

# SCHOOL COMPANY UNION – STUDENTS GET IN TOUCH WITH LOCAL FOOD PRODUCTION COMPANIES



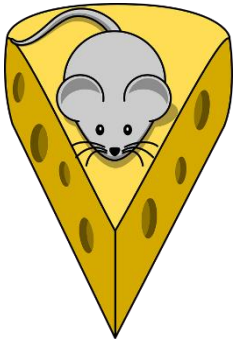
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2. Determination of sugar in must
3. Catabolism (breakdown) of glucose
4. Metabolic pathways of glucose
5. Detection of the ingredients of milk
6. CLIL-exercises

## Myths about food

### **You have to wash the fish with cold water!**

Right, the smell of fish is the smell of methylamine. This is a gas and the solubility of gases grows with the temperature drop.

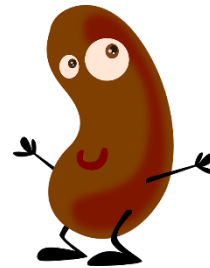


### **There are wholes in the cheese because mice ate these parts!**

Wrong, carbon dioxide secreted by bacteria that feed on lactic acid. This carbon dioxide amass in bubbles and those are the wholes when the cheese is settled.

### **Eat a lot of potatoes to get vitamin C!**

Right, it contains three times more vitamin C than a lemon. But its also a good recourse. Polish people deliver their vitamin C need with potatoes.

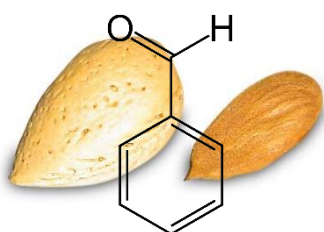


### **Lactobacilli are in milk!**

Wrong, lactobacilli are used to lactic fermentation. The concentration of lactic acid increases because proteins are denatured under the influence of acid- coagulates casein.

### **Carrots are good for the eyes!**

Right, carrots are rich in red-orange alkene  $\beta$ -carotene. It is converted by liver enzymes into vitamin A. Vitamin A is isomerized to 11-cis-retinal - light sensitive pigment which is essential for humans.



### **Aldehydes and ketones smell nice!**

Right, they are used mainly in the aromas and perfume industry. They make our food smell, for example benzaldehyde is known as the typical almond smell.

### **Garlic is good for your health!**

Right, garlic works like penicillin. Garlic is an anti-inflammatory, antithrombotic and antifungal factor. It fights bacteria and viruses.



### **Beer and wine are made by yeast!**

Right, the yeast led the anaerobic catabolism of sugars to alcohol.

## Determination of sugar in must

We have three methods for determining sugars in must:

1. **Refractometer:** The refractometer is used to measure the amount of sugar (actually, the percentage Brix) in the juice of grapes. Once the sample is in place underneath the daylight plate, you can see the percentage Brix reading by looking through the monocular / eyepiece and reading the scale that is seen holding the refractometer in natural light.

In simplest terms, the refractometer works much like a prism: it reacts differently to light (by giving a reading on a scale) depending upon the amount of sugar that is available in the liquid sample held between the daylight plate and the main prism assembly.

2. **Must saccharimeter:** It's a glass cylinder provided with a measuring rod and with and a thermometer. There are different types of must saccharimeters, which differ according to the calibration of the tool. The two most popular ones are the Babo must saccharimeter (it's calibrated to 17,5°C) and the GUYOT must saccharimeters (it's calibrated to 15°C).

**PROCESS:** Fill up the glass cylinder with the must (it's necessary to fill the cylinder to  $\frac{3}{4}$ ). You have to immerse the tool carefully and pay attention, so that it doesn't touch the inside of the cylinder. When the tool floats and when it's stable you have to read the density on the measuring rod and the temperature of the must on the thermometer. In the Guyout must saccharimeter you have to read the yellow line on the rod.



3. **Fehling:** Fehling's solution is a quantitative analysis made for the determination of the concentration of sugars. For this analytical method two solvents are required:

- solution A (light blue):  $\text{CuSO}_4$
- solution B (white):  $\text{NaOH}$  and  $\text{C}_4\text{H}_4\text{KNaO}_6$  (potassium, sodium tartrate).

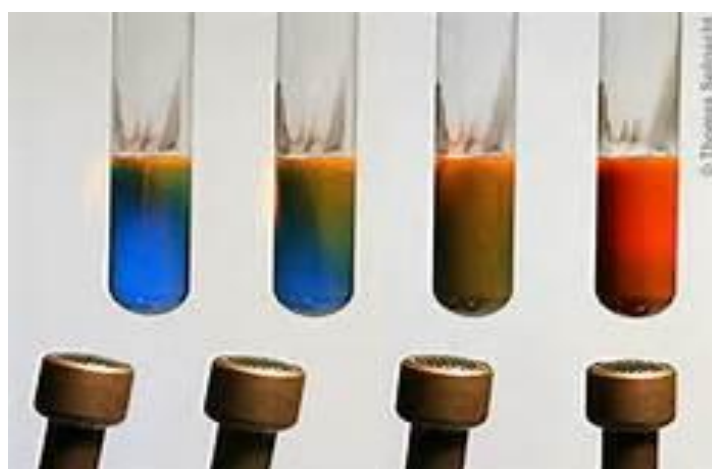
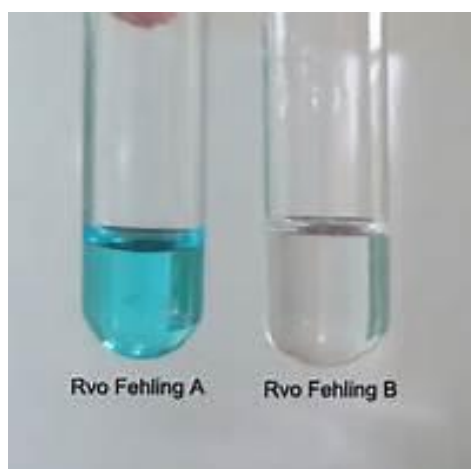
The reduction reaction happens because the glucose and the fructose are reducing sugar thanks to their molecular structure; in fact the glucose is composed by 6 carbonic atoms and a final aldehyde group ( $\text{RCHO}$ ), while the fructose is structured in 6 carbonic atoms and a ketone group ( $\text{RCOR}$ ).

The aldehyde and ketone groups permit the oxidation of these two sugars, so they reduce the reagents of the Fehling's liquid, obtaining, after a boiling process, a red precipitated powder.

All this can happen because the Cupric ion ( $\text{Cu}^{++}$ ) is reduced in Cuprous ion ( $\text{Cu}^+$ ) by this chemical reaction:



The test is so sensitive that even 1ml of glucose will produce the characteristic red colour of the compound.



# Catabolism of glucose

## Polysaccharide

### cellulose

$\beta$  -1,4 bonded glucose

→ indigestible for humans

→ digestible for microorganism

example of food :

vegetable fiber, bran



### starch

$\alpha$  -1,4 bonded glucose

→ stored in plants, like potatoes, flour



### glycogen

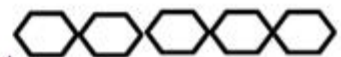
$\alpha$  -1,4 bonded glucose

→ stored in muscles of humans and animals



### dextrin

cereals, bread, potatoes



(double sugar)

## disaccharide

example of food:

### sucrose

fruit, sweets



### maltose

beer, cereals, bread, potatoes



### lactose

milk, cheese



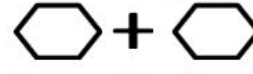
(simple sugar)

## monosaccharide



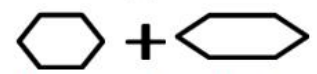
glucose + fructose

juice, sweets, fruit



glucose + glucose

fruit, vegetables, cereals



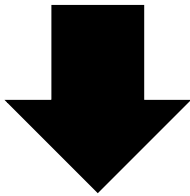
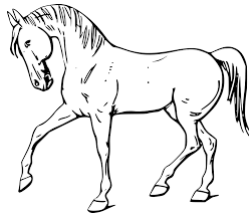
glucose + galactose

dairy products

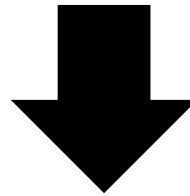
Example of food:



## Glucose provides energy for:



Humans and animals store glycose as glycogen in muscles.



Plants store it in roots, tuber, leaves and fruits.

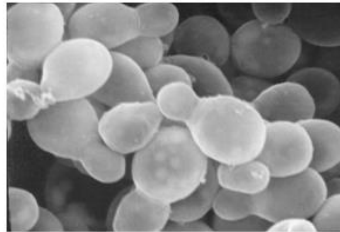
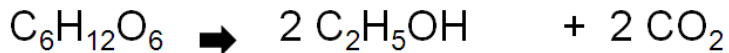


## Types of glucose breakdown

- Breakdown by alcoholic fermentation in yeast
- Breakdown by lactic acid fermentation
- Breakdown in humans and animals at low levels of oxygen

### Breakdown by alcoholic fermentation in yeast

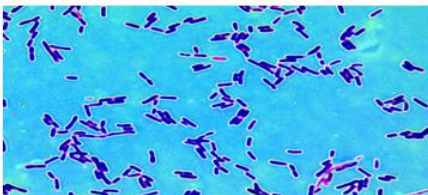
glucose ➡ alcohol/ethanol + carbon dioxide



It is used for the yeast dough, beer, wine and sourdough.

### Breakdown by lactic acid fermentation

glucose ➡ lactic acid

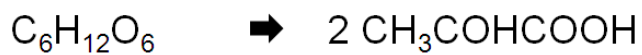


It is used for the production of yoghurt, cheese, curd and sourdough.

## Breakdown in humans and animals...

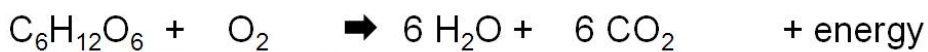
...at low levels of oxygen.

glucose ➡ lactic acid



...at normal level of oxygen.

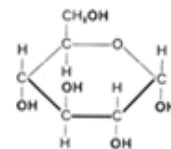
glucose + oxygen ➡ water + carbon dioxide + energy



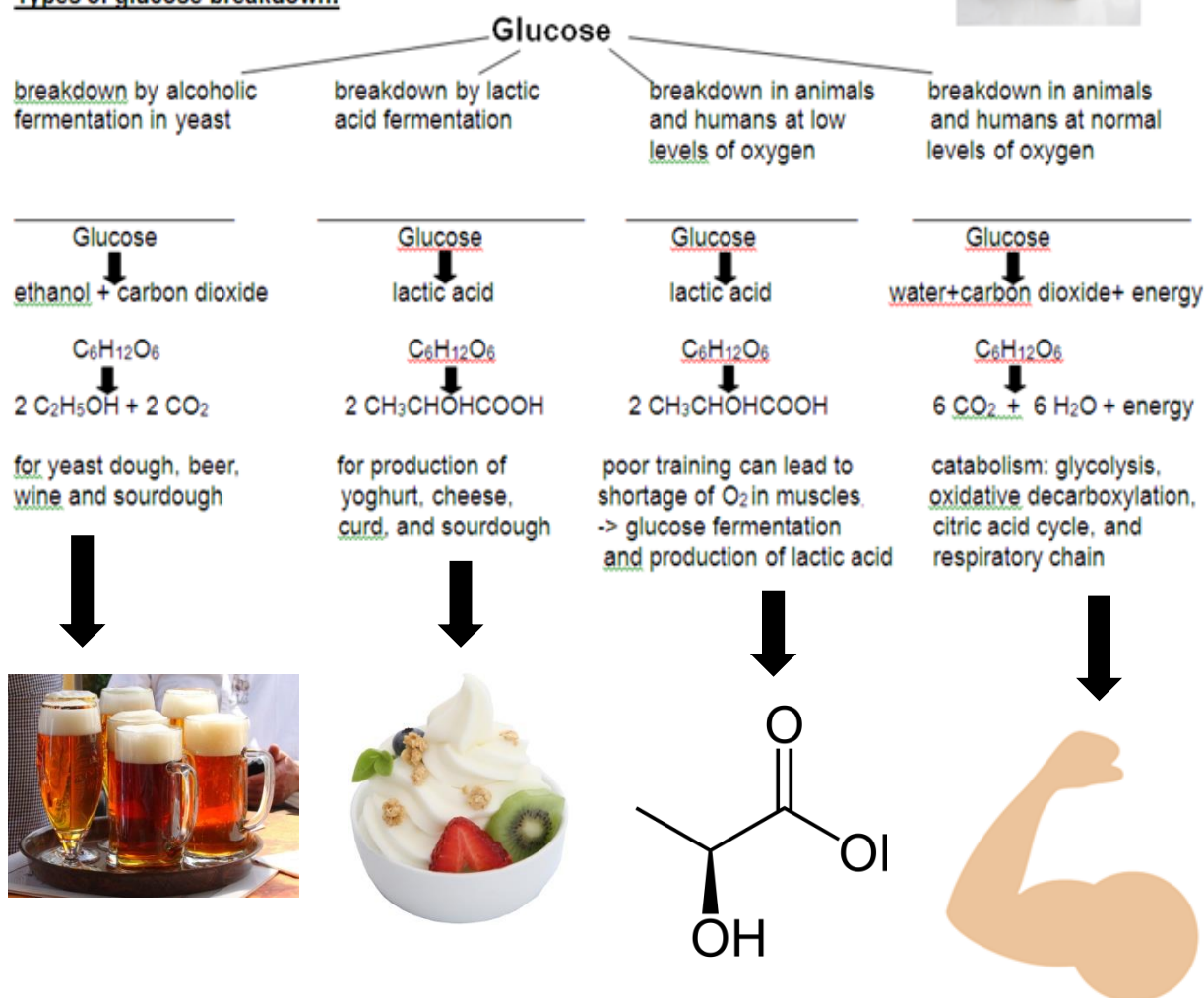
# Breakdown of glucose

## Glucose:

- Provides energy for humans, animals, plants and microorganisms.
- Can be stored in all organisms.
- Stored as glycogen in human and animal muscles.
- Stored as starch in roots, tubers, leaves and fruits.



## Types of glucose breakdown:



# Detection of the ingredients of milk

## Milk and Milk Products

1. Produce **butter and buttermilk** from fresh cream.  
Each group will get a cup of fresh cream and an empty canning jar.
2. Produce **cream cheese and whey**.  
Each group will get 200 ml of fresh unskimmed milk and lemon juice from one freshly squeezed lemon. Heat the milk in a pot and add the lemon juice. The milk is going to clot (the protein curdles). You can then pour the contents of the pot through a strainer in order to divide the curd from the whey.

After production you will be able to identify the ingredients inside these products (in terms of quality, not quantity). You will test for fat, sugars, protein and calcium.

Milk Product	Fat	Sugars	Protein	Calcium
Fresh Cream	+		+	
Butter	+			
Buttermilk		+	+	+
Unskimmed Milk	+	+	+	+
Cream Cheese	+		+	
Whey		+	+	+



### Fat:

Pour 1ml of the test substance (=milk product) into a test tube and add 2ml of water. Add one pinch of the coloring substance Sudan (III). If the substance turns red, it contains fat.

### Sugars:

Pour 2ml of the test substance into a test tube and add 5 drops of Fehling's solution I and 5 drops of Fehling's solution II. Heat up the mixture carefully (inside a water bath). The mixture contains sugar (Glucose) if it turns orange during the process.

### Protein:

Pour 2ml of the test substance into a test tube and add 5 drops of sodium hydroxide solution. Add 5 drops of Fehling's solution I. If the solution turns purple, it contains protein.

### Calcium-ions:

Pour 2ml of the test substance into a test tube and add 20 drops of ammonium oxalate solution (3%). Shake properly in order to mix. If a white sediment develops the solution contains calcium ions.

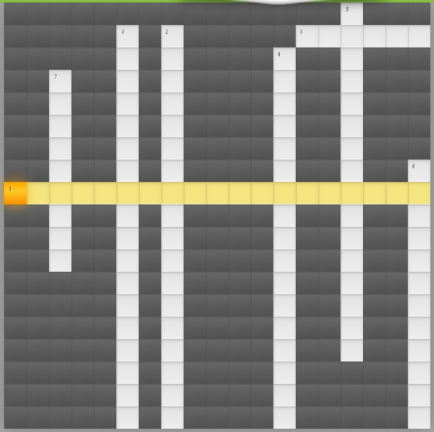
# CLIL

## Crossword puzzle

PROTEINS

100  
SCORE

00:05  
TIME



1

*If the protein consists of several peptide chains it has another structure. An example for this structure is hemoglobin, which is formed by hundreds of amino acids. Hemoglobin only works if all four parts are bonded together.*

Show Letter Show Word

+ -

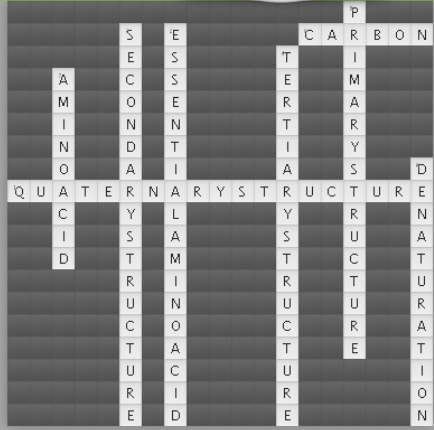
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educaplay  
by ADR Formación

PROTEINS

0  
SCORE

01:04  
TIME



6

*When you heat up proteins to a temperature like 50°/60° their structure will be destroyed. When they are heated up they lose their function and will be useless for our body. How do you call this process?*

Show Letter Show Word

+ -

Check

educaplay  
by ADR Formación

Find the words

ALKANES

0

SCORE

00:02

TIME

D N Y I K Q M X U K Q W U F C N C D U  
V X J A G C P Y W P O M Y S P G F O V  
H X A E P V W E X C T X M B S J U A H  
E J J J N B S G H G T P Y E W J N D T  
A K J R U A A S D O J K T R S D P W R  
B E U Q L A K P N V P A N N E L P J I  
G J J N N O H L B I A C W R V G Y A C  
O S X V M L R Y A F L J W J E I O K H  
G W X H D W R B D O E A M W Q E A G L  
O M I P W L E Q S R A J A G T V C G O  
J Y V J M S L W B L O R B C U J S F R  
G S H C Y J T N S L S C L P R E F D O  
Q A I K S L L F Q W V L A A W G O V M  
X N T B E U O F J G Y W U R I B F C E  
B X K D E R J V S E F T G D B A J C T  
E W F O C E R Y X C L U J Q Y O V K H  
E C K E A A T Q S I B V K F P O N Y A  
F T S U D O M O U F N Q I F W F O S N  
Q A V D S C A R B O N M O N O X I D E

1. VANDERWAALSFORCES

2. TRICHLOROMETHANE

3. CARBONMONOXIDE

4. HYDROCARBONS

5. ALKANE

Show word

ALKANES

0

SCORE

00:05

TIME

H E W N S Q E H K P S J T W Y I G Q I  
O Y A R T R K Q K B J P D Q G D V Q V  
X G U E I X O L R F B N M V N C L A W  
L X R V N G R R Y Q P W P B P H N M T  
B O Y F I A U T O L N T X E D D H L R  
A Y G X N B K Q M C P R P U E O E P I  
O R E Y R Y H L K R B T W R G F W C C  
G S C T M P P Y A B T P W W Q J H U H  
K X P M I F Q V D Q P A L D H N D U L  
G B W T R J H F D R A T F J R G F N O  
Q M S V M D Y B M L O N I J B B P W R  
L E N K H Y K R S I A C Y A E K E E O  
K R Y L W J C F D J I T A I K Y D Y M  
V X M D I Q O Y Y X P N K R G A W V E  
L S H Y R R N G L B T L C E B U U R T  
C P O T C Y N V M U C T P M U O Y M H  
K F Y E F R R F D O B J W O C J N C A  
W O S J E V N K W L Q M Q O U E U S N  
M A S G I C A R B O N M O N O X I D E

1. VANDERWAALSFORCES

2. TRICHLOROMETHANE

3. CARBONMONOXIDE

4. HYDROCARBONS

5. ALKANE

Show word

# Aromatic compounds

0

SCORE

00:02

TIME

U P W L E M C S X R R  
S E F O L D S A M G F  
S B K O E G P B E Y E  
W C Q K C H C K W S Y  
S A L S T N A O L X S  
J R A K R H V F T V E  
J B E Q O C J O P J N  
N O K A N R F O U G E  
D N C O S W I R N J K  
Q L W L E L B U O D L  
H E X A G O N B Y V A

1. CARBON
2. DOUBLE
3. ALKENES
4. HEXAGON
5. ELECTRONS

Show word

# Aromatic compounds

0

SCORE

00:03

TIME

F S T Q E I T G G E D  
B V K D L F F X X Y W  
Y A C H E K A C M S X  
M C E O C F E E N P D  
G A O V T L I F F Q S  
F R U T R X E W K M E  
W B X Q O M O E C U N  
F O I K N W P N E I E  
N N D C S H O Q G U K  
O G F V E L B U O D L  
H E X A G O N T E X A

1. CARBON
2. DOUBLE
3. ALKENES
4. HEXAGON
5. ELECTRONS

Show word

Aldeidi

0

SCORE

00:03

TIME

J O F P Y Q B F F F F H C G R X H T O H H

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O H W T J C A F C K J X B C U O G O S H F

U X H A K I B M A M H X B Y Q F W H R J S

C M I S O R G T R B L Y R N A O G S S F B

L S C S H G J U B C O A L D H E Y D E S I

O C R I Q W A G O Y J K E W P K C M C F I

H C E U Y K Q I N J H U U W Q Q J O K G Q

O S K M B M L C Y S K V G M E X U T I A C

C O A D V A H J L W X C M I S J H A L A Q

L L U I C U H Q V Y E O L X E Y I H N A G

A W V C K F I U L J D Q Y T E V F E E M O

H C J H A D V F X N W Y F U L L V G G R H

I L Y R Q Q A W Q R H Q I R F T I O Y V G

D J R O A H M L U U E P X E O F Q R X F R

W A C M A L D E I D I H L T V H L D O E C

E Y R A F G T O J Y H D Q P H F P Y H A P

O N K T T U R T A I D G B I C I F H J I I

I E T E Y E A L U B U A A I W I W B J S V

E R J I V K R S F O W X T G B A C C S T H

C Y F P J A J W T C U Q W H N F T C Y P H

- MIXTURE
- OXYGEN
- IONS
- ALDEIDI
- ALCOHOL
- HYDROGENATOM
- ALDHEYDES
- CARBONYL
- POTASSIUMDICHROMATE

Show word

Aldeidi

0

SCORE

00:33

TIME

J O F P Y Q B F F F F H C G R X H T O H H

Y M H O Q E W I D R A H P L T R B I A H H

O H W T J C A F C K J X B C U O G O S H F

U X H A K I B M A M H X B Y Q F W H R J S

C M I S O R G T R B L Y R N A O G S S F B

L S C S H G J U B C O A L D H E Y D E S I

O C R I Q W A G O Y J K E W P K C M C F I

H C E U Y K Q I N J H U U W Q Q J O K G Q

O S K M B M L C Y S K V G M E X U T I A C

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I E T E Y E A L U B U A A I W I W B J S V

E R J I V K R S F O W X T G B A C C S T H

C Y F P J A J W T C U Q W H N F T C Y P H

- MIXTURE
- OXYGEN
- IONS
- ALDEIDI
- ALCOHOL
- HYDROGENATOM
- ALDHEYDES
- CARBONYL
- POTASSIUMDICHROMATE

Show word



## Fill in the gaps

**Alkenes**

0/2  
HINT TIPS

100  
SCORE

00:04  
TIME

Alkenes are made of  and  atoms, so they are called hydrocarbons.

Their general formula is:  and the Alkene molecules have at least one carbon-carbon double covalent bond (C=C) which is  that is it's attracted to places that don't have enough . That means the double bonds is attracted to positive charges.

For example:

These are the words to use

alkenes organic hydrogen

nucleophilic carbon electron

petrochemicals attacked

CnH2n polymers

compounds electrons

halides electrophiles

position molecules

Check

Alkenes are made of carbon and hydrogen atoms, so they are called hydrocarbons.

Their general formula is: CnH2n and the Alkene molecules have at least one carbon-carbon double covalent bond (C=C) which is nucleophilic that is it's attracted to places that don't have enough electrons. That means the double bonds is attracted to positive charges.

For example:

## The authors: Meetings in Germany, Italy and Poland



