CHAPTER 1

Conflict by the Numbers: The story of conflict through mathematics

Conflict is part of our everyday lives. It is everywhere. When people think of the word conflict, they often think of war. War is indeed a conflict, but it isn't the only one. Conflicts range from person vs. self to society vs. society. Conflict could be destructive, but it can also be positive.

Math and science are subjects that usually have a right or wrong answer. They aren't anything like English or history where everything is elaborate. Math and science are concise, but they can like history or English, tell stories. Math and science are able to prove theories, make sense out of things and create evidence that can help to tell a story of conflict.

SECTION 1

History/Background of Mustard Gas

History

Mustard gas was possibly discovered first by Cesar-Mansuete Despretez in 1822. Despretez, however described the reaction of sulfur dichloride and ethylene, but never described the harmful affects mustard gas has, therefore this discovery is not certain. This situation repeated itself in 1854, when Alfred Riche didn't describe the affects of mustard gas, making his discovery doubtful as well. However in 1860, Frederick Guthrie noted the irritating properties of mustard gas, especially in taste, making this the most certain discovery. Later in 1886, chemist Alber Niemenn repeated this reaction and recorded blister-forming properties. That same year, Viktor Meyer changed the mustard gas compound, making it purer and more harmful. In 1913, Hans Thacher Clarke once again changed the formula making it more affective and this mustard gas formula was later used in World War I.

Uses

Mustard gas was used in chemical warfare. It was used as a weapon by dispensing it into the air as a vapor. It causes ill effects and it is an incapacitating agent.

Symptoms

Skin: redness and itching of the skin may occur 2 to 48 hours after exposure and change eventually to yellow blistering of the skin.

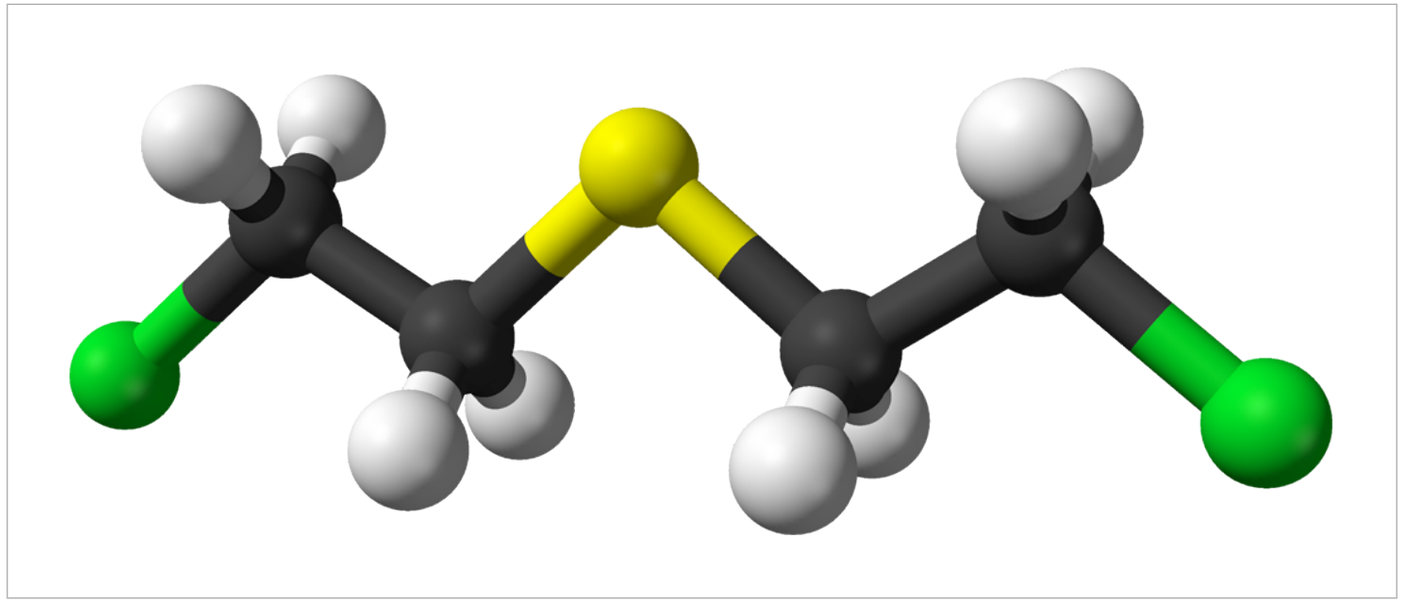
Eyes: irritation, pain, swelling, and tearing may occur within 3 to12 hours of a mild to moderate exposure. A severe exposure may cause symptoms within 1 to 2 hours and may include the symptoms of a mild or moderate exposure plus light sensitivity, severe pain, or blindness (lasting up to 10 days).

Respiratory tract: runny nose, sneezing, hoarseness, bloody nose, sinus pain, shortness of breath, and cough within 12 to 24 hours of a mild exposure and within 2 to 4 hours of a severe exposure.

Digestive tract: abdominal pain, diarrhea, fever, nausea, and vomiting.

SECTION 2

Properties of Mustard Gas



Molecular formula: $C_4H_8Cl_2S$

Molar Mass: 159.08 g mol^{-1}

Appearance: Colorless if pure.

Normally ranges from pale yellow to dark brown.

Slight garlic or horseradish type odour.

Density: 1.27 g/mL liquid

Melting Point: 14.4° C

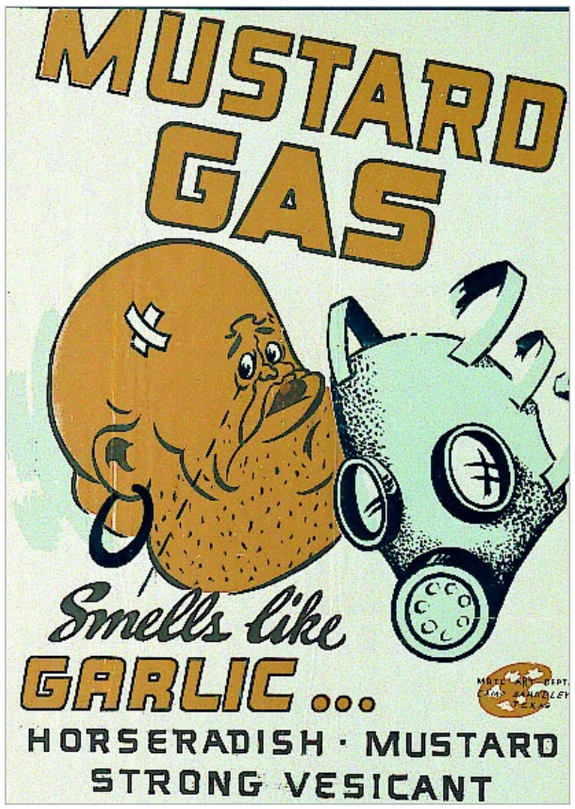
Boiling Point: 218° C

Mustard Gas is a covalent bond. A covalent bond is a bond in which the valence electrons from one element **share** valence electrons from other elements. Atoms that are bonded share electrons rather than transfer electrons from one to the other, like in an ionic compound. Covalent compounds are made up of nonmetals. Nonmetals have to share electrons instead of transfer electrons because they have roughly the same electronegativity. Electronegativity is a measure of how much an element pulls electrons away from other elements. If the two nonmetals want to look like the noble gases, to fulfill the octet rule, they have to share their valence electrons. Mustard gas is also a single bond. This causes less attraction between atoms. Atoms are held looser and this causes less stability.

SECTION 3

Reactions and Atomic Mass

Mustard gas is made up of four elements found on the periodic table: carbon, sulfur, chlorine and hydrogen. Despretez made the very first mustard gas by combining ethylene with sulfur dichloride. A scientist named Levinstein changed the reactant sulfur dichloride and used sulfur monochloride instead. Meyer changed both reactants to thiodiglycol and phosphorus trichloride, making the product more affective. The most recent and common mustard gas is called the Meyer-Clarke method. Phosphorus trichloride was replaced by concentrated hydrochloric acid.



The balanced equation of the Meyer-Clarke method is as follows:
$(HO\text{-}CH_2CH_2)_2S + 2\ HCl \rightarrow (Cl\text{-}CH_2CH_2)_2S + 2\ H_2O$

Linear Equation: $4C + 8H + 2Cl + 1S = 159.08\ g/mol^{-1}$

Solving Linear Equations through Cramer's Rule:

Hydrogen Cynanide: 1C + 1H + 1N = 27.03
Nitroglycerin: 3C + 5H + 3N + 9O = 227.1
RDX: 3C + 6H + 6N + 6O = 222.1
TNT: 7C + 5H + 3N+ 6O = 227.1
Chloropicarin: 1C + 1N + 2O + 3Cl = 164.375

1	0	1	2	0	3
1	1	1	0	0	0
3	5	3	9	0	0
3	6	6	6	0	0
7	5	3	6	0	0
4	8	0	0	1	2

= -90

1	0	1	2	164.375	3
1	1	1	0	27.03	0
3	5	3	9	227.1	0
3	6	6	6	222.1	0
7	5	3	6	227.1	0
4	8	0	0	159.08	2

= -2820.92/-90 S=31.34

1	0	1	2	0	164.375
1	1	1	0	0	27.03
3	5	3	9	0	227.1
3	6	6	6	0	222.1
7	5	3	6	0	227.1
4	8	0	0	1	159.08

= -3194.66/-90

Cl=35.5

164.375	0	1	2	0	3
27.03	1	1	0	0	0
227.1	5	3	9	0	0
222.1	6	6	6	0	0
227.1	5	3	6	0	0
159.08	8	0	0	1	2

= -1078.56/ -90

C = 11.984

1	164.375	1	2	0	3
1	27.03	1	0	0	0
3	227.1	3	9	0	0
3	222.1	6	6	0	0
7	227.1	3	6	0	0
4	159.08	0	0	1	2

= -99.09/-90

H=1.101

Cramer's Rule solves variables in linear equations. If a scientist is trying to determine the elements mass when they have an unknown substance, they simply have to create a series of linear equations with the mass of of the elements of the unknown substance as the variable, and with those variables they need to label the coefficient with the corresponding element, and make the equation equal to the mass of the substance. Then, they simply solve the equations using Cramer's Rule like previously done in the section.

An arm blistered by Mustard Gas

Works Cited

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