



Tishk
International University



TISHK INTERNATIONAL UNIVERSITY
FACULTY OF APPLIED SCIENCE
MEDICAL ANALYSIS DEPARTMENT

Iodine Test for Starch



Autumn Semester 2023-2024

Course Name : **Biochemistry (Practical)**

Stage : 3 Lecture 4: **Iodine Test**

Lecture: Dr. Soma Majedi / Ph.D. in Organic Chemistry





Iodine Test



Main Goal:

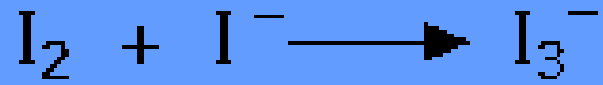
- Using **Iodine** to test for the presence of **Starch** is a common experiment.

Minor Goals:

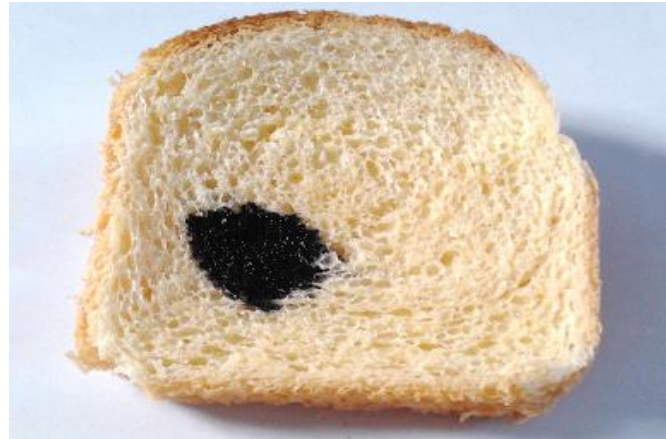
- 1- Understanding somewhat about the structure of **Starch**.
- 2- Learning some more about the structure of **Iodine-Starch Complex**.

Principle:

A solution of elemental iodine (I_2) and potassium iodide (KI) in water (contains triiodide anion; I_3^-) has a light **orange-brown** color (**Lugol's iodine**).



If it is added to a sample that contains starch, produces an intense "**blue-black**" color. Starch forms a very **dark blue-black** complex with **triiodide**.



Such as the bread pictured above, the color changes to a **deep blue**

Notice:

1. The complex is **not formed** if only iodine or only iodide (**I⁻**) is present.
2. The **color** of the starch complex is **so deep**, that it **can be detected visually** when the concentration of the **iodine** is as low as **0.00002 M** at **20 °C**.
3. The intensity of the color **decreases** with **increasing temperature** and with the presence of **water-miscible organic solvents** such as **ethanol**.

Notice:

4. The test cannot be performed at very **low pH (acidic)** due to the Hydrolysis of the starch under these conditions.
5. Iodine by itself is very poorly soluble in water. One way to dissolve Iodine in water is to add **Potassium Iodide** or **Sodium Iodide**.
6. Foods that are high in starch include **grain foods** and **some vegetables**, such as **dried beans** and **peas**, **potatoes**, **corn**, and **lentils**.
7. As fruits **ripen**, the amount of starch can **decrease**.

Lugol's iodine is available in various concentrations.

The most commonly used 15% solution consists of:

10% (wt/v) Potassium Iodide (KI)

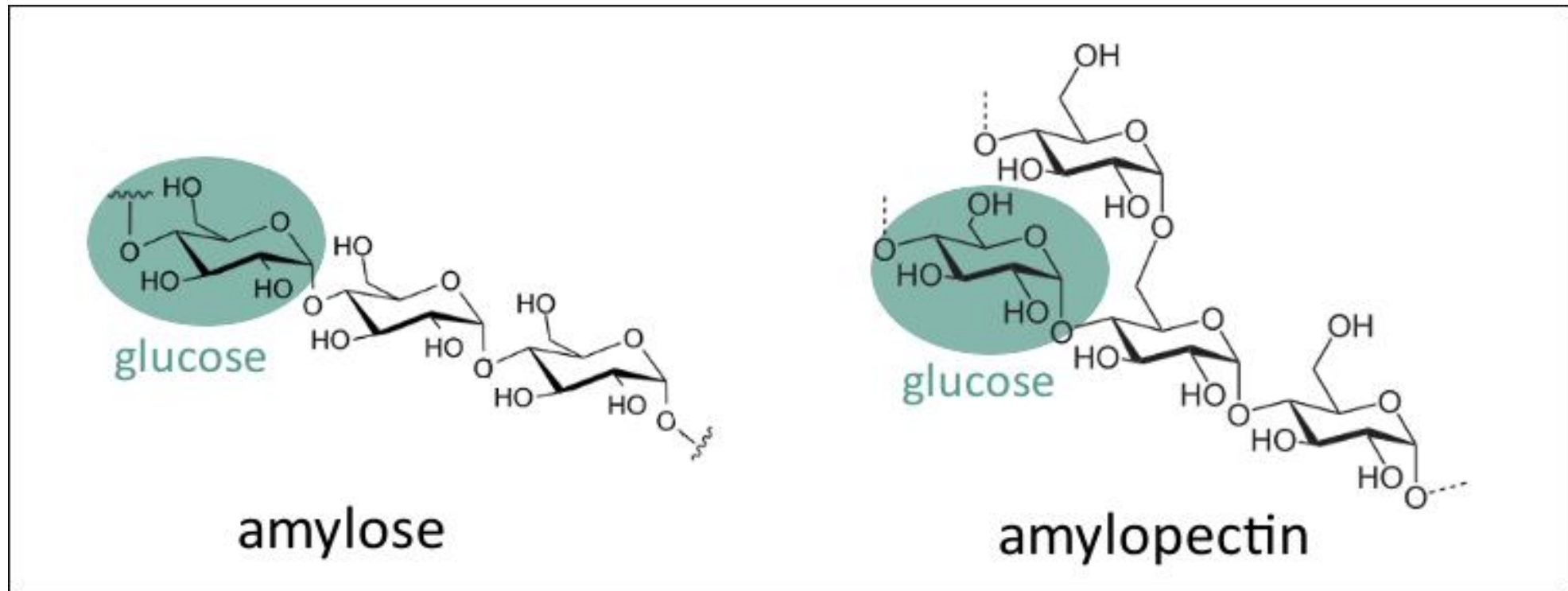
5% (wt/v) Iodine (I_2) mixed in distilled water has a total iodine content of 126.5 mg/mL.



The 15% solution thus has a total iodine content of 6.32 mg per drop of 0.05 mL; the 2% solution has 0.84 mg total iodine content per drop.

Starch is a carbohydrate found in plants. Natural starches - from plants consists of two different types of polysaccharides that are made up of glucose units which are connected in two different ways.

One is the **linear amylose (10 - 20%)** and the other is the **branched amylopectin (80-90%)**. The **structure of the helical amylose** is key to the Iodine-starch reaction. A helix is a coil or a spring.



Procedure of Iodine Test

Step 1:

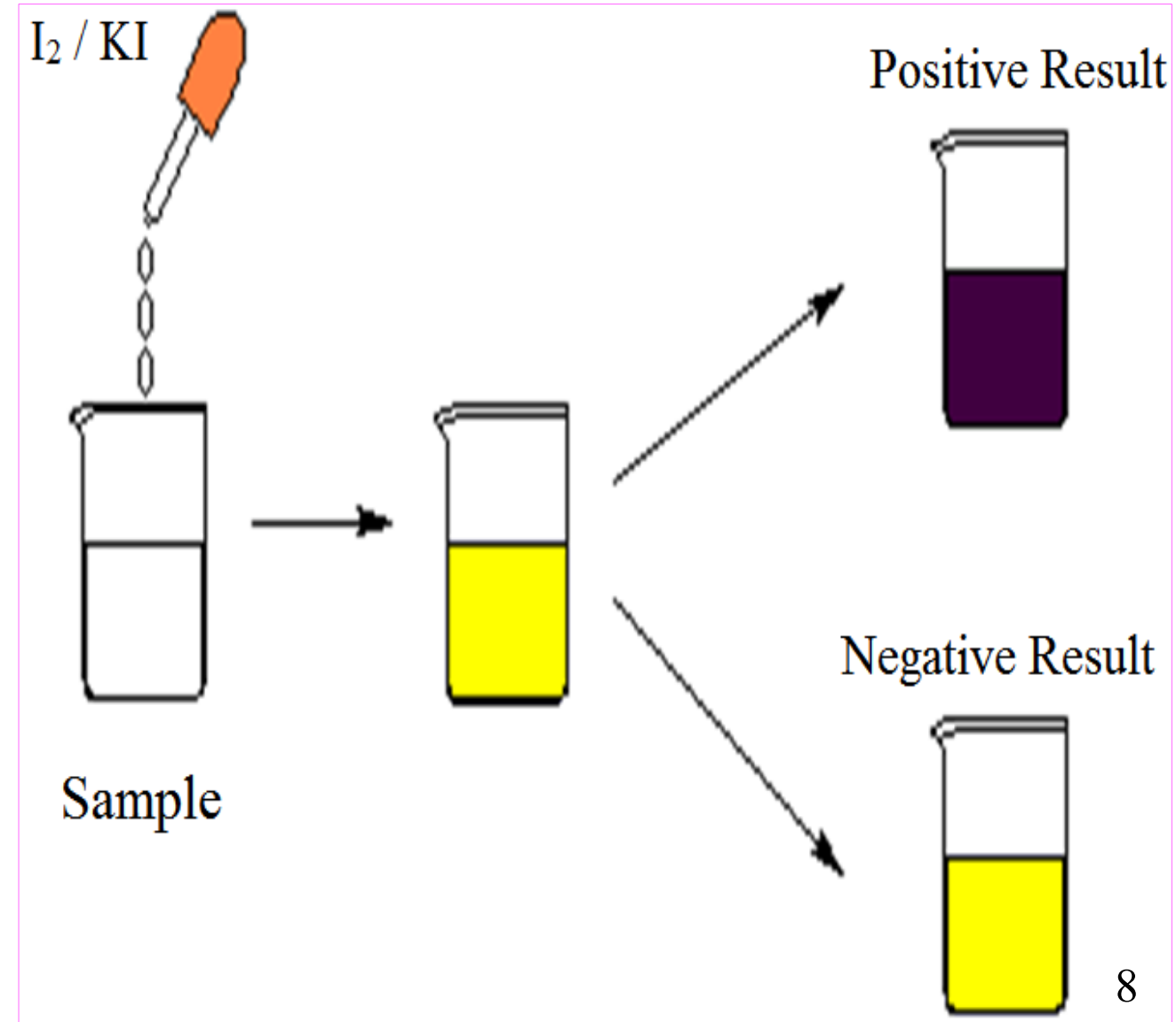
- 1- Pour **2 ml** of each sample solutions in a test tube.
- 2- Add **3 drops** of **Lugol's iodine** (**triiodide anion; I_3^-**) to the solution.
- 3- (**Mix well**).

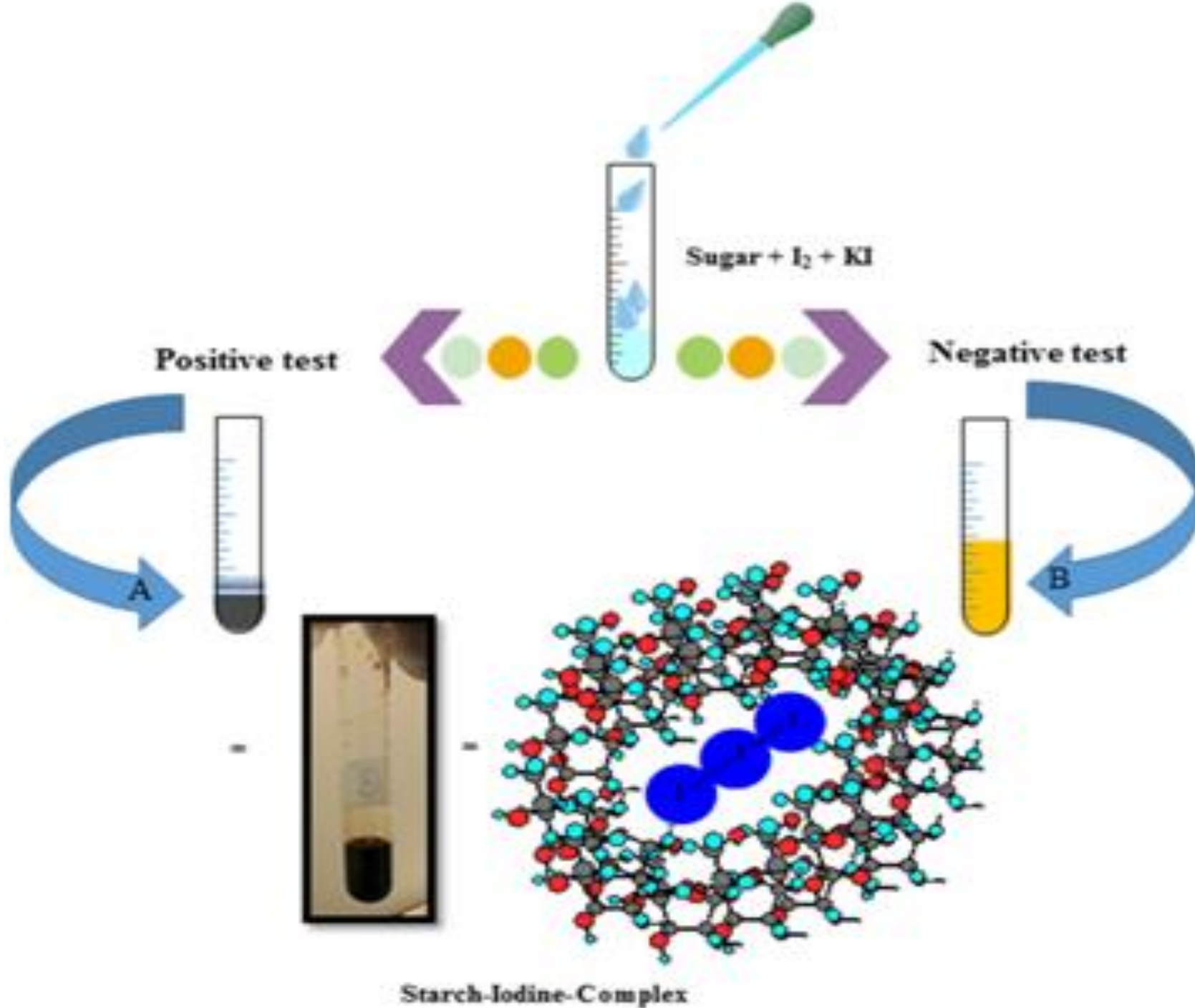
Step 2:

- Record the observed color changes.

Note:

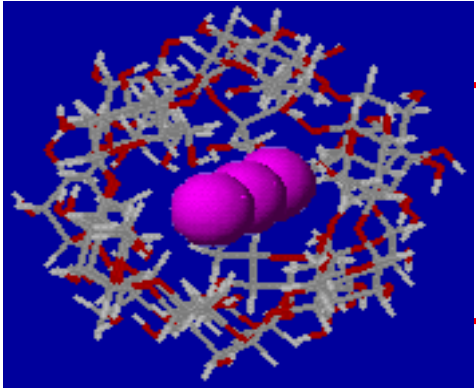
These conditions are whether sample used in the test is solid or a liquid.





Result:

Dark blue-black, if the test is positive



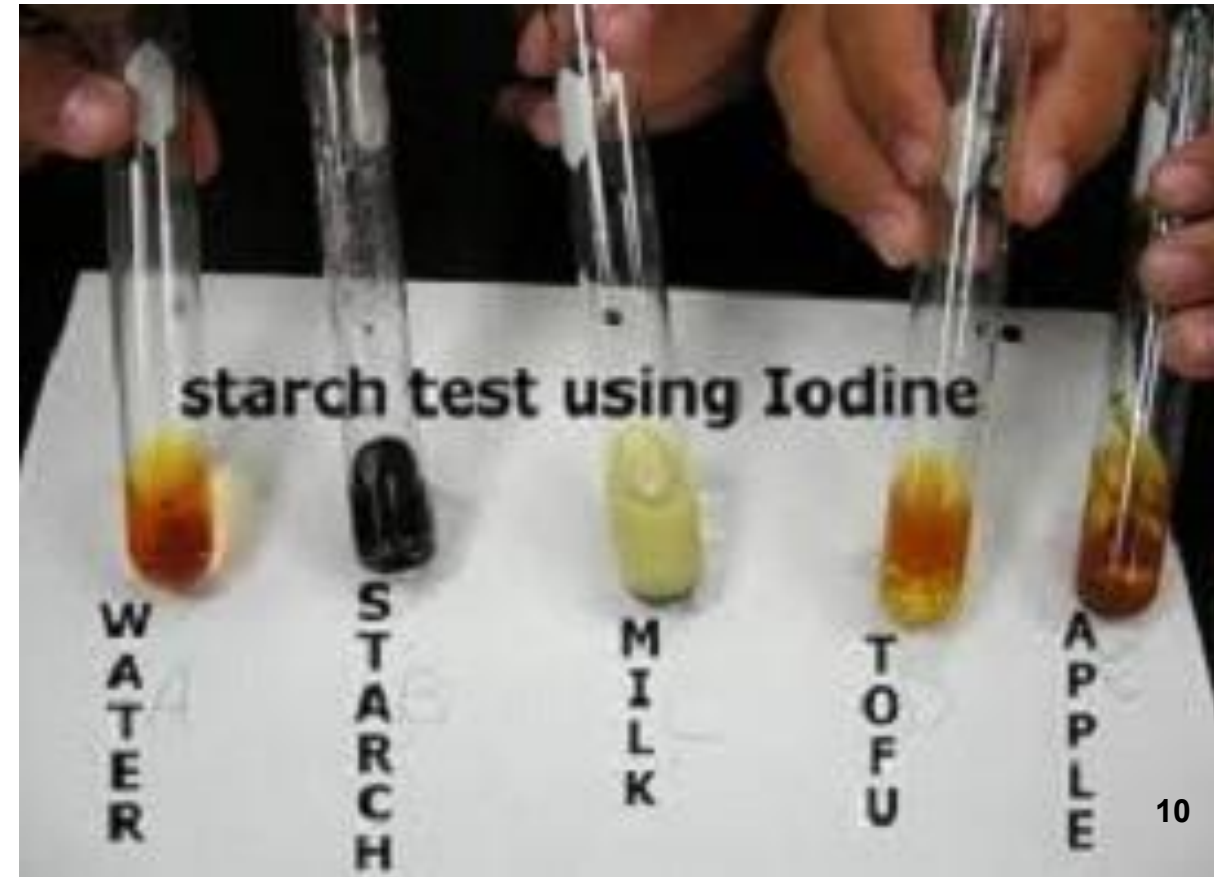
+ result - result



+ result - result

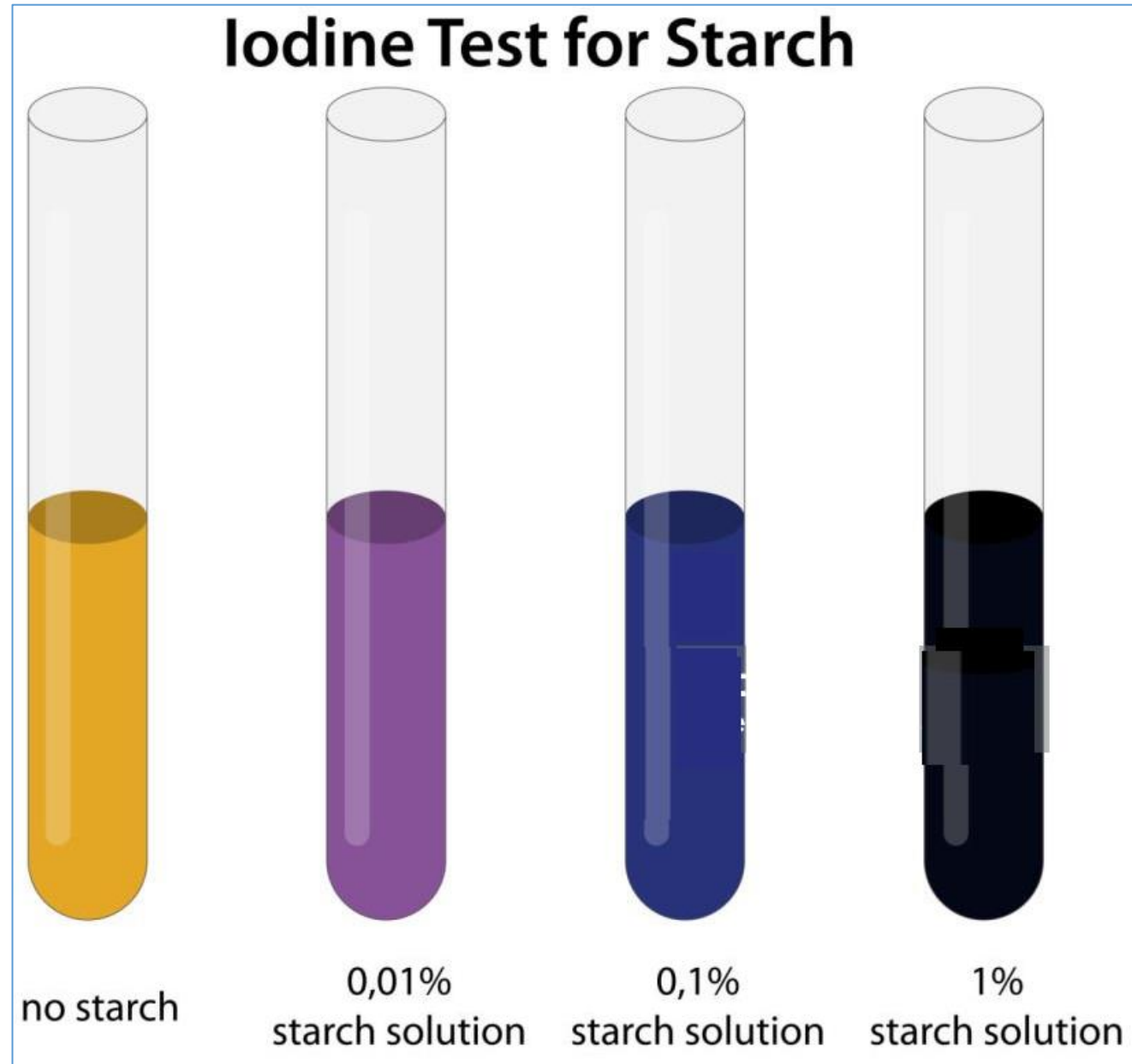
In the case of presence of **starch**, the color of the solution changes.

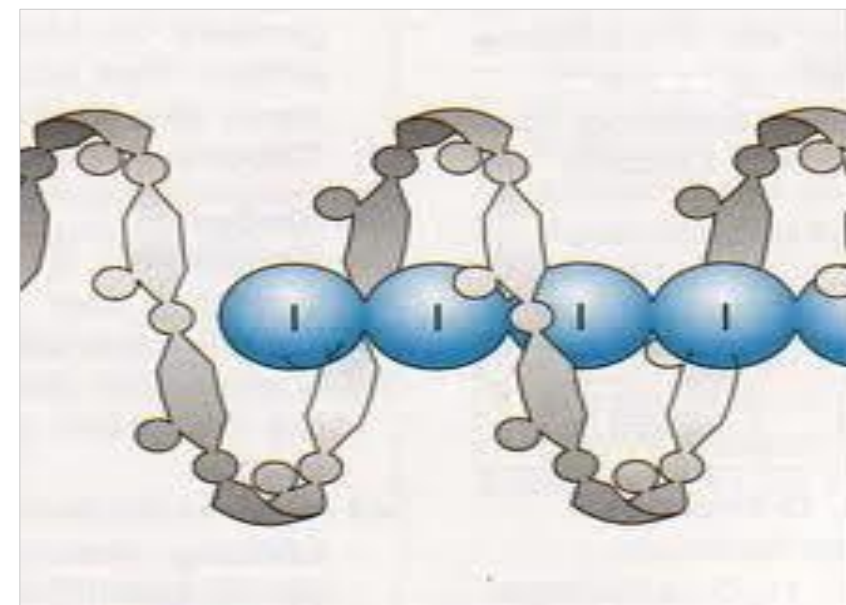
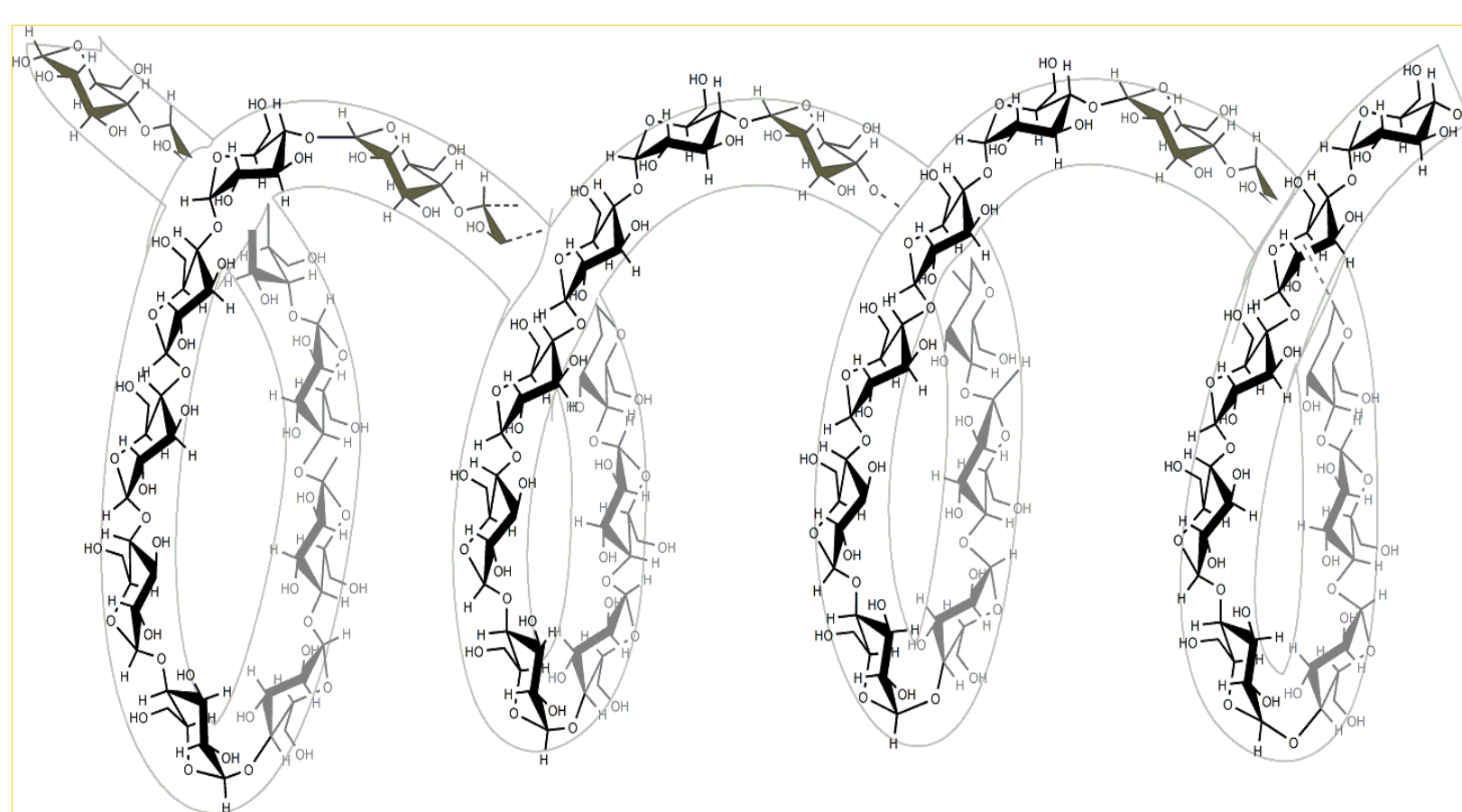
The color change should be a **blue-black color** which appears only in the case if **positive results** which are that the **starch** is present in the solution.



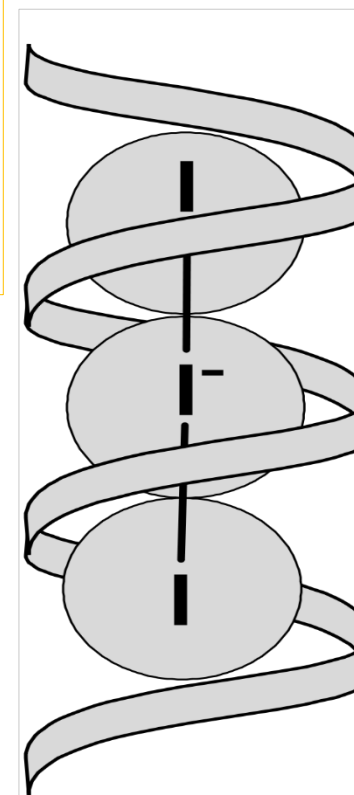
Semi-Quantitative Test

Through visual comparisons or more advanced techniques like spectrophotometry to estimate approximate starch concentration.

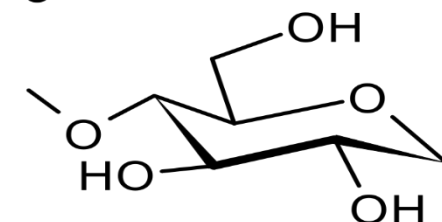




Interpretation:
Amylose is the compound that is responsible
 for the **blue color**.
 Its chain forms a **helix shape**, and **iodine** can
 be bound inside this helix.



Amylose helice with the
 glucose-monomerunit:



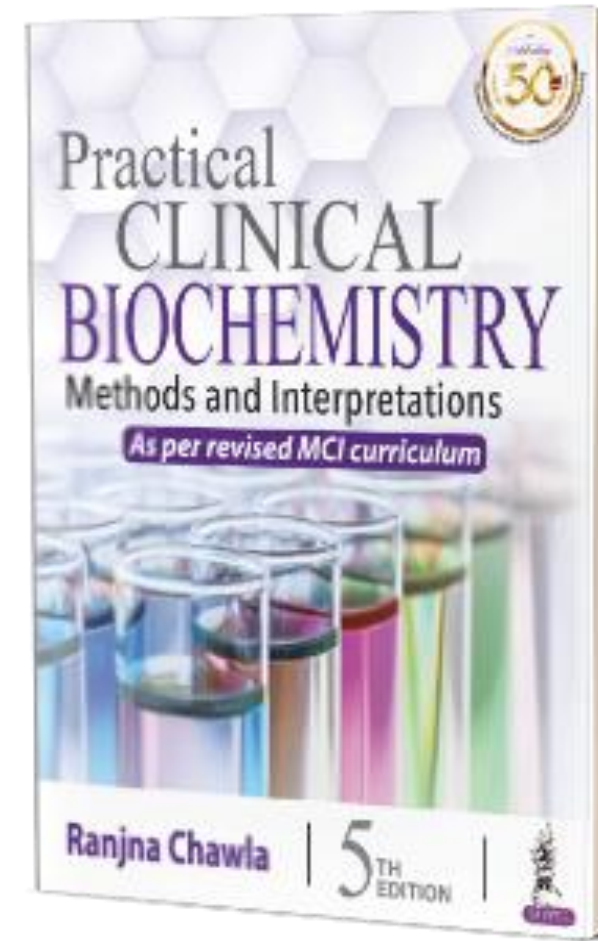
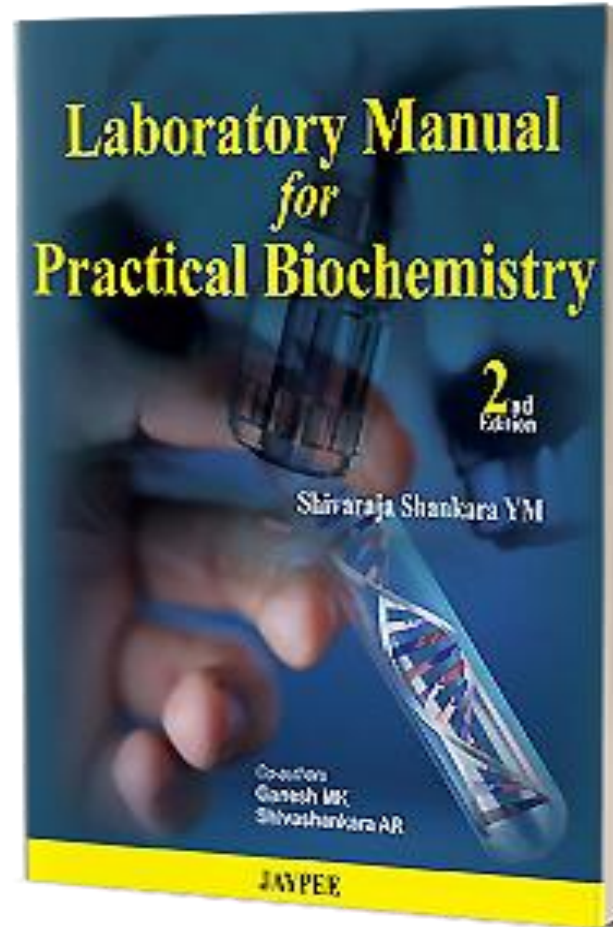
Homework

1. Describe the “charge-transfer” and explain how this phenomenon affects on the iodine test?
2. Why does the blue color disappear after heating, or does it decrease in intensity by adding Ethanol?
3. Why does the amount of starch decrease as fruits ripen?

- ✓ https://www.google.com/search?q=iodine+test+cartoon&source=lmns&tbm=vid&bih=739&biw=1536&hl=en&sa=X&ved=2ahUKEwj-qKO8xJGCaxW2mycCHU85CVkQ_AUoAnoECAEQAg#fpstate=ive&vld=cid:1ee229c6,vid:6rjakS5W0Go,st:0
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References



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