Testing for Ions

1. Imagine you're about to take a drink from your water bottle. What kinds of substances might be present in the water?

2. People often say that water from a different area has a different taste. Suggest an explanation for this observation.

Drinking water actually contains many different substances. Some are added deliberately during the process of water purification.

3. Name a substance that might be added deliberately.

Many substances in water occur naturally. As rainwater passes through the ground, minerals dissolve into the water. These minerals are ionic compounds that may contain ions such as calcium (Ca^{2+}), magnesium (Mg^{2+}), iron (Fe^{3+}), chloride (Cl^{-}), nitrate (NO^{3-}), or sulfate (SO_4^{2-}).

An important aspect of water quality monitoring involves detecting the presence of dissolved ions in a water sample. One method of detecting these ions is to use chemical tests. Such tests can also be used to identify unknown ions. A **positive test** for a substance is one that clearly indicates the substance is present. A positive test for a dissolved ion may produce an insoluble precipitate or it may produce a coloured product.

Aztech Laboratory Inc in Quispamsis does water quality testing. Imagine they have received a water sample from KVHS and have been asked to test it for the presence of chloride ions (Cl^{-}), sulfate ions (SO_4^{2-}), and iron ions (Fe^{3+}). To test for a particular ion they add the test reagent to the water sample and observe the results. Table 1 shows the results of a positive test for each ion when a sample is mixed with the test reagent.

The lab results are shown in Table 2.

Table 1: Positive results for each ion test

Test for which ion?	Test reagent added to sample	Positive test result
Chloride ion	Silver nitrate	White precipitate
Sulfate ion	Barium chloride	White precipitate
Iron (III) ion	Potassium thiocyanate	Red color

Table 2: Results of water tests performed by Aztech

Test reagent added to sample	Precipitate formed	Solution Color change
silver nitrate	White	None
barium chloride	White	None
potassium thiocyanate	None	Red

4. a) Explain what is meant by a positive test for an ion.

b) Describe two types of changes that demonstrate a positive test.

5. Why do you think chemical tests, similar to the tests used in this investigation, are called qualitative analyses?

6. Describe how this type of test could distinguish between a sample that contains a large amount of an ion and one that contains less of the ion.

(P, D) 7. If a silver nitrate solution is added to a potassium chloride solution and a precipitate forms, what are the names and formulas of the possible products?

(P, D) 8. Write chemical formulas for the following substances:
a) silver nitrate
b) barium chloride
c) sodium sulfate
d) iron(III) nitrate