

科目：普通物理

適用：電機系二

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

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1. Explain :

- (a) Gravity force (4%)
- (b) Spring force (4%)
- (c) Tension (4%)
- (d) Reaction force (4%)
- (e) Friction force (4%)

2. Fig. (1) shows a pattern of resonant oscillation of a string of mass $m = 2.500 \text{ g}$ and length $L = 0.800 \text{ m}$ under tension $\tau = 325.0 \text{ N}$.

- (a) Find the wavelength of the transverse waves. (4%)
- (b) What is the harmonic number n . (4%)
- (c) Find the speed of the transverse waves. (4%)
- (d) Find the frequency of the transverse waves. (4%)
- (e) The displacement of a string element as a function of position x and time t is $y(x, t) = 2y_m \sin kx \cos \omega t$; what is the transverse velocity u . (4%)
- (f) What is the maximum of the transverse velocity u_m of the element oscillating at coordinate $x = 0.180 \text{ m}$. (5%)

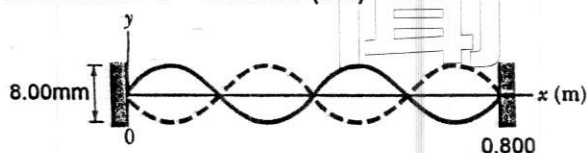


Fig. (1)

3. Fig. (2) is showing a charged particle (either an electron or a proton) moving rightward between two parallel plates separated by distance $d = 2(\text{mm})$. The potential are $V_1 = -70.0(\text{V})$ and $V_2 = -50.0(\text{V})$. The particle is accelerating from an initial speed of $90.0(\text{m/s})$ at the left plate.

- (a) Is the particle an electron or a proton? (4%)
- (b) Find the electric field E at a point between two parallel plates. (8%)
- (c) What is its speed just as it reaches plate 2. The mass of electron is $9.10 \times 10^{-31}(\text{kg})$, and the mass of proton is $1.67 \times 10^{-27}(\text{kg})$. (8%)

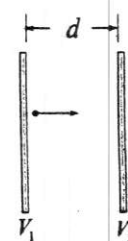


Fig. (2)

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4. Please explain the following questions regarding n moles of ideal gas: (gas constant = R)
- (a) What is isothermal expansion? (4%)
 - (b) What is free expansion? (4%)
 - (c) If an ideal gas is expanded isothermally at temperature T from volume V to $2V$, what is the final pressure P' ? (4%)
 - (d) Same as (c), what are the work done by the gas? (4%)
 - (e) If an ideal gas is expanded freely from volume V to $2V$, what is the final pressure P' ? (4%)
5. Fig. (3), $R_1 = 10.0 \text{ k}\Omega$, $R_2 = 15.0 \text{ k}\Omega$, $C = 0.400 \text{ }\mu\text{F}$, and the ideal battery has emf $\mathcal{E} = 20.0 \text{ V}$. First, the switch is closed a long time so that the steady state is reached. Then the switch is opened at time $t = 0$. What is the current in resistor 2 at $t = 4.00 \text{ ms}$? (15%)

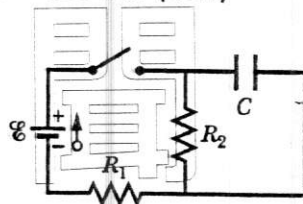


Fig. (3)

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