Project Mc 2

SMART IS THE NEW COOL™

PICKING UP S.T.E.A.M.

WITH SCIENCE, TECHNOLOGY, ENGINEERING, ART & MATH

FIND OUT ABOUT THE SCIENCE BEHIND
OUR ULTIMATE LAB KIT BOOKLET EXPERIMENTS!

1. CRAZY COLORS MILK EXPERIMENT

THE COLORS DANCING IN YOUR MILK ARE A RESULT OF SOAP DISSOLVING MILK FAT. YOU HEARD THAT RIGHT -- MILK HAS A BIT OF NATURAL FAT. WHEN SOAP IS ADDED TO MILK, THE MOLECULES DANCE AROUND AS THE SOAP DISSOLVES THE FAT (THAT'S WHY SOAP IS GOOD AT CLEANING). THE FOOD COLORING SIMPLY GOES ALONG FOR THE RIDE CREATING A COLORFUL MOLECULAR DANCE.

2. WATER MAGNIFIER

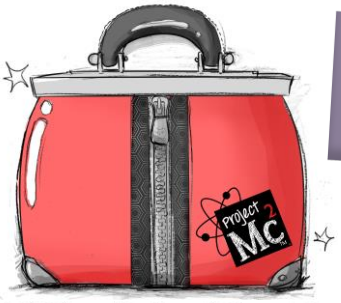
CURVED SURFACES ARE THE KEY TO MAGNIFICATION. A MAGNIFYING GLASS HAS A CURVE, THE CAMERA LENS IN A SMART PHONE IS CURVED, AND EVEN WATER DROPLETS ARE CURVED. YES, THAT MEANS WE CAN USE A WATER DROPLET AS A MAGNIFYING GLASS! LIGHT THAT PASSES THROUGH A CURVED SURFACE CHANGES DIRECTION SLIGHTLY (BENDS), AND IT CAN BE FOCUSED IN YOUR EYE. THE SMALLER THE DROPLET THE HIGHER THE MAGNIFICATION, BECAUSE SMALL DROPS ARE MORE CURVED.

3. BLOW UP A BALLOON

YOU CAN FILL UP A BALLOON WITH YOUR BREATH, OR YOU CAN LET CHEMISTRY DO THE WORK FOR YOU. THE CHEMICAL REACTION BETWEEN BAKING SODA AND VINEGAR MAKES CARBON DIOXIDE GAS. IT HAS NO COLOR OR SMELL, BUT IT TAKES UP LOTS OF SPACE. YOU CAN SEE THAT BY PUTTING A BALLOON ON TOP OF YOUR TEST TUBE TO CAPTURE THE GAS. THERE IS A LOT OF IT!

4. FOUR COLOR FLOWERS

THE STEM OF A FLOWER IS LIKE A DRINKING STRAW THAT A FLOWER USES TO STAY HYDRATED. WATER, SUGAR, AND A LOT OF NUTRIENTS FLOW THROUGH THE STEM AND INTO THE FLOWER PETALS. THE WATER FLOWS DOWN MANY TINY PIPES INSIDE THE STEM. BY SLICING THE STEM INTO SECTIONS, WE CAN SEPARATE SOME OF THE PIPES AND ALLOW DIFFERENT COLORS TO FLOW UP TO THE PETALS.



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5. GROWING GUMMY BEARS

WE CAN MAKE A GUMMY BEAR GROW OR SHRINK BY SOAKING IT IN DIFFERENT LIQUIDS. WHEN A GUMMY BEAR IS PLACED IN PURE WATER, THE BEAR SLOWLY ABSORBS THE WATER CAUSING IT TO EXPAND. WHEN WE USE SALTY WATER, THE OPPOSITE HAPPENS -- THE BEAR EXPELS WATER, CAUSING IT TO SHRINK. THIS IS CALLED OSMOSIS. IT ALSO HAPPENS WHEN YOU PUT SOFT GRAPES IN WATER -- THEY SLOWLY FIRM UP DUE TO OSMOSIS.

6. SWEET OR SALTY BUBBLES

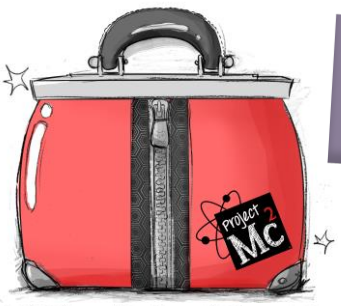
WHAT MAKES THE PERFECT SOAP BUBBLE? BUBBLEOLOGISTS HAVE BEEN PERFECTING THE RECIPE FOR YEARS AND FOUND THAT ADDING TABLE SUGAR OR GLYCERIN (A MOISTURIZER) CAN MAKE LONG LASTING BUBBLES BECAUSE THE ADDITIVES SLOW EVAPORATION. SALT, ON THE OTHER HAND, DISRUPTS THE SOAP LAYER. THAT'S WHY DISTILLED WATER IS BEST FOR MAKING BUBBLES BECAUSE IT HAS ZERO SALT AND NO MINERALS.

7. MAKE YOUR OWN BUBBLE BLOWER

MAKING A BUBBLE USUALLY REQUIRES A SOAPY SOLUTION, A BUBBLE WAND, AND A STREAM OF AIR SUCH AS YOUR BREATH. A TINY BUBBLE WAND MAKES TINY BUBBLES. IN THIS EXPERIMENT, OUR BUBBLE WAND IS A PIECE OF CLOTH. UNDER A MICROSCOPE, YOU CAN SEE THAT THE CLOTH IS POROUS, OR MADE OF LOTS OF TINY HOLES. EACH TINY HOLE ACTS LIKE A BUBBLE WAND, AND YOU CAN MAKE THOUSANDS OF BUBBLES WITH ONE BREATH.

8. PH STRIPS

SCIENTISTS RATE HOW STRONG AN ACID OR A BASE IS ON A 14-POINT SCALE CALLED THE "PH SCALE." A VALUE OF 14 MEANS THE LIQUID IS A VERY STRONG BASE. A VALUE OF 7 (THE MIDDLE OF THE SCALE) IS NEUTRAL LIKE WATER, AND A VALUE OF 1 IS A VERY STRONG ACID. WE CAN TEST DIFFERENT LIQUIDS USING PH STRIPS, WHICH MAKE USE OF A COLOR CODE THAT INDICATES THE PH ON THE 14-POINT SCALE.



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9. LAVA FLASK

THIS LAVA LAMP HAS 2 LAYERS -- OIL AND WATER. THE OIL FLOATS ON TOP BECAUSE IT IS LIGHTER (LESS DENSE). TO START THE LAMP, WE ADD A FIZZY TABLET THAT MAKES CARBON DIOXIDE BUBBLES. AS THE BUBBLES RISE, THEY DRAG SOME WATER DROPLETS UP INTO THE OIL LAYER. THOSE WATER DROPS FALL BACK DOWN BECAUSE THEY ARE HEAVIER. THIS REPEATS UNTIL THE BUBBLES RUN OUT.

10 ADD FIZZ TO YOUR LEMONADE

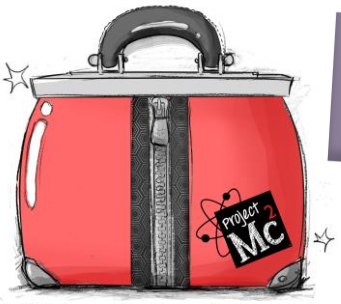
THE FIZZ IN SODA COMES FROM CARBON DIOXIDE GAS THAT IS DISSOLVED IN IT. THE GAS IS RELEASED WHEN YOU SHAKE AN OPEN SODA BOTTLE. WE CAN ADD THE SAME CARBON DIOXIDE TO OUR LEMONADE USING THE BAKING SODA AND VINEGAR REACTION. MIXING THIS ACID AND BASE PRODUCES CARBON DIOXIDE AND SOME OF IT DISSOLVES IN OUR LEMONADE, MAKING IT SLIGHTLY FIZZY.

11. GLITTER SLIME

SLIME IS A TYPE OF POLYMER, WHICH IS FORMED WHEN MOLECULES LINK TOGETHER. THINK OF THE MOLECULES IN GLUE AS TONS OF LITTLE PAPERCLIPS. ADDING THE LIQUID STARCH CAUSES ALL THESE PAPERCLIPS (MOLECULES) TO LINK TOGETHER INTO CHAINS. MOLECULES THAT ARE LINKED TOGETHER ARE MUCH THICKER (AKA SLIMY).

12. MAKE CO_2

LET'S MAKE A TON OF BUBBLES USING THE CHEMISTRY OF ACIDS AND BASES. AN ACID IS SOMETHING SOUR LIKE LEMON JUICE OR VINEGAR. A BASE IS SOMETHING BITTER LIKE BAKING SODA. WHEN WE MIX VINEGAR (THE ACID) AND BAKING SODA (THE BASE), WE PRODUCE LOTS OF CARBON DIOXIDE GAS BUBBLES THAT WILL OVERFLOW THE CONTAINER. ADDING SOAP ALLOWS US TO KEEP THE BUBBLES AROUND LONGER.



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13. GOOEY OOBLECK

IS IT A LIQUID OR A SOLID? THE ANSWER IS BOTH...DEPENDING ON HOW YOU TREAT IT. CORNSTARCH IS A VERY FINE POWDER THAT DOES NOT DISSOLVE. WHEN YOU MOVE YOUR HANDS THROUGH IT SLOWLY, IT FLOWS LIKE LIQUID. HOWEVER, WHEN YOU HIT IT HARD, WATER IS TEMPORARILY SQUEEZED OUT FROM BETWEEN THE TINY PARTICLES OF CORNSTARCH AND IT FEELS SOLID. RELEASING IT ALLOWS WATER TO FLOW IN BETWEEN THE PIECES AGAIN, AND IT NOW ACTS LIKE A LIQUID AGAIN.

14. MAKE A RAINBOW

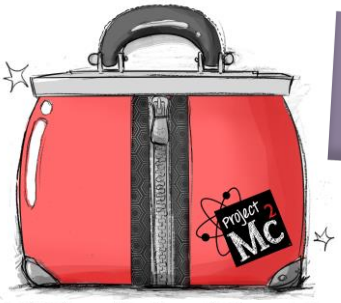
AN IMPORTANT PROPERTY OF LIQUID IS ITS DENSITY. WE CAN THINK OF THIS AS HOW HEAVY 1 CUP OF A LIQUID IS COMPARED TO 1 CUP OF WATER. HEAVIER LIQUIDS LIKE HONEY WOULD SINK IN WATER, AND LIGHTER ONES LIKE RUBBING ALCOHOL WOULD FLOAT. WE CAN USE THIS KNOWLEDGE TO CAREFULLY LAYER LIQUIDS OF DIFFERENT DENSITIES. THE HEAVIEST (MOST DENSE) LIQUID IS ON THE BOTTOM, AND THE LEAST DENSE LIQUID IS AT THE TOP.

15. DANCING RAISINS

RAISINS ARE MOSTLY WATER AND SUGAR, MAKING THEM SLIGHTLY HEAVIER THAN WATER. THIS MEANS THEY SINK. THE CARBON DIOXIDE BUBBLES IN SODA ARE VERY LIGHT, SO THEY FLOAT. THE HEAVY RAISINS ARE ABLE TO CATCH A RIDE WITH THE RISING BUBBLES. AS THE RAISINS REACH THE TOP, THE BUBBLES POP AND THE RAISINS SINK BACK DOWN. IT HAPPENS OVER AND OVER AGAIN.

16. LOOK THROUGH YOUR MICROSCOPE

LOTS OF AMAZING THINGS ARE AROUND US, BUT THEY ARE JUST TOO SMALL TO EASILY SEE. A MICROSCOPE ALLOWS US TO LOOK AT THE DETAILS OF SMALL OBJECTS. SALT, WHICH SEEMS TO BE JUST A POWDER YOU PUT ON YOUR FOOD, IS MADE OF THOUSANDS OF TINY CRYSTAL CUBES. A PICTURE FROM A NEWSPAPER IS MADE OF TINY DOTS, AND LEAVES HAVE INTRICATE PATTERNS THAT CAN ONLY BE APPRECIATED WITH A MICROSCOPE.



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