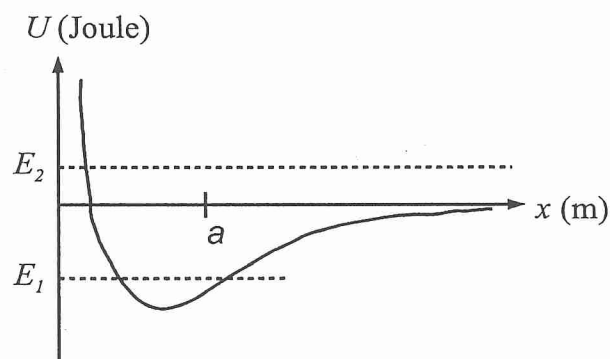


1. Consider a one-dimensional system with potential energy plotted below.
  - (a) Discuss, then plot the v-x diagram for a particle with energy  $E_1$ . (7pt)
  - (b) Discuss, then plot the v-x diagram for a particle with energy  $E_2$ . (7pt)
  - (c) Discuss, then plot the v-t diagram for a particle with energy  $E_2$ , initial position  $a$ , and negative initial velocity. (6pt)



2. A mass  $m$  attached to a spring with spring constant  $k$  (the other end of the spring is fixed). The mass of the spring is negligible. When the mass moves at velocity  $v$ , there is a drag force  $-bv$  acting on the mass.
  - (a) Write down the equation of motion for the mass  $m$  when there is no other external force acting on the system. (5pt)
  - (b) Solve the displacement  $x$  of the mass as a function of time for arbitrary initial condition under the condition that the oscillator is underdamped. (5 pt)
  - (c) Solve the displacement  $x$  of the mass as a function of time for arbitrary initial condition under the condition that the oscillator is overdamped. (5 pt)
  - (d) Now consider an extra external force  $F_{\text{ext}} = F_0 \cos \omega t$  acting on the mass. Discuss the phenomenon "resonance" under this situation. (5pt)

參考用

注意：背面有試題

國立中央大學103學年度碩士班考試入學試題卷

所別：物理學系生物物理碩士班 不分組(一般生) 科目：普通物理 共 2 頁 第 2 頁

本科考試禁用計算器

\*請在試卷答案卷(卡)內作答

3.

(a) Explain what happens to the molecules in a dielectric when an external electric field is applied to it. (10pt)

(b) From (a), give the microscopic meaning of the dielectric constant of a material. (10pt)

4.

(a) State the 2<sup>nd</sup> law of thermodynamics precisely. (7pt)

(b) What is the definition of entropy ( $S$ ) of a system? What is the physical meaning of entropy? (6pt)

(c) Let  $U$  be the internal energy,  $F = U - TS$  is the Helmholtz free energy of a thermodynamic system. What is the physical meaning of  $F$ ? (7pt)

5.

(a) Use an example to discuss the phenomenon "diffraction" in waves. (10 pt)

(b) Discuss the physical restriction on the spatial resolution of an optical device. (10 pt)

參考用

注意：背面有試題