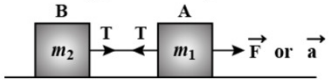
QUES 05

Two bodies of masses 10 kg and 20 kg respectively kept on a smooth, horizontal surface are tied to the ends of a light, inextensible string. A horizontal force F = 60 kgf is applied to



a. A,
b. B along the direction of the string.

What is the tension in the string in each case? [Given, g = 10 m/s^2]

Sol. Horizontal force is given by, F = 60 kgf = 60 × g N = 60 × 10 N = 600 N
Mass of body is given by A, m_1 = 10 kg
Mass of body B is given by, m_2 = 20 kg
Total mass of the system is given by, m = m_1 + m_2 = 30 kg
By Using Newton's second law of motion, the acceleration (a) produced in the system can be calculated as:
F = ma

$$a = \frac{F}{m} = \frac{600}{30} = 20 m/s^2$$

a. Both the bodies A and B will move with this acceleration as shown in the image. Now when force F is applied on body A, say the tension acting in the string between A and B is T.

The equation of motion can be written as:
F - T = m_1a
$\therefore$ T = F - m_1a
$= 600 - 10 \times 20$ = 400 N ,Hence tension= 400N.

b. In this case two bodies A and B will also move with the same acceleration, a = 20 m/s^2 but in the opposite direction as shown in the figure. Now when the force F is applied on body B, say the tension in the string between A and B is T' in this case.

The equation of motion can be written as:
F - T' = m_2a
T' = F - m_2a
$\therefore T' = 600 - 20 \times 20 = 200\text{N}$