

**The Strange Case of Mole Airlines, Flight 1023****Chemistry 405**

At 6:02 AM, you and your team of medical examiners are called to the scene of an airplane crash in a remote location. The plane shows evidence of a pre-crash explosion. Eight victims are found at the scene, but none are identifiable by witnesses, dental records, or DNA evidence. One victim was murdered prior to the plane crash. The flight manifest shows the names and some information about the victims. You must use the available tools and information to identify each victim. You must also solve the murder mystery.

**The Plane**

A section of the plane has been blown apart by an explosion. It appears as if the explosion happened before the crash. Residue from the explosion site shows the following elemental analysis: 37.01% carbon; 2.22% hydrogen; 18.5% nitrogen; 42.27% oxygen

**Passenger Manifest**

The passenger manifest lists the following passengers who boarded the flight at takeoff.

Joaquin Loera	Suspected drug smuggler on the TSA watch list
Burnett Sullenberger	Licensed commercial pilot with a recently diagnosed heart condition
Sayfullo Saipov	Suspected terrorist on the TSA watch list
Shapur ibn Sahl	Naturalized citizen employed as a licensed pharmacist
Randy Gregory	Pro athlete; recently suspended for drug use
Martha Browner	Depressed EPA worker who was recently fired
Jaime Escalante	Retired teacher who will only drink diet sodas
Sara Lee	Owens a family bakery

**Table 1 Compounds Found at Crash Site**

Chemical Name	Formula	Uses
Nitroglycerin	$C_3H_5N_3O_9$	Explosive; also used as a heart medication
Trinitrotoluene (TNT)	$C_7H_5N_3O_6$	Explosive, a.k.a. dynamite
Theobromine	$C_7H_8N_4O_2$	Found in chocolate, cocoa beans
Vanillin	$C_8H_8O_3$	Found in vanilla flavoring
Acetaminophen	$C_8H_9NO_2$	Over the counter pain killer, a.k.a. Tylenol
Aspirin	$C_9H_8O_4$	Over the counter pain killer
Dimetacrine	$C_{10}H_{13}N^*$	Prescription antidepressant
Aspartame	$C_{14}H_{18}N_2O_5$	Artificial, low calorie sweetener
Cocaine	$C_{17}H_{21}NO_4$	Narcotic (illicit) drug
Codeine	$C_{18}H_{21}NO_3$	Prescription (only) pain killer
Curare	$C_{40}H_{44}N_4O$	Causes paralysis; can be used as a poison

\*empirical formula

## The Victims

The following table presents the information obtained from laboratory tests of all of the victims. Remember that the bodies were not identifiable, so hopefully we can gain some clues as to the passengers' identity based on this forensic data.

**Table 2: Residue found on Victims**

Victim Number and Name	Sample Location	Percent Composition				Empirical Formula	Compound Name
		C	H	N	O		
1	blood sample	67.31%	6.98%	4.62%	21.10%		
2	on face of victim	63.15%	5.30%	-	31.55%		
	stomach contents	46.66%	4.48%	31.1%	17.76%		
3	In tablets found in victim's pocket	72.15%	7.08%	4.68%	16.03%		
4	In pocket and in blood sample	15.87%	2.22%	18.15%	63.41%		
5	blood sample	80.48%	7.45%	9.39%	2.68%		
	clothing	37.01%	2.22%	18.5%	42.27%		
6	pocket	57.14%	6.16%	9.52%	27.18%		
7	pocket	80.48%	7.45%	9.39%	2.68%		
	pocket	81.58%	8.90%	9.52%	-		
8	pocket	60.00%	4.48%	-	35.53%		
	pocket	63.56%	6.00%	9.27%	21.17%		

## Your Job

1. Use the data in Table 2 to determine empirical formulas for the compounds found on or within the passengers. Match these formulas with the identity of each compound listed in Table 1.
2. Use the personal data in the passenger manifest to make a *probable* identification of each passenger. Write their names in Table 2.
3. Write and attach a narrative (1 page) of your conclusions from the investigation. Be sure to mention:
  - A. The NAME of the explosive used to bring down the plane and WHO probably did it.
  - B. WHO was murdered and WHO is the most probable murderer.
  - C. Identification of ALL victims- JUSTIFY your answers with your analysis of the evidence, i.e. why do you think each victim was this specific passenger.