2. A body of mass m = 10 kg is attached to one end of a wire of length 0.3 m. The maximum angular speed (in rad s^{-1}) with which it can be rotated about its other end in space station is (Breaking stress of wire = 4.8×10^7 Nm^{-2} and area of cross-section of the wire = 10^{-2} cm^2) is _____ .

[9 Jan 2020 I]

2. **(4)** Given : Wire length, $l = 0.3$ m

Mass of the body, m = 10 kg

Breaking stress, $\sigma = 4.8 \times 10^7\ Nm^{-2}$

Area of cross-section, $a = 10^{-2}\ cm^2$

Maximum angular speed $\omega = ?$

$T = Ml\omega^2$

$$\sigma = \frac{T}{A} = \frac{ml\omega^2}{A}$$

$$\frac{ml\omega^2}{A} \le 48 \times 10^7 \Rightarrow \omega^2 \le \frac{\left(48 \times 10^7\right)A}{ml}$$

$$\Rightarrow \omega^2 \le \frac{\left(48 \times 10^7\right)\left(10^{-6}\right)}{10 \times 3} = 16 \Rightarrow \omega_{max} = 4\ \text{rad/s}$$