CLASS SET DO NOT WRITE ON

MOLARITY LAB- MURDER MYSTERY

BACKGROUND:

A crime has been committed and you, as the forensic detective, are going to use your knowledge of solution chemistry to solve the crime. Miss Scarlet was found dead on the floor of the ballroom. Beside her body police found a clear liquid, undoubtedly the murder weapon. Detective were quick to ascertain that the murder weapon was one of two chemicals. They know that Miss Scarlet has a violent reaction to potassium iodide, and that there was widespread use of calcium chloride, which is toxic if ingested, by several members of the household. Police further discovered the following evidence.

Professor Plum:, an eccentric chemistry teacher, was working in the study of calcium chloride solutions of molarites 0.20 to 0.30. Miss Scarlet was Plum's worst student, arriving to class late, being responsible for lots of broken glassware, and rarely cleaning up after her experiments. The policeman in charge, never having had a chemistry class, did not seriously consider this to be a motive for murder.

Mrs. White, an asthmatic, has a prescription for potassium iodide in the bathroom. Her pharmacist assures us that her potassium iodide solution has a molarity in the range of 0.05 M to 0.15M. Mrs. White was presently rooming with Miss Scarlet's ex-boyfriend led the police to suspect her. Neither she nor her boyfriend could be found in the lounge for comment

Mr. Green, a photographer, had solutions of calcium chloride between 0.05 M and 0.15 M in the darkroom. Mr. Green apparently had been caught scarlet-handed at his own blackmail game. Pictures of him with Miss Scarlet were found hidden in Scarlet's bedroom. Mrs. Green should be spared seeing the pictures if at all possible.

Mrs. Peacock, wearing the same dress as Miss Scarlet, was found in the stable, administering potassium iodide solution to her horse. When questioned, she admitted that her horse had a severe cause of bronchitis. Her veterinarian informed detectives that the strength of the solution was greater than 0.20M. It is likely that she knew of Miss Scarlet's violent allergy to potassium iodide, since they had been lab partners in Professor Plum's chemistry class. Professor Plum recalled how angry Mrs. Peacock would get when Miss Scarlet came late to class, unprepared for the experiments and how she invariable got sick a few days before the labs were due.

Colonel Mustard, had calcium chloride solutions in excess of 0.30 M, in the conservatory. The Colonel, who despised the left winged politics of Miss Scarlet, enjoyed his leisure hours making explosives. Colonel Mustard had been the interim assistant principal at the high school and was largely responsible for closing the campus when Miss Scarlet, then president of the student body, overthrew the administration and took control of the school. .

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YOUR TASK:

You can obtain a sample of the murder wapon found at Miss Scarlet's aide by asking your teacher for it, in the classroom. If you can determine whether it is calcium chloride or potassium iodide, then you can narrow the lists of suspects considerably. And if you can determine the molarity of the unknown solutions, then you can solve the case.

Who was the murderer? What was the weapon? What was its molarity? Provide a short, formal lab report giving evidence and analysis useful for the prosecution of the murderer. Your evidence will be Exhibit A at the trial, and will be subjected to the scrutiny of the defence attorney. On the basis of your evidence, a murderer might be set free or an innocent person executed.

MATERIALS AVAILABLE:

100mL of unknown solutions (calcium chloride and potassium iodide), 0.1 M NaCl (aq), 0.1 M $NaCO_3$ (aq), beakers, flasks, graduated cylinders, filters, filter paper, balances

SUGGESTED PROCEDURE:

1. Use your knowledge of double replacement reactions and solubility rules to determine how each of the possible murderous solutions would react with the known solutions provided
2. Once you have figured out which of the possible solutions the unknown is, use your knowledge of separation of mixtures, and the definition of molarity to determine the approximate molarity of the solution (hint-stoichiometry will be involved!)
3. After you have determine the identity of the murderous solution and its molarity you should be able to conclude which of the suspects is the murderer and where the murder was commited in order to write up your report for the court trial

FINAL REPORT:

The final report you turn in (to google classroom) must contain the following sections:
Purpose (10pts): In one to two sentences, state what the problem is that you are trying to solve

Materials (5 pts): List the materials that you used in the lab

Procedure (25 pts): List the steps that you used to determine the identity of the solution and its molarity. Be very specific so that someone could repeat what you did and get the same results. Include amounts used and types of glassware. Write in passive voice (no I, me, we, us, them, etc)

Data (15pts): This section should include tables with all observations made and any measurements recorded

Calculations (15pts): Show all reaction predictions and calculations here

Conclusions (30pts): In a short paragraph, summarize the conclusions that you have made as to the identity of the solution and its molarity, using the lab techniques that you used to arrive at those conclusions. Finally, state who you suspect the murderer is and where the murder was committed, based on the police evidence.