

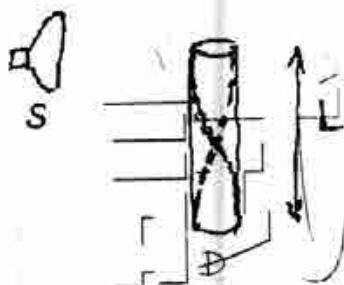
考生注意：1. 依次序作答，只要標明題號，不必抄題。

2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。

3. 試題隨卷繳回。(餘詳詳閱試場規則)

1. [20pts] Six particles, each with mass  $M$ , trapped in a two-dimensional infinite potential well with width  $L_x = L_y = L$ . There are no special interactions between the particles ~~no significant mutual electrostatic repulsion, gravitational attraction, etc., compared to the strength of their interaction with the harmonic potential itself.~~ Remember that the energy levels of a particle in box are  $E_{n_x, n_y} = \frac{h^2}{8mL^2} (n_x^2 + n_y^2)$ . Assume that the system is in its ground state. i.e.,  $T=0$  Kelvin. Calculate the total energy  $E$ , for the case
- The particles are distinguishable.
  - The particles are identical bosons.
  - The particles are identical spin 1/2 fermions.

2. [20pts] As shown in the figure below,  $S$  is a small loudspeaker driven by an audio oscillator and amplifier, adjustable in frequency from 1000 to 2000 Hz only. Tube  $D$  is a metal pipe 51.5 cm long and open at both ends. (a) If the speed of sound in air is 344 m/s at the existing temperature, at what frequencies will resonance occur in the pipe when the sound with frequency  $f$  emitted by the speaker is varied from 1000 Hz to 2000 Hz? (b) Sketch the standing wave (using the same style as the figure below) for each resonance frequency.



3. [20pts] In a 1911 paper, E. Rutherford said: "In order to form some idea of the forces requires to deflect an  $\alpha$  particle through a large angle, consider an atom [as] containing a point positive charge  $Ze$  at its center and surrounded by a distribution of negative electricity  $-Ze$  uniformly distributed within a sphere of radius  $R$ . The electric field  $E$  ... at a distance  $r$  from the center for a point inside the atom [is]  $E = \frac{Ze}{4\pi\epsilon_0} \left( \frac{1}{r^2} - \frac{r}{R^3} \right)$ " Verify this equation.
4. [20pts] Select what you think is correct answers inside the parenthesis, and write them down. Noted that sometimes there is more than one right answer.
- a reversible process is one that proceeds by a succession of very small incremental steps, all of which are at (equilibrium, spontaneous,

國立暨南國際大學九十二學年度轉學生入學考試試題

第 2 節普通物理適用：(應化系二 342 )

(本試題共 2 頁，第 2 頁)

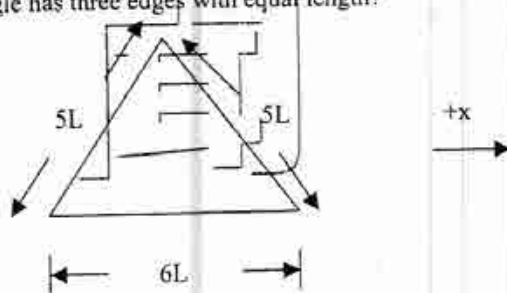
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3. 試題隨卷繳回。(除讀詳閱試場規則)

enthalpically driven, entropically driven).

- b. ( $\Delta H, \Delta S, \Delta G, \Delta E$ ) implies constant pressure.
- c. When a sample of liquid is converted reversibly to its vapor at its normal boiling point, ( $q, w, \Delta P, \Delta V, \Delta E, \Delta H, \Delta S, \Delta G, \Delta T$ ) is equal to zero for the system.
- d. An ideal gas expands adiabatically into a vacuum.  $\Delta E$  for the system is (greater than zero, equal to zero, less than zero).
5. [20pts] As shown in the figure below, a triangle, with lengths of edges as 5L, 5L and 6L, moves in +x direction with speed 0.5 c (speed of light) respect to you. What is the area of this square when you take the measurement? At which speed, does this triangle has three edges with equal length?



試

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