**Science fair Notes**

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| Known chemical substances used in chemical attacks | Effects of chemical attacks on the human body |
| Sulfur (G) | Inhalation of sulfur dioxide can cause severe irritation of the nose and throat and at high concentrations can cause life threatening accumulation of fluid in the lungs. Symptoms may include coughing, shortness of breath, difficult breathing and tightness of the chest even a single exposure to high concentration can cause a long-lasting condition like asthma. If touches skin the gas will irritate or burn the skin causing permanent scarring. If gas comes in contact with the eyes the gas will irritate or burn your eyes and may cause permanent damage including blindness can result.  https://ccohs.ca/oshanswers/chemicals/chem\_profiles/sulfurdi.html |
| Chlorine (G) | Inhalation can cause severe irritation of the throat and nose. Can cause severe lung injury. Can cause life threatening accumulation of fluid in the lungs. Symptoms may include coughing, shortness of breath, difficult breathing and tightness in the chest. Symptoms may develop hours after exposure and are made worse by physical effort. Long-term damage may result from a severe short-term exposure. If chemical comes in contact with your skin the gas will irritate or burn and can cause permanent scarring.  http://www.ccohs.ca/oshanswers/chemicals/chem\_profiles/chlorine.html |
| Mustard Gas | The gas causes redness and itching of the skin that results in yellow, pus-filled blisters due to the gas stripping away mucus membranes of the eyes, nose and respiratory tract. Victims may also experience irritation of the eyes, temporary blindness, runny nose, coughing, shortness of breath and sinus pain. The digestive tract is also affected resulting in abdominal pain, diarrhea, fever and vomiting.  http://www.livescience.com/39248-what-is-mustard-gas.html |
| Sarin nerve Gas | Inhaled or absorbed through, the skin the gas kills by crippling the respiratory center of the nervous system and paralyzes the muscles around the lungs. And may cause foaming around the mouth and shaking uncontrollably.  http://www.huffingtonpost.com/2013/09/01/what-is-sarin\_n\_3853044.html  (Line 7)  <http://www.huffingtonpost.com/2013/09/01/what-is-sarin_n_3853044.html>  (line 3) |
| Pesticides | Pesticides affect the nervous system. General heath effects from short term exposures or poisonings include irritation of the throat, nose, eyes or skin, headache, dizziness, loss of appetite, thirst, nausea, diarrhea, sweating, weakness or fatigue, restlessness, nervousness, changes in mood, insomnia, vomiting, excessive salivation, coughing, feeling of construction in the throat and chest, rapid pulse, blurring of vision, mental confusion, inability to breath, chemical burns, faster breathing, loss of reflexes, unconsciousness and even death  http://www.ccohs.ca/oshanswers/chemicals/pesticides/health\_effects.html |
| Rat poison | If inhaled rat poison can cause nose bleeds, bleeding of the gums, blood in your urine, bloody diarrhea, hair loss, extensive bruising, fatigue and shortness of breath.  https://www.verywell.com/rat-poison-first-aid-1298860 |
| Fentanyl Incapacitating  Agent | Fentanyl can produce delayed reduced respiratory function and if exposed to the eyes can cause irritation. If ingested will cause reduced levels of consciousness, reduced respiratory function, reduced blood oxygen, accumulation of acid in the blood, low blood pressure, slow heart rate, shock, slowing of muscular movement of the stomach, accumulation of fluid in the lungs, lethargy, coma and death  https://www.cdc.gov/niosh/ershdb/emergencyresponsecard\_29750022.html |
| anthrax | If inhaled anthrax will cause flu like symptoms such as sore throat, mild fever, fatigue and muscle aches which may last a few hours or days, mild chest discomfort, shortness of breath, nausea, coughing up blood, painful swallowing, high fever, trouble breathing, shock, Meningitis (a potentially life-threatening inflammation of the brain and spinal cord)  http://www.mayoclinic.org/diseases-conditions/anthrax/basics/symptoms/CON-20022705 |
| Methyl isocyanate gas | Exposure to methyl isocyanate might cause eye and throat irritation that could cause you to cough or wheeze. Larger levels of this methyl isocyanate may swell your lungs potentially making it difficult to breath and even in severe situations may cause death.  https://www.atsdr.cdc.gov/toxfaqs/tfacts182.pdf |
| Cyanide (G) | If inhaled cyanide gas enters the bloodstream and prevents oxygen from getting to your blood cells causing weakness or confusion, Headache, Nausea, felling sick to your stomach, difficult breathing, faster breathing, loss of consciousness, seizures and cardiac arrest  https://www.health.ny.gov/environmental/emergency/chemical\_terrorism/cyanide\_general.htm |
| phosgene | Inhalation of phosgene gas can cause nausea, Watery eyes, blurred vision, difficulty breathing and coughing  http://www.answers.com/Q/How\_does\_phosgene\_effect\_the\_human\_body#slide=3 |
| Agent Orange | If inhaled agent orange can cause cancer, liver damage, pulmonary and heart diseases, defects in reproduction and nervous disorders.  http://www.truth-out.org/opinion/item/10729-the-toxic-effects-of-agent-orange-persist-51-years-after-the-vietnam-war |

**Materials for entire experiment**

520ml pop can

3 makeup remover pads

Duct tape

144g of activated charcoal or activated carbon (Coconut Base)

(2) 2L pop Bottle

2-3 Elastic bands or Velcro bands

Hot glue W/ hot glue gun

Water goggles

Ammonia cleaner

Large Tupperware container

Small Tupperware container

scale

Scissors

Philips head Screw driver

Hammer

**Construct Gas Mask**

Step 1: cut 520mL pop can in half

Step 2: iscard side with tab and drinking hole on it and flip over the bottom half of the can so the bottom side faces upwards

Step 3: Take Philips head screwdriver and make about 8 holes in a circle by banging the screwdriver with the hammer up against the metal of the top of the can to punch holes through the metal.

Step 4: Put one makeup remover pad on the inside of the can covering the holes. Use the duct tape to seal off the exposed areas of the holes not being covered by the makeup remover and duct tape the makeup remover in place so it does not move.

Step 5: Take 36g of activated charcoal and evenly distribute it so there is no makeup remover visible

Step 6: Take another one of the makeup remover pads and put on top of the activated charcoal and use duct tape so it is secure.

Step 7: Cut 2L pop bottle in half and keep the side with the original opening and cut the bottle so it fits firmly on your face

Step 8: Glue the filter up to the original opening of the pop bottle so no air leaks out and use duct tape to reinforce

Step 9: Hot glue Velcro straps or elastic bands onto the sides of the pop bottle until it fells tight and comfortable on your face then put duct tape up against the start of the Velcro straps or elastic bands for reinforcement.

**Experiment Steps**

Step 1: Construct gas mask

Step 2: Put Ammonia Cleaner directly up against air intake of gas mask without fully covering the holes for 30 seconds and record if you can smell the ammonia (repeat 3 Times)

Step 3: Take small see through Tupperware container and put inside small Tupperware container with 100mL of ammonia to the side of the container.

Step 4: take 3 tablespoons of activated charcoal must be exactly (36g) and put into the center of the container.

Step 5: put lid on container

Step 6: leave container undisturbed for 1 hour

Step 7: remove the lid and takeout the ammonia container

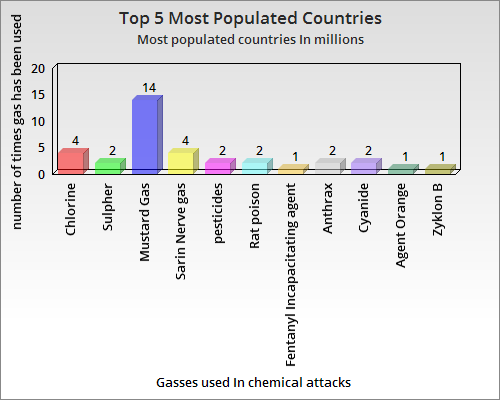
Step 8: carefully pour out the activated charcoal making sure it is all out of the container onto your scale.

Step 9: measure the difference between your starting weight and your weight after then record your results

Step 10: repeat steps 3-9 two times

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test #1 | Test #2 | Test #3 |
| Gas mask on head | No Gas | No Gas | No Gas |
| Activated charcoal weight (mg) | 9378.921mg | 9289.742mg | 9352.925mg |
| Activated charcoal after exposure to ammonia weight (mg)  After 1 hour | 9324.0004892mg | 9227.0005378mg | 9341.0003821mg |

Most commonly used gasses in chemical attacks (1915-2017)

-chlorine 4

-Sulphur 2

-mustard gas 14

-sarin nerve gas 4

-pesticides 2

-rat poison 2

-Fentanyl Incapacitating agent 1

-Anthrax 2

-cyanide 2

-Agent orange 1

-zyklon B 1

Why is mustard gas the most commonly used gas in chemical attacks?

Mustard gas is most commonly used because it is the most cost effective gas to make and it is much easier to create. In a sophisticated war form it is usually bonded in a lab by combining carbon, hydrogen, Chlorine, and Sulphur (C4H8Cl2S) but can be made in a simple form just from your house by mixing pure ammonia and bleach 2 common household products you can buy from the supermarket for about 3.97 for bleach and 8 dollars for ammonia so in total a terrorist or a country could make a chemical attack happen for just under $15.

What does Activated charcoal do and what you need to know about gas masks

Charcoal bonds with the active ingredients in nerve gas and other chemicals, effectively filtering toxic compounds out of the air inhaled by the mask's wearer. As long as there's space on the charcoal filter's fibers for incoming toxins, the wearer is safe. But after a period of time depending on the density of toxic chemicals in the air, the wearer's rate of breathing and other factors an activated charcoal filter will stop working and will need to be replaced.

<http://www.livescience.com/39217-how-do-gas-masks-work.html>

Results

Results showed that activated charcoal most certainly works in keeping harmful gasses out of your lungs. All of the tests showed in favor of our hypothesis all gas mask tests came up without smelling ammonia and still being able to breath and all of the measuring tests came up showing very small but amazing amounts of ammonia gas trapped inside the charcoal.

Conclusion

In conclusion activated charcoal is a perfect use for gas masks it is cheap, affordable and easy to get the average amount of gas the activated charcoal soaked up is 0.0004697 which shows that activated charcoal is a effective substance for gas masks.

To make your own

* Use a different form of filter in the gas mask
* Use a different type of chemical
* Leave the charcoal in the container for longer and see if the amount of ammonia increases

Things I would have done differently

I would have used a higher quality tape

I would have used higher quality materials

I would have made more tests so I could get even more accurate results