注意：分數的評定，不是只看最終答案的正確與否。作答時要說明所根據的原理，逐步說明或推導所使用的公式，這些也是給分的依據。

1. A homogeneous gate shown in Fig. A consists of one quarter of a circular cylinder and is used to maintain a water depth of 4 m. That is, when the water depth exceeds 4 m, the gate opens slightly and lets the water flows under it. Determine the weight of the gate per meter of length. (15%)

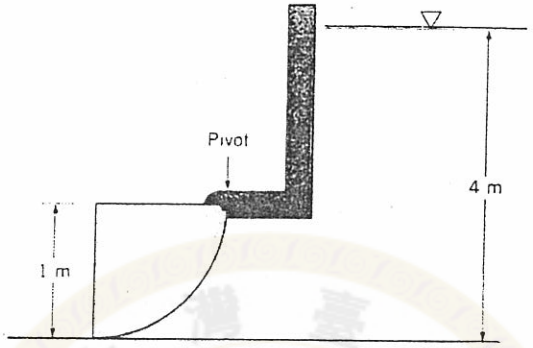

Fig. A

2. Wind blowing past a flag causes it to flutter in the breeze. The frequency of this fluttering is w and the area density of the flag is ρ_A (with dimensions of ML^{-2}). It is desired to predict the flutter frequency of a large $l = 10$ m flag in $V = 10$ m/s wind. To do this a model flag with length $l = 1$ m is to be tested in a wind tunnel. (a) Determine the required area density of the model flag material if the large flag has $\rho_A = 1$ kg/m^2. (b) What wind tunnel velocity is required for testing the model? (c) If the model flag flutters at 6 Hz, predict the frequency for the large flag. (15%)
3. Explain why the fan or the blower becomes more noisy when its rotation speed is greater? You may use the phenomenon or the theory of the flow past an airfoil to interpret this problem. (15%)
4. Aircraft and missiles flying at high altitude may have regions of laminar flow that become turbulent at lower altitudes at the same speed. Explain a possible mechanism for this effect. (10%)
5. Hydrogen bubbles frequently are used as markers for flow visualization. Consider bubbles with diameters from 0.01 to 0.1 m. How do you estimate their terminal speeds in water. Note: Be sure to consider the effect surface tension on the pressure of hydrogen within the bubble. (15%)
6. Two disturbance sphere created by an object moving at a supersonic speed in the high altitude of atmosphere with the temperature of -20℃ are as shown in Figure B. The speed of sound at standard sea level atmosphere (15℃) is 340m/s. Calculate (a) the Mach number, (b) velocity of the object and (c) the Mach angle of the cone created by the disturbance. (15 %)
7. The axial velocity profile of water in the radial direction is parabolic in a circular pipe with diameter of 2cm. The flow rate is 200 liters per minute.
   (a) Drive the velocity profile as function of the radial distance.
   (b) Compute the maximum speed of water in the pipe.
   (c) If the flow rate is doubled, how much does the friction increase? (15%)

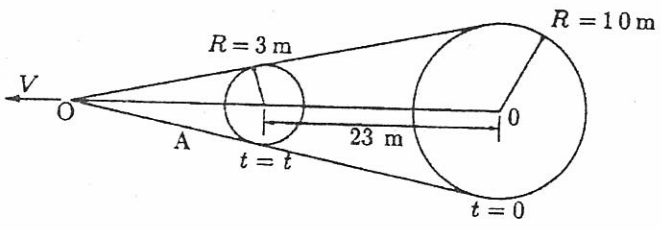

Fig. B

試題隨卷繳回