



50 minutes total

Overview of Activities

1. Introduction
2. Chemical Testing Method Presentation
3. Chemical Testing Method Evaluation
4. Review

Learning Outcomes

At the end of this session participants will be able to:

1. Identify appropriate chemical testing methods
2. Evaluate different chemical testing methods

Materials & Preparation

- Activity: Introduction
- Prepare: Two samples in Whirl-Pak® bags: one with weak tea or coffee (brown colour but NOT turbid), one with clear water
- Activity: Chemical Testing Methods Presentation
- PowerPoint: Chemical Testing Methods
- Prepare: Examples of different chemical testing options, see list below
- Water quality test strips, e.g., chlorine test strips
- Colour disc comparator with colour disc and cuvettes, e.g., chlorine
- Photometer or colorimeter with cuvettes, e.g., Palintest photometer
- Digital meter, e.g., pH meter
- Arsenic test kit (optional), e.g., Wagtech Arsenator kit
- Activity: Write out the four chemical test methods, one per flip chart page, with advantages and limitations listed below in two columns (see end of lesson for reference chart)
- Activity: Review
- Handout: Case Study, see end of lesson (one page; one copy per group)
- Prepare: Cut out scenarios along the cutline on the Case Study handout

Recommended Reading

- Technical Brief: Chemical Aspects in Drinking Water

5 minutes



Introduction

1. Pass around a Whirl-Pak® sample bag with light brown coloured water.
2. Explain: “This water sample came from a shallow well.”
3. Ask: “What chemical parameters would you test for in this sample and why? Think back to the Chemical Aspects activity.”
 - Test for iron and manganese because of the colour
4. Pass around a second sample of clear water in a Whirl-Pak® bag.
5. Ask: “What chemical parameters would you test for in this sample and why?”
 - Test for priority chemicals: fluoride, arsenic, nitrate because the sample is colourless and there are no other clues for what to test
 - Can also test for chlorine and pH
6. Present the learning outcomes or an overview of the lesson.

Trainer tip:

Participants can refer to the Information Treasure Hunt from the Chemical Aspects activity or the Acceptability Aspects table in their workbooks.

15 minutes



Chemical Testing Method Presentation

Use PowerPoint: Chemical Testing Methods for this presentation.

1. Use PowerPoint to explain different chemical testing methods (optional).
2. Alternatively, demonstrate and discuss chemical testing options using examples:

Water Quality Test Strips

- Available to measure pH and a variety of chemicals, e.g., chlorine
- Single-use paper or plastic strips that change colour when activated in sample water to indicate the concentration of a chemical when compared to a colour chart
- Strips have different activation methods and wait times. Always follow manufacturer’s instructions to ensure correct results

Colour Disc Comparator

- Designed to react with a wide range of specific chemicals e.g., chlorine, iron, manganese
- Interchangeable colour discs for specific chemicals
- Visual comparison of reacted sample colour to colour disc standard to determine concentration of the chemical in the test sample

Trainer Tips

This lesson demonstrates portable test kits for use in non-laboratory environments for rapidly assessing chemical parameters.

Photometer and Colorimeter

- Digital instruments that use a light source to measure chemical concentration
- Read a wide variety of chemicals, (must have appropriate reagents)
- More sensitive and accurate than methods that use visual comparison
- Measures the amount of coloured light absorbed by a coloured sample in reference to a colourless sample blank
- Photometer and colorimeter are similar but use different technologies to take the colour measurements

Digital Meters

- Portable
- Digital readouts
- Measure specific parameters, e.g., pH, TDS, electrical conductivity, turbidity
- Require calibration

Arsenic Field Test Kit (optional)

- Commercially available field test kits with varying detection limits, e.g., Palintest Arsenator reports a detection range of 2–100 ppb
- Most use the Gutzeit method with visual comparison to a colour reference chart
- Some digital meters are available that use an optical photometer to measure the colour change, e.g., Palintest Arsenator
- Accuracy of arsenic field tests has improved dramatically allowing large-scale testing for rapid assessments

20 minutes

Chemical Testing Method Evaluation

Use PowerPoint: Chemical Testing Methods for this presentation or a prepared flip chart.

1. Explain that they are going to play a game where they have to identify the advantages and limitations of the different chemical testing methods.
2. Divide into two teams. (Count off one and two and divide into Group 1 and Group 2.)
3. Have participants come up with a team name.
4. On a flip chart page or PowerPoint slide, display one chemical testing method with the advantages and limitations written in two columns below the title. Use the Chemical Testing Options chart at the end of the lesson for reference.
5. Display the PowerPoint slide or flip chart page but with the advantages and limitations covered.

Trainer Tips

Be prepared to moderate this activity. Group dynamics will affect how the debate proceeds. Be prepared with questions if the group is quiet.

6. Explain that in their groups they are going to try to identify all the advantages and limitations listed and the team that identifies the most wins the game.
7. Allow 10 minutes for groups to write down their answers in their workbooks.
8. Bring groups together and show the answers of one testing method at a time.
9. The group that identifies the most wins the game.

Trainer Tips

Groups may identify more advantages or limitations than what are listed. Use your best judgment for the acceptability of the points made.

10 minutes

Review

1. Hand out one case study to each group. (Stay in the same groups as the debate activity.)
2. Ask: “Based on the case study you have been given, what testing method would you recommend and why?”
3. Allow a few minutes for groups to read and discuss the case study.
4. Allow groups to briefly summarize the study and explain their recommendations.
5. Discuss responses as a group and ask if there are any other ideas.

Solutions:

- **Scenario 1:** Iron is the likely contaminant because of the appearance and taste; colour comparators are a good testing alternative because they are less expensive, are fairly accurate and only require moderate training.
Note: Test strips would also be appropriate but are less accurate
- **Scenario 2:** Photometer or colourimeter would be the best option for accurate results and ease of use; the cost is more than a colour comparator but well worth the expense; the technician has water quality testing experience; want confidence in the results for an important project where results are used to make decisions that affect people’s lives.

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Chemical Testing Options

Advantages and Limitations

Chemical Testing Option Considerations

Testing Option	Advantages	Limitations
Test strip	Inexpensive, fast, easy, simple, gives a rough estimate	Visual interpretation of colour, low accuracy
Colour comparator	Good for moderate field conditions, better accuracy, robust	Needs reagents, more expensive, visual interpretation of colour, some training required
Photometer/colorimeter	Digital, more accurate and repeatable results, tests many chemical parameters	More expensive, require power source, proper training required, more fragile
Digital meter	Very accurate, portable, easy to use	More expensive, needs calibration, requires training
Arsenic test kit (optional)	Portable, relatively easy to use, provides first assessment in high arsenic areas	Some require visual interpretation of colour, expensive, requires training, test may produce toxic waste

Case Study

Handout

Scenario 1

People in a compound have just drilled a new well and are complaining that their groundwater tastes bad. You notice that the water has an orange colour to it. The women are complaining that their clothes are being stained an orange colour after washing them. What do you think is the potential cause of the taste and colour?

You want to test the water to see if your suspicions are correct. You have a modest budget and some water quality testing skills. You will use the results of the tests to help you advise the people how to remove the contaminant from their drinking water.

What chemical testing method would you use to verify the contaminant?



Scenario 2

You are conducting a survey of fluoride contamination in a wide rural region. Many people from villages in the area have spots and pits on their teeth and some have been observed with skeletal problems. The local government has hired you to do a preliminary assessment of the fluoride levels and to map the contamination levels to help them plan a response to high fluoride levels.

You have been given a moderate budget and have experience conducting water quality testing. What testing equipment would you purchase to complete the fluoride assessment project and why?