選擇題 (30 分)

1. (6 points) According to the Bohr theory, what is the radius of the ground state orbit of the hydrogen atom? (a) 5.290×10^{-11} m (b) 1.058×10^{-10} m (c) 2.116×10^{-10} m (d) 2.645×10^{-9} m (e) 5.290×10^{-9} m.
2. (6 points) When 10^{12} electrons are transferred from one plate to the other, the potential difference across an infinity uncharged capacitor reaches 20 V. What is its capacitance? (a) 2 nF (b) 8 nF (c) 16 nF (d) 32 nF (e) 64 nF.
3. (6 points) A photon has an energy E, frequency ν, wavelength λ, and speed c. Which one of the following expressions is **wrong** to represent its momentum? (a) E/c (b) $h\nu/c$ (c) h/λ (d) h/ν (e) $E/(\nu\lambda)$. Note h is the Planck's constant.
4. (6 points) An electron with a kinetic energy of 10^3 eV moves perpendicular to the lines of uniform magnetic field B = 1 G. What is the period of its orbit? (a) 3.6×10^{-7} s (b) 1.8×10^{-5} s (c) 3.6×10^{-5} s (d) 1.6×10^{-3} s (e) 1.8×10^{-1} s.
5. (6 points) Two rockets, A and B, approach each other with speeds of c relative to the earth frame, with c the speed of light in vacuum. What is the velocity of A relative to B? (a) $0c$ (b) c (c) $0.1c$ (d) $0.5c$ (e) $2c$.

計算與簡答題 (70 分)

1. (10 points) Two equal charges, each with charge Q, lie at $(0, a)$ and $(0, -a)$ on the y axis, as shown in Fig. 1. (a) Find the electric field strength E at the point $(x, 0)$. (b) What is the form of $E(x)$ for $x >> a$? (c) At what point is $E(x)$ a maximum?

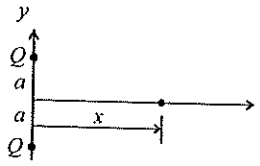

Fig. 1

2. (10 points) A convergent thin lens with focal length $f = 4$ cm is 12 cm in front of a second thin convergent lens ($f = 7$ cm). What are the final image position relative to the $f = 7$ cm lens, and the transverse magnification of the image when the object distance from the first lens is 5 cm?

3. (15 points) A 2-kg block is attached to a spring for which the spring constant k = 200 N/m. It is held at an extension of 5 cm and then released at t = 0. Find: (a) the displacement as a function of time; (5%) (b) the velocity when x = +A/2; (5%) (c) the acceleration when x = +A/2. (5%). Note A is the amplitude of the oscillation.
4. (15 points) Find the moment of inertia of a circular disk or solid cylinder of radius R with mass M about the following axes: (a) through the center and perpendicular to the flat surface (8%); (b) at the rim and perpendicular to the flat surface. (7%)
5. (20 points) A ladder of length L and weight W rests on a rough floor and against a frictionless wall, see the figure in below. The coefficient of static friction at the floor is μ_s=0.6. (a) Find the maximum angle θ to the wall such that the ladder does not slip, (10%); (b) the force extracted by the wall at this θ. (10%)