

AS – 5300 Physical Gas Dynamics
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Supplementary Exercise – 1
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1. Derive the expression for Chemical potential using similar method as used for

Temperature and pressure in class: $\left. \frac{\mu_i}{T} = -\frac{\partial S}{\partial N_i} \right)_{V, E, N_{j \neq i}}$

2. (a) Prove that ΔS for a cyclic process = 0.

(b) Does this mean that the reverse of the cycle is also possible? Explain.

(c) How does the cyclic process occur spontaneously in Nature?

3. Show that the maximum available work from a system undergoing a process is given by ΔG (for the process).

4. Draw:

(a) constant P, V curves in a T-S diagram

(b) constant T, S curves in a P-V diagram

(c) constant S, V curves in a P-T diagram

(d) constant S, P curves in a V-T diagram

5. Why do most engine cycles add heat at the highest pressure in a cycle? Or, Why is the combustion always following a compression phase in all the engines?

6. Show that:

$$\mu_i = \left. \frac{\partial E}{\partial N_i} \right)_{S, V, N_{j \neq i}} = \left. \frac{\partial G}{\partial N_i} \right)_{P, T, N_{j \neq i}} = \left. \frac{\partial H}{\partial N_i} \right)_{S, P, N_{j \neq i}} = \left. \frac{\partial F}{\partial N_i} \right)_{T, V, N_{j \neq i}}$$