

M = mass of cuttings (unknown)

D = density of cuttings (to be determined) SG

V = volume of mud cup (unknown)

$\rho_1$  = density with cuttings in cup (measured) SG

$\rho_2$  = density with cuttings and water in cup (measured) SG

Q = SG of fluid used to fill cup

Measurement of first density – balance does not know that the cuttings are not filling cup

$$\frac{M}{V} = \rho_1 \quad \text{A}$$

Measurement of second density

Volume taken up by cuttings is  $\frac{M}{D}$

Volume of water added [volume of cup – volume of cuttings] =  $V - \frac{M}{D}$

$$\text{Total mass in cup} = M + \left(V - \frac{M}{D}\right) \times Q$$

$$\text{Density} = \frac{\left(M + \left(V - \frac{M}{D}\right) \times Q\right)}{V} = \rho_2 \quad \text{B}$$

From (A)

$$V = \frac{M}{\rho_1}$$

Substituting for V in (B)

$$\rho_2 = \frac{\left(M + \left(\frac{M}{\rho_1} - \frac{M}{D}\right) \times Q\right)}{M} \times \rho_1$$

$$\rho_2 = \left(1 + \left(\frac{1}{\rho_1} - \frac{1}{D}\right) \times Q\right) \times \rho_1$$

$$\frac{\rho_2}{\rho_1} = 1 + \frac{Q}{\rho_1} - \frac{Q}{D}$$

$$\frac{Q}{D} = 1 + \frac{Q}{\rho_1} - \frac{\rho_2}{\rho_1}$$

$$\frac{Q}{D} = \frac{(\rho_1 - \rho_2 + Q)}{\rho_1}$$

$$D = \frac{Q \times \rho_1}{(\rho_1 - \rho_2 + Q)}$$

For the example  $\rho_1 = 1$ ,  $\rho_2 = 1.681$  SG (14 lbm/gal),  $Q = 1$  (water)

$D = 3.13$  SG