

1. (2 points) What is the normal force and how does it relate to (simple) friction?
2. (2 points) When a bottle of vinegar both the vinegar and the glass bottle expand, but the vinegar expands significantly more than the glass. Explain why the bottle would break if it were filled to the brim and tightly capped.
3. (1 point) Centripetal force is directed towards the center of circular motion. Explain why you instead seem to feel a force directed outward when driving around a corner.

4. (2 points) A wooden box is sliding down a wooden board propped up at an angle of 30° above the horizontal. What is the acceleration of this box, given that the coefficient of kinetic friction is 0.3 for wood on wood? (Note that you do not need to know the mass of the box to find the acceleration)
5. (3 points) What is the terminal velocity of a sphere of steel with radius 1.00 m? The density of steel is 8050 kg/m^3 , the density of air is 1.21 kg/m^3 , and the drag coefficient for a sphere is 0.45. (Recall that the area of a circle is $A=\pi r^2$ and the volume of a sphere is $V=(4/3)\pi r^3$.)

6. (2 points) What is the acceleration of gravity at the surface of the sun? The sun has a mass of 1.989×10^{30} kg and a radius of 6.9634×10^8 m.

7. (3 points) A toy car is made to go in a circle by attaching it to a nylon string. If the car has a mass of 0.25 kg and it makes one revolution every 2 s and the string is 1 m long, what is the force of tension in the string?

8. BONUS (2 points) The Young's modulus of nylon is 5×10^9 N/m². By how much does tension cause the string in problem 7 to stretch?