

國立中央大學97學年度碩士班考試入學試題卷

所別：大氣物理研究所碩士班

科目：普通物理 共 1 頁 第 1 頁

\*請在試卷答案卷(卡)內作答

1. Terminology and short problem (20%)
  - (1) Give Bernoulli's equation and three practical applications.
  - (2) Explain why the temperature is generally cooler on the top of a high mountain than that at the sea level.
  - (3) What is the terminal velocity? If the radius of raindrop A is 2 times larger than that of raindrop B, find the ratio of their terminal velocities.
  - (4) Write Maxwell's equations and their associated physical meanings.
2. A man driving a 2000 kg car at 144 km/hr across the salt flats observes an extended barrier 310 meters ahead. (a) What is the smallest coefficient of friction that will allow him to turn the car (maintain his speed) in a circle of radius 300 to avoid hitting the barrier? (b) Determine the work done during the turning. (10%)
3. A 6 meter long 20-kg boat has a frictionless track along its length. A 20-kg ball is given a velocity of 2.0 m/s towards the front of the boat while the boat is at rest. The ball experiences an elastic collision at the front of the boat. Determine the velocities of the ball and boat as well as the total energy of the two after the collision. (10%)
4. A 1080 Hz source is moving with a velocity of 30 m/s. (a) What is the minimum wavelength that a stationary observer would measure? (b) Calculate the associated Doppler shift. Use 340 m/s as the speed of sound. (10%)
5. A dipole is made of two opposite charges of magnitude  $3 \times 10^{-10}$  coul separated by 2 cm. This dipole is placed in a uniform electric field with the line joining the charges at an angle of  $60^\circ$  with the field. (a) If the magnitude of the electric field is 200 nt/coul, what is the magnitude of the dipole moment, and torque, on the dipole (in terms of  $10^{-12}$  coul m and  $10^{-12}$  nt m)? (b) Determine the work require to rotate the dipole so that the dipole is antiparallel to the field. (15%)
6. A positive ion beam has  $5 \times 10^8$  double charged ions per cubic centimeter. If each ion travels at  $4 \times 10^6$  m/s, what are the current density and ion flux in the beam? (10%)
7. The active element in a Hall-Effect gausemeter is a slab of semiconductor 1.0 mm thick, 8.0 mm wide, 2.0 cm long. A current of 0.2 amps is lengthwise in the slab. The density of electron is  $1.2 \times 10^{24}$  el/cm<sup>3</sup>. The instrument is rotated until a maximum voltage of 0.6 millivolts is measured across the strip. (a) What is the magnetic field (in tesla)? (b) Draw the electron flows, the electric field, and magnetic field of the experiment. (15%)
8. The Poynting Vector for an E and M wave is  $26.5 \text{ w/m}^2$  and is parallel t the positive x-axis. At a certain time and position, the electric field is 100 v/m in the positive z direction. Determine the magnitude and direction of the accompanying magnetic field. (10%)

參考  
用