

Pascal's Principle

Directions to practice problems: To receive credit you must show your work, round to the hundredths and label your answer with the correct unit.

1. According to Pascal, pressure applied to a fluid _____
2. To calculate pressure, what two variables do you need to know? _____ and _____
3. What is the SI unit for pressure? _____
4. Explain the following using Pascal's Principle:

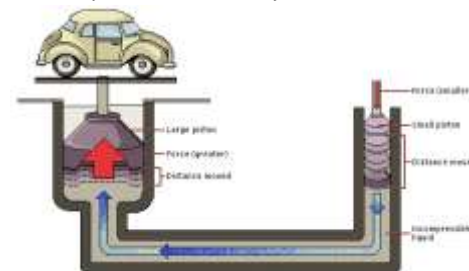
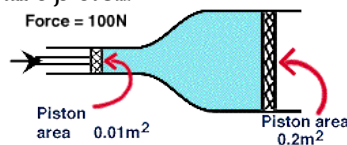


✓ squeezing a tube of tooth paste.



✓ a hypodermic needle

4. The lift cylinder is 25 cm^2 and the small cylinder is 1.25 cm^2 . How much force would need to be applied to lift a 6000 N car?
5. A hydraulic lift is used to lift a heavy machine that is pushing down on a 5.5 m^2 piston A_1 with a force F_1 of 750 N . What force F_2 needs to be exerted on a 0.0072 m^2 piston A_2 to lift the machine?
6. Water is sandwiched between the pistons. The areas of the 2 pistons are shown in the diagram below. Say you apply a force of 100 N on the small piston. What pressure does this piston produce on the enclosed water?
7. The small and large pistons of a hydraulic press have areas of 2 cm^2 and 4 cm^2 . If the load on the large piston is 3200 N , what is the input force (effort) that must be applied on the small piston?
8. A hydraulic car lift has a pump piston with area $A_1 = 0.0120 \text{ m}^2$. The resultant piston has an area of $A_2 = 0.150 \text{ m}^2$. The total weight of the car and plunger is $F_2 = 2500 \text{ N}$. If the bottom ends of the piston and plunger are at the same height, what input force is required to stabilize the car and output plunger?



9. A hydraulic lift is used to lift a heavy machine that is pushing down on a 3.2 m^2 piston A_1 with a force F_1 of 1200 N. What force F_2 needs to be exerted on a 0.0068 m^2 piston A_2 to lift the machine?
10. A hydraulic lift is used to lift a heavy machine that is pushing down on a 3.5 m^2 piston A_1 with a force F_1 of 1000 N. What force F_2 needs to be exerted on a 0.0554 m^2 piston A_2 to lift the machine?
11. In changing a tire, a hydraulic jack lifts 7468 N on its large piston, which has an area of 28.27 cm^2 . How much force must be exerted on the small piston if it has an area of 1.325 cm^2 ?
12. A dentist's chair makes use of Pascal's principle to move patients up and down. Together, the chair and a patient exert a downward force of 2269 N. The chair is attached to a large piston with an area of 1221 cm^2 . To move the chair, a pump applies force to a small piston with an area of 88.12 cm^2 . What force must be exerted on the small piston to lift the chair?
13. A student in the lunchroom blows into his straw with a force of 0.26 N. The column of air pushing the liquid in the glass has an area of 0.21 cm^2 . If the liquid in the glass pushes upward with a force of 79 N, what is the area of the liquid at the surface of the glass?
14. A hydraulic lift office chair has its seat attached to a piston with an area of 11.2 cm^2 . The chair is raised by exerting force on another piston, with an area of 4.12 cm^2 . If a person sitting on the chair exerts a downward force of 219 N, what force needs to be exerted on the small piston to lift the seat?
15. In a hydraulic car lift, compressed air exerts a force on a piston with an area of 5 cm^2 that is transmitted to a second piston with an area of 100 cm^2 . How much of an applied force must be exerted on the small piston to lift a car that weighs 15567 N? What pressure produces this force?
16. A bicycle pump uses Pascal's law to operate. The air in the hose acts as a fluid and transfers force and pressure from the piston to the tire. If a pump has a piston with an area of 7.1 cm^2 , how much force must be exerted on it to create a pressure of $8.2 \times 10^5 \text{ Pa}$?