Physics Detective 2019

Maths and Physics Club, IIT Bombay

29th September, 2019

Name:

E-mail:

1. **Whimsical Stick**

   (a) Why does the propeller rotate?

   (b) What does one need to do to change the direction?

   (c) How does the above action actually change the direction?

2. **Catch It If You Can!**

   (a) Suggest a way to throw the ball up such that it becomes simple to catch it at the tip.

(b) Why does the above way actually make it simple?

3. **The Tom and Jerry Show**

(a) Is there a reason some droplets chase each other and others merge?

(b) How do the permanent marker lines create a 'racetrack' for the 'chase' demonstrated?

4. **Defying the laws of Newton**

(a) What's the reason for the observed behavior of this System? (Hint: Don't go by the title:))

(b) Observe that the heavier arm slides only when the lighter arm is at its maximum. Why? What will happen in an ideal case (no friction)?

(c) What are the different possible trajectories of the lighter arm? (Hint: look at the phase space, a graph of velocity versus position).

5. **Small Tesla Collider**

(a) The initial ball is traveling at a low speed initially compared to the ejected ball. Is energy conserved? Justify.

(b) Do bigger magnets and bigger balls mean larger speeds? Why or why not?

(c) What can be done to improve the performance of the machine?