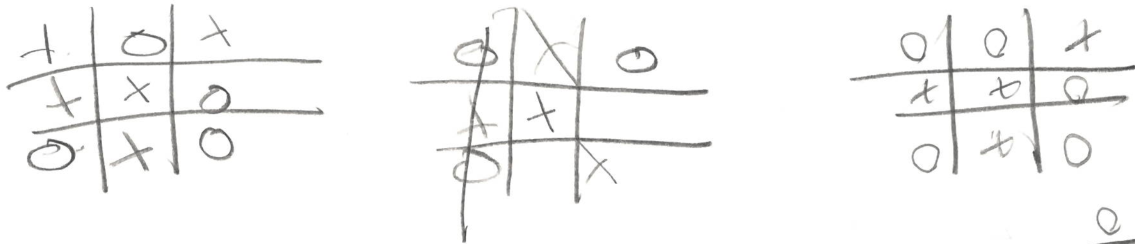


Pulleys

$v = \omega r$

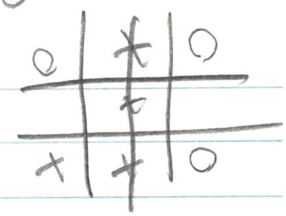
$v_1 = v_2$

$\omega_1 r_1 = \omega_2 r_2$

$T_1 = T_2 \left(\frac{r_1}{r_2} \right)$

Gears

$v = \omega r$

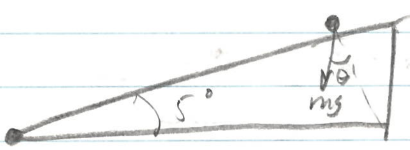


$\omega_1 r_1 = -\omega_2 r_2$

$T_1 = -T_2 \left(\frac{r_1}{r_2} \right)$

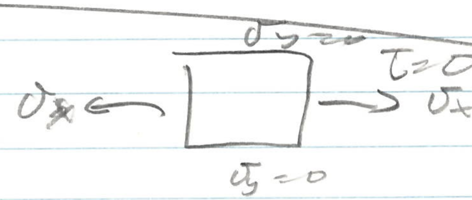
Efficiency factor makes power less 1 $P_{out} = \eta P_{in}$

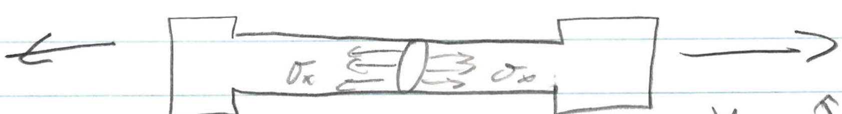
$P_{out} < P_{in}$

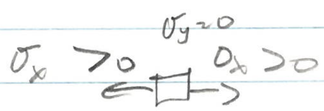


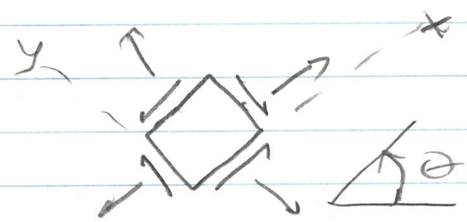
$\Delta P = F V$

$(mg \sin 5^\circ)(9.55) =$









Ductile → Fail due to normal

Brittle → Fail due to shear

3. 2 rods both 1 in diameter, 3 ft. Long

I would choose ~~the~~ to <u>measure the weight</u> of each rod since we ~~[illegible]~~ you can calculate volume which then allows you to calculate the unit weight. but to make sure I am confident in what material I have I would also do a <u>Deflection test</u> to get Young's modulus. If this is ~~still~~ still not good enough to determine the material ~~[illegible]~~ I would then use ~~hardness test~~ <u>scratch test</u> and <u>visual description</u> to determine the material.

<u>Rod B.</u>

- Reddish, Brown, Tarnished
- ~~[illegible]~~ - Shiny, Brassy color deep scratch
- $W = 9.00\ lbf = 4.0823\ kg$
- $\delta = 17/32\ in$
- Unit weight $(w) = \frac{W}{V} = \frac{9.00\ lbf}{\pi(.5\ in)^2(36\ in)} = .318\ \frac{lbf}{in^3}$
- $E = \frac{PL^3}{3\delta I} = \frac{(100\ lb)(\cancel{36}\ 24\ in)^3}{3(17/32\ in)\left(\frac{\pi(1\ in)^4}{64}\right)} = \cancel{[illegible]}\ 17.67\ lbs/in^2\ (Psi)$
-

Rod B is Copper

~~Rod B~~

~~Weight = 9 lbf~~

~~Volume = .0163 ft³~~

~~$w = \frac{9\ lbf}{.0163\ ft^3} = 550\ \frac{lbf}{ft^3}$~~

~~$\delta = 17/32\ in$~~

~~$E = \frac{PL^3}{3\delta I} = \frac{(100\ lb)(36\ in)^3}{3(17/32\ in)\left(\frac{\pi(1\ in)^4}{32}\right)} = 29.82\ ksi$~~

Matthew Donaldson

Machine elements HW2 January 26, 202[illegible]

1. a. For a ductile material in a tensile test, There is no appreciable difference between The engineering and True stress-strain curve? False.

b. Ductile material tends to fail along planes of maximum Shear stress

c. Brittle material tends to fail along planes of maximum normal stress.

d. Material That is normally Ductile can never behave as if it is Brittle. False

e. i. creep:

ii. Toughness:

iii. Resilience:

2. a. $\delta = \frac{PL^3}{3EI} \rightarrow E = \frac{PL^3}{3I\delta} \rightarrow \boxed{\frac{64PL^3}{3\pi d^4 \delta} = E}$

b. $G = \frac{E}{2(1+\nu)} \rightarrow \nu = \frac{E}{2G} - 1$ $E = \frac{PL^3}{3I\delta}$ $G = \frac{TL}{k'\theta}$

$\nu = \frac{\left(\frac{PL^3}{3I\delta}\right)}{\left(2\frac{TL}{k'\theta}\right)} - 1 \rightarrow \nu = \frac{PL^3}{3I\delta} \cdot \frac{2k'\theta}{TL} - 1$

$\nu = \frac{2}{3} \frac{PL^2\theta k'}{I\delta T} = \frac{1}{24} \frac{P\pi d^4 \theta L^2}{I\delta T}$

c. E: $\frac{N}{m^2} = \frac{N \cancel{m^3}}{\cancel{m^4} m}$ ν: $\frac{N \cdot m^4 \cdot m^2}{m^4 \cdot m \cdot \cdot Nm} \Rightarrow$ no units ✓

$\frac{N}{m^2} = \frac{N}{m^2}$ ✓

Lab 2 Calc.

$\delta = \frac{PL^3}{3EI}$ $L = \cancel{1.1\,m}$ 1100 mm $\delta = -3.955$ mm $= 0.003955$

$I = I_{zz} = 1017.88\ mm^4$ $P = 1\ N$

$E = \frac{PL^3}{3\delta I} = \frac{(1N)(1100\,mm)^3}{3\,(3.955\,mm)(1017.88\,mm^4)}$

$E = 110208.155\ \frac{N}{mm^2} \cdot \left(\frac{1000\ mm}{1\ m}\right)^2$

$E = 1.1 \cdot 10^{11}\ \frac{N}{m^2}$ $1.10208 \cdot 10^{11}$

$\theta = \frac{TL}{JG}$ $T = .99\ N\cdot m$ $L = 1100\ mm$

$J = \frac{\pi \cdot 02}{2}$ $\theta = .01372$ ~~1.372~~

$G = \frac{TL}{J\theta}$ $= \cancel{2.0357}$ $2035\ mm^4$

Displacement $8.232 \cdot 10^{-2}$ mm

$r = .06\ mm$ $\theta = D/r$

$G = \frac{E}{2(1+\nu)}$ $1+\nu = \frac{E}{2G}$ $\nu = \frac{E}{2G} - 1$

$G = \frac{(.99\ N\cdot m)(1.1\ m)}{\left(2035\ mm^4 \cdot \left(\frac{1\ m}{1000\ mm}\right)^4\right)(.01372)}$

.37

$G = 4 \cdot 10^{10}$

$\boxed{G = 3.89 \cdot 10^{10}\ N/m^2}$

$\nu = .413$

$E = \frac{PL}{A\delta}$ $\delta = 9.726 \cdot 10^{-2}\ mm$ $L = 1.1\ m$

$P = 1100\ N$ $A = 113.1\ mm^2$

N/m^2

$E = \frac{(1100\,N)(1.1\,m)}{\left(113.1\,mm^2 \cdot \frac{}{1000^2}\right)\left(9.726 \cdot 10^{-2}\,mm \cdot \frac{}{1000}\right)} = 1.0999 \cdot 10^{11}$