

Name _____

Chemistry Module Quiz for Science and Technology for NPTS

Spring 2017

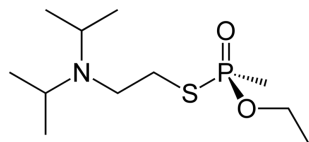
1. Write the term in the blank that corresponds to the following definitions. (1 point each)
 - a. _____ Any chemical reactant that takes part at any stage in the production by whatever method of a toxic chemical.
 - b. _____ Compounds that disrupt the victim's ability to breathe. Chlorine and phosgene are examples.
 - c. _____ A specific section of the protein structure of an enzyme in which the substrate fits and reacts.
 - d. _____ Protocol on the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare
 - e. _____ A poisonous substance produced within living cells or organisms.
 - f. _____ The reaction in which water, H_2O , divides into H, which combines with one part of a molecule, and OH, which combines with another part of the molecule, splitting the molecule into two parts.

2. Kim Jong-nam, the half-brother of North Korea's leader, died in Malaysia on 13 February 2017. Subramaniam Sathasivam, Malaysia's health minister, said he was exposed to the nerve agent VX, and he died in pain within 15-20 minutes. Let's evaluate the credibility of this claim. (Unless otherwise stated, 3 points each part)
 - a. How quickly do nerve agents act? Does death within 15-20 minutes fit for VX?

- b. Kim Jong-nam was thought to be exposed to VX when someone rubbed it on his face. Can VX be lethal from skin exposure? Is it just as likely that the nerve agent was sarin?
- c. Subramaniam Sathasivam said that no antidote would have worked. Is this true? What are the two primary antidotes for nerve agents, such as VX. Do they both work quickly?
- d. Malaysian police said that the two attackers had been instructed to wash their hands immediately after the attack. Although reports say that one of the attackers vomited after the attack, they did not exhibit any other significant effects of VX exposure. One suggestion used to explain the lack effects on the attackers is that they transferred two nonlethal chemicals that form VX to Kim Jong-nam's face and not VX itself. These chemicals then reacted to form VX. Based on your knowledge of binary nerve agent weapons, does this seem like a credible suggestion?
- e. Some people have questioned whether VX was used and point to the fact that the emergency personnel had no ill effects. Does the VX evaporate fast enough to be dangerous to people close to Kim Jong-nam? If the emergency personnel wore gloves and disposed of the gloves properly, does it make sense that they would have no ill effects?

- f. It has been suggested that the North Korean government was behind the attack. What are the ways someone can get chemical weapons? How hard would it be to obtain VX? How difficult is it to make VX? Does it seem like a small terrorist group could obtain VX? How difficult is it to obtain the precursors necessary to make VX?
- g. Has North Korea signed and ratified the Chemical Weapons Convention? Are they thought to have chemical weapons?
- h. It has been suggested that the OPCW step in and evaluate the situation. Describe the steps that the OPCW goes through to determine whether chemical weapons have been used. (4 points)

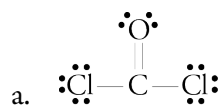
- i. Draw a Lewis structure that corresponds to the line drawing of VX below.

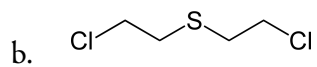


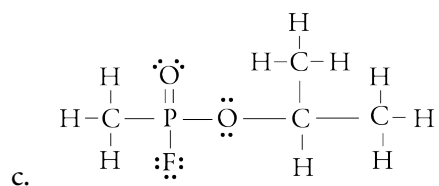
3. Let's assume that you have been radicalized by ISIL (ISIS), and you are now committed to their cause. Because of your growing knowledge of chemical weapons, you have been asked to provide general information about some of them and make recommendations for their use. Although ISIL does not yet have technical excellence in the areas of making, handling, and dispersal of chemical weapons, your contacts in ISIL tell you that the group now has followers with advanced scientific education in Western universities and Iraqi followers who have WMD experience. They also have access to chemical equipment captured from Mosul University in Iraq, and they have moved much of this equipment to a secure area in Syria where it will be safe from attack in Mosul. They have obtained other basic chemical equipment from captured chemical plants. They also are willing to commit a significant amount of money to making chemical weapons and developing their ability to handle and disperse them.
- a. First they ask you some questions about hydrogen cyanide, HCN.
- i. Draw a Lewis structure for hydrogen cyanide. (3 points)
- ii. Describe the different ways that ISIL would obtain hydrogen cyanide. How easy do you think it would be? Briefly, explain why. (3 points)

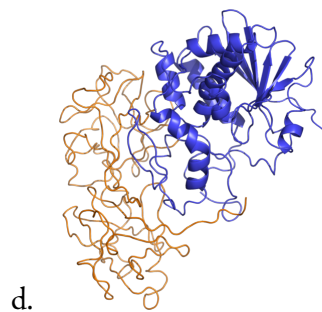
- iii. Is hydrogen cyanide more likely to be lethal or incapacitating? (2 points)
- iv. Which schedule for the CWC is hydrogen cyanide on? Is it on Part A or Part B? Explain why. (4 points)
- v. When hydrogen cyanide moves into the bloodstream from the lungs, what physiological changes does it cause? Why are these changes damaging to the body? (3 points)
- b. Next, they ask you some questions about sulfur mustard, $\text{ClCH}_2\text{CH}_2\text{SCH}_2\text{CH}_2\text{Cl}$.
- i. Draw a Lewis structure for sulfur mustard. (3 points)
- ii. Is it difficult to obtain the precursors for mustard agent? Explain why or why not? Compared to the difficulty in making nerve agents, how difficult is it to make sulfur mustard if the precursors are available? Briefly, explain why. (3 points)

4. Identify each of the following structures as chlorine, phosgene, sulfur mustard, hydrogen cyanide, sarin, VX, fentanyl, BZ, or ricin. (2 point each)









5. Identify each of the following descriptions as associated with chlorine, phosgene, sulfur mustard, hydrogen cyanide, sarin, VX, fentanyl, BZ, or ricin. (2 points each)
- a. _____ This chemical agent was first produced in England in 1954. It disrupts the mechanism by which nerves transfer messages to organs, causing seizures and loss of body control. A small drop on the skin could kill an adult in fifteen minutes. When sprayed on the ground, it remains lethal for up to three weeks, so it is an area denial weapon. The U.S. still has some of this agent stored in Bluegrass, Kentucky. It will be destroyed by chemical neutralization.
 - b. _____ This gas was the first chemical weapon used by the Germans in the first world war. It reacts with water to form hydrochloric acid and hypochlorous acid, which damage tissues in the lungs and draw water into the lungs causing “dry-land drowning”.
 - c. _____ This chemical agent is a military incapacitating agent. Its effects are similar to atropine. It is a competitive inhibitor of acetylcholine at receptor sites in smooth muscle, exocrine glands, autonomic ganglia, and the brain. The effects include stupor, confusion, and hallucinations. It is on schedule 2 of the Chemical Weapons Convention.
 - d. _____ This chemical agent disrupts the mechanism by which nerves transfer messages to organs, causing seizures and loss of body control. It was adopted as the standard U.S. chemical agent in its general category in 1948.
 - e. _____ This chemical agent causes suffocation by reacting with proteins in the lungs to disrupt the blood-air barrier. It is used to make important compounds, including pharmaceuticals and plastics. It smells like new-mown hay.

8. Describe the goals of the Australia Group and describe some of the difficulties in achieving these goals. (4 Points)

