

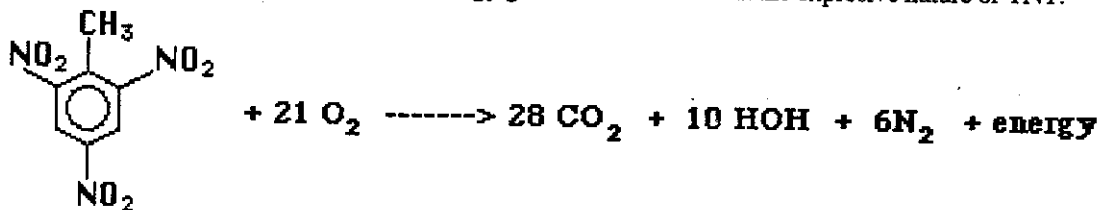
Societal Issue *Poisons and Chemical Warfare*

Men and women have been using chemicals to kill each another for as long as history has been recorded. Famous poisoners of history are Agrippina, the mother of Nero; Catherine de Medici; and Cesare Borgia and his sister, Lucrezia. During the middle ages, poisoning was considered to be an art (*World Book*).

Cyanide is a notorious poison. Small amount of both cyanide gas, HCN, and ionic-cyanide compounds, KCN, are lethal. In the 1970s, a commune leader, James Jones, killed 950 of his followers by having them drink KCN laced Kool-aid.

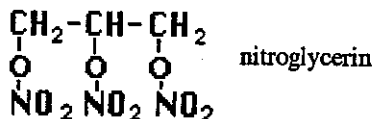
Gunpowder is a chemical mixture which has been used to kill since ancient times. Gunpowder was used by the ancient Chinese, Arabs, and people of India, but the exact directions for making gunpowder were not known in Europe until 1242. Gunpowder was made by mixing 10% sulfur with 15% charcoal, and 75% saltpeter (potassium nitrate). The key to the effectiveness of gunpowder is the nitrate group on the potassium nitrate. When the reaction is activated, nitrogen gas is formed, and it explodes because of gas pressure. It also is an exothermic reaction that gives off a lot of energy (*World Book*).

Nitro groups make substances unstable. Trinitrotoluene, TNT, is an example of an aromatic hydrocarbon with nitro groups which reacts with oxygen gas to produce nitrogen gas and energy. It is the combination of the pressure of the nitrogen gas and the energy given off that results in the explosive nature of TNT.



2,4,6-trinitrotoluene (TNT)

Nitroglycerin contains nitro groups. It is a clear, heavy, oily liquid. It was once used as blasting gel but was very dangerous to handle. In an effort to produce a safer nitroglycerin, Alfred Nobel, Swedish Chemist, invented dynamite by mixing nitroglycerin with an absorbant material.



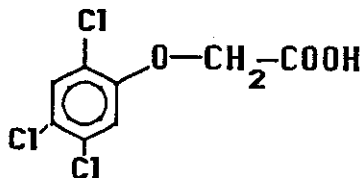
Nobel's dynamite proved to be much safer than nitroglycerin. His invention quickly became the most widely used explosive, and he became one of the world's richest men. When World War I began, dynamite was used as a weapon. A story tells why Alfred Nobel established the Nobel Prizes. One morning Alfred Nobel read in the paper that an explosion in his dynamite plant had killed him. The obituary said that Nobel would be remembered as the man who got rich by inventing dynamite, which killed thousands during the war. Alfred Nobel decided that he did not want to be remembered that way and dedicated his huge fortune to establish the Nobel prizes. This story may or may not be true, but I think it is a good story. By the way, a friend of mine, Dr. Denny Gulick, who teaches mathematics at the University of Maryland, tells me that his graduate teacher, Dr. Einar Hille, claimed that there is no Nobel prize in mathematics because Alfred Nobel's wife had an affair with the Swedish mathematician, Mittag-Leffler. Mittag-Leffler was Einar Hille's graduate advisor, so Dr. Gulick is convinced the story is true.

Chemical warfare began in World War I when the Germans used chlorine gas, Cl₂, a pale green gas, against the Allies. Fritz Haber, a German scientist, supervised the release of chlorine gas. The Allied soldiers discovered the first "gas mask" by urinating on their handkerchiefs and holding them to their nose and mouth (PBS series "Up Stairs Downstairs"). The urine countered the effects of the chlorine gas. The Germans also released the first blistering agent, mustard gas, S(CH₂CH₂Cl)₂ and a choking gas, phosgene, COCl₂ (Sesnick 31). These chemicals are liquid, but are very volatile. Over 30 different chemicals were

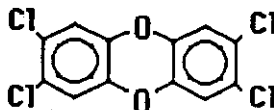
used in WWI, killing nearly 100,000 and injuring 1.2 million ("The Winds of Death" 24). In 1925, the Geneva Convention banned the use of chemical and biological warfare (Sesnack 31).

Chemical warfare was not used in World War II by the Allies or by Germany. Germany had developed nerve gases in the 1930s, and they were tested on prisoners in concentration camps. They were never used against the Soviets or the Allies because Hitler was afraid that the Allies also had nerve gases and would retaliate (Sesnack 32). Japan used gas in the 1930s and 40s on China.

In recent times, chemical warfare has reemerged. The United States began using chemicals during the Vietnam War. These included riot-control gases and Agent Orange, a toxic defoliant called Dioxin. The Soviet Union used poisonous gas in Afghanistan ("The Winds of Death" 24). In 1988, Iraq used a mixture of mustard gas and hydrogen cyanide against the Kurdish people.



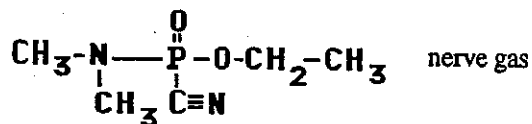
2,4,5-trichlorophenoxyacetic acid
(defoliant used in Vietnam War)



dioxin

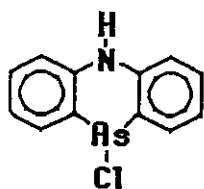
It was greatly feared that Iraq would use chemical warfare against the United Nations troops in the Gulf War in January 1991. When representatives of 145 nations met to discuss the use of chemical warfare, some Third World leaders argued that they armed themselves with chemical weapons because their enemies had nuclear weapons. They pointed out that Iraq used chemicals against Iran on a massive scale, and "the superpowers turned a blind eye because they did not want Iran to win the war" ("The Winds of Death" 24).

Chemical warfare is still a big business in the United States today. The U.S. spends more than one billion dollars per year on chemical warfare. The research is on incapacitating nerve gases. Nerve gases are among the most toxic synthetic chemicals known. Only a milligram of nerve gas inhaled or five drops on the skin is needed to kill (Sesnack 32).

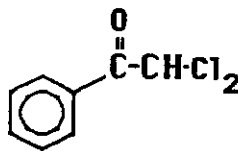


nerve gas

Other less lethal gases has been developed. MACE (chloroacetophenone) is fairly mild and is used for riot control. The battlefield form can leave troops helpless (Sesnack 32). Adamsite (diphenylaminochloroarsine) is also used in riot control. It causes tearing, sneezing, itching, and vomiting (Sesnack 32).



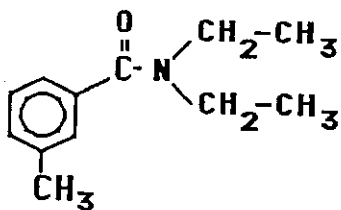
Adamsite



MACE

There are some positive outcomes of chemical warfare research. Some chemicals developed for warfare in the 1930s have been found to cause complete remission of a formerly fatal skin cancer. These are the nitrogen mustard gases. On the other hand, chemicals that were developed for peaceful purposes, such as DDT, have threatened entire species of animals. They may also affect humans. There is some evidence that exposure to pesticides, dioxin, and PCBs can cause reduced fertility and shifts in sexual orientation. These

chemicals may mimic hormones, which affect reproductivity and sexual behavior. Young children are most susceptible to these chemicals (Magner). Insecticides should be used with extreme caution.



N,N-dimethyl-m-toluamide (insect repellent)

References

1. *Chemistry*, Jan. 1968.
2. Hill, John W. *Chemistry for Changing Times*. 6th Ed. Minneapolis: Macmillan Publishing Company, 1992.
3. Magner, Mike. "Pollutants Linked to Subtle Changes in Human Sexuality." *Minneapolis Star Tribune* 17 Sept. 1992.
4. Sesnick, Irwin L. and John A. Miller. "Difficult Decisions: Chemical Warfare." *The Science Teacher* Feb. 1988: 31-32.
5. "The Winds of Death." *Newsweek* 16 Jan. 1989: 22-25.
6. "Questions Raised on Why Iraq Failed to Use Chemicals." *Minneapolis Star Tribune* Apr. 1991.
7. *World Book Encyclopedia*.

Answer this based on the reading.

Trace the history of chemical warfare.

Research Questions

Students will work in cooperative groups to research one of the questions listed below and write a HyperCard program, newsletter, or brochure to present the material.

•Good references are *Chemistry for Changing Times* by Hill and *Breaking the Pesticide Habit* by Terry Gips.)

1. Research and report on the use of pesticides such as daminozide, a ripening agent for fruit.
2. Research and report on the uses and dangers of PCBs, polychlorinated biphenyls.
3. Many household chemicals are poisonous. Find out which ones are poisonous. Research what experts say should be done to prevent small children from ingesting these chemicals. Tell what should be done if accidental poisoning occurs. Tell how household chemicals should be stored, and give methods of disposal.
4. Research and report on the safety of lawn care chemicals.
5. Use the computer database, ASAP Magazine Index Database, to call up CHEMICAL WARFARE and NERVE GAS. Review the printout which gives articles about suspected use and international policy. Choose a topic based on the articles that interest your group.
6. Research and report on alternatives to pesticides.
7. Cosmetics and sunscreens are very closely regulated by the FDA because in the past they have caused blindness and even death. Research and report on cosmetic and/or sunscreen chemistry.

POISONS AND CHEMICAL WARFARE

1. What cult leader killed 950 of his followers with Kool-aid laced with a cyanide containing compound?
2. How do you make gun powder?
3. What groups make substances unstable?
4. What does TNT stand for?
5. What did Alfred Nobel invent?
6. Why did he invent "it"?
7. Why did he start the Nobel Prizes?
8. What is the rumor behind the fact that there is no Nobel prize for math?
9. What was the first gas mask?
10. What did mustard gas do to people?
11. How were nerve gases used in WW II?
12. Why didn't Hitler use nerve gases on the allies?
13. What was Agent Orange used for?
14. How much does the US spend per year on chemical warfare?
15. What chemicals are used for riot control? and their effects?
16. Has anything positive come out of chemical warfare research? if yes, that?