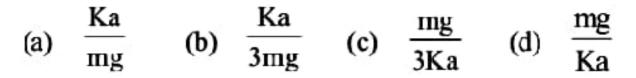
24. A solid sphere of radius *r* made of a soft material of bulk modulus K is surrounded by a liquid in a cylindrical container. A massless piston of area a floats on the surface of the liquid, covering entire cross-section of cylindrical container. When a mass *m* is placed on the surface of the piston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

the radius of the sphere
$$\left(\frac{dr}{r}\right)$$
, is: [2018]



24. (c) Bulk modulus, $K = \frac{\text{volumetric stress}}{\text{volumetric strain}}$

$$K = \frac{mg}{a\left(\frac{dV}{V}\right)}$$

...

$$\Rightarrow \quad \frac{dV}{V} = \frac{mg}{Ka} \qquad \dots (i)$$

volume of sphere,
$$V = \frac{4}{3}\pi R^3$$

Fractional change in volume
$$\frac{dV}{V} = \frac{3dr}{r}$$
 ...(ii)

Using eq. (i) & (ii)
$$\frac{3dr}{r} = \frac{mg}{Ka}$$

$$\therefore \frac{dr}{r} = \frac{mg}{3Ka}$$
 (fractional decrement in radius)