

招生學年度	105	招生類別	碩士班
系所班別	物理學系 應用物理碩士班 (一般組)、材料科學與工程學系碩士班		
科目名稱	普通物理		
注意事項	本考科禁止使用掌上型計算機		

- (10%) Please qualitatively state the "Gauss's Law".
- (15%) Please qualitatively state the "Newton's 3 Laws of Motion".
- (15%, each in 5%) Elastic collision of two pucks on a frictionless table. Puck A has mass  $m_A=0.5$  kg, and puck B has mass  $m_B=0.3$  kg. Puck A has an initial velocity of 4 m/s in the positive x direction and a final velocity of 2 m/s in an unknown direction. Find the final speed  $V_{B2}$  of puck B and the angles  $\alpha$  and  $\beta$  in the Fig. 1.

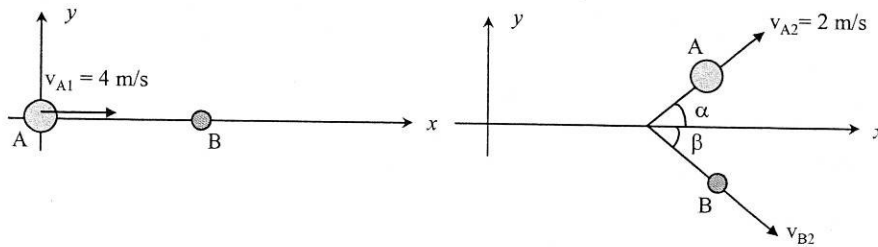


Fig. 1

- In a water molecule the distance between the oxygen and hydrogen atoms is  $9 \times 10^{-11}$  m and the masses of the atoms are  $m_O=16m_H$ , where  $m_H=1.67 \times 10^{-27}$  kg. The angle between the two H-O bonds is  $105^\circ$  (see Fig. 2). Please find the moment of inertia of the molecule about:
  - (5%) (a) An axis along the H-O bond.
  - (5%) (b) An axis through the O atom parallel to the line joining the two H atoms.

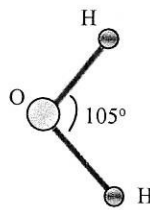


Fig. 2

- (10%) Prove the moment of inertia of a cylindrical rod of mass  $m$  and length  $L$  is  $\frac{1}{12} mL^2$ .

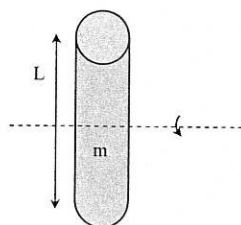


Fig. 3

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6. Ultraviolet laser at 248 nm is incident on a flat surface and leads to the photoemission from the surface.  
 (5%) (a) What is the work function of the flat surface? (Assume the stopping potential is 2V.)  
 (5%) (b) What is the maximum kinetic energy of the photoelectrons?
7. Fig. 4 shows the  $F$  vs.  $t$  curve for the force exerted by the hip joints on the 50-kg torso of a sprinter as he starts to run.  
 (5%) (a) What is the impulse exerted on the torso?  
 (5%) (b) Estimate the sprinter's change in speed? Assume that the force and the motion are horizontal.

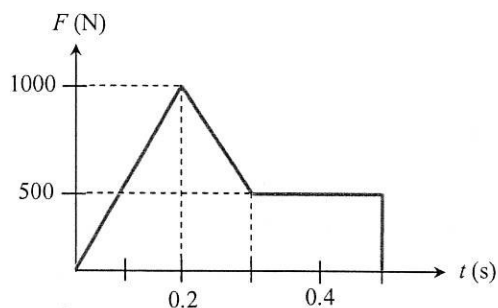


Fig. 4

8. (10%) An electron with an energy of 500 eV moves at right angles to a uniform magnetic field of 1.2 T. Please find the radius of the circular motion.  
 ( $m_e = 9.11 \times 10^{-31} \text{ kg}$ ,  $q_e = 1.6 \times 10^{-19} \text{ C}$ )
9. (10%) A square metal plate (with area of  $64 \text{ cm}^2$ ) on one side carries a total charge of  $6 \times 10^{-6} \text{ C}$ . Please estimate the electric field 0.5-cm above the surface of the plate near the plate's center.  
 ( $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 / \text{N} \cdot \text{m}^2$ )