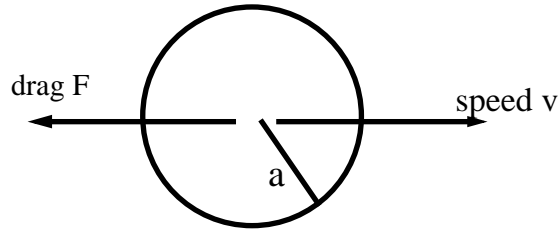**Worksheet #1: Dimensional Analysis**

Say we suspect that drag force F depends only on a sphere's radius a, its speed v, and the surrounding fluid density ρ.

a) What are the dimensions of a, v, ρ and F?

b) Create the dimensions matrix for this problem.

c) Find a dimensionless combination of the quantities, π.

d) Find $\boldsymbol{\alpha} = [\alpha_1, \alpha_2, \alpha_3, \alpha_4]$ so that $\pi = a^{\alpha_1} v^{\alpha_2} \rho^{\alpha_3} F^{\alpha_4}$. Is this choice unique? Find the subspace of all such vectors and find a basis.

e) What is the number of independent dimensionless parameters?

f) What does the Pi Theorem tell us for this problem? How must F depend on a, v, ρ?

g) If F also depended on visocity η (units $ML^{-1}T^{-1}$) Repeat part e).