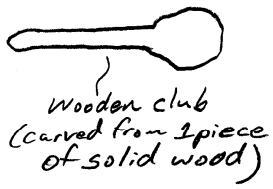
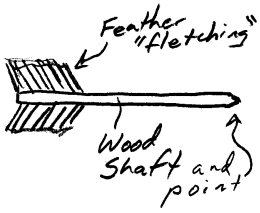
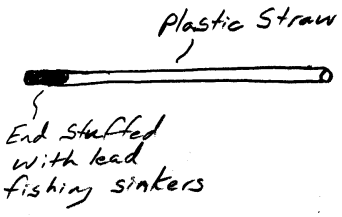
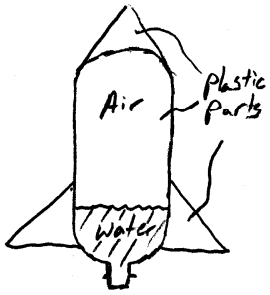
Physics
Water Rocket Notes

1. Define "center of mass."
2. Explain how to find an object's center of mass.
3. Define "center of pressure."
4. Explain how to find an object's center of pressure.
5. Label the centers of pressure of the objects on the right (use "CP
6. Label the centers of mass of the objects on the right (use "CM").
7. In order for a rocket to fly as straight as possible, it should have fins toward its back end. Explain why.
8. According to Newton's 2nd Law, F=ma. This means that, if the force is the same, a rocket with less mass should accelerate faster. If lighter rockets accelerate faster, why is it a good idea to add some extra mass, such as a rock, to your water rocket?









9. Why is it bad for your rocket to wobble, even if it generally flies straight?
10. If you're going to add a rock to your rocket, where should you add it (what part of the rocket)?
11. What is the technical term for the force of air resistance?
12. What determines the force of drag on a rocket?
13. When you make rockets, neatness counts. Why is it important for your rocket to be symmetric (balanced)?
14. What is the term for the force that pushes a rocket forward?
15. Explain how a water rocket's upward thrust is created.
16. What two things determine the amount of force pushing the water out of the bottle?
17. Rocket thrust <u>does not</u> depend on the amount of water in the rocket. So…
    a. Why doesn't a water rocket go very high when there is only compressed air in the rocket?
    b. Why doesn't a water rocket go very high when it is almost completely full of water?

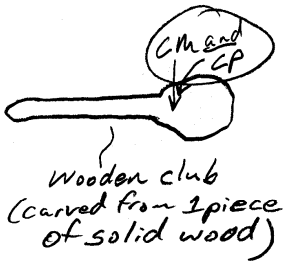
Answers:

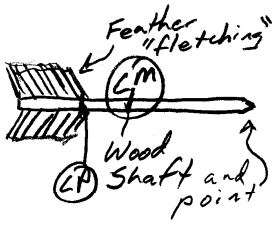
1. **The balance point of an object; the average position of all of the mass in an object.**

2. **Balance it on your finger. Once it's balanced, the center of mass will be right above your finger.**

3. **The dividing line through object where the force of wind pushing on that object is equal on opposite sides of the dividing line.**

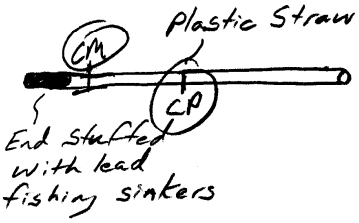
4. **Poke a pin through the object, and hold it in a wind. When neither end rotates into the wind, your pin is at the center of pressure.**

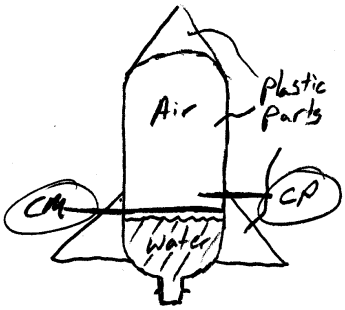




5. **CP is always nearer the big end.**
6. **CM is always nearer the heavy end.**

7.
   - **The end of the rocket with fins is biggest, so wind pushes on the fin end with the most force.**
   - **The fin end gets pushed backward, and the smaller nose end points forward.**





8.
   - **The extra mass gives the rocket more momentum.**
   - **The rocket needs this momentum to overcome air resistance.**

9. **A wobbly rocket offers more for the air to push against, so it will get slowed down more by drag (air resistance).**

10. **The nose**

11. **Drag**

12. **The rocket's velocity – faster = more drag**
   - **The rocket's overall size – larger = more drag**
   - **The rocket's shape – more "aerodynamic" (sleeker) = less drag**
   - **Density of air – more dense (lower altitude) = more drag**

13. **If the rocket is not balanced, air may push more on side than the other, causing it to curve.**

14. **Thrust.**

15.
   - **Air pressure applies a downward force that pushes water down and out of the bottle.**
   - **The "reaction" to this force is an opposite force that pushes the rocket upward.**

16.
   - **The area of the bottle neck**
   - **The pressure in the bottle**

17. a. **Air rushes out much faster than water, so the rocket thrust doesn't last very long.**
    b. **There is not much energy stored in the tiny amount of compressed air.**