# UP201: Introductory Physics III

*IISc Bangalore*

*Semester I, 2017–2018*

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PROBLEM SET 0, FINISH BY: AUG. 15, 2017

**A request:** Please try to work out the problems, as far as possible, by yourself (discuss with friends, if necessary). Please do not give in to your urge to "google out the answer".

**A note on the problems:** Problems are marked by C, T, C/T or E. C means that the problem is *conceptual*, i. e., it helps you to understand and use the conceptual ideas of the subject. Such problems, usually, will not involve long calculations. On the other hand, problems marked with a T have primarily *technical* content. They should help you familiarise with a calculational technique that has been either discussed in class, or is newly introduced in the problem. A suggestion to approach the T problems is to reason out what the answers *ought to be* by conceptual arguments, i. e., always do the physics before you do the math. C/T problems involve both. E stands for *exploratory*, i. e., that will point you to material elsewhere or ask you a question to ponder and think about.

As noted we will follow the book by **Serway and Jewett, 7th edition** which will be indicated by SJ. Problems/Questions from the book will be indicated by SJ-19-Q10 which means Question 10 from Chapter 19, or SJ-19-P14 means Problem 14 from chapter 19.

**Reading:** SJ, Chapter 19.

0/1. **(C) Conceptual ideas:**

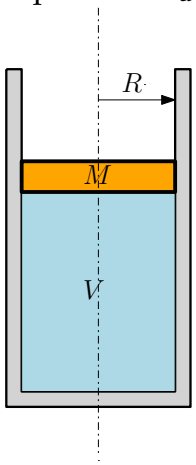
(a) SJ-19-Q3
(b) SJ-19-Q7
(c) SJ-19-Q10
(d) SJ-19-Q11
(e) SJ-19-Q12
(f) SJ-19-Q13

0/2. **(C/T) Problems – real and reel life!**

(a) SJ-19-P5
(b) SJ-19-P7
(c) SJ-19-P17
(d) SJ-19-P18
(e) SJ-19-P39

0/3. **(E) Sun's temperature:** An estimate of the Sun's interior temperature was mentioned in class. How can this be measured?

0/4. **(C/T) Air cushion:** You may have seen "luxury" buses with markings like "air suspension". Lets make a model of how this works. Consider a cylinder of radius R containing air, and the disk of mass M fits the opening of the cylinder perfectly (both the disk and cylinder are made of the same material, say!). If the cylinder is carefully placed, the final equilibrium state is such that the gas inside occupies a volume V and is in thermal equilibrium with atmosphere at temperature $T_a$.




(a) The disk may be disturbed (say by a bump). Assuming the vertical motion of the cylinder (remember we are on earth!) is such that the gas is always in thermal equilibrium with the atmosphere at $T_a$, find frequency of oscillation of M if it is disturbed.

(b) Will this make for a good "air suspension"? Justify.

(c) Do you think you will get a better suspension on a warmer day or a cooler day? Justify.

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