A Jet of water of diameter 50mm strikes a fixed plate in such a way that the angle between the plate and jet is 30°. The force exerted in the direction of the Jet is 1471.5 N. Determine the rate of flow of water.

30°

$d = 50mm = .05$

$\theta = 30°$

$F_x = 1471.5N$

$F_x = \rho A V^2 \sin^2\theta$

$F_x = F_n \sin\theta$

$1471.5 = 1000 \times \frac{\pi}{4} \times (.05)^2 \times V^2 \times \sin^2 30°$

$V = \sqrt{2958.28}$

$V = 54.75 \ m/s$

$Q = AV$

$\boxed{Q = .1074 \ m^3/s}$

A Jet of water of 20mm diameter and moving at 15m/s, strikes upon the center of a symmetrical vane. After impingement, the Jet gets deflected through 160° by the vane. Presuming vane to be smooth determine,

(i) The force exeted by jet on the vane, and

(ii) The ratio of velocity at outlet to that at inlet if actual reaction of the vane is 127 N.

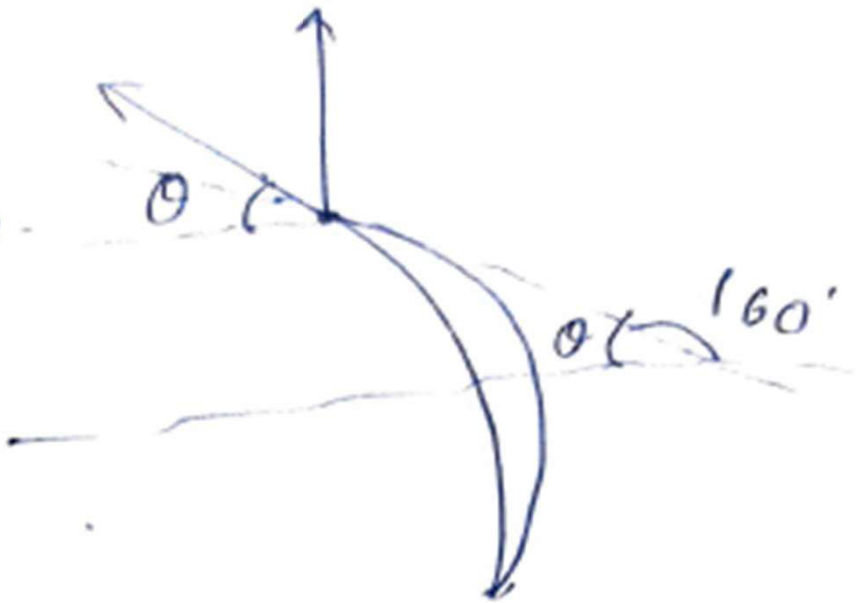
d = ·02 m

v = 15 m/s

A_{gm} = 180°

of

deflecta



$$f_n = \rho A V^2 [1 + \cos\theta]$$

$$\theta = 180 - 160 = 20^\circ$$

$$= 2 \times 1000 \times \frac{\pi}{4} .02^2 \times 15^2 [1 + \cos 20]$$

$$\boxed{F = 137.10\ N}$$

$$f_{actua} = 127\ N$$

$$K = \frac{V_2}{V_1}$$

$$F_x = \rho A V^2 [1 + K \cos\theta) \quad \{V_1 + V_1 K (\cos\theta)$$

$$= [000 \times \frac{\pi}{4} (.02)^2 \times (V_1)^2 [1 + K \cos\theta)$$

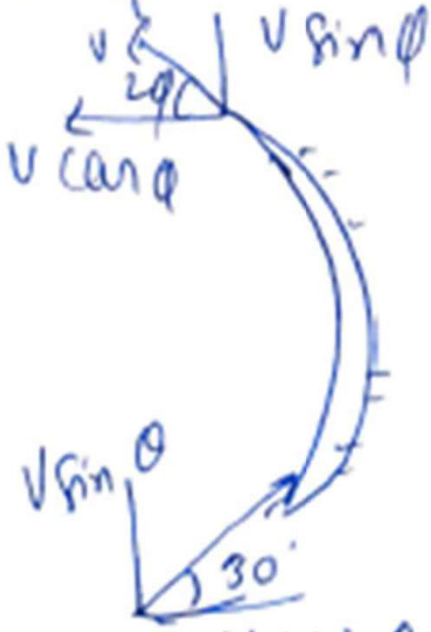
$$127 = 1000 \times \frac{\pi}{4} (.02)^2 \times (15)^2 \times [1 + K \cos\theta)$$

$$K = .84$$

Blade Factor

A Jet of water of diameter 60mm moving with velocity of 40 m/s strikes a curved Fixed Plate tangentially at one End at an angle of 30° to H2. the Jet leaves the plate at at an angle of 20° to the H2. Find the force exerted by Jet on the plate in the H2 and Vertical direction

$\theta = 30$, $\phi = 20°$, $V = 40$ m/s $d = 60$ mm $= 0.06$ m



$F_x = \dot{m}(V_{1x} - V_{2x})$

$= \rho A V [V\cos\theta + V\cos\phi]$

$= 1000 \times \frac{\pi}{4} \times (0.06)^2 [40\cos 30 + 40\cos 20]$

$= 0.167$ kN

$F_y = \dot{m}\rho A V [V_{\sin\theta} - V\sin\phi]$

$= 1000 \times \frac{\pi}{4} \times (0.06)^2 [\sin 30 - \sin 20] \times (40)^2 = -714.5$

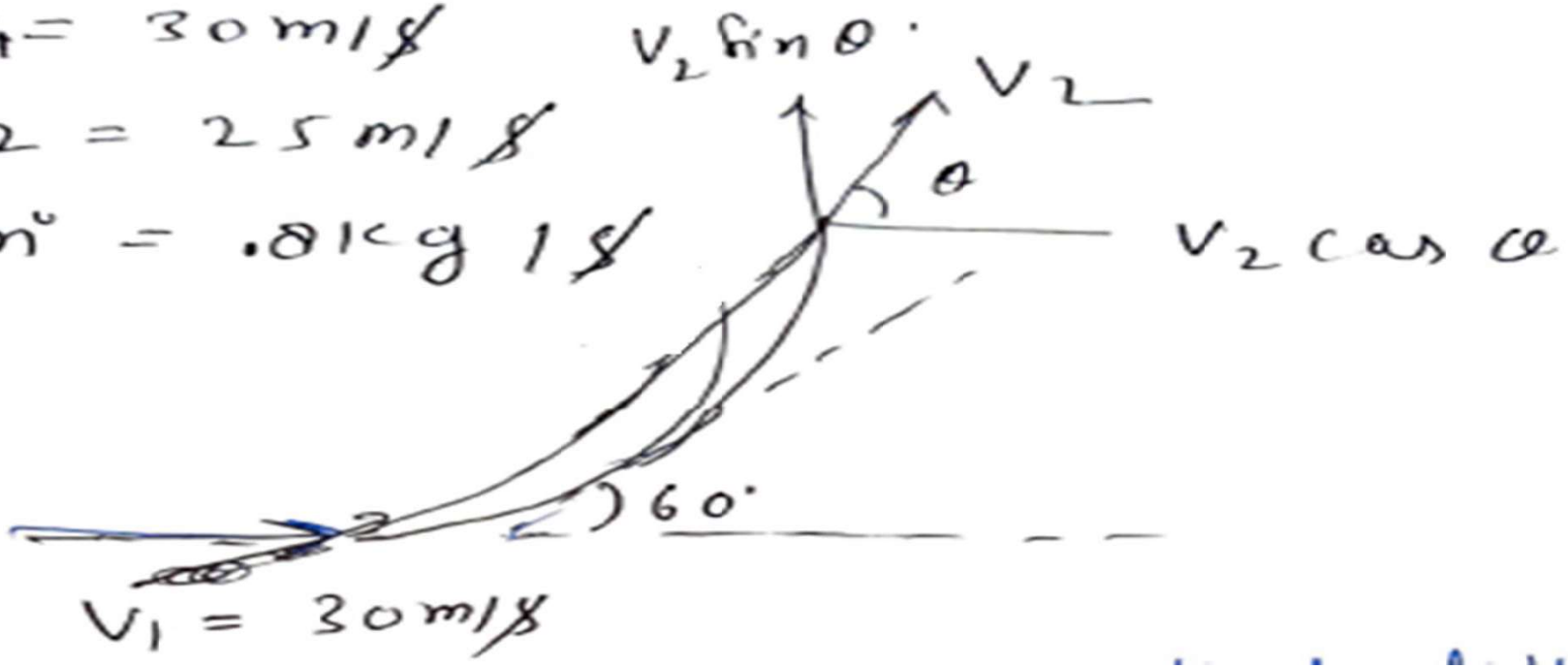
A jet of water from nozzel is deflected through 60° from its original direction by curved plate which it enters tangentially without shock with a velocity of 30 m/s and leaves with a mean velocity of 25 m/s if the discharge from nozzel is .01 kg/s calculate the magnitude & direction of the resultant force on the vane if vane is stationary.

$\theta = 60°$

$V_1 = 30 \text{ m/s}$

$V_2 = 25 \text{ m/s}$

$\dot{m} = .81 \text{ kg/s}$



Force ... in direction of x

$F_x = m(v_{1x} - v_{2x})$

$= 1.8 \times [30 - 25 \cos 60]$

$F_x = 14 \text{ N}$

Force in normal direction

$F_y = 1.8 [v_{1y} - v_{2y}]$

$= 1.8 [0 - 25 \sin 60]$

$= -17.32 \text{ N}$

$R = \sqrt{F_x^2 + F_y^2}$

$= \sqrt{\quad}$

$= 22.23 \text{ m/s}$

$\tan \alpha = \frac{F_y}{F_x} = \frac{17.32}{14}$

$\alpha = 51.05°$