Archimedes' principle is a powerful tool for solving many problems involving equilibrium in fluids. It states the following: When a body is partially or completely submerged in a fluid (either a liquid or a gas), the fluid exerts an upward force on the body equal to the weight of the fluid displaced by the body. As a result of the upward Archimedes' force (often called the buoyant force), some objects may float in a fluid, and all of them appear to weigh less. This is the familiar phenomenon of buoyancy. Quantitatively, the buoyant force can be found as \( F_{\text{buoyant}} = \rho_{\text{fluid}} g V \), where \( F_{\text{buoyant}} \) is the force, \( \rho_{\text{fluid}} \) is the density of the fluid, \( g \) is the magnitude of the acceleration due to gravity, and \( V \) is the volume of the displaced fluid.

An object is placed in a fluid and then released. Assume that the object either floats to the surface (settling so that the object is partly above and partly below the fluid surface) or sinks to the bottom. For Parts A through D, you should assume that the object has settled in equilibrium.

A. Consider the following statement: The magnitude of the buoyant force is equal to the weight of fluid displaced by the object. Under what circumstances is this statement true?

- for every object submerged partially or completely in a fluid only
- for an object that floats
- only for an object that sinks
- for no object submerged in a fluid

B. Consider the following statement: The magnitude of the buoyant force is equal to the weight of the amount of fluid that has the same total volume as the object. Under what circumstances is this statement true?

- for an object that is partially submerged in a fluid
- only for an object that floats
- for an object completely submerged in a fluid
- for no object partially or completely submerged in a fluid

C. Consider the following statement: The magnitude of the buoyant force equals the weight of the object. Under what circumstances is this statement true?

- for every object submerged partially or completely in a fluid for an object that floats
- only for an object that sinks
- for no object submerged in a fluid

D. Consider the following statement: The magnitude of the buoyant force is less than the weight of the object. Under what circumstances is this statement true?

- for every object submerged partially or completely in a fluid for an object that floats
- for an object that sinks
- for no object submerged in a fluid