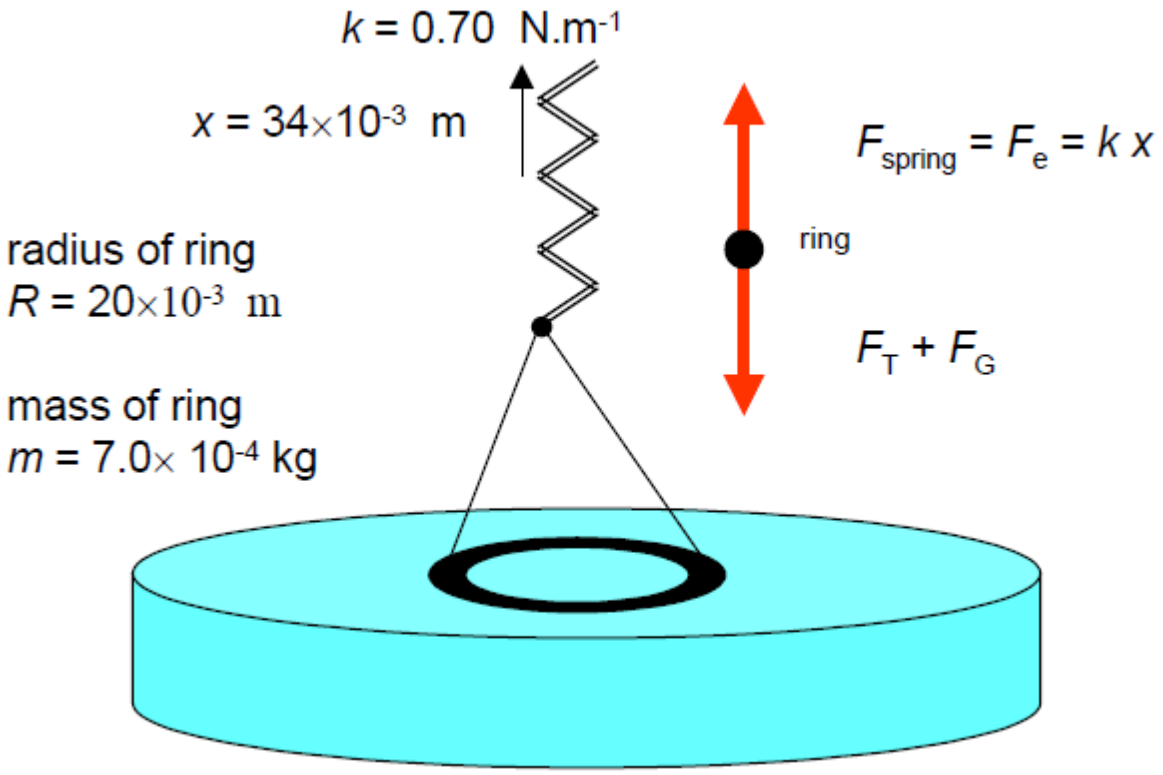
A thin, circular wire of diameter 40 mm and total mass of 0.70 g is gently pulled vertically from a water surface by a sensitive spring ($k = 0.7\ \mathrm{Nm^{-1}}$). When the spring is stretched 34 mm from its equilibrium position in air the ring is on the verge of being pulled free from the water surface. Find the coefficient of surface tension of water. Neglect the mass of water lifted.



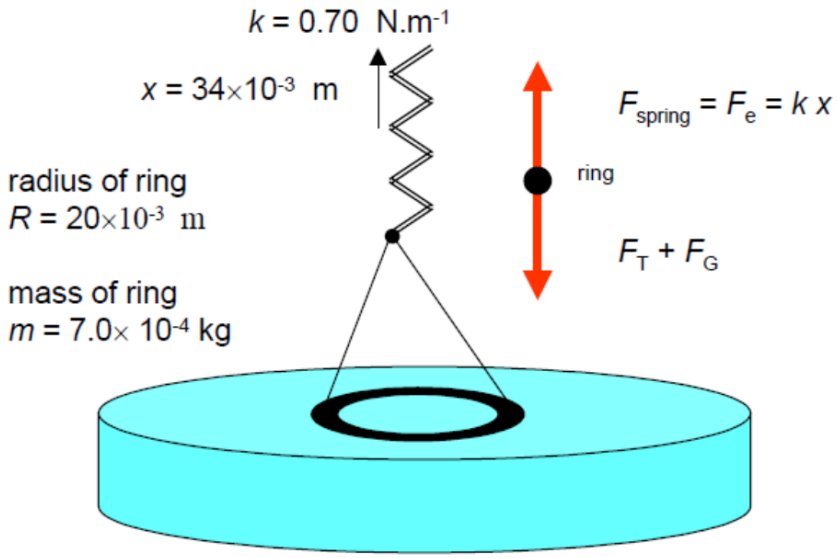
Equilibrium:

$$F_e = F_{ST} + F_G$$

$$kx = 4\pi R\sigma + mg$$

$$\sigma = \frac{kx - mg}{4\pi R}$$

$$\sigma = \frac{0.7 \times 34 \times 10^{-3} - 7 \times 10^{-4} \times 9.8}{4 \times 3.14 \times 20 \times 10^{-3}} = 0.076\ \mathrm{Nm^{-1}}$$



Surface of any liquid behaves as though it is covered by a stretched membrane