Part I.

The following information comes from a thermodynamic model of a hypothetical 6-cylinder CI engine based on the limited pressure (dual) cycle. The engine is running unthrottled. Assume that the compression ratio is 15. The displaced volume of a single cylinder is 1.5 liters.

Point	Internal Energy (KJ/Kg)	Enthalpy (KJ/Kg)	Entropy (KJ/Kg-K)
1	218	306	5.715
2	638	884	
3a	1624	2182	6.45
3b	2386	3167	6.876
4	1053	1436	

Based on this information, answer the following questions.

1. What is the specific entropy at Point 2?

2. What is the total equivalent heat release per unit mass of working fluid?

3. What is the specific work of compression done per unit mass of working fluid?

4. What is the specific entropy at Point 4?

5. What is the work done per unit mass during the portion of the power stroke going from Point 3a to Point 3b?

6. What is the specific work done per unit mass during the portion of the power stroke going from Point 3b to Point 4?

7. What is the net specific work per cycle done in the cylinder?

8. What is the gross indicated fuel conversion efficiency of the engine?

9. What is the engine $imep_g$? Assume the cylinder processes 0.001 kg/cycle.

10. What is the indicated gross power of the engine at 3500 RPM?

Part II.

You are to create a simple Otto Cycle model of an SI engine. The following data are given:

- $\gamma = 1.35$
- $c_v = 1.0$ KJ/(Kg-K)
- $x_r = 0.05$
- A/F = 15.0
- Q_{LHV} of fuel = 42,000 KJ/Kg
- $V_1 = 1.2$ L $= 1.2 \times 10^{-3}$ m^3, the maximum cylinder volume.
- $V_2 = 0.15$ L $= 0.15 \times 10^{-3}$ m^3, the minimum cylinder volume.

1. Calculate the compression ratio.

2. Calculate the equivalent heat release per unit mass of working fluid.

3. Complete the calculation of temperature and pressure of the working fluid as it move through the cycle. Use your answers to fill in the table below.

Point	Temperature (K)	Pressure (KPa)
1	300	80
2		
3		
4		

4. What is the fuel conversion efficiency of the engine based on this data?

5. Calculate the imep.

6. Comment on the accuracy of this analysis. For example, how will your efficiency prediction compare with the efficiency from real engine measurements?