

ASG v2 EX 1.1 (Ivory balls)

Consider 2 ivory spheres of different diameter falling in the same medium.



$$D_A = 10 D_B$$



In air (almost a vacuum)

$$\frac{w_A}{w_B} = 1000$$

(since $w \propto \text{Vol} \propto D^3$)

In water, the weight of each is reduced by the buoyant force

$$\frac{w_{A, \text{water}}}{w_{B, \text{water}}} = \frac{w_{A, \text{air}} - B_A}{w_{B, \text{air}} - B_B} = \frac{V_A (\rho_a - \rho_{\text{water}}) g}{V_B (\rho_a - \rho_{\text{water}}) g}$$

$$\frac{w_{A, \text{water}}}{w_{B, \text{water}}} = 1000$$

The weight of A is 1000 times greater than B.

The ratio is the same.

$$\frac{S_A}{S_B} = 100$$

Since $S \propto D^2$

The surface area of A is just 100 times greater than that of B.

So A will descend more rapidly, since its weight is more able to overcome drag forces, which act on its surface, than B.