Chemistry & Chemical Engineering Group

Developers
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Activity Name
Don't Overreact! Is there a Pattern to Chemical Reactions?

Grade Level 6-12	**Unit Topic** Connection Chemical Reactions **Purpose:** How do we know that a chemical reaction took place and how can we categorize the reaction and observe patterns?

The Hook

Let's look at the following demonstrations of chemical changes! Maybe we can use our observations as evidence of different types of chemical change. Then we can use any patterns we see to classify a type of chemical reaction.

Scenario/Background Information

Students need to be able to recognize evidence of a chemical change, classify the type of chemical change, and then represent that chemical changes macroscopically, microscopically (as a particle picture), and symbolically (as a balanced chemical equation).

Safety

Reaction demonstrations will be conducted in a chemistry laboratory that maintains a working fire extinguisher, fume hood, ventilation fan, eye wash station, and safety shower. Instructors will wear proper safety equipment as applicable. Students conducting reactions will wear safety goggles without exception.

Student Question/Problem/Challenge

How do we know a chemical reaction happens? (Temperature change- energy release/absorb, Ph Change, color change, precipitate, gas produced)
What happens in a chemical reaction?
Can we classify chemical reactions? Are there patterns?
Model the reaction in the micro, macro, and symbolic level.

Learning Goals/NGSS Performance Expectations

What will you need?

Supplies	Setup
Mg Ribbon, Copper Metal, 30% Hydrogen Peroxide, Sodium Bicarbonate, Sodium Carbonate, Silver Nitrate, Copper Wire, Zinc, 3M Hydrochloric Acid, Calcium Chloride. Sorting Cards (laminated or as a Google slide) Bingo Chips (homemade or as a Google slide)	Standard chemistry lab equipment will be required: assortment of beakers, test tubes, well plates, lab tongs, Bunsen Burner. **Tips** Lead (II) Nitrate/Potassium Iodide reaction should be video only. Lead Compound use should be avoided. Use a second video camera in the Zoom or Google Meet to have in-person students demonstrate some of the simpler reactions

Process

(Write a process that will **guide the facilitation** of the activity. Remember that the point of the activity is for the students to think about what **they** need to do to achieve their goals.)

Procedure:

1. Balancing Equations; Math Cards - Use the mathematical equations to identify the different types of reactions.
2. Identifying Different Types of Reactions: Reaction Types Card Sort: Cartoons, CW, Equations, Particle Pictures
3. Show Demos in-person or via video link to students to identify the type of reaction and its representation in the macro, micro and symbolic scale.

Demos that can be done for evidence of chemical reactions

Silver Nitrate + Potassium Bromide
Magnesium + Hydrochloric acid
Silver Nitrate + Potassium Iodide
Acetic acid + Sodium Bicarbonate
Silver Nitrate + Sodium Chloride
Ammonium Chloride + water
Sodium Hydroxide + water+ phenolphthalein

Calcium Chloride + water

Combination (Synthesis)

- Burn Magnesium Metal
  https://www.youtube.com/watch?v=nAulWNRcnvs

- Burn Copper Metal
  https://www.youtube.com/watch?v=myFJYGDkoUs

Decomposition

- Baking Soda
  https://www.youtube.com/watch?v=JYaBlFijkRM

- Hydrogen Peroxide
  https://www.youtube.com/watch?v=3Tn-7JcZJuQ

Single Replacement

- Silver Nitrate and Copper Metal
  https://www.youtube.com/watch?v=P5QlfMRvvF8

- Zinc and Hydrochloric Acid
  https://www.youtube.com/watch?v=ft82C6jQq30

Double Replacement

- Silver Nitrate and Calcium Chloride
  https://www.youtube.com/watch?v=qnZnKrk5A_w

- Lead(II) Nitrate and Potassium Iodide
  https://www.youtube.com/watch?v=diW7q7RFJBM

Combustion

- Burning Ethanol
  https://www.youtube.com/watch?v=V8jYIxzosDI

- Burning Methane
  https://www.youtube.com/watch?v=cP77VIgeP1A

Wrapping it up

(Provide suggestions for classroom discussion and pacing from lesson to lesson as well as connecting to the curriculum unit topic and learning goal.)

Students will find a reaction that they observe. Students will identify the reaction type and model the reaction in the macro, micro, and symbolic representation.

Assessment

(This activity may serve as a performance assessment for a unit. How can the students apply their content knowledge and be aware of the many practices they utilized during the challenge activity? Provide suggestions on how to assess student success. Suggestions may include student logbooks, including notes, data and reflection on their thinking.)

Performance assessment from their "Wrap-up".

Standards Connections (Connect to learning goals/performance expectations.)

NGSS Disciplinary Core Ideas	**NGSS Science and Engineering Practices**	**NGSS Crosscutting Concepts**
CCSS Math	**CCSS ELA**	
SEL	**CTE**	

Other	

Resources and References
https://www.chemedx.org/activity/adjusting-types-reactions-lab-virtual

https://www.chemedx.org/blog/diy-particulate-models

AtomSmith - chemical reaction videos and particulate models

(List any useful links for teacher background information. List student resources that may be needed.)

We are one Fermilab
https://news.fnal.gov/wp-content/uploads/2018/10/we-are-one-fermilab.jpg

How Particle Physics Discovery Works
https://www.fnal.gov/pub/science/particle-physics-101/how-works.html

Fermilab Ecology
https://ecology.fnal.gov/

NGSS - Science and Engineering Practices https://www.nextgenscience.org/sites/default/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf

Science, Technology, Engineering and Mathematics Career Cluster Knowledge and Skill Statements (2008)
https://cte.careertech.org/sites/default/files/K%26S-CareerCluster-ST-2008.pdf

CCTC - Career Ready Practices
https://cte.careertech.org/sites/default/files/CareerReadyPractices-FINAL.pdf

Project Lead the Way, Engineering Design https://www.pltw.org/our-programs/pltw-engineering-curriculum

5Es
https://ngss.sdcoe.net/Evidence-Based-Practices/5E-Model-of-Instruction

Claim, Evidence, and Reasoning

- **BSCS Scientific Explanation Tool - https://www.amnh.org/content/download/146458/2328830/file/Explanation_Tool_MASTER.pdf**
  - **Rubric https://www.amnh.org/content/download/146460/2328840/file/Explanation_Tool%20RUBRIC.pdf**
- **Scientific Argument Tool - http://sepuplhs.org/pdfs/Argument_Tool_MARCH2016.pdf**
  - **Rubric - http://www.argumentationtoolkit.org/uploads/2/1/4/1/21417276/evidence_rubric.pdf**
- **Sentence Starters for CER - http://www.thinksrsd.com/wp-content/uploads/2014/02/CER-Sentence-Starters-CER.pdf**
- **NSTA Resources on CER - https://learningcenter.nsta.org/mylibrary/collection.aspx?id=GBdqFKABr0U_E**