

國立嘉義大學九十四學年度 科學教育研究所碩士班招生考試試題

科目：普通物理

說明：本試題分三部分，第一部分為選擇題，請標明題號，只需將答案作答在「答案卷」上；第二部分為名詞解釋，請標明題號作答；第三部份為計算與簡答題，請標明題號，並將過程作答在「答案卷」上。

一、選擇題：(每題 5 分，共 50 分)

- Maxwell's equations predict that the speed of light in free space is
(A) an increasing function of frequency (B) a decreasing function of frequency
(C) independent of frequency (D) a function of the distance from the source
(E) a function of the size of the source
- Radio waves of wavelength 3 cm have a frequency of:
(A) 1MHz (B) 9MHz (C) 100MHz (D) 10,000MHz (E) 900MHz
- If a satellite moves above the earth's atmosphere in a circular orbit with constant speed, then:
(A) its acceleration and velocity are always in the same direction
(B) the net force on it is zero
(C) its velocity is constant
(D) it will fall back to the earth when its fuel is used up
(E) its acceleration is toward the earth
- The potential energy of a 0.20-kg particle moving along the x axis is given by $U(x) = 8.0x^2 + 2.0x^4$. When the particle is at $x = 1.0\text{m}$, the magnitude of its acceleration is:
(A) 0 (B) 4m/s^2 (C) 8m/s^2 (D) 40m/s^2 (E) 80m/s^2
- A solid wheel with mass M , radius R , and rotational inertia $MR^2/2$, rolls without sliding on a horizontal surface. A horizontal force F is applied to the axle and the center of mass has an acceleration a . The magnitudes of the applied force F and the frictional force f of the surface, respectively, are:
(A) $F = Ma, f = 0$ (B) $F = Ma, f = Ma/2$ (C) $F = 2Ma, f = Ma$
(D) $F = 2Ma, f = Ma/2$ (E) $F = 3Ma/2, f = Ma/2$
- A 0.25-kg block oscillates on the end of the spring with a spring constant of 200N/m. If the system has an energy of 6.0 J, then the maximum speed of the block is:
(A) 0.06m/s (B) 0.17m/s (C) 0.24m/s (D) 4.9m/s (E) 6.9m/s
- An organ pipe with one end closed and the other open has length L . Its fundamental frequency is proportional to:
(A) L (B) $1/L$ (C) $1/L^2$ (D) L^2 (E) $L^{1/2}$
- A charged capacitor and an inductor are connected in series. At time $t = 0$ the current is zero, but the capacitor is charged. If T is the period of the resulting oscillations, the next time after $t = 0$ that the voltage across the inductor is a maximum is:
(A) $T/8$ (B) $T/4$ (C) $T/2$ (D) T (E) $2T$

- In a Young's double-slit experiment, the separation between slits is d and the screen is a distance D from the slits. D is much greater than d and λ is the wavelength of the light. The number of bright fringes per unit width on the screen is:
(A) Dd/λ (B) $D\lambda/d$ (C) $D/d\lambda$ (D) λ/Dd (E) $d/D\lambda$
- A glass ($n = 1.6$) lens is coated with a thin film ($n = 1.3$) to reduce reflection of certain incident light. If λ is the wavelength of the light in the film, the least film thickness is:
(A) less than $\lambda/4$ (B) $\lambda/4$ (C) $\lambda/2$ (D) λ (E) more than λ

二、名詞解釋：(每題 5 分，共 10 分)

- Specific Heat
- Bernoulli's Principle

三、計算與簡答題：(每題20分，共40分)

- A frictionless roller coaster is given an initial velocity v_0 at a height h , as in Fig. 1. The radius of curvature of the track at point A is R . (a) Find the maximum value of v_0 necessary in order that the roller coaster not leave the track at A. (10 分) (b) Using the value of v_0 calculated in (a), determine the value of h' necessary if the roller coaster is to just make it to point B. (10 分)

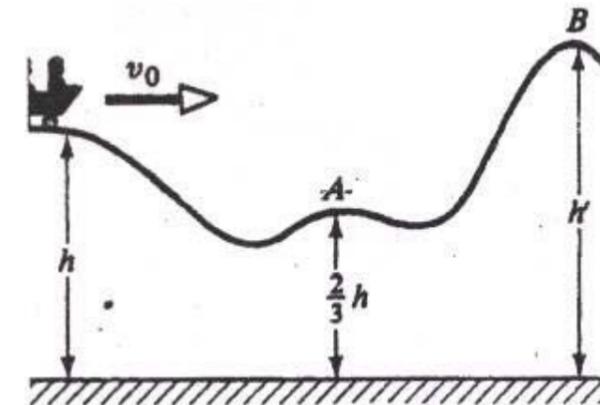


Fig. 1

- Pipe A, which is 1.2m long and open at both ends, oscillates at its third lowest harmonic frequency. It is filled with air for which the speed of sound is 340m/s. Pipe B, which is closed at one end oscillates at its second lowest harmonic frequency. The pipes A and B happen to match. (a) If an x-axis extends along the interior of pipe A, where along the axis are the displacement nodes? (6 分) (b) How long is pipe B? (7 分) (c) What is the lowest harmonic frequency of pipe A? (7 分)