**33.49 A car is designed to have a top speed of $120mph$. The drag coefficient is 0.4 and the frontal area is $28ft^2$. What is the minimum required motor size?**

A. $16hp$

B. $129hp$

C. $160hp$

D. $404hp$

Find the Drag Force on the car by using the drag coefficient, frontal area, and velocity in $\frac{ft}{s}$. Note that for US customary units, the gravitational constant, $g_c$, must be included in the denominator for the units to work, converting $lb_m$ to $lb_f$.

$$F_D = \frac{C_D \rho v^2 A}{2g_c}$$

$$v = 120\frac{mi}{hr}\left(\frac{1hr}{3600s}\right)\left(\frac{5280ft}{mi}\right) = 176\frac{ft}{s}$$

$$F_D = \frac{(0.4)\left(0.075\frac{lb_m}{ft^3}\right)\left(176\frac{ft}{s}\right)^2(28ft^2)}{2\left(32.2\frac{lb_m \cdot ft}{lb_f \cdot s^2}\right)} = 404lb_f$$

Use the definition of power found by searching Power and Efficiency. Power may be expressed as the product of force and velocity. Convert units to $hp$.

$$P = F \cdot v$$

$$P = \frac{(404lb_f)\left(176\frac{ft}{s}\right)}{550\frac{lb_f \cdot ft}{s \cdot hp}} = 129hp$$

**Answer B**