所別：機械工程學系碩士班 丙組(熱流)(一般生)　科目：熱力學　共 _2_ 頁　第 _1_ 頁
　　　能源工程研究所碩士班 不分組(一般生)

＊請在試卷答案卷（卡）內作答
＊本科考試可使用計算器，廠牌、功能不拘

請按題號順序作答，避免被漏改。若您要先做後面題目，請先在答案本預留空間。
選擇題為單選或複選請自行判斷，必須全部答對才給分。

1. (10 %) What is heat engine? Please explain its purpose, efficiency and give a sketch to show its operating character.
The worker returns 24 hours later and the absolute pressure has dropped to 183 kPa, while the air temperature inside the pipe has decreased to 21 °C. Universal gas constant is 287 Pa·m^3/(kg ·K).

2. (10 %) Briefly explain what is the greenhouse effect? How does the excess CO_2 gas in the atmosphere cause the greenhouse effect?

3. (10 %) Briefly describe the usage of entropy and exergy in energy analysis.

4. (2 %) Energy can across the boundary of a closed container through what mechanism:
   (a) mass flow　　(b) heat　(c) work　(d) none of above.

5. (2 %) Under what conditions is the ideal gas assumption suitable for real gases:
   (a) high pressure, high temperature　　　(b) low pressure, low temperature
   (c) low pressure, high temperature　　　(d) high pressure, low temperature

6. (2 %) The saturated pressure is P_{sat}=47 kPa at T= 80 °C, respectively. If the state of the water is given as T=80 °C, P=5 MPa. The state of the water is
   (a) saturated mixture of liquid and vapor　(b) compressed liquid　(c) superheated vapor
   (d) none of above

7. (2 %) Which expression is correct for the definition of the flow energy: (T=temperature, s=entropy, P=pressure, h=enthalpy, v=specific volume, u=internal energy)
   (a) $P \cdot T$　　(b) $P \cdot v$　　　(c) $u \cdot v$　(d) $s \cdot h$

8. (2 %) The entropy of the working fluid of the ideal Carnot cycle during the isothermal heat addition process will (a) increase　(b) decrease　　(c) unchanged

9. (2 %) Which statements below violate the second law of thermodynamics?
   (a) A heat engine cannot have a thermal efficiency of 100%.
   (b) For all reversible processes, the second-law efficiency is 100%.
   (c) The second-law efficiency of a heat engine can be greater than its thermal efficiency.
   (d) The second-law efficiency of a process is 100% if no entropy is generated during that process.
   (e) The COP of a refrigerator always small than 1.

10. (2 %) Consider the entropy balance of a tank with open valve with outside, what will affect the entropy change of the tank?
    (a) tank volume, (b) heat transfer to the tank, (c) mass flow in/out through the valve, (d) entropy generation due to friction of the mass flow.

注意：背面有試題

11. (2 %) A unit mass of an ideal gas at temperature T undergoes a reversible isothermal process from pressure P_1 to pressure P_2 while losing heat to the surroundings at temperature T in the amount of q. If the gas constant of the gas is R, the entropy change of the gas Δs during this process is

　　(a) $\Delta s = R(\ln P_2/P_1)$　(b) $\Delta s = R(\ln P_2/P_1) - q/T$　(c) $\Delta s = R(\ln P_1/P_2)$　(d) $\Delta s = R(\ln P_1/P_2) - q/T$
　　(e) $\Delta s = 0$

12. (2%) The specific heat at constant volume for an ideal gas is given by $c_v = 0.1 + (2.7 \times 10^{-4})T$ (kJ/kg.K) where T is in Kelvin. The change in the internal energy for this ideal gas undergoing a process in which the temperature changes from 27 to 127°C is most nearly

　　(a) 70 kJ/kg　(b) 72.1 kJ/kg　(c) 79.5 kJ/kg　(d) 82.1 kJ/kg　(e) 84 kJ/kg

13. (2%) Which properties will change when a flow across a throttling valve?

　　(a) pressure　(b) temperature　(c) enthalpy　(d) internal energy　(e) volume

14. (10 %) What are the differences between an Otto cycle and a Diesel cycle? Compare their performances.

15. (10 %) Why turbofan engines, instead of turbojet engines, are preferred for commercial civil airplanes?

16. (14 %) A large coal fired power plant is being designed to produce 800 MW of power to drive its electrical generators.　The plant engineer has testified that the plant will burn coal that produces a flame temperature of 1500 °C, and that water is available for condenser cooling from a nearby river at a temperature of 27°C. Environmental restrictions allow the river to increase in temperature by no more than 2°C because of heat transfer from the plant.　What is the minimum volumetric flow rate (m³/s) that the river must have in order to supply adequate plant cooling?　For water at 27°C, $c_p = 4.18 \ kJ/kg \cdot K$, $v = 0.001003 (m^3/kg)$.

17. (16 %) For the single compressor refrigerator – freezer system shown in Fig. P.17, (a) draw the cycle process relative to the saturation curves on a $T-s$ diagram, (b) explain its operation.
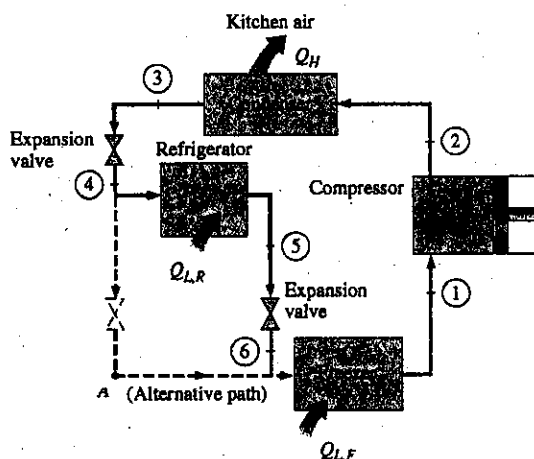

Figure P.17

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