



Experimentell kemi - Gävle 2017

Part 1

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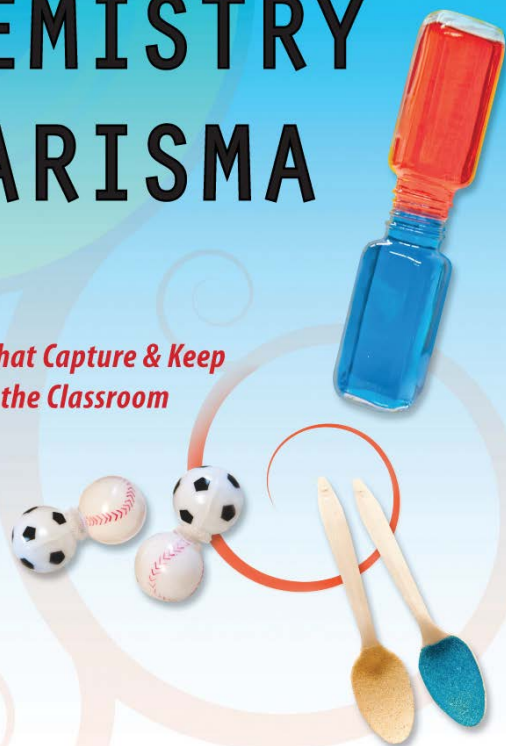
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www.terrificscience.org

*In addition to things we do with you
check out our resources at*
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CHEMISTRY with CHARISMA

*24 Lessons That Capture & Keep
Attention in the Classroom*



Terrific Science Press, with funding from the National Science Foundation, Ohio Board of Regents,
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volume 2 CHEMISTRY with CHARISMA

*MORE
28 Lessons That Capture & Keep
Attention in the Classroom*



Terrific Science Press, with funding from the National
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**Miami
University**



Play is learning without punishment!

If I were to present myself before you with an offer to teach you some new game—
If I were to tell you an improved plan of throwing a ball,
of flying a kite, or
of playing leapfrog,
Oh, with what **attention** you would listen to me!

Well, I am going to teach you many new games.
I intend to instruct you in a science full of

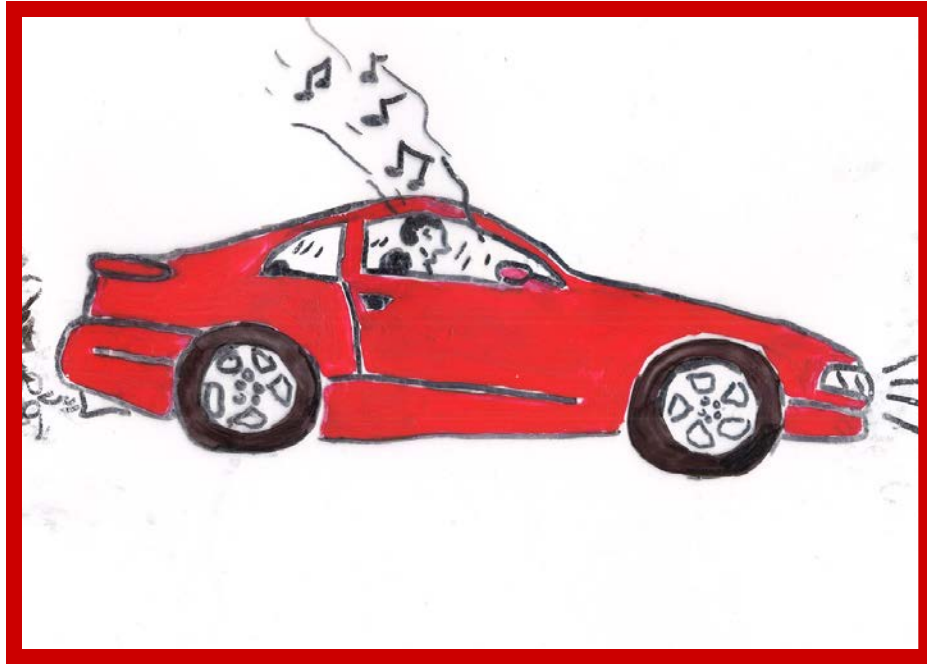
interest, wonder, and beauty

a science that will afford you amusement in your youth, and riches in your more
mature years.

In short, I am going to teach you the science of **CHEMISTRY!**

— Dr. Scoffern, Devonshire, England,
Chemistry No Mystery, 1848

Where Would We Be Without Chemistry?

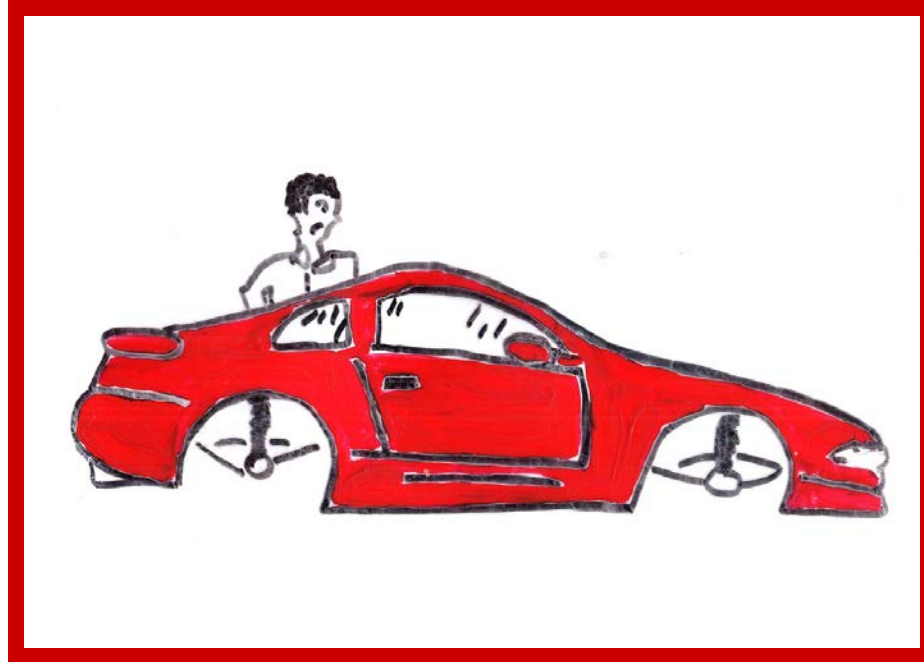


Where Would We Be Without Chemistry?



no chemical reactions

Where Would We Be Without Chemistry?



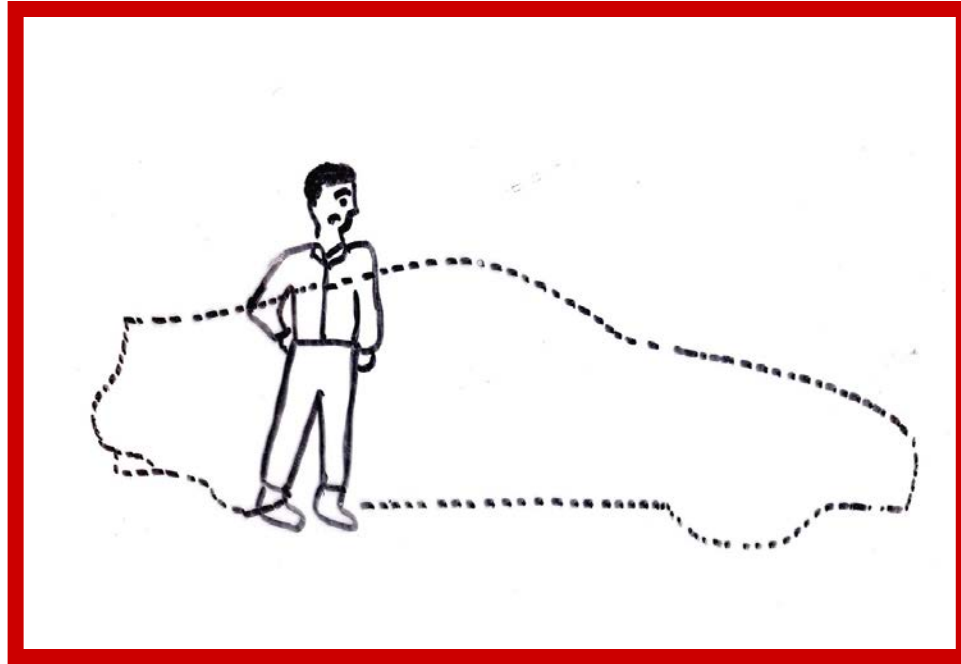
no leather or rubber

Where Would We Be Without Chemistry?



no paint or coatings

Where Would We Be Without Chemistry?



no metals or polymers

Where Would We Be Without Chemistry?



No fabrics

Where Would We Be Without Chemistry?

70 kg male

H ₂ O	—————	50.1 kg
C	—————	12.6 kg
N	—————	1.8 kg
Ca	—————	1.7 kg
P	—————	.68 kg
K	—————	.25 kg
Na, Mg, Fe, etc	—	.32 kg

Where Would We Be Without Chemistry?

No you!



TIMSS and PIRLS in Sweden

Chemistry instruction should give students the opportunity to:

- examine information
- communicate
- form an opinion on questions concerning energy, the environment, health, and society
- carry out systematic studies by formulating questions & plan, execute, and evaluate studies)
- use chemistry concepts, models, and theories to describe & explain chemistry in society, nature, and people.

Instruction

Teaching is about negotiation

Critical skills

- Big ideas – planning and referring to

- Provide framework for students to engage in active learning process

- Small group to whole group transitions – claims and evidence discussion

- Non threatening learning environment

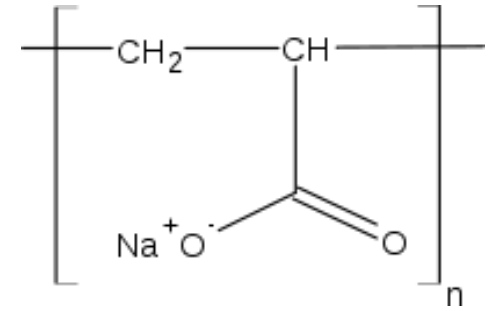
Align science instruction with what scientists do

What do scientists do?

How keen are your powers of observation?

The old shell game.

“Super Slurper” (Sodium Polyacrylate):
From Entertainment to...



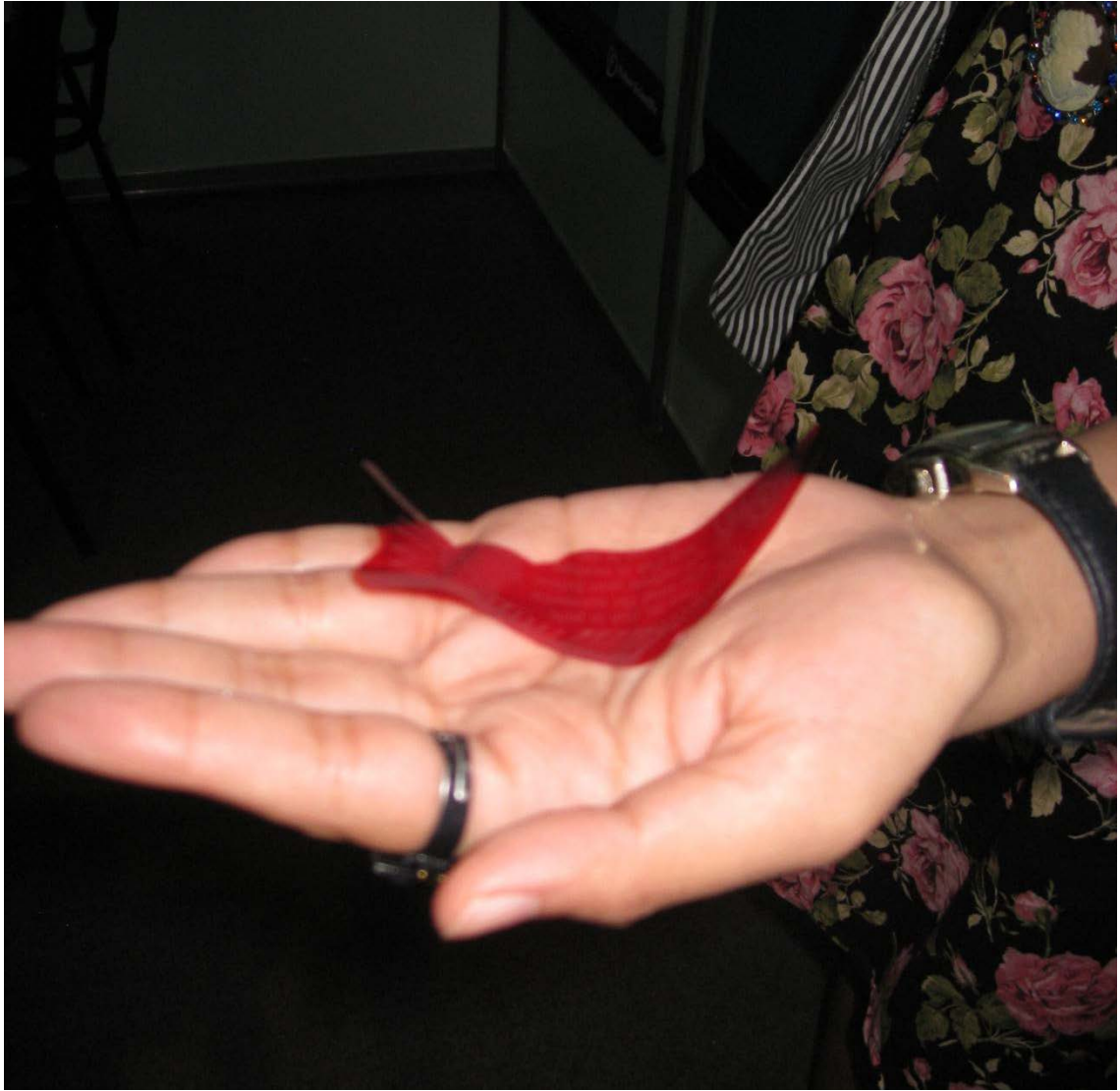
METHOD

- Students do an activity or observe a demonstration
- Students form testable questions
- Students devise an experiment to answer testable question
- Students make observations and collect data
- Students interpret data to provide evidence
- Students make a claim about the system they are investigating
- Students use evidence to substantiate their claims

Your next challenge:

make observations
formulate testable questions
design an experiment
collect evidence
formulate a claim









Hot Stuff:

Investigating Reusable Heat Packs



supersaturated sodium acetate solution

Crystallizing the Supersaturated Solution



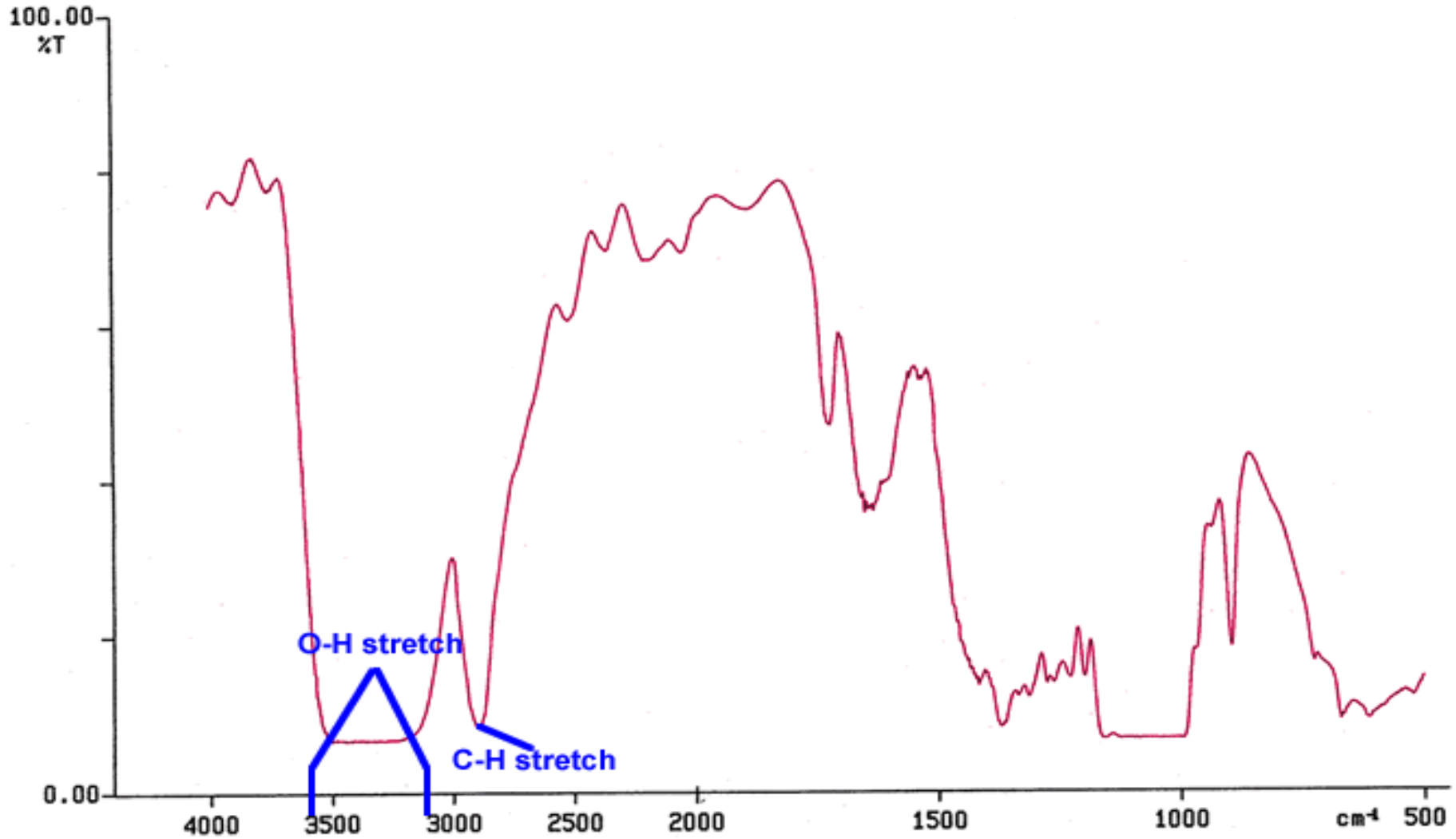
- How much of the sodium acetate remains in solution after this crystallization process?
- Design an experiment to determine the amount of heat required to recrystallize this solid.



***Additional research & literature
reveals***

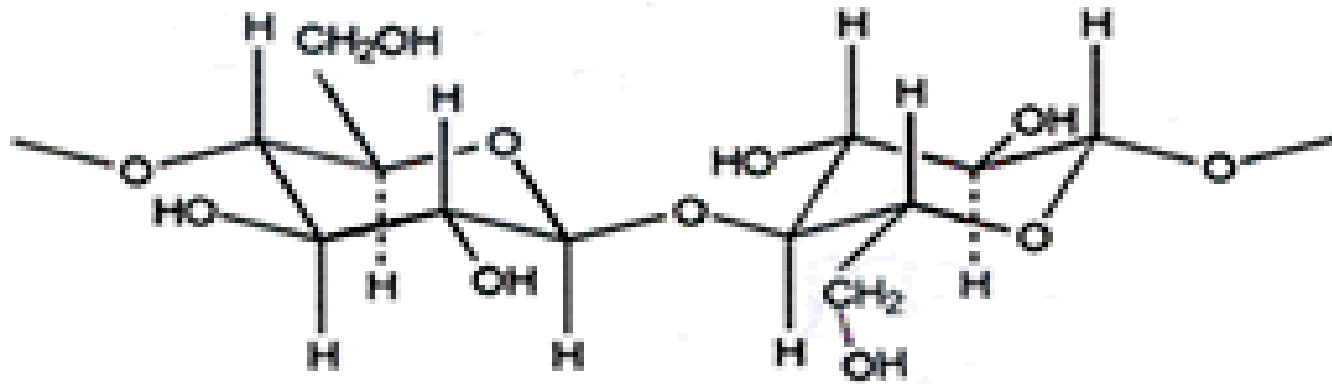
Fortune Telling Fish
Non-moisture-resistant cellophane

PERKIN ELMER



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Fourier Transform Infra Red Spectrometer (FTIR)

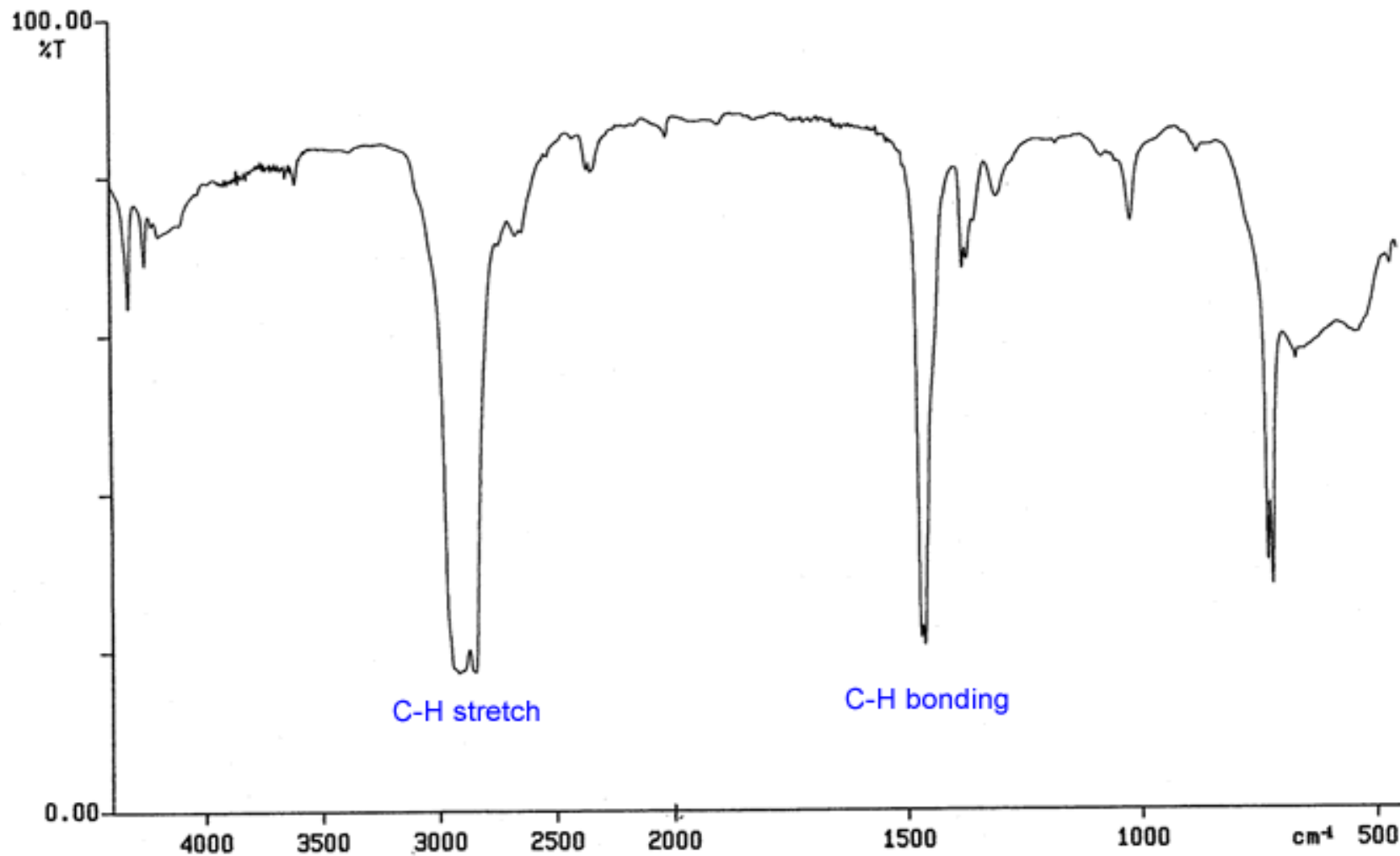
the fish is made of



Cellulose

Wrapper for Fortune Telling Fish

PERKIN ELMER

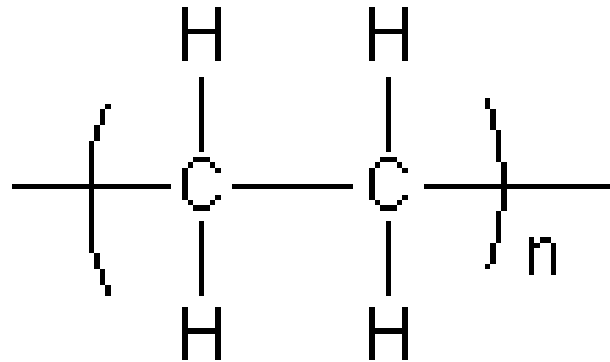


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Fourier Transform Infra Red Spectrometer (FTIR)

the wrapper is made of



Polyethylene

SCIENCE

Argument-based inquiry

- Testable Questions
- Design appropriate investigations
- Data collection and analysis
- Make a claim
- Evidence

Construction and Critique (practices of science)

Interpreting data

- **“This isn’t working.. My results are wrong”**
 - Evidence is what it is..
 - Even if the results may be unexpected
- **“nothing is happening”**
 - No noticeable change is valuable information
- Experiments are repeated many times to show **reliability** of data/observations

BIG BEN

Gathering Evidence



Testing if the type of hanger affects the results

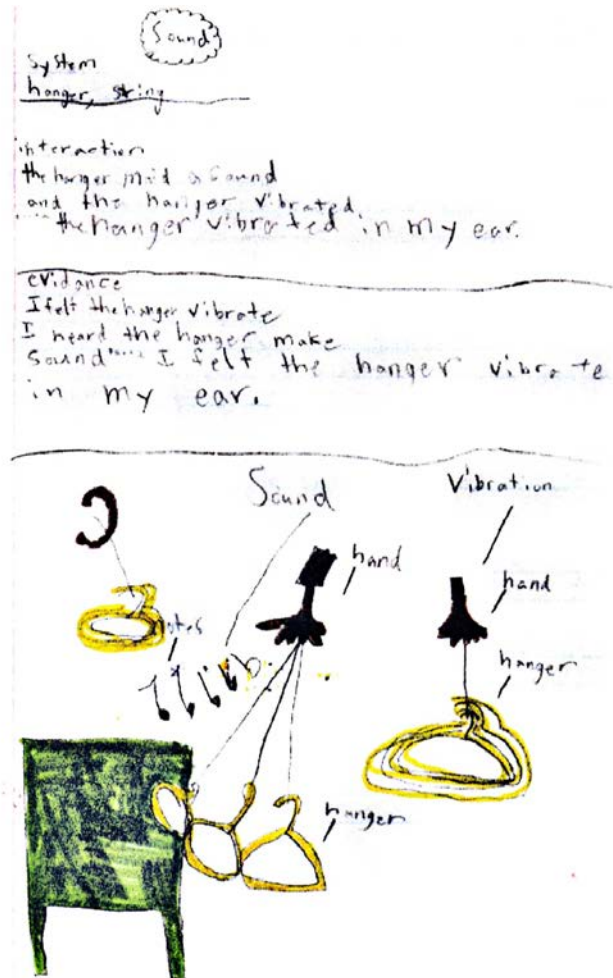


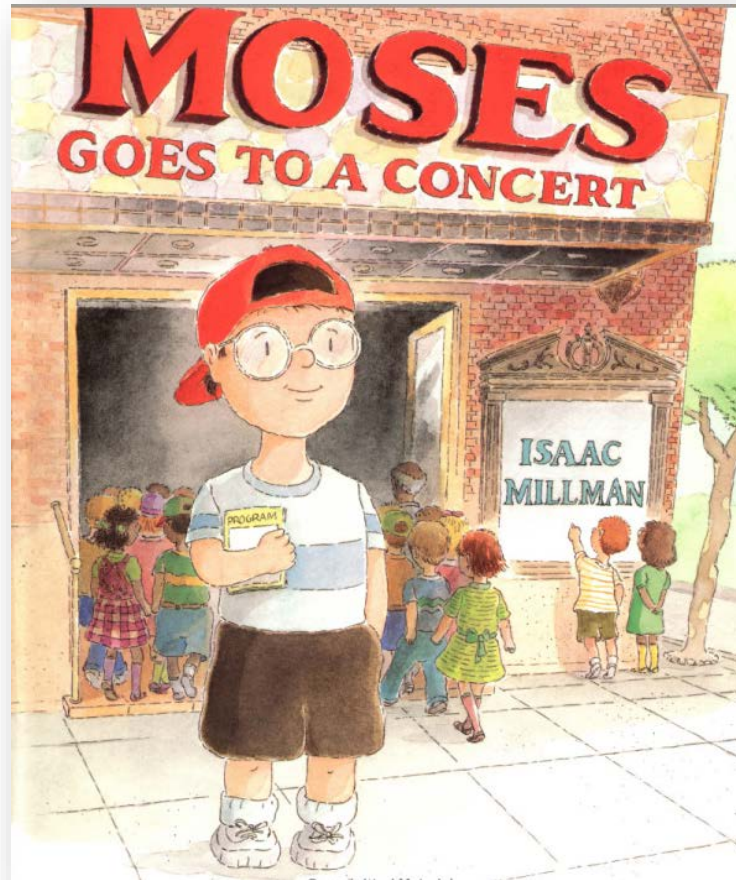


Testing if the length of the string affects the results



Grade 2 student's claim
with substantiating
evidence





ISBN 0-374-35067-1

What types of observations?



Qualitative Observations

Quantitative Observations

*Discrepant events are only possible if
prior experience would tell you otherwise*

“Expect the unexpected”

Chinese proverb



Students do science by

- using observational skills
- forming testable questions
- designing experiments
- data collecting
- analyzing data to provide evidence for a claim that can be defended



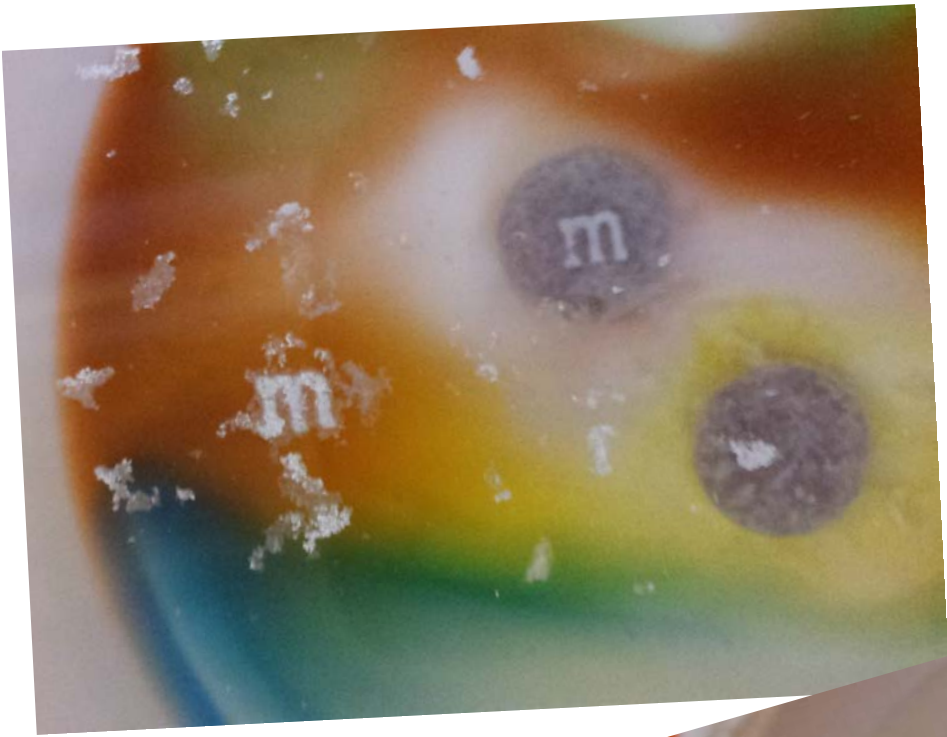
Teachers set the perimeters

(asking students)

- Is there something you observed about your system that led you to ask this question?
- What materials will you need for your experiment?
- What data will you need to gather in order to answer your question?
- What tools and methods will you use to collect this data?

Student-generated Testable Questions

- Do all the colors act similarly?
- Does the temperature of the water affect the dissolving rate?
- If more than one M&M are in the same bowl, will the colors mix?
- Will the results be the same if I use oil instead of water?
- What will happen if I stack M&M's in a test tube instead of a bowl? Will the order of stacking make a difference?
- Are the results different if I pour the water over the M&M's as opposed to dropping them into water?
- Do different types of M&M's (peanut, pretzel) act similarly?
- Do other types of hard-shelled candy (Skittles, Reese's pieces) act in a similar manner?
- Is the color that dissolves in a sphere completely surrounding the candy?
- Would a colored sugar solution dropped in water act similarly?



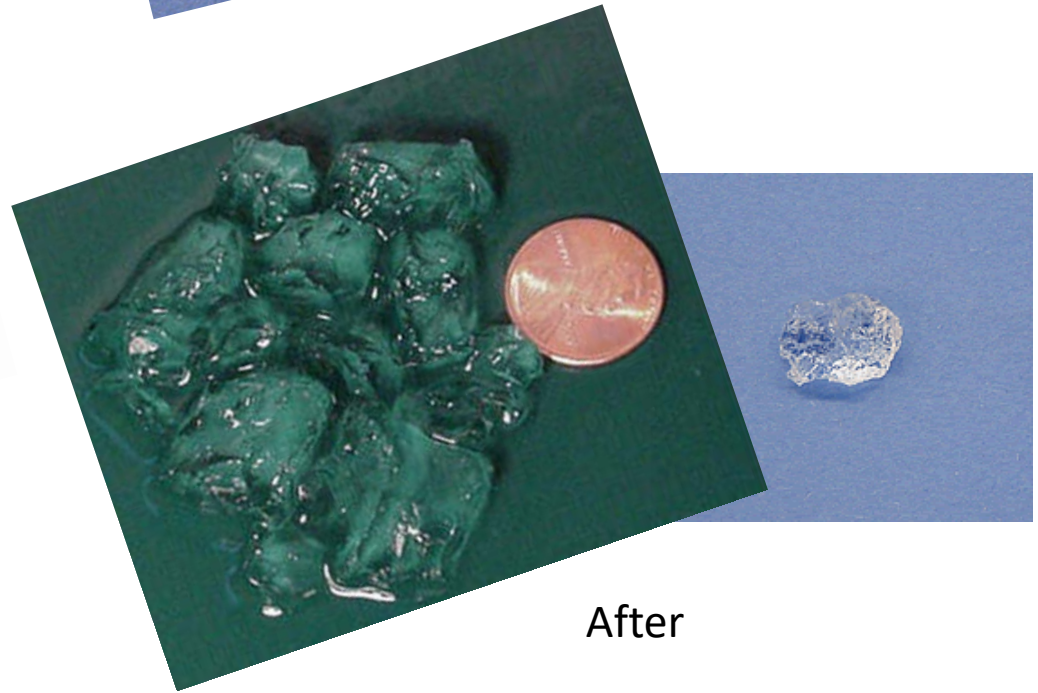
Magic or Science?



sodium polyacrylamide

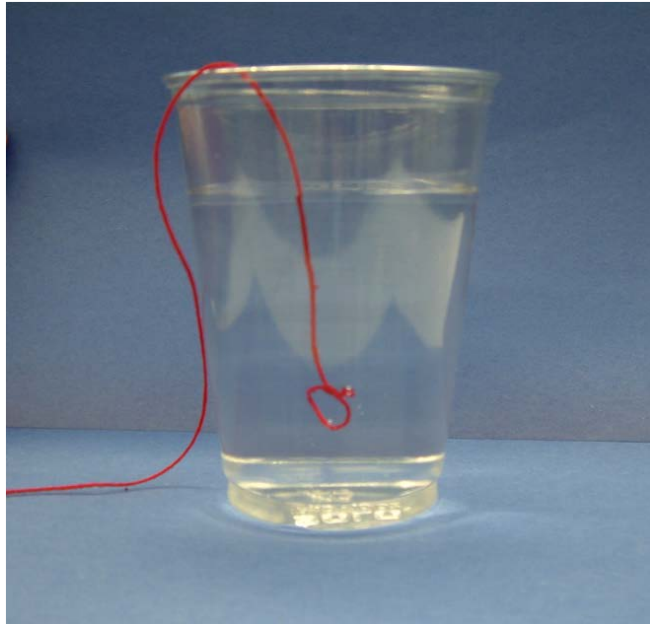


Before



After

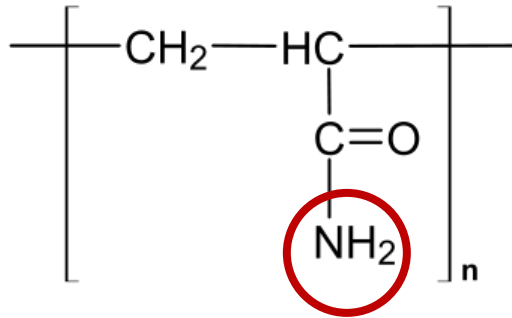
Magic or Science?



Water saturated polymer
has same index of
refraction as water



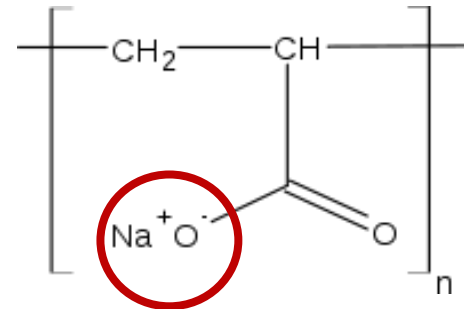
close relatives



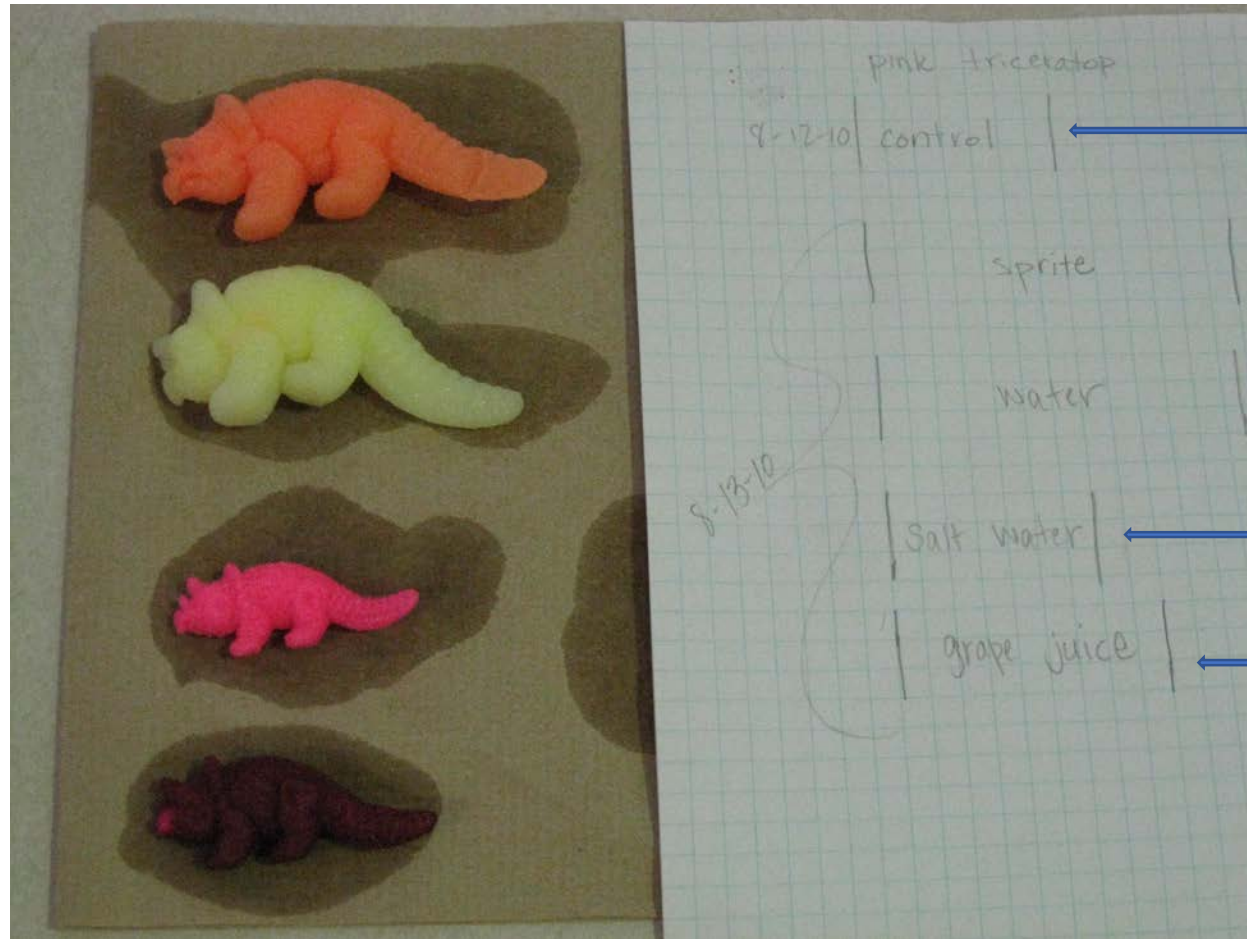
polyacrylamide
Soil Moist

sodium polyacrylate

‘Where’d the water go?’ demo



Gro-Dinos



control

sprite

water

salt water

grape juice



Tracing and counting
squares to estimate
growth over time



ISBN_ 0-06-444186-5

Reunite the *FUN* and *MENTAL* aspects
of scientific play !

By combining the *fun/hands-on* and
mental/minds-on aspects of science teaching
and learning, we have found that **BOTH**
increased motivation and understanding result.