

A body weighs 9.8N on equator of earth which does not spin. If earth starts spinning what will be its weight? Please show your work.

When earth will start spinning, on body will act the force of inertia

$$F_i = ma_i = m\omega^2 R$$

Weight of body is equal to the total force which act on body:

$$F_g - F_i = P$$

where F_g – gravitational force.

When earth does not spinning its weight is equal to gravitational force.

$$P_0 = F_g = mg$$

$$P_0 = mg \rightarrow m = \frac{P_0}{g}$$

So, the weight of the body is:

$$P = P_0 - m\omega^2 R = P_0 - \frac{P_0 \omega^2 R}{g} = P_0 \left(1 - \frac{\omega^2 R}{g}\right)$$

Assuming that $R = 6.4 * 10^6 m$, $\omega = \frac{2\pi}{24*3600s} = 7.27 * 10^{-5} rad/s$

$$P = 9.8N \left(1 - \frac{(7.27 * 10^{-5} rad/s)^2 * 6.4 * 10^6 m}{9.8m/s}\right) = 9.76N$$