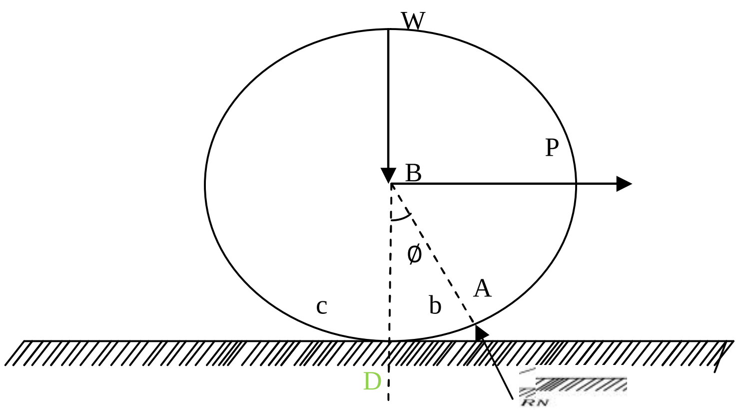
Rolling resistance

When a body is made to roll freely over an another body , a resistance is developed in the opposite direction known as rolling resistance.This resistance helps to roll the body without any slipping (or) turning of the body.



Taking moment about A,

$$\sum m_A = 0$$

$$P \times BC = W \times AC$$

BC is very small. Hence BC= radius of the roller

$$P \times r = W \times b$$

$$P = \frac{Wb}{r}$$

The distance 'b' is known as the co-efficient of rolling resistance .

Problem 15:

A rail road freight car is having a weight of 80 metric tons. The diameter of the wheels is 0.75m and co-efficient of rolling resistance between wheel and truck is 0.025mm. Find the horizontal force required to maintain uniform speed.

What will be the horizontal force for the truck and trailer of weight If the diameter of the tires is 1.2m and co-efficient of rolling resistance between the truck tires and the road is 0.625mm?. In which case the horizontal force is minimum.

Solution :

Rail road freight can,

$$P_1 = \frac{W_1 b_1}{R_1}$$

$$P_1 = \frac{80 \times 1000 \times 9.81 \times 0.025}{375}$$

$$P_1 = 53.32\ \text{N}$$

$$W_1 = 80 \text{ metric tons}$$
$$= 80 \times 1000 \text{ kgf}$$
$$= 80 \times 1000 \times 9.81\ \text{N}$$
$$D_1 = 0.75\text{m}$$
$$\therefore D_1 = 750\ \text{mm}$$
$$R_1 = 0.375\ \text{mm}$$
$$b_1 = 0.025\ \text{m}$$

Truck and trailer ,

$$P_2 = \frac{W_2 \times b_2}{R_2}$$

$$= \frac{80 \times 1000 \times 9.81 \times 0.625}{375}$$

$$P_2 = 817.5\ \text{N}$$

$$w_2 = \text{same as } w_1 = 80 \times 1000 \times 9.81\ N$$
$$b_2 = 0.625\ \text{mm}$$
$$R_2 = 1.2\text{m} = 1200\text{mm}$$
$$= 600\ \text{m}$$

In case of railroad freight can, the horizontal force required to maintain uniform speed is minimum.