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Deep Penetrating Geochemistry (DPG) field protocols

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Overview

The DPG Geochemical programme utilises laboratory and field techniques to look specifically for deposits buried under cover with very low (ppb to ppt concentrations) surface geochemical signals.

The DPG Geochemical techniques all assume there is some form of upward movement of ions that has taken place through the cover to change the surface chemistry in some detectable fashion. The programme has been designed to be non-invasive, economical in time and budget and return prospective results.

Background

ABM Resources has sampled selectively taken surface samples from active tenements in the Tanami-Arunta region in 2010 and 2011 with positive results, several new prospects were identified. Consultation with industry professionals such as Dave Heberlein defined a more effective, efficient and accurate sampling programme covering large areas of land systematically and economically.

The aim of sampling the soils through DPG in a systematic fashion is to delineate areas / lines of anomalous metallic concentrations for further exploration.

The DPG techniques will involve a combination of pH sampling, weak leach technologies and Charcoal sampling. The beauty of the pH sampling and the weak acid leach techniques is that we can conduct them simultaneously at the same sample locations, within the same sampling programme. This saves on time and cost and allows comparison between the techniques and utilisation of the results simultaneously. The pH sampling requires minimal equipment and results will be instant.

Weak acid leach / partial leach

Weak acid leaches / partial leach technologies have been around for a substantial amount of time – however historically they have been ineffectively used as a “one method fits all” technique. With smart and efficient use of these techniques this historical perception can be overcome. In depth knowledge of the regolith profile and consequent trials of multiple weak leach methods to assess the most effective for the region will maximise ABM's ability to test for buried mineralisation.

pH Survey

The pH technique will involve the measurement of H⁺ ions through the use of a pH meter. H⁺ is extremely reactive and can mobilise other cations (such as Fe, Mn, Ca and Mg – sensitive to changes in pH) through the regolith to the surface. A mineral deposit contains some sulphides which will be actively oxidising at depth generating an electro-geochemical cell. The H⁺ and other ions will generate a surface signature of the mineralisation in response to the changing eH-pH conditions.

Regolith influences

The recognition of the changing regolith environments encountered over the geochemical surveys is vital to the interpretation of the geochemical results.

The regolith provided and indication of both the potential mobility of elements of interest and of the potential effectiveness of specific (soil) components (horizons) as geochemical sample media. The eH-pH environment of the desert environment is alkaline, meaning that base metals and Iron are more stable and the control on mobility and pH is more carbonate based.

METHODOLOGY

The sampling surveys will be run out of remote camps comprising 2 field teams and including one senior geologist. Light Polaris vehicles will be used to negotiate the terrain and all sample sites will be predefined. Please note that the pH and weak leach samples will be taken simultaneously and in the same location when specified by the programme co-coordinator.

The geologist will be required to complete the following:

- I. Generating a map each morning of the days sampling lines/grid
- II. Supervise the field officers –
 - a. To ensure they are sampling correctly
 - b. Reduce contamination of samples
 - c. Ensure the data / information is being correctly recorded
- III. Ensure Health and Safety of all concerned and ensure scheduled call and other HSEC guidelines are adhered to.
- IV. Ensure that all Exclusion zones restrictions are adhered to.
- V. Simultaneously map the regolith and any outcrop that is near by
 - a. Taking note of soil colours, textures, grainsize etc.

CONTAMINATION

It is very easy to contaminate the sample due to the low detection limits of the analytical methods used. Please adhere to the following at all times. It will be the responsibility of the Geologist to ensure field officers are following these guidelines and sampling correctly.

- **NEVER** Sample at disturbed sites
 - Move sample site away from roads/ historical drill holes
- **ALWAYS** wear disposable gloves
 - Sunscreen can be a possible source of metal contamination
- **NO** jewellery can be worn during the sampling process and lab processes
- **ENSURE** all sample equipment in clean – washed or dusted down – prior to taking every sample
- Label all BULKA bags with **Low detection** – don't ship and store with drill samples

Equipment

Field

GPS or handheld mapping unit with preset coordinates of line/grid

Stakes to pre-mark sampling line & grid

Hammer / mallet

Flagging tape

Shovel - plastic

Tape Measure

Camera

Plastic sample scoop or trowel

Plastic snap lock bags – 2-5L capacity

Black marker

Notebook

Powder free latex Gloves (reduce contamination) optional

Calico bags – pre-numbered

Calico bags - blank

pH meter

Batteries – 4 x 1.5 V alkaline batteries

Buffer solution pH4

Buffer solution pH7

Buffer solution pH10

Plastic vials

20ml measuring spoon - plastic

HCL 10% plus dropper bottle

Deionised water – lab quality ca. 25L

Timer – stopwatch

At least 10 L Drinkable water - *Note: Do not use the bore water as it will be enriched in salts and ions*

Wash bottle with topspout

Regolith Atlas / Guidelines - printed & bound

Hard copy maps

- Sample sites
- Regolith
- Interpretive geology

A guide to Plants of Inland Australia – if unfamiliar with identifying vegetation in the area

GEOCHEMICAL SAMPLING

Pre-sampling

Prior to the start of every day the geologist will be required to set-up the metadata for the samples taken that day – this will make logging more time efficient. The ADD MANY Tab is used to create the complete surface sample ID list for the collection and insert Duplicates at the specified frequency (1 in 20).

The GEOCHEM Tab is used to collect the information about the geology and/or sampling variables and/or update the lab submission details for a particular sample/s.

The QAQC tab is used to insert QAQC types information in the surface sample list and update the sample sequence number for the lab submission.

1. Open the Geochem Profile in Logchief and go to the view 'ADD MANY'
2. Select the correct Dataset to save data to
3. Only date fields are defaulted to the current date and all fields need data before record is saved
4. The duplicate inserts are defaulted to 1 in 20 samples
5. The sample submission group field is there to specify that the group of samples being collected belong to a particular lab submission. This can be a temporary number/code and the final LAB submission number can be done at the end of data collection outside of Logchief.
6. Once all fields are entered with data, save the record and then close the window completely

LogChief

Geochem Sampling Save Synchronise Export Generate IDs Undo Redo Copy Paste Clear Cells Select All User Settings Windows

ADD MANY QAQC

First Sample ID GC1000001 # Samples to Create 200 Starting Sequence # 1 QAQC to be Inserted FDUP Sample Type SOIL Sample Depth (m) 0.1

Lease ID EL23208 Prospect AS Company ABM Date Sampled 25/05/2012 Sampled By AR

Map Sheet THE GRANITES Grid ID AMG66_50 Survey By FLDY Survey Date 25/05/2012 Survey Method GPS

Commodity Au Assay_Method1 AU - ICP21 Assay_Method2 Assay_Method3

Sample Submission Group re PO number 1234 DataSet Twin Bonanza

Current Row: 1 of 1

Sampling

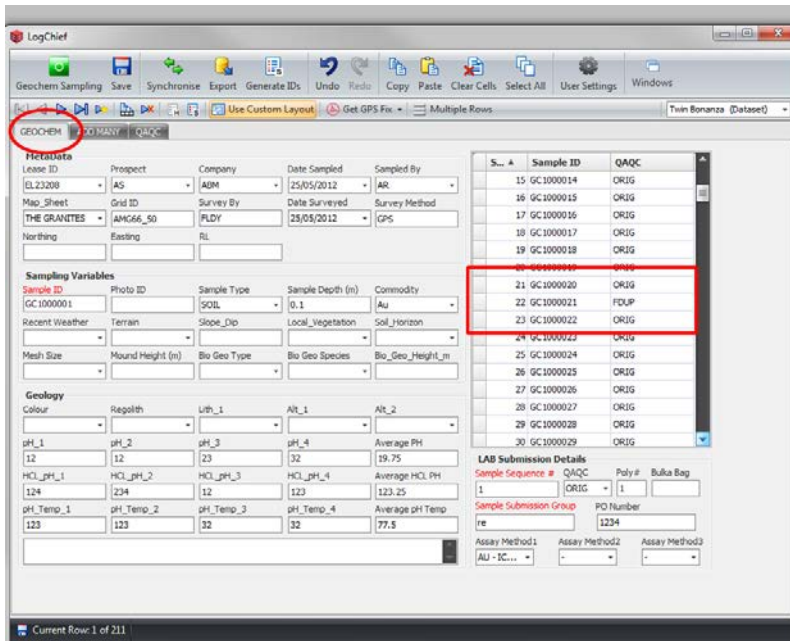
For each sample site conduct the following.

1. Ensure the sample site is typical of the immediate area
 - a. Avoid the abnormal

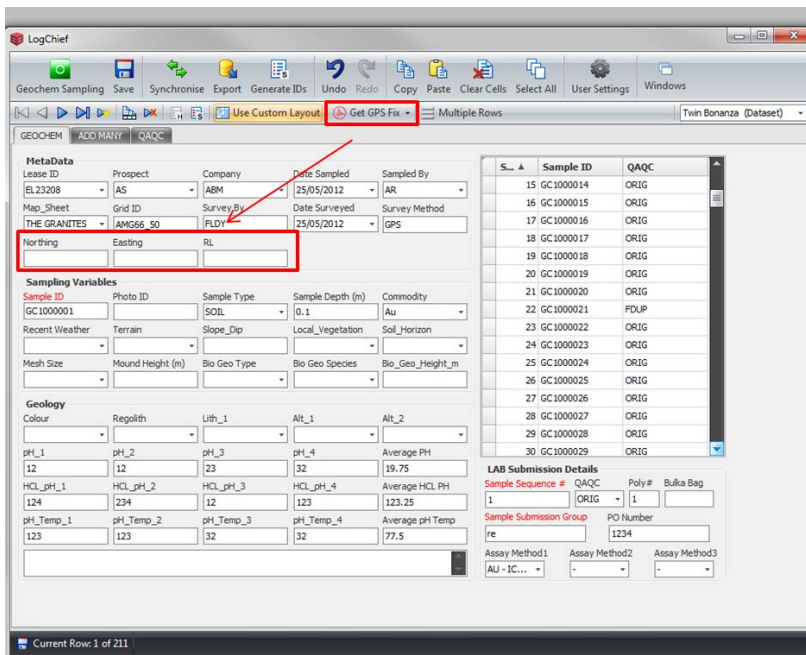
- b. Avoid disturbance - if there are old tracks or drill holes move 10-20m away from intended sample site.
- c. If possible try to sample under/around well-established vegetation in disturbed areas and record IDs in the comments.

2. Go to the GEOCHEM tab in Logchief and check that you are looking at the correct dataset

- a. sort the grid view by Sample Sequence number before you begin data entry to view the pattern of original and duplicate samples



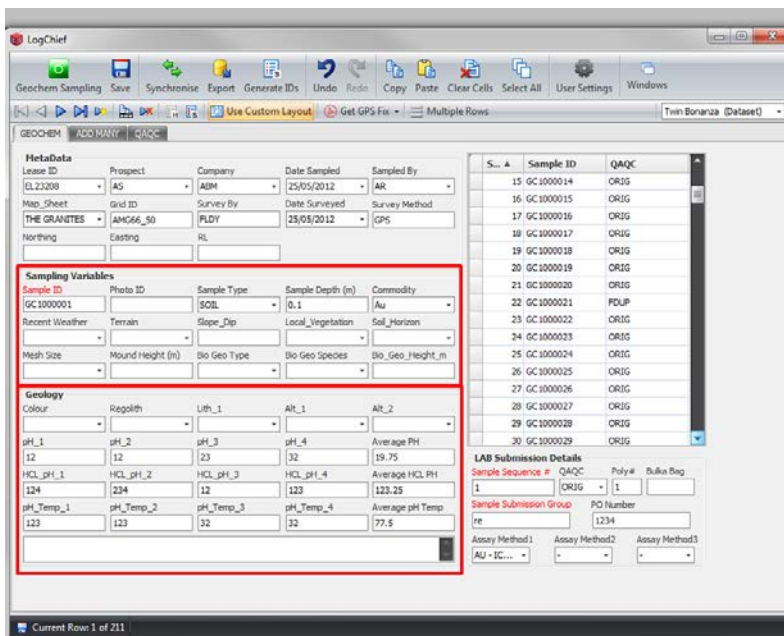
3. Click GPS to populate the Easting, Northing and RL fields.



4. Record the following Sampling Variables in Logchief

- a. Photo ID (once taken)

- b. Terrain
 - c. Local vegetation (with 50m radius of sample site)
 - d. Recent weather events (i.e. recent rainfall / morning dew)
 - e. Sample description – anything unusual
 - f. Comments
5. Record the following Geology Variables in Logchief
- a. Colour
 - b. Regolith
 - c. Lith1 (if possible)
 - d. pH sampling results if applicable
 - i. Average pH, Average HCL pH and Average pH Temp fields auto calculate the averages from the readings collected



6. Take photos of (example below – with Camera on Toughbook):
- g. regolith – soil surface (with Boot for scale)
 - h. vegetation of surrounding area (50m buffer)



7. Record the designated photo ID's in Logchief – under sampling variables

SOIL SAMPLE

(ONLY use plastic sample scoops and ALWAYS wear plastic gloves)

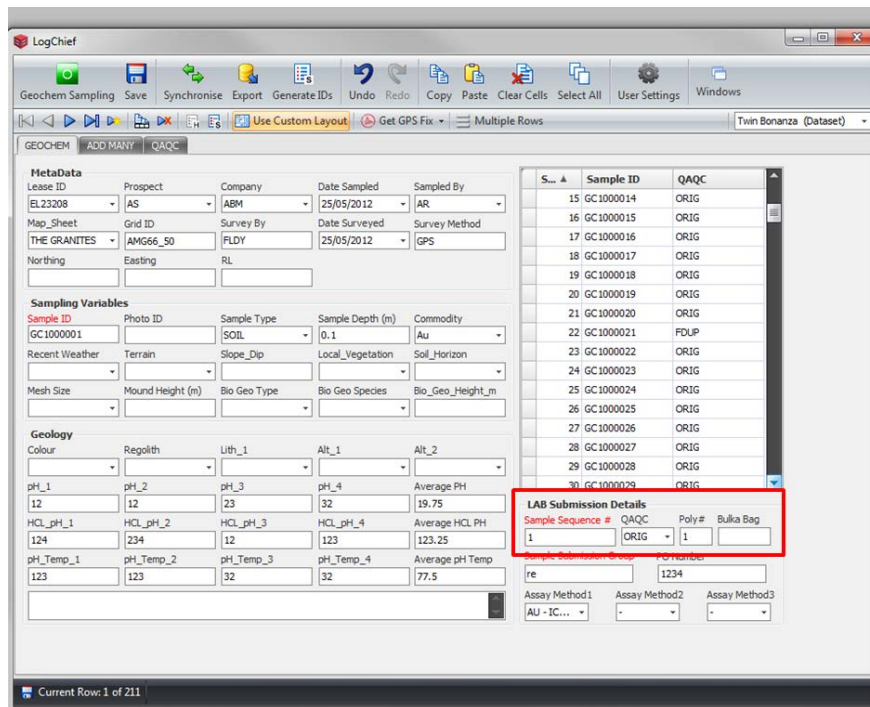
1. Clear off a square meter at the sample site
2. Clear down to 10 cm sample depth



3. Sample an area of approx. 25 x 25 cm to a depth of 15cm maximum
 - a. collect approximately 1kg of soil material
4. Place in a plastic ziplock bag seal and label accordingly with the corresponding calico bag number
 - a. Ensure that the sample is dry as any moisture will cause degradation of the sample and bag
 - i. Drying of the sample back at camp may be a feasible option



5. Place ziplock bag containing sample into a pre-labelled calico bag
 - a. This prevents tearing of the plastic ziplock bags during transport
6. Place the calico in a labelled polyweave bag with other samples – 6 samples per polyweave is sufficient
7. Record the following QAOC variables in Logchief
 - a. Polyweave bag number
 - b. Bulka bag number
8. Click "Save" to save the record and next to move to the next record ready for the next sample site



7. After every 20 samples a duplicate must be taken
 - a. The sample ID will be consecutive – roll on from the last
 - b. The duplicate must be taken within 5m of the original sample and be representative of the sampling area
 - i. DO NOT collect from the original hole
 - c. Ensure the “FDUP” code is correctly filled out in the QAQC box in Log chief
8. Before moving to the next site rake material across the surface to fill in the sampled areas

IF outcrop is encountered along or beside sampling lines (including hard laterite)

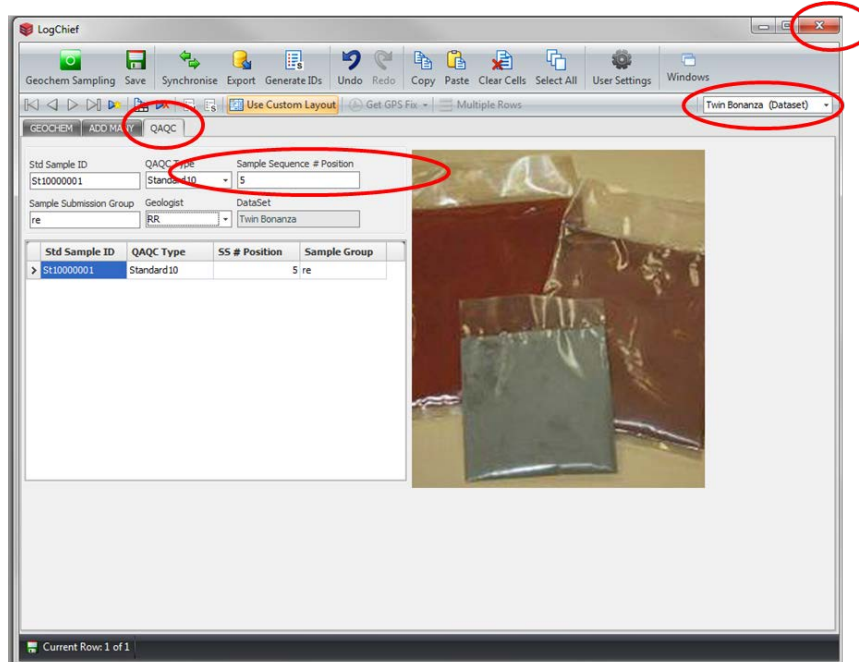
1. mark site on GPS and notify geologist
2. Take sample and place in blank calico bag
3. Label calico with predefined Rock chip numbers (from geologist)
4. Take a representative photo of outcrop and area surrounding
5. Record data in Logchief – ROCK Sampling
 - a. Click add field
6. Go to the ROCKS tab and check that you are looking at the correct dataset
7. You can sort the grid view by Sample Sequence number before you begin data entry to view the pattern of original and duplicate samples
8. GPS fix is used to populate the Easting, Northing and RL field (From internal tablet GPS +/- 5m accuracy). Co-ordinate can also be picked up from Garmin or post-logchief capture into the excel export.
9. Enter information in all fields before you SAVE
10. Keep rock chip samples separate from soil samples – new polyweave bag

SAMPLE SUBMISSION – Soil sample only

- Once field sampling is complete the Geologist can then enter the QAQC records in the **QAQC** tab
- The Sample Sequence # position is where the QAQC record will be inserted into the sample sequence run
- Enter information in all fields before you SAVE
- Close window and reopen the **GEOCHEM** tab to view inserted QAQC records.

On completion of a sampling transect or days' work the geologist must complete the LogChief Surface sampling submission and the appropriate lab submission form.

1. All polyweaves will be placed in a large bulka bag back at camp for transport
2. Bulka Bag must be spray painted with "LOW DETECTION" and must not be transported/stored with drill samples.
3. Open Logchief – enter QAQC records in the QAQC tab
4. Ensure all fields are filled out in LogChief, including:
 - i. Bulka Bag number
 - ii. ALS Submission Number
 - iii. PO number
 - iv. Assay Method 1 – ME-MS23
 - v. Assay method 2 – Au-ICP
 - vi. Blanks need to be routinely be inserted every 35th sample – ALS
 - vii. Two different standards must be inserted after the blank (– every 36th sample) – ALS
 - a. STD 12 (Custom Blend Ionic Standard) – for the Ionic leach split
 - b. STD 1-8 (dependent on geologist) – for the Fire Assay split
5. The Sample Sequence # position is where the QAQC record will be inserted into the sample sequence run



6. Enter information in all fields before you SAVE
7. Close window and reopen the GEOCHEM tab to view inserted QAQC records.

S... ▲	Sample ID	QAQC
>	1 GC1000001	ORIG
	2 GC1000002	ORIG
	3 GC1000003	ORIG
	4 GC1000004	ORIG
	5 St10000001	Standard 10
	6 GC1000005	ORIG
	7 GC1000006	ORIG
	8 GC1000007	ORIG
	9 GC1000008	ORIG
	10 GC1000009	ORIG
	11 GC1000010	ORIG
	12 GC1000011	ORIG
	13 GC1000012	ORIG

8. Ensure that instructions for the lab protocols are attached to the sample submission form and PO. Attach the following lab instructions.

Soil samples - DPG programme	
ALS Lab Process Requirements	
1. Samples to be shipped directly to Perth ALS for analysis	
2. No milling	
3. 1 kg sample split into 500g splits	
4. 500g stored and 500g for analysis	
5. 500g for analysis subsampled	
ANALYSIS	
8. All samples are for LOW DETECTION Geochemistry and should be treated with caution and contamination minimised	
9. Sample shaken for 2 seconds prior to sampling for analysis by lab technician	
10. Spoon used to sample material in vials are to be wiped by a new disposable tissue	
11. Automatic high value analytical duplicates to be completed when elevated Au, Cu, Pb, Zn, Ni	

pH SAMPLING & ANALYSIS

1. Select 4 sites in a 2.5m radius of the intended sample site for the main soil sample
2. Ensure the pH meter is calibrated with all 3 buffer solutions prior to the day's work (see Appendix 1)

At each site complete the following...

1. Take a 20ml sample of the surface micro layer (top 5cm of the soil surface) with a plastic scoop
2. Make a slurry of 20ml of deionised water and 20ml sample in the plastic vial
 - a. Shake to mix
3. Set timer for 20 seconds
4. Take a pH measurement after 20 seconds
 - i. Regardless of whether the pH reading is changing
 - ii. Repeat the slurry mixture if left for more than 20 seconds
5. Press the HOLD/ENT button to freeze the reading at 20 seconds
6. Rinse the pH meter in drinkable water (NOT bore water or de-ionised water)
7. Record pH measurement and temperature (at the time of sampling) in Log chief
8. Add one drop of 10% HCL acid
9. Mix and wait 10 seconds
10. Take a second reading and record in Log chief
11. Ensure that the pH meter and sample vials are flushed with tap water after every measurement
12. Repeat the entire process for each of the 4 samples at the sample site
 - a. Record data for each of the following for each of the 4 sites
 - i. pH
 - ii. HCL – pH
 - iii. Temperature

The screenshot shows the LogChief software interface with a red box highlighting the 'Geochemistry' section. This section contains a table for recording pH and temperature data across four samples.

Sample ID	Photo ID	Sample Type	Sample Depth (m)	Commodity
GC1000001		SOIL	0.1	Au

Geochemistry	Depth	Urb_1	Urb_2	Air_1	Air_2	Average pH
pH_1						
12	12	23	32			19.75
HCL_pH_1	HCL_pH_2	HCL_pH_3	HCL_pH_4			Average HCL pH
124	234	12	123			133.25
pH_Temp_1	pH_Temp_2	pH_Temp_3	pH_Temp_4			Average pH Temp
123	123	32	32			77.5

12. Store the pH meter in a vial of tap water when not in use

APPENDICES

Appendix 1.

pH Meter Calibration

To calibrate the machine

1. Condition the pH meter by immersing the pHTestr electrodes in tap water (drinking quality – not the bore water) at least 30 mins before use
 - a. DO NOT use de-ionized water
 - b. If the meter is left in a water solution over night during sampling programmes the meter will be ready for use immediately
2. Press the HOLD/ENT button, switch on the tester by pressing on the ON/OFF button
3. Release the HOLD/ENT button – the display will flash USA
 - a. If the display flashes NIST use the CAL button to switch to USA.
 - b. Press the hold button to confirm the selection of the buffer set
4. Press the ON/OFF switch to turn unit on
5. Pour about 2-3 cm worth of buffer into a plastic vial (these can be the standard solutions taken out into the field)
 - a. There are 3 buffers
 - i. pH 4
 - ii. pH 7
 - iii. pH 10.01
6. Dip electrode about 2-3cm into the first pH standard buffer solution "pH 4"
7. Press the CAL button to enter calibration mode
8. The CAL indicator will be shown, the upper display will show the measured reading based on the last calibration while the lower display will indicate the pH standard buffer solution
9. Allow 2 minutes for the tester reading to stabilise before pressing the HOLD/ENT button to confirm the first calibration point
 - a. The upper display will be calibrated to the pH standard buffer solution and the lower display will then be toggling in between readings of the next pH standard buffer solution
10. Repeat with other buffers pH 7 and pH 10.01