

Stoichiometry Murder Mystery



The wealthy businessman Bruce Rockefeller walked into his home last night to find his butler dead on the floor. Before Bruce could check the body, police stormed through the door and tackled him to the ground. Bruce was arrested immediately, but he insisted that he was innocent. The police also arrested four suspicious men just outside of the mansion. Information about each suspect is listed below.

Use your stoichiometry skills to identify the true murderer(s) to the police.

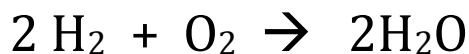
Suspect #1: Suave Steve

Suspect #1 was arrested just outside of the mansion. He has already been imprisoned previously for nearly drowning somebody. When police entered the bathroom upstairs, they found a bathtub halfway full of water. The police think that the butler may have died in the bathtub by electrocution.

Police found loose electrical wires in the water. Electricity can be used to split water (H₂O) into hydrogen and oxygen. Police believe that some of the water in the bathtub was broken down into hydrogen and oxygen using electricity. When they tested the amount of hydrogen gas in the bathroom, they found an unusual amount – 5,000 extra grams of hydrogen in the air.



In order to murder somebody in the bathtub, police say that the suspect would need at least 50,000 grams of water. Was there enough water? Can Steve be the murderer?



Clue: Police said that there were 5,000 grams of H₂ in the room.

Convert grams of hydrogen into grams of water and see if there was enough.

Conclusion: Police say that 50,000 grams of H₂O must have existed to murder somebody. Was there enough? Is this man the murderer?

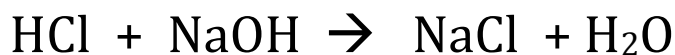


Suspect #2: Acid Albert

The second suspect arrested outside of the mansion was a large man with a stained shirt. Albert was arrested eight years ago when he tried to murder his brother by burning him to death with acid. After looking at his record, police immediately thought that he may have murdered the butler with acid.

The police mentioned that they found a few suspicious items on the floor: **salt (NaCl), lye (NaOH) and water (H₂O)**. Lye is used to neutralize acid and turn it into salt (NaCl). When an acid is neutralized, it produces salt and water. It is possible that the murderer used acid to kill the butler, and then used lye (NaOH) to turn the acid into salt (NaCl).

The police found 70 grams of NaCl (salt) in the room. To kill somebody with acid, you would need at least 60 grams of HCl (acid). Is there enough salt to prove that Albert killed the butler with acid?

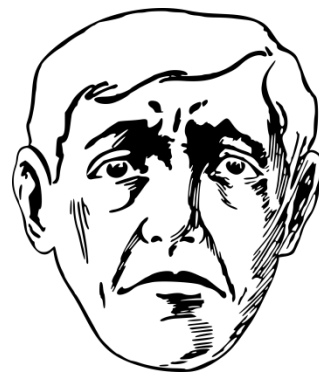


Clue: Police found 70 grams of NaCl in the room. Convert grams of NaCl (salt) into grams of HCl (acid) to see if there was enough acid to murder the butler.

Conclusion: Police say that 60 grams of HCl acid must have existed to burn the butler to death. Was there enough? Is this man the murderer?

Suspect #3: Grizzly Greg

The third suspect arrested outside of the house was a large man named Greg. He was arrested in previous years for setting his pets (a dog and three cats) on fire in his backyard. Police think that he might be the murderer. When police investigated the house, they found a suspicious chemical called methanol (CH₄O). Methanol is a flammable liquid often used to set things on fire.



In the room, the police also found a suspicious amount of CO₂ in the air, which is produced when methanol is burned. They said that there was an extra 7000 grams of carbon dioxide in the room. The police say that Greg would have needed at least 5000 grams of methanol to burn a person to death. Was there enough carbon dioxide (CO₂) in the room to prove that Greg is the murderer?



Clue: Police found 7000 grams of CO₂ in the room. Convert grams of carbon dioxide (CO₂) into grams of methanol (CH₄O) to see if there was enough methanol for a murder.

Conclusion: Police say that 5000 grams of methanol must have existed to murder somebody. Was there enough? Is this man the murderer?



Suspect #4: One-Eyed Edward

The fourth suspect was a man with one eye that was found with a knife. The police noticed that the knife had 10 grams of rust on it. The formula for rust is $\text{Fe}(\text{OH})_3$. The police say that an iron (Fe) knife big enough to murder somebody should contain at least 60 grams of iron for it to be deadly.

We don't know how much iron is in the knife, but we *do* know that it produced 10 grams of rust ($\text{Fe}(\text{OH})_3$). Is there enough rust on the knife to prove that Edward is the murderer?



Clue: Police found 10 grams of $\text{Fe}(\text{OH})_3$ on the knife. Convert grams of rust ($\text{Fe}(\text{OH})_3$) into grams of iron (Fe) to see if the knife contained enough to murder the butler.

Conclusion: Police say that a knife made of at least 60 grams of iron (Fe) was needed if the butler was stabbed to death. Was there enough? Is this man the murderer?