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Cause of Death

The following instructions were found near the 3D printer:

Cleaning instructions

1. Take 2 cap-fulls of bleach and dilute with one liter of distilled water.
2. Caution: Do NOT mix with ammonia

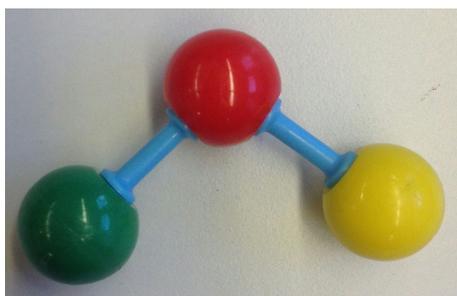
Bleach and ammonia are **both household cleaners**. So why can't you mix them together? You will discover why in this lab. You may also discover the cause of death.

Setup

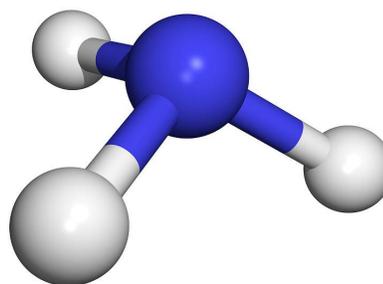
- **Create** the following molecules (hint: the big 2 means you need 2 of each!)



+



Bleach molecule



Ammonia molecule

Color Key:

- Red - Oxygen (O)
- Green - Chlorine (Cl)
- Blue - Nitrogen (N)
- White - Hydrogen (H)
- “Other” - Sodium (Na)

Simulate mixing:

Below is a picture of the “**middle**” of the chemical reaction.



Question:

What is happening so far in this picture?

Answer:

Question:

What do the balls represent (in general)?

Answer:

The reaction:



- Red - Oxygen (O)
- Green - Chlorine (Cl)
- Blue - Nitrogen (N)
- White - Hydrogen (H)
- "Other" - Sodium (Na)

Figure out the mystery substance using your molecule models. Take apart the **reactants** and try and make the **products**. You should be left with 2 atoms that make one molecule of the "mystery substance"

The mystery substance is:

The Dangers of Mixing Bleach and Ammonia

Bleach and ammonia are **both household cleaners**. So why can't you mix them together?

Using cleaning products

Household cleaning products are safe to use on their own as directed. However, sometimes when mixed together, they can have a chemical reaction that creates dangerous substances. **Do not mix** cleaning products together.

Look back at the chemical reaction between bleach and ammonia:



Do you see that Cl_2 on the right hand side there? This means a molecule of chlorine gas, made up of two chlorine atoms. It means that the chlorine gas has *been created by the chemical reaction*. It is quite capable of **causing harm when inhaled!**

If you know how dangerous chlorine gas is to humans (it was used as a chemical weapon during World War I and later by Nazi Germany in World War II), this will be very apparent. Please, **do not** try any of this at home. That warning is there to protect you.

Reflection questions

1. Why is it important to **never** mix cleaning products together?

2. What do you think killed the victim?

3. Think back about the note from the killer found at the crime scene:

“Beth-- Can you meet me in the Drish last period today? I need help cleaning the 3D Printer”

Also, consider the instructions for cleaning the 3D printer:

3. Take 2 cap-fulls of bleach and dilute with one liter of distilled water.
4. Caution: Do NOT mix with ammonia

Answer this question: What did the killer do to murder the victim?

If you are done, you can **research** more about chlorine gas. Are there any positives about it?