

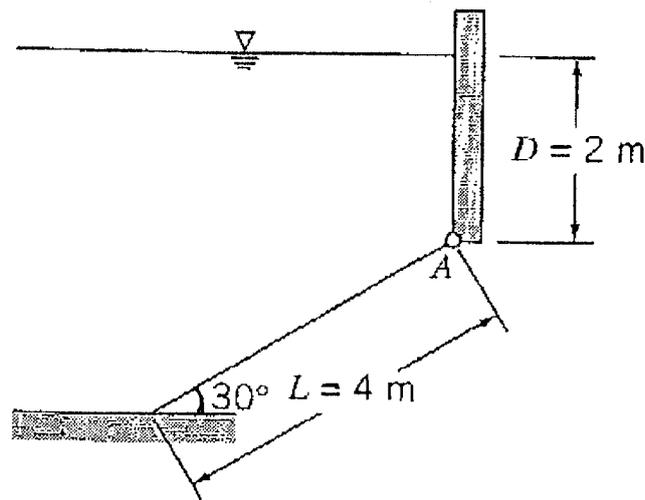
系所組別： 系統及船舶機電工程學系甲組

考試科目： 流體力學

考試日期： 0223，節次： 2

※ 考生請注意：本試題不可使用計算機

1. Discuss each of the following
 - (a) Write the expression relating gage pressure, absolute pressure, and atmospheric pressure? (5%)
 - (b) What is the Bernoulli equation, explain its physical significance? (5%)
 - (c) Explain the relationship between rotation, vortex, vorticity and viscosity. (5%)
 - (d) What is D'Alembert's Paradox? (5%)
2. The inclined surface shown, hinged along edge A, is 5 m wide. Determine the resultant force, FR, of the water and the air on the inclined surface. (20%)



3. A small rocket, with an initial mass of 400kg, is to be launched vertically. Upon ignition the rocket consumes fuel at the rate of 5 kg/s and ejects gas at atmospheric pressure with a speed of 3500 m/s relative to the rocket. Determine the initial acceleration of the rocket and the rocket speed after 10 sec, if air resistance is neglected. (20%)
4. The pressure drop, Δp , for steady, incompressible viscous flow through a straight horizontal pipe depends on the pipe length, l , the average velocity, V , the fluid viscosity, μ , the pipe diameter, D , the fluid density, ρ , and the average "roughness" height, e . Determine a set of dimensionless groups that can be used to correlate data. (20%)
5. Water flows at $U=1\text{ m/s}$ past a flat plate with $L=1\text{ m}$ in the flow direction. The boundary layer is tripped so it becomes turbulent at the leading edge. Evaluate the disturbance thickness, δ , displacement thickness, δ^* , and wall shear stress, τ_w , at $x=L$. Compare with laminar flow maintained to the same position. Assume a $1/7$ - power turbulent velocity profile. (20%)