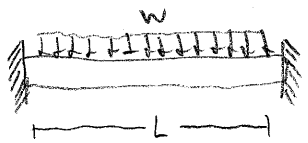
Spring 2016,
Solids Candidacy

① 

Beam is Designation: W 36 x 135
$w = 20\ kN/m$
$L = 4\ m$
$E = 200e9$

(a) Draw Mohr's circle to determine the principle stresses and max shear stress, at the midspan ($\frac{L}{2}$) at both the centroid and top surface.

(b) Now consider the additional load of $\alpha = 29E\text{-}6/^\circ F$ and $\Delta T = 100^\circ F$, draw the two Mohr's circles again.

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② (a) Metal is cold-worked by hammering or cold rolling. What happens to ductility and yield strength? Justify

(b) Can a material have a negative poisson's ratio? If so, give an example.

(c) Define a orthotropic and cubic crystal structure. How many material constants does each have?

(d) What relationship between stress is shown by the conservation of angular momentum?

(e) What is the difference between mechanics of materials method and elasticity?

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⑦ What is the difference in necking for metals and polymers. Why are metals unstable during necking, but polymers are stable?

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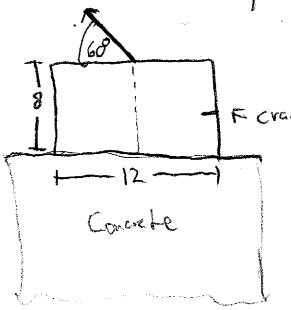
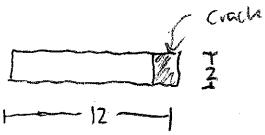
④ A material is incompressible. What does this mean for poisson's ratio and bulk modulus?

(a)

(b) A pressure vessel is incompressible, will the length of the vessel change when subject to internal pressure?

③ Given material properties : S_y = something and $K_{cI} = 93$





The load on the cable is normally $P = 200$ kips but can reach up to 500 kips during hurricane conditions.

It is very expensive to replace this support, should it be replaced?

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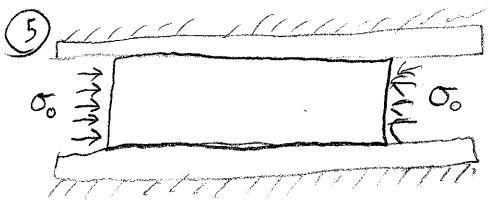
⑤



A thin plate is between two rigid frictionless walls and subjected to σ_0.

Show that the displacement fields are given by:

$$u = -\frac{(1-\nu^2)}{E}\sigma_0 x \; ; \; v = 0 \; ; \; w = \frac{\nu(1+\nu)}{E}\sigma_0 z$$

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⑥ Describe the state of stress at a point in the middle of the neck zone (necking has occurred) in a sample subjected to uniaxial tension. Draw the 3D Mohr's circle for the point.