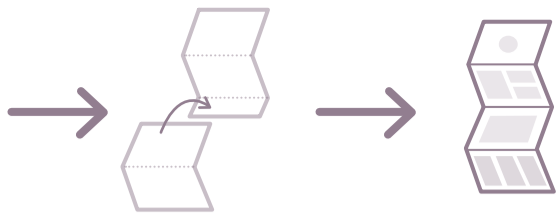
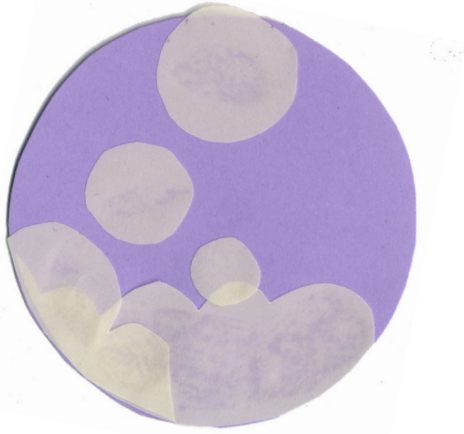


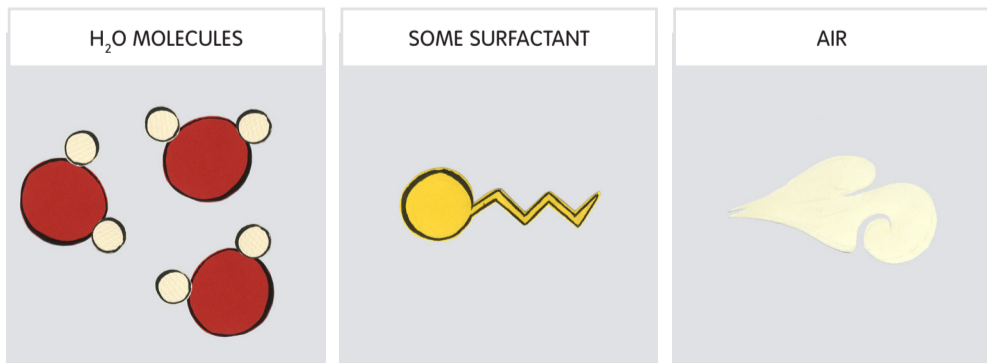
CUT FOLD



BUBBLE

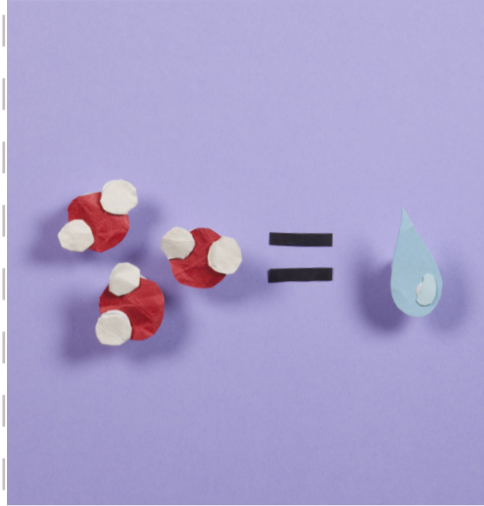


TO MAKE A SOAP BUBBLE, WE NEED :

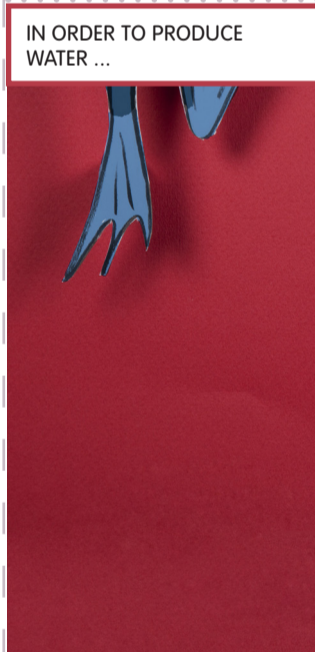
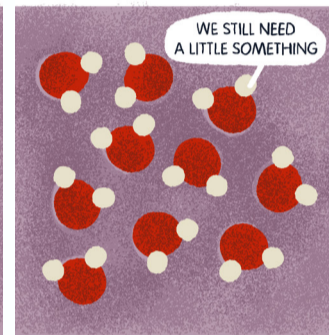
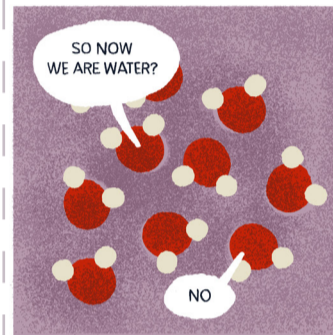
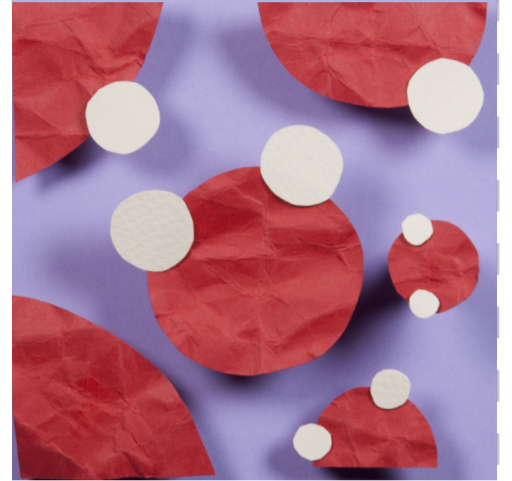


GLUE HERE

TO MAKE WATER, WE NEED H₂O MOLECULES.



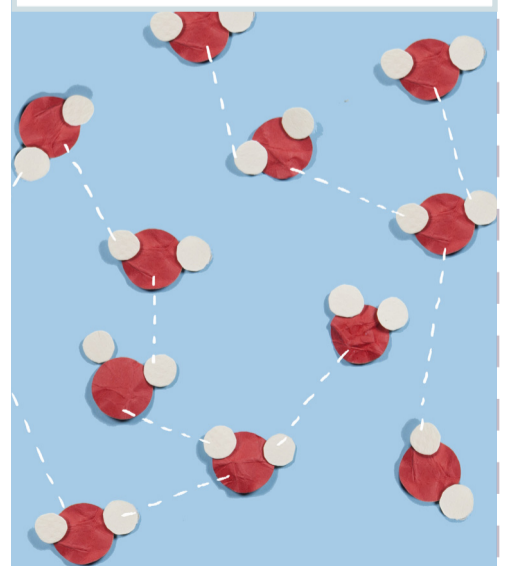
WE WANT TO GATHER THESE MOLECULES AND WARM THEM UP TO ABOUT 20 DEGREES.



HYDROGEN BONDING WILL JOIN THE MOLECULES TOGETHER, LINKING AN OXYGEN ATOM WITH A HYDROGEN ATOM.



THE MOLECULES ARE THEN ATTACHED TO ONE ANOTHER ...



GLUE HERE

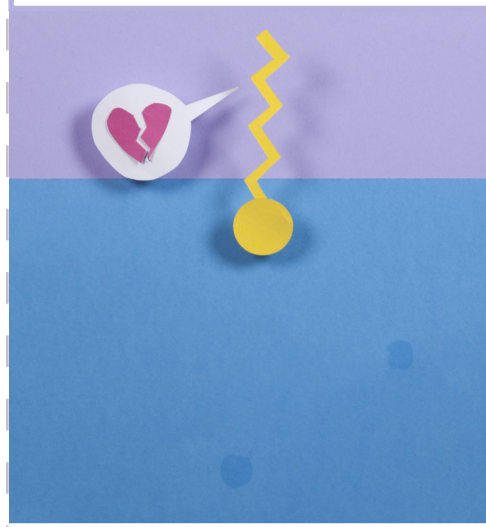
TO FORM WATER !



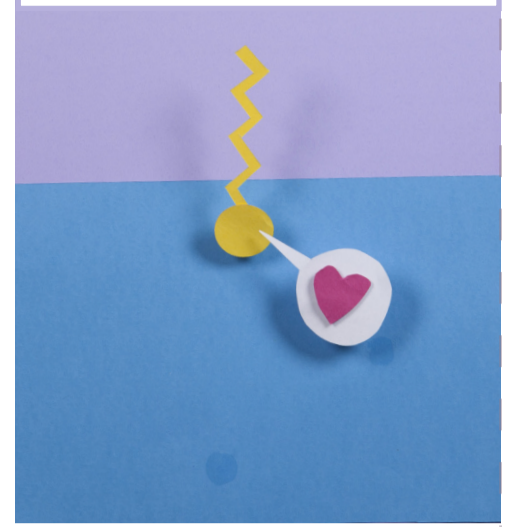
NOW, TO MAKE A BUBBLE, WE NEED SOME SOAP.



THE TAIL IS THEREFORE HYDROPHOBIC...



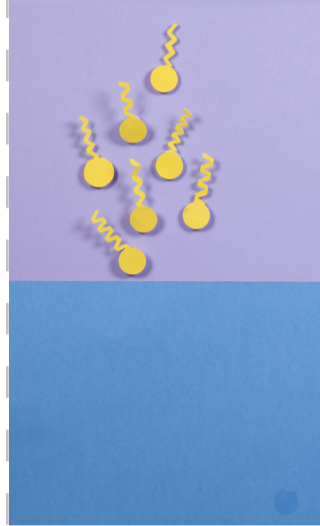
AND THE HEAD IS HYDROPHILIC !



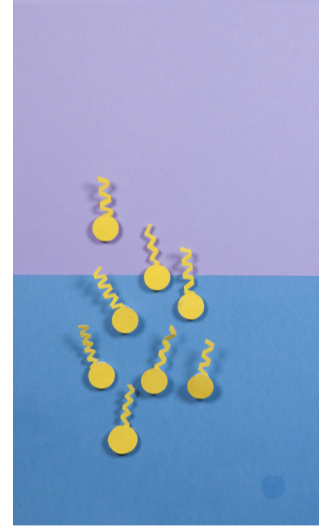
SOAP IS COMPOSED OF SURFACTANT MOLECULES, SUCH AS SODIUM DODECYL SULFATE (C₁₂H₂₅NAO₄S).



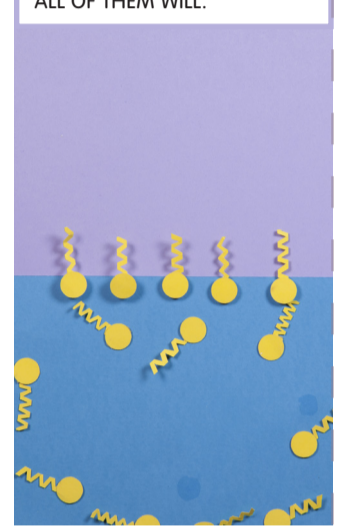
SO WHEN WE POUR SOAP INTO WATER...



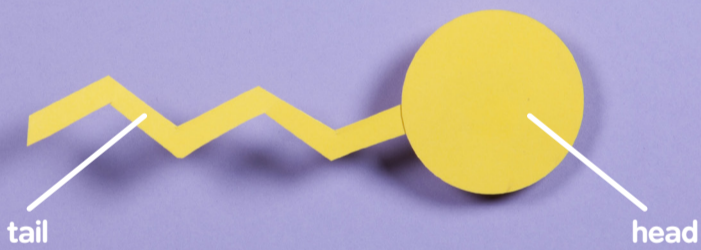
THE TAILS OF THE MOLECULES WILL STRIVE TO AVOID WATER.



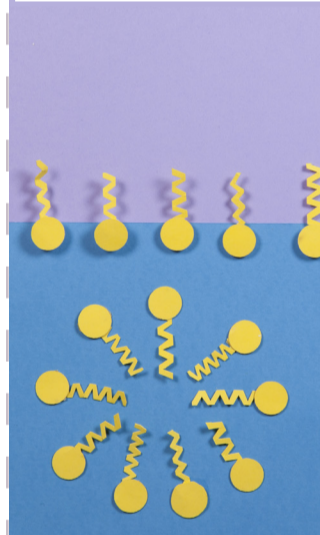
SOME WILL MANAGE TO GET OUT OF THE WATER, BUT NOT ALL OF THEM WILL.



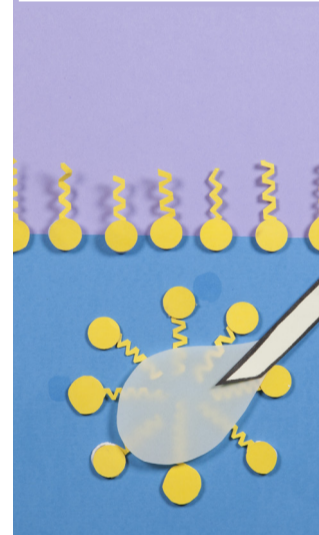
BASICALLY, WE HAVE :



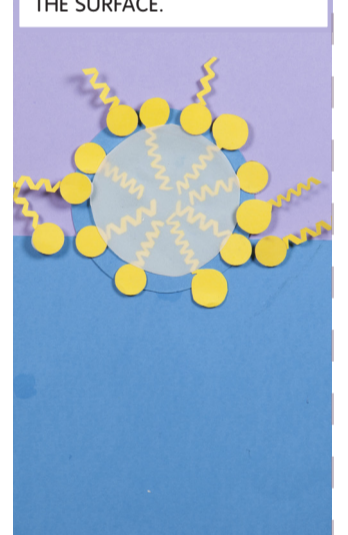
THE TAILS WILL THEN FORM SMALL SPHERES TO SHIELD THEMSELVES FROM WATER.



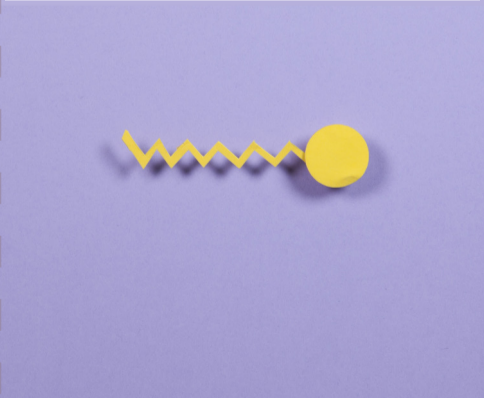
IF YOU BLOW ON THEM, THE AIR WILL PENETRATE THE SPHERES...



AND WILL PUSH THE MOLECULES BACK UP, WHICH WILL GRAB THOSE ON THE SURFACE.



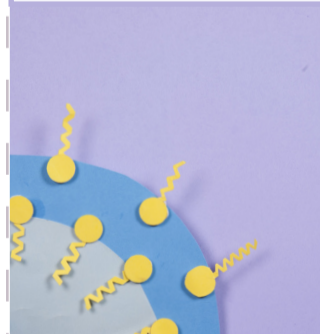
THE HEAD, WHICH IS ELECTRICALLY CHARGED BECAUSE OF SODIUM, CAN EASILY STICK TO THE MOLECULES OF WATER, IN ACCORDANCE WITH THE LAWS OF ELECTRICITY. HOWEVER, THE TAIL WITH THE ATOMS OF CARBON AND HYDROGEN DOESN'T LIKE WATER, BECAUSE WATER IS FORCED TO CHANGE ITS STRUCTURE WHEN IN CONTACT.



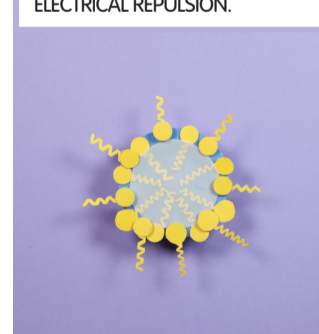
THIS ELECTROSTATIC INTERACTION WAS USED TO ATTRACT THE HEADS TO THE WATER.



BUBBLES ARE MADE BY THE AIR IN THE MIDDLE AND BY A LAYER OF WATER STUCK BETWEEN TWO LAYERS OF SURFACTANT.



BUBBLES CAN RESIST BECAUSE THE SURFACTANT MOLECULES SEPARATED BY WATER REJECT ONE ANOTHER: THAT'S ELECTRICAL REPULSION.



THE FILM OF WATER ON A SMALL BUBBLE IS EXTREMELY THIN, A MERE FEW HUNDRED NANOMETRES.

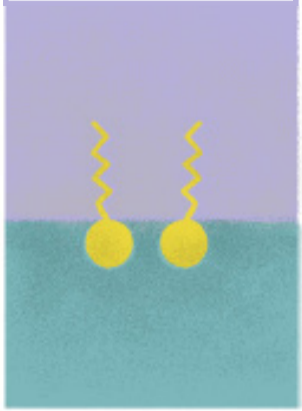


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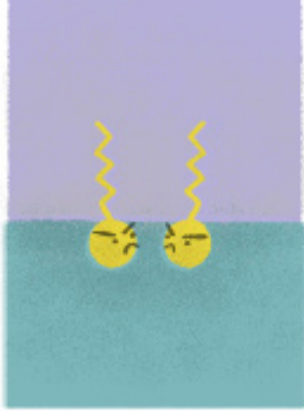
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BUT WHAT IF THE LAWS OF PHYSICS WORKED DIFFERENTLY?

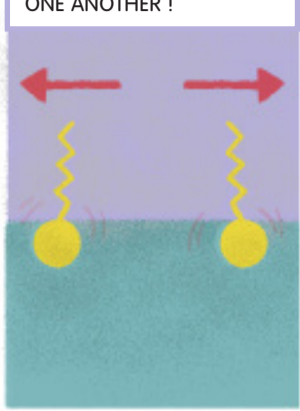
LET'S SAY OUR
LITTLE SURFACTANT
MOLECULES...



COULDN'T STAND TO BE
SIDE BY SIDE...



IN THIS UNIVERSE, THEY
WOULD DO THEIR UTMOST
TO GET AWAY FROM
ONE ANOTHER !



IF THIS EFFECT PREVAILED
OVER ALL THE OTHERS
BUBBLES WOULD NOT BE
SPHERIC ANYMORE...



BUT WOULD BE... FRACTALS !

