$V_{\cancel{car}char} = \sqrt{\dfrac{l}{UG}}$

$$UG = \frac{l}{V_{car}^2} \quad \text{—} \ (1)$$

we know $UG = \dfrac{m}{l} \cdot \dfrac{C\alpha l r - C\alpha f l f}{C\alpha R \, C\alpha f}$

& $l r = w_R l$

$l f = l - l r$

Substituting these values in (1)

$$\frac{m}{l} \cdot \frac{C\alpha R(w_R l) - C\alpha R(l - w_R l)}{C\alpha R \, C\alpha f} = \frac{l}{V_{char}^2}$$

~~$w_R l (m C\alpha R l + m C\alpha f l + m$~~

$$C\alpha R w_R l + \cancel{R} C\alpha f w_R l = \frac{l^2 C\alpha R C\alpha f}{V_{char}^2 \cancel{C\alpha R C\alpha f} \cdot m} + m C\alpha f l$$

$$w_R = \cancel{\frac{l^2 C\alpha R C\alpha f}{C\alpha R^2 C\alpha f^2}} + m C\alpha f l$$

$$w_R = \frac{l^2 C\alpha R C\alpha f}{V_{char}^2 (\cancel{C\alpha R C\alpha f m})(C\alpha R \cancel{l} + C\alpha f \cancel{l})m} + \frac{m C\alpha f \cancel{l}}{C\alpha R \cancel{l} + C\alpha f \cancel{l}}$$

$$w_R = \frac{l \, C\alpha f C\alpha R}{V_{char}^2 (C\alpha R + C\alpha f) m} + \frac{m \, C\alpha f}{C\alpha R + C\alpha f}$$