

大同大學 98 學年度轉學入學考試試題

考試科目：物理

所別：各系所

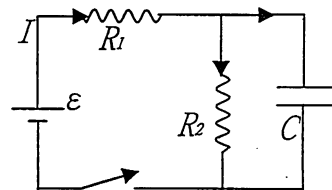
第 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

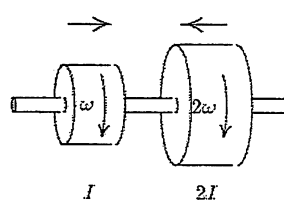
一、選擇題(30%)： $\epsilon_0=8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$ ， $\mu_0=4\pi \times 10^{-7} \text{ H/m}$ ，光速 $c=3 \times 10^8 \text{ (m/s)}$

- 兩個不互相垂直的向量 \vec{A} 、 \vec{B} ，若 $\vec{R} = \vec{A} \times \vec{B}$ ，下列關係式何者有誤 (A) $|\vec{R}| = |\vec{A}||\vec{B}| \sin \theta$ (B) $-\vec{R} = \vec{B} \times \vec{A}$ (C) $\vec{R} \cdot \vec{A} = 0$ (D) $\vec{R} \cdot \vec{B} = 0$ (E) $\vec{A} \cdot \vec{B} = 0$
- 一內徑 a 、外徑 b 的金屬球殼，所帶總電荷量為 $2Q$ ，今在其球心處置入一點電荷 Q ，則下列何者『錯誤』 (A) $E = \frac{kQ}{r^2}$ for $r < a$ (B) $E = \frac{kQ}{r^2}$ for $a < r < b$ (C) $E = \frac{3kQ}{r^2}$ for $r > b$ (D) 球殼外表面共帶電 $3Q$ (E) 球殼內表面電荷為 $-Q$ 。
- ABCD 四個平行電容板，其面積 A 及電容板間的距離 d 分別為：A: (A_0, d_0)；B: ($2A_0, d_0$)；C: ($A_0, 2d_0$)；D: ($2A_0, 0.5d_0$)，此四電容的大小關係下列何者正確？(A) $A=B=C=D$ (B) $A > B > C > D$ (C) $B > D > C > D$ (D) $D > B > A > C$ (E) $D > C > B > A$

- 如圖的線路，當開關剛關上那瞬間電流 I 的值為 (A) $\frac{\epsilon}{R_1}$ (B) $\frac{\epsilon}{(R_1 + R_2)}$ (C) $\frac{\epsilon}{R_2}$ (D) 0 (E) 無窮大

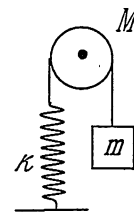


- 已知真空中傳遞的平面電磁波的電場如下所示 $\vec{E}(y, t) = E_0 \cos(ky - \omega t) \hat{k}$ ，下列何者正確？(A) 其磁場的數學形式為 $\vec{B}(y, t) = B_0 \cos(ky - \omega t) \hat{i}$ (B) 電磁波的能量沿 +z 方向傳遞 (C) 磁場的大小及方向皆與電場相同 (D) 此電磁波的波長為 $2\pi k$ (E) 此電磁波為縱波。
- 下列何者正確 (A) 由 Fermat 定律可導出繞射現象 (B) 由 Young's 實驗中屏幕上干涉條紋的兩亮紋間距可計算出狹縫的寬度 (C) Snell 定律無法用幾何光學的理論(即光為直線進行的)來解釋 (D) 緯度越高，空氣密度越小，所以光速變小 (E) 以上皆非
- Block A, with mass m_A , is initially at rest on a horizontal floor. Block B, with mass m_B , is initially at rest on the horizontal top surface of A. The coefficient of static friction between the two blocks is μ_s . Block A is pulled with a horizontal force. It begins to slide out from under B if the force is greater than (A) $m_A g$ (B) $m_B g$ (C) $\mu_s m_A g$ (D) $\mu_s m_B g$ (E) $\mu_s (m_A + m_B) g$
- A block is attached to the end of an ideal spring and moved from coordinate x_i to coordinate x_f . The relaxed position is at $x = 0$. The work done by spring is positive if: (A) $x_i = 2 \text{ cm}$ and $x_f = 4 \text{ cm}$ (B) $x_i = -2 \text{ cm}$ and $x_f = 4 \text{ cm}$ (C) $x_i = -2 \text{ cm}$ and $x_f = -4 \text{ cm}$ (D) $x_i = 2 \text{ cm}$ and $x_f = -4 \text{ cm}$ (E) $x_i = -4 \text{ cm}$ and $x_f = -2 \text{ cm}$
- A solid wheel with mass M , radius R , and rotational inertia $\frac{1}{2}MR^2$, rolls without sliding on a horizontal surface. A horizontal force F is applied to the axle and the center of mass has an acceleration a . The magnitudes of the applied force F and the frictional force f of the surface, respectively, are: (A) $F = Ma, f = 0$ (B) $F = Ma, f = Ma/2$ (C) $F = 2Ma, f = Ma$ (D) $F = 2Ma, f = Ma/2$ (E) $F = 3Ma/2, f = Ma/2$
- Two disks are mounted on low-friction bearings on a common shaft. The first disc has rotational inertia I and is spinning with angular velocity ω . The second disc has rotational inertia $2I$ and is spinning in the same direction as the first disc with angular velocity 2ω as shown. The two disks are slowly forced toward each other along the shaft until they couple and have a final common angular velocity of: (A) ω (B) 3ω (C) $5\omega/3$ (D) $\omega\sqrt{3}$ (E) $\omega\sqrt{7}/3$

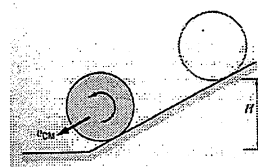


二、計算題 (50%)

- A block of mass m is attached to a vertical spring via a string that hangs over a pulley of mass M and radius R , as shown in the figure. The spring does not slip, write down the **motion equation** and find the **angular frequency** of oscillations. (10%)

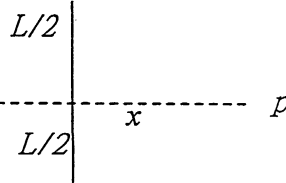


- 如圖，質量 M 、半徑 R 的圓盤，從斜面上(斜角 θ) 靜止開始地滾下來(不滑動)。(1) 求質心(即中心點)的(線性)加速度 a_{CM} (2) 摩擦係數至少須為何？才能使其滾動而不滑動 (3) 求其滾到底時(垂直高度 H)，質心的(線性)速率 v_{CM} 。(15%)



- A solenoid (螺線管) of length L and radius R ($L \gg R$) has N turns of wire (a) Find the magnetic field at a point along the axis when the solenoid carries a current I . (b) Find the inductance value of the solenoid (10%)

- (a) 一長 L 的長直帶電導線，設其線電荷密度 $\lambda \text{ C/m}$ (λ 為常數)，距導線 x 處 p 點的電場 (b) 一無窮長的長直帶電導線，(線電荷密度 $\lambda \text{ C/m}$ ， λ 為常數)，求距導線 x 處 p 點的電場



三 Write down and explain the following (20%)

- (a) Maxwell's equations (b) work-energy theorem (c) polarization angle (偏極角) (d) Entropy