Physics | 105B Midterm

(5)

$$\frac{dm}{dt} = kAv \qquad A = \pi r^2 \qquad m = \frac{4\pi}{3}\rho r^3$$

$$\frac{dm}{dt} = k\pi r^2 v$$

$$mg = \frac{d}{dt}(mv) = v\frac{dm}{dt} + m\frac{dv}{dt}$$

$$\frac{dv}{dt} = g - \frac{v}{m}\frac{dm}{dt}$$

$$\frac{dv}{dt} = g - v\frac{3}{4\pi\rho r^3}k\pi r^2 v$$

$$\boxed{\frac{dv}{dt} = g - \frac{3}{4}\frac{kv^2}{r\rho}}$$