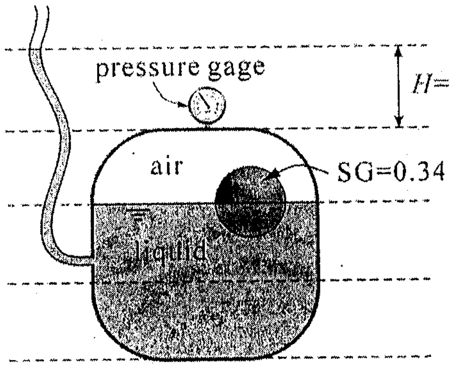

Fig. 1

Problem 1. Consider the pressurised tank shown left on Figure 1. A solid sphere of specific gravity SG = 0.34 floats half-emerged at the surface of the liquid inside the tank.

What is the absolute pressure p at the pressure gage ?

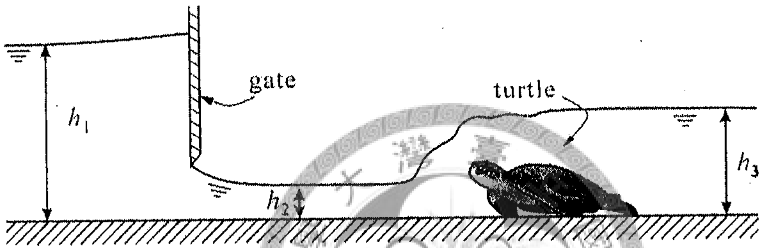

Fig. 2

Problem 2. A steady flow of water in an open-channel of width = 1 m is shown on Fig. 2. The three depths are $h_1 = 1$ m, $h_2 = 0.2$ m, and $h_3 = 0.6$ m.

a) What is the discharge Q under the gate ?

b) Find the magnitude and direction of the horizontal force F_1 exerted by water on the gate.

c) Find the magnitude and direction of the horizontal force F_2 exerted by water on the turtle.

d) Compute the Froude numbers at sections 1, 2, and 3, and check that the flow regimes depicted on Fig. 2 are correct.

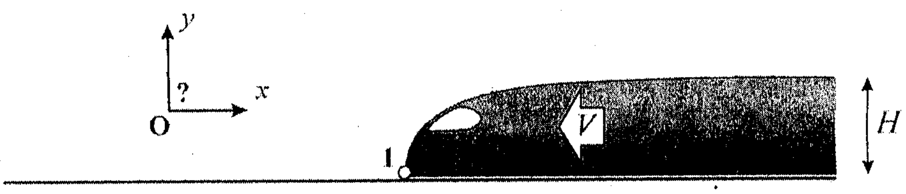

Fig. 3

Problem 3. A train having height $H = 3\,\text{m}$ is travelling from right to left at a constant velocity $V = 10$ m/s, as shown on Figure 3.

a) Draw streamlines in a frame of reference for which the air flow around the train is steady.

b) What is the absolute air pressure p_1 at the nose of the train (point 1 on the figure).

c) In order to approximate the steady air flow around the train by the potential

$$\phi(x,y) = Vx + \frac{1}{\pi}VH\ln\sqrt{x^2+y^2},$$

where should you put the origin **O** (the point $(x,y)=(0,0)$) ?

接背面

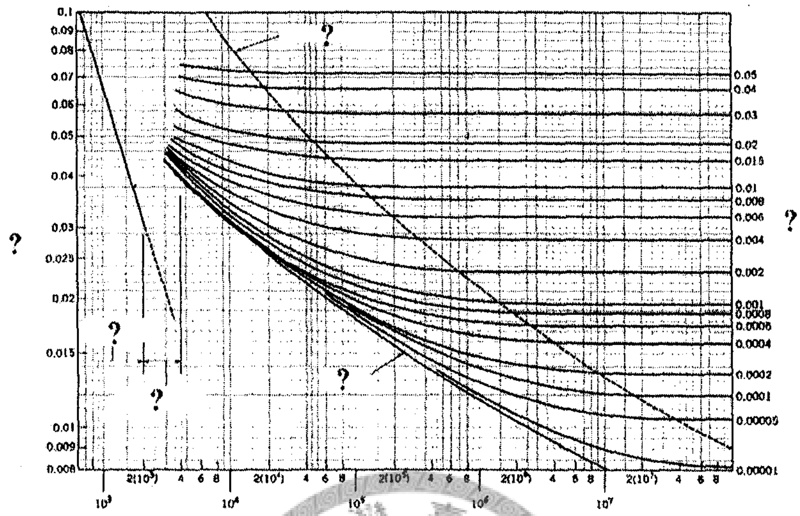

Fig. 4

Problem 4. Provide labels (legends) for the axes, parameters, curves and regimes of the Moody diagram shown above on Fig. 4.

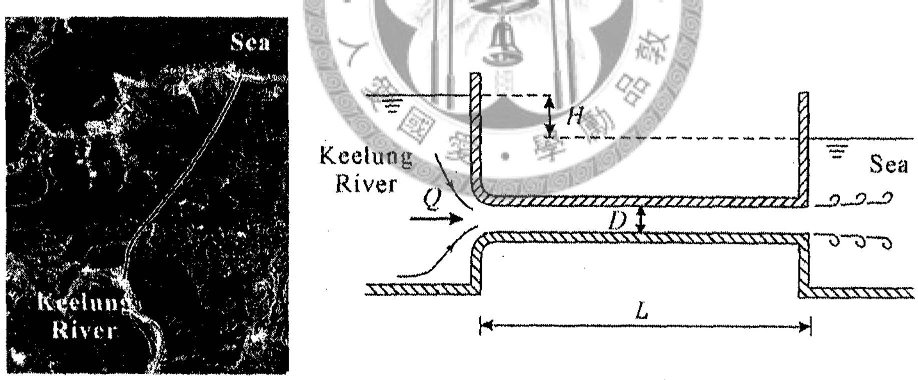

Fig. 5

Problem 5. A round pipe made of concrete diverts a discharge Q from the Keelung River to the Sea, as shown on Figure 5.

a) What is the Reynolds number of the flow in the pipe ?

b) Compute H if only major losses are considered.

c) Compute H if minor losses at the pipe exit are also included.

The following parameters are assumed: $Q = 500\ \mathrm{m}^3/\mathrm{s}$, $D = 10\ \mathrm{m}$, $L = 20\ \mathrm{km}$, roughness $\varepsilon = 1\ \mathrm{mm}$ (concrete), $\mu = 0.001\ \mathrm{Ns/m}^2$.