國立成功大學九十五學年度碩士班招生考試試題

編號：G 239　系所：醫學工程研究所丙組　　　科目：普通物理

本試題是否可以使用計算機：　☑可使用 ，　□不可使用 　（請命題老師勾選）

Physical constants:

Avogadro's number: N_a=6.02x10^{23} particles/mol

Coulomb constant: k=8.987x10^9 N·m^2/C^2

Mass of electron: m_e=9.1x10^{-31} Kg

Mass of unit: u=1.66x10^{-27} Kg

Speed of light: c=299792458 m/s

Fine structure constant: α= 7.297x10^{-3}

Permeability of free space: μ_0=4πx10^{-7} N/A^2

Boltzmann's constant: k=1.38x10^{-23} J/K

Fundamental charge: e=1.6x10^{-19} C

Mass of proton: M_p=1.67x10^{-27} Kg

Planck's constant: h=6.6x10^{-34} J·s

Constant of gravitation: G=6.67x10^{-11}N·m^2/Kg^2

Gas constant: R=8.3 J/mol·K

一、簡答題 [共五十分]

1. 請完整寫出在真空中，Maxwell 四大方程式及對應之定律名稱。 [16分]

2. 如何區分極化(polar)與非極化(nonpolar)電介質? [5分]

3. 何謂機械能守恒、線動量守恆及角動量守恆定律，使用此三大定律之先決條件爲何? [12分]

4. 簡述熱力學之能量均分原理? [4分] 簡述聲波學中之杜普勒效應? [4分]

5. 楊氏雙狹縫干涉實驗中，產生干涉極大 (亮紋) 的條件爲何? 以兩狹縫間距 d，亮紋與兩狹縫垂直中分線夾角 θ 與入射光波長 λ 表示之。 [4分]

6. 下表代表氫原子狀態的五個量子數組合，哪些組合是不可能存在？ [5分]

	n	ℓ	m_ℓ
(a)	3	2	0
(b)	2	3	1
(c)	4	3	−4
(d)	5	5	0
(e)	5	3	−2

二、計算題 [共五十分，須寫出計算過程]

1. A thin uniform rod (mass M=3.0 kg, length L=4.0 m) rotates freely about a horizontal axis A that is perpendicular to the rod and passes through a point at distance d=1.0 m from the end of

（背面仍有題目，請繼續作答）

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the rod, as shown in Fig. 1. The kinetic energy of the rod as it passes through the vertical position is 20 J. (a) What is the rotational inertia I of the rod about axis A? (b) What is the (linear) speed v of the end **B** of the rod as the rod passes through the vertical position? (c) At what angle θ will the rod momentarily stop in its upward swing? [12 分，每小題各 4 分]
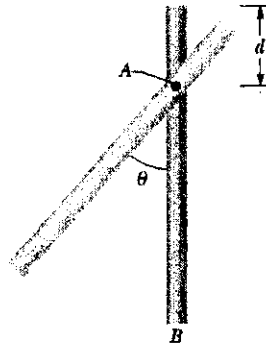

Figure 1

2. Light of wavelength 200 nm shines on an aluminum surface; 4.20 eV is required to eject an electron. What is the kinetic energy of (a) the fastest and (b) the slowest ejected electrons? (c) What is the stopping potential for this situation? (d) What is the cutoff wavelength for aluminum? [12 分，每小題各 3 分]

3. The plates of a spherical capacitor have radii 38.0 mm and 40.0 mm. (a) Calculate the capacitance. (b) What must be the plate area of a parallel-plate capacitor with the same plate separation and capacitance? [10 分，(a)小題 5 分，(b)小題 3 分]

4. A thermodynamic system is taken from state A to state B to state C, and then back to A, as shown in the p-V diagram of Fig. 2(a).
(a)–(g) Complete the table in Fig.2(b) by inserting a plus sign, a minus sign, or a zero in each indicated cell. (h) What is the net work done by the system as it moves once through the cycle $ABCA$? [18 分，(a)-(g)每小題各 2 分，(h)小題 4 分]
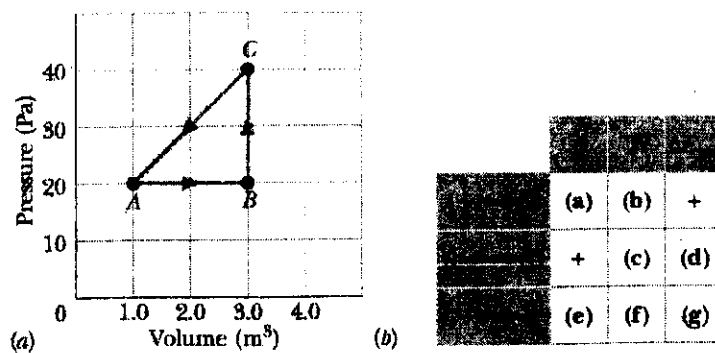

Figure 2