ffem match user manual

ffem

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Contents

1 Introduction

ffem match is a water testing app from Foundation for Environmental Monitoring (ffem). Download the app from https://play.google.com/store/apps/details?id=io.ffem.match or scan the QR Code below.

2 General Operation

2.1 Principle

ffem builds water and soil tests based on colorimetry or titration. We occasionally ship third-party meters to complete functionality provided by our kits.

2.2 Colorimetry

Colorimetry is the principle of measuring the concentrations of analytes by measuring a change in colour induced by a reagent. Usually, this would be done by eye comparing against a colour card in the field, or using a colorimeter, or for best results, using a spectrometer. ffem's colorimetric tests work by using the camera on an Android phone and produces results that are close to that of a standard laboratory test.

Before you begin to test using colorimetry, you need to calibrate your phone. The calibration step creates an internal table with which colours captured by the camera are compared with. There are two kinds of calibrations offered: the minimal calibration and the complete calibration.

Colorimetric testing is carried out by mixing the sample with the reagent in the quantities and method specified. The resulting solution is then placed in the appropriate cuvette. Clip the ring light over your phone and turn it on to its brightest setting. Place the cuvette under the light stand and the phone over the light stand. Position the cuvette so that it is directly under the camera and the sampling circle is in the brightest central spot. On analysing the colour, the app with match it with the calibration table and produce an interpolated result.

The exact steps to be followed for testing are listed against each parameter.

2.3 Titration

ffem offers some simplified titration tests. First the sample is to be prepared for titration by adding one or more reagents. Add the titrant dropwise to the sample and shake, while keeping count of the drops. At some point there will be a colour change, the app will convert the number of drops added till the change in colour to the concentration of the analyte.

The steps to be followed for each titration is listed against the respective parameter.

3 Precautions

Most tests use standard solutions, chemical reagents, and titrants. It is important to exercise care and caution while using them.

3.1 Precautions while storing and using the kit

Store the kit in a cool, dry place. Keep out of reach of children and animals. Avoid chemicals coming in contact with skin and eyes. Recommended usage of gloves and eye protection. If chemicals do come in contact with skin and eyes, rinse thoroughly with water and seek medical attention. Conduct tests in well-lit and well-insulated areas away from direct sunlight.

3.2 Disposal of reagents

Dispose of used reagents in the bottle marked for disposal. This bottle contains activated charcoal. Dry out the bottle outdoors to allow more liquids to be disposed of. After using the entire kit, empty the activated charcoal and dipose it into your area's medical/hazardous waste facility.

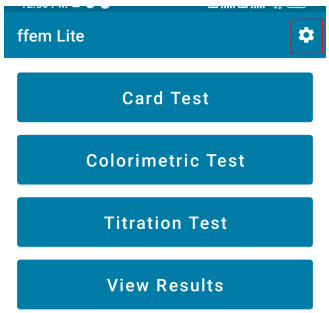
4 Minimal and Full Calibration

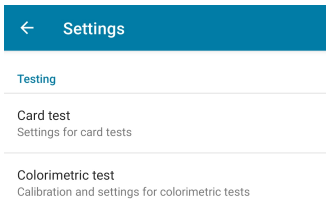
4.1 Why

Colorimetric tests are fairly accurate but require calibration to work. There is always an investment in time, effort and material with each point that needs to be calibrated. A minimal calibration is the least number of points you need to calibrate to have a working device of reasonable accuracy. Typically these are three points per parameter. A full calibration will give you accurate results but need a larger number of points.

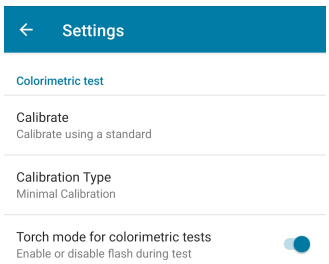
4.2 Calibration settings

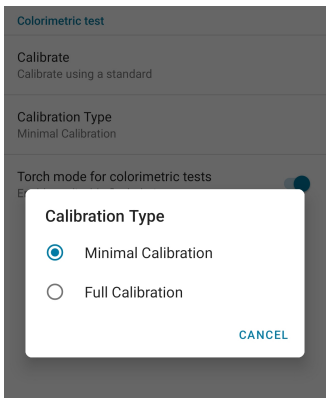
Go to `Settings`.





Choose `Colorimetric Test`





Choose Minimal or Full Calibration as required.

5 Colour / Hazen Units

5.1 Principle

Water colour is measured in Hazen Units (HU), and is a measure of the cleanness of the water source. Distilled water should have a colour of 0 HU.

The Indian Standard for drinking water holds that the acceptable limit is 5 Hazen Units, but in the absence of any other toxic substances or alternate source, this is relaxable up to 15 Hazen Units.

5.2 Calibration

To prepare calibration standards, take 20 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 HU	0
25 HU	10
50 HU	20
100 HU	40

Minimal Calibration

Standard	Drops
0 HU	0
50 HU	20
100 HU	40

You do not need to add any reagent for this test.

- Take the 0 standard and fill it into the cuvette. In this case, you will need to add the standard to the tall glass tube and place it into the white cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness
- Place the phone over the stand
- Go to `Settings` >`Colorimetric Test` >`Calibrate` >`Water` and choose `Hazen Units`
- Select the calibration point, `0.00 HU` in this case
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`
- You should have your first calibration point. Repeat similarly with the other calibration points.

5.3 Test

This test does not require a reagent.

- Collect 20 ml of sample water and place it in the cuvette. In this case, you will need to add the standard to the tall glass tube and place it into the white cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness.
- Place the phone over the stand.
- From the home screen choose `Colorimetric Test` >`Water` >`Hazen Units`.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- After some time, the app will display a result

6 Turbidity

6.1 Principle

Turbidity, measured in NTU is a colorimetric test with no reagents. Turbidity is a measure of how clear water is. Distilled water should have turbidity of 0 NTU.

The Indian Standard for drinking water holds that the acceptable limit is 1 NTU, but in the absence of any other toxic substances or alternate sources, this is relaxable up to 5 NTU.

6.2 Calibration

To prepare calibration standards, take 20 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 NTU	0
10 NTU	10
20 HU	20
30 HU	30

Minimal Calibration

Standard	Drops
0 NTU	0
10 NTU	10
30 HU	30

You do not need to add any reagent for this test. **Shake the standard solutions dropper bottle thoroughly**

- Take the 0 standard and fill it into the glass cuvette provided. Place the glass cuvette inside the blue cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness
- Place the phone over the stand
- Go to `Settings` >`Colorimetric Test` >`Calibrate` >`Water` and choose `Turbidity`
- Select the calibration point, 0.00 NTU in this case
- Click on `Start Camera`
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.

- Select `Analyze`
- You should have your first calibration point. Repeat similarly with the other calibration points.

6.3 Test

This test does not require a reagent.

- Collect 20 ml of sample water and place it in a glass cuvette and turn inside the blue cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness
- Place the phone over the stand
- From the home screen choose `Colorimetric Test` >`Water` >`Turbidity`
- Choose `No Dilution` if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- After some time, the app will display a result.

7 pH

7.1 Principle

pH is a colorimeteric test. pH is a measure of how acidic or basic the water is.

Indian standards for drinking water specify it to be within 6.5 and 8.5 with no relaxation.

7.2 Calibration

pH standards based on buffer solutions should be supplied to you. You should have standards of pH 4, 5, 6, 7, 8, 9 and 10.

Take 5 ml of the pH standard, say 4, and add 1 drop of the pH indicator.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness.
- Place the phone over the stand.
- Go to `Settings` >`Colorimetric Test` >`Calibrate` and choose `pH`.
- Select the calibration point, 4 in this case.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- You should have your first calibration point. Repeat similarly with the other calibration points.

7.3 Test

This test uses the pH indicator.

- Collect 5 ml of sample water, add 1 drop of pH indicator and place in the white cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness

- Place the phone over the stand
- From the home screen choose `Colorimetric Test` >`Water` >`pH`.
- Choose `No Dilution` if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- After some time, the app will display a result.

8 Fluoride

8.1 Principle

Fluoride is a colorimeteric test. This test uses a modified SPADNS reagent.

The Indian Standard for drinking water holds that the acceptable limit is 1 mg/l, but in the absence of any other toxic substances or alternate sources, this is relaxable up to 1.5 mg/l.

8.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
0.5 mg/l	1
1 mg/l	2
1.5 mg/l	3
2 mg/l	4

Minimal Calibration

Standard	Drops
0 mg/l	0
1 mg/l	2
2 mg/l	4

Take 5 ml of the 0 mg/l Fluoride standard, and add 5 drops of the Fluoride reagent.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness
- Place the phone over the stand
- Go to `Settings` >`Colorimetric Test` >`Calibrate` and choose `Fluoride`.
- Select the calibration point, 0 mg/l in this case
- Click on `Start Camera`
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- You should have your first calibration point. Repeat similarly with the other calibration points.

8.3 Test

This test uses the Fluoride reagent.

- Collect 5 ml of sample water, add 5 drops of Fluoride reagent and place in the white cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness
- Place the phone over the stand
- From the home screen choose `Colorimetric Test` >`Water` >`Fluoride`.
- Choose `No Dilution` if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- After some time, the app will display a result.

9 Nitrate

9.1 Principle

Nitrate is a colorimeteric test. This test uses 2 reagents per test that are shipped in small packets.

The Indian Standard for drinking water holds that the acceptable limit is 45 mg/l with no relaxation.

9.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
10 mg/l	2
25 mg/l	5
50 mg/l	10
75 mg/l	15

Minimal Calibration

Standard	Drops
0 mg/l	0
50 mg/l	10
75 mg/l	15

Take 5 ml of the 0 mg/l Nitrate standard, and add the contents of Reagent A and Reagent B. Shake till dissolved.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness
- Place the phone over the stand
- Go to `Settings` >`Colorimetric Test` >`Calibrate` and choose `Nitrate`.
- Select the calibration point, 0 mg/l in this case
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.

- This test takes 6 minutes (360 seconds) to develop ideal colour. Click on `Start Timer` to start a timer, or you can `Skip Delay` if you have already waited 5 minutes.
- You should have your first calibration point. Repeat similarly with the other calibration points.

9.3 Test

This test uses the Nitrate reagents.

- Collect 5 ml of sample water, add the contents of Reagent A and Reagent B and place in the white cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness.
- Place the phone over the stand.
- From the home screen choose `Colorimetric Test` >`Water` >`Nitrate`.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- This test takes 6 minutes (360 seconds) to develop the ideal colour. Click on `Start Timer` to start a timer, or you can `Skip Delay` if you have already waited 5 minutes.
- After some time, the app will display a result.

10 Total Iron

10.1 Principle

Iron is a colorimeteric test. This test uses two liquid reagents.

The Indian Standard for drinking water holds that the acceptable limit is 0.3 mg/l with no relaxation.

10.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
0.5 mg/l	1
1 mg/l	2
1.5 mg/l	3
2 mg/l	4

Minimal Calibration

Standard	Drops
0 mg/l	0
1 mg/l	2
2 mg/l	4

Take 5 ml of the 0 mg/l Iron standard, and add 3 drops of Reagent A, shake well, then add 20 drops of Reagent B and shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness.
- Place the phone over the stand.

- Go to `Settings` >`Colorimetric Test` >`Calibrate` and choose Total Iron.
- Select the calibration point, 0 mg/l in this case.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- This test takes 5 minutes (300 seconds) to develop the ideal colour. Click on `Start Timer` to start a timer, or you can `Skip Delay` if you have already waited 5 minutes.
- You should have your first calibration point. Repeat similarly with the other calibration points.

10.3 Test

This test uses the Iron Reagents.

- Collect 5 ml of sample water, add 3 drops of Reagent A, shake well, and add 20 drops of Reagent B, shake well, and place in the white cuvette.
- Place the cuvette under the light stand.
- Clip on the ring light over your phone and turn it on to maximum brightness.
- Place the phone over the stand.
- From the home screen choose `Colorimetric Test` >`Water` >`Total Iron`.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on `Start Camera`.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select `Analyze`.
- This test takes 5 minutes (300 seconds) to develop the ideal colour. Click on `Start Timer` to start a timer, or you can `Skip Delay` if you have already waited 5 minutes.
- After some time, the app will display a result.

11 Copper

11.1 Principle

Copper is a colorimeteric test. This test uses a PAN reagent.

The Indian Standard for drinking water holds that the acceptable limit is 0.05 mg/l, but in the absence of any other toxic substances or alternate sources, this is relaxable upto 1.5 mg/l.

11.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
0.5 mg/l	1
1 mg/l	2
1.5 mg/l	3
2 mg/l	4

Minimal Calibration

Standard	Drops
0 mg/l	0
0.5 mg/l	1
1.5 mg/l	3

Take 5 ml of the 0 mg/l Copper standard, and add 5 drops of the Copper Reagent and shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings ¿ Colorimetric Test ¿ Calibrate and choose Copper.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

11.3 Test

This test uses the Copper Reagent.

- Collect 5 ml of sample water, add 5 drops of the Copper Reagent, shake well, and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Water > Copper.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

12 Sulphate

12.1 Principle

Sulphate is a colorimeteric test. This test uses a Barium chloride reagent.

The Indian Standard for drinking water holds that the acceptable limit is 200 mg/l, but in the absence of any other toxic substances or alternate source, this is relaxable upto 400mg/l.

12.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
10 mg/l	5
20 mg/l	10
40 mg/l	20

Minimal Calibration

Standard	Drops
0 mg/l	0
20 mg/l	10
40 mg/l	20

Take 5 ml of the 0 mg/l Copper standard, and add 10 drops of Sulphate Reagent A and 1 spoonful of Sulphate Reagent B and shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings ¿ Colorimetric Test ¿ Calibrate and choose Sulphate.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

12.3 Test

This test uses the Sulphate Reagent A and Sulphate Reagent B.

- Collect 5 ml of sample water, add 10 drops of Sulphate Reagent A, and 1 spoonful of Sulphate Reagent B, and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Water > Sulphate.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

13 Chromium (IV)

13.1 Principle

Chromium is a colorimeteric test. This test uses a 2, 5 diphenyl carbazide reagent. The Indian Standard for drinking water holds that the acceptable limit is 0.05 mg/l and is not relaxable.

13.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
0.1 mg/l	2
0.5 mg/l	10
1 mg/l	20
2 mg/l	30
3 mg/l	40

Minimal Calibration

Standard	Drops
0 mg/l	0
20 mg/l	10
40 mg/l	20

Take 5 ml of the 0 mg/l Chromium standard, and add 2 drops of Chromium Reagent A and 5 Drops of Chromium Reagent B and shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings ¿ Colorimetric Test ¿ Calibrate and choose Chromium.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

13.3 Test

This test uses the Chromium Reagent A and Chromium Reagent B.

- Collect 5 ml of sample water, add 2 drops of Chromium Reagent A, and 5 drops of Chromium Reagent B, and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Water > Chromium.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

14 Ammonia

14.1 Principle

Ammonia is a colorimeteric test. This test uses Nessler's reagent.

The Indian Standard for drinking water holds that the acceptable limit is 0.5 mg/l and is not relaxable.

14.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
0.5 mg/l	1
1 mg/l	2
2 mg/l	4
3 mg/l	6
4 mg/l	8

Minimal Calibration

Standard	Drops
0 mg/l	0
0.5 mg/l	1
2 mg/l	4

Take 5 ml of the 0 mg/l Ammonia standard, and add 5 drops of Ammonia Reagent A and 5 Drops of Ammonia Reagent B and shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings ¿ Colorimetric Test ¿ Calibrate and choose Ammonia.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

14.3 Test

This test uses the Ammonia Reagent A and Ammonia Reagent B.

- Collect 5 ml of sample water, add 5 drops of Ammonia Reagent A, and 5 drops of Ammonia Reagent B, and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Water > Ammonia.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

15 Nitrite

15.1 Principle

Nitrite is a colorimeteric test. This test uses a N-(1-napthyl)-ethyelnediamine reagent.

Nitrite is not listed as a water quality parameter by Indian Drinking Water standards.

15.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
0.05 mg/l	1
0.1 mg/l	2
0.2 mg/l	4
0.3 mg/l	6
0.4 mg/l	8

Minimal Calibration

Standard	Drops
0 mg/l	0
0.05 mg/l	1
0.3 mg/l	6

Take 5 ml of the 0 mg/l Nitrite standard, and add 5 drops of the Nitrite Reagent and shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings ¿ Colorimetric Test ¿ Calibrate and choose Nitrite.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

15.3 Test

This test uses the Nitrite Reagent.

- Collect 5 ml of sample water, add 5 drops of the Nitrite Reagent, and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Water > Nitrite.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

16 Zinc

16.1 Principle

Zinc is a colorimeteric test. This test uses 4 separately packed reagents.

The Indian Standard for drinking water holds that the acceptable limit is 5 mg/L, but in the absence of any other toxic substances or an alternate source, this is relaxable upto 15 mg/L.

16.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration

Standard	Drops
0 mg/l	0
0.1 mg/l	2
0.25 mg/l	5
0.5 mg/l	10
1 mg/l	20
2.5 mg/l	50
5 mg/l	100

Minimal Calibration

Standard	Drops
0 mg/l	0
0.5 mg/l	10
2.5 mg/l	50

Take 5 ml of the 0 mg/l Zinc standard, and add 10 drops of Zinc Reagent A, 5 drops of Zinc Reagent B, 5 drops of Zinc Reagent C, and 3 drops of Zinc Reagent D, and shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings ¿ Colorimetric Test ¿ Calibrate and choose Zinc.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- This test takes 10 minutes (600 seconds) to develop the ideal colour. Click on Start Timer to start a timer, or you can Skip Delay if you have already waited 5 minutes.
- You should have your first calibration point. Repeat similarly with the other calibration points.

16.3 Test

This test uses the four Zinc Reagents.

- Collect 5 ml of sample water, add 10 drops of Zinc Reagent A, 5 drops of Zinc Reagent B, 5 drops of Zinc Reagent C, and 3 drops of Zinc Reagent D, and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test $>$ Water $>$ Zinc.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- This test takes 10 minutes (600 seconds) to develop ideal colour. Click on Start Timer to start a timer, or you can Skip Delay if you have already waited 5 minutes.
- After some time, the app will display a result.

17 Residual Chlorine

17.1 Principle

The Residual Chlorine test is a colorimetric test, but is a little different from the other colorimetric tests here. We use a colour card rather than standard solutions. This test has a range of 0 to 3 mg/l.

17.2 Calibration

You do not need to make calibration standards for this test, just use distilled water for calibration.

- Take 5ml distilled water in a 15 ml measuring tube.
- Add 3 drops of free chlorine reagent in it and mix well.
- Pour 5 ml of the solution into the cuvette.
- Place the cuvette into the holder in the box.
- On the next page click on Calibrate.
- Align the colour card to the image displayed, the instructions on the screen would help, and press Start.
- Click on Start Timer and wait the required amount of time for the reaction to take place.
- The camera immediately opens up once the specific time is up.
- Point your phone to get a uniform colour of colour solution and keep the phone on a light box to capture images of solution and calibrate.
- In case of an error message while calibrating, re-calibrate.
- On successful scanning, you will be shown the calibrated point and the colour shift.
- Press Accept.
- Your phone is now calibrated. You can now begin testing samples.

Note: Calibration needs to be done only once for every parameter. The Calibrate option changes to Re-calibrate when calibration is complete. There is no need for recalibration before testing every sample.

17.3 Test

- Measure out 5 ml of your sample in a 15 ml measuring tube.
- Add 3 drops of Free chlorine reagent.
- Shake well to ensure proper mixing of reagents.
- Pour 5 ml of the solution into the testing chamber.
- Place the testing chamber into the holder in the box.
- Put a Residual Chlorine colour card on the test chamber.
- Click on Start Test.
- Read the instructions on the screen and press Start.
- The camera immediately opens up once the specific time is up.
- Point your phone to align the green coloured grid on the screen with your colour card setup.
- Your result will be displayed on the screen.

18 Potassium

18.1 Principle

Potassium is a colorimeteric test.

The Indian Standard for drinking water does not specify an acceptable limit of potassium in water. However, according to the WHO, drinking water should have a potassium level below 12 mg/L.

18.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below. **Full Calibration**

Standard	Drops
0 mg/l	0
10 mg/l	10
20 mg/l	20
30 mg/l	30

Minimal Calibration

Standard	Drops
0 mg/l	0
10 mg/l	10
30 mg/l	30

Take 5 ml of the 0 mg/l Potassium standard, and dilute it to 10 ml with distilled water. Add 5 drops of Reagent A and mix well. Add 10 drops of Reagent B and mix well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose Potassium.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is
- within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

18.3 Test

This test uses the Potassium reagents.

- Collect 5 ml of sample water, add 5 drops of Reagent A and 5 drops of Reagent B and shake for 5 seconds to mix well. Place the solution in the white cuvette.
- Place the cuvette under the lightbox and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Water > Potassium.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

19 Total Hardness

19.1 Principle

Total Hardness is a titration test.

The Indian Standard for drinking water holds that the acceptable limit is 200 mg/l, but in the absence of any other toxic substances or alternate sources, this is relaxable up to 600 mg/l.

19.2 Calibration

No calibration is needed for this test

19.3 Test

- Take 25 ml of water sample in a 50 ml measuring tube, add 1 ml of Total Hardness Reagent A and add one small spoon of Total Hardness Reagent B.
- A wine-red color develops if hardness is present. If the solution continues to remain colourless, hardness is 0.
- Titrate the red wine color solution till turns blue, by adding drops of the Total Hardness Titrant. Keep count of the number of drops till the solution turns blue. Shake the solution on addition of each drop.
- On the app, go to Titration Test ¿ Total Hardness and enter the number of drops.
- This should give you the result in mg/l.

20 Total Alkalinity

20.1 Principle

Total Alkalinity is a titration test.

The Indian Standard for drinking water holds that the acceptable limit is 200 mg/l, but in the absence of any other toxic substances or alternate sources, this is relaxable up to 600 mg/l.

20.2 Calibration

No calibration is needed for this test

20.3 Test

Total Alkalinity is the sum of P and T Alkalinity.

P - Alkalinity

- Take 10 ml of sample in a measuring tube and add 3 drops of P-Alkalinity Reagent A.
- If the solution turns pink, titrate it with P-Alkalinity Titrant by adding drops and keeping count of the number of drops till the colour changes from pink to colourless.
- If the solution does not turn pink P-Alkalinty is 0.
- On the app, go to Titration Test ¿ Total Alkalinity and enter the number of drops in the first textfield.
- This should give you the result in mg/l.

T - Alkalinity

- To the same measuring tube add 3 drops of T-Alkalinity Reagent, The colour should change to blue.
- Titrate it with T-Alkalinity Titrant till turns reddish by adding it dropwise. Keep count of the number of drops.
- On the app, go to Titration Test ¿ Total Alkalinity and enter the number of drops in the second textfield.
- This should give you the result in mg/l.

21 Biochemical Oxygen Demand(BOD)

21.1 Principle

BOD is a titration test. BOD stands for biochemical oxygen demand. It is a measure of the amount of oxygen required for aerobic bacteria to decompose organic matter in water.

The Indian Standard for drinking water does not specify an acceptable limit of BOD in water. However, drinking water should have a BOD level below 1 mg/L.

21.2 Calibration

There is calibration needed for this test

21.3 Test

- Collect the water sample from a pond.
- Carefully fill a BOD bottle with sample water without making air bubbles.
- Add 40 drops of Reagent A to the BOD bottle. To ensure that no bubbles are formed, carefully insert the pipette just below the surface of the water.
- Add 40 drops of Reagent B to the BOD bottle in the same manner.
- Close the bottle and mix the sample by inverting many times. A brownish cloud will appear in the solution as an indicator of the presence of Oxygen.
- Allow the brown precipitate to settle out to the bottom.
- Add 40 drops of Reagent C to the BOD bottle without forming any bubbles.
- Close the bottle and mix the solution well to dissolve the precipitate.
- Keep the bottle in a BOD incubator for 5 days of incubation.
- After incubation, titrate 50 ml of the water sample with BOD titrant till it reaches a pale yellow colour.
- Add 40 drops of Reagent D to the titrate so that the sample turns blue colour.
- Continue the titration till the sample turns clear and note the readings.
- From the home screen choose 'Titration Test' > 'Water' > 'Dissolved Oxygen' and enter the titration result.
- This should give you the initial DO result in mg/L.
- Keep the bottle in a BOD incubator for 5 days of incubation
- After incubation, repeat the titration in a similar manner and note the readings
- From the home screen choose 'Titration Test' > 'Water' > 'Dissolved Oxygen' and enter the titration result.
- This should give you the final DO in mg/L
- Now, BOD can calculated from the difference between initial and final DO.

22 Chemical Oxygen Demand(COD)

22.1 Principle

Determine chemical oxygen demand (COD) of given sewage samples.

Chemical Oxygen Demand (COD) is a method for assessing water pollution post-treatment, with higher values indicating increased organic pollution. Unlike Biological Oxygen Demand, COD is suitable for toxic water and non-biodegradable organic matter in effluent treatment plants. The test employs potassium dichromate to oxidize organic substances, measuring oxygen consumption. COD determination is quicker than Biological Oxygen Demand testing, offering efficient analysis of chemically digestible matter in water samples.

22.2 Calibration

There is no calibration needed for this test

22.3 Test

This test uses the COD reagents.

- Take 10 ml of sample into a round bottom reflex flask
- Add some glass beads to prevent the solution from bumping into the flask while heating.
- Add 1 ml of Reagent A solution to the flask and mix by swirling the flask

- Add 5 ml of Reagent B to the flask.
- Now add slowly and carefully 15 ml Reagent C.
- Connect the reflex condenser and digest the content using a hot plate for 2 hours.
- After digestion cool the flask and rinse the condenser with 25 ml of distilled water collected in the same flask.
- Add 2-4 drops of Reagent D to the flask and titrate with ferrous ammonium sulfate solution to the endpoint.
- Make the blank preparation in the same manner as the sample using distilled water instead of the sample.
- From the home screen choose 'Titration Test' > 'Water' > 'Dissolved Oxygen' and enter the titration result.
- This should give you the result in mg/L.

23 Soil pH

23.1 Principle

The pH value of the soil, whether the soil is acidic or basic.

23.2 Calibration

pH standards based on buffer solutions should be supplied to you. You should have standards of pH 4, 5, 6, 7, 8, 9 and 10.

Take 5 ml of the pH standard, say 4, and add 1 drop of the pH indicator.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose pH.
- Select the calibration point, 4 in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

23.3 Extraction

- Take 5 ml of soil in the measuring spoon.
- Fill 25 ml of distilled water in the measuring tube and add the 5 ml of soil.
- Close the tube, shake well and leave to settle.
- Filter out the top clear layer of extracted solution.

23.4 Test

This test uses the pH indicator.

- Collect 5 ml of extracted solution, add 1 drop of pH indicator and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Soil > pH.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.

- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

24 Soil Available Nitrogen

24.1 Principle

The amount of Nitrogen available in the soil for plant growth.

24.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration .

Standard	Drops
0 kg/ha	0
10 kg/ha	2
20 kg/ha	4
40 kg/ha	8
60 kg/ha	12

Minimal Calibration .

Standard	Drops
0 kg/ha	0
20 kg/ha	4
60 kg/ha	12

Take 5 ml of the 0 kg/ha Nitrate standard, and add the contents of Reagent A and Reagent B. Shake till dissolved.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose Available Nitrogen under Soil.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

24.3 Extraction

Prepare an extraction solution by dissolving 1 teaspoon of table salt to 1 liter of water. Distilled water or deionized water would be ideal, but if you do not have access to it, then use tap water, RO Filtered water, or bottled water. Avoid using water from stagnant water bodies or groundwater. For the salt, do not use low sodium salt, rock salt, pink salt, black salt, or any such variant - simple store-bought table salt should suffice.

- Take 5 ml of soil in the measuring spoon.
- Fill 25 ml of extraction solution in the measuring tube and add the 5 ml of soil.
- Close the tube, shake well and leave to settle.

- Filter out the top clear layer of extracted solution.

If you are doing Nitrogen, Potassium and Phosphorous tests for the same sample, you can use the same extracted solution for the three tests.

24.4 Test

This test uses the Nitrogen reagents.

- Collect 5 ml of extracted solution, add the contents of Reagent A and Reagent B and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Soil > Nitrogen.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

25 Soil Available Phosphorous

25.1 Principle

The amount of Phosphorous available for plant growth.

25.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration .

Standard	Drops
0 kg/ha	0
5 kg/ha	1
10 kg/ha	2
15 kg/ha	3
20 kg/ha	4
25 kg/ha	5

Minimal Calibration .

Standard	Drops
0 kg/ha	0
15 kg/ha	3
25 kg/ha	5

Take 5 ml of the 0 kg/ha Phosphorous standard and add 5 drops of the Phosphorous Reagent. Shake till dissolved.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
-

- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose Available Phosphorous under Soil.
- Select the calibration point, 0 mg/l in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

25.2.1 Extraction

Prepare an extraction solution by dissolving 1 teaspoon of table salt to 1 liter of water. Distilled water or deionized water would be ideal, but if you do not have access to it, then use tap water, RO Filtered water, or bottled water. Avoid using water from stagnant water bodies or groundwater. For the salt, do not use low sodium salt, rock salt, pink salt, black salt, or any such variant - simple store-bought table salt should suffice.

- Take 5 ml of soil in the measuring spoon.
- Fill 25 ml of extraction solution in the measuring tube and add the 5 ml of soil.
- Close the tube, shake well and leave to settle.
- Filter out the top clear layer of extracted solution.
- If you are doing Nitrogen, Potassium and Phosphorous tests for the same sample, you can use the same extracted solution for the three tests.

25.2.2 Test

This test uses the Phosphorous reagent.

- Collect 5 ml of extracted solution, add 5 drops of the Phosphorous reagent and place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Soil > Available Phosphorous.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

26 Soil Available Potassium

26.1 Principle

The amount of Potassium available for plant growth.

26.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration .

Standard	Drops
0 kg/ha	0
10 kg/ha	4
20 kg/ha	8
30 kg/ha	12
40 kg/ha	16

Standard	Drops
0 kg/ha	0
20 kg/ha	8
40 kg/ha	16

Minimal Calibration .
Take 5 ml of the 0 kg/ha Potassium standard, and add 5 drops of the Potassium Reagent A, and 10 drops of Potassium Reagent B. Shake till dissolved.

- Take the resulting coloured solution and fill it into the blue cuvette provided. (Note this is the only test that uses the blue cuvette)
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose Available Potassium under Soil.
- Select the calibration point, 0 kg/ha in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

26.3 Extraction

Prepare an extraction solution by dissolving 1 teaspoon of table salt to 1 liter of water. Distilled water or deionized water would be ideal, but if you do not have access to it, then use tap water, RO Filtered water, or bottled water. Avoid using water from stagnant water bodies or groundwater. For the salt, do not use low sodium salt, rock salt, pink salt, black salt, or any such variant - simple store-bought table salt should suffice.

- Take 5 ml of soil in the measuring spoon.
- Fill 25 ml of extraction solution in the measuring tube and add the 5 ml of soil.
- Close the tube, shake well and leave to settle.
- Filter out the top clear layer of extracted solution.

If you are doing Nitrogen, Potassium and Phosphorous tests for the same sample, you can use the same extracted solution for the three tests.

26.4 Test

This test uses the Potassium reagents.

- Collect 5 ml of extracted solution, add 5 drops of the Potassium reagent A, and 10 drops of Potassium Reagent B, and place in the blue cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test > Soil > Available Potassium.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.

- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

27 Soil Organic Carbon

27.1 Principle

The amount of Organic Carbon available for plant growth.

27.2 Calibration

Use the colour cards to calibrate for Organic Carbon.

- Take the colour card for 0
- Place the cuvette under the light stand with the card over it.
- Turn on the lightbox.
- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose Organic Carbon.
- Select the calibration point, 0 in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

27.3 Test

- Take 0.5 gm of soil in the small measuring tube.
- Add 5 ml of Organic Carbon Reagent A.
- Add 5 ml of Organic Carbon Reagent B.
- Shake well and leave for 5 minutes.
- Filter and place it in the white cuvette.
- From the home screen choose Colorimetric Test > Soil > Organic Carbon.
- Choose No Dilution if this is the first test, you might have to dilute the
- sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

28 Soil Available Manganese

28.1 Principle

The amount of Manganese available in soil for plant growth.

28.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration .

Standard	Drops
0 mg/kg	0
0.5 mg/kg	1
1 mg/kg	2
1.5 mg/kg	3
2 mg/kg	4

Minimal Calibration .

Standard	Drops
0 mg/kg	0
0.5 mg/kg	1
1 mg/kg	2
1.5 mg/kg	3
2 mg/kg	4

Take 5 ml of the 0 mg/kg Magnesium standard and add 6 drops of Reagent A, 12 drops of Reagent B, 6 drops of Reagent C, 12 drops of Reagent D, and 15 drops of Reagent E. Shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose Available Manganese under Soil.
- Select the calibration point, 0 mg/kg in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

28.3 Extraction

Prepare an extraction solution by dissolving 1 teaspoon of table salt to 1 liter of water. Distilled water or deionized water would be ideal, but if you do not have access to it, then use tap water, RO Filtered water, or bottled water. Avoid using water from stagnant water bodies or groundwater. For the salt, do not use low sodium salt, rock salt, pink salt, black salt, or any such variant - simple store-bought table salt should suffice.

- Take 5 ml of soil in the measuring spoon.
- Fill 25 ml of extraction solution in the measuring tube and add the 5 ml of soil.
- Close the tube, shake well and leave to settle.
- Filter out the top clear layer of extracted solution.
- If you are doing Nitrogen, Potassium and Phosphorous tests for the same sample, you can use the same extracted solution for the three tests.

28.4 Test

This test uses the Iron reagents.

- Collect 5 ml of extracted solution, add 6 drops of Reagent A, 12 drops of Reagent B, 6 drops of Reagent C, 12 drops of Reagent D, and 15 drops of Reagent E. Shake well.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.

- From the home screen choose Colorimetric Test > Soil > Available Manganese.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

29 Soil Available Iron

29.1 Principle

The amount of Iron available in the soil for plant growth.

29.2 Calibration

To prepare calibration standards, take 5 ml of distilled water. Depending on if you chose minimal or full calibration, prepare standards as below.

Full Calibration .

Standard	Drops
0 mg/kg	0
0.5 mg/kg	1
1 mg/kg	2
1.5 mg/kg	3
2 mg/kg	4

Minimal Calibration .

Standard	Drops
0 mg/kg	0
0.5 mg/kg	1
1 mg/kg	2
1.5 mg/kg	3
2 mg/kg	4

Take 5 ml of the 0 mg/kg Iron standard and add 3 drops of Reagent A and 20 drops of Reagent B. Shake well.

- Take the resulting coloured solution and fill it into the white cuvette provided.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- Go to Settings > Colorimetric Test > Calibrate and choose Available Iron under Soil.
- Select the calibration point, 0 mg/kg in this case.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- You should have your first calibration point. Repeat similarly with the other calibration points.

29.3 Extraction

Prepare an extraction solution by dissolving 1 teaspoon of table salt to 1 liter of water. Distilled water or deionized water would be ideal, but if you do not have access to it, then use tap water, RO Filtered water, or bottled water. Avoid using water from stagnant water bodies or groundwater. For the salt, do not use low sodium salt, rock salt, pink salt, black salt, or any such variant - simple store-bought table salt should suffice.

- Take 5 ml of soil in the measuring spoon.
- Fill 25 ml of extraction solution in the measuring tube and add the 5 ml of soil.
- Close the tube, shake well and leave to settle.
- Filter out the top clear layer of extracted solution.
- If you are doing Nitrogen, Potassium and Phosphorous tests for the same sample, you can use the same extracted solution for the three tests.

29.4 Test

This test uses the Iron reagents.

- Collect 5 ml of extracted solution, add 3 drops of Reagent A and 20 drops of Reagent B. Shake well. Place in the white cuvette.
- Place the cuvette under the light box and turn it on.
- Place the phone over the stand.
- From the home screen choose Colorimetric Test $>$ Soil $>$ Available Iron.
- Choose No Dilution if this is the first test, you might have to dilute the sample and retry later if you get an error.
- Click on Start Camera.
- Position the cuvette so that the middle, most uniformly lit portion is within the circle.
- Select Analyze.
- After some time, the app will display a result.

30 Soil Calcium and Magnesium

30.1 Principle

Calcium and Magnesium are titration tests.

30.2 Extraction

Prepare an extraction solution by dissolving 1 teaspoon of table salt in 1 litre of water. Distilled water or deionized water would be ideal, but if you do not have access to it, then use tap water, RO Filtered water, or bottled water. Avoid using water from stagnant water bodies or groundwater. For the salt, do not use low sodium salt, rock salt, pink salt, black salt, or any such variant - simple store-bought table salt should suffice.

30.3 Calibration

No calibration is needed for this test.

30.4 Test

For Calcium, take 2 ml of extraction solution. Add 40 drops of Reagent A, and 1 spoon of Reagent B. Mix well. Now add the titrant drop by drop, shaking each time, till the pink turns to purple. Keep track of the drops you are adding.

For Magnesium, take 2 ml of extraction solution. Add 40 drops of Reagent A, and 2 drops of Reagent B. Mix well. Now add the titrant drop by drop, shaking each time, till the red turns to blue. Keep track of the drops you are adding.

Go to Titration Tests and then Calcium and Magnesium under Soil. Enter the number of drops of titrant to obtain the values of Available Calcium and Magnesium.