Solution: A bar can develop tensile force or compressive force. Let the force developed be a compressive force S (push on the cylinder). Free body diagram of the cylinder is as shown in Fig. 2.17 (*b*).

Since there are more than three forces in the system, Lami's equations cannot be used. Consider the equilibrium equations.

$$\Sigma F_H = 0 \rightarrow$$

$$S \cos 30° + 5 - 7 \cos 45° = 0$$

$$S = \frac{7 \cos 45° - 5}{\cos 30°} = -0.058 \text{ kN}$$

Since the value is negative the reaction from the bar is not push, but it is a pull (tensile force in the bar) of magnitude 0.058 kN. **Ans.**

Referring to Fig. 2.17 (*b*)

$$\Sigma F_y = 0 \rightarrow$$

$$R - 10 - 7 \sin 45° + S \sin 30° = 0$$

$$R = 10 + 7 \sin 45° - S \sin 30°$$

$$= 10 + 7 \sin 45° - (-0.058) \sin 30°$$

i.e., $R = 14.980$ kN **Ans.**

Example 2.14. *A roller of radius r = 300 mm and weighing 2000 N is to be pulled over a curb of height 150 mm, as shown in Fig. 2.18 (a) by applying a horizontal force F applied to the end of a string wound around the circumference of the roller. Find the magnitude of force F required to start the roller move over the curb. What is the least pull F through the centre of the wheel to just turn the roller over the curb?*

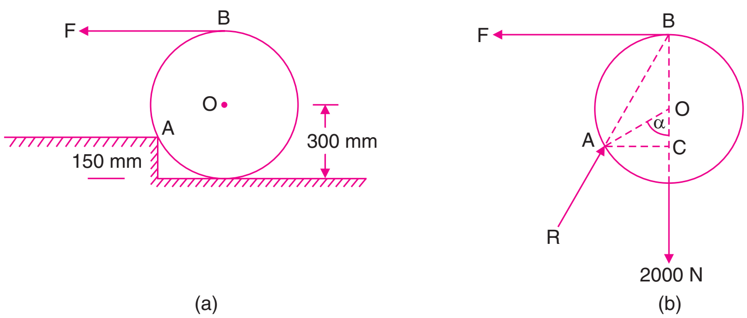

Fig. 2.18

Solution. When the roller is about to turn over the curb, the contact with the floor is lost and hence, there is no reaction from the floor. The body is in equilibrium under the action of three forces, namely,

(*i*) Applied force F, which is horizontal

(*ii*) Self weight, which is vertically downward, acting through the centre of roller, and

(*iii*) Reaction R from the edge of the curb. Since the body is in equilibrium under the action of only three forces, they must be concurrent. It means the reaction at edge A of curb passes through the point B as shown in the Figure 2.18 (*b*).

Referring to Fig. 2.18 (*b*),