所別：機械工程學系碩士班 丙組(熱流)(一般生)　科目：熱力學　共__／__頁 第__／__頁
　　　能源工程研究所碩士班 不分組(一般生)
本科考試可使用計算器，廠牌、功能不拘　　　　　　　　　　　　　　　　＊請在試卷答案卷（卡）內作答

考生作答須寫明題號，儘可能按照題號順序作答。

1. A mobile phone is being examined from a thermodynamics perspective. Identify what types of energy and determine the direction of the work (or energy) and heat transfers (to or from) when the (a) touch panel, (b) processer, and (c) speaker, is taken as the system. (5%)

2. Give an example with a plot that can be used for explaining the first law of thermodynamics applies on a system. The system must involve energy conversion and should have either heat transfer or work interaction with surrounding. The plot must indicate which one is *energy in* and *energy out*. (10%)

3. For a system consisting of 1 kg of a two-phase, liquid-vapor mixture in equilibrium at a known temperature T and specific volume v, can the mass, in kg, of each phase be determined? Explain with the T-v diagram. (10%)

4. Explain the physical meaning of enthalpy and why it is important in the thermodynamics process. (10%)

5. How do you make a Stirling engine? Describe all processes in a Stirling cycle and advantages of it compared with Otto or Diesel cycles. (10%)

6. Prove that the heat transfer is directed from a higher temperature environment to a lower temperature environment by second law of thermodynamics. (10%)

7. Answer the following questions:　(15%)
   (a) Difference between energy and exergy of a system. Are both properties dependent on system temperature and pressure only, why?
   (b) Difference between steady state and equilibrium of a system.
   (c) Conditions for $Pr_2/Pr_1 = p_2/p_1$, where pr is the relative pressure.
   (d) Conditions for $p_2/p_1 = (T_2/T_1)^{k/(k-1)}$.
   (e) Conditions for thermal efficiency = $1 - (T_2/T_1)$.

8. (a) What is the definition of the coefficient of performance a heat pump (COP_{HP})? (5%)
   (b) What is the typical value of COP_{HP} of heat pumps available commercially? (5%)

9. If we have the P, v, T data of a certain substance, can we use them to obtain the latent heat of the substance during a vaporization process? If yes, how? If no, why? (10%)

10. Describe three methods for predicting the P-v-T behavior of a real gas mixture. (10%)

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