國立彰化師範大學 98 學年度碩士班招生考試試題

系所：電子工程學系　　組別： 甲 組　　科目：(乙)近代物理

☆☆請在答案紙上作答☆☆　　

Physical constants:

Planck's constant $h = 6.626 \times 10^{-34}$ J-s., $c = 3\times10^{8}$m/sec, $m_e = 9.1\times10^{-31}$ kg.

$e = 1.602 \times 10^{-19}$ C , $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2/N\cdot m^2$,

The Boltzmann's constant $k_B = 1.38\times10^{-23}$ J/K.

1. Electron beams are used for double slit interference experiment. A (B) is the intensity profile when only top (bottom) slit is open. Explain why the resultant intensity profile is NOT A+B. (see Fig.1) (10%)

2. Qualitatively draw the wave functions (n = 4 & n = 5) of the symmetric infinite potential well shown in Fig. 2. (10%)

3. Solve the time independent Schrodinger equation for an electron in an infinite potential well with width L. What are the wavefunctions and energies of the lowest two modes? (20%)

4. (a) In Bohr's H-atom model, what is quantized angular momentum assumption? (5%)
   (b) Calculate the quantized energy levels in H-atom. (10%)
   (c) Verify that when the electron transits from higher energy level to lower energy level, the frequency of the photon it emits is f = $\frac{E_1}{h}(\frac{1}{n_f^{\,2}} - \frac{1}{n_i^{\,2}})$. (5%)
   (d) What is the frequency range of Balmer series spectrum lines of H-atom? (5%)

5. Explain why the Auger electron spectrum for elemental Al and Al oxide are shifted. (see Fig. 3) (10%)

6. (a) 0.012 nm X-ray serves as the photon in the Compton effect experiment. Find the maximum wavelength of the scattered photon. (10%)
   (b) Find the maximum kinetic energy of the scattered electron could have. (5%)

7. The potential energies are drawn down to scale. Compare the ground state energy (n=1) in each case. List them from highest to lowest. (see Fig. 4) (10%)

The figures are in page 2!

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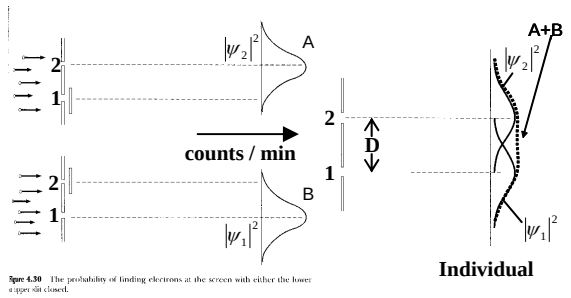

Fig. 1

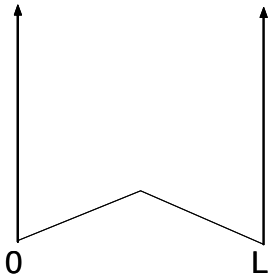

Fig.2

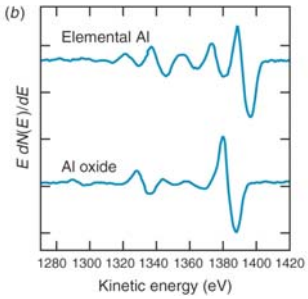

Fig. 3

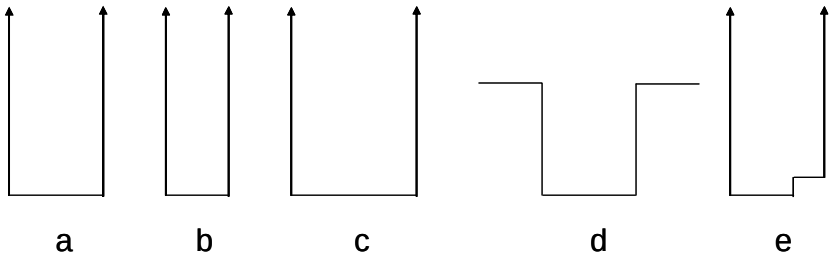

Fig. 4