

招生學年度	九十九	招生類別	轉學招生考試
系所班別	材料科學與工程學系二年級、物理學系物理組二年級、物理學系奈米與光電科學組二年級		
科目	普通物理		
注意事項	禁止使用掌上型計算機		

轉學考 2010

1. A uniform rod of length L and mass M is free to rotate on a frictionless pin passing through one end (Figure 1).
 - (a) If the rod is released from rest in the horizontal position, what is its angular speed when the rod reaches its lowest position? (10 pts)
 - (b) If the amplitude of the oscillation of the rod is small, find the period of oscillation. (10 pts)

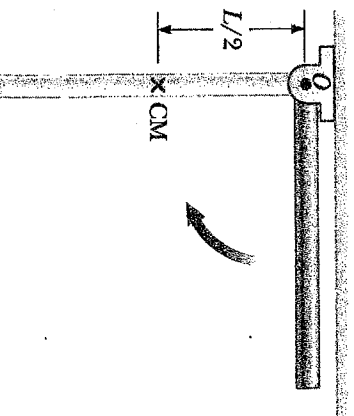


Figure 1

2. An idea gas ($\gamma = 5/3$) in an engine initially at P_i , V_i , and T_A is taken through a cycle as shown in Figure 2. The temperature $T_A = 300$ K. The pressure $P_i = 10^5$ Pa. The volume $V_i = 0.01$ m³.
 - (a) Find the net work done by the engine per cycle (5 pts).
 - (b) Find the heat transferred into the engine from A to B. (10 pts)
 - (c) Find the heat transferred into the engine from B to C. (10 pts)
 - (d) Find the efficiency of the engine. (5 pts)

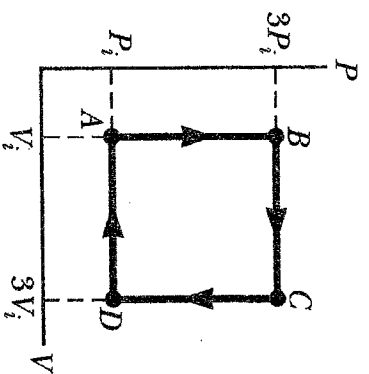


Figure 2

3. Write down the Maxwell's Equations.
 - (a) Gauss's law. (4 pts)
 - (b) Gauss's law for magnetism. (3 pts)
 - (c) Maxwell-Faraday equation (Faraday's law of induction). (4 pts)
 - (d) Ampere's circuital law (with Maxwell's correction). (4 pts)

國立東華大學招生考試試題

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4. A long coaxial cable (length ℓ) has a thin, cylindrical conducting shell of radius b concentric with a solid conducting cylinder of radius a as in Figure 3. The conductors carry the same current I in opposite directions.

(a) Find the magnitude of the magnetic field $\vec{B}(r)$ in the region between the conductors ($a < r < b$). (5 pts)

(b) Show that the inductance of the coaxial cable is $L = \frac{\mu_0 \ell}{2\pi} \ln\left(\frac{b}{a}\right)$. (10 pts)

(c) What is the magnetic energy stored in the coaxial cable? (5 pts)

5. A charge q is injected into a mass spectrometer, as shown in Figure 4. In the velocity selector, the electric field is \vec{E} (x direction) and the magnetic field is \vec{B}_m (into page). The magnetic

field in the mass spectrometer is \vec{B}_o (into page).