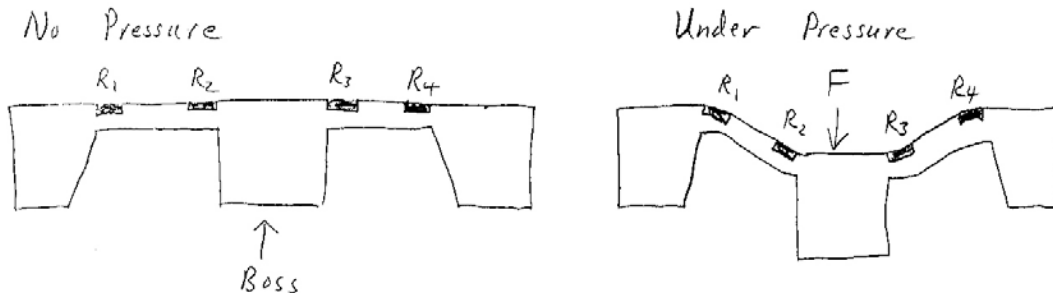


- 1) Estimate the depth in the ocean that the static pressure is 50% due to the water depth and 50% due to the air pressure above the water. Use  $1G = 9.8 \text{ m/s}^2$  and  $1 \text{ g/cm}^3$  for the density of sea water, and  $1 \text{ atm}$  for the air pressure.
- 2) A MEMS submarine is being used to monitor the cooling fluid in an industrial transformer. The transformer fluid (liquid) has a density of  $2 \text{ g/cm}^3$ . The sub is in motion and measures the total pressure ( $1960.1 \text{ Pa}$ ) and the static pressure ( $1960 \text{ Pa}$ ) that it experiences, using gage pressure sensors. For  $1G = 9.8 \text{ m/s}^2$ , estimate the velocity of the sub in  $\text{mm/s}$ ?
- 3) For the sub in (6), what is the depth of the sub in  $\text{mm}$ , ignoring atmospheric pressure?
- 4) For the pressure sensor diaphragm shown below, the four identical P-type piezoresistors have a gauge factor of  $+180$ :



- a. Under pressure, is each resistor in compression or tension?
  - b. Under pressure, has each resistor increased or decreased in resistance?
- 5) Estimate the acceleration level of a shock event of a  $1 \text{ Kg}$  object falling  $10 \text{ m}$  onto a hard surface where it completely stops moving  $10 \text{ ms}$  after initial impact. ( $1G = 9.8 \text{ m/s}^2$ )