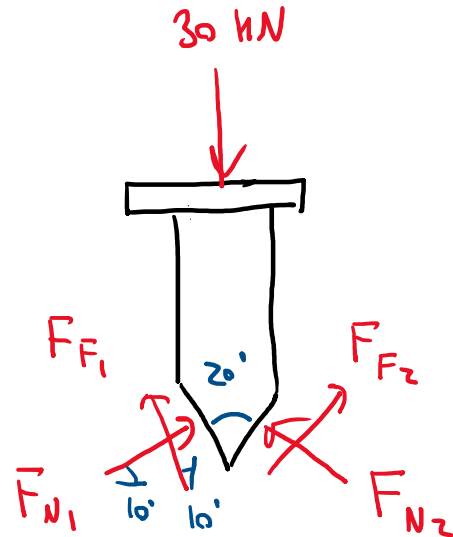
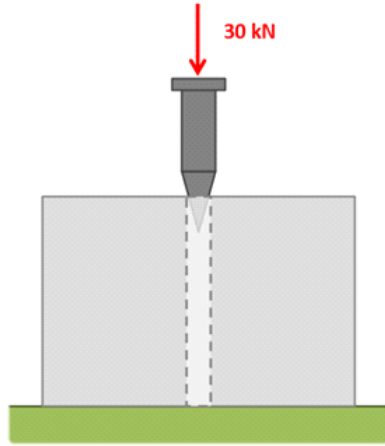


Problem 1

A geologist drills a hole through a rock and is trying to split the rock using a rock chisel as shown below. Assume the tip of the chisel has a 20-degree angle and that the coefficient of friction between the chisel and rock is 0.3. If the geologist exerts a 30 kN force by striking the chisel with a hammer, what are the expected normal forces on the rock?



Assume Symmetry

Assume negligible mass
for chisel

Impending motion

$$F_{F1} = 0.3 F_{N1} \quad F_{F2} = 0.3 F_{N2}$$

$$\sum F_x = F_{N1} \cos(10) - 0.3 F_{N1} \sin(10)$$

$$-F_{N2} \cos(10) + 0.3 F_{N2} \sin(10) = 0$$

$$F_{N1} (\cos(10) - 0.3 \sin(10)) = F_{N2} (\cos(10) - 0.3 \sin(10))$$

$$F_{N1} = F_{N2}$$

$$\sum F_y = F_{N1} \sin(10) + F_{N2} \sin(10) + 0.3 F_{N1} \cos(10)$$

$$+ 0.3 F_{N2} \cos(10) - 30 \text{ kN} = 0$$

$$F_{N1} = F_{N2} = 31.98 \text{ kN}$$