4.8: Qualitative questions

These qualitative questions are for advanced students and for those who would like to prepare themselves preliminary examinations (Ph.D. examinations).

1. The atmosphere has different thickness in different locations. Where will be atmosphere thickness larger in the equator or the north pole? Explain your reasoning for the difference. How would you estimate the difference between the two locations.

2. The author's daughter (8 years old) stated that fluid mechanics make no sense. For example, she points out that warm air rises and therefore the warm spot in a house is the top floor (that is correct in a 4 story home). So why when there is snow on high mountains? It must be that the temperature is below freezing point on the top of the mountain (see for example Mount Kilimanjaro, Kenya). How would you explain this situation? Hint, you should explain this phenomenon using only concepts that were developed in this chapter.

3. The surface of the ocean has spherical shape. The stability analysis that was discussed in this chapter was based on the assumption that surface is straight. How in your opinion the effect of the surface curvature affects the stability analysis.

4. If the gravity was changing due to the surface curvature what is the effect on the stability.

5. A car is accelerated (increase of velocity) in an incline surface upwards. Draw the constant pressure line. What will constant pressure lines if the car will be driven downwards.

6. A symmetrical cylinder filled with liquid is rotating around its center. What are the directions of the forces that acting on cylinder. What are the direction of the force if the cylinder is not symmetrical?

7. A body with a constant area is floating in the liquid. The body is pushed down of the equilibrium state into the liquid by a distance \(l\). Assume that the body is not totally immersed in the liquid. What are simple harmonic frequency of the
body? Assume the body mass is \( m \) and volume is \( V \). Additionally assume that the only body motion is purely vertical and neglect the add mass and liquid resistance.

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