

# 國立屏東教育大學 99 學年度研究所碩士班入學考試

## 普通物理學 試題

(應用物理系光電暨材料碩士班)

※請注意：1.本試題共二頁。

2.答案須寫在答案卷上，否則不予計分。

### 問答題 (共 100 分)

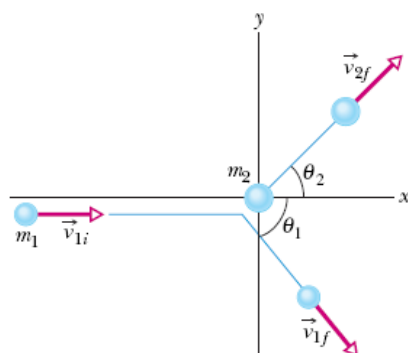
1. In Figure, projectile particle 1 is an alpha particle and target particle 2 is an oxygen nucleus.

The alpha particle is scattered at angle  $\theta_1 = 60.0^\circ$  and the oxygen nucleus recoils with speed

$1.2 \times 10^5$  m/s and at angle  $\theta_2 = 45.0^\circ$ . In atomic mass units, the mass of the alpha particle is 4.00

u and the mass of the oxygen nucleus is 16.0 u. What are the (a) final and (b) initial speeds of

the alpha particle? (15%)

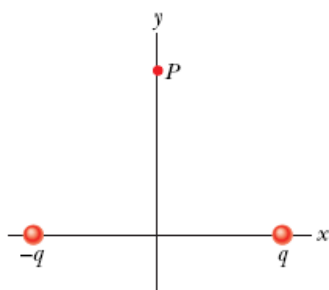


2. Figure shows two charged particles on an x axis:  $-q = -3.20 \times 10^{-19}$  C at  $x = -3.00$  m and

$q = 3.20 \times 10^{-19}$  C at  $x = +3.00$  m. What are the (a) magnitude and (b) direction (relative to the

positive direction of the x axis) of the net electric field produced at point P at  $y = 4.00$  m ?

$$\frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 \text{ N} \cdot \text{m}^2 / \text{C}^2 \quad (15\%)$$



3. Charge is distributed uniformly throughout the volume of an infinitely long solid cylinder of radius  $R$ . (a) Show that, at a distance  $r < R$  from the cylinder axis,  $E = \frac{\rho r}{2\epsilon_0}$ , where  $\rho$  is the volume charge density. (b) Write an expression for  $E$  when  $r > R$ . (15%)
4. 請解釋光電效應 (photoelectric effect)。(8%)
5. 請敘述熱力學第二定律。(8%)
6. Give two reasons why it is harder to stop a car quickly when it is going downhill. (8%)
7. Ultraviolet radiation, X-rays, or gamma rays that pass through a gas can ionize some of the atoms or molecules and make the gas conduct electricity. Would you expect the greatest from (a) a low intensity of high-frequency light or (b) a high intensity of low-frequency light? (Please explain the reason.) (8%)
8. Light from high-powered lasers can be focused with a lens and used to weld delicate metal parts. Such lasers can also drill (or melt) smooth holes in ultrahard metals to one-millionth of an inch. Explain why such a powerful laser beam does not crack the lens as it travels through the glass. (8%)
9. Explain why you could put your hand into an oven at  $260^\circ\text{C}$  for 15 seconds without harm, whereas you would never put your hand into a boiling water at  $100^\circ\text{C}$  for even a second. (8%)
10. In earth's core there are liquid regions. Some geophysicists think iron (with relatively high density) is sinking in this region even today. If true, what effect would this have on the earth's rotation rate? (7%)