The chemistry of chemical weapons: answers

Education in Chemistry
November 2019
rsc.li/36092UV

1. a. Molecular formula of mustard gas $C_4H_8SCl_2$

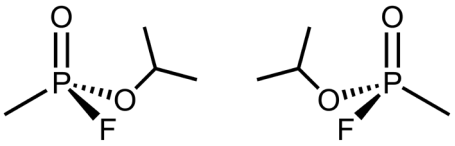
Chlorine has two isotopes; 75% Cl-35 and 25% Cl-37

Explanation of peak	**Explanation of abundance**
m/z 158 = $C_4H_8S^{35}Cl^{35}Cl$	3 × 3 = **9**
m/z 160 = $C_4H_8S^{35}Cl^{37}Cl$	(3 × 1) × 2 = **6**
m/z 162 = $C_4H_8S^{37}Cl^{37}Cl$	(1 × 1) = **1**

b. *m/z* 109/111 $[ClCH_2CH_2SCH_2]^+$

m/z 63/65 $[ClCH_2CH_2]^+$

2. a.



b. 10,000 l = 10 m^3

Air breathed in per minute = 10 m^3 / (24 × 60) = 6.94 × 10^{-3} m^3 min^{-1}

Sarin inhaled per minute = 6.94 × 10^{-3} m^3 min^{-1} × 100 mg m^{-3} = 0.694 mg min^{-1}

Time taken to inhale 0.5 mg = 0.5 mg / 0.694 mg min^{-1} = 0.72 min = **43 s**