

prob.1 | 請由熱力學觀點，解釋為何一個發電廠，利用水為工作  
16% 流体，透過 Rankine cycle 來產生電力。其鍋爐或反應器需要  
加高壓？甚至利用超臨界壓力水來作動。(8%)  
其主冷凝器中又要抽成負壓，真空度愈大愈好？(8%)  
試闡述之。

prob.2 | 請由熱力學觀點解釋為何 Rankine cycle 發電，對其使用 pumps  
16% 之不可逆度耗損(如磨擦力耗損等)，遠不如 Brayton cycle 發電  
對其使用之 compressors 不可逆度耗損要求要高(Brayton cycle  
要求其 gas turbines 及 compressors 之不可逆度耗損減少之程度  
非常嚴苛)。

prob.3 | 試闡述增加 Rankine cycle 熱機效率之作為有那些？(8%)  
16% 增加 Brayton cycle 熱機效率之作為有那些？(8%)

prob.4 | 試闡述日後石化燃料價格飛漲；全球暖化之衝擊，  
16% 限排 CO<sub>2</sub> 之要求，對動力機械(如汽車、飛機、輪船等)  
動力之制原，需要如何去規劃及研尋其非動能之制原？  
請發表己見。

prob.5 | An ideal gas-turbine cycle with two stages of compression and two stages of  
20% expansion has an overall pressure ratio of 8. Air enters each stage of the compressor at 300 K and each stage of the turbine at 1300 K. Determine the back work ratio and the thermal efficiency of this gas-turbine cycle, assuming (a) no regenerators and (b) an ideal regenerator with 100 percent effectiveness. (10%)

國立清華大學命題紙

97 學年度 工程與系統科學系 系(所) 乙 組碩士班入學考試

科目熱力學 科目代碼 2902 共 2 頁第 2 頁 \*請在【答案卷卡】內作答

< 續 prob. 5. >

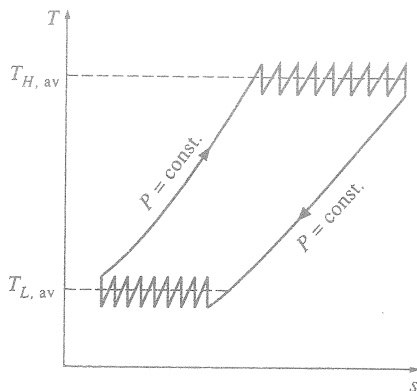


FIGURE I.

As the number of compression and expansion stages increases, the gas-turbine cycle with intercooling, reheating, and regeneration approaches the Ericsson cycle.

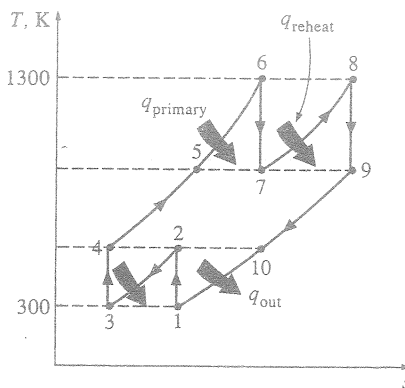


FIGURE II.

T-s diagram of the gas-turbine cycle discussed in Example 8-8.

請參用下列資料:

$$T_1 = 300\text{K} \rightarrow h_1 = 300.19 \text{ KJ/kg}$$

$$P_1 = 1.386$$

$$P_2 = 3.92 \rightarrow T_2 = 403.3\text{K}$$

$$h_2 = 404.33 \text{ KJ/kg}$$

$$T_6 = 1300\text{K} \rightarrow h_6 = 1395.97 \text{ KJ/kg}$$

$$P_6 = 330.9$$

$$P_{r7} = 117. \rightarrow T_7 = 1006.4\text{K}$$

$$h_7 = 1053.35 \text{ KJ/kg}$$

Prob. 6

16%

The interior lighting of refrigerators is provided by incandescent lamps whose switches are actuated by the opening of the refrigerator door. Consider a refrigerator whose 40-W light bulb remains on continuously as a result of a malfunction of the switch (Fig. III). If the refrigerator has a coefficient of performance of 1.3 and the cost of electricity is 8 cents per kWh, determine the increase in the energy consumption of the refrigerator and its cost per year if the switch is not fixed.

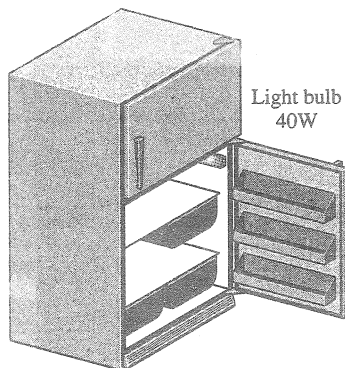


FIGURE III.

(Assuming the refrigerator is opened 20 times a day for an average of 30 s)