CHAPTER 1

Conflict by the Numbers: Through the Works of Science and Mathematics

What is conflict?

Conflict is the having of different opinions and values that arise to come between the working towards a common goal.

How can science and mathematics help us to tell a story of conflict?

Science and Math can tell a story by providing evidence supporting or against that conflict as the it progresses.

Section 1

History of Nitroglycerin

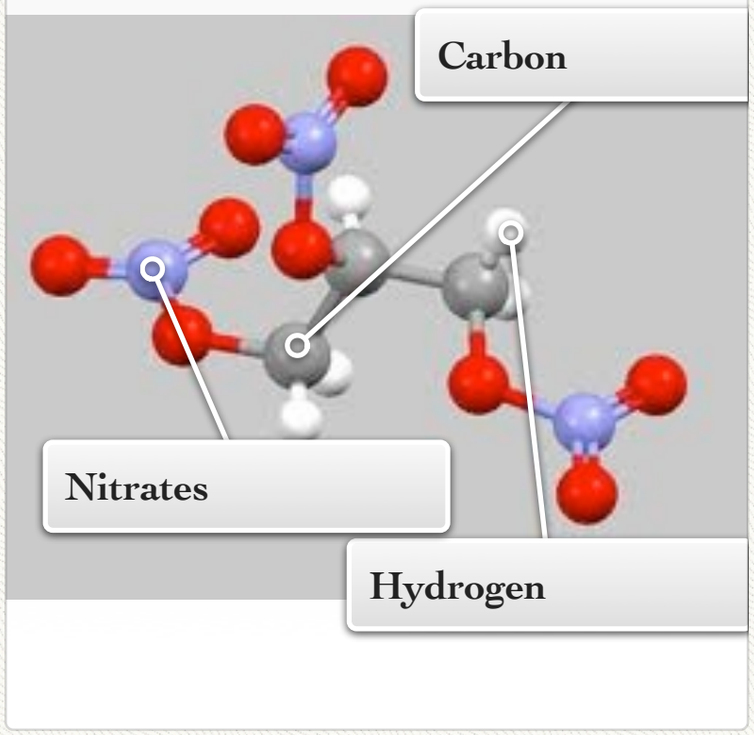
Nitroglycerin was first prepared in a mix of sulfuric and nitric acids that are added to glycerol. Italian Ascanio Sobrero made the monumental discovery in 1846, and in later years, a laboratory plant was built to manufacture it by members of the Nobel family.

Nitroglycerin, which is also commonly referred to as GTN, is an extremely powerful secondary explosive. It is particularly more dangerous than other traditional explosions because it is extremely unstable. Being unstable means that any unnecessary movement can cause the substance to detonate, making unstable substances extremely hazardous and dangerous to work with or around. If a person were to drop a drop of nitroglycerin into a petri dish, the dish would explode along with the surrounding area.

Normally, nitroglycerin is toxic to handle regularly and causes headaches when you come into contact with it improperly. However, nitroglycerin contains nitrates that work to relax blood vessels. it is used to treat high blood pressure during surgery and congestive heart failure associated with heart attacks.

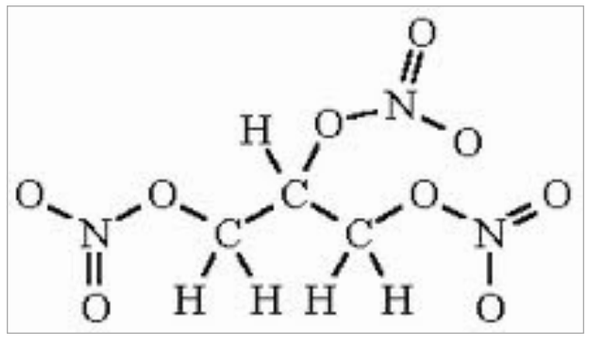
Despite how dangerous nitroglycerin is, there are still many ways we use it in society. During the Building of the transcontinental railroad, nitroglycerin was an essential part of the building process. When it is manufactured the right way, it can cause an explosion three times as powerful as gunpowder.

Interactive 1.1 This is the atomic model of Nitroglycerin



THE BONDING: BROKEN DOWN

Nitroglycerin is a covalently bonded structure because it contains all non-metals. All covalent compounds happen when two non-metal elements share their valence electrons, with the objective to obtain a full valence shell of eight electrons. Three carbon atoms bond together to share electrons and each carbon atom becomes bonded with a nitrate. From there each nitrate is double bonded to an oxygen atom. Because almost all of the bond lengths are short and bendy single bonds, this makes the substance very unstable and more possible for a reaction to occur. Hydrogen atoms are bonded with extra electrons from each carbon atom.



SECTION 2

Properties

CHARACTERISTICS	NITROGLYCERIN
Appearance	It is a yellow oil
Density	160 g/cm^3
Molar Mass	227.1 g/mol
Melting point	13 degrees C
Boiling point	50 degrees C
Molecular Formula	$C_3H_5N_3O_9$

Section 3

Reactions and Atomic Mass

WHAT'S THE REACTION? When an nitroglycerin reacts, it doesn't necessarily need more than one substance to cause a reaction. It does however, react very vigorously. The type of reaction nitroglycerin goes through is called a decomposition reaction, which means that one substance reacts to form two separate ones. The equation is...

$$4C_3H_5N_3O_9(l) \cong 12CO_2(g) + 10H_2O(g) + 6N_2(g) + O_2(g)$$

It creates an explosion, so combustion is also involved because to of the products are carbon dioxide and water. However, nitrogen and oxygen are also produced in the aftermath.

HOW CAN CRAMER'S RULE HELP? Cramer's Rule is a great tool to use when figuring out the components of a substance. When the weight is known, but nothing else is, it is possible to plug in the solutions for a missing element and find the mass and corresponding element of a periodic table. When using Cramer's Rule, it is possible to solve for any missing element's atomic mass, therefore identifying it.

EQUATIONS

$7C+5H+3N+6O=227.1$

$3C+6H+6N+6O=222.1$

$3C+5H+3N+9O=227.1$

$1C+1H+1N=27.03$

3	6	6	6
7	5	3	6
3	5	3	9
1	1	1	0

This matrix is the original coefficient matrix. The coefficients from each of the equations were put into a four by four matrix, then I solved for the determinant and got a -30.

222.1	6	6	6
227.1	5	3	6
227.1	5	3	9
27.03	1	1	0

To find the atomic mass of carbon, you plug in the solutions of each of the equations for the carbon values and find the determinant, getting -359.52. Then divide by the determinant of the coefficient matrix and you will get 11.984 as the mass of carbon.

3	222.1	6	6
7	227.1	3	6
3	227.1	3	9
1	27.03	1	0

To find the atomic mass of hydrogen, you will plug in the solutions of the equations in place of your hydrogen values. Find the determinant of the matrix, which is -33.03, and divide that by the original determinant -30 to get 1.101.

3	6	222.1	6
7	5	227.1	6
3	5	227.1	9
1	1	27.03	0

To find the atomic mass of nitrogen, you will plug in the solutions of your equations in place of the nitrogen values. Then you will find the determinant of the matrix, -418.35, and divide by -30 to get 13.945 as the atomic mass of nitrogen.

3	6	6	222.1
7	5	3	227.1
3	5	3	227.1
1	1	1	27.03

To find the atomic mass of oxygen, you are going to take the solutions of your equations once more and put them in place of the oxygen coefficients. Solve for the determinant, getting -479.36, and then divide by the determinant form your original matrix and you should get 15.97 as the atomic mass of oxygen.

Works Cited

INFORMATION:
Lebron, Terry "Chemistry help5" chegg.com/
Retrieved: 3/19/13 www.chegg.com/chemistry/

"Nitroglycerine and Dynamite" Nobelprize.org.
Retrieved 3/19/13
http://www.nobelprize.org/alfred_nobel/biographical/articles/life-work/nitrodyn.html

"Nitroglycerin" pbs.org/ Retrieved 3/19/13 http://www.pbs.org/wgbh/americanexperience/features/general-article/tcrr-nitro/

Senese, Fred "Why is nitroglycerin explosive?"
antione,frostburg.edu/ Last revised: 2/15/10
Retrieved 3/19/13 http://antoine.frostburg.edu/chem/senese/101/redox/faq/nitroglycerin.shtml

PHOTOS:
"Nitroglycerin Tablets" sequenza21.com/ Retrieved 3/19/13
www.sequenza21.com/nitroglycerin_tablets/

"Nitroglycerin" The Columbia Encyclopedia, 6th ed.
Retrieved 3/19/13 http://www.encyclopedia.com/topic/nitroglycerin.aspx

"How nitroglycerin explodes" bbc.co/uk/Last revised oct. 2012 Retrieved 3/19/13
http://www.bbc.co.uk/news/science-environment-11485672

"Ascanio Sobrero" Wikepedia.com Retrieved 3/19/13
http://en.wikipedia.org/wiki/Ascanio_Sobrero

"Nitroglycerin" 3dchem.com Retrieved 3/19/12 http://www.3dchem.com/molecules.asp?ID=311