1. (10pts) By considering a point of a body under general loading condition, please draw a small cube to describe the components of stress in x-y-z coordinate system. Also show that $\tau_{xy} = \tau_{yx}$, $\tau_{xz} = \tau_{zx}$ and $\tau_{yz} = \tau_{zy}$.

2. (10pts) Write down the generalized Hook's Law for a homogeneous isotropic material under most general stress condition. Use the above equations and show the stress-strain relationships for the plane stress and plane strain conditions.

3. (10pts) What are the definitions of the dilatation, hydrostatic stress and bulk modulus? What is the relationship among them? It is known that the bulk modulus can be expressed by the modulus of elasticity and Poisson's ratio. Based on the expression, show that the Poisson's ratio is larger than 0.5.

4. (10pts) State the maximum-shearing-stress and maximum-distortion-energy yield criteria, and show the relative relationships for plane stress condition.

5. (10pts) The initial portion of a tension test on 7075-T651 aluminum. Note that data points A and B are labeled with their stress-strain coordinates.
   (a) Obtain the approximate values of the modulus of elasticity and 0.2% offset yield strength.
   (b) If a sample of this material 150 mm long is strained to point B and then unloaded, what are the plastic strain and its length remains after unloading?

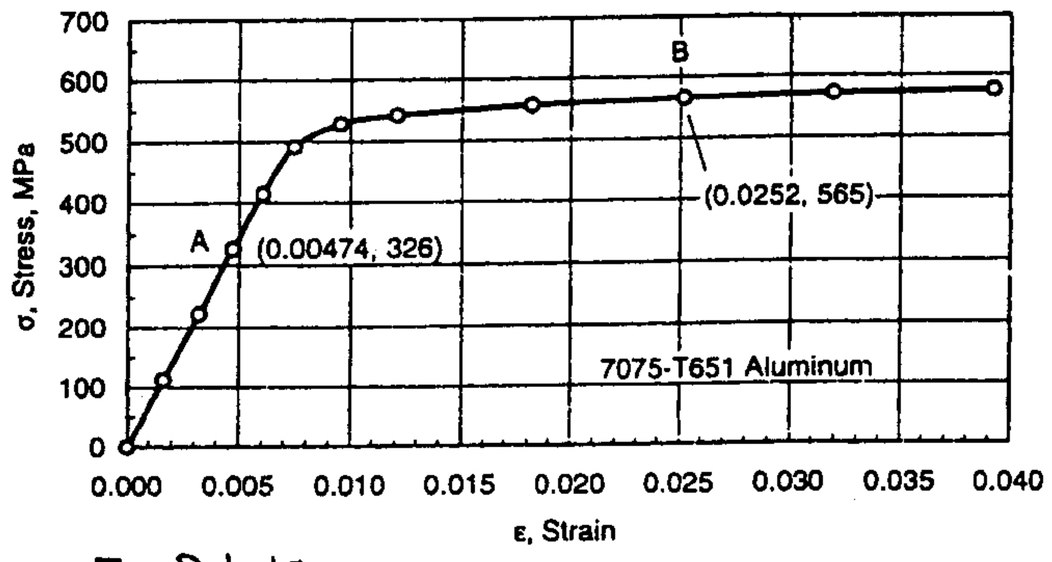

Fig. Prob.5

6. (10pts) For the solid brass shaft shown, determine (a) the maximum shearing stress in portion AB, (b) the angle of twist at point C ($G = 5.6 \times 10^6$ psi)

(背面仍有題目,請繼續作答)

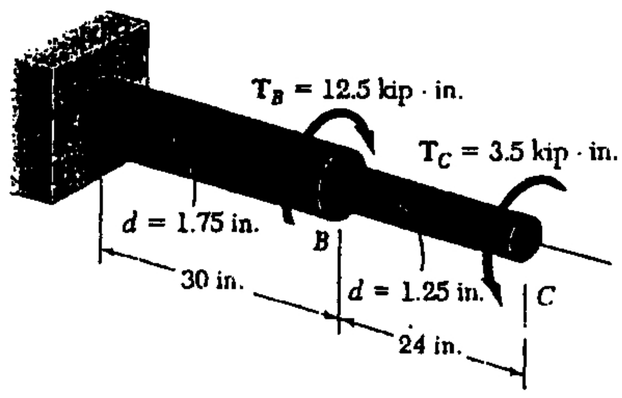

Fig. Prob. 6

7. (10pts) Two metal strips are securely bonded to a metal bar shown. Using the data given below, determine the largest permissible bending moment when the composite bar is bent about a horizontal axis.

	Aluminum	Brass
Modulus of elasticity	70 GPa	105 GPa
Allowable stress	100 MPa	160 MPa

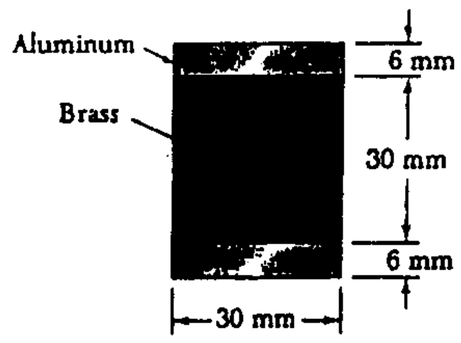

Fig. Prob. 7

8. (10ts) Determine the maximum value of the bending moment in the beam shown.

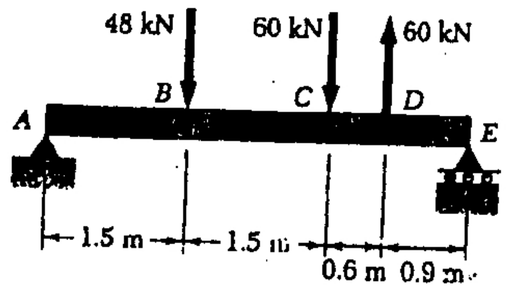

Fig. Prob. 8

Fig. Prob. 9

9. (20pts) A torque of magnitude T = 12 kN · m is applied to the end of a tank containing compressed air under a pressure of 8 MPa. Knowing that the tank has a 180-mm inner diameter and a 12-mm wall thickness, determine the maximum normal stress and maximum shearing stress in the tank.