Under Pressure. Space School

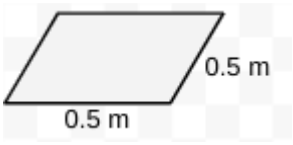
1.
The mass of books on a woman's head is 4 kg.
The bottom book has an area of 0.09 square metres.
Calculate the pressure on the woman's head caused by the books.

2.
A car has a mass of 800 kg..
Each tyre has a contact area of 0.06 square metres.
Calculate the total pressure of the car `s tyres on the road.

3.
An elephant has a mass of 4000 kg and each foot has an area of 0.18m^2. Calculate the total pressure exerted by the elephant on the ground.

4.
The atmospheric pressure on a particular day is 1.05 x 10^5 Pa.

Find the force acting on a large sheet of paper flattened out on a desk of the dimensions shown.

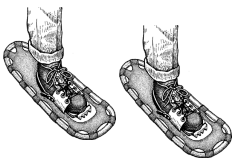


5.
The area of the point of a tack is 100 mm^2

If a force of 20 Newtons is applied to it, calculate the pressure at the point.
[1mm^2 = 1 x 10^{-6} m^2]

6.
The area of a snowshoe is 0.09 m^2

Find the total pressure exerted on snow by a person of mass 80 kg.

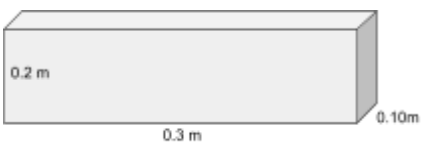


7.
A lady steps on the foot of her dancing partner without pushing down.. The lady has a mass of 60 kg.

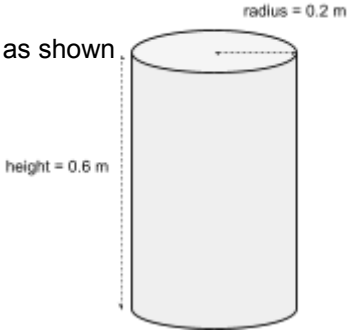
Calculate the pressure exerted by the heel of the lady if it has an area of 1 x 10^{-4} m^2

8.
A rectangular block has a mass of 10 kg and it has dimensions shown in the diagram.

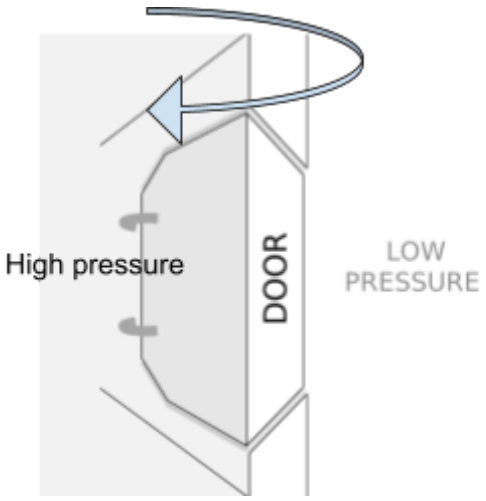
Determine the maximum pressure this block can exert on a flat surface.



9. A cylinder has the dimensions shown. It has a mass of 4 kg. Determine the pressure it exerts on a table placed as shown

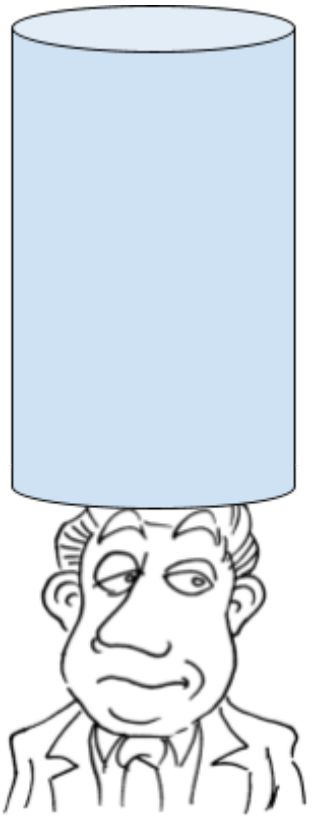


10) The outdoor pressure when a jet is flying is estimated to be 37,474 Pa. Inside the air pressure is much higher to enable the passengers to breathe properly. The inside pressure of the abin is 78,842 Pa
Jet doors can only be opened inwards.



a) Determine the resultant pressure acting on the door stating its direction.
b) Determine the force acting on the door if it has an area of 2 square metres.
c) Explain why it is impossible to open a jet door even when it is accidentally unlocked by the pilot.

11) The average air pressure on a given day might be 1×10^5 Pa



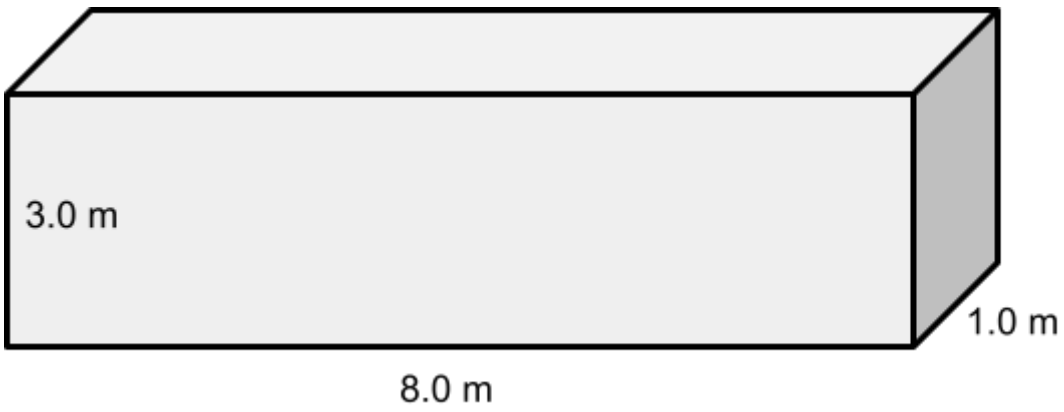
a) Determine force due to a column of air above your head given that average area of the top of a head is 0.02 m^2

b) Assuming that the air is uniformly distributed and the value of g remains constant, determine the mass of air resting on the top of the head.

c) Explain why we don't feel this weight of air on our heads.

12) Estimate the pressure on a ballerina's toe as she performs a dance.

13) Determine the maximum and minimum pressure that this 5 kg block would exert on a flat surface.



14) Four students made some observations about a phone holder suction cup. Decide which student is correct.

Answers

1) 436 N/m^2 2) 32 666 Pa 3) 54 444 N/m^2 4) 26 250 N

5) 200 000 Pa 6) 4 356 Pa 7) 5 880 000 Pa 8) 4 900 Pa

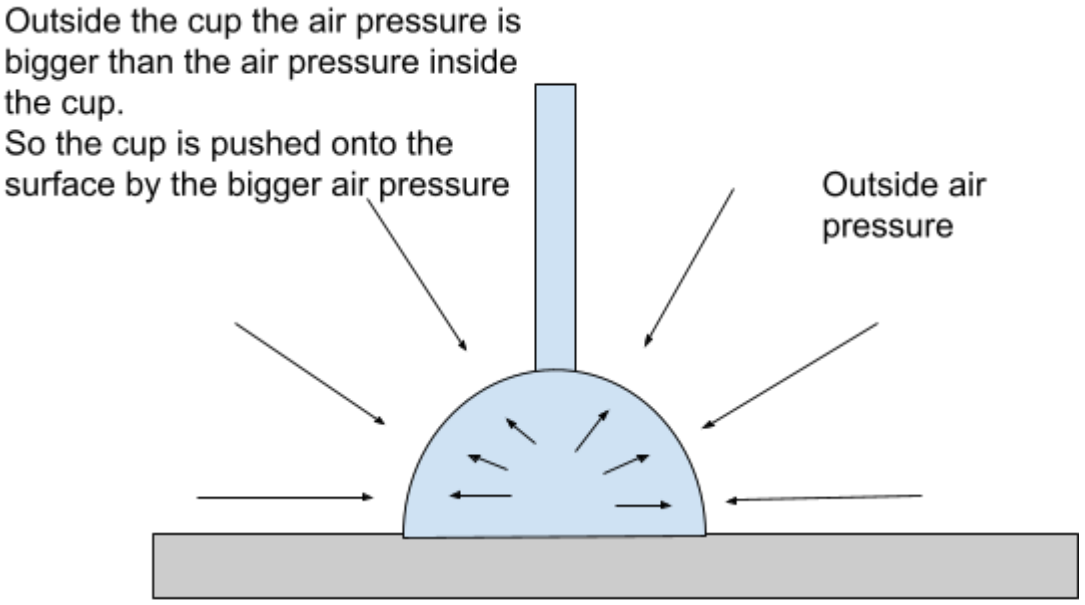
9) 312 Pa 10) a) 78 098 Pa b) 156 196 N

c) Large force pushing outwards while you are trying to pull inwards. Also the door is locked. Even if it was open you could not pull against such force.

11) a) 2000 N b) 204 kg 12) estimated 5 880 000 N/m^2

13) Max pressure = 16 Pa, minimum pressure = 2 Pa

14) Ling is correct



Air has been pushed out the cup leaving less air inside. This means there is less pressure inside the cup.