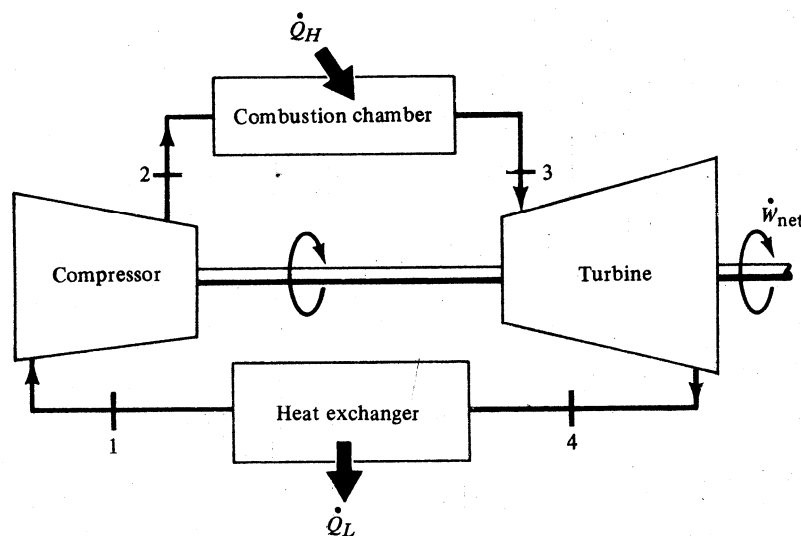所別：航空與電子科技研究所甲組

科目：專業科目（熱力學、材料力學）

注意事項：

（1）共八大題，任選其中四大題作答，每大題二十五分，共一百分。
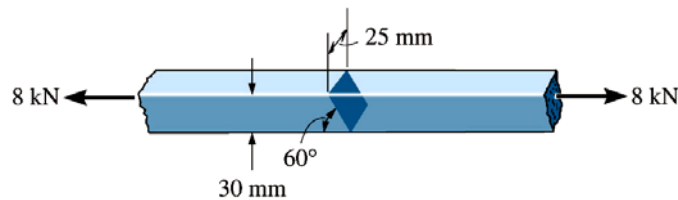
（2）請於答案卷上註明選答題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前
　　　之題目計分。

1.(1)北歐小國冰島使用地熱來發電，請使用熱力學第二定律解釋其可行性。(10%)

　(2)一汽車引擎吸入 20℃ 空氣，再排出至 15℃ 大氣中，並產生功，過程中未加入燃料，請使
　　　用熱力學第一與第二定律來解釋其可行性。(15%)

2.(1)在一杯水中的冰塊會逐漸融化，最終整杯水會達到室溫，請解釋此過程是否為可逆過程。
　　　(10%)

　(2)某機器由溫度 1200K 之熱儲槽接收 400 kJ 之熱量，釋放 200kJ 之熱量至溫度 600K 之熱儲
　　　槽，請問此機器為可逆？不可逆？或是不可能存在？(15%)

3.Please refer to the diagrams

　（1）Draw the P-v and T-s process diagrams for the ideal Brayton cycle.

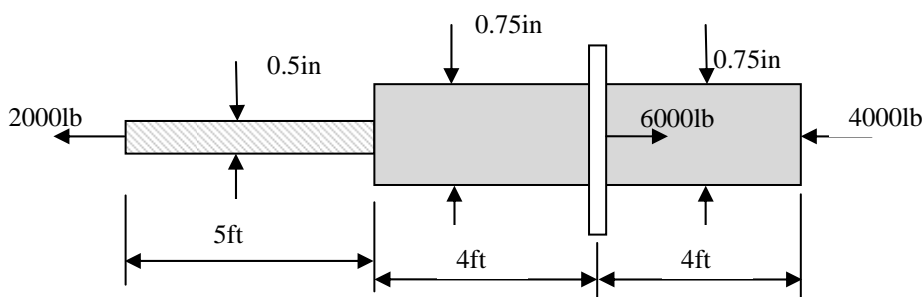　（2）Describe the each process of the ideal Brayton cycle.

4.(1)The volume of the passenger compartment of an aircraft is 2100 m^3. Automatic equipment maintains the air inside the plane at a pressure of 97 kPa and a temperature of 27℃. Calaulate the mass of the air inside the plane.

(2)A piston cyclinder assembly contains 1 kg of Nitrogen at 100kPa. The initial volume is 0.5 m3. Heat is transferred to the Nitrogen in an amount necessary to cause a slow expansion at conatant temperature. This process is termined when the final volume is twice the initial volume. Determine the magnitude of the heat transfer required.
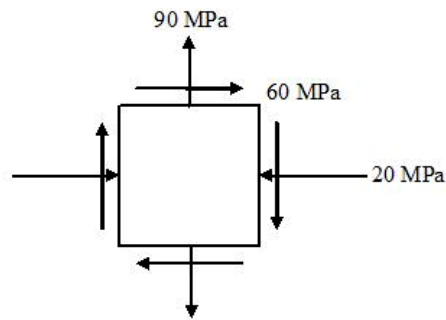
5.A long steel rectangular member as shown is subjected to an 8 kN axial load. Determine the average normal and average shear stresses acting on the 60° plane.

6.已知公式 $\delta = \int_0^L \frac{p}{EA}dx$ ，鋼的 E=20x10^6 psi，請求受軸向力作用後的軸長變化。

7.The state of plane stress at a point on a body is as shown. Determine the in-plane principal stresses, σ_1 and σ_2, for this stress state.

8.如下圖所示之簡支樑具有矩形截面 120mmx200mm。忽略樑的重量，試求出
   (1) 樑內最大彎曲應力
   (2) 求在 B 點截面上樑頂端下 25mm 處之彎曲應力