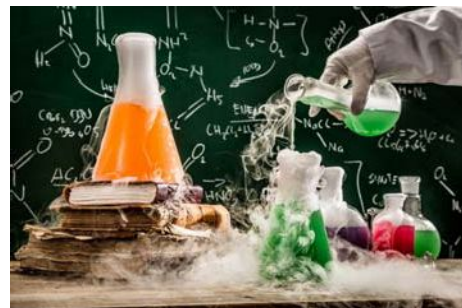


UNIVERSITY OF MINNESOTA 4-H STEM PROGRAM

Chemical Engineering and the 4-H Engineering Design Challenge Level 2

The 4-H Engineering Design Challenge is exciting because it allows participants to make use of more than one type of engineering design. For the 4-H Engineering Design Challenge, at least one step will be a chemical reaction. This information will help you learn about chemical reactions and their application to your machine.



WHAT IS A CHEMICAL REACTION?

Chemical reactions happen when two or more molecules interact and the molecules change. Bonds between atoms are broken and created to form new molecules. That's it!

Here are a few key points you should know about chemical reactions:

1. *A chemical change must occur.* You start with one molecule and turn it into another. Chemical bonds are made or broken in order to create a new molecule. One example of a chemical reaction is the rusting of a steel garbage can.

When a refrigerator or air conditioner cools the air, there is no reaction in the air molecules. The change in temperature is a physical change. When you melt an ice cube, it is a physical change. When you put bleach in the washing machine to clean your clothes, a chemical change breaks up the molecules in your stains.

2. *A reaction could include atoms, ions, compounds, or molecules of a single element.* A chemical reaction can happen with anything, just as long as a chemical change occurs. If you put pure hydrogen gas (H_2) and pure oxygen gas in a room, they might be involved in a reaction to form water (H_2O). However, it will be in very very small amounts. If you were to add a spark, those gases would be involved in a violent chemical reaction that would result in a huge explosion.

CHEMICAL REACTIONS IN THE 4-H ENGINEER DESIGN CHALLENGE LEVEL 2

For the 4-H High School Engineering Design Challenge, at least one-step needs to focus on a chemical reaction-taking place. The reaction should be simple and safe. **If at any time you have questions about what is safe, see contact the person listed at the end of this resource.**

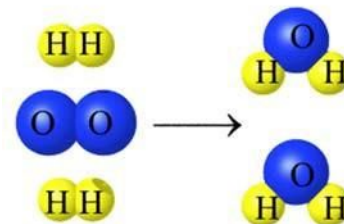
Protective eyewear will be required for team members to handle their chemical reaction steps.

Safety first! Any type of safety glasses are an easy, affordable option to use.

Chemicals you CAN use to create reactions:

There are a number of components that create safe chemical reactions that teams can use, including but not limited to:

- Vinegar
- Baking soda
- Corn Starch
- Dry Ice (proper hand wear and handling tools required.)
- Anything organic such as sugar, flour, etc.
- Borax
- Hydrogen Peroxide that you can easily purchase in a store.



Chemicals and reactions you CANNOT use:

Any reactions resulting in or containing the following are not permitted:

- Open flames
- Explosions
- Anything toxic that cannot be put in the garbage or poured down a sink drain.
- Bunsen Burners/Hot Plates

Containing chemical reactions and your machine:

The reaction(s) that you use in your machine should not splash outside of the borders of the machine. Bystanders must be able to view your machine without having to wear protective eyewear.

CHEMICAL REACTIONS IN ACTION!

Chemical reaction example 1:

https://www.youtube.com/watch?v=ajDtV_IHSbw

Chemical reaction example 2:

<https://www.youtube.com/watch?v=8KrGhtpEmdM>

Chemical reaction example 3:

<https://www.youtube.com/watch?v=gfykVni5Eyo&t=22s>

The basics about chemical reactions:

http://www.chem4kids.com/files/react_intro.html

What triggers a chemical reaction?

<https://www.youtube.com/watch?v=8m6RtOpqvtU>



FOR MORE INFORMATION, CONTACT:

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