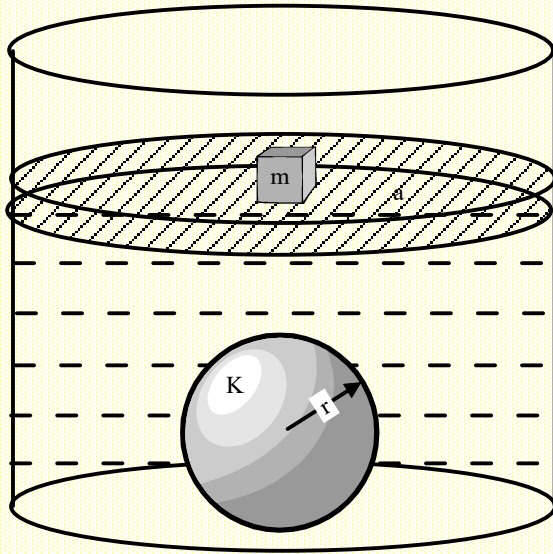


A solid sphere of radius r made of a soft material of bulk modulus K is surrounded by a liquid in a cylindrical container. A massless piston of area a floats on the surface of the liquid, covering entire cross section of cylindrical container. When a mass m is placed on the surface of the piston to compress the liquid, the fractional decrement in the radius of the sphere, dr/r is :

- (1) $\frac{Ka}{mg}$ (2) $\frac{Ka}{3mg}$
 (3) $\frac{mg}{3Ka}$ (4) $\frac{mg}{Ka}$

Solution



$$\Delta P = \frac{mg}{a}$$

$$K = \frac{\Delta P}{\Delta V/V} = \frac{mg/a}{\Delta\left(\frac{4}{3}\pi r^3\right)/\left(\frac{4}{3}\pi r^3\right)} \approx \frac{mg/a}{3\Delta r/r}$$

$$\therefore \frac{\Delta r}{r} \approx \frac{mg}{3Ka} \quad \text{Or,} \quad \frac{dr}{r} = \frac{mg}{3Ka} \quad \text{as} \quad \frac{\Delta r}{r} \approx \frac{dr}{r}$$

Hence, Option (3).

[Based on JEE Main 2018 - [123IITJEE](#)]