

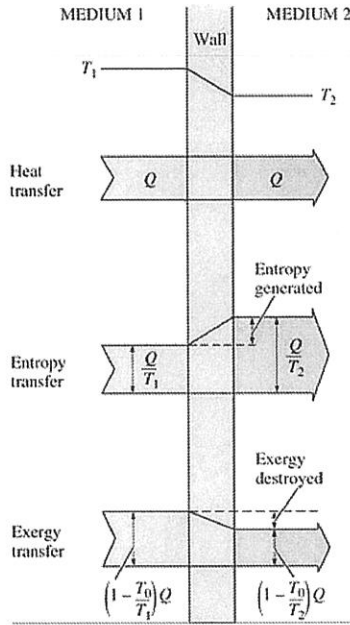
1011 機械系博士班資格考試題目

考試科目	方式	
熱力熱傳學	Closed Book, 可使用計算機	Part I

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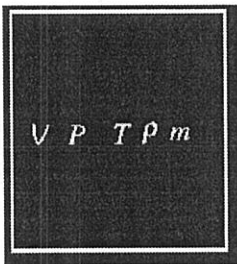
1. 如下圖 T_1 高於 T_2 ，而導致熱能傳遞 (Q)。證明熱力學第二定律之(a)熵增

(Entropy generated) 與 (b) 熵減 (Exergy destroyed) (10%)



2. For a closed (and stationary) system undergoing const-P expansion and process, prove that $\Delta U + W_b = \Delta H$ (10%) (provided $W = W_b + W_{\text{other}}$) 10%

3. 下列五者特性，何者為 intensive property? 何者為 extensive property? 如何判別? (5%)



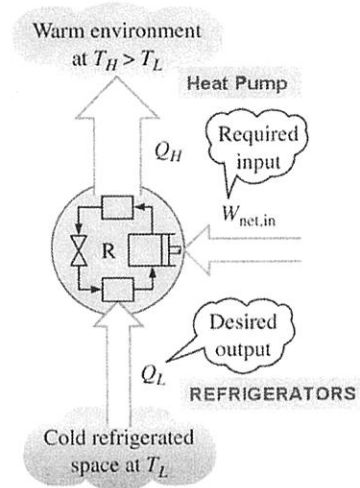
4. (壓)力的定義 (a) 1 N (Newton) 定義 (2%)
 (b) 1 lbf (pound-force) 定義 (2%)
 (c) 1 Pa 定義 (1%)

5. Refrigerator and Heat Pump are shown as below

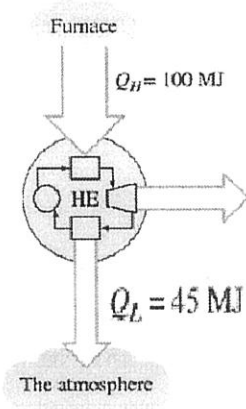
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(a) Refrigerator 與 Heat Pump 之效率定義 COP_R and COP_{HP} 。 (5%)

(b) Prove $COP_{HP} = COP_R + 1$ (5%)



6. Heat is transferred to a heat engine from a furnace at a rate of 100 MW. If the rate of heat rejection to atmosphere is 45 MW, determine the net power output and the thermal efficiency of the heat engine. (10%)



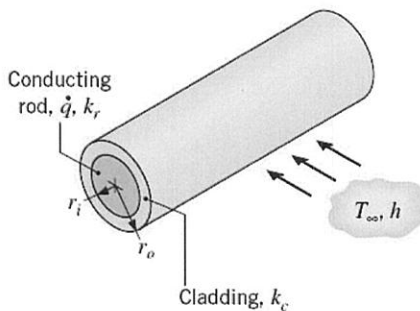
1011 機械系博士班資格考試題目

考試科目	方式	
熱力熱傳學	Closed Book, 可使用計算機	Part II

1. (15%)

- (a). Please describe the physical mechanisms of conduction, convection and radiation, and then also write their rate equations.
- (b). What is heat transfer defined ?
- (c) What is a contact resistance ?, How is it defined in plane wall condition?
- (d) What is fin efficiency defined ?, What is its range of possible values ?

2. (15%) Passage of an electric current through a long conducting rod of radius r_i and thermal conductivity k_r results in uniform volumetric heating at a rate of q . The conducting rod is wrapped in an electrically nonconducting cladding material of outer radius r_o and thermal conductivity k_c , and convection cooling is provided by an adjoining fluid.



For steady state conditions, write appropriate forms of the heat equations for the rod and cladding. Express appropriate boundary conditions for the solution of these equations.

3. (20%) A two-dimensional rectangular plate is subjected to the boundary conditions shown as below. Derive an expression for the steady state temperature distributions $T(x,y)$ in sine, cosine, sinh or cosh series functions with solving the heat conduction equation.

