59. (a) To avoid confusing weight with work, we write out the word instead of using the symbol W. Thus,

$$\text{weight} = mg = \left(1.85 \times 10^4 \text{ kg}\right)\left(9.8 \text{ m/s}^2\right) \approx 1.8 \times 10^5 \text{ N} .$$

(b) The buoyant force is $F_b = \rho_w g V_w$ where $\rho_w = 1000 \text{ kg/m}^3$ is the density of water and V_w is the volume of water displaced by the dinosaur. If we use f for the fraction of the dinosaur's total volume V which is submerged, then $V_w = fV$. We can further relate V to the dinosaur's mass using the assumption that the density of the dinosaur is 90% that of water: $V = m/(0.9\rho_w)$. Therefore, the apparent weight of the dinosaur is

$$\text{weight}_{\text{app}} = \text{weight} - \rho_w g\left(f\frac{m}{0.9\rho_w}\right) = \text{weight} - gf\frac{m}{0.9} .$$

If $f = 0.50$, this yields 81 kN for the apparent weight.

(c) If $f = 0.80$, our formula yields 20 kN for the apparent weight.

(d) If $f = 0.90$, we find the apparent weight is zero (it floats).

(e) Eq. 15-8 indicates that the water pressure at that depth is greater than standard air pressure (the assumed pressure at the surface) by $\rho_w gh = (1000)(9.8)(8) = 7.8 \times 10^4$ Pa. If we assume the pressure of air in the dinosaur's lungs is approximately standard air pressure, then this value represents the pressure difference which the lung muscles would have to work against.

(f) Assuming the maximum pressure difference the muscles can work with is 8 kPa, then our previous result (78 kPa) spells doom to the wading Diplodocus hypothesis.