# Question 6.3

| Weight (lb) | Moisture Ratio | Moist Unit Weight ($lb/ft^3$) | Dry Unit Weight ($lb/ft^3$) |
|---|---|---|---|
| 3.26 | 8.4% | 97.8 | 90.2 |
| 4.15 | 10.2% | 124.5 | 112.9 |
| 4.67 | 12.3% | 140.1 | 124.8 |
| 4.02 | 14.6% | 120.6 | 105.2 |
| 3.63 | 16.8% | 108.9 | 93.2 |

The moist unit weight was obtained by dividing by the volume of the proctor mold. The dry unit was obtained using the following equation:

$$\gamma_d = \frac{\gamma_w}{1 + \frac{w}{100}}$$

$w$ being the moisture ratio and $\gamma_w$ being the moist unit weight. The maximum dry unit weight is $\boxed{124.8 \text{ lb/ft}^3}$ and the corresponding optimum moisture content is $\boxed{12.3\%}$.

# Question 6.4

$$e = \frac{G_s \times \gamma_{\text{water}}}{\gamma_{\text{dry max}}} = \frac{2.72 \times 62.4 \text{ lb/ft}^3}{124.8 \text{ lb/ft}^3} = 0.36 = \boxed{36\%}$$

$$S = \frac{G_s \times w_{\text{opt}}}{e} = \frac{2.72 \times 12.3\%}{0.36} = 0.93 = \boxed{93\%}$$

# Question 6.8

Calculate the total dry unit weight (independent of $G_s$) using the following equation:

$$\gamma_d = V \times \frac{\gamma_{\text{water}}}{1 + e} = 8000 \text{ m}^3 \times \frac{62.4 \text{ lb/ft}^3}{1 + 0.7} = 293647.1$$

| Pit | Void Ratio | Cost per $m^3$ | Excavated Volume ($m^3$) | Total Cost |
|---|---|---|---|---|
| A | 0.82 | \$11 | 8564.701 | \$94211.76 |
| B | 1.1 | \$8 | 9882.35 | \$79058.82 |
| C | 0.9 | \$9 | 8941.18 | \$80470.59 |
| C | 0.78 | \$10 | 8376.47 | \$83764.71 |

The excavated volume is calculated by taking the total dry unit weight and dividing it by $\frac{\gamma_{\text{water}}}{1+e}$ for each pit. The total cost is taken by multiplying the excavated volume by the cost per unit meter. From this table, the pit that minimizes the cost is $\boxed{\text{borrow pit B}}$.