

To understand advanced physics, you need to be very observant as to what is going on around you! How precisely do things move? When do you feel forces on you, and what direction are those forces?

From the following list of 19 possible observations, pick 8. For each observation, write 5 - 8 sentences explaining what you did, what happened, and what specific things you observed. Record your answers in your brand new lab notebook.

1. Get a spinner toy. Play with it a lot. Look at it. Think about it. Specifically, while the toy is spinning, try moving it around, tilting it, and turning it. What do you notice? What could be going on? If possible, take the weights out of the fidget spinner. What changes?

2. Have you ever tried to balance a on bike without turning the pedals and without putting your feet on the ground? What happens?

3. Ride a bike sitting down, and standing up. Why do you think you have more power in a bike when you are standing up?

4. Watch any sports game where a ball (or a human!) flies in the air. Look at the trajectory of the ball as it moves. Draw the path that the ball takes, and comment on how it looks. In particular, any time you watch a sports game, watch the trajectories of the ball. Try looking at different sports: there are similarities between the trajectory of a home run, a 50 yard pass, and a three point shot.

5. When I was in little league, my coaches told me to “Keep your eye on the ball!” Presumably, as the ball came towards me, I was supposed to follow it with my eyes. Get a tennis ball and play catch with a friend, or simply throw a ball up in the air and catch it. Is “keeping your eye on the ball” the best strategy? Should you follow the ball with your eyes, or do something else? Trying watching a Major League Baseball game, and see where elite hitters eyes are. Do their eyes follow the baseball to home plate, or do they watch the ball a different way?

6. The next time you are in your car, and someone presses the accelerator, what do you feel against your back? What does it feel like when someone presses the break hard?

7. Take an elevator to the top of a tall building (or any building). What do you feel when the elevator reaches the top? Now, take the elevator back down. What do you feel when it reaches the bottom?

8. Go to a playground and *swing*!

When is the chain on the string the tightest? When is the chain on the string very loose?

During the course of the string, at what point do you feel the swing pressing into you?

At what point do you feel like you are falling?

At what point are you moving the fastest? When do you stop?

9. Watch the rain on a rainy day.

How does a raindrop fall? Does it accelerate or fall at a constant speed? Do not think about the “right answer” from what you learned in class or in a textbook. Focus only on what you observe the raindrops doing. And make sure you get it right, because all of humanity depends on the answer! [That is, if the wrong answer were true, human life on earth would be very impossible.]

Which falls faster, a raindrop or a snowflake? Why do you think so?

10. If there is a thunderstorm and you can safely watch (maybe from a window), spend some time looking at the lightning bolts. (This is beautiful!)

Observe what they look like. Does the entire sky light up? Can you see individual bolts?

How long does it take the sound of the thunder to reach you?

11. Play your favorite video game, and see which laws of physics it follows correctly and which it does not:

For example, if I played Super Mario World on my SNES:

- If Mario kicks a shell, does it stay in motion until acted upon by an outside force?

- Does Mario accelerate continuously as he falls down? Does he always decelerate as he moves upward?

- If Mario jumps on something or runs into something, does that thing provide an equal and opposite force on Mario? How could I tell?

12. The next time you do laundry, when you take your clothes out of the drier, turn off the lights and close the blinds (or just do it at night). What do you see? This works especially well with a drier full of socks!

13. In drivers-ed, they tell you to use low beams, not high beams when driving in a fog. The next time you are in a fog and can safely do so, turn on your high beams for a second and find out why! What do you think is going on?

[Again, please don't do anything unsafe during this observation!]

14. The next time you see a car commercial on TV, look very carefully at the tires. Do you notice anything out of the ordinary?

15. While holding a lit candle, turn it to the side. Which way does the flame point? Why? Draw what is going on.

16. Throw a ruler up in the air so that it spins around. Look at the center of the ruler (the point about which it's spinning). What does that point do? What path does that point follow?

[This is a good experiment to compare to number 4., following the path of a ball in a sports game.]

17. The next time you are riding in a car (not driving!) that is going fast on the highway, throw a ball up in the air. Does it smack you in the face, or fall safely into your hand? If you can safely do so, throw a ball up in the air while the car is *breaking* or *accelerating*. What happens then?

18. Ride on a merry go round! While going around, which direction can you feel yourself being pulled? [Which direction is the force on you?] Also, try throwing a tennis ball in the air while on a merry-go-round. What does it do? Does it easily land back in your hand?

19. If you have a chance, go on lots of *rolling chair races*. What is the best strategy for moving a rolling chair around a turn? Which direction do you need to push? In a similar observation, try spinning while in a spinny chair with your arms far out. Pull your arms in. What happens?