

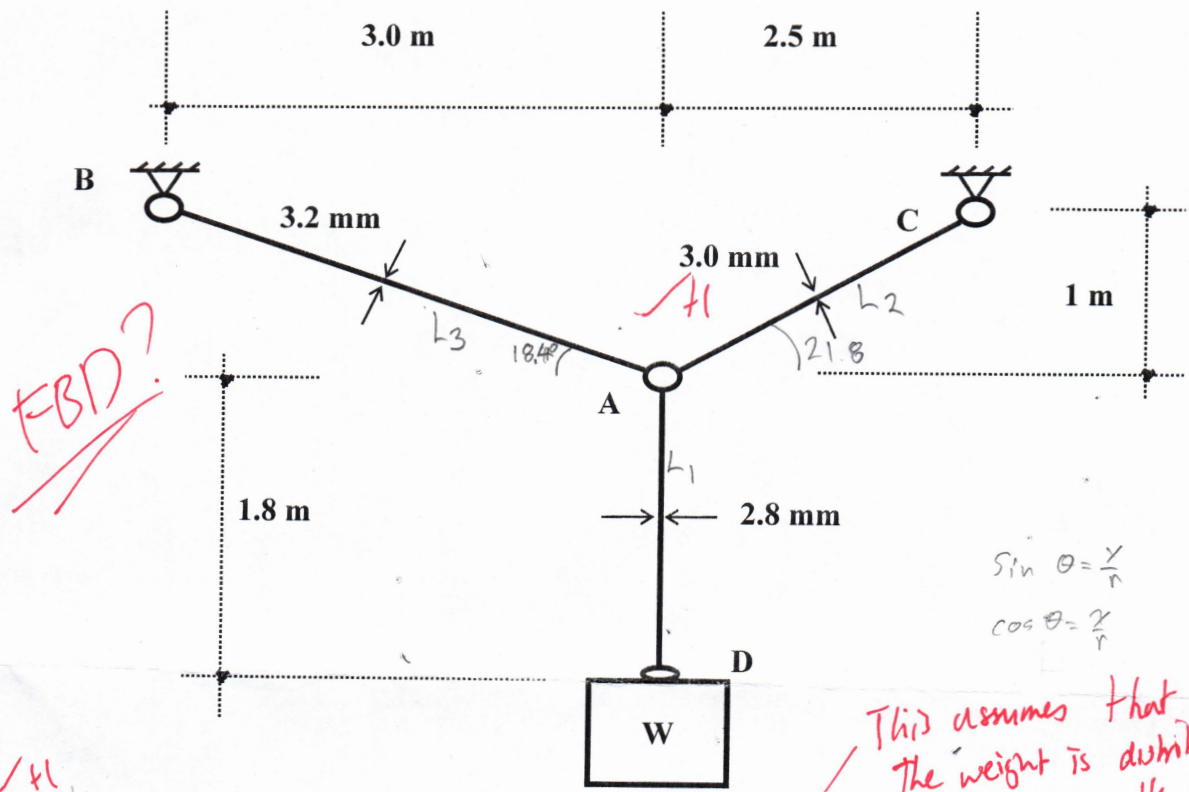
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10

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(Last) (First)

CIV102F Quiz # 2: 1300h-1500h Thursday September 19, 2019
Force Equilibrium

The weight W is supported by steel wires with the diameters shown. The breaking stress of the three steel wires is 450 MPa. Weight W is to be increased until one wire fails.

- Which is the first wire to fail?
- At what value of the weight W will the first wire fail?



a.) $\sigma_u = \frac{F}{A}$ ✓ H

$A_{L1} = \frac{\pi(d_{L1})^2}{4} = \frac{\pi(2.8\text{ mm})^2}{4} = 6.16\text{ mm}^2$ ✓ H

$A_{L2} = \frac{\pi(d_{L2})^2}{4} = \frac{\pi(3.0\text{ mm})^2}{4} = 7.07\text{ mm}^2$

$A_{L3} = \frac{\pi(d_{L3})^2}{4} = \frac{\pi(3.2\text{ mm})^2}{4} = 8.04\text{ mm}^2$

if $\sigma_{L3} = 450\text{ MPa}$: $F_{L3} = 3618\text{ N}$: $F_{L3y} = 1142\text{ N}$

$\therefore F_{L2} = 3697\text{ N}$: $\sigma_{L2} = 522.97\text{ MPa}$

✓ H

$\sum F_x = 0$
 $\sum F_y = 0$

This assumes that the weight is distributed equally between the two wires which is incorrect.

b.) If $\sigma_{L2} = 450\text{ MPa}$: $F_{L2} = 3181.5\text{ N}$
 $F_{L2x} = 2953.52\text{ N}$
 $F_{L2y} = 1181\text{ N}$

$\therefore F_{L3x} = 2953\text{ N}$
 $\therefore F_{L3y} = 982\text{ N}$: $F_{L3} = 3112\text{ N}$

$F_{L1} = F_{L3y} + F_{L2y} = 982\text{ N} + 1181\text{ N} =$

if $\sigma_{L2} = 450\text{ MPa}$: $F_{L2} = 3181.5\text{ N}$: $F_{L2x} = 2953.52$
 $\therefore F_{L2y} = 1181$

$\therefore F_{L3} = 3113\text{ N}$: $\sigma_{L3} = 387.148$
 $\therefore F_{L1} = 2163.63\text{ N}$: $\sigma_{L1} = 351\text{ MPa}$

$\therefore L_2$ $d = 3.00\text{ mm}$ will fail first ✓ H

the weight of W that will cause the first wire to fail is $\approx 2160\text{ N}$,
✓ H

28

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DEPARTMENT OF CHEMISTRY

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NO. 1

1950

1951

1952

1953

1954

1955

1956

1957

1958

1959

1960

1961

1962

1963