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What are our learning goals in a lab?

- Observing key phenomena first-hand
- Building Hands-on Skills with lab equipment
- Making careful measurements, collecting aggregate data to analyze
- Learning to use key instrumentation & interpret results

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Observing key phenomena	Building Hands-on Skills with lab equipment	Making careful measurements, collecting aggregate data to analyze
<ul style="list-style-type: none"> • Is it physically interactive (i.e. feel a texture or temperature change?) • Is it more visually impressive in person or can it be conveyed over video? • Can you allow students to design parts of the experiment such as incorporating safe at-home materials? 	<ul style="list-style-type: none"> • Are there key skills they can learn by handling specific equipment? • Is there equipment that can be used for multiple activities? • Are there some skills that could be caught up on once we're in person? 	<ul style="list-style-type: none"> • What data can be obtained from home? • What can be supplied from past experiments or TAs? • Can you take advantage of increased time to focus on data analysis?

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Case Study: Limiting Reagents Lab

2g I₂ 2g Zn

$Zn + ZnI_2$

Goals:

- 1) Visually observe a leftover limiting reagent
- 2) Take mass measurements before and after the reaction to calculate molar amounts



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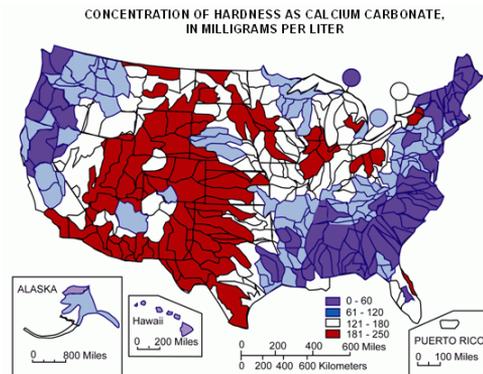


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Use home to your advantage!

- Think about what we can observe in our daily lives – how can that be used and explained with class material
- Examples:
 - Measuring hardness of tap water across the country
 - Exploring conductivity of different household items
 - Scavenger hunt for acids and bases using pH meter and indicator
 - Testing antacids

How does your tap water compare?



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But consider new risks from an uncontrolled environment...

Healthy Child Care

Indoor Safety

Keep children safe from common hazards.

- 1 Poison, toxic things
- 2 Choking hazards
- 3 Hot things
- 4 Sharp things
- 5 Pinching hazards
- 6 Electrical shock hazards



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Design a kit for Home Safety



- Identify potential hazards and send appropriate PPE
- Minimize amounts – the dose makes the poison (EX: baking soda)
- Rework protocols to minimize tools, small parts, or other components unnecessary to learning goals
- Keep things contained and be explicit about clean-up and storage protocols

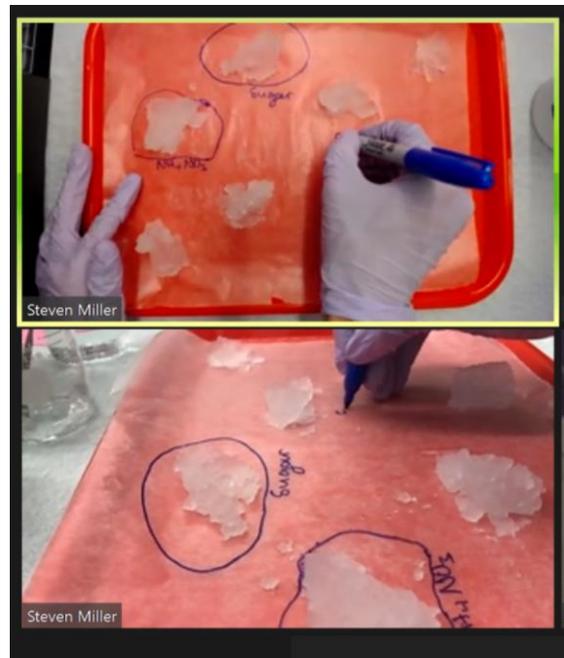


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Practice on camera with identical equipment!

- Practice in front of others!!
- Use identical supplies and equipment as the students to avoid confusion
- Use multiple camera angles
- Label clearly
- Think about what process needs to be demonstrated – is it better in real time or pre-recorded?
 - Recordings allow you to pause, rewind, and add additional commentary
 - Live demos allow students to observe you troubleshooting and more easily repeat simple actions for emphasis



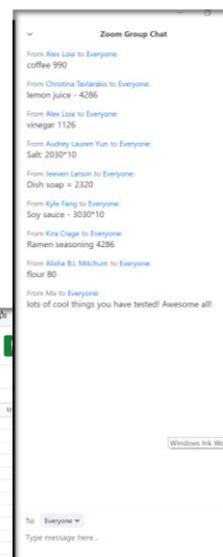
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Collect data together

Substance Tested	Chemical Formula	Prediction	Observations
Sugar	$C_{12}H_{22}O_{11}$		
Moth balls	$C_{10}H_8$		
Baking soda	$NaHCO_3$		
Urea (in urine)	CH_4N_2O		
Bath salt			

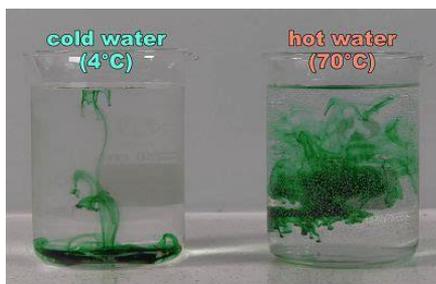
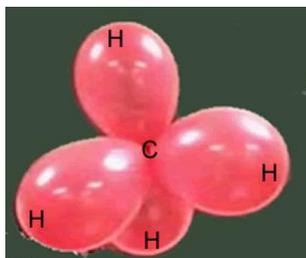
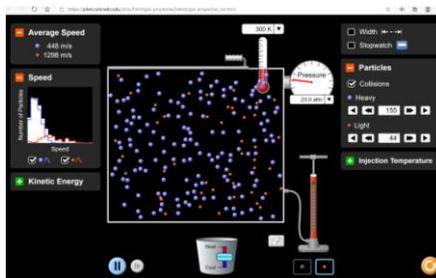
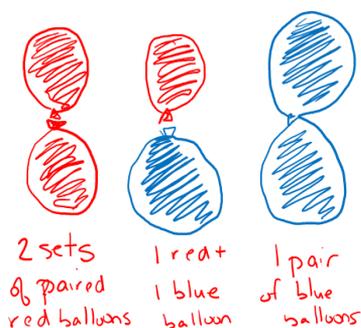
Lab 5 - Calorimetry Data

	CaCl2	change in temp (K)	mL of water	Group	Sodium Bicarbonate	Mass	change in temp mL of water	Group
1	8.0g	12.5	100	Sarah and Owen	$NaHCO_3$	4.07 g	-1.4	100 Jarbo
2	8.0 g	5	200	Sarah and Owen	$NaHCO_3$	4.0 g	-2.8	100 Sarah and Owen
3	8g	6.1	200	JZ	$NaHCO_3$	4.0 g	-1.2	200 Sarah and Owen
4	8g	5.9	200	Andy + Carvaggio	$NaHCO_3$	4g	-6.3	200 JZ
5	8.23 g	11.9	100	Erica	$NaHCO_3$	3.95g	-1.9	100 Erica
6	7.89g	10.9	100	Tina	$NaHCO_3$	3.94 g	-1.9	100 Tina
7	7.90 g	12.6	100	Jarbo	$NaHCO_3$	4.0g	-1.6	200 Andy + Carvaggio

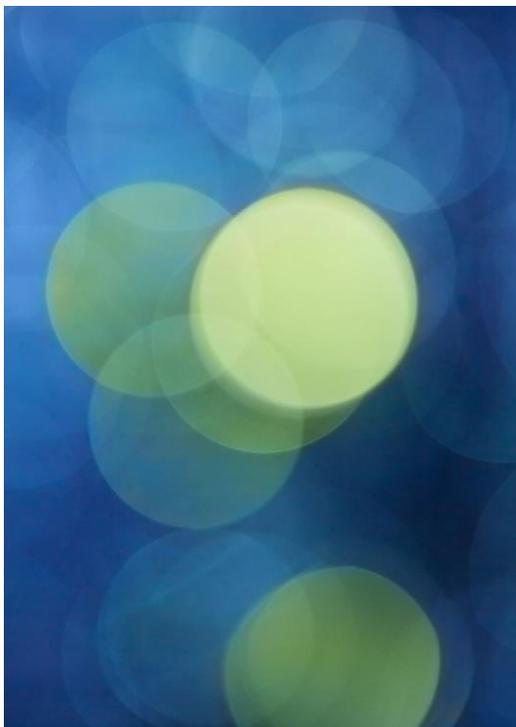


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Keep it simple! Focus on careful observation



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Now it's your turn! Consider:

What is one learning goal I expect my students to accomplish through a hands-on activity? What part of the activity accomplishes this goal?

Is there a portion of an activity for which I could easily supply home materials that accomplishes this? Are there safer components that accomplish the same thing?

What concepts in my course might relate to something students can observe in their home? Are there materials readily available in a house or supermarket that could be repurposed?

Many Thanks To:

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- Yuxuan Chen & Steven Miller, Summer TA's

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Q&A



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