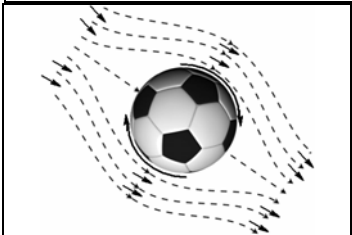


Instructions:

- Do all of your work on this sheet.
- Show all of your steps in problems for full credit.
- Be clear and neat in your work. Any illegible work, or scribbling in the margins, will not be graded.
- Place your answers in a box. Do not forget units!
- If you need more space, you may use the back of the page and write **On back** in the problem space.

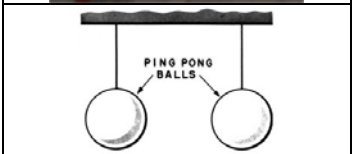
1. **Multiple Guess (3 pts)** Find the answer which best fits the question and write it in the space provided.
- The pressure at depth h in a liquid column is independent of the
 - liquid density;
 - acceleration due to gravity;
 - shape of the container the liquid is in;
 - height of the column;
 - none of these.
 - Pressure applied to an enclosed fluid is transmitted in all directions to every portion of the fluid. This effect is known as
 - Bernoulli's Principle;
 - Pascal's Principle;
 - Archimedes' Principle;
 - Newton's Principle
 - A planet is discovered and its period measured. The distance the planet is from the Sun can be determined from Kepler's
 - first law;
 - second law;
 - third law.
2. **Principles (4 pts)**



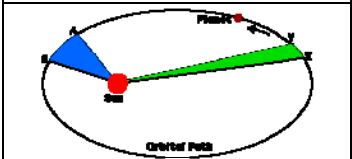
If the ball is rotating clockwise, draw the lift force direction resulting from the pressure difference between the top and bottom airflows.



If the cans are full, use physics terminology to explain why one floats.



Blow air upward between the balls. What happens to the balls?



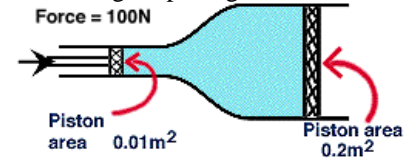
If the shaded areas are the same, then what can you say?

Bonus: Jupiter takes 11.9 years to revolve around the sun. What is the mean distance of Jupiter from the sun in AUs? (1 AU = mean distance between the Earth and the Sun.)

Constants: $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$, $M_E = 5.98 \times 10^{24} \text{ kg}$.

3. **Problems (13 pts)**
- Find the pressure at the 3.0 m end of a swimming pool given that the surface is at sea level. (Give the answer in Pascals.)

- Given the input force and piston areas in the below figure, determine the output force at the larger opening.



- Global Positioning System (GPS) satellites circle the Earth at 26,560 km from the center of the planet. How fast must they be moving to maintain a circular orbit?

- On an episode of Mythbusters, Adam and Jamie constructed a cube-shaped lead balloon using lead foil to bust the phrase "going over like a lead balloon". Their balloon consisted of 11.0 kg of lead foil with a surface area of 59.0 m² and a volume of 28.3 m³.
 - If helium has density 0.179 kg/m³, what is the total weight of the filled balloon (helium plus lead)?

- If air has density 1.28 kg/m³, what is the buoyant force of the helium filled balloon?

- If the lead balloon can rise, then how much extra weight can it carry?

- Water flows 0.410 m from point A to B with $v_A = 5.00 \text{ m/s}$ and $v_B = 3.00 \text{ m/s}$. Determine the pressure difference $P_B - P_A$.

