

Chemistry Honors Lab 1

Identification of an Unknown Substance

Purpose:

1. To ensure proper use and knowledge of laboratory equipment and safety precautions.
2. To conduct a variety of laboratory tests to identify characteristics of known chemicals.
3. To introduce the concepts of chemical reactions, melting points, precipitates, and solubility when conducting experiments with chemicals.
4. To compare the characteristics of an unknown substance to the known in order to properly identify the unknown.

Background:

Substance identification is very important in many real-life situations. An unconscious victim has ingested some drug – it is critical to identify the substance as quickly as possible. A child has swallowed some pills from a medicine cabinet – identification could be a matter of life or death. Someone is seen selling bags of white powder – it must be identified for the safety of the public and for a criminal conviction to occur. A person has died as a result of someone tampering with drug bottles at a local pharmacy – what was added to the antacid tablets?

The basis for identification of unknown substances always hinges upon using known standards for comparison. It is vital that these known standards included proper knowledge and use of scientific equipment as well as a variety of tests to differentiate chemicals from one another. Without knowing exactly how a known substance reacts to all tests, it would be impossible to make a positive identification of an unknown substance. As new drugs and substances are created, standards for testing for these substances must also be developed. The FBI Crime Laboratory, for example, works very closely with pharmaceutical companies to produce tests for all new drugs as they are developed. The “standards”, which are kept on file, are critical for proper identification of unknowns.

In the first part of this laboratory, a set of standards will be established for known substances. Proper use and knowledge of laboratory equipment and procedures will be necessary in all tests to ensure precision. The same tests will be conducted to identify an unknown substance. Though this simulation is clearly an oversimplification, the principles are the same as those utilized by a crime laboratory. In the crime lab, the simple chemical reactions would be replaced by complex analyses utilizing very expensive and sophisticated equipment.

Hypothesis:

Materials:

Hand lens	0.10 M HCl (0.10 molarity hydrochloric acid)
Aluminum foil	Test tube with lid/rubber stopper
Distilled water	1.0 M Na ₂ CO ₃ (1.0 molarity sodium carbonate solution)
Iodine solution	AgNO ₃ (silver nitrate solution)
Small cups	Plastic spoons
Forceps	Paper towels
Sharpies	Beral pipets
Hot plate	10 mL Graduated cylinder
Scogaine	Davlate
Bradlin	Irenin
Markopan	Unknown substance

Safety:

Procedures:

Day 1:

1. Use a plastic spoon to obtain approximately one level teaspoonful of your assigned drug and place into sample into a small cup (with proper label).
2. Place 0.5 mL of drug into a graduated test tube.
3. Examine drug with a hand lens. Describe the appearance of the substance in the data table.
4. Make a small, flat cup from a piece of aluminum foil. Write your initials on the foil cup with a Sharpie marker. Pour the contents of test tube into the aluminum cup. Use forceps to place the cup on a hot plate and observe for 3-4 minutes. Record results in the data table (melt or no reaction). Remove the cup from the hot plate and let cool. Crumple drug inside foil and throw away in the trash.
5. Refill graduated test tube to the 0.5 mL mark with drug.
6. Use a beral pipet to add 5 drops of 0.1M hydrochloric (HCl) acid to test tube. As the acid is added, note any reaction that occurs and record results for the HCl test in the data table.
7. Pour mixture down sink and thoroughly wash and dry the test tube.
8. Add a fresh 0.5mL sample of drug to the clean test tube.
9. Using a clean beral pipet and a 10 mL graduated cylinder, add about 5 mL of distilled water to the test tube. Place the cover on top of the test tube and shake for 1 minute. Record if drug is water soluble (dissolves) or water insoluble (does not dissolve) in the data table.
10. Save the test tubes for the next test.
11. Using a clean beral pipet add 2-3 mL of 1.0 M Na_2CO_3 solution to the test tube from step 9. Observe and record results in data table.
12. Pour mixture down sink and thoroughly wash and dry test tube.
13. Add a fresh 0.5 mL sample of drug to the clean test tube.
14. Using a clean beral pipet, add 5 drops of iodine solution to test tube. Iodine solution is an orange/brown color and will stain skin and clothing. Observe and record any color change.
15. Pour mixture down sink and thoroughly wash and dry test tube.
16. Add a fresh 0.5 mL sample of drug to the clean test tube.
17. Using a clean beral pipet and a 10 mL graduated cylinder, add 5 mL of distilled water to the test tube. Place the cover on top and invert it several times. Allow test tube to sit for 30 seconds.
18. Add 5 drops of AgNO_3 solution to test tube from step 17 using a clean pipet. AgNO_3 will stain skin and clothing. Record if a precipitate (solid particles formed from mixing two or more liquids) forms.
19. Clean up: Pour mixture down sink and thoroughly wash and dry test tube. Return to proper location. Dispose of remaining drug by throwing it away in the trash. Return cup to original location. Return any graduated cylinders, chemical bottles, pipets, and distilled water wash bottles to proper stations. Throw away any remaining trash, return goggles to goggle cabinet, and be seated.

Day 2:

1. Get into collaborative groups as directed by teacher. Come to a consensus on data table results and write them on the data table on the overhead.
2. Copy all of the data for each drug as other students write their results.
3. Obtain an unknown sample from your teacher and run all of the tests from procedures 2-18 on the unknown. Record the results from all of the tests on the unknown column in the data table.
4. Clean up as directed in procedure 19.

Pre-Lab Questions (due as part of pre-lab check):

1. Describe the concept of soluble and insoluble using salt as an example.
2. Describe the difference between a precipitate in a chemistry lab and precipitation in a weather report.
3. Briefly describe each of the safety concerns for this lab based on the safety symbols.
4. Why is it so important to clean the test tube thoroughly when directed?
5. You were to obtain no more than 3 mL of the Na_2CO_3 solution but you obtained 10 mL. What should you do with the excess **and** why?

Data Table:

	Assigned Drug Name	Scogaine	Daviate	Bradlin	Irenin	Markopan	Unknown
General Appearance							
Heat Test							
HCl Test							
Solubility Test							
Na_2CO_3 Test							
Iodine Test							
AgNO_3 Test							

Identity of Unknown Drug _____

Analysis Questions:

1. Define chemical reaction. List some of the occurrences seen in this lab that indicated a chemical reaction took place.
2. Is melting point considered a physical or chemical change of matter **and** why?
3. When you collaborated with the other groups who tested the same drug, did you all have the exact same results? List what was the same for all groups and what was different. How could these differences have happened?
4. What was your favorite test in this lab and why?

Conclusion Guidelines:

1. List the main reason for conducting this experiment as well as main materials and procedures.
2. Restate your hypothesis and state whether you accept or reject it **and** why.
-Compare the results of 2-3 different standards from the data table to your unknown results. List specific information from the data table to support your hypothesis position.
3. State your confidence in this lab by explaining some procedures that you did well or could improve upon. Earn points for the quality of your self evaluation.