

Group4

~~Monster Batteries~~



Group4

**Monosaccharide
batteries**



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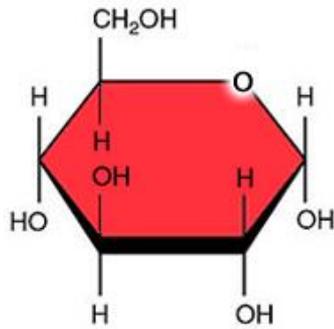
References

Key Words

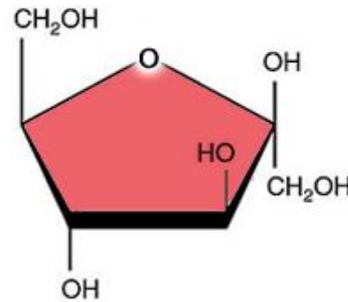
Monosaccharide:

The simplest forms of sugar

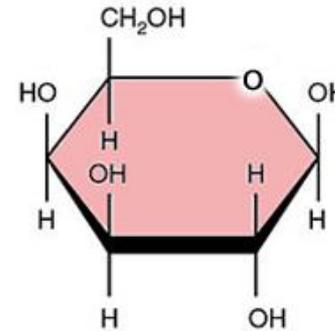
Ex.



Glucose

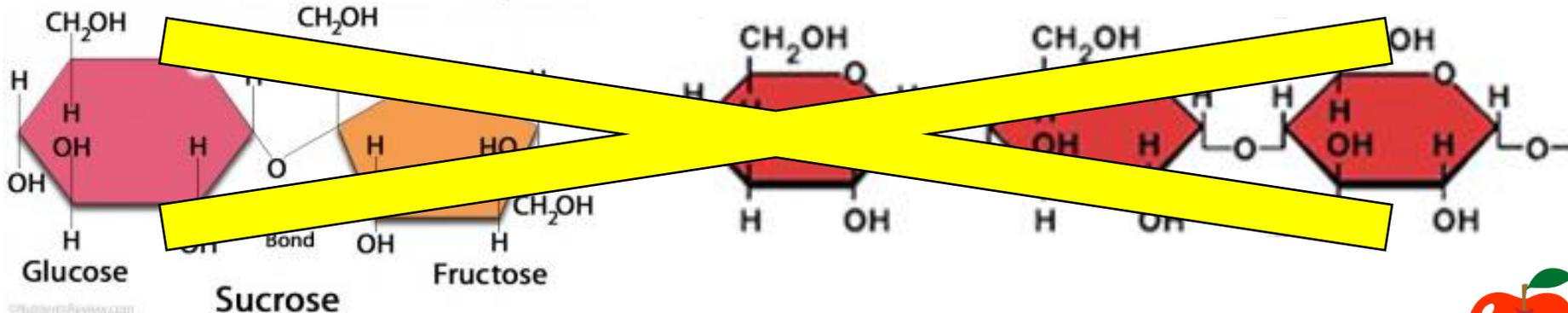


Fructose



Galactose

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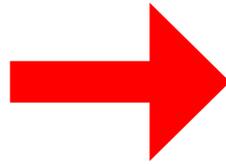
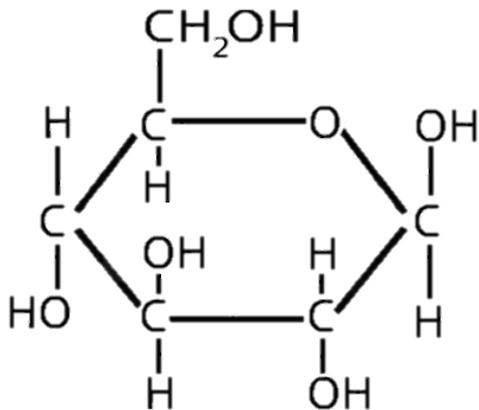


Key Words

Glucose Batteries:

Batteries made from glucose, a type of monosaccharide

Research into these types of batteries has become popular in recent years.



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Lack of electricity due to
power cuts



Purpose

Lack of electricity due to
power cuts

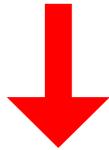


Purpose

Glucose batteries



Have the potential to be of use during a power cut in a disaster



Let's try to apply this principle to **other sugars AND familiar everyday foods**



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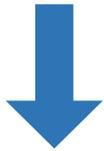
References



Experiment I Applying the principle to other sugars

Hypothesis I

Galactose and fructose are kinds of sugar.



We will use glucose, galactose and fructose.



Can we make monosaccharide batteries?

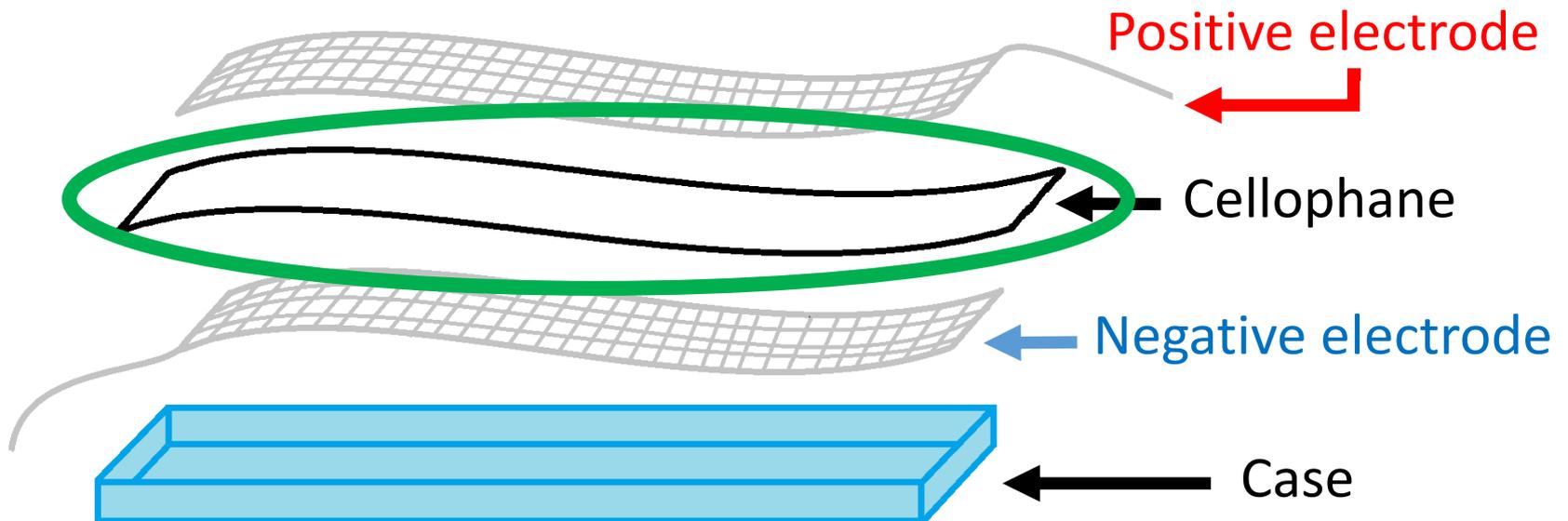


Experiment I Applying the principle to other sugars

Making a glucose battery

KOH

KOH+sugar

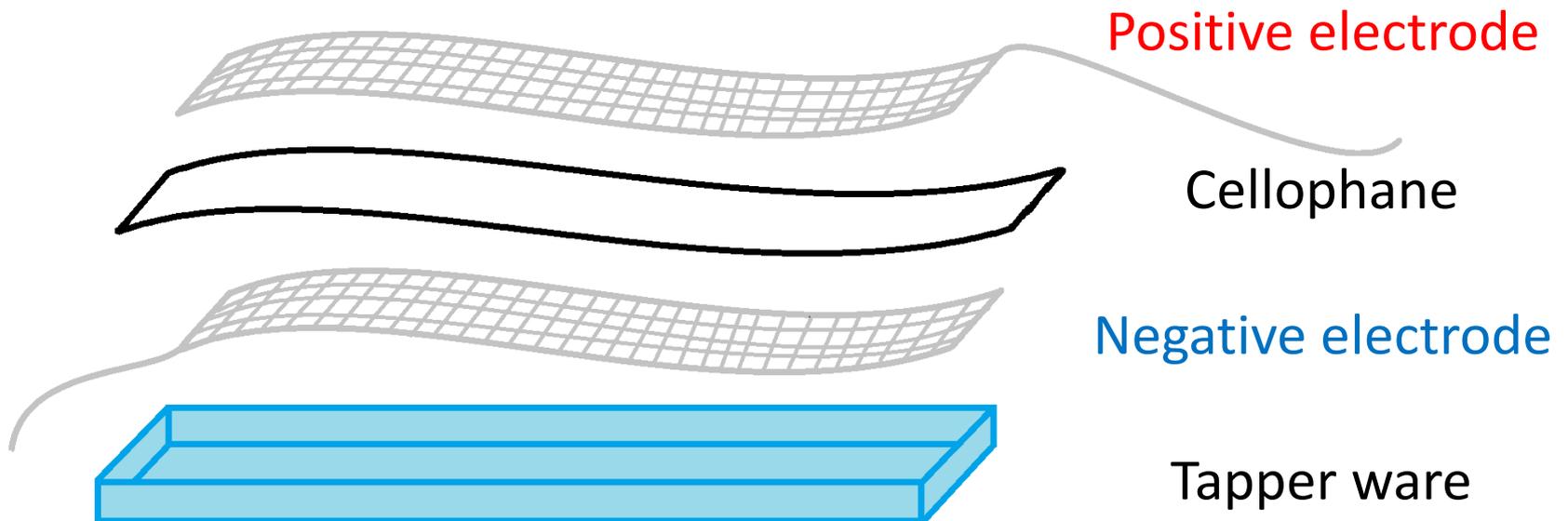




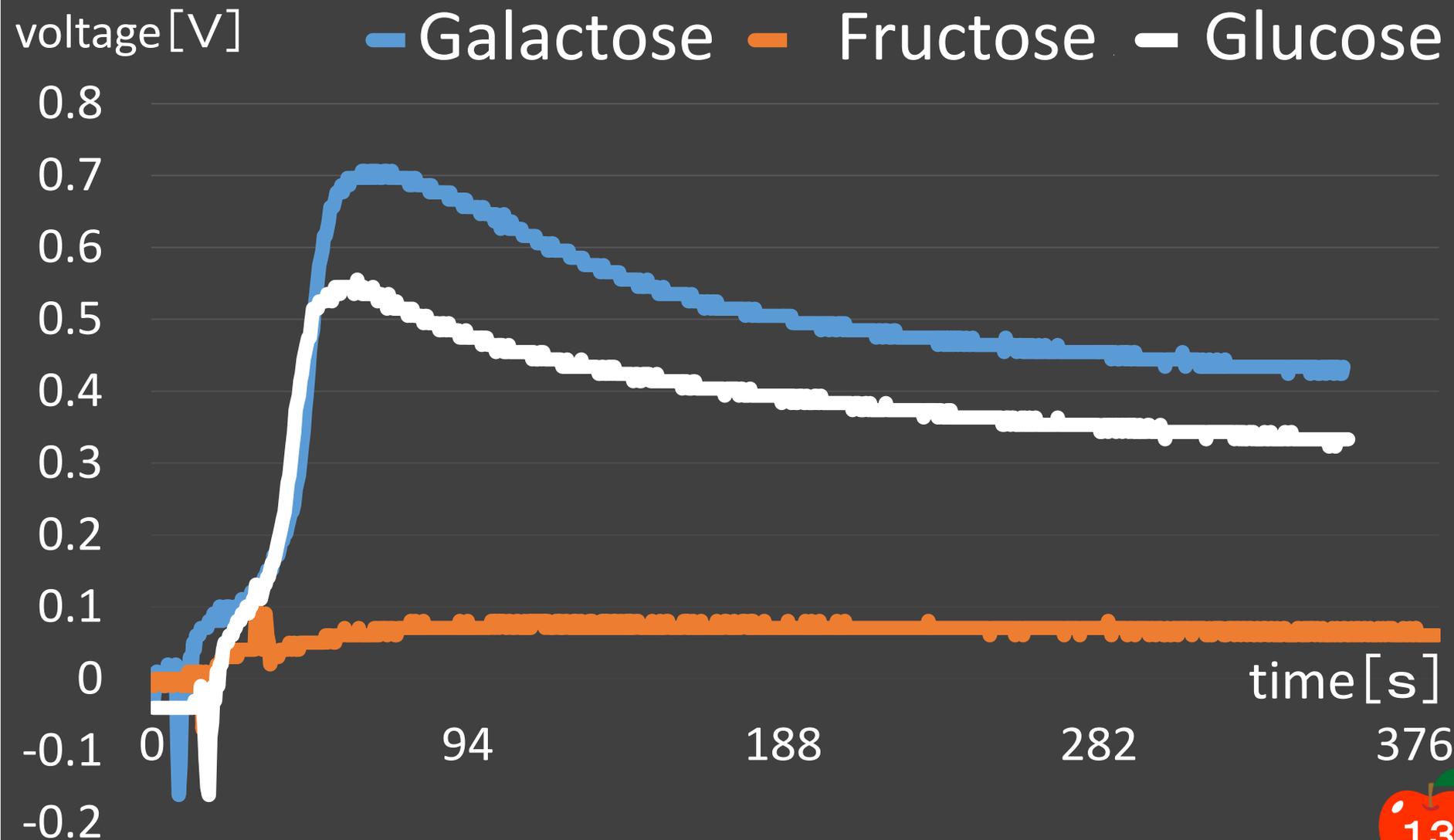
Experiment I Applying the principle to other sugars

Making a glucose battery

Measuring the output voltage



Experiment I Applying the principle to other sugars



Experiment I Applying the principle to other sugars

Analysis

Galactose

High

Glucose

Fructose

Low



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Experiment II Using the food around you

Hypothesis II

Original purpose = Application during a disaster



Power generation using the food around you

This time ...

Honey

Cola

Milk

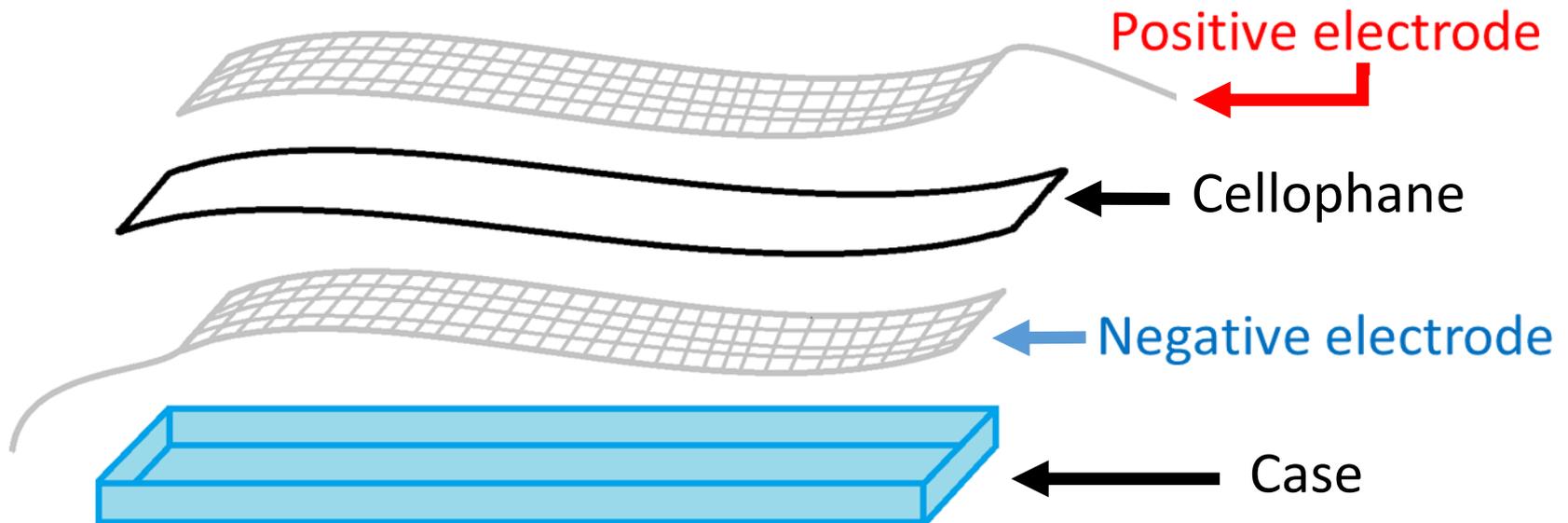
Tomato juice

Experiment II Using the food around you

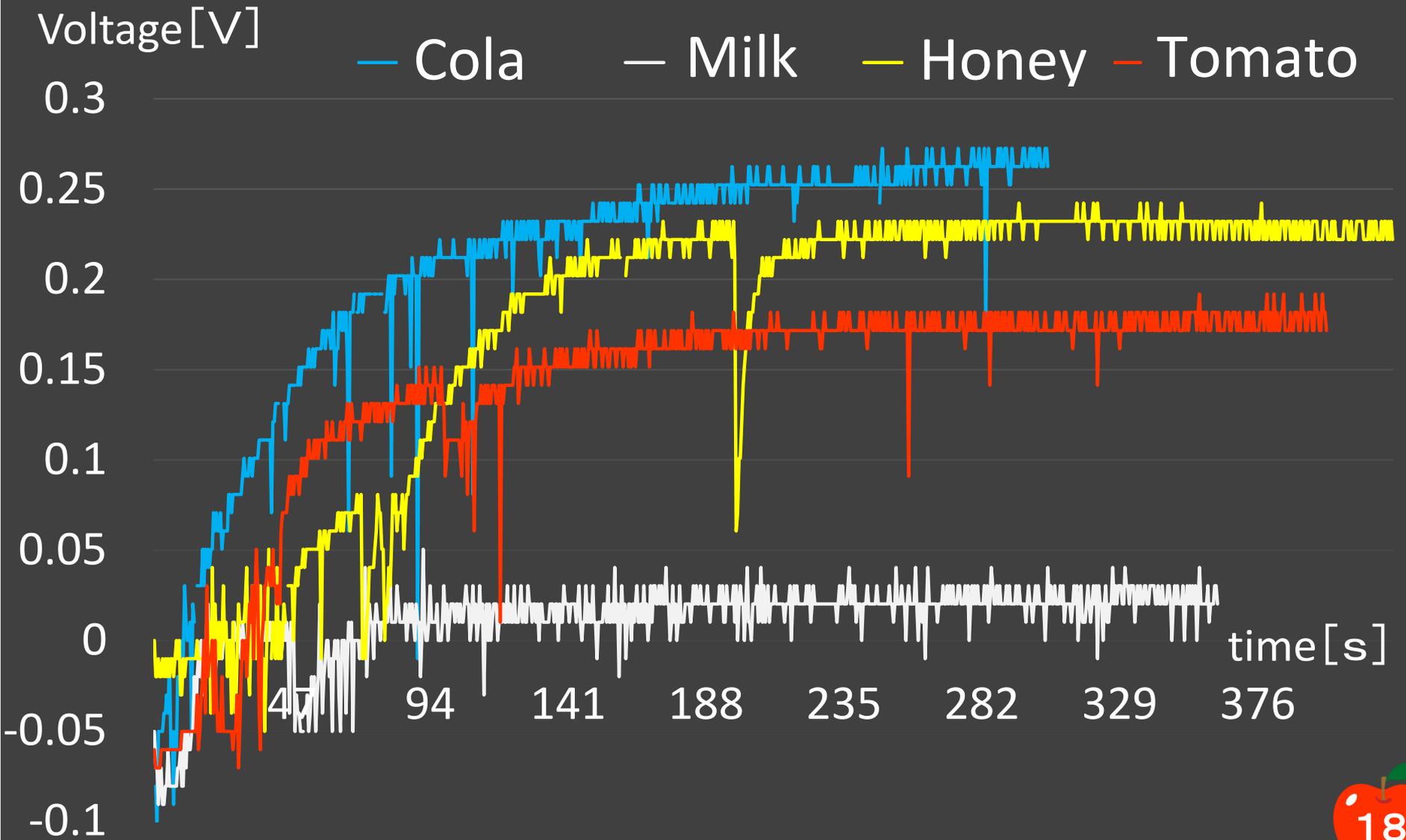
Making a food battery

KOH

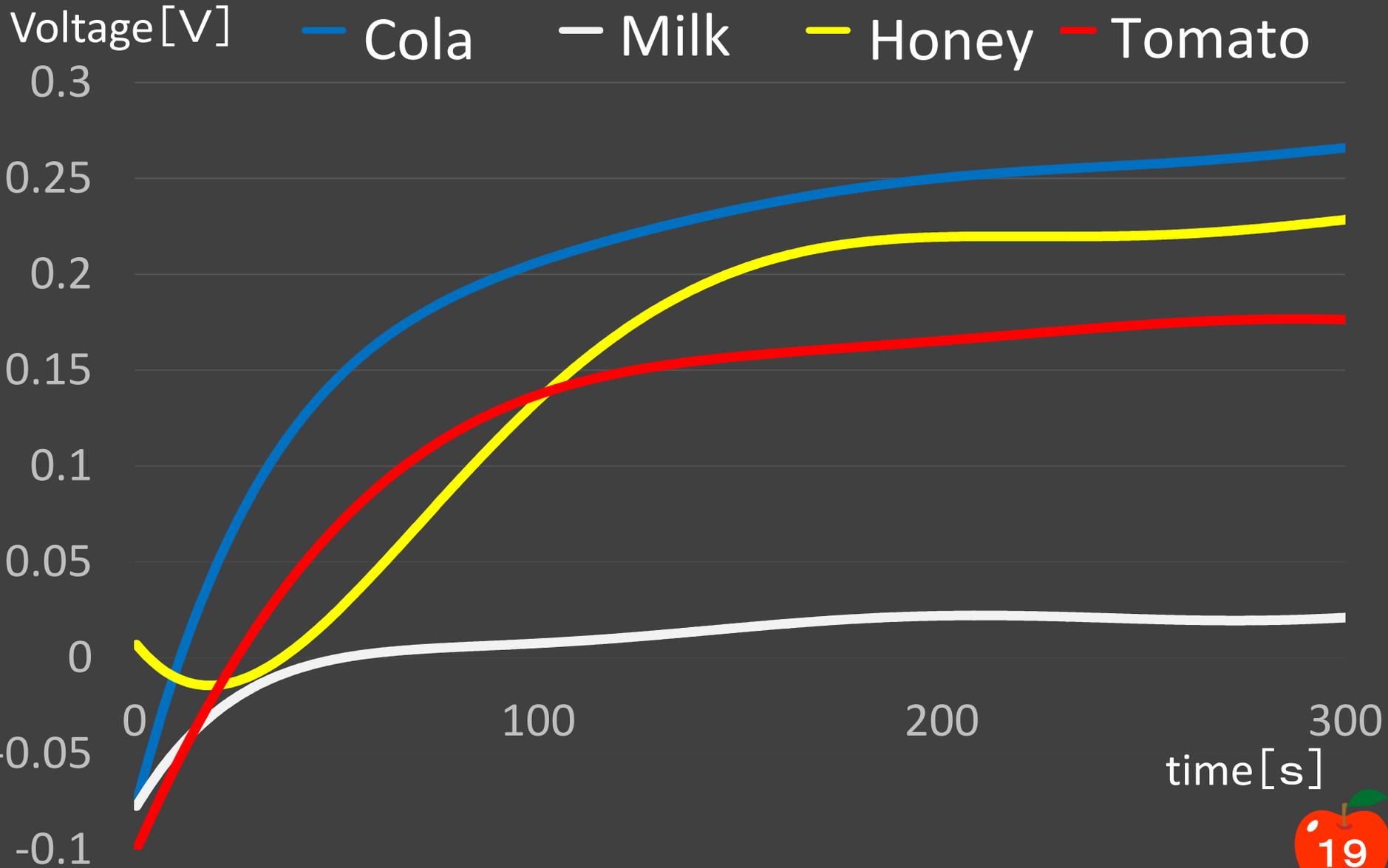
KOH + Food



Experiment II Using the food around you



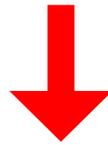
Experiment II Using the food around you



Experiment II Using the food around you

Analysis

The output voltage values were
Milk **low** → Denatured milk fat precipitated
Cola > Honey > Tomato juice > Milk
in the battery cell



Suppress the reaction

Tomato juice was **higher than we expected**

→ Vitamins cause

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Experiment I

- We were able to generate electricity from fructose and galactose.
- In terms of output voltage
galactose > glucose > fructose

Experiment II

- We were able to generate electricity using common everyday foods.

Future Tasks

Investigate the voltage differences depending on the type of sugars



- Do more experiments
- Discover if there is any connection between sugar concentration and output voltage

References

- (1) Tomoyuki Nosohara "Development of high efficiency, simple fuel cell" Toray Science Education Award 2007
- (2) Minoru Asida, Ryuzo Omukai, Hitoshi Kondo, Makoto Shimizu, Takahiro Suzuki, Syoji Yamada, 2015 "Development and practical application of chemistry teaching materials focusing on dye-sensitized solar cells and glucose type fuel cells" FY2008 - FY2006 grant for scientific research (challenging sprout research) report
- (3) Syoji Yamada "Development of glucose type fuel cell (tube type supply model): innovation and practical report of production"

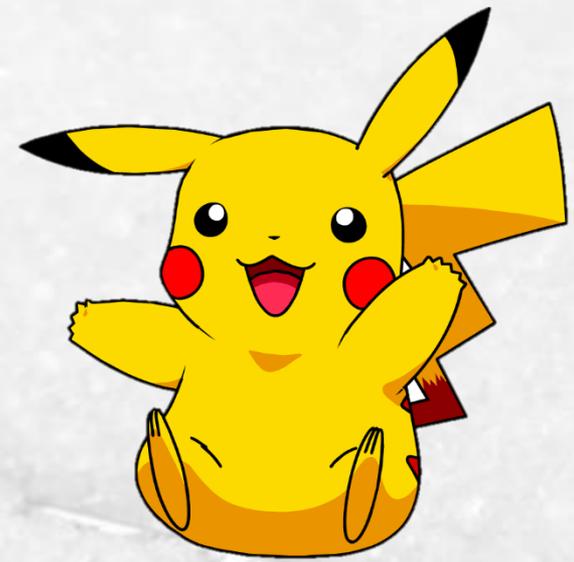
acknowledgements

Mr. Yamada

Former Saitama Prefectural Sakado
High School teacher

Mr. Yasuda

Kyoto University



Thank you for
your time and attention.

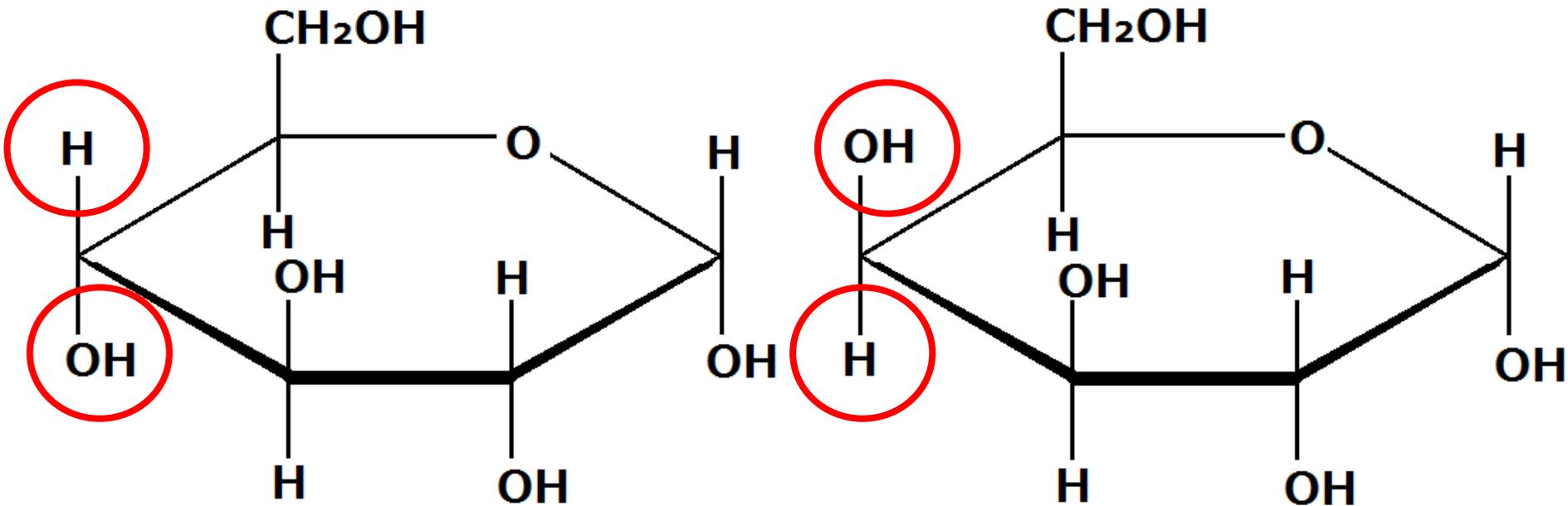


The substances of each food (per 200mL)

	Cola	Cow's milk	Honey	Tomato juice
The name of ingredients	Sugar/Carbonic acid/Caramel pigment/Acidifier/Perfume/Caffeine	-	honey	Tomato juice: (concentrated tomato)
Protein	0g	6.8g	0g	3.2g
Lipid	0g	7.8g	0g	0g
Carbohydrate	22.6g	9.9g	228g	16.7g(saccharide 11.9g)
Others	-	Sodium chloride equivalent 0.22g Calcium 227mg	Sodium 4mg	Sodium chloride equivalent 0~0.44g Potassium 572~1295mg Vitamin E 3.1mg Vitamin K 1~19μg lycopene 30mg



Glucose and Galactose



Glucose

Galactose

Reducibility

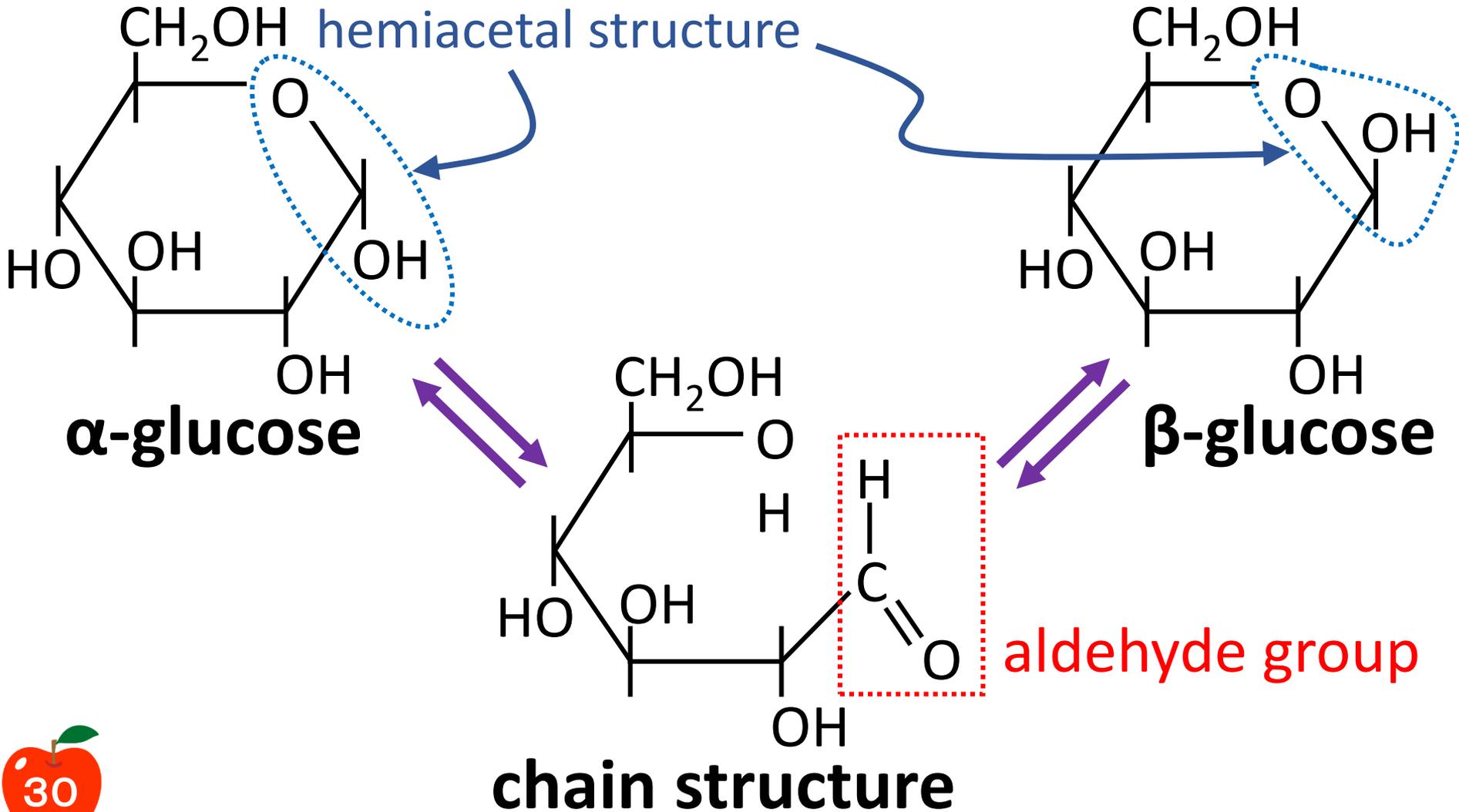
Reducibility is included in mechanism of glucose battery

The property of depriving oxygen from the other material

All of Glucose, Fructose, and Galactose have reducibility, although constructions are different each other.

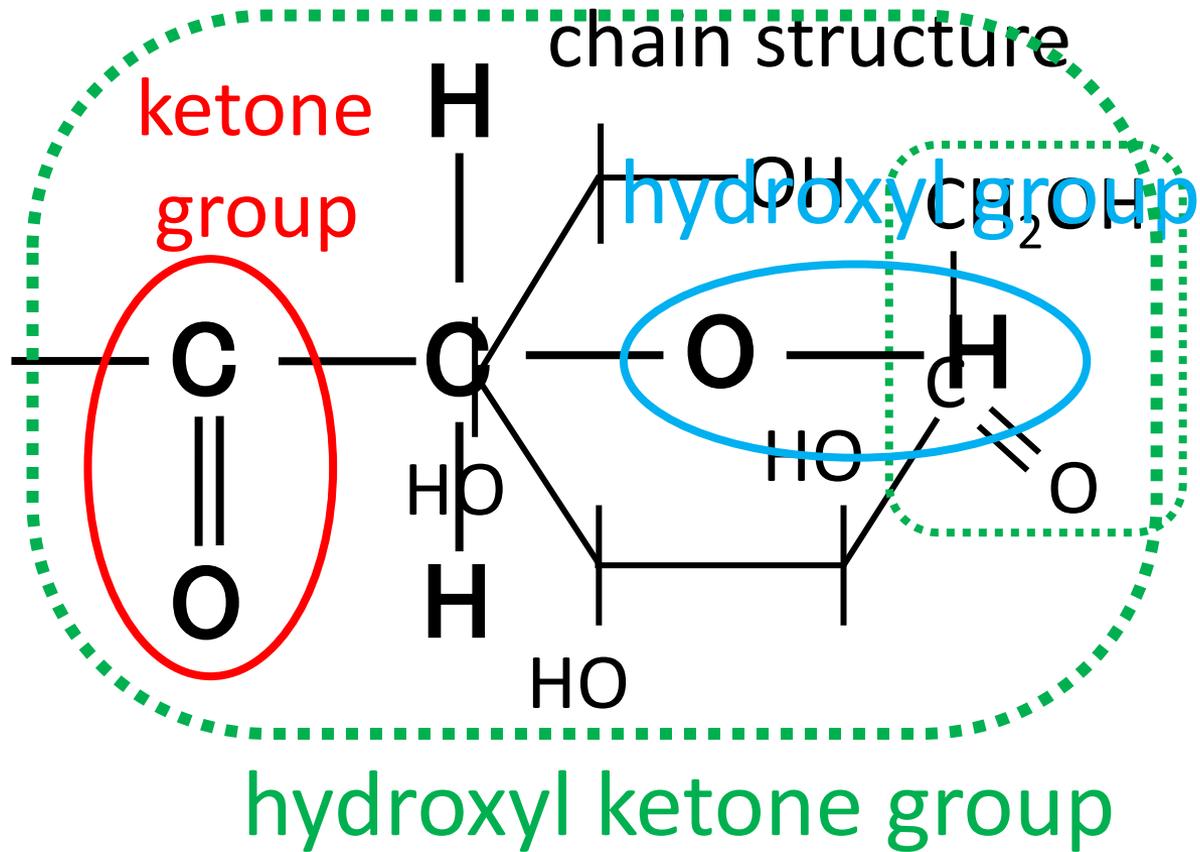
Q and A

Glucose



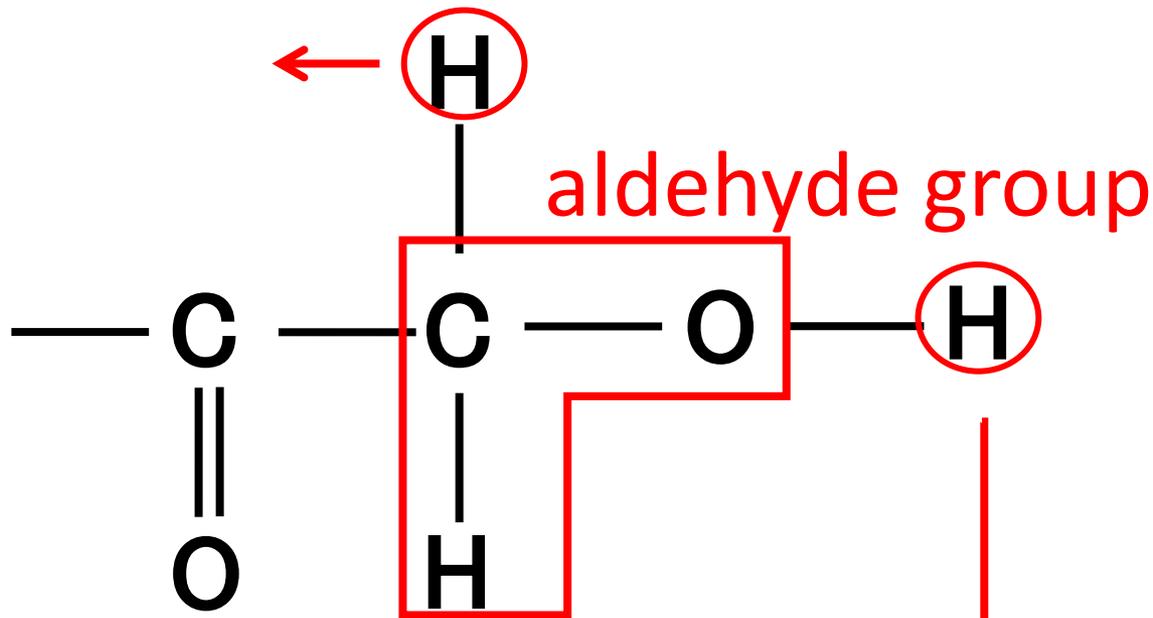
Q and A

Fructose



Q and A

Fructose



Easy to change into the forms that
have aldehyde group

Come to able to reduce something

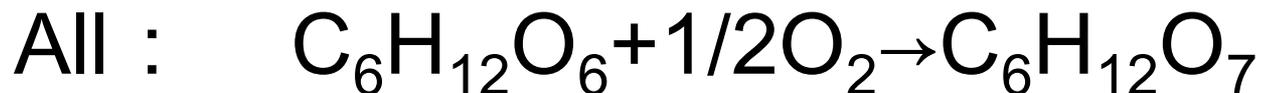
Q and A

A reaction formula for a monosaccharide battery

Negative electrode :



Positive electrode :



Examples of food containing monosaccharides

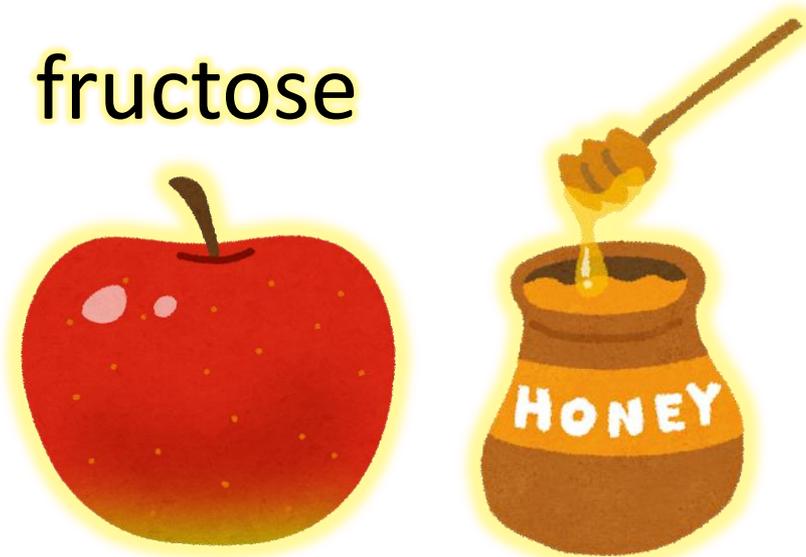
glucose



galactose



fructose



Precipitation of milk







monosaccharides







