

Assignment II.1

Complete all the problems. Give the answers in **two decimal places**.

Problem 3.1

There is an air mixture under the following conditions: P is 3.5 atm, T is 20°C, and assume that the molecular concentration of the air is 19 g/mol. (1 mol ideal gas at 0°C and 1 atm occupies a volume of 22.4 L)

- (i) What's the volume of 2 mol of the above air? (1 mark)
- (ii) Assume there is an air pollutant with a concentration of 20 ppmv, what's the air pollutant concentration in mg/m³? (1 mark)

Problem 3.2

Table 1: Composition of municipal solid waste (MSW) in country A

Composition	Average daily quantity (tpd)
Leather	256
Cardboard and paper	1,745
Plastic and rubber	2,396
Food waste	4,025

Estimate HHV of the MSW in country A based on the information given in Table 1. (4 marks)

Problem 3.3

Typical MSW has a moisture content of around 25%. Given the empirical of dry mass of the MSW in country A is C₅₀H₁₀₂O₄₉N.

- (i) Calculate the percentage of hydrogen by mass (in dry basis) in the MSW from the empirical formula. (1 mark)
- (ii) Find the latent heat of water vapor released in 1 kg of the MSW. (1 mark)
- (iii) Based on the results obtained from Problem 3.2 and Problem 3.3, find the LHV of the MSW in country A. (1 mark)

Note: **Molecular weight of elements:**

Element	Molecular weight (g/mol)
C	12
H	1
O	16
N	14

Problem 3.4

In order to make full use of the MSW, HKSAR decided to build a modern waste-to-energy incinerator for MSW treatment. The Hong Kong government plans to use MSW to produce

2500 MWh/day of electricity for public facilities operation. Given that the LHV of the MSW in Hong Kong is about 12,500 kJ/kg and the efficiency of the incinerator for electricity generation is 15%. To reach the electricity demand, please calculate the minimum capacity of the incinerator. (3 marks)