

STEM Teaching Hacks Workshop #1: Student Participation

BRANDON CAMPITELLI, SARAH EICHHORN, KEELY FINKELSTEIN,
KRISTIN PATTERSON



The University of Texas at Austin

Texas Institute for Discovery

Education in Science

College of Natural Sciences

Workshop Expectations



The University of Texas at Austin

Texas Institute for Discovery

Education in Science

College of Natural Sciences

Warm-Up Activity

Arrange the active learning techniques in your envelope from “simple” to “complex”.



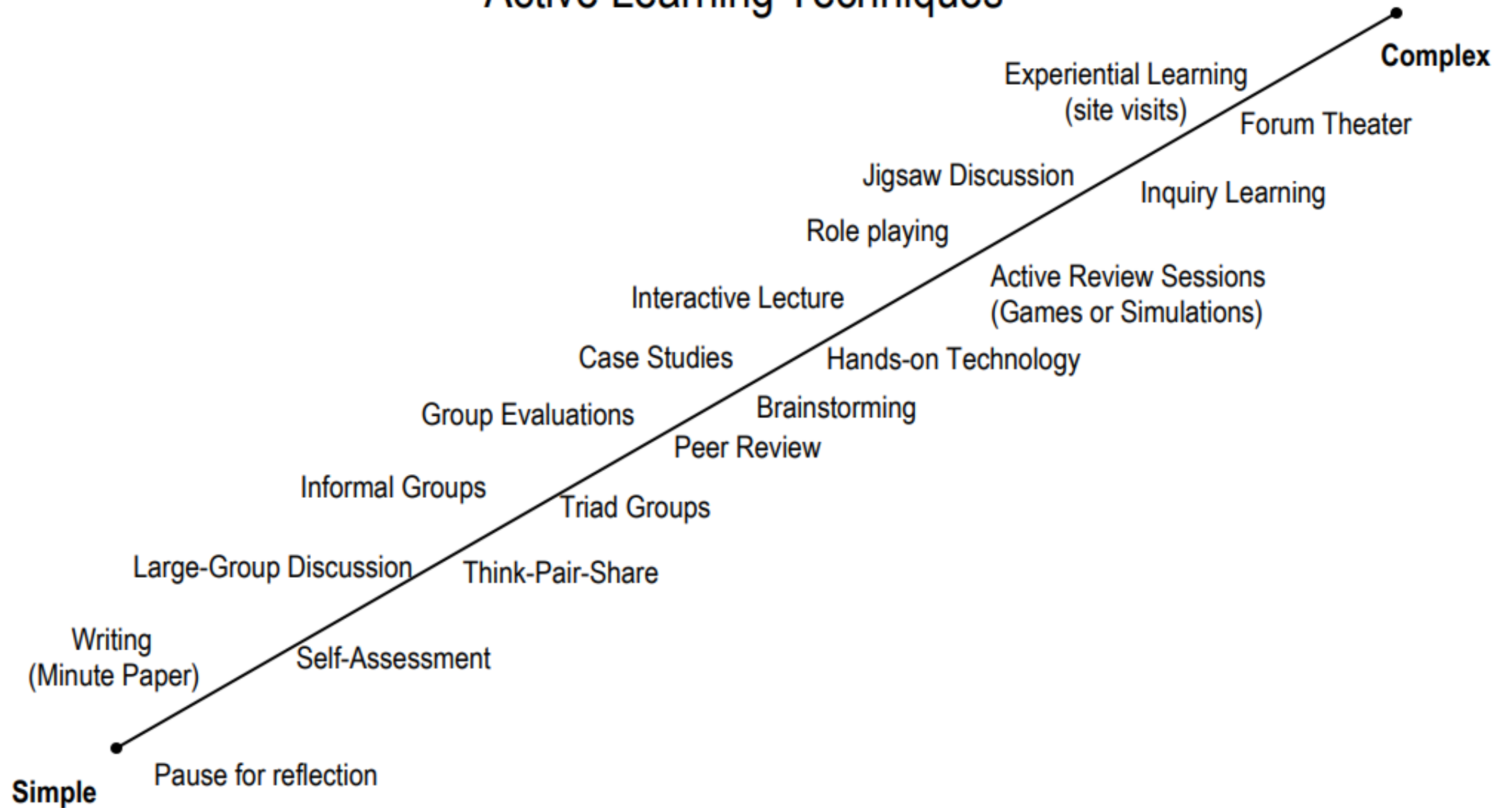
The University of Texas at Austin

Texas Institute for Discovery

Education in Science

College of Natural Sciences

Active Learning Techniques



This spectrum arranges active learning techniques by complexity and classroom time commitment.

Hack #1 – Sorting Tasks

Provide students slips of paper with words, phrases or pictures to be sorted in specified way



The University of Texas at Austin

Texas Institute for Discovery

Education in Science

College of Natural Sciences

Hack #1 – Sorting Tasks Examples

1. Calculus course team competition to sort definite integrals from smallest to largest value
2. Astronomy – sort phases of the Moon – rank from greatest to least the amount of the Moon's illuminated surface as visible from Earth.
3. Biology – classify animal body structures into categories based on function (eg, survival, mate acquisition, etc.)



Hack #1b – One Worksheet per Group

Providing just one copy of a worksheet for small groups encourages immediate collaboration.

You can make a copy of the handout available on the class website for those students who later want their own copy.



The University of Texas at Austin
Texas Institute for Discovery
Education in Science
College of Natural Sciences

Hack #2 – Vizia Video Participation

Vizia is a digital tool that lets you add interactions to any online video.

Great to use for pre-class video viewing.



The end of passive viewing

Engage viewers by integrating quizzes, polls, and CTAs into videos



The University of Texas at Austin
**Texas Institute for Discovery
Education in Science**
College of Natural Sciences

Vizia Demonstration

Hack #2 – Vizia Walkthrough

Set-up:

1. Go to <https://vizia.co/> .
2. Click “Get Started” and use your name and email to make an account (or use Google account).
3. Check your email to verify / activate your account.

Use:

1. Go to <https://vizia.co/> and click “Login” in the upper right.
2. Click “+ New Video” on upper menu bar.
3. Enter the URL of the desired video (Youtube works particularly well!) and click “Continue”.
4. Mouse over the bar below your video to add interactions.
5. Share the URL or use the embed code from the right-side of the screen to give to students.
6. Come back to your video in Vizia later by clicking “My Videos” and selecting the appropriate video. Click “Download CSV” from the right-side to view student responses to all the interactions.

Hack #2 – Vizia Video Participation Examples

1. Pre-lab preparation (eg, how to use a micropipette)
2. Flipped course pre-class viewing
3. Extension of in-class content
4. Alternative or supplement to textbook readings



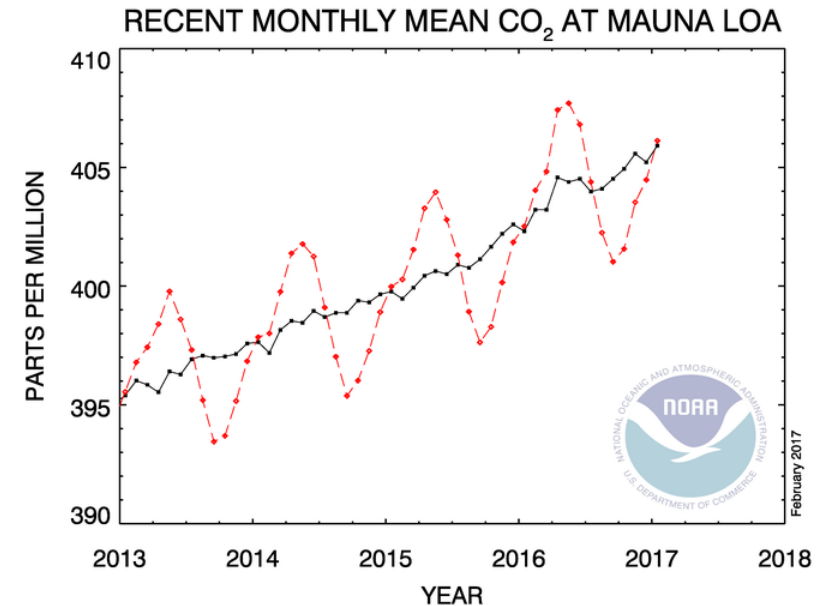
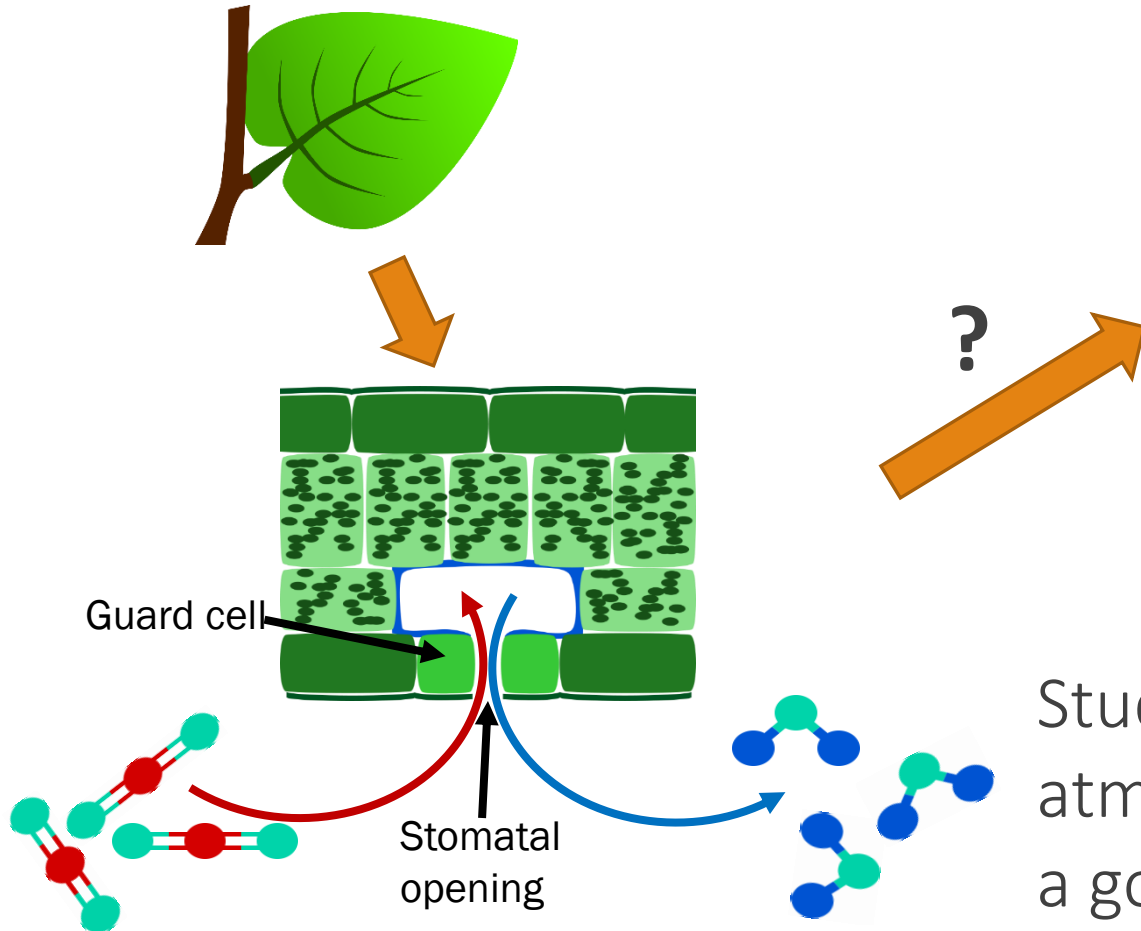
Hack #3 – Design Challenge

After exposure to some content, ask groups to design experiment or other item to apply the knowledge, then produce a product.

Group products can include ppt slide, written product, or presentation.



Hack #3– Example 1

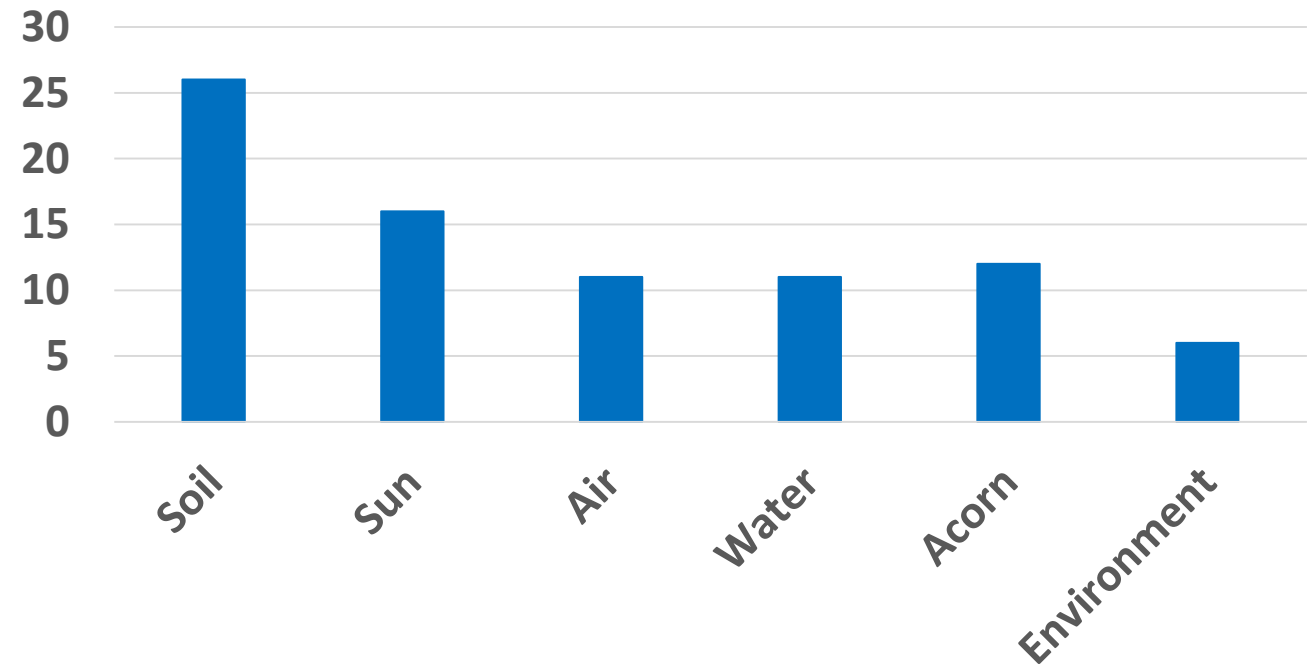


Students hypothesize response to increased atmospheric CO₂, design experiment, share a google slide, and give 2 min presentation.

Hack #3– Example 2



When asked where plants get the raw materials for growth...students answered:



How would you test the hypothesis that plants get the majority of their raw materials from the soil?



Hack #3 – Scaling up

1. Within class vs between classes
2. 20 (share with class) vs 80 students (share with another group)



Hack #3 – Design Challenge Examples

1. Linear algebra course – find a 5 by 5 non-triangular matrix with given set of eigenvalues
2. Genetics – Write a general formula for calculating the frequency of any genotype found at a crime scene.
3. Physics – Develop a 2-3 minute voice-over for a sports clip explaining the physics involved in the sport.



Hack #4 – Doc Cam Participation

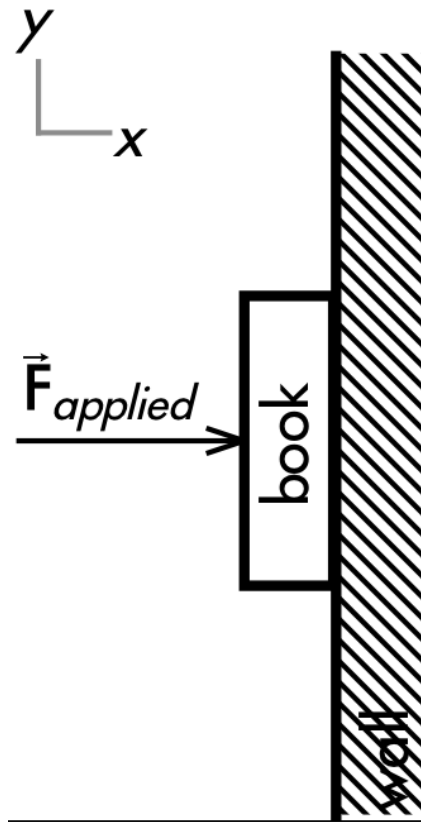
Group work and problem solving with written artifacts.

Artifacts can then be displayed on doc cam – Instructor can give feedback, show solutions.

Work can remain anonymous – but everyone benefits from seeing solutions, and different ways to solve problems.



Hack #4 Physics Problem Solving – Free body diagrams / Newton's laws



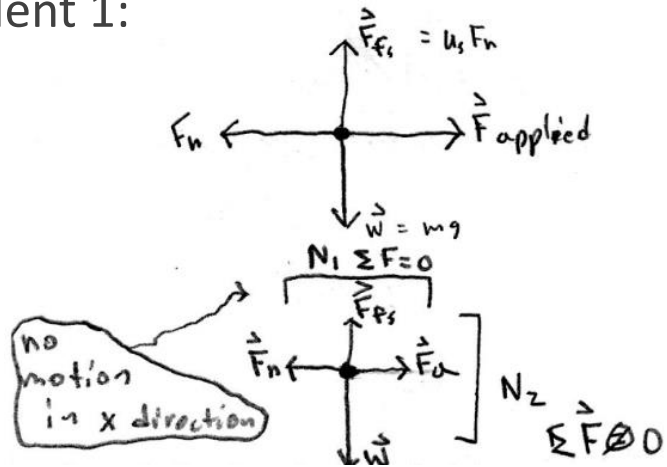
An applied force pushes horizontally on a book with just enough force to still keep it stationary against a vertical wall that is not frictionless.

Discuss why the book will begin to slide downwards if the magnitude of the applied force is slightly decreased. Explain your reasoning using free-body diagrams(s), the properties of forces, and Newton's laws.



Hack #4 Physics Problem Solving – Student Solutions

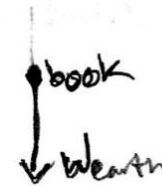
Student 1:



The force of static friction = $\mu_s F_n$
 so if the applied force is decreased, because of N_1 , F_n will also decrease, causing the \vec{F}_{f_s} to decrease. The \vec{W} will remain constant
 And move the book down N_2

Student 2:

The book will slide down because gravity will begin acting on the book.



Hack #4 Chemistry One Minute Write – Chemical Structures

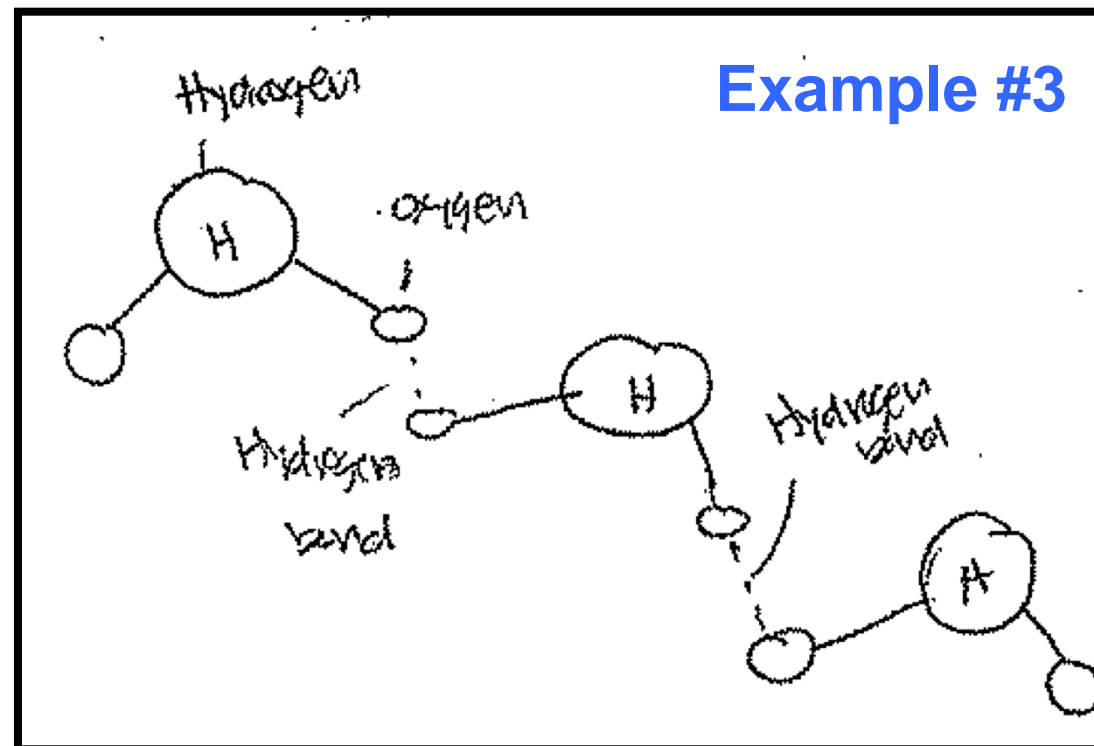
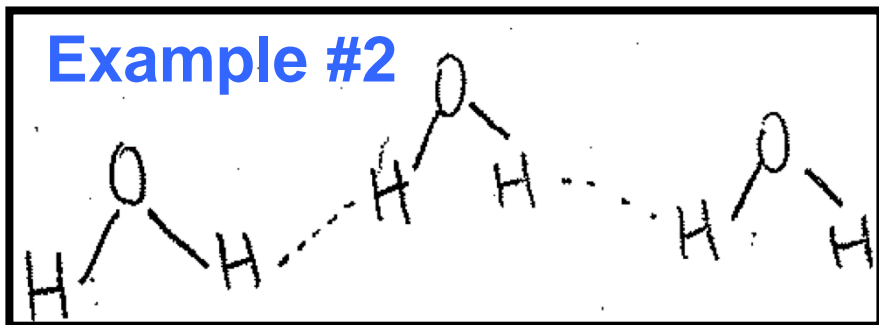
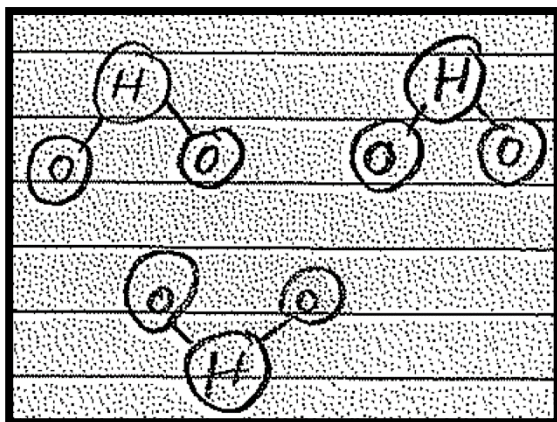
Draw a picture of 3 water molecules that are in this water bottle on your index card.

Include any details about the structure of water molecules that you can remember!



Hack #4 Chemistry One Minute Write – Individual Students' Answers

Example #1



Hack #4 – Doc Cam Participation Examples

Great for giving solutions and quick feedback on

1. any problem solving exercise
2. any type of drawing
3. multiple representations of data – equations, graphing, tables, written explanations.



Hack # 5 Demo Activity

Hack #5 – Poll Everywhere

Free tool for limited, real-time audience polling.

Nice substitute for clickers for occasional use.

Low overhead- no student downloads or account registration.



The University of Texas at Austin
Texas Institute for Discovery
Education in Science
College of Natural Sciences

Hack #5 – Poll Everywhere Walkthrough

Set-up:

1. Go to <https://www.polleverywhere.com/> .
2. Click “Get Started” and select “You’re Presenting”.
3. Use your name and email to make an account.
4. Answer two quick survey questions about intended use.

Prepare a poll:

1. Go to <https://www.polleverywhere.com/> and click “Login” in the upper right.
2. Click the red “Create” button in the upper left.
3. Click the poll type you would like to create (i.e. multiple choice, word cloud, Q&A, etc.)
4. Enter the question components in the blanks.
5. Click the blue “Create” button in the lower right.

Deliver a poll:

1. Click on the “My Polls” on the left menu bar.
2. Project from your computer.
3. Click on the desired poll to give to students.
4. Click on the tree-like, arrowed icon to start poll.

What would happen if you put a crisp stalk of celery in salt water?

When poll is active, respond at **PollEv.com/saraheichhor178**
Text **SARAHEICHHOR178** to **37607** once to join

It would remain crisp.

It would become limp.

It would not change.



1. Configure | 2. Test | 3. Present

- ▶ How people can respond
- ▶ Response settings
- ▶ Schedule lock/unlock times

Hack # 6 Demo Activity

Hack #6 – Peer-instruction

Your sister in-law calls to say she is having twins. Assume she is having fraternal, not identical twins.

Which is most likely?

- A. Twin boys
- B. Twin girls
- C. One girl and one boy
- D. All are equally likely



Hack #6 – Peer Instruction

- Students answer a clicker-style question that highlights a misconception or challenging concept.
- After answering, students discuss the question with a peer who chose a different answer.
- After discussion, all students respond again.



Hack #6 – Voting Question Databases

1. Physics - Colorado

<http://www.colorado.edu/per/resources/course-materials>

2. Carl Wieman – UBC – resource page for multiple disciplines “clicker questions / concept tests”

<http://www.cwsei.ubc.ca/resources/clickers.htm>

