AS 203 Gas Dynamics
Practice Problems -1

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1. Air from a reservoir at 10MPa and 1000K is expanded to 1atm pressure. Find the Mach number, temperature and velocity of the flow.

2. Air is flowing at 1000 m/s at 1atm and 300K conditions. Find the velocity and pressure if the flow is isentropically expanded to have a static temperature of 100K.

3. A special gas (γ=1.3 and MW = 18) is to replace argon (γ = 1.67 and MW=40) to generate a Mach 5 flow. Assuming the stagnation conditions are remaining the same, find the factor by which the actual velocity of the gas will differ from that of Argon at the same Mach number.

4. A supersonic aircraft is flying at 5 km altitude at 500 m/s. Its structures are rated for a max pressure of 10 bar. What is the maximum relative air speed the aircraft can handle at that altitude?

5. A meteor entering the upper atmosphere is flying at mach 25, It is made of an alloy whose melting point is 1300 K. What is the altitude at which it is expected to melt away?? Assume the mach number of the object does not change

6. A shock is moving at 2000 m/s in a duct with still air at 500K and 3 atm pressure. Find the velocity of the air that follows the shock. Also give its temperature and pressure.

7. A tube has 50 m/s air flow at 300K and 1 atm from left to right w.r.t the tube. There is a Normal shock moving at 800 m/s from right to left. Find the pressure, temperature and the final velocity of the gas after being processed by the shock, w.r.t the tube.

8. A blast wave created by some explosion sends out an expanding shock wave. When this shock wave gets to a wall nearby, it has the potential to apply huge pressure loads. Lets assume that there is still air at 300K and 1 atm, around a building, which was close to an explosion. Lets say the shock wave was traveling at 800 m/s. Find the maximum pressure experienced by the building wall.

9. A Mach 3 supersonic flow is having an oblique shock at 15 degrees angle. What will be the turning angle for γ=1.3, 1.4, 1.67. What will be the P2/P1, T2/T1 and Po2/Po1.

10. Supersonic flow with M1=3, P=2atm, T=450K, through a duct is deflected by one of the walls by 5 degrees. The oblique shock formed reflects on the other wall (which is straight) of the duct. Find the final conditions after the second reflection (M3, T3, P3, Po3).