系所組別： 民航研究所甲、乙組

考試科目： 普通物理

考試日期：0307，節次：2

※ 考生請注意：本試題 ☑可 □不可 使用計算機

Problem 1. The pendulum in a grandfather clock is made of brass (with coefficient of linear expansion $19 \times 10^{-6}\,(°C)^{-1}$) and keeps perfect time at $17°C$. How much time is gained or lost in 24 hours if the clock is kept at $28°C$?

(*Hints: Assume the period T of the pendulum is given by $T = 2\pi\sqrt{\dfrac{L}{g}}$ where L is the length of the pendulum.*)

(15%)

Problem 2. Speakers A and B are vibrating in phase. They are directly facing each other, are 7.80 m apart, and are each playing a 73.0-Hz tone. The speed of the sound is 343 m/s. On the line between the speakers there are three points where constructive interference occurs. What are the distances of these three points from speaker A? (15%)

Problem 3. A 6 kg mass is sliding on an inclined plane with friction. The incline makes an angle of 25° with regard to the horizontal. After travelling 10 m, it losses 2 J of energy. If its initial velocity was 15 m/s.

(a). How far does it travel before coming to rest?

(b). How long does it take for the mass to stop?

(20%)

Problem 4. For a solid body immersed in the air, it is acted by the aerodynamic force, which is proportional to the air density, the square of the relative speed between the solid body and the air, and the surface area of the solid body. Let the air density, the relative speed and the surface area be denoted as ρ, V, and S, respectively. Prove that the dimension of $\rho V^2 S$ is equal to the dimension of force. (15%)

Problem 5. Let the speeds of light in the air and in the water be c and c', respectively. Is $c' < c$, $c' = c$, or $c' > c$? If the incidence angle of the light in the air is θ, what is its refraction angle in the water? Explain your answer. (15%)

Problem 6. As shown in the following figure, an RC circuit is composed of a resistor with
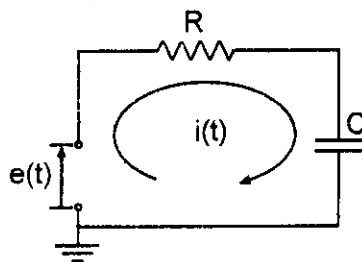
resistance R and a capacitor with capacitance C. If the input voltage is

$$e(t) = \begin{cases} 0, & \text{if } t < 0 \\ e_0, & \text{if } t > 0 \end{cases}$$

where t is the time and e_0 is constant, determine the circuit $i(t)$ in terms of R, C, e_0, and t. Assume that the initial state is $i(0) = 0$. (20%)