

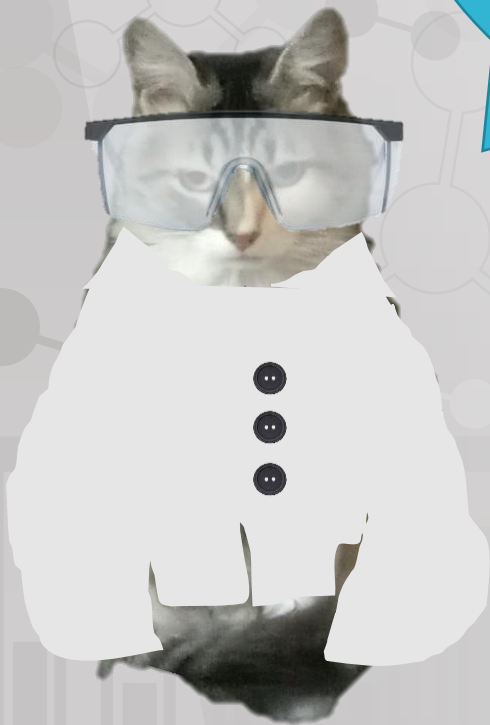


ADVENTURES IN CHEMISTRY

CTYI 2020

SARA USAI

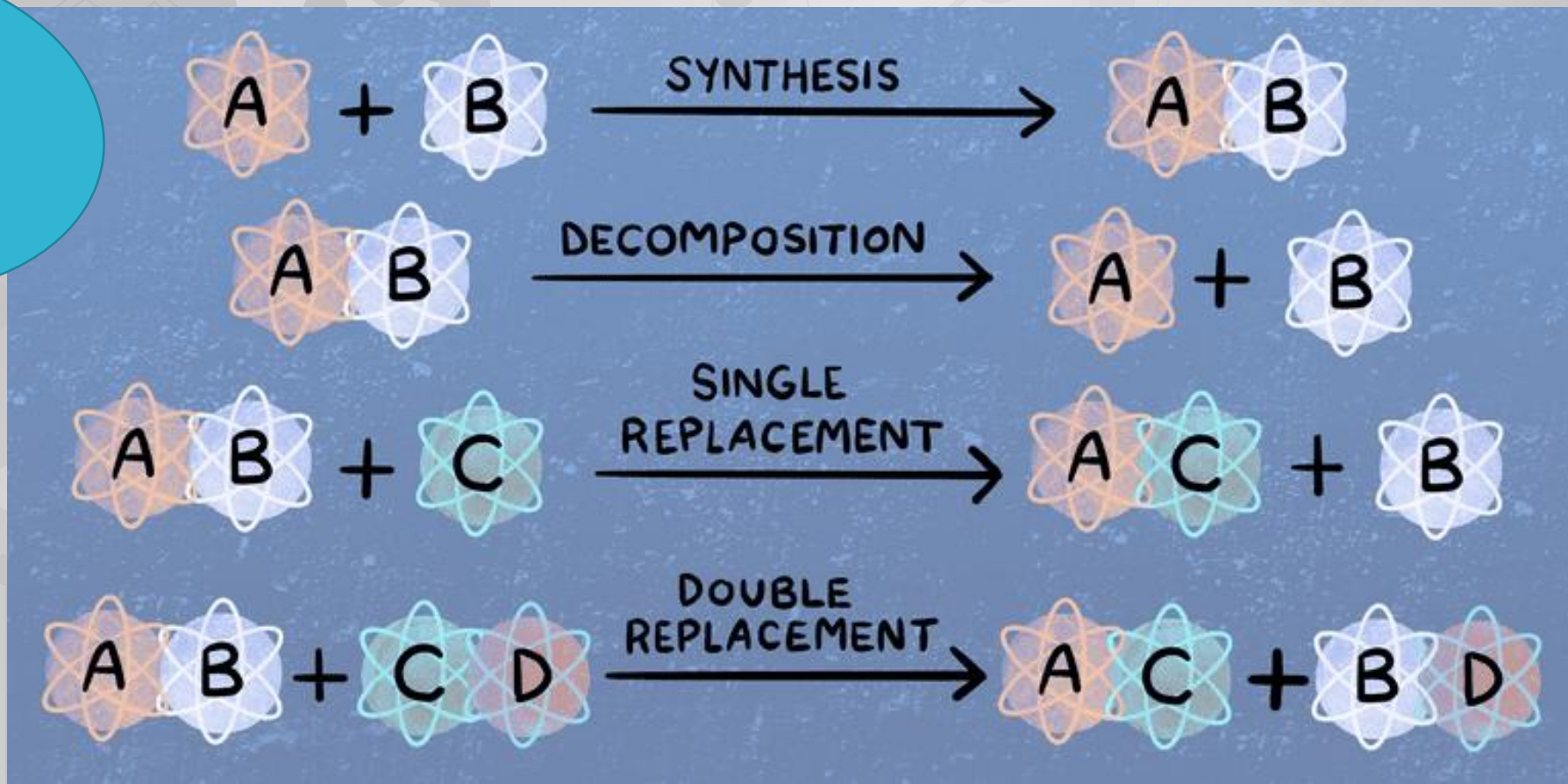
HI GUYS!
THIS IS THE LAST
CHEMISTRY CLASS!
LET'S TRY AND
HAVE SOME FUN
EVEN IF WE ARE AT
HOME!



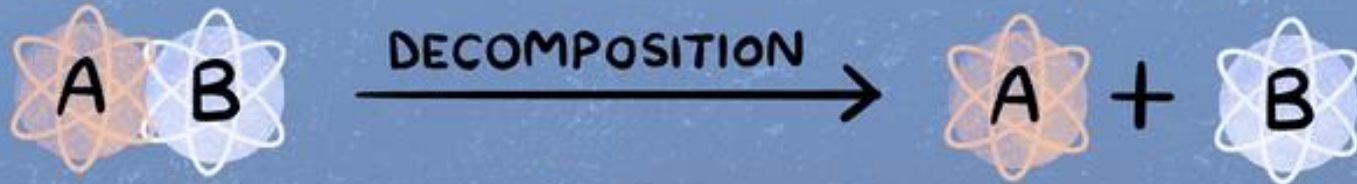
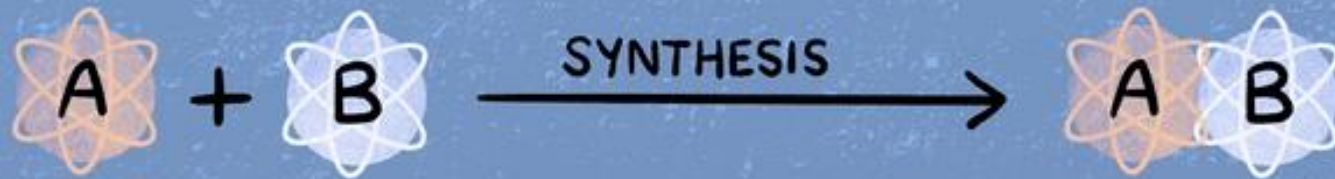
FEW WEEKS AGO
YOU LEARNT
ABOUT REACTIONS.



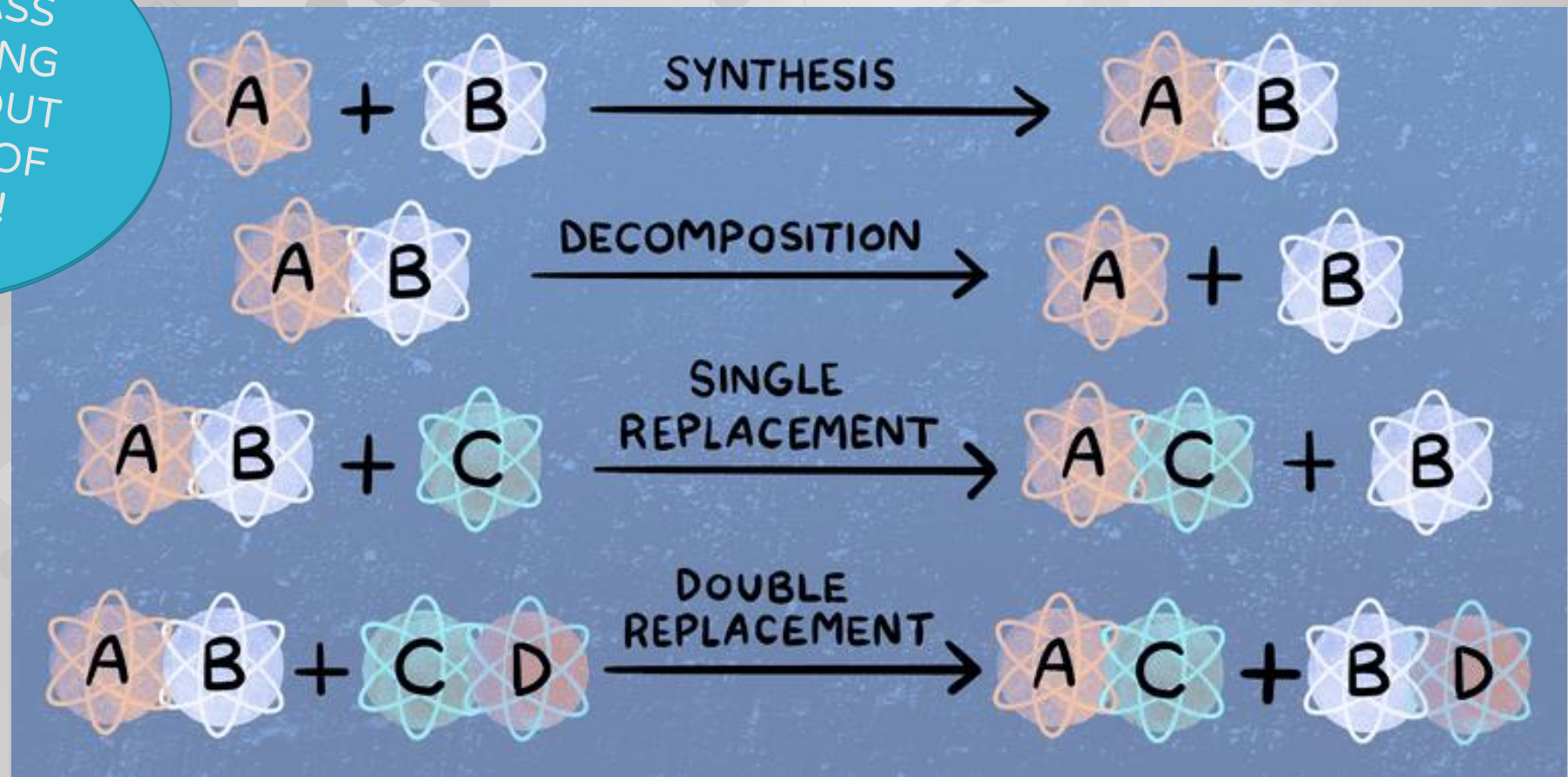
DO YOU REMEMBER THIS?



SARA TOLD YOU ABOUT 5 TYPES OF REACTIONS, THOUGH!



IN THIS CLASS
WE ARE GOING
TO TALK ABOUT
THE 5^o TYPE OF
REACTIONS!



THIS TYPE OF
REACTIONS ARE
CALLED
REDOX
REACTIONS



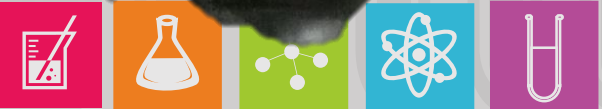


REDOX IS THE
COMBINATION
OF THE
BEGINNING OF
TWO WORDS:

REDUCTION

&

OXIDATION



REDOX IS THE
COMBINATION
OF THE
BEGINNING OF
TWO WORDS:

REDUCTION

&

OXIDATION



REDOX



BUT WHAT DOES IT
MEAN? AND WHY
ARE WE
COMBINING THESE
TWO WORDS?



DURING A CLASSIC
REACTION, YOU
HAVE DIFFERENT
COMPOUNDS THAT
REACT TOGETHER



LIKE IN THE
VINEGAR-BAKING
SODA REACTION



LIKE IN THE
VINEGAR-BAKING
SODA REACTION



LIKE IN THE
VINEGAR-BAKING
SODA REACTION



BAKING
SODA
(REAGENT)



LIKE IN THE
VINEGAR-BAKING
SODA REACTION



LIKE IN THE
VINEGAR-BAKING
SODA REACTION



IN A REDOX
REACTION SOME
OF THE REAGENTS
ARE
ELECTRONS



GOOD
QUESTION,
WHAT ARE
ELECTRONS?



DO YOU
REMEMBER WE
TALKED ABOUT
THE BUILDING
BLOCKS OF THE
MATTER?



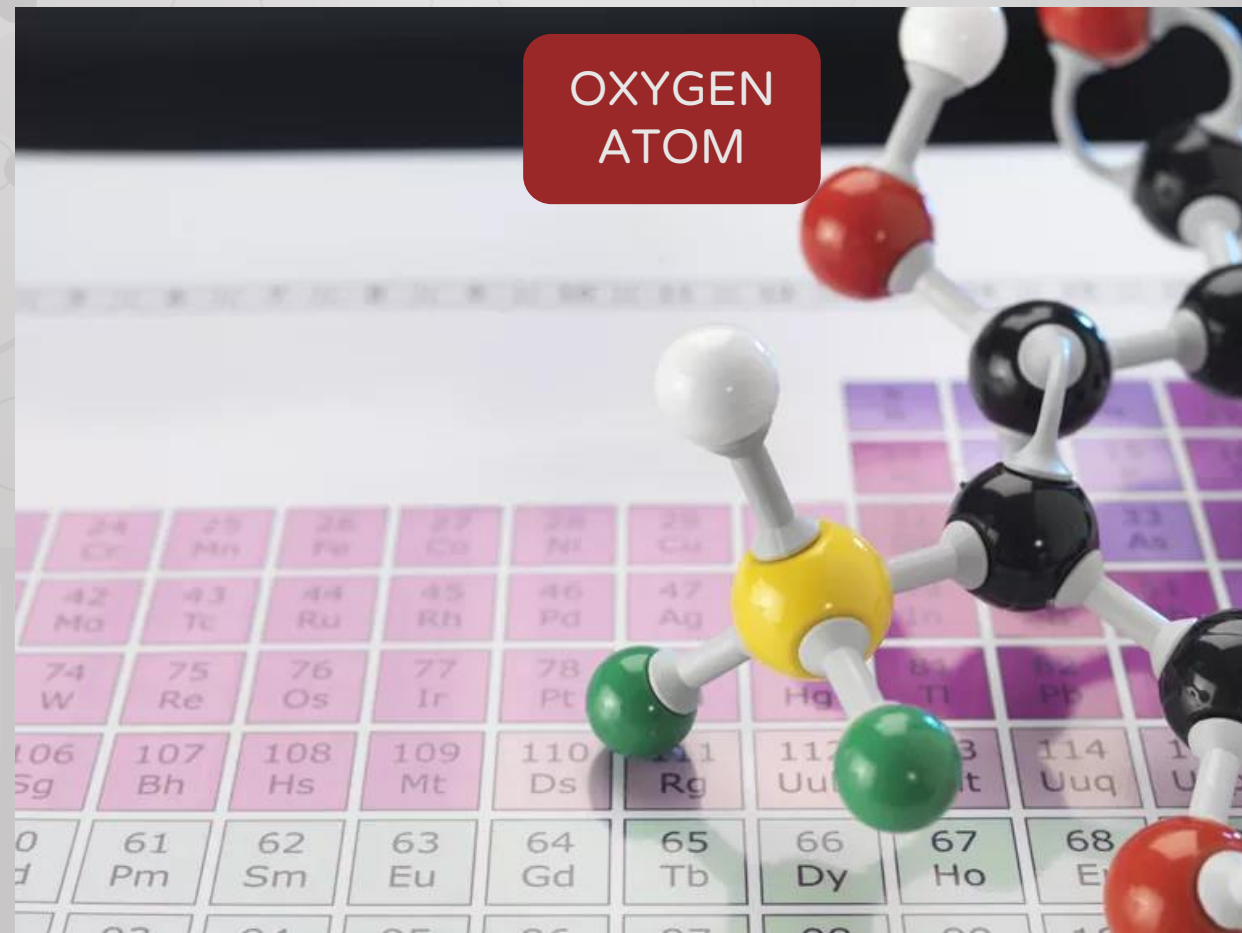
YES, THE ATOMS!



LIKE
ATOMS OF
OXYGEN



OXYGEN
ATOM

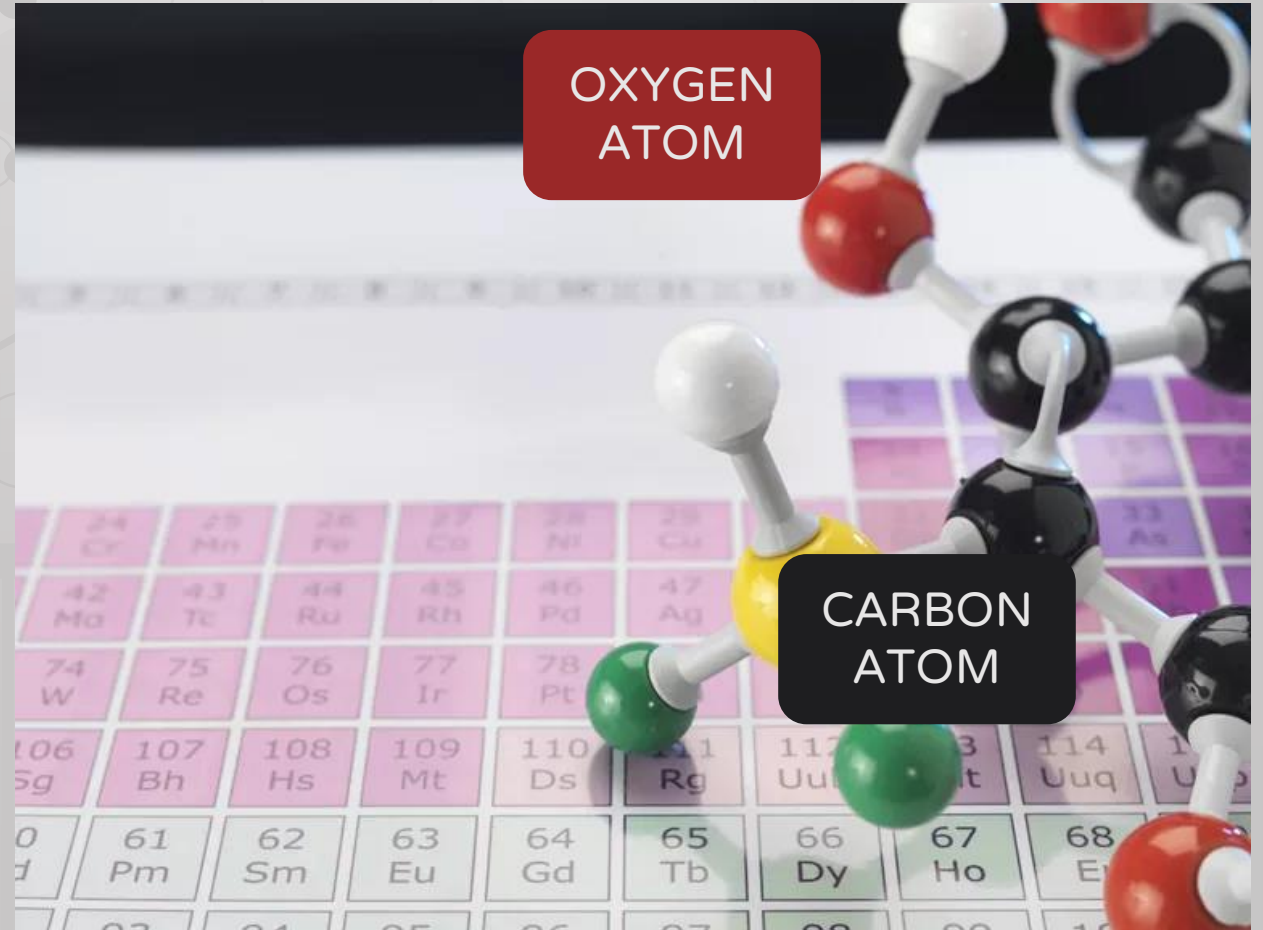


ATOMS OF
CARBON



OXYGEN
ATOM

CARBON
ATOM



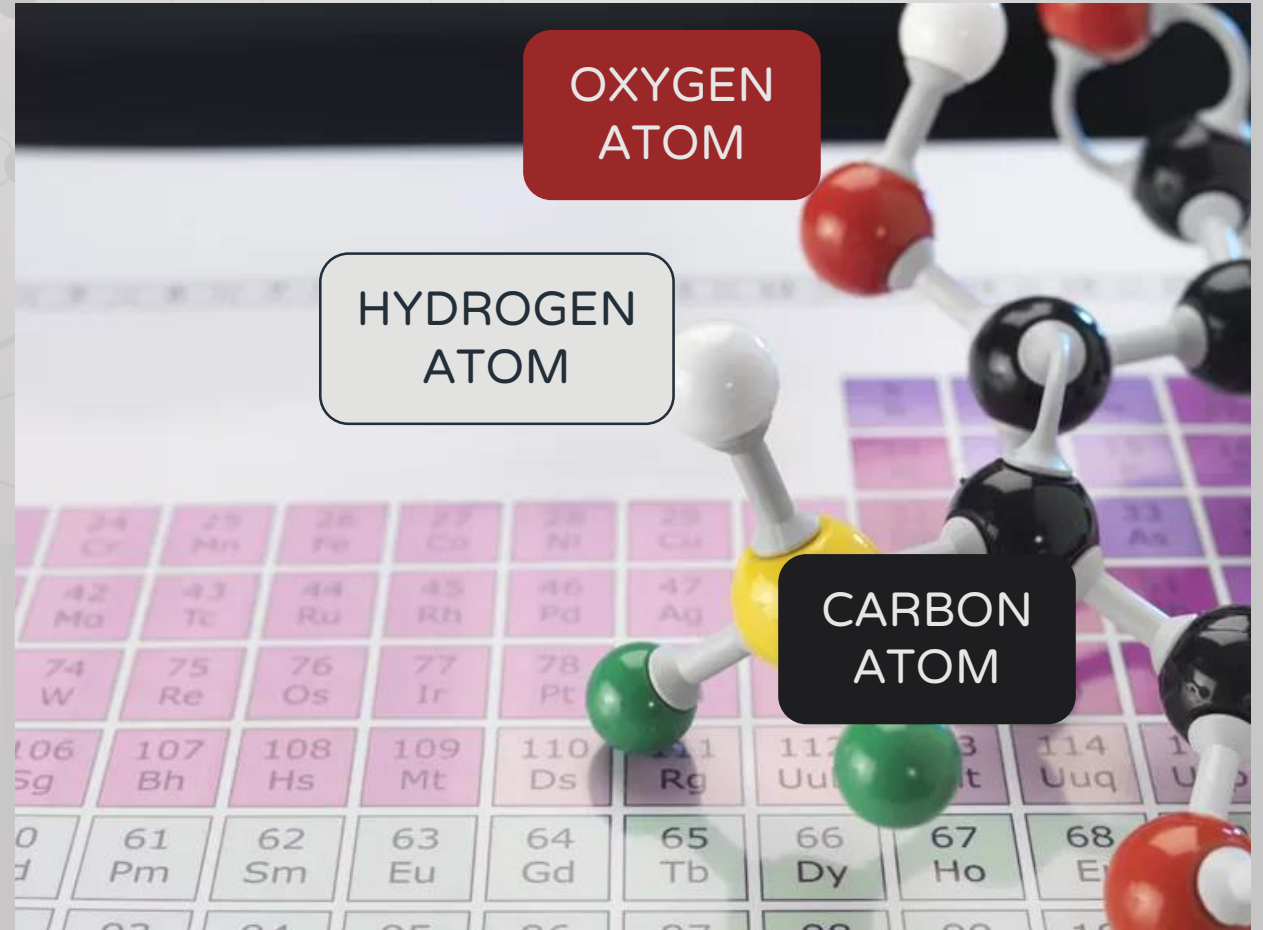
ATOMS OF
HYDROGEN...



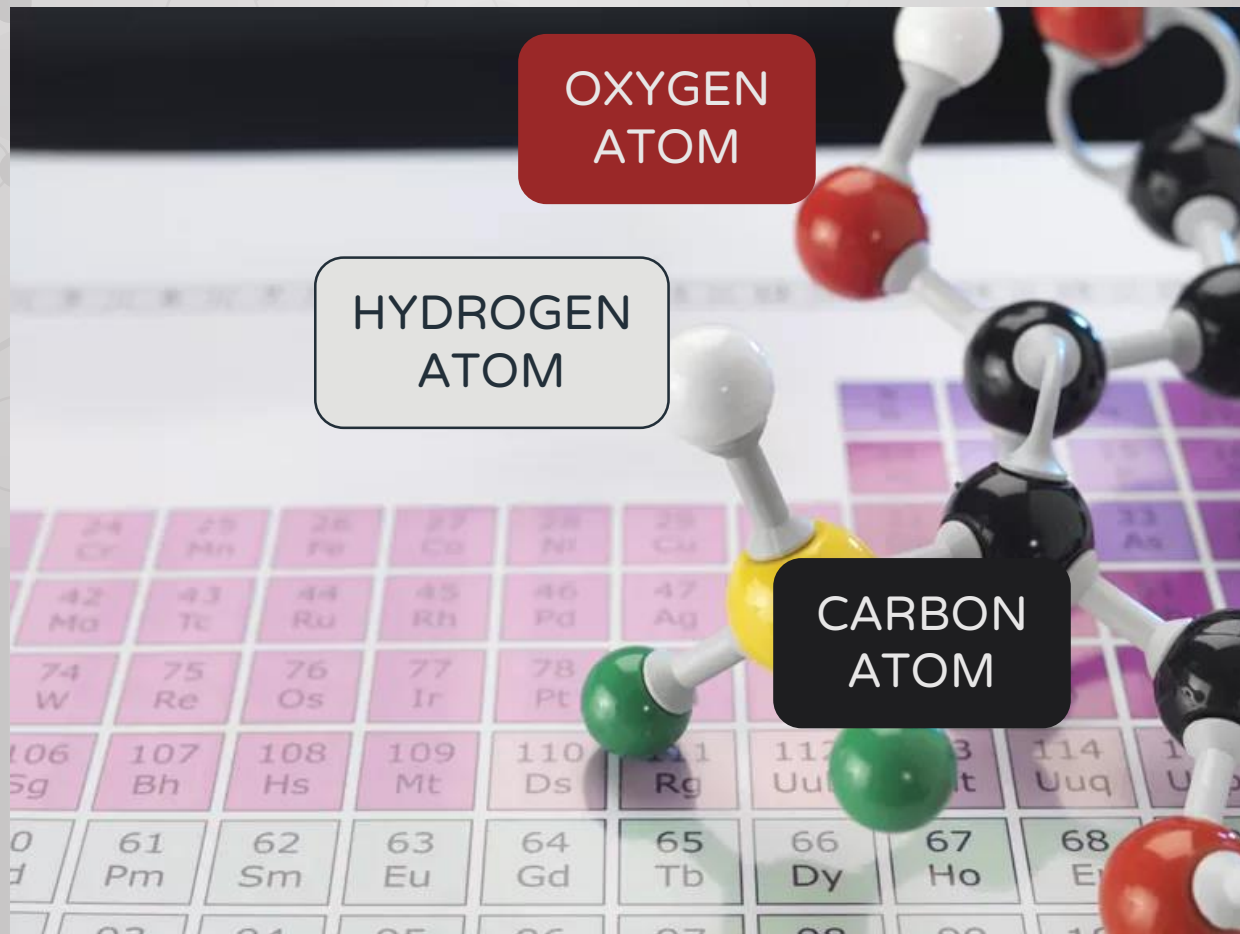
OXYGEN
ATOM

HYDROGEN
ATOM

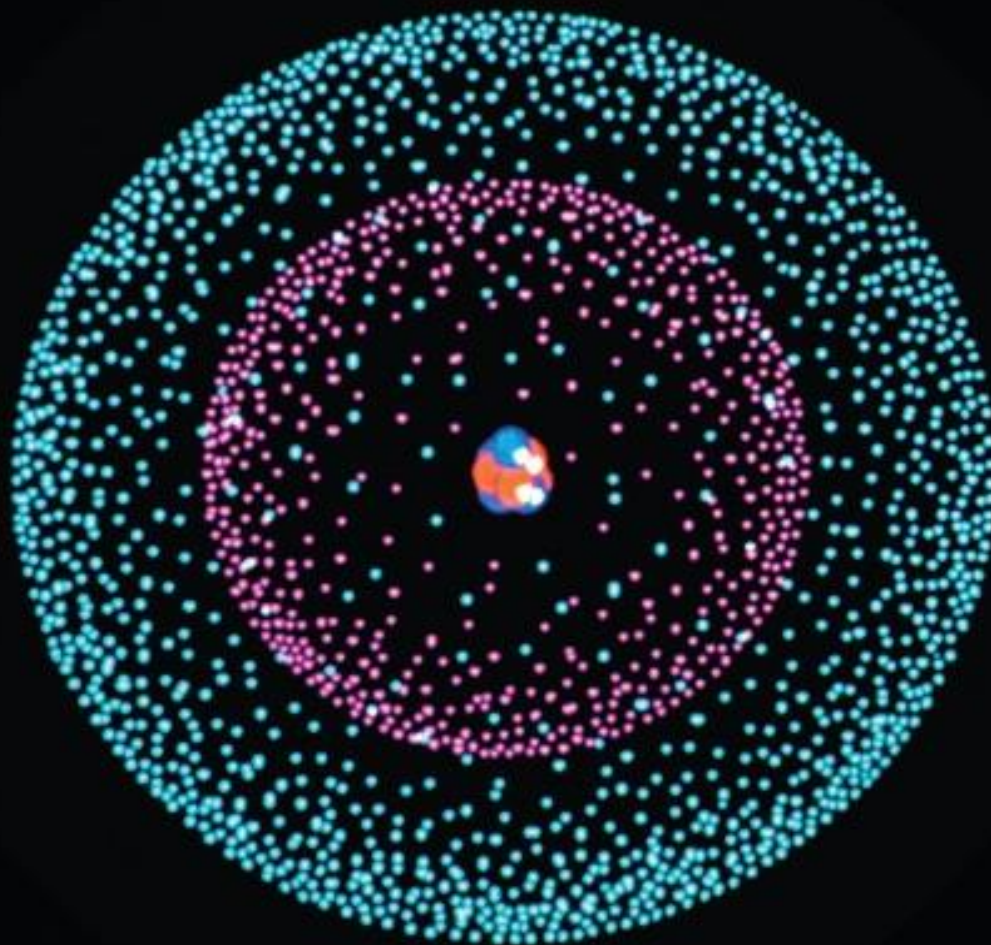
CARBON
ATOM



ATOMS ARE MADE OF SMALLER PARTS, CALLED PROTONS, NEUTRONS AND ELECTRONS



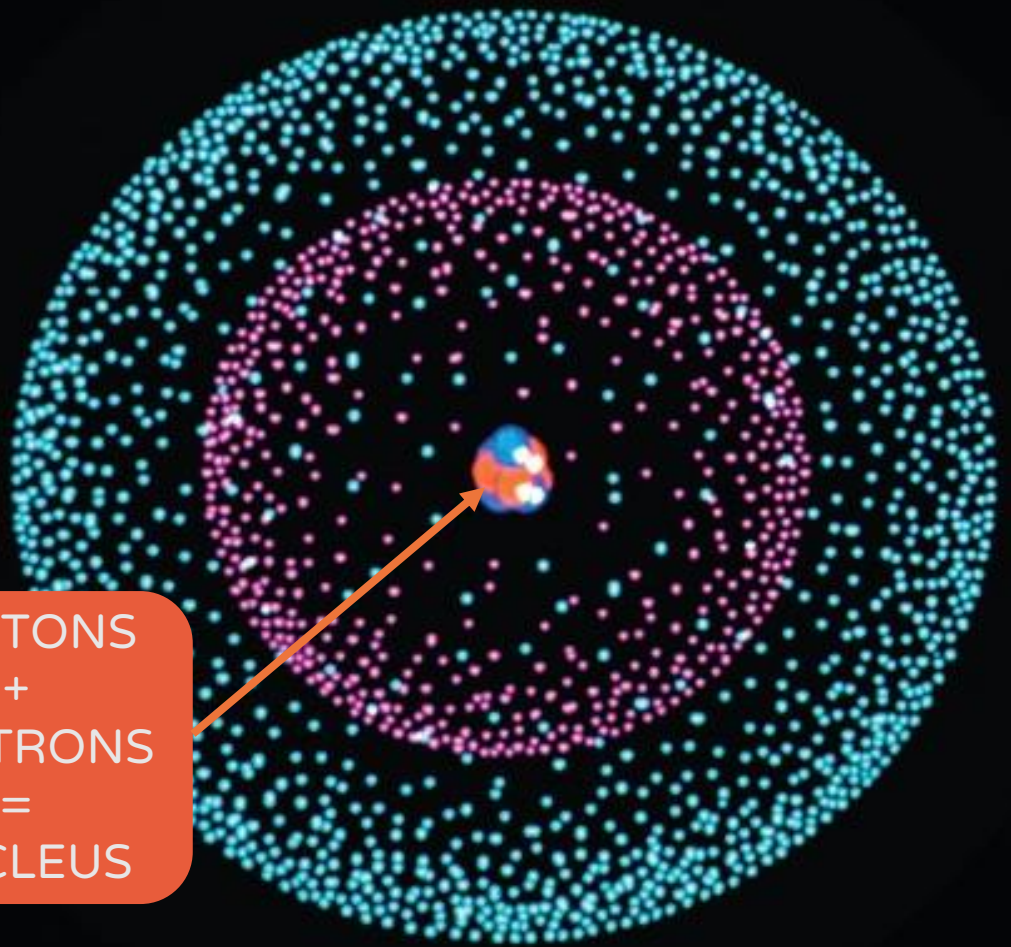
THIS IS A
DRAWING OF AN
ATOM



THE SPHERE IN
THE CENTER,
THE NUCLEUS, IS
MADE OF
PROTONS AND
NEUTRONS



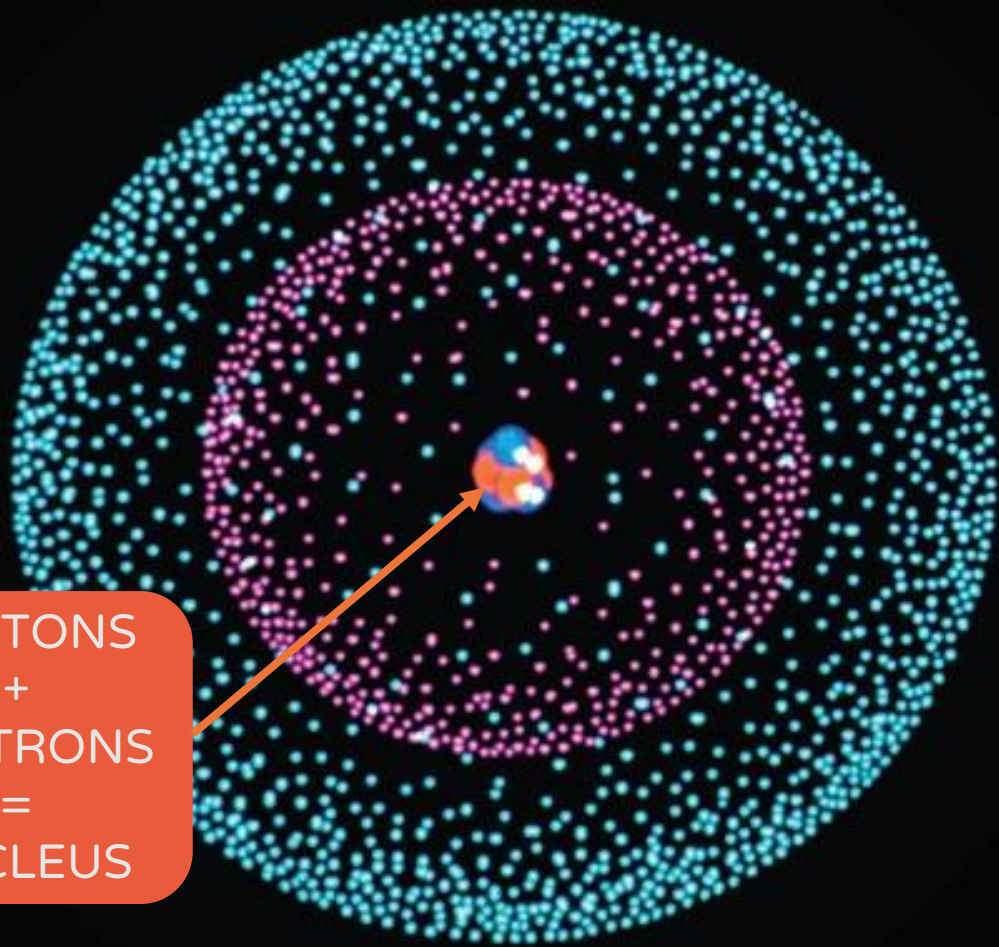
PROTONS
+
NEUTRONS
=
NUCLEUS



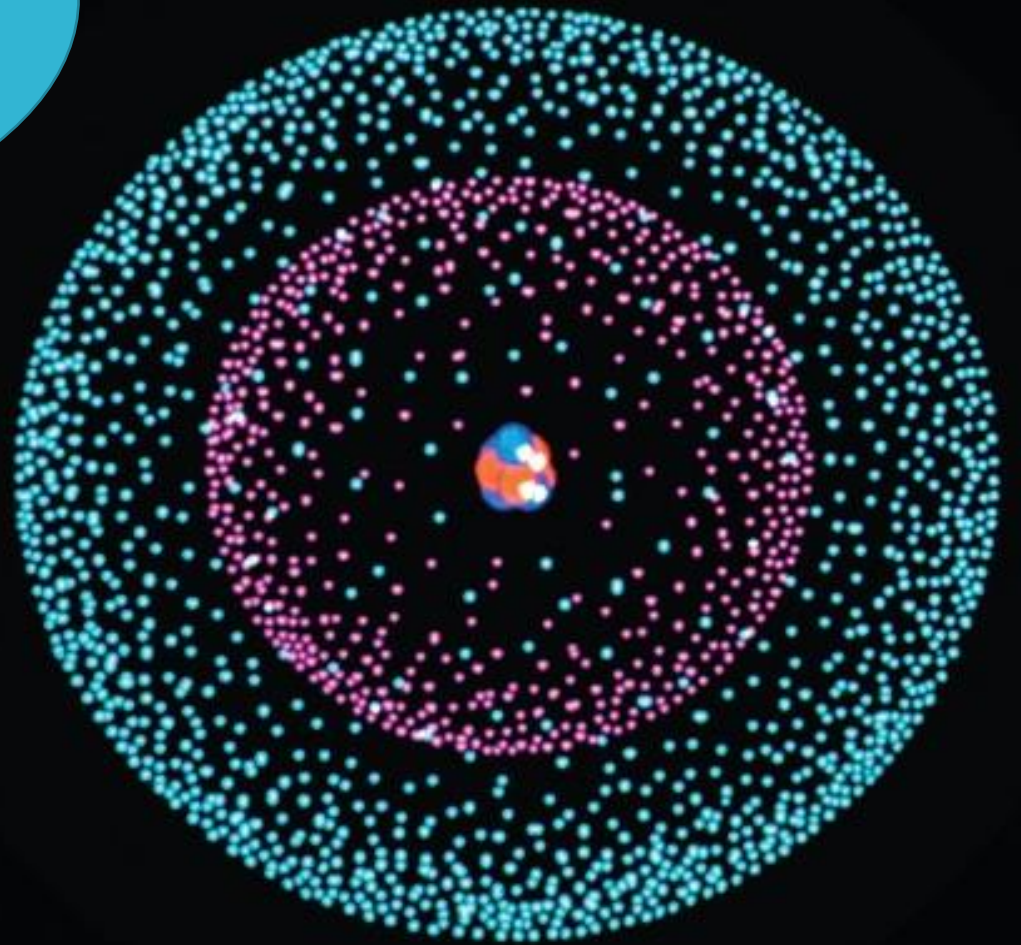
AND THE SMALL
DOTS ALL
AROUND ARE THE
PLACES WHERE
THE ELECTRONS
CAN BE



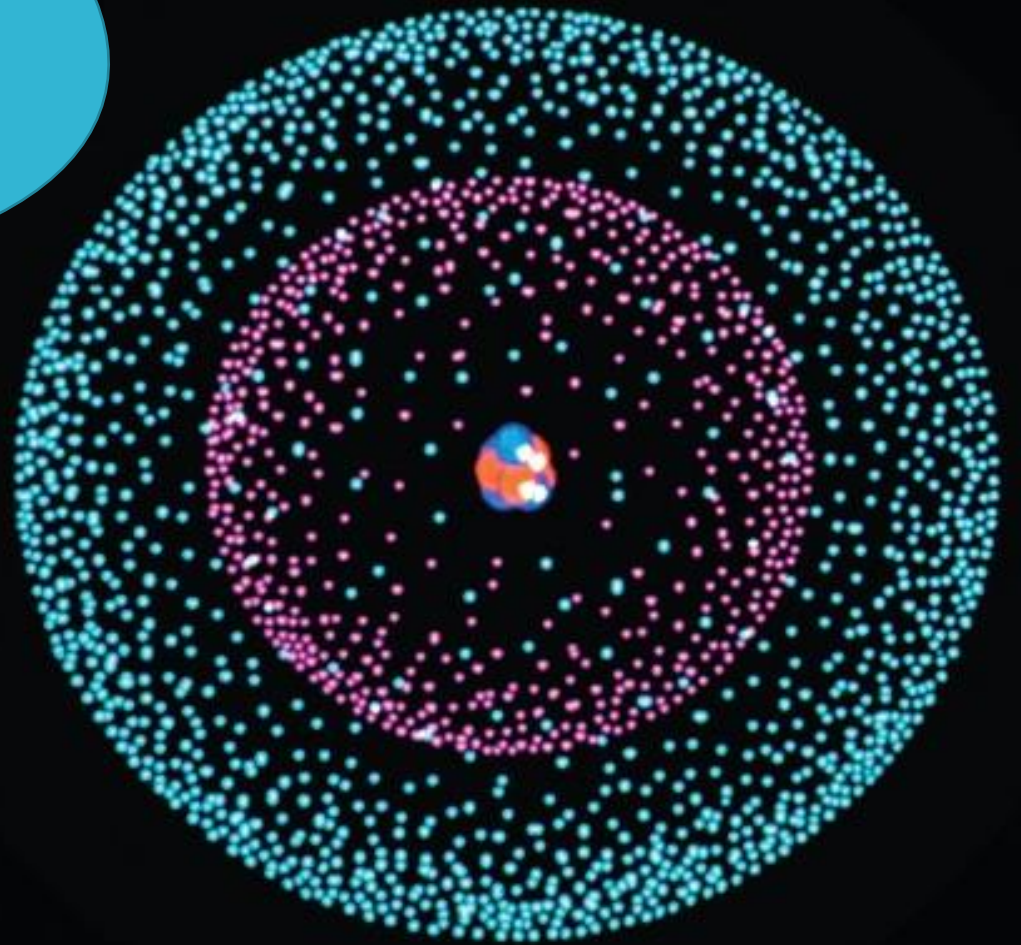
PROTONS
+
NEUTRONS
=
NUCLEUS



YES, IT SOUND WEIRD,
BUT CHEMISTS DO NOT
KNOW WHERE THE
ELECTRONS ARE EVERY
TIME... LET'S SAY THAT
THEY HANGING AROUND
THERE



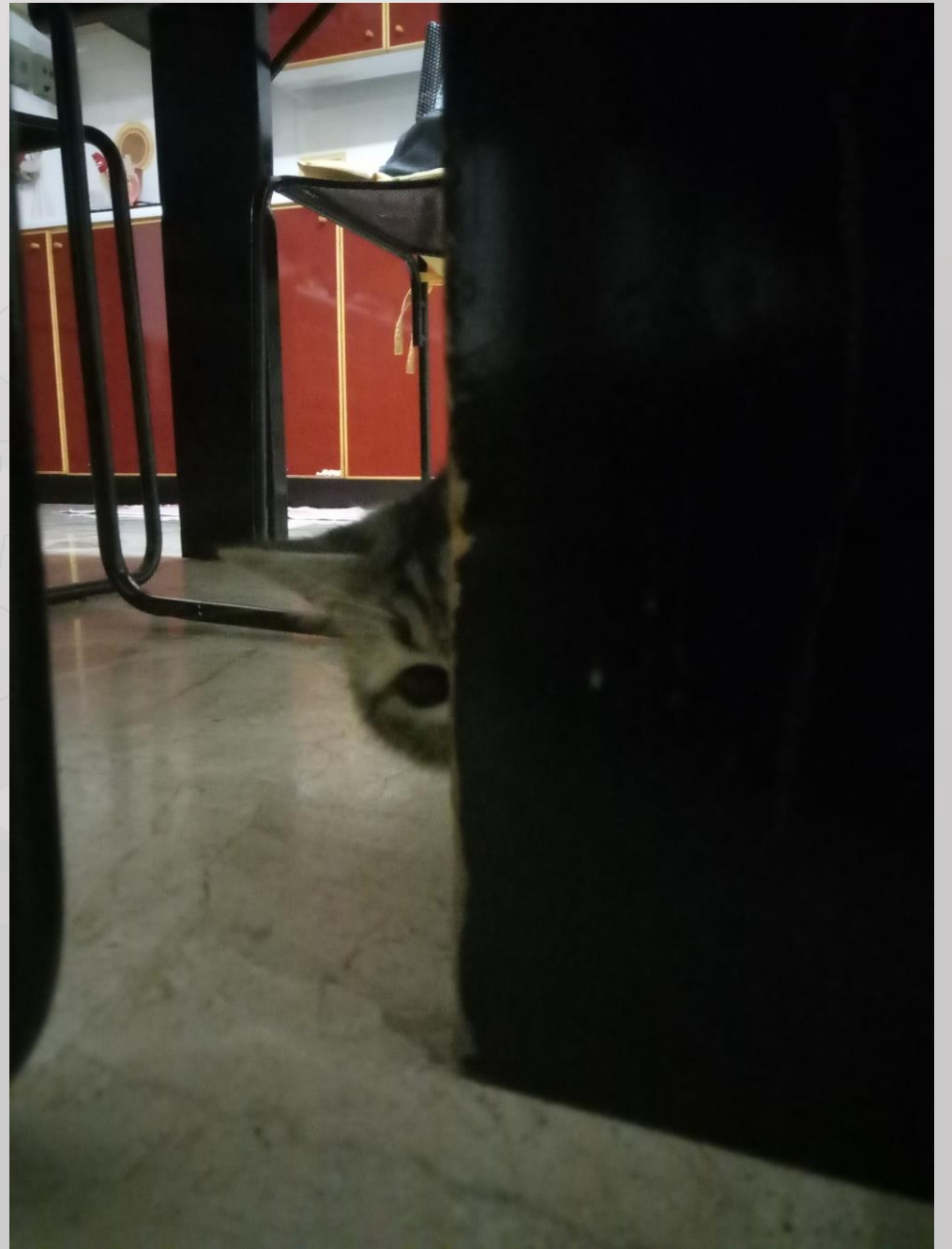
IT IS LIKE THEY LIKE TO
PLAY HIDE AND SEEK.
THEY ARE CLOSE TO THE
NUCLEUS
(=PROTONS+NEUTRONS)
BUT WE DO NOT KNOW
PRECISELY WHERE



I LOVE TO PLAY HIDE
AND SEEK, AS WELL!
BUT THEY ARE BETTER
THAN ME... SARRI FIND
ME ALL THE TIME...
I WONDER WHY!



I LOVE TO PLAY HIDE
AND SEEK, AS WELL!
BUT THEY ARE BETTER
THAN ME... SARRI FIND
ME ALL THE TIME...
I WONDER WHY!



BUT NOW, LET'S
GO BACK TO
OUR REDOX
REACTIONS



SO, REDOX REACTIONS
HAVE AS REAGENTS
COMPOUNDS AND
ELECTRONS



THERE ARE MANY REDOX REACTIONS. VERY COMMON ONES ARE WITH METALS. AND YOU KNOW ONE VERY WELL!



YES! THE
FORMATION
OF RUST!



IN THIS CASE WE SEE THE
RUST ON STEEL, BUT IT
CAN HAPPEN
EVERYWHERE AS LONG
AS THERE IS IRON!



LET'S SEE A
REACTION
NOW!





iron (METAL)

iron (CATION)



METALLIC IRON
(Fe) LOSE TWO
ELECTRONS TO
GIVE Fe²⁺



iron (METAL)

iron (CATION)



WHEN THE
COMPOUND LOSE
ELECTRONS THE
REACTION IS
CALLED
OXIDATION



CATION
=
ATOM THAT HAVE
LOST ELECTRONS

iron (METAL)

iron (CATION)



Fe²⁺ IS THE STARTING POINT TO OBTAIN GREEN RUST. BUT THIS WILL HAPPEN ONLY WHEN THERE IS WATER AND OXYGEN!



CATION
=
ATOM THAT HAVE
LOST ELECTRONS

iron (METAL)

iron (CATION)



GREEN RUST IS THE
BEGINNING (BUT YOU
WILL NOT SEE IT!!!)
AT THE END THE
BROWN RUST WILL BE
FORMED



CATION
=
ATOM THAT HAVE
LOST ELECTRONS

iron (METAL)

iron (CATION)



THE REACTION
FOR THE RED
RUST IS THIS



CATION
=
ATOM THAT HAVE
LOST ELECTRONS

iron (METAL)

iron (CATION)



THE REACTION
FOR THE RED
RUST IS THIS



CATION
=
ATOM THAT HAVE
LOST ELECTRONS

iron (METAL)

iron (CATION)



!!! FOR THE RUST TO
BE FORM BOTH THE
REACTIONS NEED TO
HAPPEN !!!



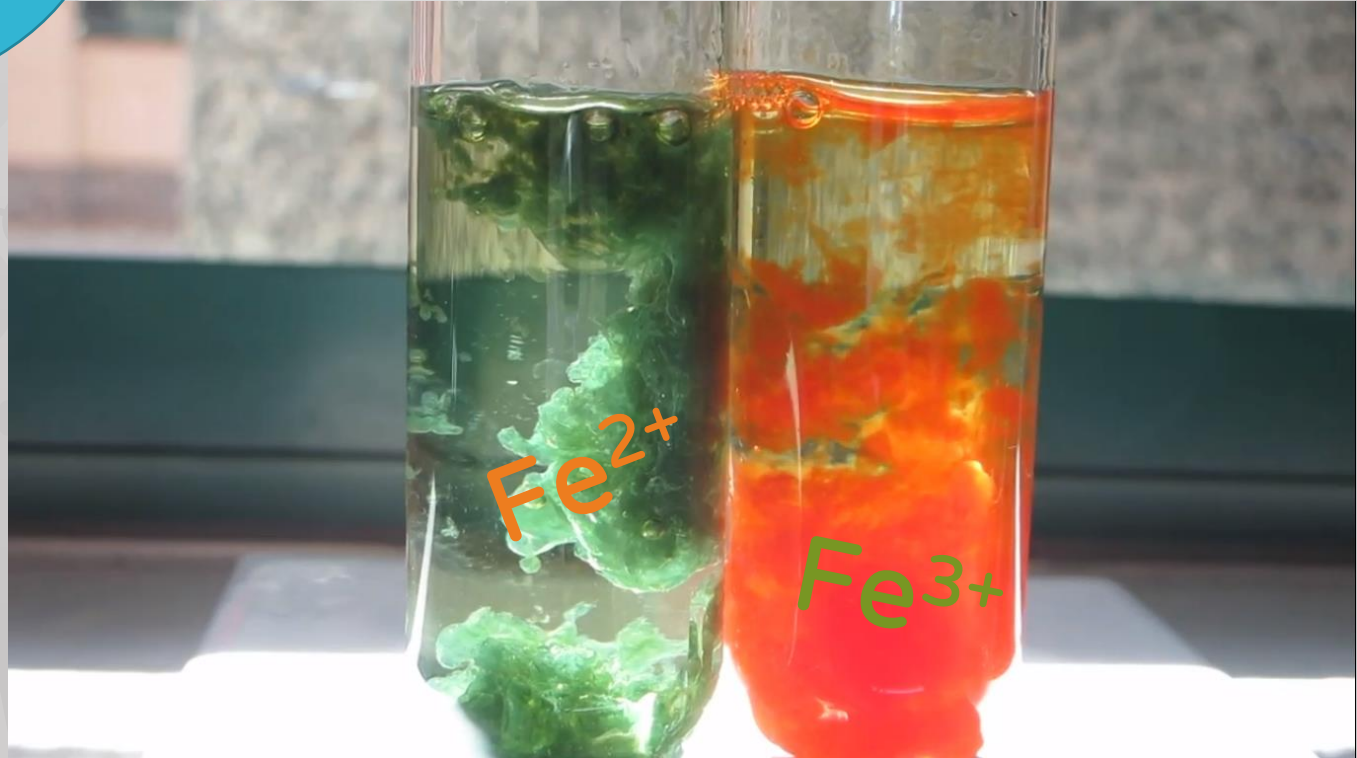
CATION
=
ATOM THAT HAVE
LOST ELECTRONS

iron (METAL)

iron (CATION)

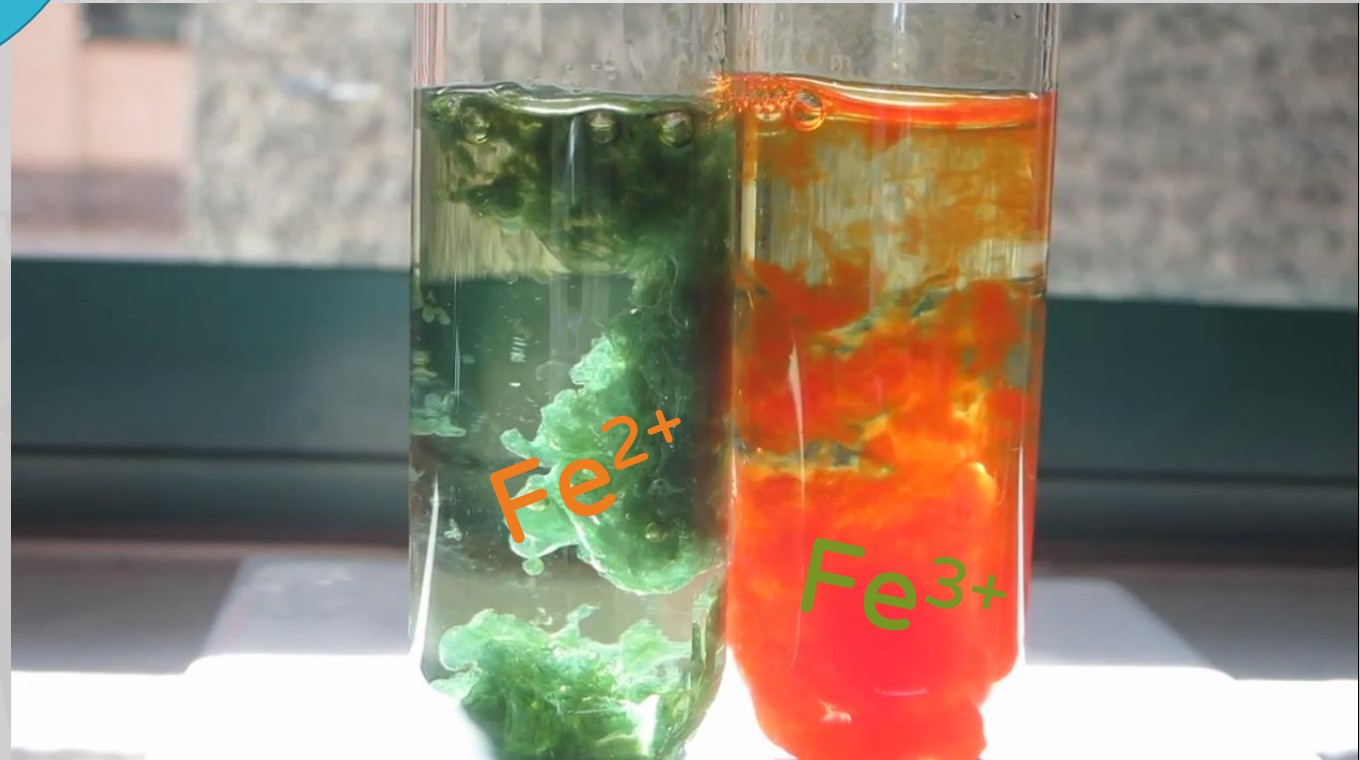


LOOK AT THE
DIFFERENCE
BETWEEN THE
GREEN RUST AND
THE RUST YOU
NORMALLY SEE



CLICK ON THE
LINK FOR A
BEUTIFUL VIDEO!!

<https://www.youtube.com/watch?v=fGie2rfVCiY>



AND NOW LOOK
AT SOME RUST
FORMING!



<https://nusteelfab.com/rust-time-lapse-video/>



OKAY, WE TALKED
ONLY ABOUT
OXIDATION, WHAT
ABOUT THE
REDUCTION
PART?



EVERYTIME AN
OXIDATION
HAPPENS AT
THE SAME TIME
A REDUCTION
REACTION
HAPPENS!



REDUCTION
HAPPENS WHEN
THE COMPOUND
GAINS
ELECTRONS!

ANION
=
ATOM THAT HAVE
GAINED ELECTRONS



WE SAID THE RUST
FORMATION IS A REDOX
REACTION WE SAW THAT
IRON IS OXIDISED (LOSES
ELECTRONS).
SO WHAT DOES GET
REDUCED (GAIN
ELECTRONS)?

ANION
=
ATOM THAT HAVE
GAINED ELECTRONS



OXIGEN!!!

ANION
=
ATOM THAT HAVE
GAINED ELECTRONS



LET'S HAVE
A LOOK AT
THE
REACTION!



ANION
=
ATOM THAT HAVE
GAINED ELECTRONS

oxygen

water

hydroxide (ANION)



OKAY, NOW THAT
WE KNOW A BIT
MORE ABOUT
REDOX REACTION
WE CAN TRY TWO
SIMPLE
EXPERIMENTS



NOW, YOU WILL NEED
TO BE A BIT PATIENT
FOR THE FIRST ONE, BUT
IT IS GOING TO BE QUITE
FAST FOR THE SECOND
ONE
ARE YOU READY?



1° EXPERIMENT: WHAT IS GOING TO GET RUSTED?

- OXIDATION OF IRON



1° EXPERIMENT: WHAT IS GOING TO GET RUSTED?

- OXIDATION OF IRON

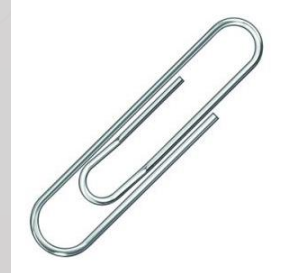
2° EXPERIMENT: OXIDISE OR NOT OXIDISE? THIS IS THE QUESTION... IF YOU ARE AN APPLE!

- OXIDATION OF AN APPLE



1° EXPERIMENT_MATERIAL

- 3 NAILS
- 3 SCREWS
- 3 PAPER CLIPS
- 3 STRIPS OF STAPLES
- 3 BOBBY PINS
- 3 BRADS
- PLATIC/PAPER CUPS
- WATER
- KITCHEN SALT (=NaCl!)
- MARKER



YOU CAN USE
ALL THESE
MATERIAL OR
ONLY FEW OF
THEM



REMEMBER THAT YOU
NEED TO HAVE THREE
PIECES OF EACH
OBJECT FOR
COMPARISON!



1° EXPERIMENT_PROCEDURE

- PLACE ONE OBJECT IN ONE PLASTIC/PAPER CUP. NOW YOU SHOULD HAVE THREE SETS OF CUPS (SEE PHOTO ON THE NEXT SLIDE FOR AN EXAMPLE)
- FILL TWO SETS OF CUPS WITH WATER BEING SURE THAT THE OBJECT IS COMPLETELY COVERED
- !!! LEAVE THE REMAINING SET OF OBJECTS WITHOUT WATER !!! YOU WILL USE THIS AS YOUR CONTROL EXPERIEMENT !!!
- NOW, IN ONE OF THE SET WITH WATER ADD HALF OF TEA SPOON OF SALT !!! ADD THE SALT IN SMALL PORTION AND STIR IT, SO THAT THE SALT WILL DISAPPEARED COMPLETELY. IF YOU SEE THAT THE SALT DOES NOT DISSOLVE ANYMORE, STOPP ADDING IT !!!
- LET THE OBJECTS SIT FOR A WEEK
- AFTER THE WEEK CHECK ALL THE SET AND WRITE DOWN IF SOMETHING CHANGED!



PAPER CLIP

STRIP of
STAPLES

NAIL

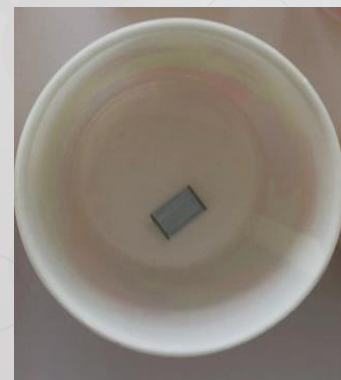
SET 1

WATER



SET 2

WATER+SALT



SET 3

NO LIQUID



FOR WRITING DOWN
THE CHANGES, YOU
CAN USE THE
DOCUMENT
«OBSERVER'S
NOTEBOOK (PART 4)»
OR USE YOUR OWN
NOTEBOOK

FOR CHANGES YOU
CAN WRITE ABOUT THE
COLOUR, THE TEXTURE
AND, WHY NOT, YOU
CAN ALSO WEIGHT THE
OBJECT AFTER AND
BEFORE!



2° EXPERIMENT_MATERIAL

- 1 APPLE
- PLATIC/PAPER CUPS
- WATER
- SOLUTION WITH KITCHEN SALT (=NaCl!) AND WATER (1/8 of a tea spoon of salt in 100 mL of water)
- SOLUTION WITH SUGAR AND WATER (1 table spoon of sugar in 100 mL of water)
- LEMONADE/ORANGE JUICE
- PURE LEMON JUICE/PURE ORANGE JUICE
- MILK
- A MARKER



IF THERE IS
ANOTHER LIQUID
THAT YOU WANT TO
TRY, GO FOR IT!
USE YOUR
IMMAGINATION!



2° EXPERIMENT_PROCEDURE

- CUT 1 APPLE IN 8 PARTS !!! ASK YOUR PARENTS TO DO IT FOR YOU !!! (TRY TO CUT THEM SO THAT THE PIECES HAVE THE SAME SIZE)
- PUT A PIECE OF APPLE IN EACH CUP
- FILL EACH CUP WITH ONE OF THE DIFFERENT LIQUID IN THE MATERIALS LIST !!! MAKE SURE THE APPLE IS COMPLETELY COVERD WITH THE LIQUID !!!
- PUT A PIECE OF YOUR APPLE IN A CUP WITHOUT ADDING ANY LIQUID. WRITE WITH THE MARKER ON EACH CUP WICH LIQUID YOU POURED IN IT
- LET THE PIECES SIT FOR 3 MIN. MEANWHILE, WRITE DOWN WHAT DO YOU THINK IS GOING TO HAPPEN TO THE PIECES OF APPLE
- REMOVE THE APPLE FROM THE CUP AND PUT IT ON A PLATE. WRITE DOWN THE DIFFERENCES «AFTER» AND «BEFORE» AND THE DIFFEERNCES AMONG YOUR PIECES
- WAIT OTHER 5 MIN AND WRITE DOWN AGAIN THE DIFFERENCES



FOR WRITING DOWN THE
CHANGES, YOU CAN USE
THE DOCUMENT
«OBSERVER'S NOTEBOOK
(PART 5)» OR USE YOUR
OWN NOTEBOOK



WHAT IS
HAPPENING IN
BOTH THE
EXPERIMENTS?



READ THE LAST
SLIDES AFTER
YOU FINISHED
YOUR
EXPERIMENTS!

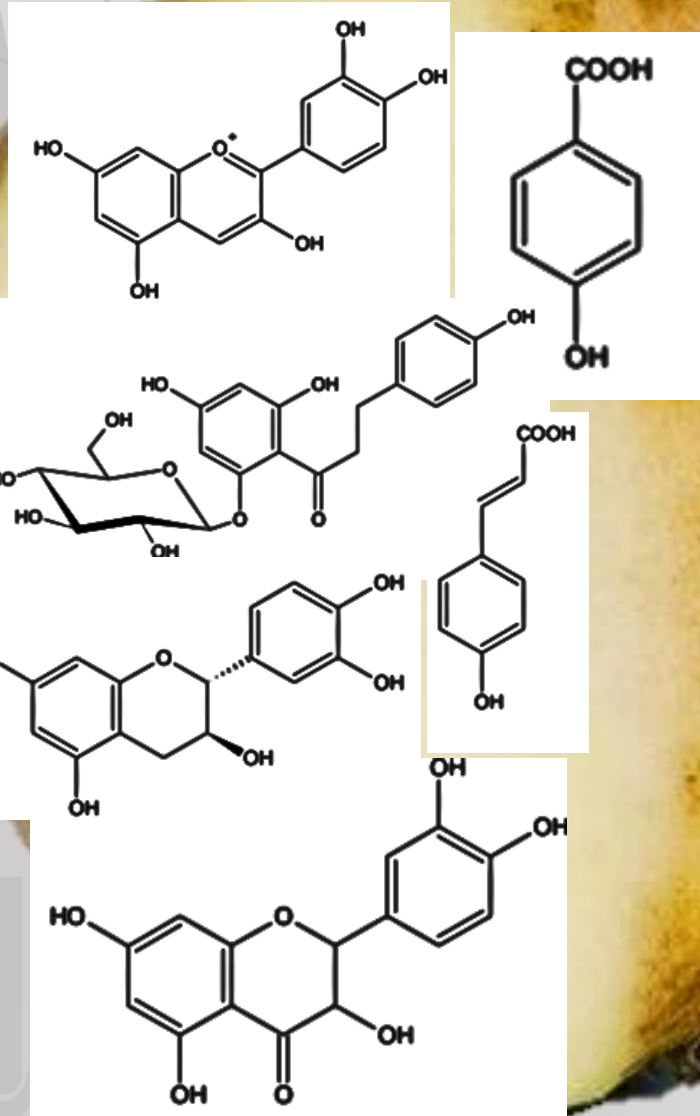
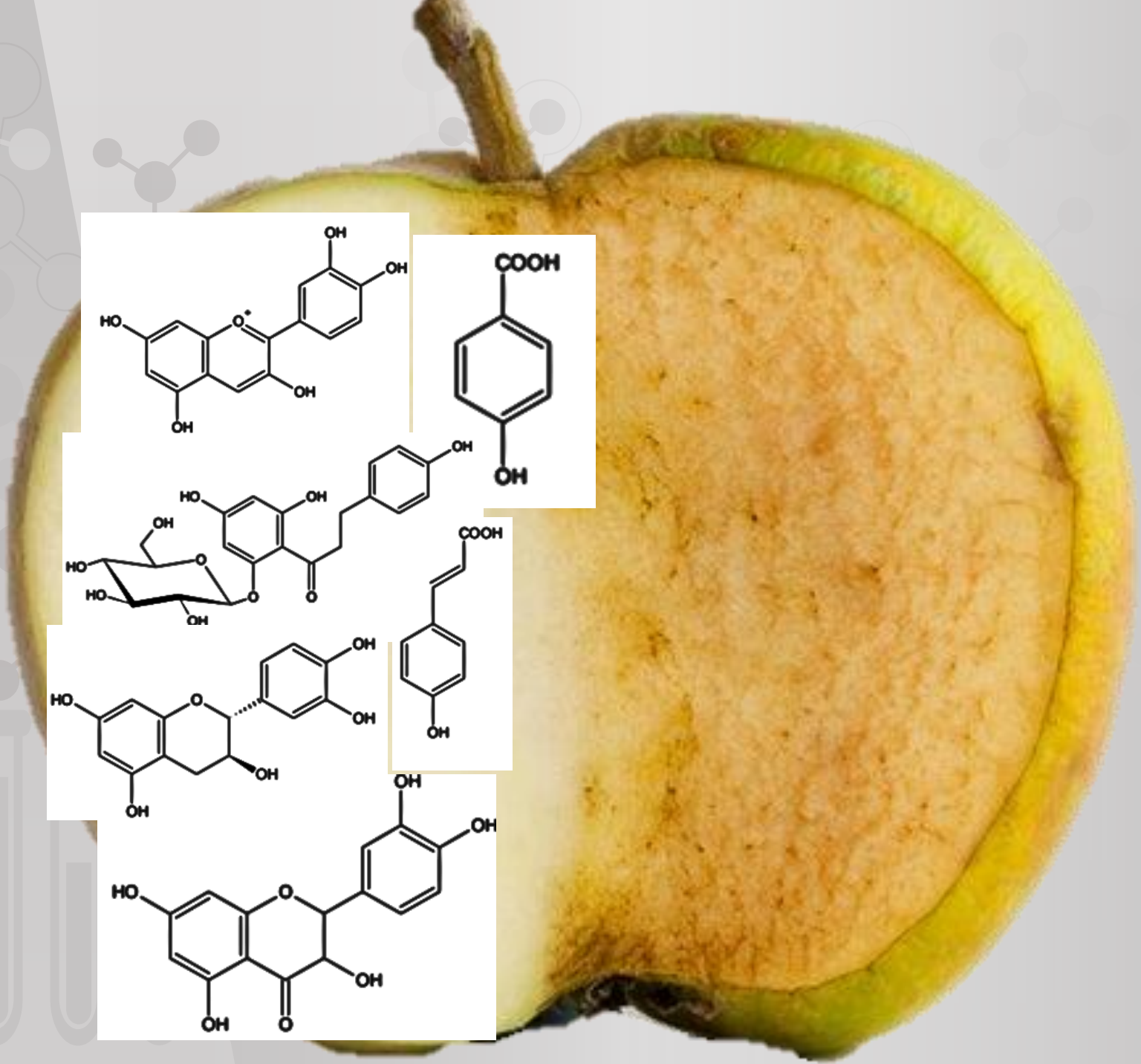


IN THE SECOND
EXPERIMENT, YOU ARE
OBSERVING A
OXIDATION REACTION
OF SOME COMPOUNDS
IN THE APPLE



THESE COMPOUNDS ARE CALLED PHENOLIC COMPOUNDS (LOOK AT THE COMPOUNDS AT THE NEXT SLIDE TO SEE HOW THEY LOOK LIKE!) AND THEY GET OXIDISED WHEN THE APPLE IS IN CONTACT WITH AIR!





IN THE FIRST EXPERIMENT IS
SIMPLY RUST FORMATION.
IF THE OBJECT THAT YOU
CHOOSE THERE IS NOT
IRON, OR IT IS COVERED
WITH SOMETHING (LIKE
PAINT), THE RUST IS NOT
GOING TO FORM

