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College of Pharmacy
third level

practical lab.(1) (Carbohydrates)

Carbohydrates

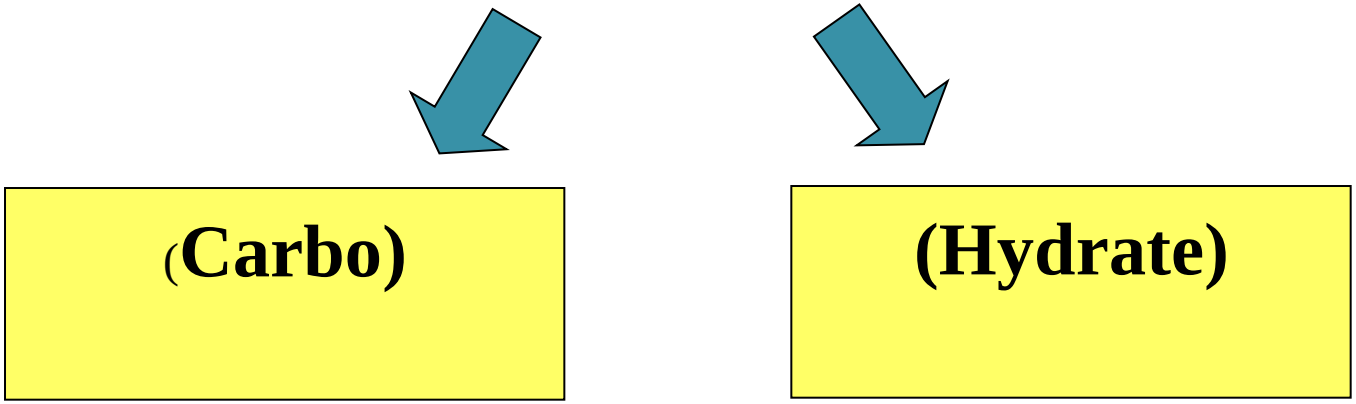
- Carbohydrates are an important components of the nutrition, because they are easy to digest compared to other nutrients such as fats and proteins.

Carbohydrates

- **Sugars have two sources:-**
- **A- A plant source** that is involved in the synthesis of the cell walls of a plant
- **B- The animal source** is found in (blood, urine, milk) concentrated in the form of a multiple sugar called glycogen, which is found mainly in the liver and muscles.

Carbohydrates

- **It means carbon water**



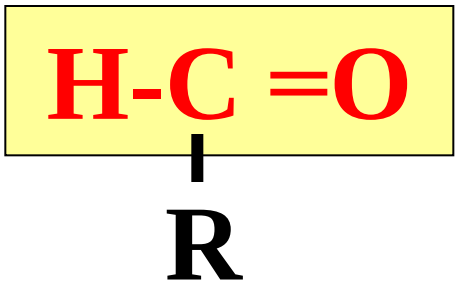
- Compounds that contain in their composition carbon, hydrogen and oxygen in a ratio of 1: 2

Definition of carbohydrates

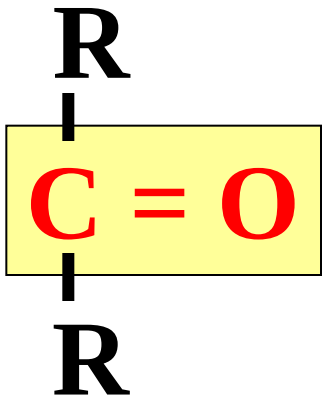
$$(CH_2O)_n \quad n \geq 3$$

- They are organic compounds aldehydes or polyhydric ketones,
- Hydrolysis, give aldehydes or polyhydric ketones.

Aldehyde and ketone

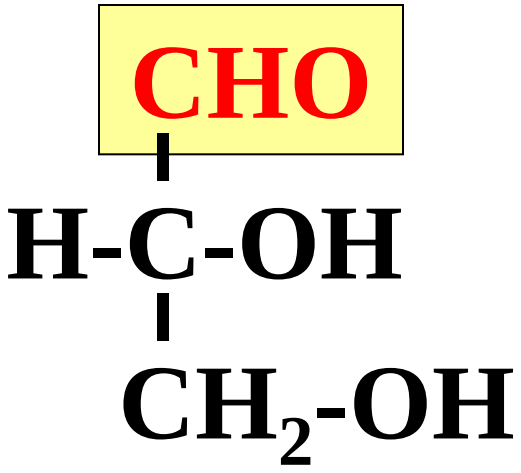


Aldehyde

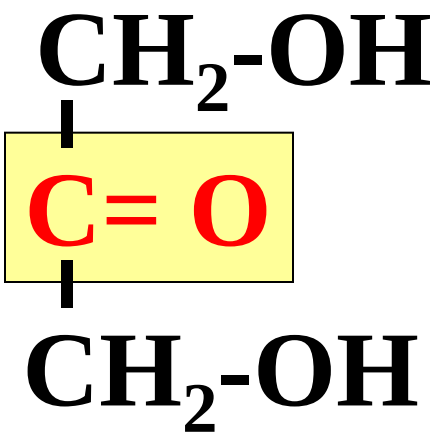


Ketone

Polysaccharides exist in the form of aldehyde or polyhydric ketone



جليسرالدهيد
(ألدوترايوز)
Aldotriose



ثنائي هيدروكسي أسيتون
(كيتوترايوز)
Ketotriose

Classification of carbohydrates

Disaccharides

2
Molecule of
monosaccharides

Monosaccharides

8-3
Corn carbon

Polysaccharides

More than 10
Molecule of
monosaccharides

Oligosaccharides

10-3
Molecule of
monosaccharides

The importance of carbohydrates

- Carbohydrates are one of the primary sources of energy, especially the brain and nervous system.
- Some types of sugars are involved in the structure of cells and tissues of plants and animals.
- A source for synthesis of a large number of important organic compounds such as nucleic acids.
- Heparin is a polysaccharide and anti-clotting agent.
- It is involved in many industries such as the textile industries based on cotton cellulose fibers.

Monosaccharides

- **General composition $(CH_2O)_n$**
  They are simple sugars that cannot be broken down into simpler substances such as glucose, fructose, and galactose.
- **Divide based on the number of carbon corn into:**

  Tri – Tetr – Pent – Hex – Hept – Oct -
- **Divide according to the presence of the effective group** (aldehyde or ketone)

The most important mono sugar

- **sugar (hexose)** glucose, fructose, galactose
- **sugar (pentose)** sugar Raibose ---------- RNA
- **sugars (triose)** glyceraldehyde, dihydroxyacetone ------- metabolism intermediates

Monosaccharides

- **include:**
- **A. Glucose:**
- It is the simplest type of carbohydrate and is called blood sugar.
- it is in the form of natural sugar in food or the body can provide it through the digestion of complex carbohydrates such as the starches found in rice, pasta and potatoes.

Monosaccharides

- **B. Fructose:**

- It is found in fruits and honey. It is the sweetest type of sugars and starches in terms of taste.
- combines with **glucose** to form **sucrose**.

- **C. Galactose:**
- combines with **glucose** to form **lactose**, "milk sugar"

Experiments

1- Molisch Test :

It is a general test for CHO .

Principle:-

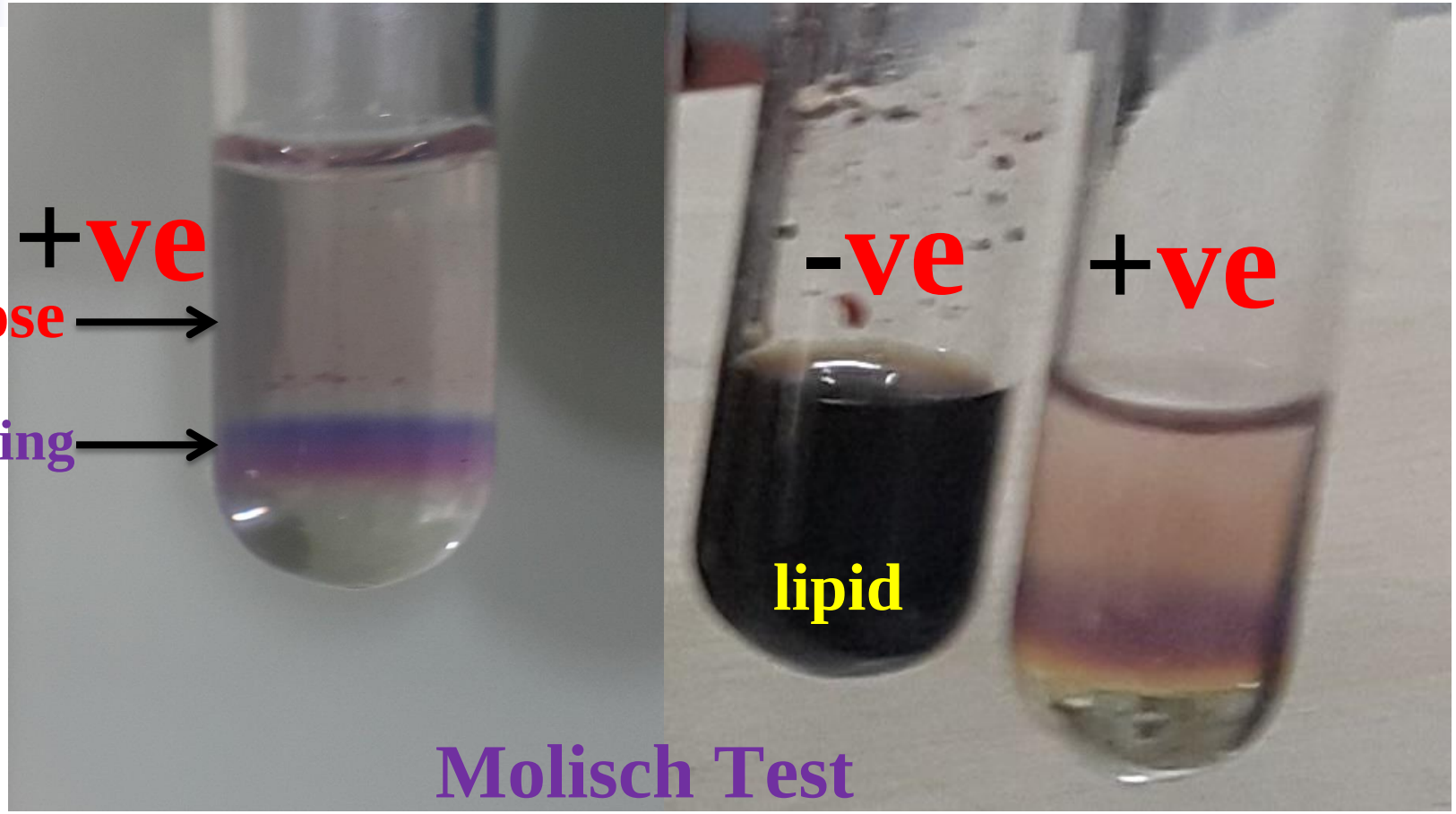
- The sulfuric acid **(H_2SO_4)** strips 3 water molecules to form the furfural compound and binds with the alpha-naphthol to a **violet ring**.

Experiments

Molisch Test :

Method:-

- 1ml test solution + 2 drops of α-naphthol
- mix well
- add 2-3 ml of conc. H_2SO_4
- **violet ring** appears at the junction of two layers.


+ve
Glucose
violet ring
-ve
+ve
lipid
Molisch Test

2- Benedict Test:

This test is to differentiate between reducing mono, disaccharides and non-reducing disaccharides.

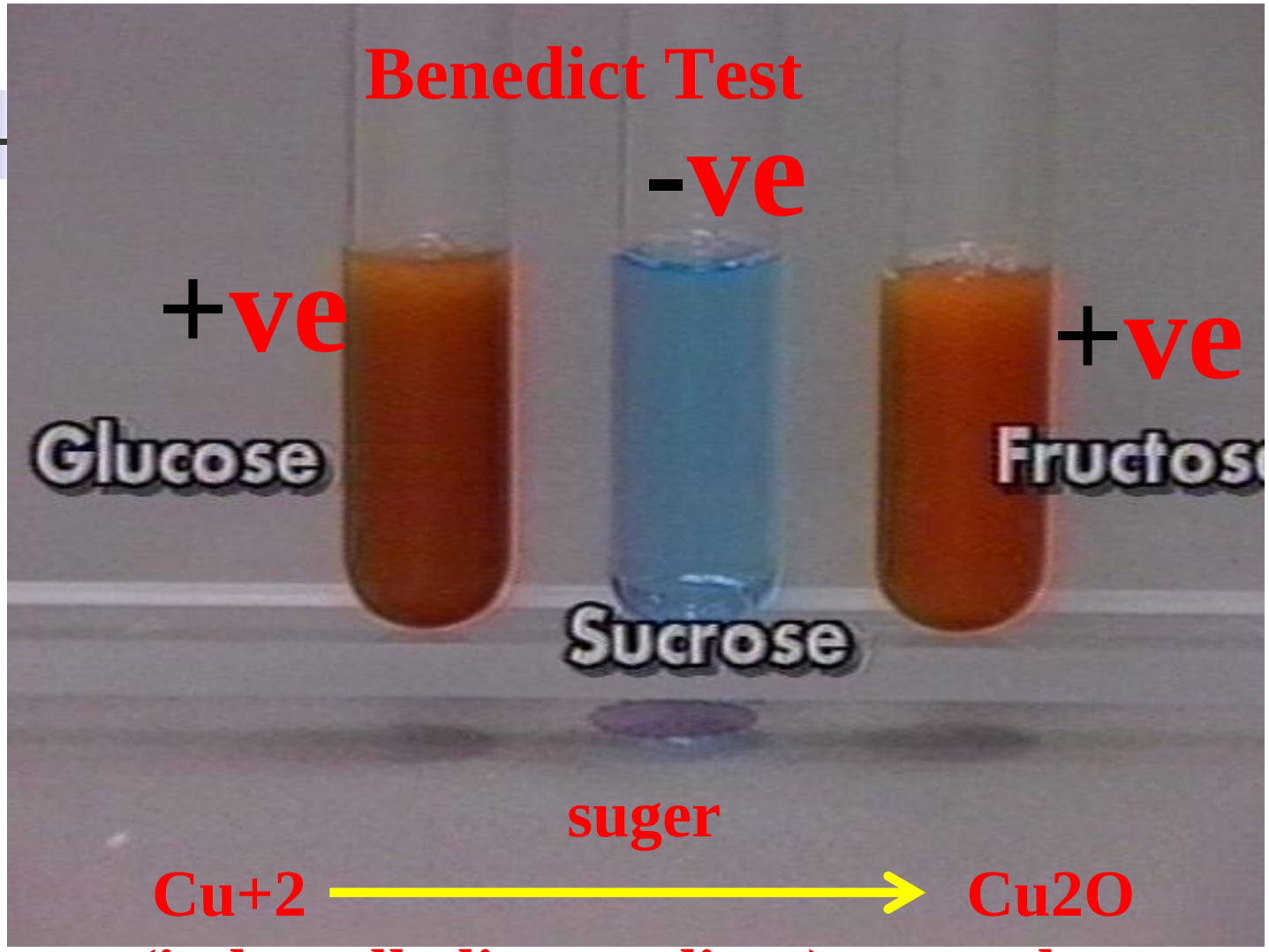
Principle:-

It is based on the reduction of copper ions to copper oxide in a hot alkaline medium.

Benedict Test:

Method:

- 1ml test solution + 1ml Benedict's reagent
- heat the mixture in Boiling Water Bath for (3mim)
- Reddish brown ppt.



suger

Cu+2 ⟶ Cu2O

(in hot alkaline medium) red ppt

3- Barfoed's Test:

This test is used to distinguish between monosaccharides and disaccharides, since the monosaccharide reduces the Cu+2 ion faster than disaccharide in the hot acidic medium.

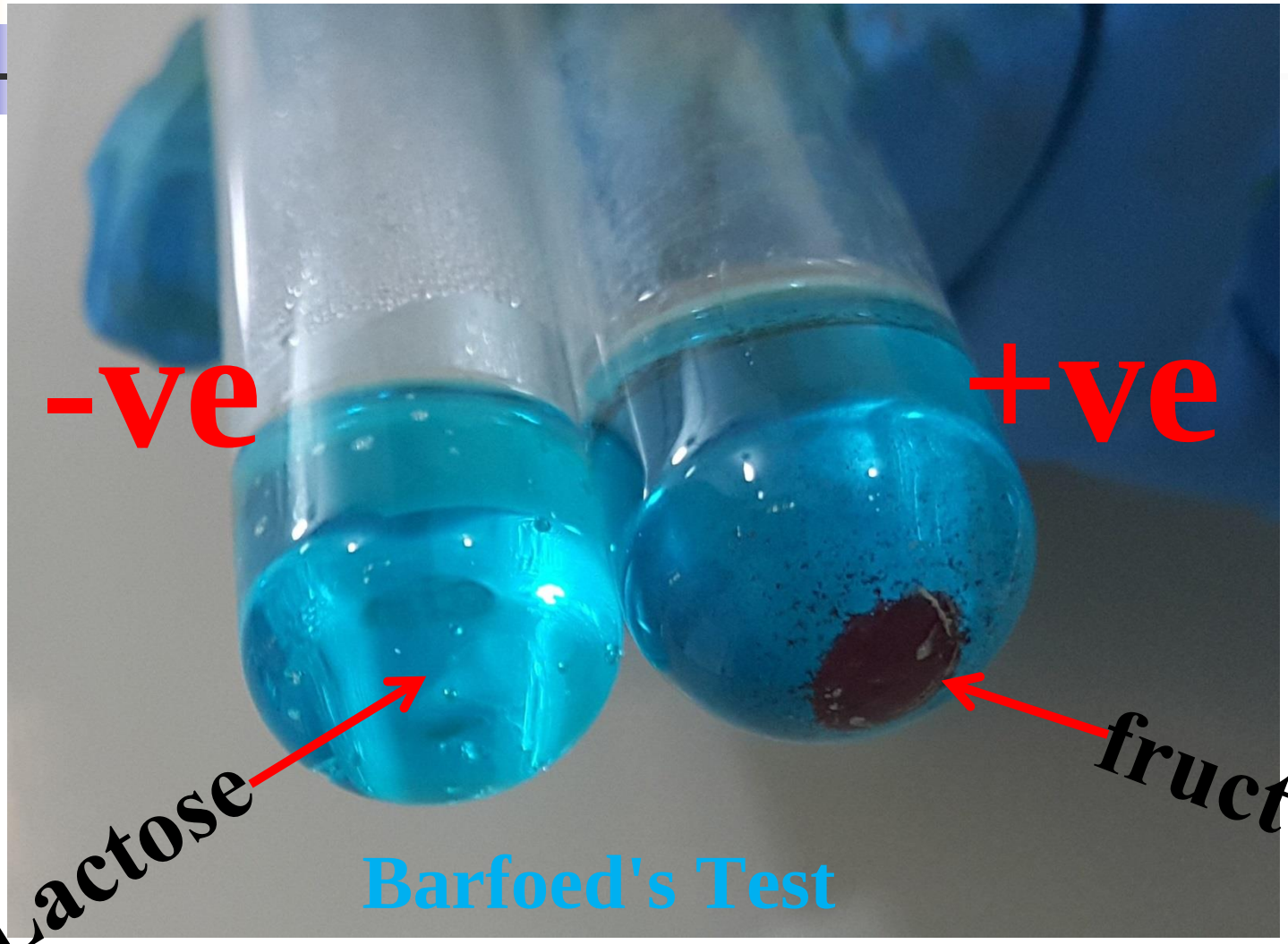
Method:

• 1ml of the solution to be tested +2ml of Barfoed's reagent.

.• test tubes into a boiling water bath and heat for 2 minutes.

• Remove the tubes from the bath and allow to cool.

• Formation of a red precipitate of Cu2O .


-ve
+ve
Lactose
fructose
Barfoed's Test


thank you for
listening

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Disaccharides

1-Maltose: (malt sugar)

It is the simplest reducing disaccharide consisting of :-

glucose + glucose

- found in barley or in saliva and pancreatic juice.

2-Lactose:(milk sugar)

- It is a disaccharide in nature and is known as milk sugar because it is present in milk only.
- It consists of two molecules:

  glucose + galactose

- it is also a reducing sugar.

Lactose

- It is possible for lactose to be present in the urine of a woman during pregnancy, and that its lack of absorption in the intestine can cause diarrhea.

3-Sucrose : (cane sugar,table sugar)

- It is one of the most important disaccharides present in nature.
- It consists of two parts

glucose + fructose

- it is a non-reducing sugar because the Link between both groups is active (the aldehyde group in glucose and the ketone group in fructose called dextrose and is found in sugar cane and beet.

Poly saccharides

- **Starch**:
- It is a multiple sugar found in the plant.
- It consists of two main:

A- non-branching glucose chains called amylose.

B- Branching chains called amylopectin

- **Glycogen**:
- It is called animal starch. It is similar to vegetable starch but is more branched. It stores in the liver and muscles.

Experiments

4- Seliwanoff's Test:

This test is used to distinguish between the aldoses and ketoses due to the presence of the **ketone group**

Principle:-

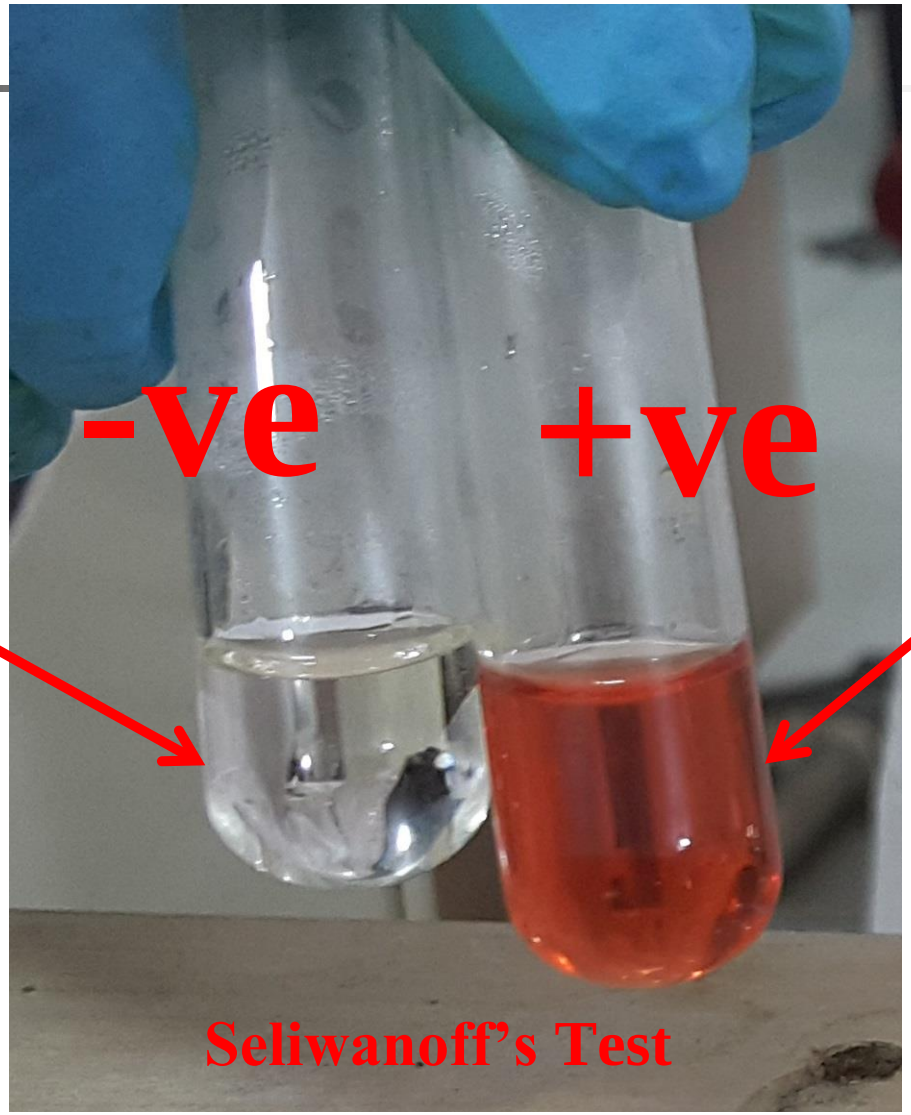
Ketone sugars differ from aldehyde sugars in that they lose water and form furfural more easily. When **fructose sugar** is heated with **HCl**, furfural is formed and condensed with **resorcinol** to form a **red complex.**

Experiments

Seliwanoff's Test:

Method:

- 1ml of a suger solution+ 2ml of Seliwanoff's reagent
- heat the mixture in Boiling Water Bath for (2min)
- A positive test is indicated by the formulation of a **red product**


-ve
+ve
Glucose
Fructose
Seliwanoff's Test

5- Bial's Test:

This test is used to distinguish pentose sugars.

Principle:

Arabinose(pentoses) +HCl _____ Furfural

Furfural+ orcinol __ Fe+3 _____ Deep green complex

Method:

- 0.5 ml of suger solution+ 1ml of Bial's reagent
- heat the mixture in Boiling Water Bath for (2min)
- cooled the solution become for green, deep green than blue green.

Deep green complex

Bial's Test

6-Iodine Test:

This test is used to distinguish for polysaccharides.

Principle:-

The principle of this test is based on the interaction of iodine ions with chains of the **starch molecule** (**amylose**) and the formation of **blue complexes**.

Iodine Test:

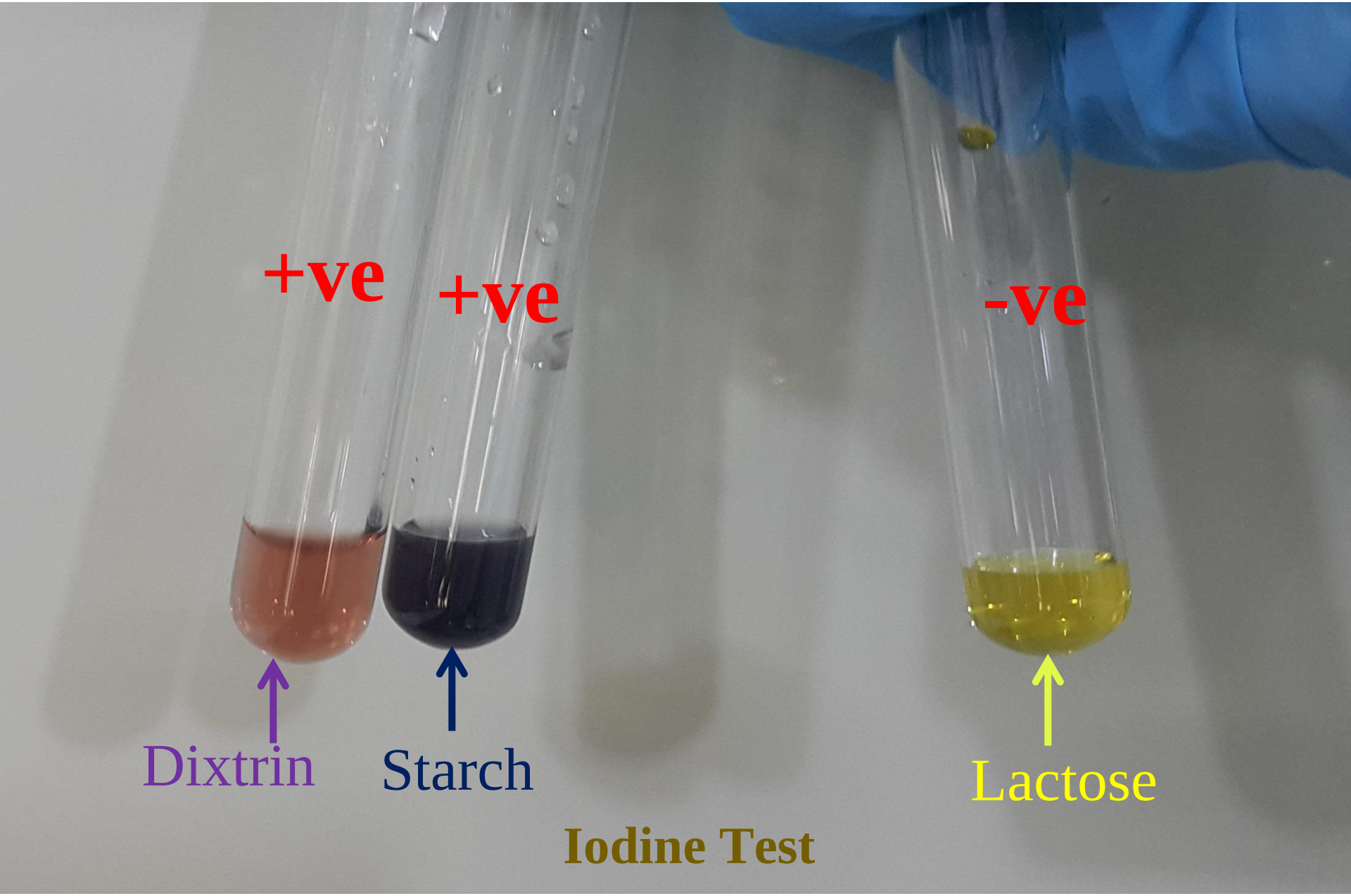
Method:

- 1ml of starch solution + 1 drop of the iodine solution
- A deep blue colour is produced.

Starch ---------- deep blue colour

Dixtrin ---------- purparal colour

Glycogen ---------- Reddish brown colour.



Iodine Test


thank you for
listening