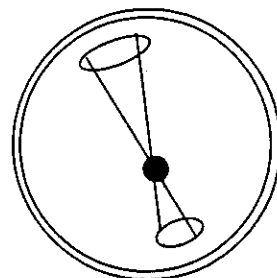


**作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符!

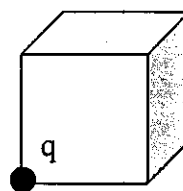
甲部分:選擇題(單選)共八題(答對一題得 5 分答錯一題扣 1 分)

1. A spherical shell with total charge $+Q$ uniformly distributed, for any point inside the shell, what is the correct answer: (a) the total electric fields are nonzero if the point charge induced electric field is $\propto 1/r^2$. (b) The fields are zero as the point charge induced electric field is $\propto 1/r^2$. (c) The fields are zero as the point charge induced electric field is $\propto 1/r^3$. (d) The fields are zero as the point charge induced electric field is $\propto 1/r^1$.



2. A charge q sits at the back corner of a cube. What is the electric flux through the shaded area?

(a) $\Phi_E = \frac{q}{36\epsilon_0}$ (b) $\Phi_E = \frac{q}{12\epsilon_0}$ (c) $\Phi_E = \frac{q}{24\epsilon_0}$ (d) $\Phi_E = \frac{q}{15\epsilon_0}$

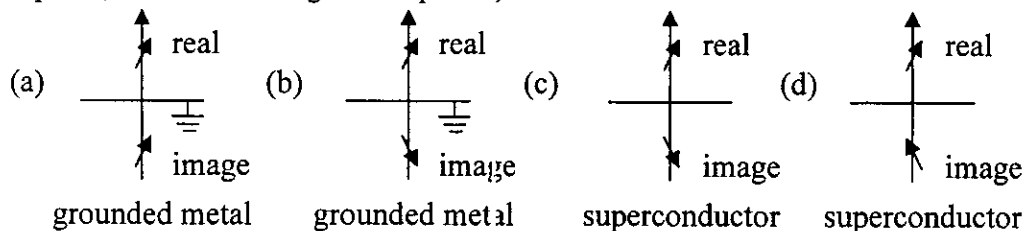


3. Suppose a point charge q is held a distance d above an infinite grounded conducting plane. What is the correct answer? (a) The induced surface charge density is

$\sigma = \frac{1}{4\pi} \frac{-qd}{(x^2 + y^2 + d^2)^{3/2}}$ (b) The induced total charge is $-q/2$. (c) The force is

$\vec{F}_{on+q} = \frac{1}{4\pi\epsilon_0} \frac{(+q)(-q)}{(2d)^2} \hat{z}$. (d) The energy stored is $W = -\frac{1}{4\pi\epsilon_0} \frac{q^2}{(2d)}$.

4. What is the correct answer for dipoles and image dipoles? (a and b are electric dipoles; c and d are magnetic dipoles.)



5. The wave number (k) for the TE_{mn} mode of a rectangular wave guide, with height a and width b , is $k = \{(\omega/c)^2 - \pi^2[(m/a)^2 + (n/b)^2]\}^{1/2}$. Where, c is the speed of light. What is the lowest cutoff frequency if $a < b$? (a) ca/b , (b) $\pi a/b$, (c) $c\pi/b$, (d), $c\pi/a$.

6. For light incident on glass ($n_2=1.5$) from air ($n_1=1$), the Brewster's angle is (a) $\sin^{-1}(n_2/n_1)$, (b) $\sin^{-1}(n_1/n_2)$, (c) $\tan^{-1}(n_2/n_1)$, (d) $\tan^{-1}(n_1/n_2)$.

國立交通大學 95 學年度碩士班考試入學試題

科目：電磁學(4022)

考試日期：95 年 3 月 12 日 第 3 節

系所班別：電子物理學系

組別：電物所乙組

第 2 頁, 共 2 頁

**作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符!

7. Two concentric metal spherical shells of radius a and b , respectively, are separated by weakly conducting material of conductivity σ . What is the resistance between the shells? (a) $(1/a - 1/b)/(4\pi\sigma)$, (b) $2\pi\sigma/\ln(b/a)$, (c) $(4\pi\sigma)^{-1}(b/a)$, (d) $4\pi\sigma ab$.

8. A point charge q traveling in along the x axis at a constant speed does not constitute a steady current. Which description is correct? (a) No magnetic field can be produced by the point charge. (b) It produces a constant magnetic field in x direction. (c) It produces a constant magnetic field in y direction. (d) It produces magnetic fields which circle the x axis.

乙部分:計算題共四題(每題 15 分)

9. A specified charge density $\sigma_0(\theta) = 3\cos^2\theta + 3\cos\theta + 3$ is glued over the surface of a spherical shell of radius R . Find the resulting potential inside the sphere.

$$(P_0(x)=1, P_1(x)=x, P_2(x)=(3x^2-1)/2, \int_{-1}^1 (P_l(x))^2 dx = \frac{2}{2l+1})$$

10. (a) If $\vec{B} = B_0 \hat{z}$, find the vector potential. (b) Find the vector potential of an infinite solenoid with n turns per unit length, radius R , and current I .

11. A long coaxial cable carries current I (the current flows down the surface of the inner cylinder, radius a , and back along the outer cylindrical shell of radius b). Find the magnetic energy stored in a section of length L .

12. A long circular cylinder of radius R carries a magnetization $\vec{M} = ks\vec{\phi}$, where k is a constant, s is the distance from the axis, and $\vec{\phi}$ is the usual azimuthal unit vector. Find the magnetization due to $\vec{M}$, for points inside and outside the cylinder.

Note: you might need the following formula

$$\text{Curl:} \quad \nabla \times \mathbf{v} = \left[\frac{1}{s} \frac{\partial v_z}{\partial \phi} - \frac{\partial v_\phi}{\partial z} \right] \hat{s} + \left[\frac{\partial v_s}{\partial z} - \frac{\partial v_z}{\partial s} \right] \hat{\phi} + \frac{1}{s} \left[\frac{\partial}{\partial s}(s v_\phi) - \frac{\partial v_s}{\partial \phi} \right] \hat{z}$$