



# Problem Statement: PhysX GC 2017

## Maths & Physics Club

**Design experimental setups to realise both of the below adhering to the respective rules.**

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1. Demonstrating the Kapitza Pendulum experiment (60 Marks)

Kapitza pendulum is a rigid pendulum in which the pivot point vibrates in the vertical direction. The vibration of the base causes the pendulum to balance stably in the inverted position, with the bob above the suspension point. That is due to the vibrating pivot the unstable equilibrium becomes a stable equilibrium. **The task is to demonstrate the Kapitza Pendulum and the stability of the inverted position.** [Wikipedia article](#).

Youtube video : [https://www.youtube.com/watch?v=is\\_ejYsvAjY](https://www.youtube.com/watch?v=is_ejYsvAjY)

- 1.1. The components have to be discrete, i.e, the setup for building the vibrating base cannot be pre-purchased.
  - 1.2. Marks will be awarded subjectively based on stability and number of suspended bodies.
  - 1.3. **Bonus: Build a double Kapitza pendulum and demonstrate its stability.**
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2. Creating a mechanism for measuring very small masses (40 Marks)

Design a setup to measure very small masses (of the order of  $10^{-5}$  to  $10^{-4}$  gram - approximately the mass of a strand of hair or a grain of salt). In the market the digital weighing scales can measure accurately up to 0.1 gm, keeping this as the basis marks will be given accordingly.

- 2.1. The components have to be discrete. **The judges reserve the right to deduct marks of excessive use of purchased compound parts.**
  - 2.2. Marks will be awarded based on the smallest mass that can be measured with an error of 10%. Standard weights will be brought in for the purpose.
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# General Rules

- Teams will have to **submit their final abstracts** which should consist of the idea, method of implementation, main concept which will be used, some basic calculations if required and basic details of the team. **Deadline : 22 Jan 2017**
  - **The final experiment will be judged sometime in first weekend of February.**
  - For your experiment, you need to prepare a presentation which would consist of the physical explanation of the experiment.
  - The experiments would be judged by professors and it is extremely important that the experiment is in working condition.
  - Teams are expected to work in the hostel tech rooms. Apart from this, the teams can work in TL or ask TL to provide necessary equipment.
  - Wall Sockets are preferred over portable batteries for power requirements. If you need multiple sockets, or high-amp ones, please let us know with the abstract.
  - The whole experiment should not be more than  $1 m^3$ .
  - **5% of the credit is reserved for completing a fraction of the work one week before the competition.**
    - This 5% would be awarded in binary - it's all or nothing!
    - The concept and design (with dimensions, materials, etc) amounts to 5% of the work. Because ideas are a dime a dozen, the people who implement them are priceless!
    - Procuring the required materials amount to another 10%. Because the hardest thing to do is to start.
    - Progress in building the setup amounts to another 5%.
    - Representatives from the Maths and Physics club will be visiting the hostels one week before the final presentation. The marks will be awarded if the majority decides that the team met the above mentioned criteria.
    - To ensure fairness, **no two representatives from the Maths and Physics Club will be from the same hostel.**
  - **Scoring -**
    - **The GC will be judged by Professors.**
    - Experimental technique used
    - Subjective judgment by Professors, different physical quantities might get different marks due to different difficulty level of the experiment.
    - Degree of innovation.
  - Maths and Physics Club has the final authority to disqualify/penalise any team based on its own judgement, in case of violation of integrity and the spirit of the contest. In any case of dispute, the decision of the managers will be final and binding.
  - **A working video of the setup should be made beforehand.** This will serve as a documentation for both you, and the community. Also, a good evaluation scheme in case of last minute failures.
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