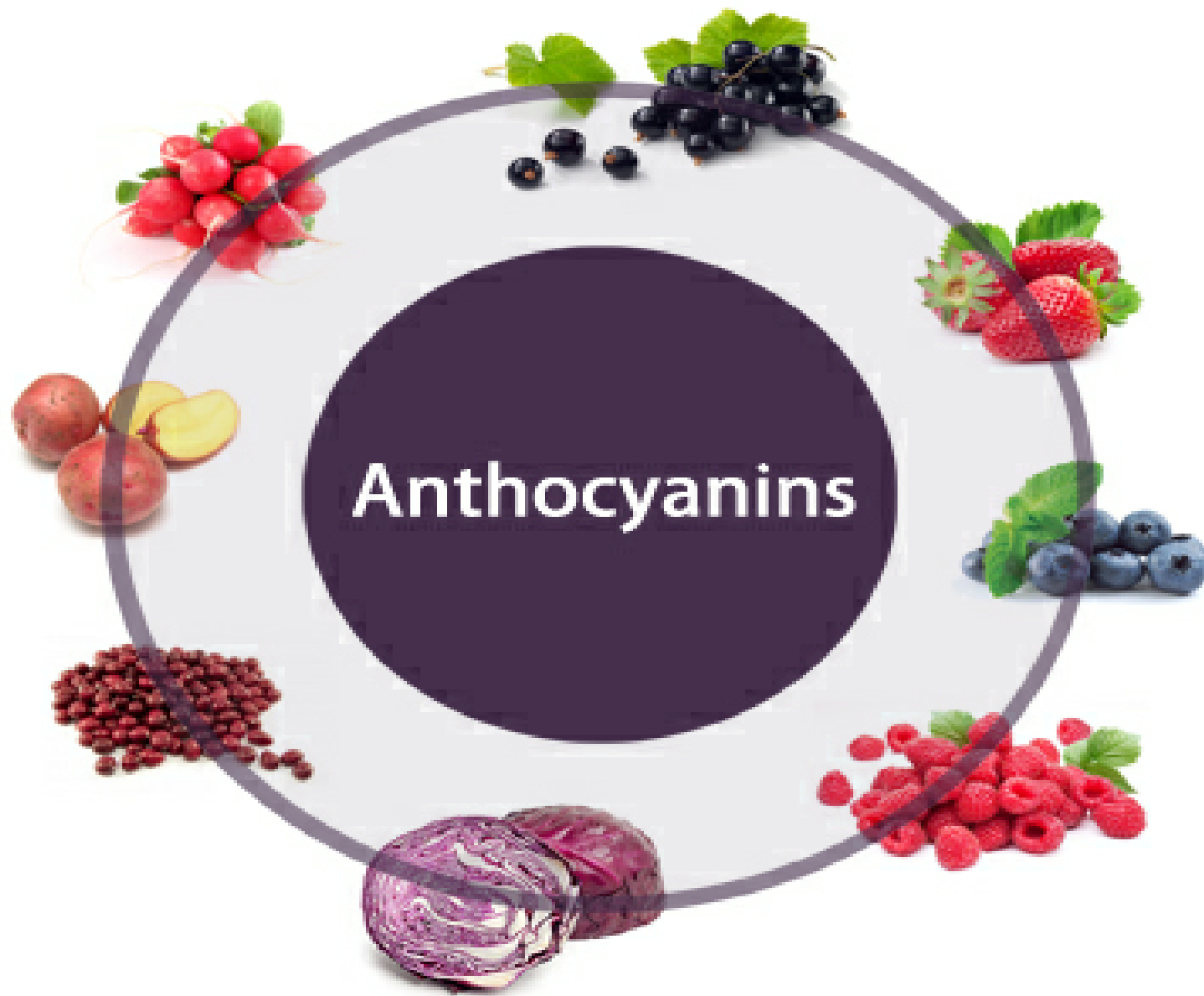






Naturally pH indicators:





# experiment





Experiment No.1:  
red cabbage  
juice



# What do we need?





How can we  
make the red  
cabbage juice?







Acids: sulfuric acid, ketchup sous, vinegar, lime juice.



Bases: dish washing liquid, washing machine powder, sodium hydrogen bicarbonate





It's too amazing!!!

Experiment No.2:  
red cabbage  
&cherry paper





What we need?





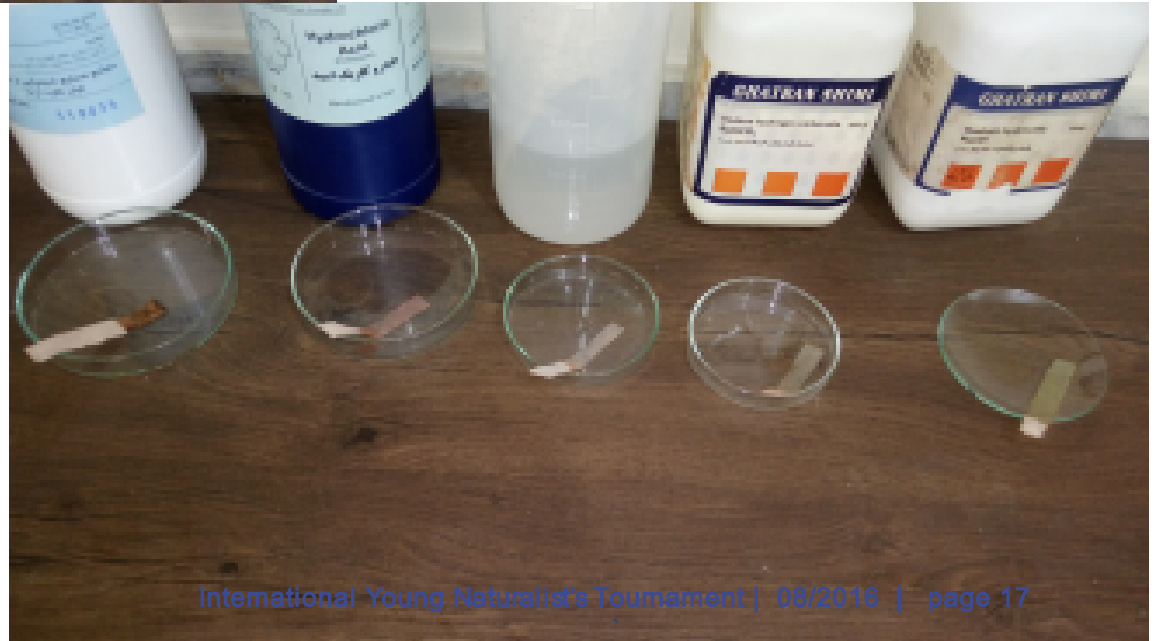
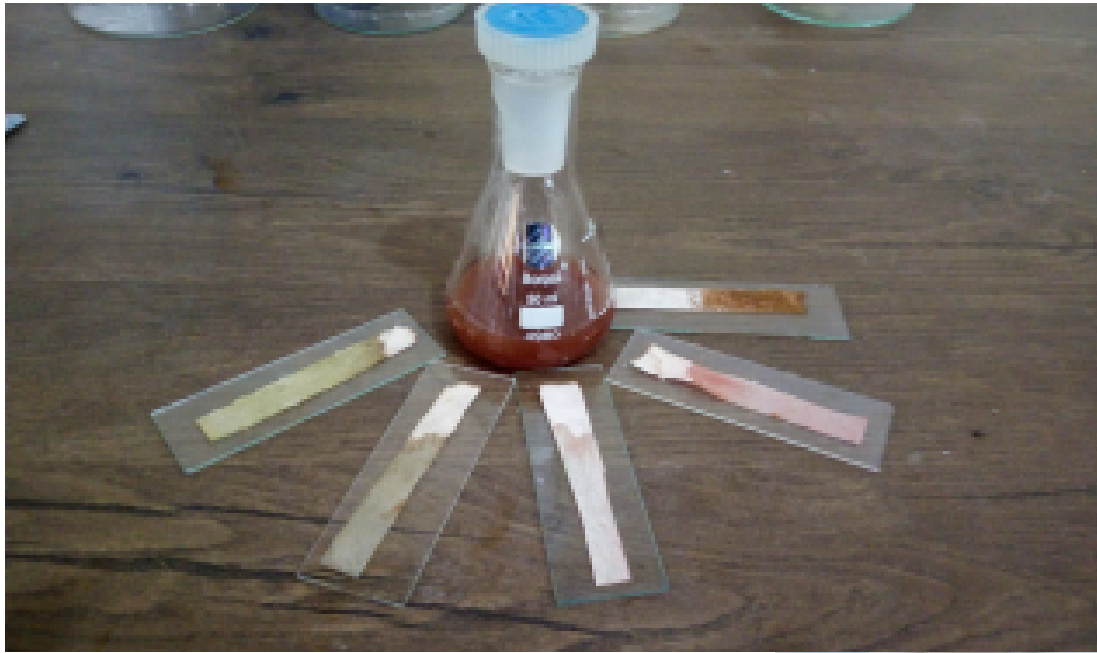
Red cabbage juice



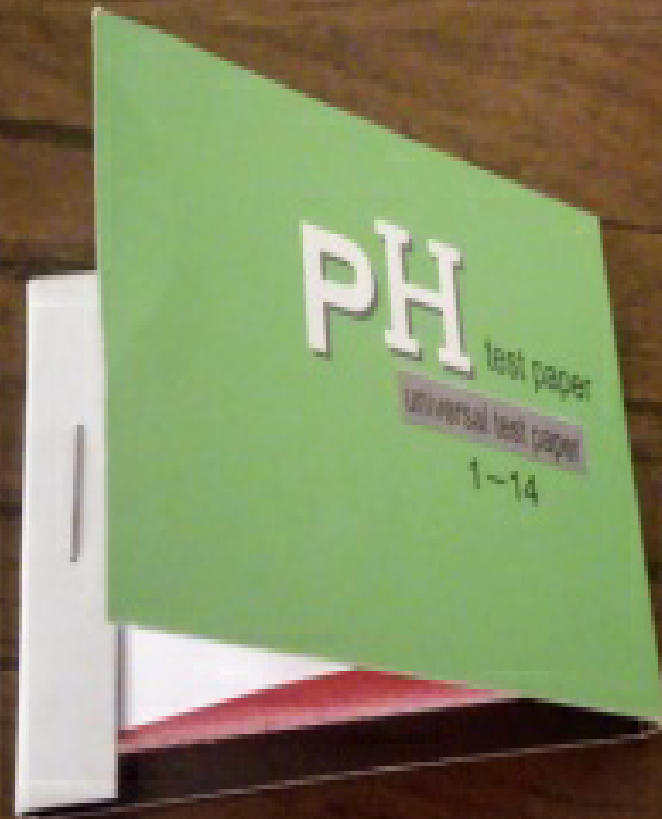
Cherry juice



# Cherry indicator:



# Comparing:



Sulfuric acid

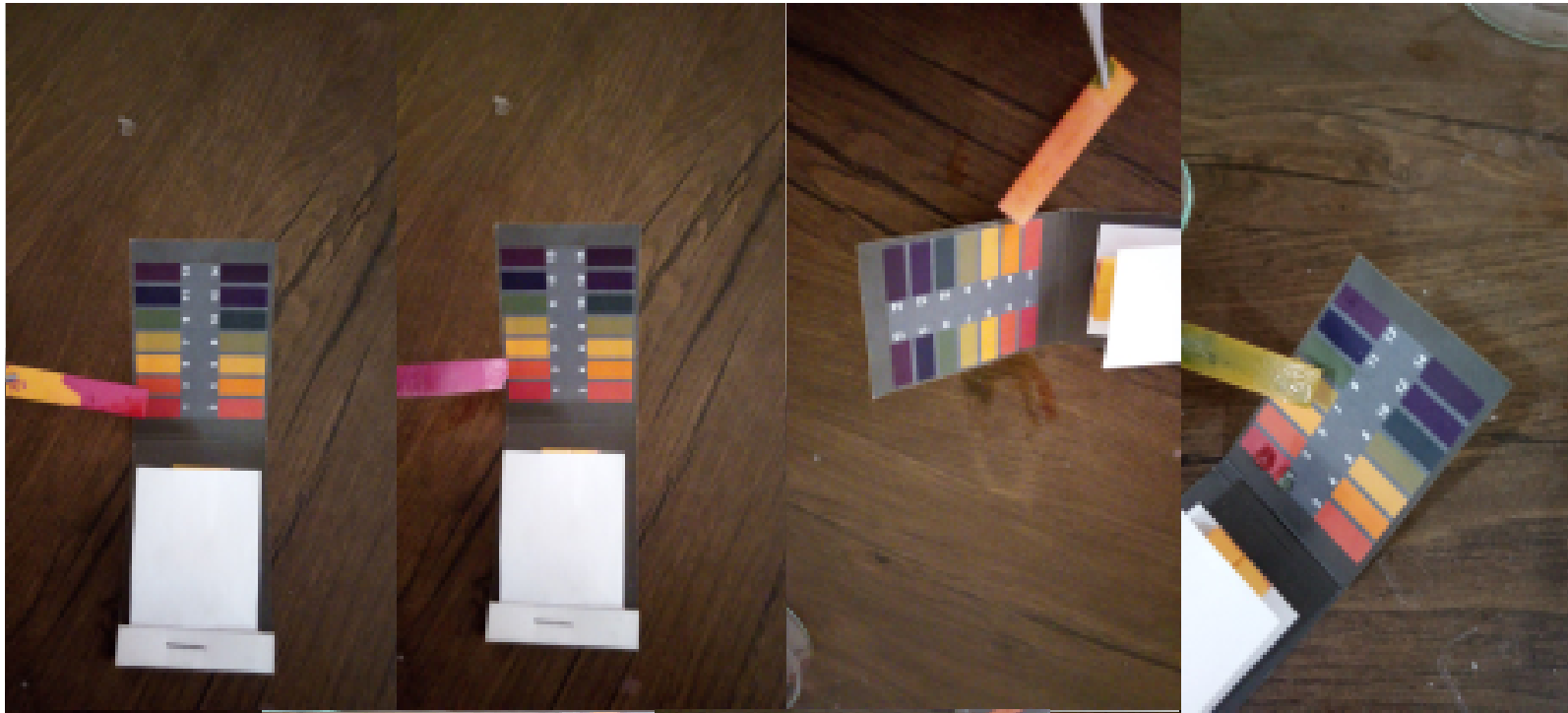
Hydrochloric acid

Pour water

sodium hydrogen bicarbonate

NaOH



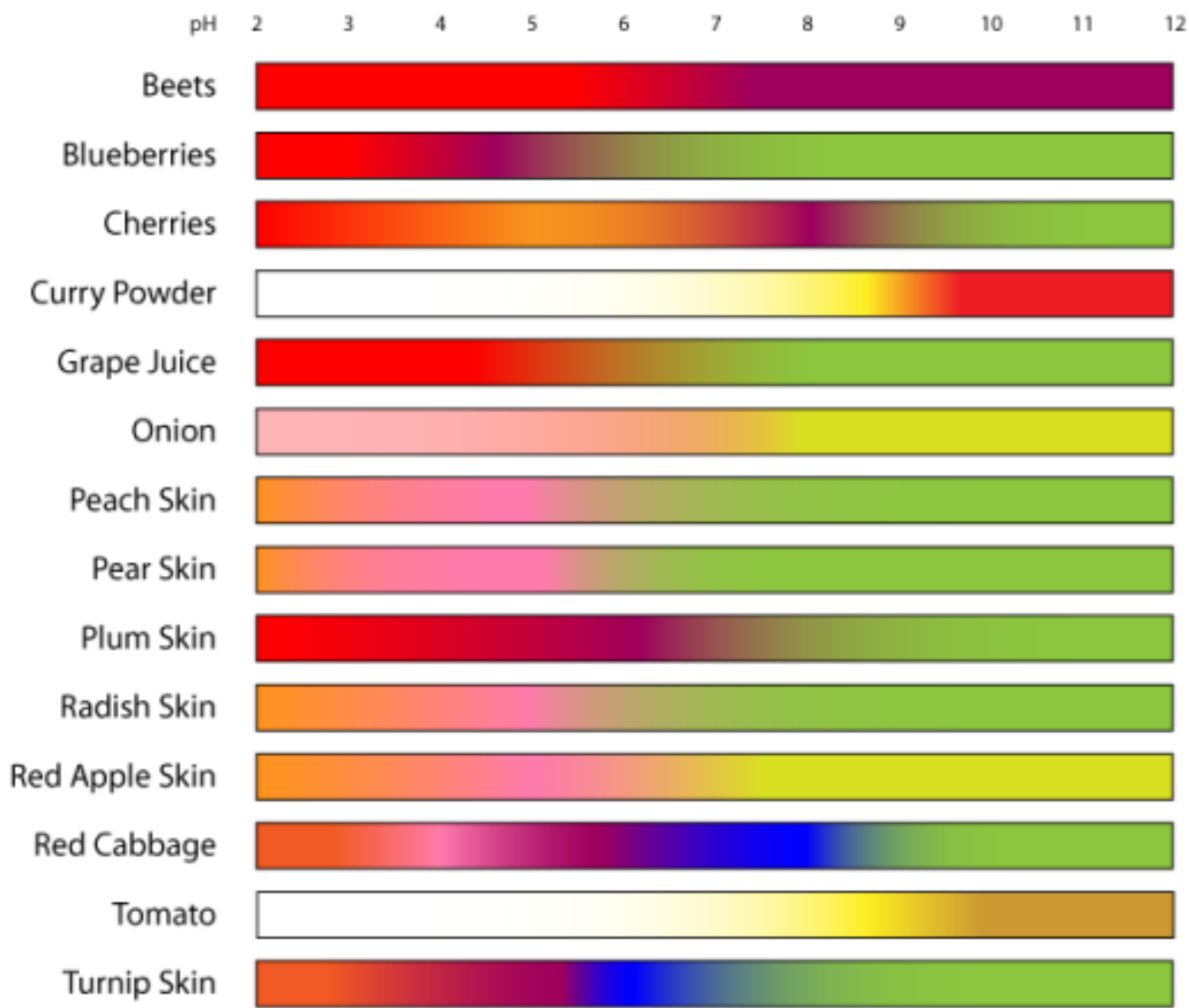


# And.... The result!

PH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Red cabbage	Red	Red	Orange	Yellow	Yellow	Yellow	Purple	Purple	Dark Purple	Light Green	Green	Dark Green	Dark Green	Dark Green
universal	Red	Red	Red	Orange	Yellow	Yellow	Light Green	Green	Dark Green	Dark Blue	Blue	Purple	Purple	Purple
cherry	Red	Red	Red	Red	Red	Red	Pink	Light Orange	Light Green	Light Green	Light Green	Light Green	Dark Green	Dark Green
Black cherry	Red	Red	Red	Red	Red	Red	Red	Pink	Pink	Pink	Pink	White	White	White



## Edible pH Indicator Color Changes



# Craven experiments:



# reference

## 1. Team's own solution

The end,  
Thanks for your attention!

