

	TRACE-PM 10.2 Acids and Bases	
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	<i>Document Manager: Cheryl Lozen</i>	<i>Approved By: Jeffrey Nye</i>

10.2 Acids and Bases

10.2.1 Purpose

To identify common acids and bases that may be encountered in casework.

10.2.2 Safety Considerations

10.2.2.1

Acids and bases, e.g., HCl, HNO₃, H₂SO₄, H₃PO₄, NH₄OH, NaOH, KOH, may be encountered as evidence. These are very corrosive. Eye and skin protection must be used.

10.2.2.2

Acids may be very reactive with chlorates, acetone, flammable liquids and water. Extreme care must be taken when mixing these compounds.

10.2.2.3

Minimum Standards and Controls

10.2.3.1

Treat the questioned samples and any control/standard samples in the same manner.

10.2.3.2

When performing extractions also analyze a blank of the extraction liquid and an undisturbed portion of the substrate, if possible.

10.2.3.3

Controls and blanks will be run with each case and the results recorded in the case record notes.

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10.2.4 Analytical Procedures

10.2.4.1

If the sample is a solid or is on a solid substrate, dissolve in deionized (DI) H₂O. If the sample is a liquid, check if it is miscible with H₂O by adding a small amount of the liquid to H₂O.

10.2.4.2

A preliminary pH may be determined with pH paper. Various pH papers are available, which can fairly accurately determine the approximate pH. A pH value can also be obtained from the use of a pH meter.

10.2.4.3 If the pH is acidic proceed as follows:

10.2.4.3.1

Hydrochloric acid: Test unknown with a few drops of silver nitrate reagent. A white precipitate indicates the presence of a chloride.

10.2.4.3.2

Sulfuric acid: Test unknown with a few drops of barium chloride reagent. A white precipitate indicates the presence of a sulfate.

10.2.4.3.3

Nitric acid: Test unknown with a few drops of diphenylamine reagent. Immediate development of a deep blue color indicates the presence of nitrates.

10.2.4.3.4

Phosphoric acid: Test unknown by placing 6 ml of acetone in a small test tube. Place 3 drops of unknown liquid into test tube. Mix. Add 3 drops of ammonium hydroxide and mix. A precipitate indicates the presence of ammonium phosphate dibasic, (NH₄)₂ HPO₄, if phosphoric acid is present.

10.2.4.3.5

Specific anion test strips (such as EM Quant) may be used in place of, or in addition to, any of the above microchemical tests. While these test strips may have an expiration date they will continue to be used as long as they test positive with an appropriate known acid.

10.2.4.4 If the pH is basic proceed as follows:

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10.2.4.4.1

Ammonium hydroxide: Test the unknown with Nessler reagent. The formation of an orange to brown precipitate indicates the presence of ammonium ions. Ammonium test strips (such as EM Quant) may be used in place of, or in addition to, the Nessler reagent test.

10.2.4.4.2

Sodium hydroxide: Basic pH and SEM/EDS.

10.2.4.4.3

Potassium hydroxide: Basic pH and SEM/EDS.

10.2.4.4.4

A report may be generated at this time if the results of the pH test and the spot tests are sufficient for the case report.

10.2.4.4.5

If further characterization of the acid/base is necessary, then the extract and/or the precipitate from the microchemical testing may either be run using X-ray fluorescence, ion chromatography or FTIR, each combined with SEM/EDS, as appropriate.

10.2.5 References

Anger, V., and Feigl, F., *Spot Tests in Inorganic Analysis*, 6th ed., Elsevier Publishing Company: Amsterdam, The Netherlands, 1972.

Illinois State Police, *Trace Chemistry Procedures Manual, Common Acids Identification*, February 1, 1997.

Jungreis, Ervin.; "Spot Test Analysis, Clinical, Environmental, Forensic, and Geochemical Applications", Volume 75, 1985.