

系別：物理學系

科目：普通物理(含近代物理)

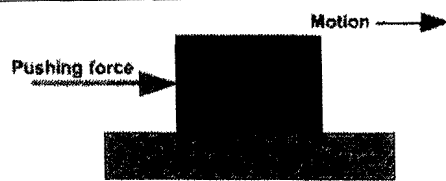
考試日期：3月4日(星期六) 第2節

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1. How much work do the man do (horizontally 水平地) in pushing a 200 kg crate 木箱 10.0 m across a floor at constant speed if the coefficient of friction is 0.5? ($g = 9.8 \text{ m/s}^2$)

(a) 98 J (b) 980 J, (c) 9800 J, (d) 0 J. 10%

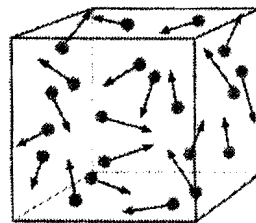


2. Consider a cylinder 圓柱 and a hollow cylinder 中空圓柱, rotating about an axis going through their centers of mass. If both objects have the same mass and radius, which object will have the larger moment of inertia?

(a) The hollow cylinder (b) the cylinder (c) the same. 10%

3. Three identical containers 容器 hold equal masses of gas, hydrogen in one, oxygen in the other one, and nitrogen in the last one. The gases are held at the same temperature. How does the highest pressure of the gas?

(a) P_{hydrogen} , (b) P_{oxygen} , (c) P_{nitrogen} , (d) the same. 10%

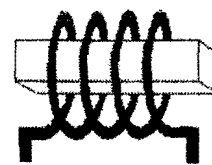


4. An insulating solid sphere of radius a has a uniform volume charge density ρ and total positive charge q . The strength of the electric field inside the sphere at a distance r from the center ($r < a$) is proportional to which answer?

(a) a , (b) r , (c) $1/r$, (d) $1/r^2$. 10%

5. A coil of wire 20 cm length and 200 turns carries a current of 10 A. A bar of titanium 鈦棒(magnetic susceptibility 1.81×10^{-4}) is positioned within the coil. The magnetic field inside the titanium bar is which answer?

(a) $7.590 \times 10^{-4} \text{ T}$, (b) $4.145 \times 10^{-4} \text{ T}$, (c) $12.6 \times 10^{-4} \text{ T}$, (d) $1.257 \times 10^{-2} \text{ T}$. 10%



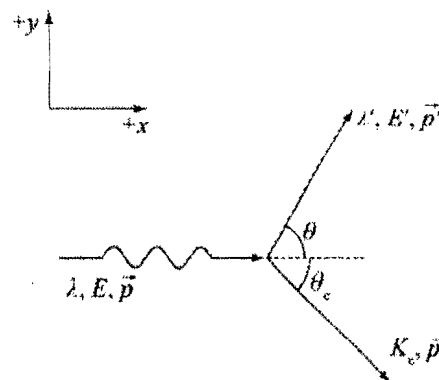
6. It is speculated that isolated magnetic "charges" (magnetic monopoles 磁單極) may exist somewhere in the universe. Which of Maxwell's equation, (1) Gauss's Law for Electric Fields, (2) Gauss's Law for Magnetic Fields, (3) Faraday's Law of Induction, and/or (4) the Maxwell-ampere Law, would be altered by the existence of magnetic monopoles? Why? 10%

7. Ultra-high-energy Gamma rays are found to come from the equator of our galaxy with energies up to $3 \times 10^{12} \text{ eV}$. (Planck number = $4.14 \times 10^{-15} \text{ eV} \cdot \text{s}$) 20%

(a) What is the wavelength of this light?

(b) How does the energy of this light compare to the rest mass of a proton?

8. An X-ray photon with an energy of 100 keV strikes and electron that is initially at rest inside a metal. The photon is scattered at an angle of 30° . What is the kinetic energy and momentum (magnitude and direction) of the electron after the collision? You may use the nonrelativistic relationship



淡江大學 106 學年度碩士班招生考試試題

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connecting the kinetic energy and momentum of the electron. Report angles measured from the +x axis. (i.e. in the range $-90^\circ < \theta < 90^\circ$.) 10%

9. What is the ratio of energy difference between the ground state (E_1) and the first excited state (E_2) for an infinite square well of length L to that of length $2L$.

That is, find the energy difference ratio of $(E_2 - E_1)_{\text{length}=L} /$

$(E_2 - E_1)_{\text{length}=2L}$. 10%

