

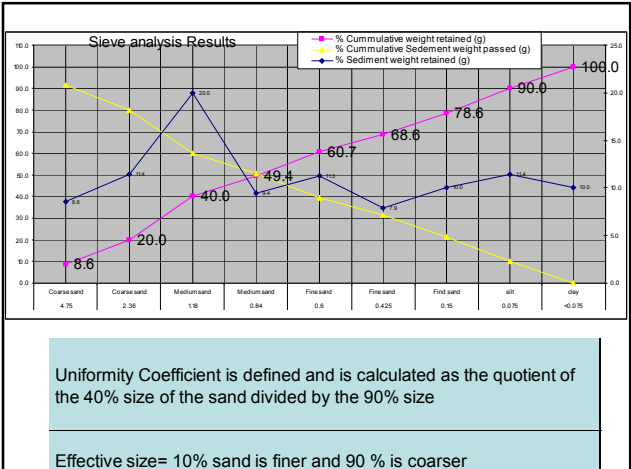
# Sand and Soil Analysis

### Sand analysis- Test results

Grain Diameter (mm)	Classification of soil	Sediment weight retained (g)
4.75	Coarse sand	60
2.36	Coarse sand	80
1.18	Medium sand	140
0.84	Medium sand	66
0.6	Fine sand	79
0.425	Fine sand	55
0.15	Find sand	70
0.075	silt	80
<0.075	clay	70

#### Sieve analysis results

Sieve #	Grain Diameter (mm)	Classification of soil	Sediment Weight Retained (g)	Cummulative Weight Retained (g)	Cummulative Sediment weight Passed (g)	% Sediment Weight Retained (g)	% Cummulative weight Retained (g)	% Cummulative Sediment Weight passed(g)
4	4.75	Coarse sand	60	60	640	8.6	8.6	91.4
8	2.36	Coarse sand	80	140	560	11.4	20.0	80.0
16	1.18	Medium sand	140	280	420	20.0	40.0	60.0
20	0.84	Medium sand	66	346	354	9.4	49.4	50.6
30	0.6	Fine sand	79	425	275	11.3	60.7	39.3
40	0.425	Fine sand	55	480	220	7.9	68.6	31.4
100	0.15	Find sand	70	550	150	10.0	78.6	21.4
200	0.075	silt	80	630	70	11.4	90.0	10.0
pan	<0.075	clay	70	700	0	10.0	100.0	0.0

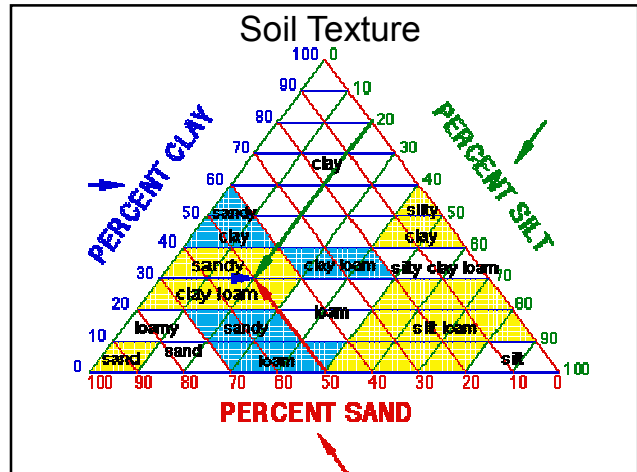


**Soil Texture**

The **texture** of a **soil** refers to the size distribution of the mineral particles composing the soil. Particles are normally grouped into three main classes: **sand**, **silt**, and **clay**.

**Table 1.** Particles sizes for various textural groups.

Textural group	Particle size (mm)	Particle size (in)
Gravel	> 2.0	>0.08
Silt	0.002 - 0.05	0.00008 - 0.002
Clay	< 0.002	< 0.00008
<b>Sand</b>		
coarse sand	0.5 - 1.0	0.02 - 0.04
medium sand	0.25 - 0.5	0.01 - 0.02
fine sand	0.10 - 0.25	0.004 - 0.01
very fine sand	0.05 - 0.10	0.002 - 0.004



**Quality of soil water**

**Sodicity Measurement**

- Measured as the sodium absorption ratio of water (SAR<sub>w</sub>)
- Expressed as the ratio:  

$$Na^+ / ([Ca^{+2} + Mg^{+2}]/2)^{1/2}$$
- Where the concentration of each ion is expressed in milliequivalents per liter (meq/L)

**Problem**

With a water-quality report providing sodium, calcium, and magnesium concentrations as 76, 146, and 39 mg/L, how do we express these in meq/L? and Calculate SAR



Ion	Multiply by
Bicarbonate	0.11119
Ca	0.04990
Carbonate	0.33333
Chloride	0.02820
Mg	0.08224
Potassium	0.02558
Nitrate	0.01613
Sodium	0.04350
Sulphate	0.02082

**Atomic Weights**

Element	Atomic Weight (g/mole)	Ion	Molecular Wt. (mg/mmole)	Valence (#)	Equivalent Wt. (mg/meq)
Calcium, Ca	40	Sodium (Na <sup>+</sup> )	23	1	23
Carbon, C	12				
Chlorine, Cl	35.5	Calcium (Ca <sup>2+</sup> )	40	2	20
Copper, Cu	63.5				
Hydrogen, H	1	Magnesium (Mg <sup>2+</sup> )	24	2	12
Iron, Fe	55.9				
<b>Magnesium, Mg</b>	<b>24.3</b>				
Manganese, Mn	55				
Nitrogen, N	14				
Oxygen, O	16				
Phosphorus, P	31				
Potassium, K	39				
<b>Sodium, Na</b>	<b>23</b>				
Sulfur, S	32				
Zinc, Zn	65.4				

Sodium: 76 mg/L / 23 mg/meq = 3.3 meq/L  
 Calcium: 146 mg/L / 20 mg/meq = 7.3 meq/L  
 Magnesium: 39 mg/L / 12 mg/meq = 3.2 meq/L

SAR = 3.3 / ((7.3 + 3.2)/2) 1/2 = 3.3/(5.25) 1/2 = 3.3/2.29 = 1.44

**Chemical Quality of groundwater( Example)- Banaskantha district**

Constituents	PPM TO EPM (Multiply)	Dantivada (PPM)	Dantivada( EPM)	Dantivada( EPM %)	Santalpur (PPM)	Santalpur (EPM)	Santalpur (EPM%)
Ph		7.9			8		
Specific conductance (mS/cm at 25C)		480			38400		
TDS		336			26880		
CO3	0.03333	0	0.00	0.00	0	0.00	0.00
HCO3	0.01639	159	2.61	47.04	1159	19.00	4.96
CL	0.0282	43	1.21	21.89	11076	312.34	81.54
NO3	0.01813	30	0.48	8.73	61	0.98	0.26
SO4	0.02082	18	0.37	6.76	2400	49.97	13.04
PO4	0.03159	0.3	0.01	0.17	0.9	0.03	0.01
SIO2	0.02082	41	0.85	15.41	36	0.75	0.20
TOTAL			5.54	100.00		383.07	100.00
CA	0.0499	52	2.59	53.64	960	47.90	12.43
MG	0.08224	14	1.15	23.80	240	19.74	5.12
NA	0.0435	23	1.00	20.68	7234	314.68	81.68
K	0.02558	1	0.03	0.53	51	1.30	0.34
IRON	0.03581	0.5	0.02	0.37	0.3	0.01	0.00
F	0.05263	0.9	0.05	0.98	30.8	1.62	0.42
TOTAL			4.84	100.00		385.26	100.00

