元智大學 103 學年度研究所 **碩士班** 招生試題卷

系(所)別：機械工程學系碩士班　組別：甲組　科目：熱力熱傳學　用紙第 1 頁共 2 頁

●不可使用電子計算機　（盡量作答，請勿空白）

1. (a) 2nd law of thermodynamics **-Clasius Statement?** ; (2%) ;
   (b) **Purpose** of heat engine? (2%);
   (c) **Difference** between saturated vapor and superheated vapor (2%)?
   (d) **Difference** between Immediate surroundings and Environment (2%)
   (e) **Definition** of dead state (2%)

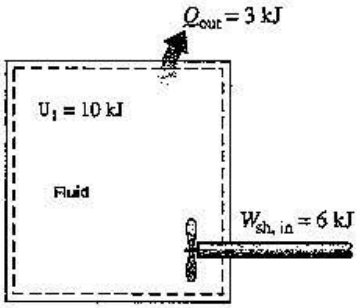
2 . Compared to saturated liquid(**飽和液體**), compressed liquid (**過壓液體**) is characterized (特色) by

	compressed liquid			**saturated liquid**	
a)	P	(	)	P_{sat} at a given T	(2%)
b)	T	(	)	T_{sat} at a given P	(2%)
c)	v	(	)	v_f at a given P and T	(2%)
d)	u	(	)	u_f at a given P and T	(2%)
e)	h	(	)	h_f at a given P and T	(2%)

請於空格處填入<, >, 或 =

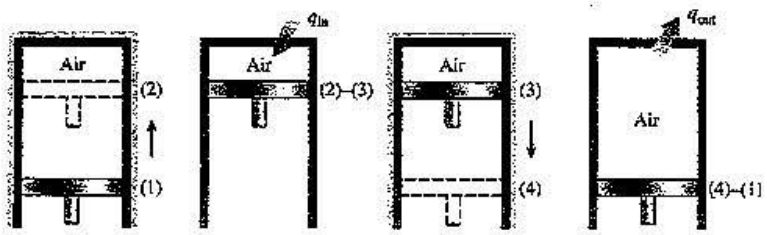
3. Make use of equation $\Delta S_{sys} = S_2 - S_1 = \int_1^2 \frac{\delta Q}{T} + S_{gen}$ and demonstrate
   (a) a reversible adiabatic process **is necessarily** isentropic process (5%)
   but (b) a isentropic process **isn't necessarily** a a reversible adiabatic process (5%)

4. A tank contains a fluid that is cooled while being stirred by a paddle wheel. Initially, the internal energy of the fluid is 10 kJ. During the cooling process, the fluid loses 3 kJ of heat, and the paddle wheel does 6 kJ of work on the fluid. Determine the **final internal energy** of the fluid? (10%)



5. Ideal Otto cycle 如下，請說明 （a）- (d) 之運作/特性 (10%)

(a)　(b)　(c)　(d)



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6. (20%) (a). Please describe **the physical mechanisms** of conduction, convection and radiation, and then also **write their rate equations.** 5%
(b). What is heat transfer defined ? 5%
(c) What is a thermal contact resistance ? 5%
(d) Please **write heat equation** in Cartesian coordinates, with three dimensions, heat generation and unsteady. 5%

7. (15 %) A thin walled copper tubes of radius r_i is used to transport a low temperature refrigerant and is at a temperature T_i that is less than that of the ambient air at T_∞ around the tube. Is there an optimum thickness associated with application of insulation to the tube. Please construct the thermal circuit of heat flow resistance. And prove the optimal insulation radius is $r_{cr} = k/h$.

8. (15%) For flow of a liquid metal through a circular tube, the velocity and temperature profile at a particular axial location may be approximated as being uniform and parabolic, respectively. That is, $u(r) = C_1$ and $T(r) - T_S = C_2 [1-(r/r_0)^2]$, where C_1 and C_2 are constants. What is the values of the Nusselt number Nu_D at this location ?

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