
# Strength of Materials 1

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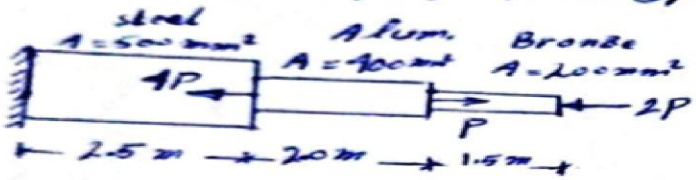
# H.W No. 1

1- An aluminum rod is rigidly attached between a steel rod and a bronze rod as shown in Fig.(1). Axial loads are applied at the positions indicated. Find the maximum value of P that will not exceed a stress in steel of 140 Mpa, in aluminum of 90 Mpa, or in bronze of 100 Mpa.

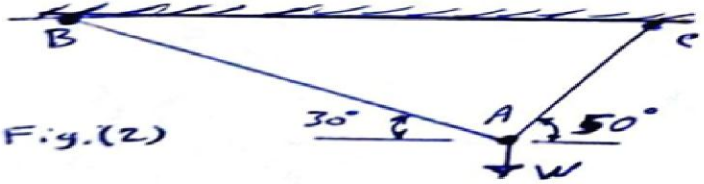
Ans. P=10kN




F.g.(1)

2- Determine the largest weight W that can be supported by the two wires shown in Fig.(2). The stress in wire is not to exceed 30 ksi. The cross-sectional areas of wires AB and AC are 0.4 in² and 0.5 in², respectively.

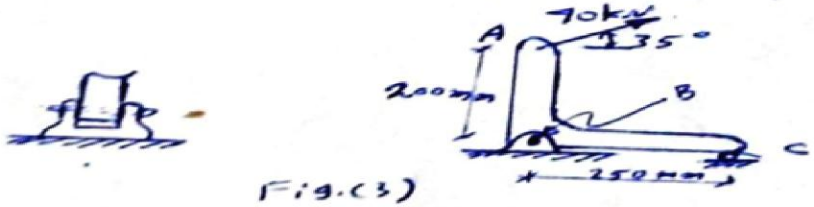
Ans. W=17.1 kips




F.g.(2)

3- Compute the shearing stress in the pin at B for the member supported as shown in Fig.(3). The pin diameter is 20 mm.

Ans. 94.1 Mpa

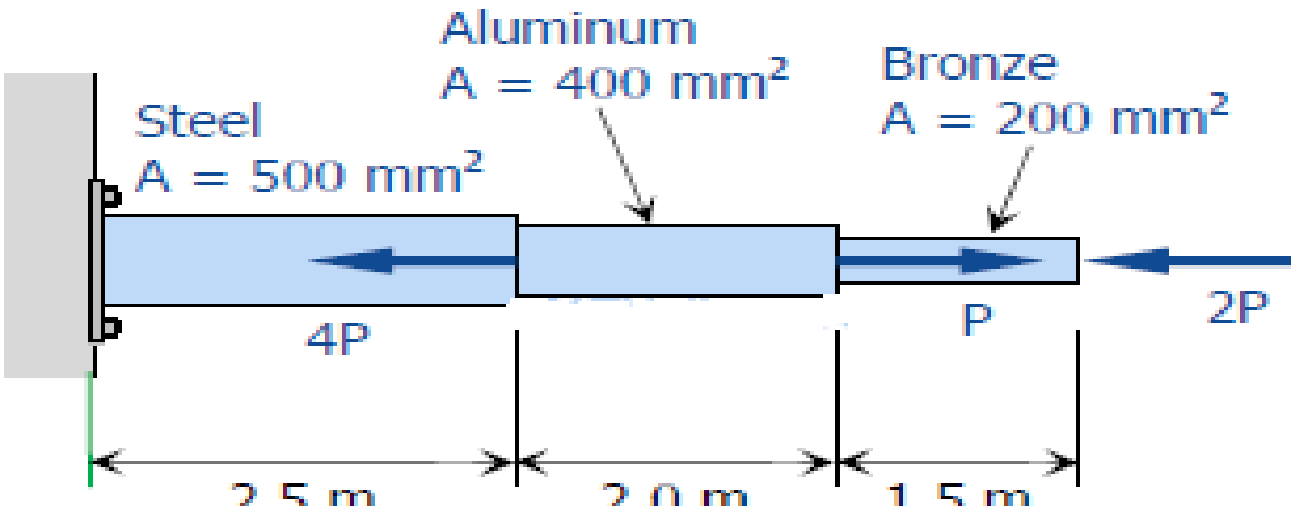


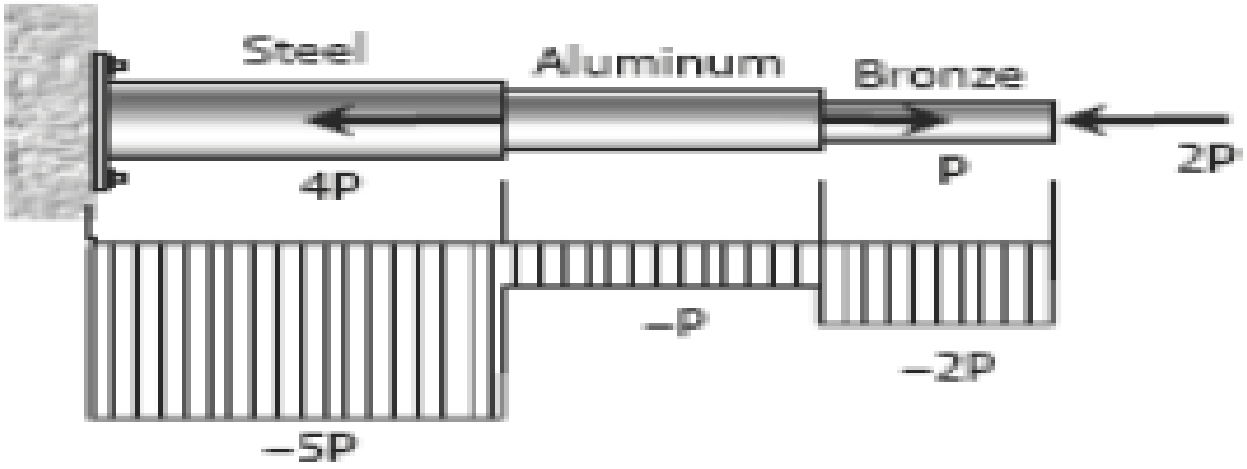

F.g.(3)

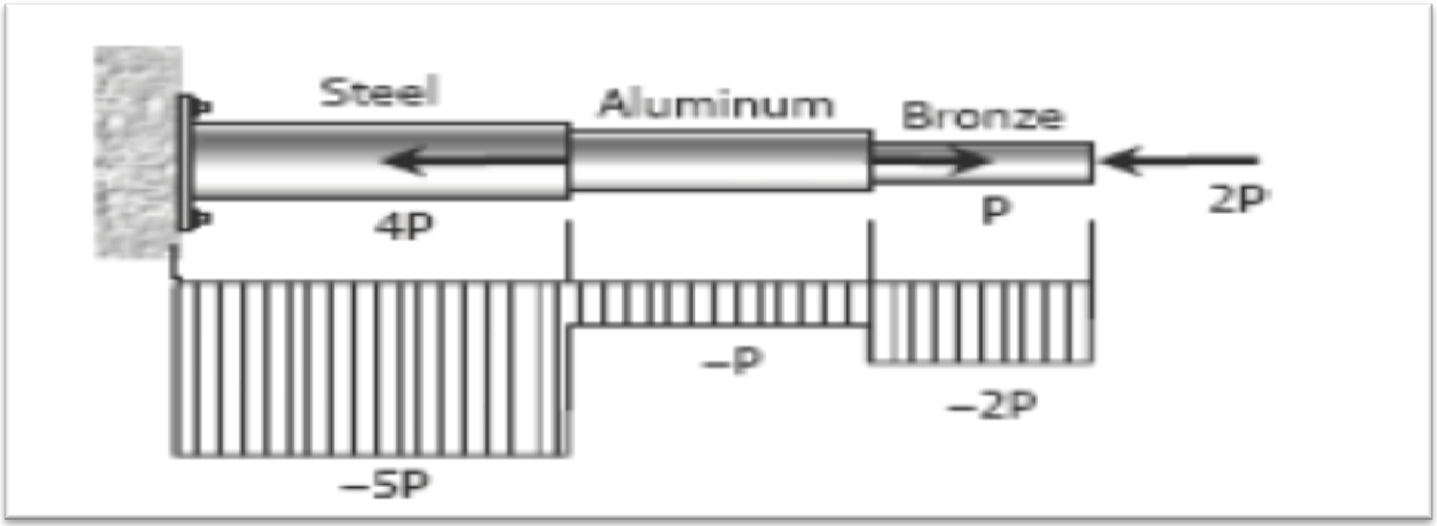
4- What force is required to punch a 20-mm-diameter hole in a plate that is 25 mm thick? The shear strength is 350Mpa.

Ans. 550 kN

H.W1/An aluminum rod is rigidly attached between a steel rod and a bronze rod as shown in fig.(1). Axial load are applied at the position indicated .Find the maximum value of P that will not exceed a stress in steel of 140 Mpa , in aluminum of 90 MPa , or bronze of 100MPa






$$\sigma = \frac{P}{A}$$

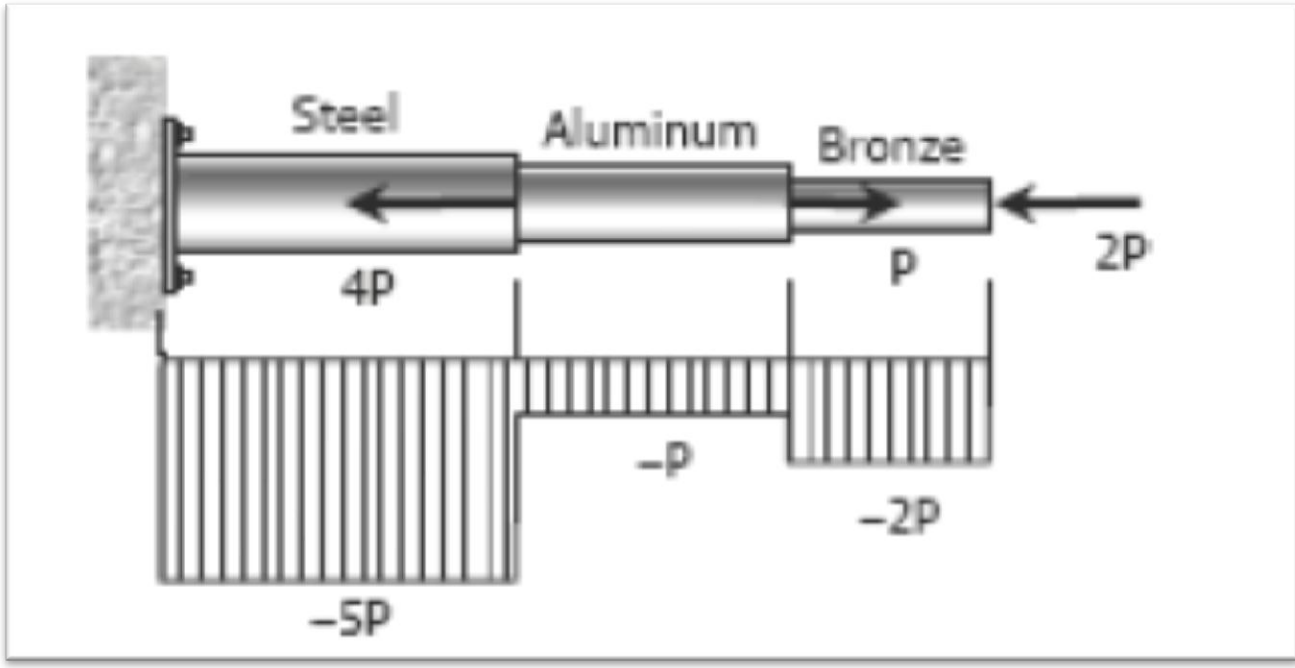
*For bronze*

$$\sigma_{br} = \frac{P_{br}}{A_{br}}$$

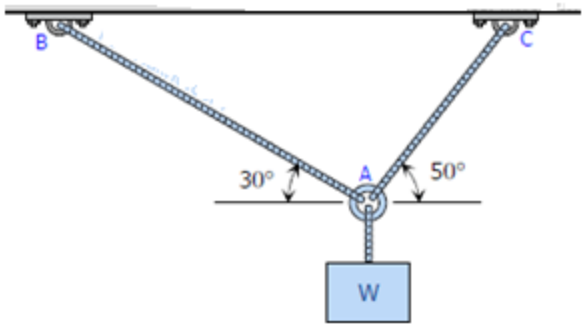
$$P_{br} = \sigma_{br} * A_{br}$$

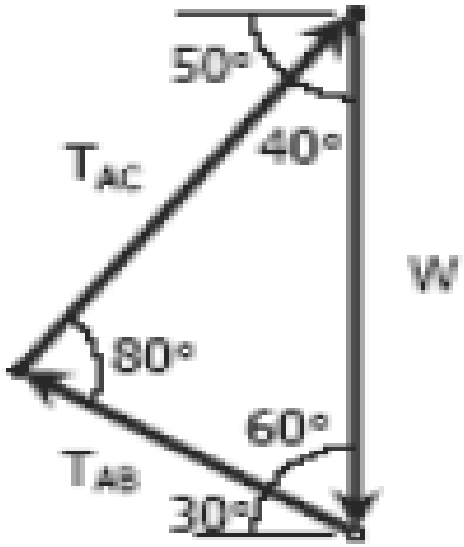
$$2P = \sigma_{br} * A_{br}$$

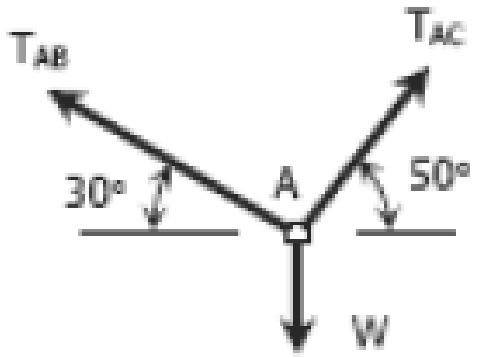
- $2P=100*(200)$
- $P_{br}=10000\ N$
- $For\ aluminum$
- $P_{al}=\sigma_{al}*A_{al}$
- $P=90*400$
- $P_{al}=36000\ N$
- For steel
- $5P=\sigma_{sl}*A_{sl}$
- $5P=140*500$
- $P_{sl}$=14000 N



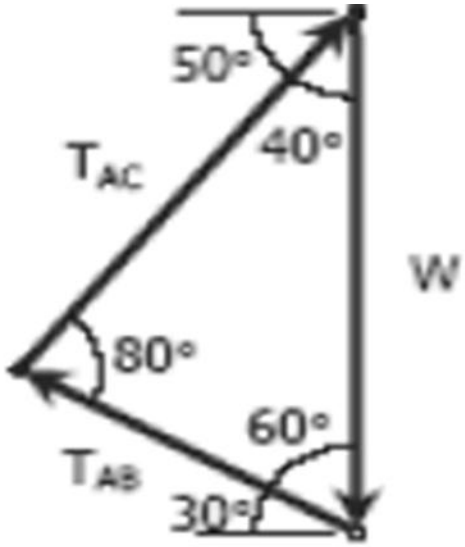
H.W 2 /Determine the largest weight W that can be supported by the two wires shown in fig (2) .the stress in wire is not to exceed 30 KSi. The cross-sectional areas of wires AB and AC are 0.4 $in^2$ . And 0.5 $in^2$ respectively



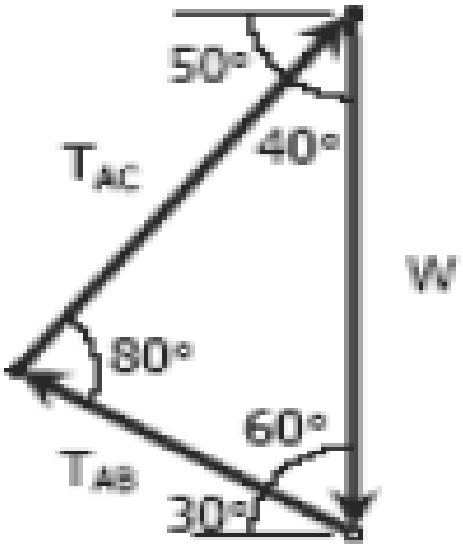



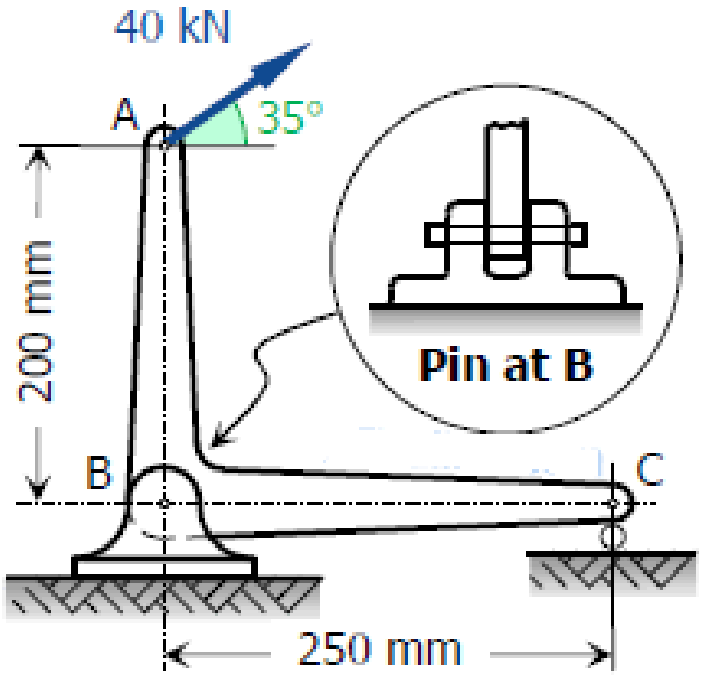
- *For wire AB*
- $\frac{T_{AB}}{sin_{40}} = \frac{W}{sin_{80}}$
- $T_{AB} = sin_{40} * W * sin_{80}$
- $T_{AB} = 0.633 * W$
- $\sigma = \frac{P}{A}$
- $P = \sigma_{AB} * A_{AB}$
- $0.633 * W = 30 * (0.4)$
- $W = 18.4$ *Kips*

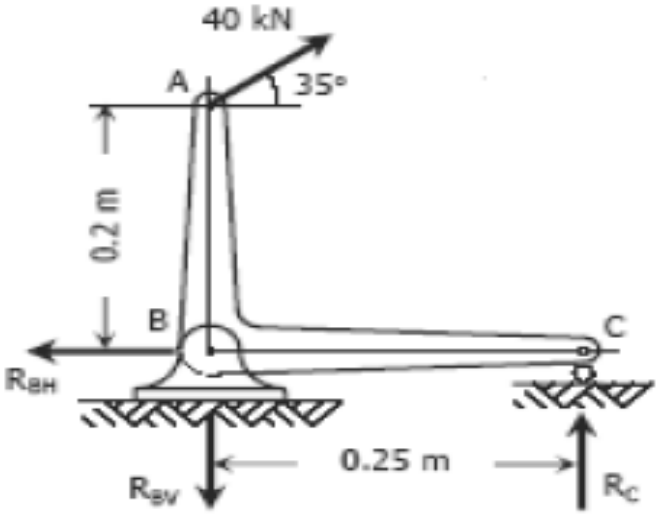


- *For wire AC*
- $\frac{T_{AC}}{sin_{60}} = \frac{W}{sin_{80}}$
- $T_{AC} = 0.8528 * W$
- $\sigma_{AC} = \frac{P_{AC}}{A_{AC}}$
- $P_{AC} = \sigma_{AC} * A_{AC}$
- $0.8528 * W = 30 * (0.5)$
- $W = 17.1$ *Kips*



**H.W3/ Compute the shearing stress in the pin at B for the member supported as shown in fig (3). The pin diameter is 20 mm.**




Free Body Diagram

From F.B.D

$\sum M_C$=0

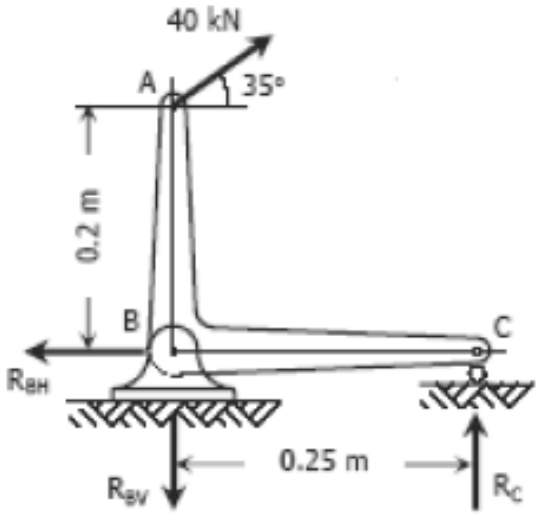
0.25*$R_{BV}$=0.25*(40*$sin_{35}$)+0.2*(40*$cos_{35}$)

$R_{BV}$=49.156 $K_N$

$\sum f_x$=0

$B_X$=40*$cos_{35}$

$B_X$=32.766 $K_N$



Free Body Diagram

$R_B = \sqrt{BX^2} + \sqrt{By^2}$

$= \sqrt{32.766^2} + \sqrt{49.156^2}$

$R_B = 59.076\ K_N$

Shear force of point at B

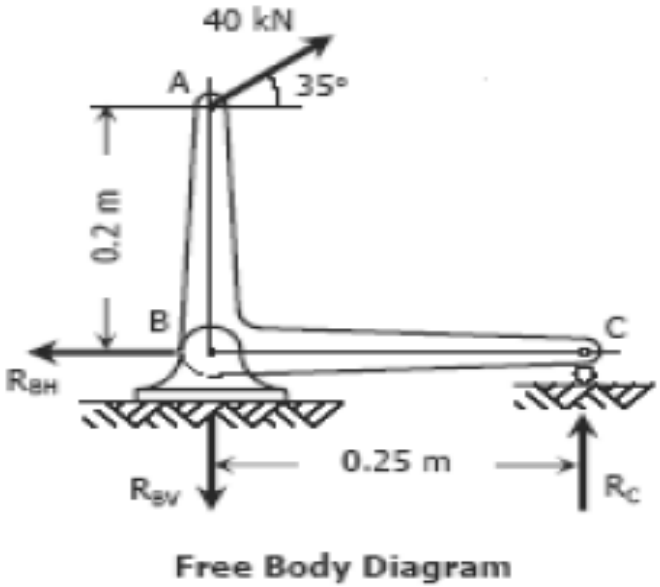
$T = \frac{V}{A}$

$V_B = T_B * A$

*Double shear*

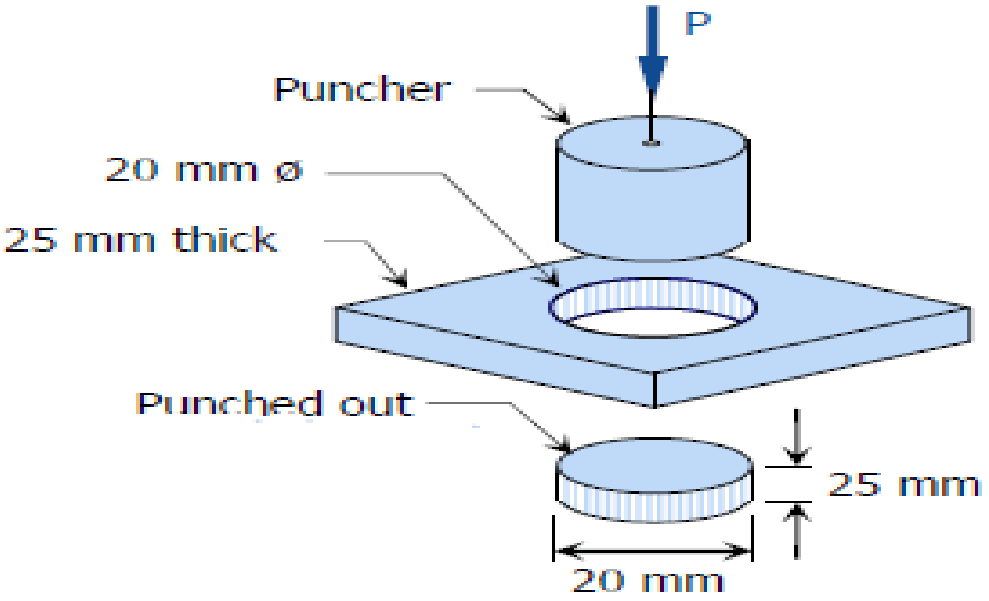
$59.076 * 1000 = T_B * (2 * \frac{\pi}{4} * 20^2)$

$T_B = 94.02\ MPa$



Free Body Diagram

**H.W4/What force is required to punch a 20mm diameter hole is a plate that is 25mm thick? The shear strength is 350 MPa.**



$$T=\frac{V}{A}$$

$$V=T*A$$

$$V=T*(\pi*d*t)$$

$$=350*(\pi * 20 * 25)$$

$$= 549778.7N \bullet$$

$$P=549.8\ K_N \bullet$$