KGW-1 (later re-designated as LTV-N-2) was the US Navy’s version of American flying bomb *JB-2 Loon*. It was developed to be carried on the aft deck of submarines in watertight containers. The first submarine to employ them was the **SS-348 Cusk** which successfully launched its first Loon on 12 February 1947 in **Point Mugu, California**. It has the following data:

- Static thrust 2200 N with air inlet speed of 180 m/s @ Sea Level
- Intake area 0.145 m²
- Fuel is standard 80-octane gasoline having heating value $Q_R = 40$ MJ/kg
- Burner efficiency 0.90
- Typical flight duration is 1800 s
- Exhaust temperature 735 K

*Assume Nozzle Optimized for Sea Level*
Homework 4.2 (2) Part 1

Assume specific heat of air \( C_{p_a} = 1.005 \frac{kJ}{kgK} \) and specific heat of hot gases \( C_{p_h} = 1.12 \frac{kJ}{kgK} \)

Calculate

1. Air mass flow rate into engine
2. Exhaust velocity
3. Maximum temperature inside the engine
4. Maximum pressure
5. Thrust specific fuel consumption (TSFC)
6. Average range  \( \text{Launch Weight} = 2,150 \text{ kg} \)
7. Mean L/D for (Sea Level) Cruise Conditions

Assume Stagnation
Homework 4.2, Part 2

A ramjet operates at an altitude of 10,000 m ($T_a = 223 \, K$, $P_a = 0.26 \, atm$, $\gamma = 1.4$) at a Mach number of 1.7. The external diffusion is based on an oblique shock and on a normal shock, as described in the shown figure.

Calculate

- Stagnation pressure recovery, $\frac{P_{02}}{P_{0a}}$?
- At what Mach number does the oblique shock become detached?
- What is the distance $x$, from the cone tip to the outer inlet lip, for the condition described in the figure?
- What is the best turning angle $\theta$ in terms of highest pressure ratio, $\frac{P_{02}}{P_{0a}}$?

Assume $\infty = a$