PQRST Science Journal

Group Table 1

scientist's name

Notice, Wonder, and Learn

Digital Journal

BY NC SA

DaNel Hogan-STEMAZing.org, Brooke Meyer-SARSEF, and Sherrie Dennis-STEMAZing and SARSEF

SLIDESMANIA.COM

Phenomenon

Questions

Research Investigation

Science Story

Thinking More

SLIDESMANIA.COM

Draw and Label Phenomenon

Add a Google drawing or take a picture and insert in this slide.

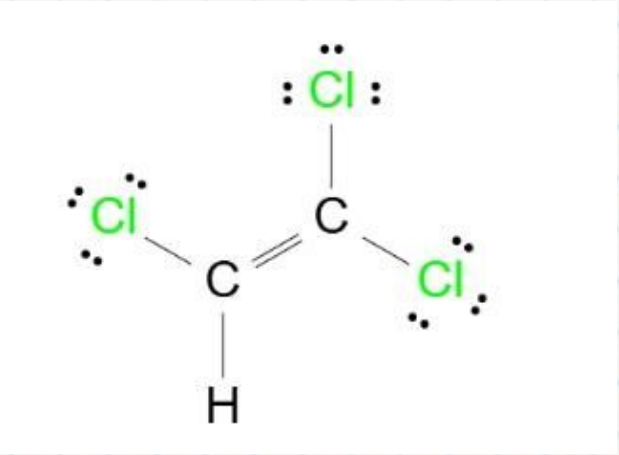
Trichloroethylene (C_2HCl_3)

EN Diff.
Cl 3.16
C -2.55
0.61

Moderately Polar Covalent

EN Diff.
C 2.55
H -2.20
0.35

Non-Polar Covalent



Unbonded pairs on Cl (high EN)
Strong bond → dipole, dipole.

Phenomenon Polarity & Degreasing

SLIDESMANIA.COM

Phenomenon observations

I notice the moderately polar covalent chlorine and carbon EN diff. total is higher than the non-polar covalent carbon and hydrogen EN diff. total.

I notice that this example is a dipole-dipole bond.

I notice the chlorine atoms are bonded with only the carbon atoms, not the hydrogen atom.

I notice these chlorine atoms have a high electronegativity level, making it polar.

I notice that the carbon and hydrogen atoms are non-polar because it

SLIDESMANIA.COM

Questions

I wonder why...? I wonder if...? I wonder what...? I wonder how...? I wonder what would happen if...?

I wonder if we can predict a better, safer, less toxic, green chemistry degreaser replacement to TCE using our knowledge of inter & intramolecular forces?

I wonder if the type of dipole-dipole reaction would change if there was a oxygen, nitrogen, or fluoride atom bonded to the hydrogen atom and does could a potential change make this a good replacement?

I wonder how affective, if at all, this chain/bond would be as a replacement degreaser to TCE?

I wonder ___?

I wonder ___?

I wonder ___?

SLIDESMANIA.COM

Sodium Percarbonate, SLS, Aqueous Detergent

List all materials and equipment (be as specific as possible with quantity and type)

- Distilled H_2O (180 mL)
- Sodium Lauryl Sulfate (SLS) 18 mL
- Sodium Percarbonate 4.28 g
- ?
- ?
- ?
- ?
- ?
- ?
- ?
- ?
- ?
- ?
- ?

SLIDESMANIA.COM

Ethanol, Sodium Bicarbonate, SLS, Aqueous Detergent

List all materials and equipment (be as specific as possible with quantity and type)

- Distilled H_2O (188 mL)
- Ethanol 5.8mL
- Sodium Bicarbonate 2.4 g
- Sodium Lauryl Sulfate (SLS) 3.4 mL
- ?
- ?
-
- ?
- ?
- ?
- ?
- ?
- ?
-

SLIDESMANIA.COM

Food Grade D-Limonene

List all materials and equipment (be as specific as possible with quantity and type)

- Nature's Orange (D-Limonene) 200mL
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

SLIDESMANIA.COM

Play to Learn More

Tinker and experiment with materials and equipment you have available to explore how everything works.

I notice _____

I notice _____

I notice _____

I notice _____

I notice _____

SLIDESMANIA.COM

Even More Questions

I wonder why...? I wonder if...? I wonder what...? I wonder how...? I wonder what would happen if...?

Now I wonder how does the better degreaser differ from the worse one?

Now I wonder ?

ONow I wonder how different degreasers compare in their effectiveness at removing grease?

Now I wonder____?

Now I wonder____?

Now I wonder____?

SLIDESMANIA.COM

Research Investigation (Experiment)

Independent Variables (a variable manipulated or changed by the experimenter-think "I" control it)

The different degreasers →

Distilled H_2O (188 mL)

Ethanol 5.8mL

Sodium Bicarbonate 2.4 g

Sodium Lauryl Sulfate (SLS) 3.4 mL

Dependent Variables (a responding variable which could vary depending on other factors and can be measured and/or calculated with available equipment)

How much oil was removed (percentage) after degreased by the different mixtures.

SLIDESMANIA.COM

Testable Question (can be answered with a claim based on evidence from a scientific experiment)

How will changing ___The degreaser___

Independent variable selected for testing

affect __the percentage mass degreased__?

dependent variable selected for testing

SLIDESMANIA.COM

Multiple Hypotheses/Predictions (consider every possible claim you might be able to make once you collect data)

1. Direct Relationship

Increasing the _____ will **increase** the _____
independent variable selected for testing *dependent variable selected for testing*

2. Indirect Relationship

Increasing the _____ will **decrease** the _____
independent variable selected for testing *dependent variable selected for testing*

3. No Relationship

Increasing the _____ will **not change** the _____
independent variable selected for testing *dependent variable selected for testing*

SLIDESMANIA.COM

Draw and label experimental setup

Add a Google drawing or take a picture and insert in this slide.

Male pipe fittings

SLIDESMANIA.COM

Experimental Procedure (detailed enough to allow data collection to be repeated exactly as you collected it)

Note: Control Variables (all independent variables not selected for testing must be given a set value or controlled. These controlled settings must be explicitly noted in the procedure.)

Our experimental procedure was conducted by applying a set amount of grease on a metal fitting and trying a sulfate percarbonate cleanser. We checked the weight of the metal fitting before, set the scale, and check the weigh after. Then we mixed the sulfate percarbonate with our water beakers and made the solution to put in our ultrasonic cleaner. Then we put our three metal fittings with grease in the ultrasonic cleaner and set to clean for 5 minutes. After we left them to dry standing up, then redid the entire procedure a second time for an another trial.

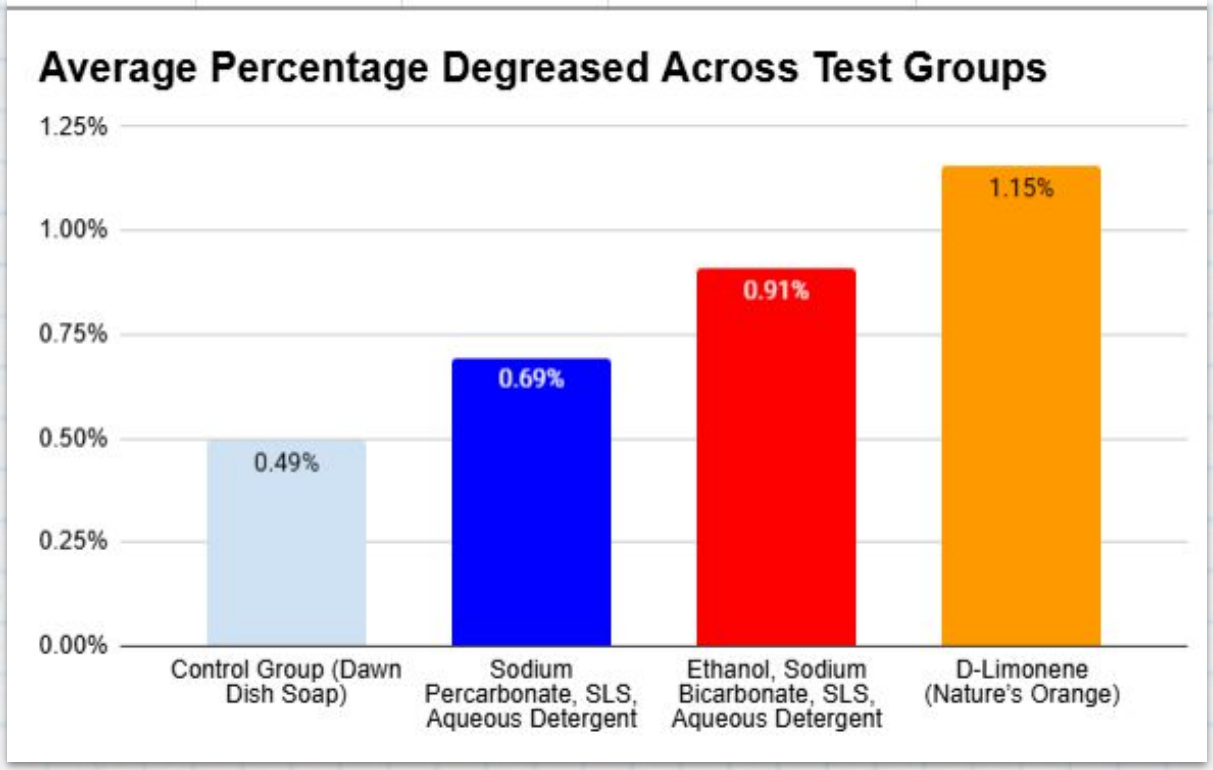
SLIDESMANIA.COM

	Piece I					Piece II				
Independent Variable (alternative degreaser) ⬇️	Mass of fitting	Mass of Fitting & Grease (1 g)	Mass of fitting & Grease 5 minutes after degreasing	% remaining	% degreased	Mass of fitting	Mass of Fitting & Grease (1 g)	Mass of fitting & Grease 5 minutes after degreasing	% remaining	% degreased
Control Group (Dawn Dish Soap)	23.79	23.62	23.81	100.80%	**-0.80%**	23.75	23.96	23.75	99.12%	**0.88%**
Sodium Percarbonate, SLS, Aqueous Detergent	23.66	23.96	23.78	99.25%	**0.75%**	23.75	24.1	23.94	99.34%	**0.66%**
Ethanol, Sodium Bicarbonate, SLS, Aqueous Detergent	23.78	23.93	23.76	99.29%	**0.71%**	23.73	24	23.79	99.13%	**0.88%**
D-Limonene (Nature's Orange)	23.76	24.41	23.88	97.83%	**2.17%**	23.77	24.31	23.83	99.50%	**0.50%**

Mass of fitting	Mass of Fitting & Grease (1 g)	Mass of fitting & Grease 5 minutes after degreasing	% remaining	% degreased		Average % degreased
23.79	23.96	23.83	99.46%	**0.54%**	Control Group (Dawn Dish Soap)	**0.49%**
23.71	24.04	23.84	99.17%	**0.83%**	Sodium Percarbonate, SLS, Aqueous Detergent	**0.69%**
23.72	24	23.77	99.04%	**0.96%**	Ethanol, Sodium Bicarbonate, SLS, Aqueous Detergent	**0.91%**
23.71	23.96	24.12	100.67%	**-0.67%**	D-Limonene (Nature's Orange)	**1.15%**

SLIDESMANIA.COM

Dependent Variable Name vs. Independent Variable Name



Dependent Variable Name (units)

Independent Variable Name (units)

SLIDESMANIA.COM

Data Observations (What do you notice as you look at the raw data collected in the data table and at the graphical representation of the data?)

Based on all of the raw data taken and collected from the degreasing experiment, D-Limonene does the best during batch 2 in piece 1 and piece 2.

SLIDESMANIA.COM

Science Story (Using Claim, Evidence, and Reasoning, share the story the data tells and the science explains.)

Claim (answer to investigation question, should either be one of your hypotheses from page 7 or a new claim you had not considered)

Our non polar molecule of a different degreaser was D-Limonene and it had a high efficacy of emulsification.

Evidence (cite data from the experiment to support the claim)

From our raw data from our experiments, it shows that, out of four alternative molecules from different degreasers, D-limonene had an outcome of 1.15% efficacy degreased.

SLIDESMANIA.COM

Science Story continued using CER

Reasoning (connect evidence to claim using scientific principles and rules)

When comparing the other degreasers, D-Limonene had a higher % degreased than the other 3 alternatives. When analyzing D-Limonene, it is non-polar, while the other alternatives are polar. It can be inferred that iit performed the best because it was the only non-polar molecule.

Peer Critique of CER (is there another way to interpret the data? Is there something they might not have considered? Is there another explanation which could connect the evidence to the claim?)

The claim is specific, clear, and it directly answers the investigation question. The evidence and reasoning in the CER, are great examples of credible and relevant experiments taken to show the best alternative degreasers.

SLIDESMANIA.COM

Thinking more..

Now I wonder why...? Now I wonder if...? Now I wonder what...? Now I wonder how...? Now I wonder what would happen if...?

Now I wonder ____?

Now I wonder ____?

Now I wonder ____?

Now I wonder ____?

Now I wonder ____?

Now I wonder ____?

SLIDESMANIA.COM

THANK YOU!

Digital Notebook made by:

SlidesMania

SLIDESMANIA.COM