

EART 265 : PROBLEM SET #3

Same preamble as for Problem Set #2. You might need to do some research to get basic quantities (e.g. density of the Sun's convective zone). Keep it to a minimum, and be clear on what you looked up. **Due date : Thursday, March 6.**

PROBLEM 1: Estimate the (i) *Kolmogorov length scale* and (ii) *dissipation rates* for the following flows: (a) air near the top of a deep tropical thunderstorm; (b) coastal ocean; (c) the Sun's convective zone; (d) Red Spot of Jupiter. [L]

PROBLEM 2: The LA Aquaduct transports water from the Sierra Nevada to Los Angeles, and is a key source of water to the LA basin. Estimate the *time* it takes for water to make this journey. Assume that there are no pumps along the way (which is mostly true), and therefore the flow is almost entirely gravity driven. [M]

PROBLEM 3: Estimate the *instantaneous* and *time-average power requirement* of the human heart for pumping blood around the circulatory system. [M]

PROBLEM 4: Figure 1 illustrates a channel in Hawaii with lava flowing in it. The channel has a width ℓ . When the channel turns a corner, the maximum height up the wall is 2ℓ , and can be measured afterwards. Estimate the *velocity* and *flowrate* of lava in this channel. Substitute $\ell = 5$ m to your solution to yield typical values. [L]

PROBLEM 5: Wind blows over the Sierra Nevada. This leads to strong vertical shear on the lee side. Estimate *how far* downwind of the mountain range the shear-generated turbulence propagates. [S]

PROBLEM 6: Estimate the *Bowen Ratio* for the (putative) ethane lakes on Titan. [M]

PROBLEM 7: Estimate the *difference in CO_2 concentration* between the forest floor and a location well above the forest canopy (but still in the boundary layer). [M]

PROBLEM 8: Suggest, and provide a solution for, a medium-size order-of-magnitude problem on a topic relating generally to fluids. The question should be similar to those above, and will be graded on its originality as well as the solution approach. [L]

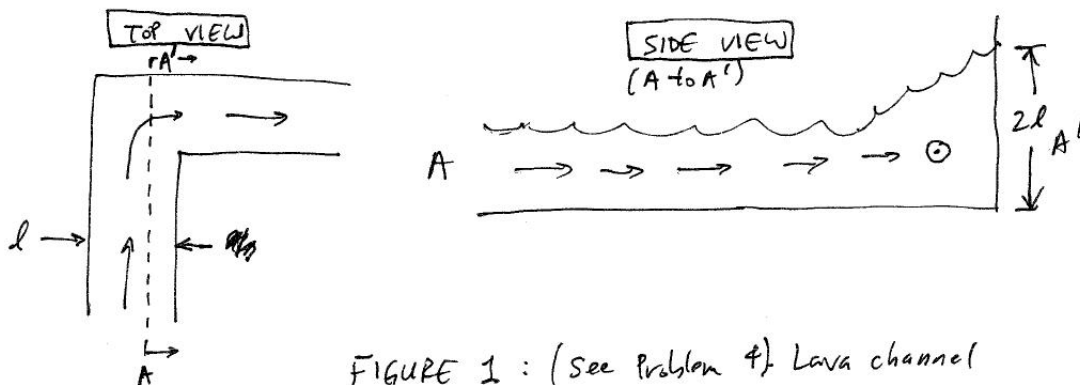


FIGURE 1 : (See Problem 4) Lava channel