

國立臺北科技大學九十九學年度碩士班招生考試

系所組別：1203 製造科技研究所

第二節 熱力學 試題 (選考)

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**注意事項：**

1. 本試題共 4 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

Problem 1.(25%)

The Helmholtz function of a substance has the form

$$a = -RT \ln\left(\frac{v}{v_0}\right) - cT_0 \left(1 - \frac{T}{T_0} + \frac{T}{T_0} \ln \frac{T}{T_0}\right)$$

Where  $R, c, T_0, v_0$  are the reference constant

Please find the thermodynamic properties expression of

- a)(5%) pressure  $P=?$
- b)(5%) enthalpy  $h=?$
- c)(5%) entropy  $s=?$
- d)(5%) constant volume specific heat  $c_v=?$
- e) (5%) constant pressure specific heat  $c_p=?$

Problem 2.(25%)

Air at  $100kPa$  and  $-10^\circ C$  enter an adiabatic diffuser steadily with a velocity of  $200m/sec$  and leaves with a pressure  $110kPa$ . The exit area of the diffuser is 6 times the inlet area. Please find

- a)(15%) the exit temperature
- b)(10%) the exit velocity of air

Problem 3.(25%)

Ethane ( $C_2H_6$ ) is burned with 30% excess air during a combustion

process, the total pressure of  $110kPa$ , Please determine

- a)(10%) the air-fuel ratio
- b)(15%) the dew-point temperature of the products

$$P_{sat} = 10kPa, T_{sat} = 45.81^\circ C$$

$$P_{sat} = 15kPa, T_{sat} = 53.97^\circ C$$

Problem 4.(25%)

An equilibrium surface tension force  $\sigma$  can be balanced at the following

Fig. Please find the relationship of  $R, g, \sigma$  where  $R$  is interface

radius,  $g$  is gravity.

