64. (a) When the model is suspended (in air) the reading is F_g (its true weight, neglecting any buoyant effects caused by the air). When the model is submerged in water, the reading is lessened because of the buoyant force: $F_g - F_b$. We denote the difference in readings as Δm. Thus,

$$(F_g) - (F_g - F_b) = \Delta m g$$

which leads to $F_b = \Delta m g$. Since $F_b = \rho_w g V_m$ (the weight of water displaced by the model) we obtain

$$V_m = \frac{\Delta m}{\rho_w} = \frac{0.63776\,\text{kg}}{1000\,\text{kg/m}^3} = 6.3776 \times 10^{-4}\ \text{m}^3\ .$$

(b) The $\frac{1}{20}$ scaling factor is discussed in the problem (and for purposes of significant figures is treated as exact). The actual volume of the dinosaur is

$$V_{\text{dino}} = 20^3\, V_m = 5.1021\ \text{m}^3\ .$$

(c) Using $\rho \approx \rho_w = 1000\,\text{kg/m}^3$, we find

$$\rho = \frac{m_{\text{dino}}}{V_{\text{dino}}} \quad \Longrightarrow \quad m_{\text{dino}} = \left(1000\,\text{kg/m}^3\right)\left(5.1021\,\text{m}^3\right)$$

which yields 5.1×10^3 kg for the *T. Rex* mass.

(d) We estimate the mass range for college students as $50 \leq m \leq 115$ kg. Dividing these values into the previous result leads to ratios r in the range of roughly $100 \geq r \geq 45$.