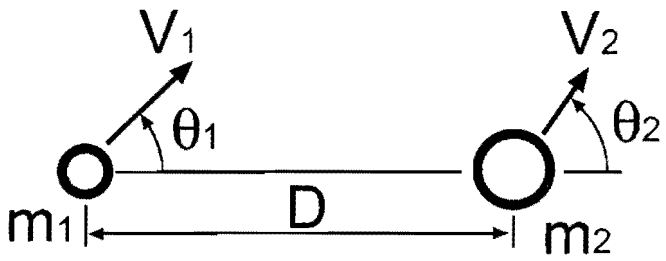
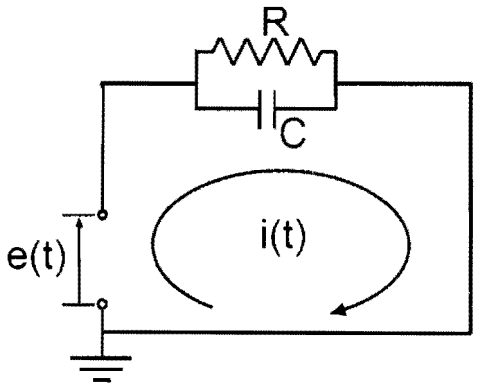
1. As shown in the following figure, two objects with masses $m_1 = m$ and $m_2 = 2m$ initially separated with distance D are moving with constant velocities of which the magnitudes are V_1 and V_2, respectively. Let the angles between a reference line and the two velocities be $\theta_1 = 45°$ and $\theta_2 = 60°$, respectively. Also, let $V_2 = V$.
   (a) Determine V_1 in terms of V, so that impact will occur between the two objects. (10%)
   (b) If both objects are plastic so that they will merge together after impact, what is the velocity of the merged object after impact? (10%)



2. 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 $e(t) = E_0 \sin \omega t$ where t is the time and E_0 and ω is constant, determine the circuit $i(t)$ in terms of R, C, E_0, ω, and t. (20%)



3. What is the horse power (1 hp=550 ft-lb/sec) required to propel an aircraft having a drag $D = 1100$ lb and flying with the speed $V = 330$ ft/sec ? (10%)

(背面仍有題目,請繼續作答)

4. A wave on a lake passes by two docks that are 40m apart.
   (a) If there is a crest at each dock and other three crests between the two docks, determine the wave length. (5%)
   (b) If 10 waves pass one dock every 16.0 seconds, determine the period and frequency of the wave. (5%)
   (c) What is the speed of the wave? (5%)

5. During a hurricane, the atmospheric pressure changes dramatically.
   (a) Explain why it is recommended that house windows be kept slightly open during hurricane. (5%)
   (b) What is the net force on a wall 300 ft^2 in area when the pressure on one side is 14.7 lb/in^2 and the pressure on the other side is 14.0 lb/in^2? (10%)

6. How much helium is needed to fill up a balloon to lift a payload of 100kg (including the mass of the balloon) in air at 1 atm pressure and 20°C.
   Note: The molecular weight of helium is 4 g/mol, and of air is 28.9 g/mol. (20%)