ENV. GEOLOGY

LAB #1 ANSWER KEY

= 0.377m

(1) CYLINDER $h = 37.7\text{cm}$ $D = 7.50\text{cm}$

$$R = \frac{D}{2} = 3.75\text{cm}\left(\frac{1\text{m}}{100\text{cm}}\right) = 0.0375\text{m}$$

$g = 9.82\text{m/sec}^2$

$$\text{MASS} = 4747\text{g}\left(\frac{1\text{kg}}{1000\text{g}}\right) = 4.747\text{kg}$$

VOL CYLINDER $= \pi r^2 h$

$$\gamma = \frac{mg}{V} = \frac{mg}{\pi r^2 h} = \frac{(4.747\text{kg})(9.82\text{m/sec}^2)}{(3.14)(0.0375\text{m})^2(0.377\text{m})} =$$

$$\frac{46.61\text{ N}}{0.00167\text{m}^3} = 27910.18\frac{\text{N}}{\text{m}^3}\left(\frac{1\text{ kN}}{1000\text{ N}}\right) =$$

$$27.91\frac{\text{kN}}{\text{m}^3}$$

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(2) $S.G. = \frac{\rho_r}{\rho_w}$ WHERE $\rho_w = 1000\text{kg/m}^3$

$$S.G. = \frac{\rho_r}{1000\text{kg/m}^3} = 3.08$$

$$\rho_r = (3.08)(1000\text{kg/m}^3) = 3080\text{ kg/m}^3$$

$$\gamma = \rho_r g = 3080\frac{\text{kg}}{\text{m}^3} \cdot 9.82\text{m/sec}^2 = \frac{30,246\text{ N}}{\text{m}^3}$$

③ $\gamma = \frac{mg}{V}$ $\quad V\gamma = mg$

$\gamma = 29.5 \frac{kN}{m^3}\left(\frac{1000\ N}{1\ kN}\right) = 29500 \frac{N}{m^3}$ $\quad * \frac{V\gamma}{\gamma} = \frac{mg}{\gamma} \Rightarrow V = \frac{mg}{\gamma}$

$V = \frac{(4570\ kg)(9.82\ m/sec^2)}{29{,}500\ N/m^3} = \frac{44877.4\ N}{29{,}500\ N/m^3} = \boxed{1.52\ m^3}$

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④ Block Volume $= (1.24m)(0.82m)(0.933m) = 0.95\ m^3$

$Wt = 24.7\ kN\left(\frac{1000\ N}{1\ kN}\right) = 24{,}700\ N$

(a) $\gamma = \frac{W}{V} = \frac{24{,}700\ N}{0.95\ m^3} = 26{,}000 \frac{N}{m^3} =$

$26.0\ kN/m^3$

$\left(W = mg \Rightarrow m = \frac{W}{g}\right)$

(b) $D = \frac{m}{V} = \frac{(W/g)}{V} = \frac{(24{,}700\ kg\text{-}m/sec^2)/(9.82\ m/sec^2)}{0.95\ m^3} =$

$= \frac{26{,}000}{[redacted]}\ kg/m^3$

$S.G. = \frac{\rho}{\rho_w} = \frac{26{,}000}{[redacted]}\ kg/m^3 / 1000\ kg/m^3 = \boxed{26.0}$

(5) $V_{rock} = (0.45m)(0.372m)(0.128m) =$

$0.021\ m^3 =$

$21,427.2\ cm^3$

$n = 0.384 = 38.4\%$

$Vol\ pores = (Total\ Vol)(n) = 21,427.2 cm^3\ (0.384) =$

$8228.04\ cm^3 = 0.008 m^3$

(6) $S.G. = \frac{\rho_r}{\rho_w} = 2.94 = \frac{\rho_r}{1.0\ gm/cm^3}$

$n = 0.344$

$\rho_r = 2.94\ gm/cm^3$

p. 6 Eq 1.11 $\rho_g = \frac{\rho_r}{1-n} = \left(\frac{2.94\ gm/cm^3}{1-0.344}\right) = \frac{2.94\ gm/cm^3}{0.656}$

$= 4.48\ gm/cm^3$

(9) $V_r = 5.56\ m^3$ $\quad n = 0.417$

$V_p = V_r \cdot n = (5.56 m^3)(0.417) = 2.32\ m^3$

$D_{oil} = \frac{m}{Vol_p}$

$D = 0.620 \frac{g}{cm^3} \frac{1 kg}{1000 g} \frac{1 \times 10^6 cm^3}{1 m^3}$

$D = 620 \frac{kg}{m^3}$

$m = (D_{oil})(V_p) =$

$\left(620 \frac{kg}{m^3}\right)(2.32 m^3) = 1438.4\ kg$

$W_T = mg = (1438.4 kg)\left(9.82 \frac{m}{sec^2}\right) = 14,125.1 N$

14.125 kN

(11) $\eta = \frac{Vol\ p}{Vol\ total}$

$Vol\ sphere = 4/3\ \pi r^3$

$r = \frac{d}{2} = \frac{0.382}{2} cm = 0.191 cm$

$\eta = \frac{37.1 cm^3}{92.0 cm^3} = 0.4038 =$ 40.3%

$Vol\ pore = \frac{4}{3}(3.14)(0.191 cm)^3 =$

$0.029\ cm^3/pore$

$Total\ pore = 1270\ pore \left(0.029 \frac{cm^3}{pore}\right) = 37.1 cm$

(12) $Vol_{rock} = \Delta_{vol} = (107.5 ml - 65.0 ml) = 42.5 ml$

$42.5 cm^3$

dry mass = 116.9 g

(a) $Vol_{SAMPLE} = 42.5 cm^3$

(b) $D = \frac{M}{V} = \frac{116.9 g}{42.5 cm^3} = 2.75 \frac{g}{cm^3}$

(c) $S.G. = \frac{\rho_r}{\rho_w} = \frac{2.75 g/cm^3}{1.0 g/cm^3} = 2.75$

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(13) CUBE = $\boxed{n = 0.384}$

↳ $Vol = L \times L \times L = 1.4m \times 1.4m \times 1.4m = 2.744 m^3$

$Vol_{CHALK} = (V_T)(1 - 0.384) = (2.744 m^3)(0.616) = 1.69 m^3$

EDGE LENGTH = $\sqrt[3]{Vol} = \sqrt[3]{1.69 m^3} =$

$\boxed{1.19 m}$

(18) $\gamma = 36.2\ kN/m^3 = 36{,}200\ N/m^3$

$$\gamma = \frac{W}{V} = \frac{mg}{V} \Longrightarrow m = \frac{V\gamma}{g}$$

$$V_{cyl} = \pi r^2 h = \pi \left(\frac{d}{2}\right)^2 h = \pi \left(\frac{0.0657}{2}_{m}\right)^2 0.158_{m} =$$

$$5.36 \times 10^{-4}\ m^3$$

$$m = \frac{(5.36 \times 10^{-4}\ \cancel{m^3})(36{,}200\ N/\cancel{m^3})}{9.8\ m/sec^2} = 1.98\ kg$$

(24) $\gamma_{SAT} = 32.4 \frac{kN}{m^3} = 32{,}400\ N/m^3$

$V_{OL} = 2.74\ m^3$, $n = 0.276$

$V_{OL\ H_2O} = V_T n = (2.74\ m^3)(0.276) = 0.76\ m^3$

$\rho_{H_2O} = 1000 \frac{kg}{m^3} = \frac{m}{V} = \frac{m}{0.76\ m^3}$

$m_{H_2O} = (0.76\ m^3)\left(1000 \frac{kg}{m^3}\right) = 760\ kg$

$W_{T\ H_2O} = mg = 760\ kg\ 9.82\ m/s^2 = 7463.2\ N$

$\gamma_{H_2O} = \frac{W_t}{V} = \frac{7463.2\ N}{0.76\ m^3} = 9820\ N/m^3$

From EQUATION 1.17 $\gamma_{SAT} = \gamma_{dry} + n\,\gamma_{H_2O}$

$\gamma_{dry} = \gamma_{SAT} - n\,\gamma_{H_2O} =$

$\left(32{,}400 \frac{N}{m^3}\right) - (0.276)\left(9820 \frac{N}{m^3}\right) =$

$32{,}400 \frac{N}{m^3} - 2710.3 \frac{N}{m^3} =$

$\star$ $29{,}689.68\ N/m^3$

(27) TOTAL Volume = 1.2 m x 1.47m x 1.35m =

$2.38\ m^3$

$n = 0.284$

$V_{H2O} = V_t\ n = (2.38\ m^3)(0.284) =$

$0.68\ m^3$

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(29)

TOTAL VOLUME = $5.30\ m^3$

M. WET = 16,600 Kg

MASS DRY = 14,700 Kg

$M_{H2O} = 1900\ Kg$

$\rho_{H2O} = 1000\ \frac{kg}{m^3} = \frac{m}{V} = \frac{1900\ kg}{V}$

$1000\ \frac{kg}{m^3} = \frac{1900\ kg}{V} \Rightarrow V = \frac{1900\ kg}{1000\ kg/m^3} = 1.9\ m^3$

$V_{pore} = 1.9\ m^3 \quad V_T = 5.30\ m^3$

$n = \frac{V_{pore}}{V_T} = \frac{1.9\ m^3}{5.30\ m^3} = 0.358 = 35.8\%$