1. How is pressure related to area and force?

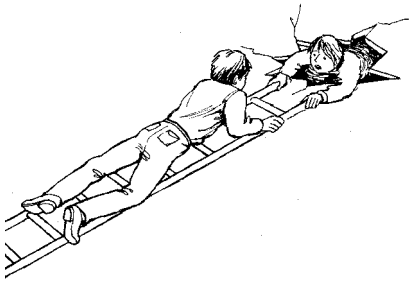
a) The greater the force exerted perpendicular over a given area, the …….. (*greater* / *smaller*) the pressure.

b) The greater the area, over which a given perpendicular force is exerted, the …….. (*greater* / *smaller*) the pressure.

c) If the force acting perpendicular to a given surface area is doubled, then the pressure is ..... (*double* / *half* / *three times* / *a third of*) the initial value.

d) If the surface area is tripled and the exerted force remains constant, then the pressure is …….. (*double* / *half* / *three times* / *a third of*) the initial value.

2. Someone's broken through thin ice on a lake. A friend is helping him, but with great caution. Explain what the person in the picture is doing and why.



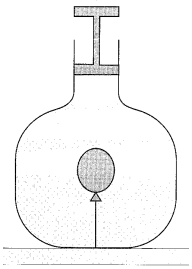
3. A carton of milk has a mass of 1.07 kg and dimensions 19.5 cm, 9.0 cm and 5.8 cm. It rests on a table on its smallest side.

a) Give the area of the carton's smallest side in cm^2 und in m^2.
b) Give the volume of the carton in cm^3 und m^3.
c) What is the weight (gravitational force) of the carton?
d) What is the pressure exerted by the carton on the table? Give your result in Pa, bar and mbar.

4. Charly (m = 45.3 kg) is standing on his snowboard, exerting a pressure of 15.2 mbar. Give the snowboard's area in m^2 und in cm^2.

5. A balloon filled with air is submerged in water. The piston exerts pressure on the water.

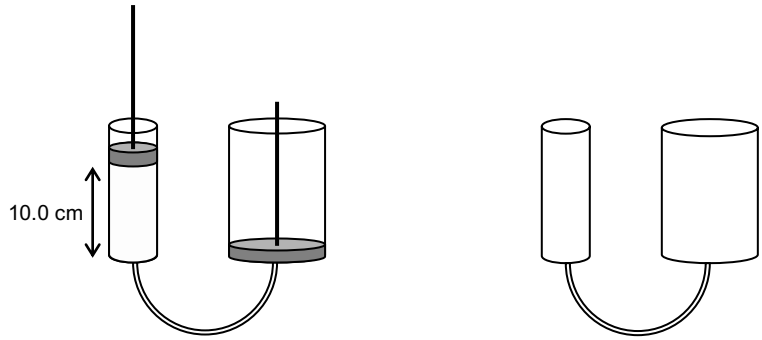
a) How does the volume of the water change? Give reasons for you answer.
b) How does the volume of the air in the balloon change? Give reasons for you answer.
c) How does the balloon's shape change? Give reasons for you answer.



6. The pressure on the inside of a bike tyre is 4.30 bar, and the air pressure on the outside is 998 mbar.

a) What is the gauge pressure in the tyre? (pressure in the tyre minus atmospheric pressure)
b) What is the force needed to keep a hole of 7.40 mm diameter tightly closed?
c) The force acting on the valve is 3.00 N. What is the diameter of the valve?

7. Here are two pistons of different diameters connected by a hose, filled with a liquid (e.g. oil). The area of the left piston ist A_{small} = 2.0 cm^2 and the area of the right piston is A_{large} = 20.0 cm^2.

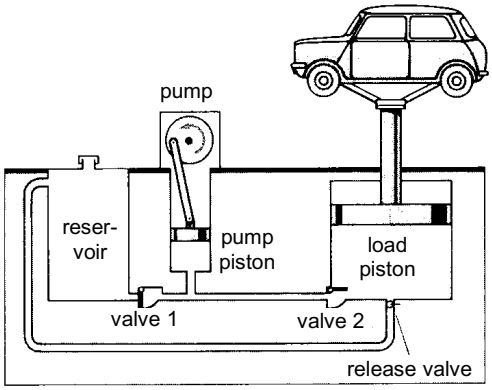


a) Imagine the left piston being pushed down completely. The liquid is moved to the rigth side and the right piston is lifted upwards.
How high does the right piston move approximately? Draw on the picture to the right what it looks like.
b) What is the pressure in the liquid if the piston to the left is pushed down with a force of 40.0 N?
c) The right piston is pushed upwards – what is the force acting on the right piston?
d) Compare the two forces. What do you notice?
e) What is the volume of the liquid?
f) How high is the right piston pushed upwards, if the left piston is pushed down completely?
g) Calulate the work done on the left side and on the right side. What do you notice?

8. Here's a car jack. Using a hydraulic press, heavy objects can be lifted with little force. All the containers and connecting tubes are filled with oil.
Look at the following link and study the functioning of a hydraulic press.

https://www.vascak.cz/data/android/physicsatschool/template.php?s=mech_lis&l=en

a) Describe what happens if the pump piston is pushed down (release valve closed):
   - Which ones of the valves do open, which ones do close?
   - Where does the oil go?
   - How does the load piston move?
b) Describe what happens if the pump piston is pulled up (release valve closed):
   - Which ones of the valves do open, which ones do close?
   - Where does the oil go?
   - How does the load piston move?
c) What happens when the release valve is opened?
d) Is the force acting on the load piston the same, larger or smaller than the force acting on the pump piston? Give reasons for your answer.



Solutions:
3. a) 52.2 cm^2 = 5.22 · 10^{-3} m^2 b) 1'018 cm^3 = 1.018 · 10^{-3} m^3 c) 10.5 N
   d) 2'011 Pa = 0.0201 bar = 20.1 mbar
4. 0.2924 m^2 = 2'924 cm^2
6. a) 3.30 bar b) 14.2 N c) 3.4 mm
7. b) 2.0 bar c) 400 N e) 20.0 cm^3 f) 1.0 cm g) 4.0 J