

81. It is recommended to look over §20-7 before doing this problem.

(a) We normalize the distribution function as follows:

$$\int_0^{v_o} P(v) dv = 1 \implies C = \frac{3}{v_o^3} .$$

(b) The average speed is

$$\int_0^{v_o} v P(v) dv = \int_0^{v_o} v \left(\frac{3v^2}{v_o^3} \right) dv = \frac{3}{4} v_o .$$

(c) The rms speed is the square root of

$$\int_0^{v_o} v^2 P(v) dv = \int_0^{v_o} v^2 \left(\frac{3v^2}{v_o^3} \right) dv = \frac{3}{5} v_o^2 .$$

Therefore, $v_{\text{rms}} = \sqrt{3/5} v_o \approx 0.775 v_o$.