For each of the following problems indicate whether its solution requires a qualitative, quantitative, characterization, or fundamental study. More than one type of analysis may be appropriate for some problems.

A hazardous-waste disposal site is believed to be leaking contaminants into the local groundwater.

Answer: Qualitative and quantitative analysis

Quantitative analysis in chemistry provides the measure of different chemical components present in a particular sample, whereas qualitative analysis in chemistry provides information on the presence or absence of various chemical components in an unknown sample.

An art museum is concerned that a recent acquisition is a forgery.

Step 1: Answer

Qualitative and/or quantitative

Step 2: Explanation

Quantitative analysis in chemistry provides the measure of different chemical components present in a particular sample, whereas qualitative analysis in chemistry provides information on the presence or absence of various chemical components in an unknown sample.

A more reliable method is needed by airport security for detecting the presence of explosive materials in luggage.

Step 1: Answer

Qualitative analysis

Step 2: Explanation

The determination of non-numerical information about a chemical species, a reaction, etc. is known as qualitative analysis. Examples include seeing that a reaction produces gas that is popping out of solution or that a reaction causes a change in hue.

 The structure of a newly discovered virus needs to be determined.

Step 1: Answer

Characterization analysis

Step 2: Explanation

Examples of characterisation analyses include the determination of chemical structure, equilibrium constants, particle size, and surface structure. A problem related to a specific sample is what a qualitative, quantitative, or characterisation study aims to address.

 A new visual indicator is needed for an acid–base titration.

Step 1: Answer

Fundamental analysis

Step 2: Explanation

The goal of a fundamental analysis is to increase our comprehension of the theory that underpins an analytical method and to better grasp the constraints of that method.

A new law requires a method for evaluating whether automobiles are emitting too much carbon monoxide

Step 1: Answer

Quantitative analysis

Step 2: Explanation

Any technique for figuring out how much of a chemical is present in a sample is considered a quantitative analysis. Always a number with the proper units is used to represent the amount. An illustration of quantitative analysis is an acid-base titration.