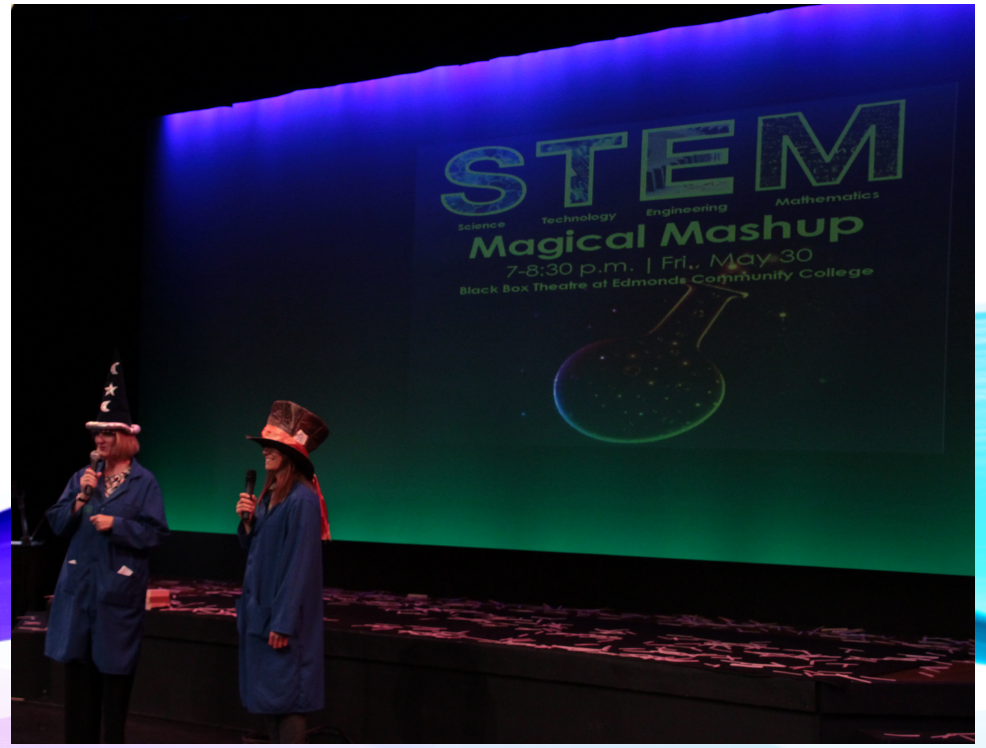
STEM MAGICAL MASHUP: OUTREACH AND EDUCATION

Heather Walsh

Edmonds Community College



Mission: Outreach

- **Target:** High School Students (RECRUITMENT), children of all ages, & community members.
- **Forum:** Annual STEM Magical Mashup show at BlackBox Theater
- **Agents:** General Chemistry 163 & Engineering 101 Students (RETENTION)
- **Funding:** **RISE** (Relationships in Science Education) - NSF-funded project.

Mission: Outreach & Recruitement

- **Personnel:** Public Relations Department – Marissa Pierce
  Snohomish Fire Marshall

- **Target:** Edmonds School District Office (Elementary → High School)

- **Forum:** Media
  - Social Media – Facebook, Twitter
  - Flyers, Posters, Digital signs
  - College Main Web Page, STEM & RISE web pages
  - Local paper announcements

Mission: Fulfill Course & General Education Learning Outcomes

- **Course-Level Learning Objectives (CLO's):**
  - Use critical thinking strategies to make connections and associations between chemical principles.
  - Interpret scientific data, draw appropriate conclusions, and make changes to experimental procedures.
  - Work effectively as a member of a team.

Mission: Fulfill Course & General Education Learning Outcomes

- **General Education Learning Objectives :**
  - **Communication Skills:** ***Communicate*** and interact effectively through a variety of methods appropriate to audience.

  - **Human Relations and Professional Development Skills:** ***Act*** responsibly in applying professional and academic standards associated with sustainable management of resources; and/or with success in educational, workplace, community, and group settings.

Mission: Fulfill Course & General Education Learning Outcomes

- **General Education Learning Objectives :**
  - **Quantitative Analysis/Symbolic Reasoning Skills: *Reason*** explore and create ideas; identify information needs; process, evaluate, and use information; and recognize, analyze and solve problems.

  - **Cultural Diversity Skills: *Explore*** and apply multiple perspectives in order to examine cultural differences and influences; maintain effective professional/working relationships; and/or interact effectively in multicultural settings.

Mission: Earn Service Learning Credit

- **Center for Service Learning:**
  - Teaching and learning strategy that integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic responsibility, and strengthen communities
  - Combine service objectives with learning objectives with the intent that the activity changes both the recipient and the provider of the service.
  - Database of student work
  - >50 hours service learning – award, >100 hours White House award

INTEGRATION: MAGIC SHOW

- Work in groups of 4 persons and each individual will research a chemical or engineering demonstration and write a paragraph describing the physics/ chemistry involved. Each individual must speak in the magic show.

- **Do not use toxic materials or materials that generate a lot of waste.** Keep this in mind when researching - for example do not choose an experiment using mercury. Be sustainable – keep costs low.

- Research the MSDS of each chemical – check for toxicity and waste disposal

(33% of Lab Grade-100 pts)

Assignment	Points
Individual Demo Submission	**5**
Service Learning Paperwork	**2.5**
Group Demo Submission	**2.5**
Materials List/Procedure/MSDS/ Shopping List Submission	**15**
PowerPoint/Story/Music	**15**
Practice Sessions (2)	**20**
Dress Rehearsal (attendance required – 5 hours)	**10**
Magic Show	**15**
Participation/Peer Evaluation	**5**
Reflection Paper	**10**
TOTAL POINTS	**100**

- **Individual Demo Submission – (Individual)**

  Write a short one page paper outlining the demo (no cutting and pasting from the internet) and the chemistry involved. Include MSDS sheets for each chemical needed. **(5 points)**

  (Reasoning, communication, research, sustainability)

- **Complete the service learning paperwork: (Individual)**

  Project Preparation, Service Learning Agreement, and Fill out the top of the Timesheet **(2.5 points)**

  (Service learning)

- **Final Demo Selection: (Group)**
  Collaborate and choose the best demonstration that your group wants to perform. **Your actual demo will be no more than 5 minutes in length in the Magic show.** **(2.5 points)**
  (Teamwork, communication)

- **Materials List, Shopping List, MSDS forms: (Group)**
  - Write a detailed procedure including any safety precautions.
  - A detailed list of materials (amounts) and equipment (quantity and size) will also be included in the paper. **State specific equipment needed**.
  - Materials that you may use from home
  - **CLEARLY INDICATE ANY MATERIALS THAT NEED TO BE PURCHASED.**
  - Set up 3 complete sets of equipment and chemicals for 3 separate trials of the demo. Don't forget waste containers too.
  - Submit the procedure, materials list, & **2 copies of the MSDS sheets** for your demo. **(15 points)**

    (Reasoning, communication, problem solve, teamwork)

- **PowerPoint/Music/Story:** **(Group)** Your group will collaboratively write a "story" and prepare PowerPoint Slides to accompany your demonstration in the Magic show. Your audience is primarily elementary and middle school students and their parents. Explain the BASIC chemistry behind the demo – defining any terms for non-science people. Include a file of music for your demo also.

- You will submit the story to me for approval – one PowerPoint file, music file, and paper explaining the story due per group. **(15 points)**
  (Reasoning, communication, create and explore ideas, diversity, audience)

- **Practice:** **(Group)** Scale up/down and test your demo. Prepare all materials, chemicals, and collect all equipment for demonstration setups - you will need to make up 3 setups. **Label everything**. You will have 2 lab periods to practice. Assemble goodie bags. **(20 points)** (Communication, research, interpret, critical thinking, teamwork, service)

- **Magic Show and Dress Rehearsal:** **(Individual)** Your participation in the Magic show **(15 points)** and the dress rehearsal **(10 points)** is also part of your grade for this project. **Clear your schedules for the Magic Show (May 29 6:00 – 9:30 pm) and the dress rehearsal (May 27 12:00 – 5:00 pm) – attendance is required!!** (Service)

- **Individual Reflection Paper: (Individual)** Complete an **individual paper** detailing your service learning reflection. The paper will be 1-2 pages in length. Use double space, times new roman font, 12 point font, and 1 inch margins. **(10 points)** (Communication, service)

- **Participation : (Individual)** Fill out an evaluation of your group members detailing their participation and your participation in the project. Based on group member's evaluations of each other, individuals can earn up to 5 participation points. Take note of group member's attendance to meetings, practices, and engagement in the activity. **(5 points)** (Communication)

Mission: Education

- **STEM MAGICAL MASHUP SHOW GOODY BAGS**

DISAPPEARING WATER & DRAGON'S BREATHE

SANTA'S ICY SNOW & I DREAM OF GENIE

THERMITE & WAKING A DRAGON

SHOW HIGHLIGHTS

https://youtu.be/2l_fdGefxHY

STUDENT REFLECTIONS

- I know for a fact I would not be where I am today if it were not for these types of programs to influence me. To be able to put on a demonstration show for children who may be influenced by me in some way was the greatest feeling to come out of this project.

- I learned skills that I would use as a potential employee – teamwork, creating ideas and pitching them to our team and instructor, discussing problems and improving our demo, communication, …boost the skills I need for my future career as a chemical engineer.

- Undeniably, I showed lack of cooperation in the team and compassion in the event preparation. I would only participate if I had to. As the event drew near, I realized how useless and grumpy I was. I challenged myself out of my comfort zone and gave this dream team the best of my abilities. I embraced the idea of cooperation and team work.

- The experience is what I consider a rare and priceless occurrence.

- I thought science was for just freak people, but I was wrong.

- This project did effect my ideas and thinking about future careers and civic engagement.

Thanks to:

- Edmonds Community College
- RISE
- College Public Relations – Marissa Pierce
- BlackBox Theater – Jennifer Matthews
- College Safety & Security – Jade Broglio & Crew
- Engineering Faculty – Pat Burnett & Stephanie Bostwick
- Snohomish County Fire Marshall
- Edmonds School District Office Personnel

RED SHOES OR BLUE SHOES?

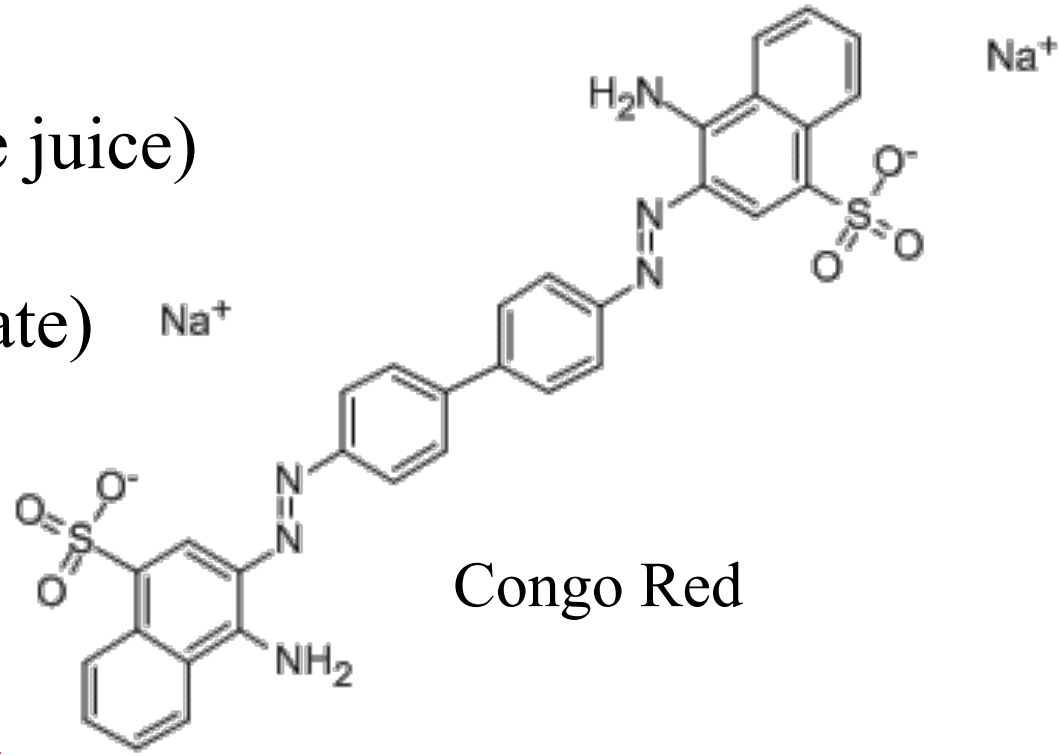
OR

What's the Chemistry?

Acid/Base Indicator Color Change

Acid – donates H^+ ions (HCl, H_2SO_4, orange juice)

Base – accepts H^+ ions (NH_3, NaOH, chocolate)



Congo Red

ACID- H CONGO RED

BASE- CONGO RED H

Try at Home?

Acid/Base Indicator Color Change

Acid – donates H^+ ions (orange juice, 7 Up, Lime Away)

Base – accepts H^+ ions (NH_3, toilet cleaner)

- Boil red cabbage
- Separate Liquid from leaves
- TEST household solutions!

AS SEEN ON TV

TP 2000

3 Easy Steps

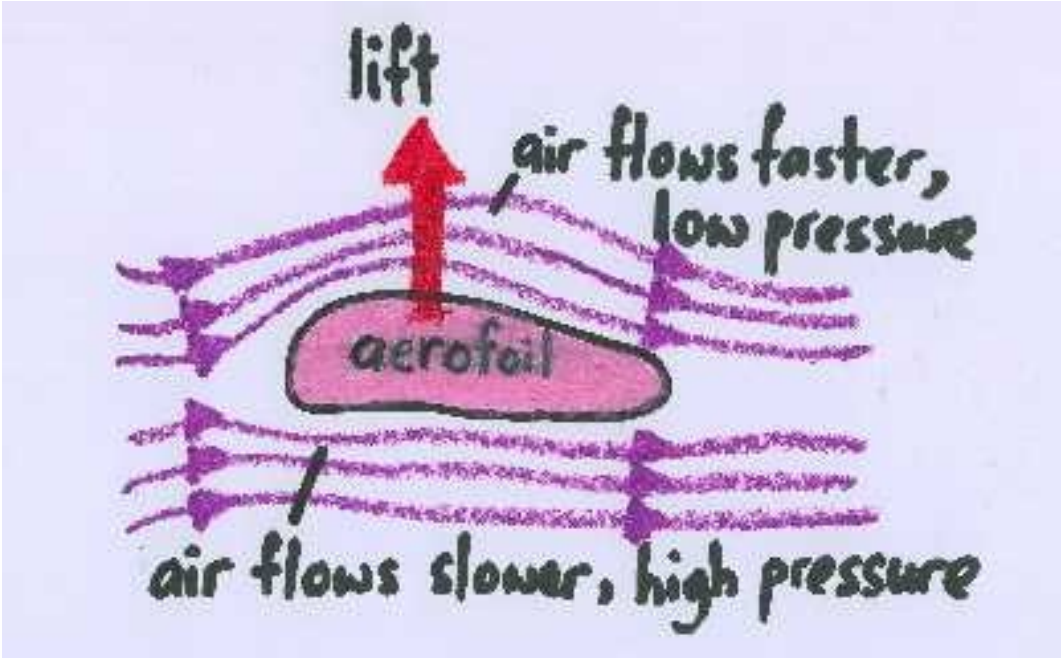
- Plug in
- Load
- Fire

What's the Science Behind the TP-2000?

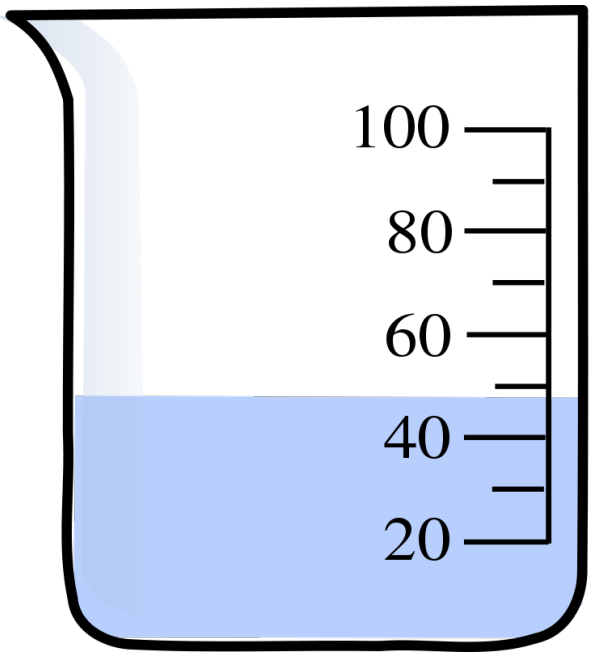
Bernoulli's Principle

- Air flows faster over the top of the wing and slower underneath.
- Fast moving air = low air pressure
- Slow moving air = high air pressure.

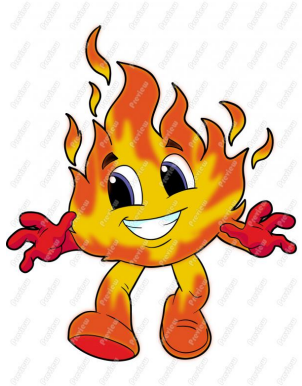
- The high air pressure underneath the wings will therefore push the aircraft up through the lower air pressure. LIFT



Magic Burning Dollar

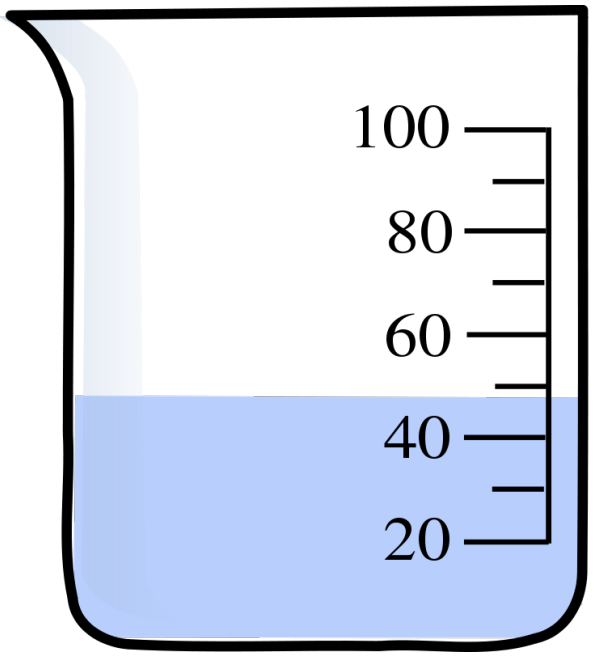


Magic Solution



Belinda the Magic Chicken

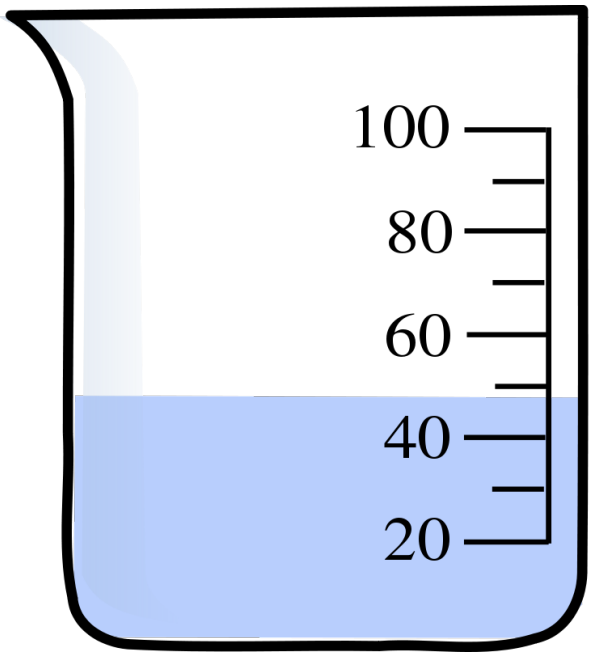
Chemistry of the Magic Burning Dollar



Magic Solution #1 = rubbing alcohol + water

The alcohol burns but water protects the dollar

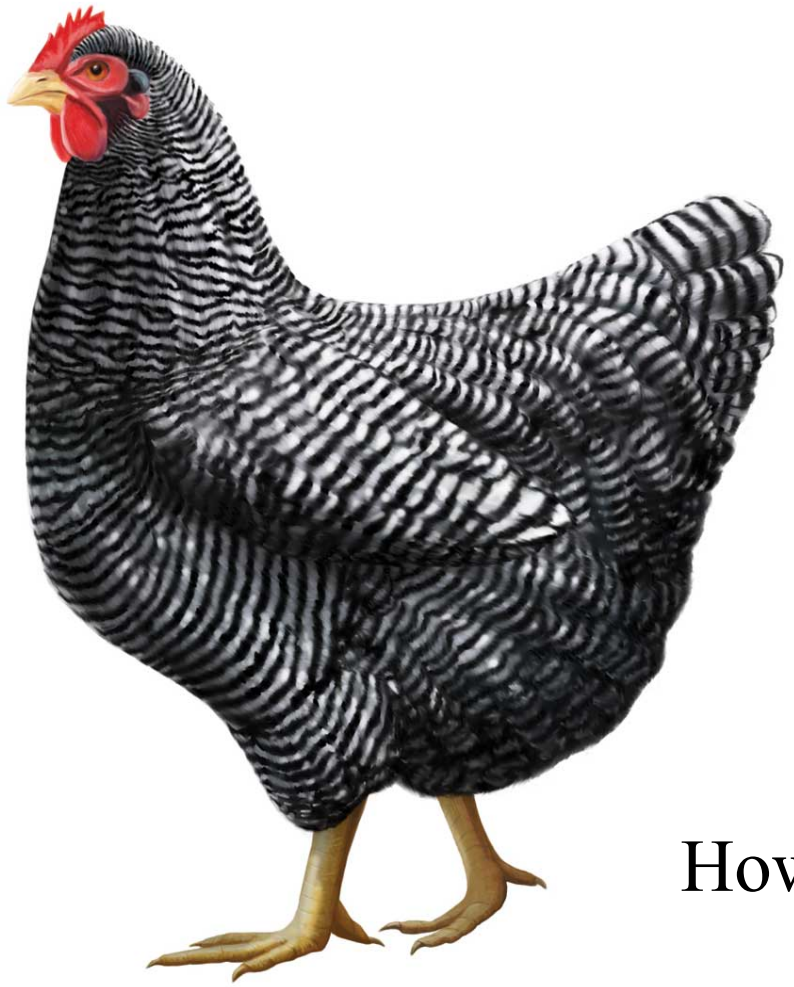
Chemistry of the Magic Burning Dollar



Magic Solution #2 = rubbing alcohol

The alcohol burns the dollar

Belinda the Magic Chicken



How did Belinda lay the egg with your dollar in it?

Magic!!

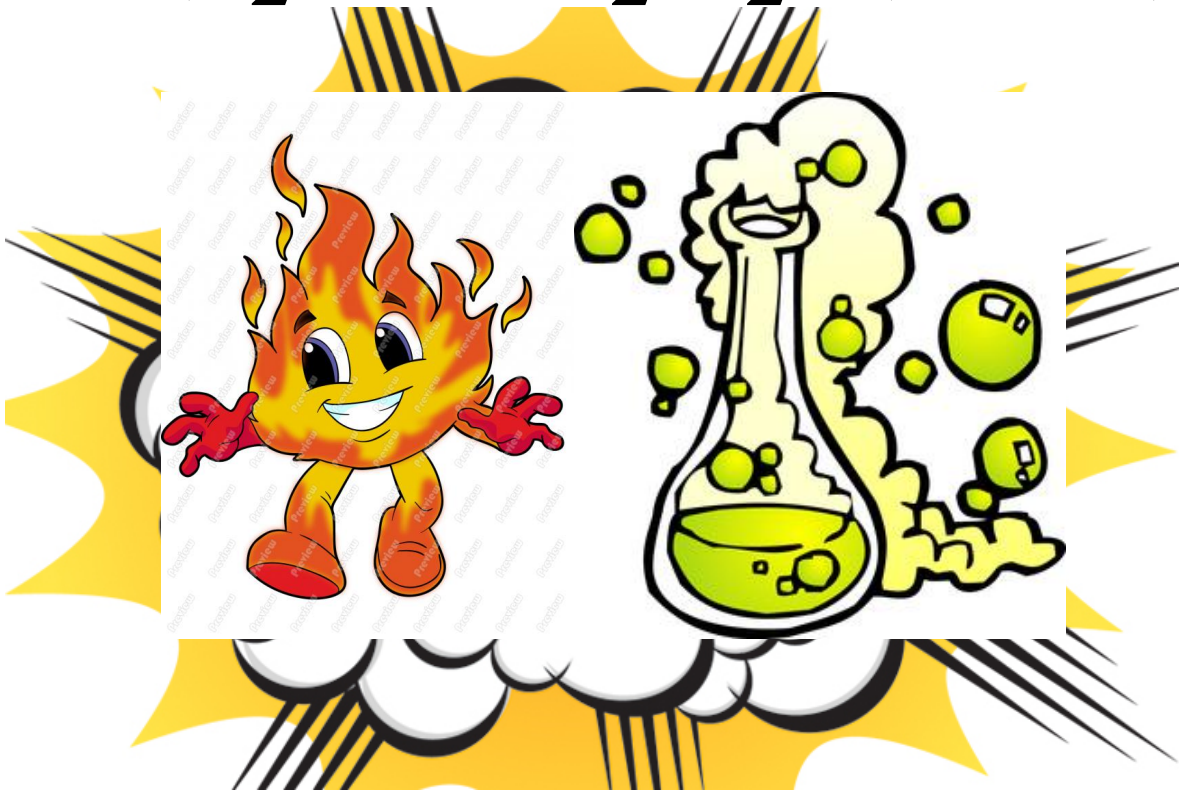
Birthday Party for the Princess

Birthday Party for the Princess

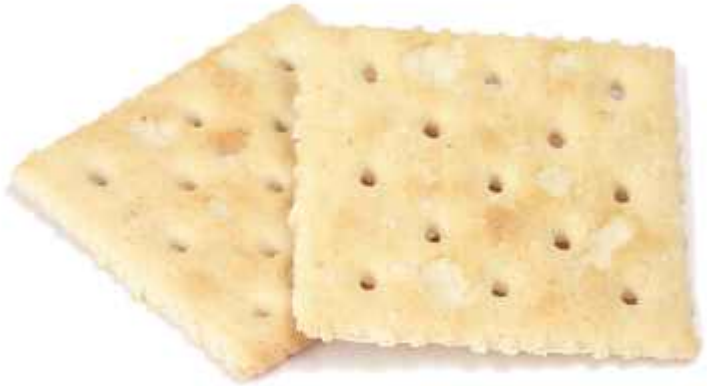
PUMPKIN TEST

Chemistry of the Exploding Pumpkin

$$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2 \text{ (GAS)}$$

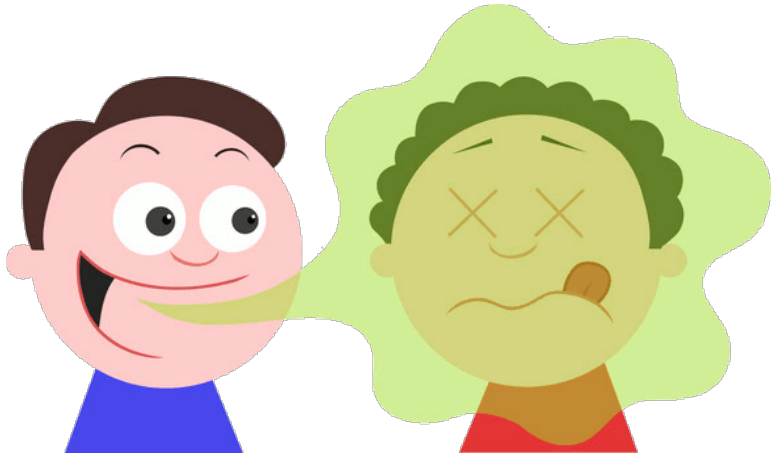


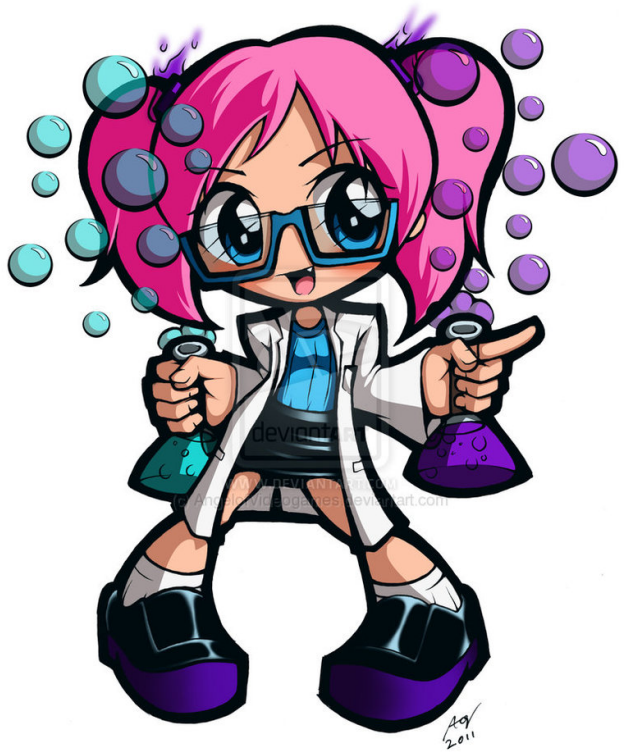
The Saltine Test



+

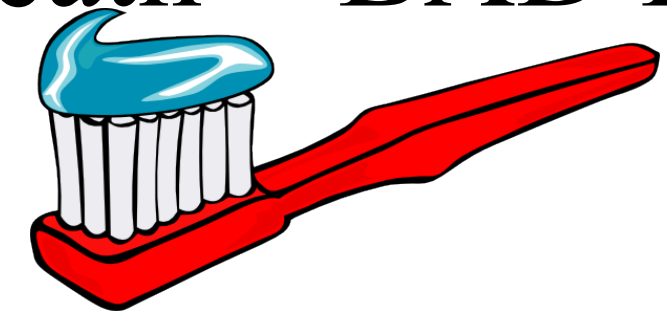
=





The “Scientific” Breath Test

White breath = BAD BREATH



Chemistry of the White Breath

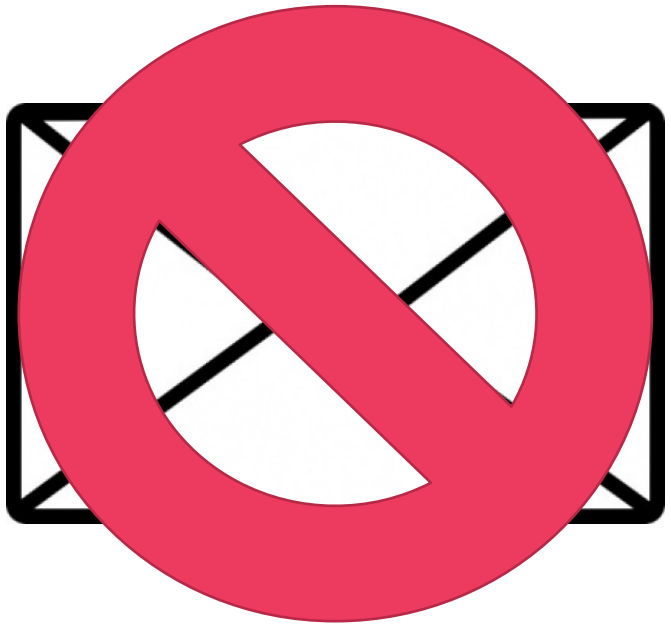
Liquid Nitrogen (N_2) -320 °F or -196 °C

Water freezes at 32 °F or 0°C

What do you breath out?

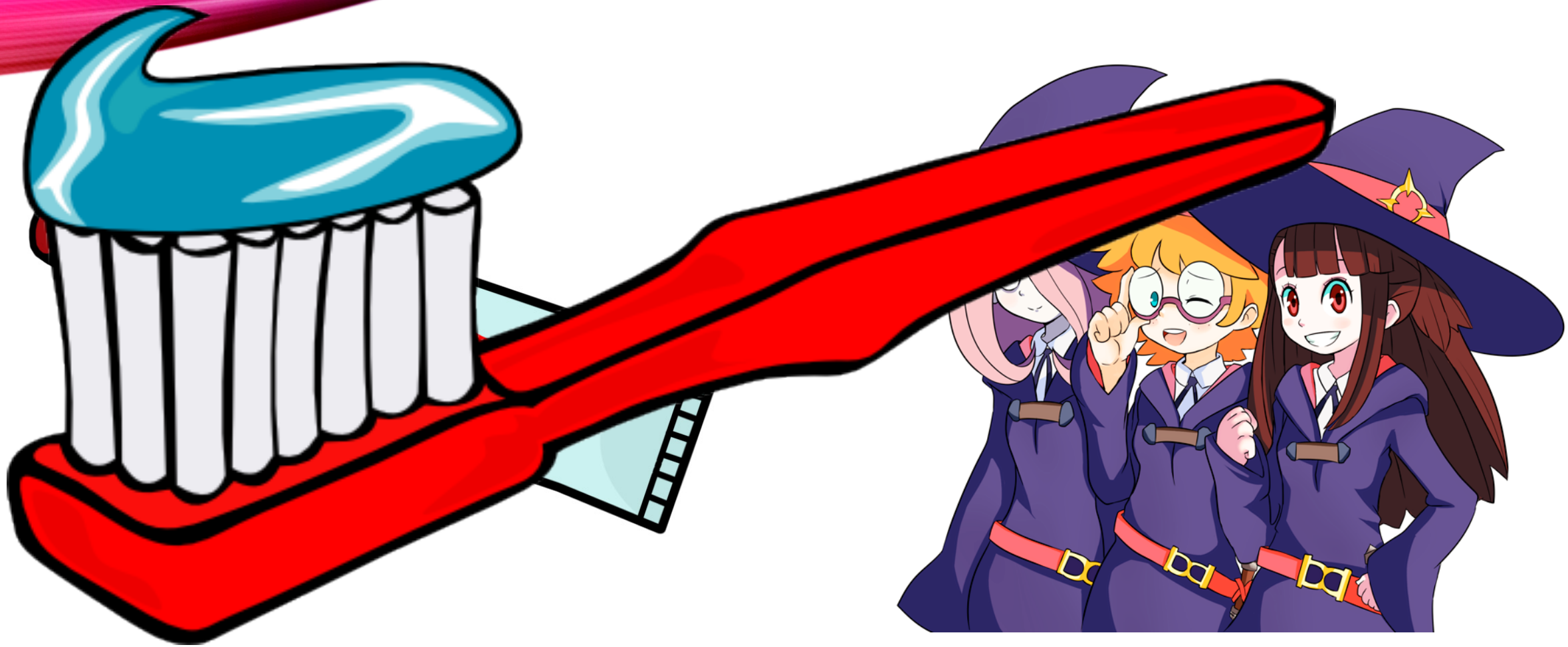
- Oxygen = colorless gas
- CO_2 = white solid (if frozen) = DRY ICE

NO INVITATION TO THE PRINCESS PARTY!



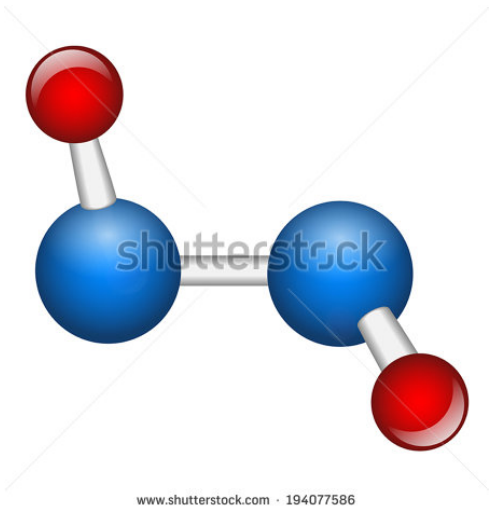
Ruin the Party!

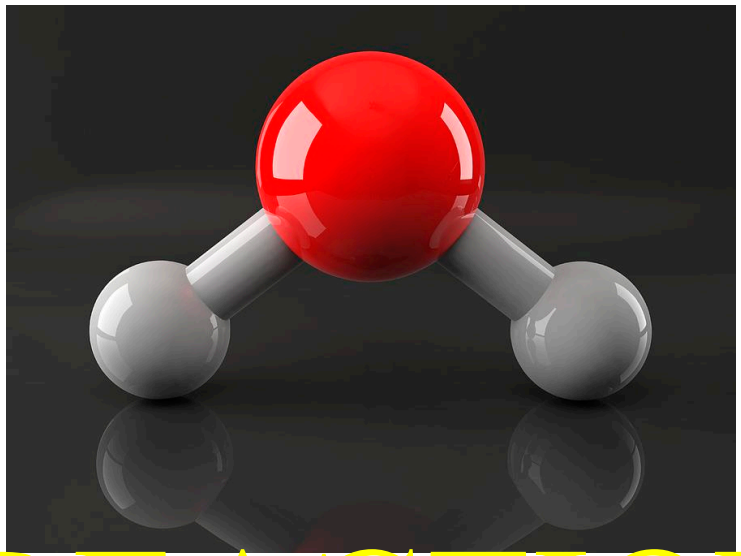
HELP ME PLEASE Miss Witches

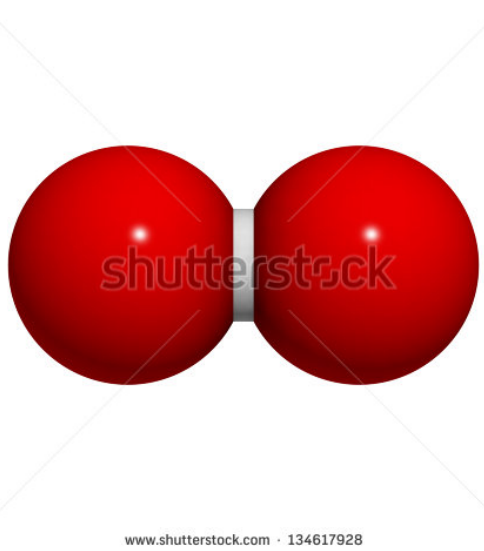


MAGIC TOOTHPASTE = GREAT BREATH

Chemistry of Elephant Toothpaste







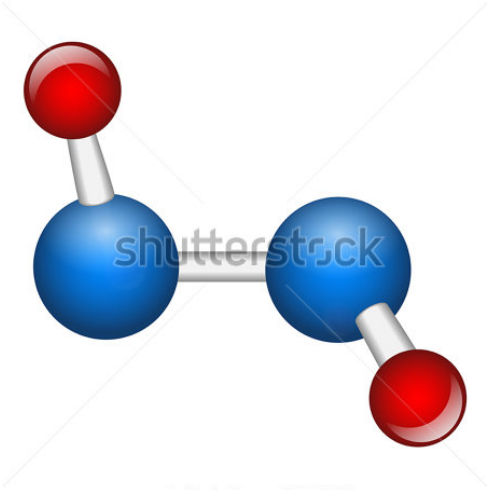
CATALYST

FAST REACTION

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Hydrogen peroxide water oxygen

Chemistry of Elephant Toothpaste



The Party is Saved!

But all the noise has woken the Princess' pet dragon…let's go outside and see her awaken.