Solution (Problem sheet I)

1. Let T_0 and T_1 be two temperatures

For perfect gas

$$T_0 = \frac{V P_0}{nR} = k P_0 \qquad T_1 = k P_1 \qquad \frac{T_1 - T_0}{P_1 - P_0} = k$$

$$T = kP = \frac{T_1 - T_0}{P_1 - P_0} \times P$$

$$T - T_0 = \frac{T_1 - T_0}{P_1 - P_0} (P - P_0) \Rightarrow (1)$$

For Van der Wall's gas $\qquad \frac{V}{nR} = k$

$$T_0 = k P_0 (1 - nb) + K_1$$

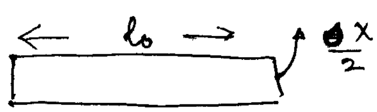
$$T_1 = k P_1 (1 - nb) + K_1$$

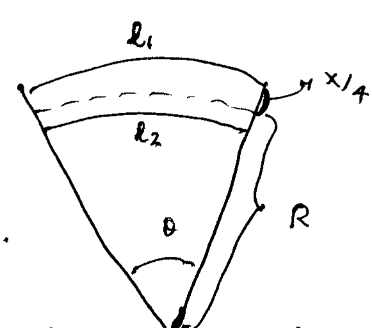
$$T_1 - T_0 = k (P_1 - P_0)(1 - nb) \qquad k(1-nb) = \frac{T_1 - T_0}{P_1 - P_0}$$

$$T = k P (1 - nb) + K_1$$

$$T - T_0 = k (P - P_0)(1 - nb)$$

$$T - T_0 = \frac{T_1 - T_0}{P_1 - P_0} (P - P_0) \quad \text{same as } (1).$$

2. 



$$l_1 = l_0 (1 + \alpha_1 \Delta T) = (R + x/4)\theta$$

$$l_2 = l_0 (1 + \alpha_2 \Delta T) = (R - \frac{x}{4})\theta$$

$$l_2 - l_1 = \frac{x}{2}\theta = l_0 (\alpha_1 - \alpha_2)\Delta T$$

$$l_1 + l_2 = 2R\theta = l_0 (2 + (\alpha_1 + \alpha_2)\Delta T)$$

$$R = \frac{l_1 + l_2}{2\theta} = \frac{(l_1 + l_2)}{2}\left(\frac{x}{2}\right)\frac{1}{(l_2 - l_1)}$$

$$= \frac{x}{4} \frac{l_0 (2 + (\alpha_1 + \alpha_2)\Delta T)}{(\alpha_2 - \alpha_1)\Delta T}$$

P.T.O

3.
(a) Extensily
(b) Intensive
(c) Extensive
(d) Intensive.