招 生 學 年 度	103	招 生 類 別	碩士班
系 所 班 別	電機光電碩士班聯合招生（電機工程學系碩士班、電機工程學系 電子工程碩士班、光電工程學系碩士班）、材料科學與工程學系碩士班		
科 目 名 稱	近代物理		
注 意 事 項	本考科可使用掌上型計算機；內容以近代物理導論為主。		

c is the speed of light.

Planck's constant $h = 6.63 \times 10^{-34}$ J·s $= 4.14 \times 10^{-15}$ eV·s

1. (10%) With what speed will a clock have to be moving in order to run at a rate that is one-half the rate of a clock at rest? Express your answer in c.

2. (10%) A spacecraft moves at a speed of $0.9c$. If its length is L as measured by an observer on the spacecraft, what is the length measured by a ground observer?

3. (20%) Molybdenum(鉬) has a work function of 4.2 eV. (a) Find the threshold frequency for the photoelectric effect. (b) Find the stopping voltage if the incident light has a wavelength of 200 nm.

4. (10%) A photon is emitted from a hydrogen atom that undergoes an electronic transition from the state $n = 3$ to the state $n = 2$. Find the wavelength of the emitted photon.

5. (10%) Halogens have one fewer electron than the inert gases. Please write down the electron configurations of lithium (Li), neon (Ne) and sodium (Na).

6. (10%) (a) Please write down the 1-D time-dependent Schrödinger equation. (b) Please write down the 1-D time-independent Schrödinger equation.

7. (20%) An electron is in a one-dimensional infinite well. Please use the time-independent Schrodinger equation to derive the following equation:

$$\psi_n(x) = \sqrt{\frac{2}{L}}\sin\frac{n\pi x}{L} \qquad n = 1,2,3,...$$
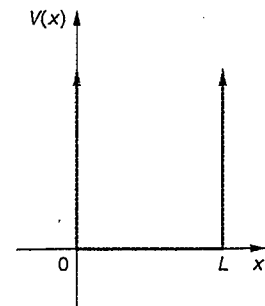
8. (10%) For an electron in the hydrogen atom, if the angular momentum quantum number $l = 2$: (a) What are the possible values of L_z (the z component of angular momentum)? (b) What is the magnitude of L (the angular momentum)?