Problems on fluid pressure exclusive of external pressure (eg atmospheric pressure)

1. What does the pressure in a fluid depend on? Select the correct options.

a) ❒ the container's width
b) ❒ planet where the fluid is (e.g. moon, earth, venus etc)
c) ❒ color of the fluid
d) ❒ thickness of the container's wall
e) ❒ depth below the liquid's surface
f) ❒ the fluid's density
g) ❒ the container's shape

2. Pascal's principal says that an external pressure applied to a completely enclosed fluid is transmitted throughout the fluid.
   To be exact, Does that rule always apply? What are the conditions?

3. Why do we not need to consider atmospheric pressure when working on problems with a hydraulic press?

4. Calculate the water pressure in sea water at in 10.0 m and in 20.0 m depth.

5. Calculate the fluid pressure 10.0 cm underneath the surface of
a) alcohol
b) mercury

6. The pressure at the bottom of a jar filled with a liquid is 20.0 mbar. Calculate the height of the liquid's column if it is
a) alcohol
b) mercury

7. A little cup on the moon is filled 5.00 cm high with an unknown liquid. The pressure at the bottom of the cup is 10.98 mbar.
   What is the density of the liquid? What liquid is it?

Problems on fluid pressure including external pressure (eg atmospheric pressure)

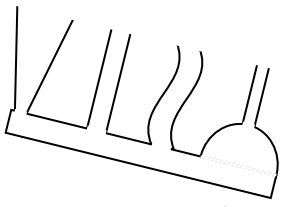
For atmospheric pressure use p = 1.00 bar

8. Calculate the total pressure (including atmospheric pressure) using the „diver's rule" when diving down to
a) 5 m
b) 10 m
c) 100 m

9. On January 23rd 1960 Jacques Piccard and Don Walsh dove down to a depth of 10'907 m in the Mariana drench in the Pacific Ocean. The windows' area of the Trieste was 1260 cm^2.
a) What is the total pressure at this depth?
b) Calculate the force acting on the window at this depth, assuming the pressure inside the Trieste was 1.00 bar.

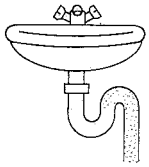
10. An aquarium filled with water has a height of 40.0 cm and width of 60.0 cm.
a) What is the total pressure at the bottom of the aquarium?
b) What is the fluid pressure (without atmospheric pressure) at half the height of the aquarium?
c) What is the force exerted on one of the walls of the aquarium?
d) Why do we not take atmospheric pressure into account when calculating c)?

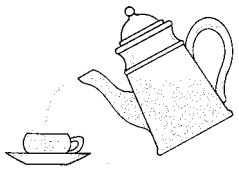
Problems on pressure equilibrium

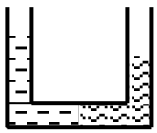
11. 

These connecting vases are filled with oil. Draw a possible surface of the liquid.

12. Here are two examples of connecting vases.
a) Draw the water's surface in the picture.
b) What is their purpose?

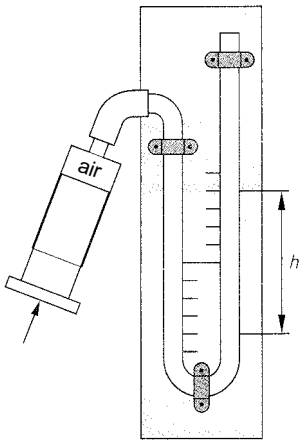




13. 

Here the levels of the liquids are at different heights. Why? Give options what liquids could possibly work for this situation.

14. Here's a tube shaped like a U. Air is being pressed into the tube by the syringe. The water is displaced and the liquid's surface on the right side is h = 55 cm higher than on the left side. Atmospheric pressure is 1.00 bar.
a) Draw the distribution of the water in the tube on the picture.
b) At what height is the pressure's value equal on either side? Draw it on the picture.
c) What is the fluid pressure in the water at the point where pressure is equal on both sides of the tube?
d) What is the total pressure at the level of equal pressure on the right side?
e) What is the total pressure inside the left part uf the U-shaped tube?
f) What is the gauge pressure of the air in the syringe?



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solutions

1. b), e) f)
4. 10 m depth: 1.01 bar, 20 m depth: 2.02 bar.
5. a) 7.74 mbar b) 133 mbar
6. a) 25.8 cm b) 1.50 cm
7. $13.6 \cdot 10^3 \frac{kg}{m^3}$, mercury
8. a) 1.5 bar b) 2.0 bar c) 11 bar
9. a) 1'103 bar b) $13.9 \cdot 10^6$ N
10. a) 1'039 mbar b) 1'958 Pa c) 470 N
14. c) 54 mbar d) 1.054 bar e) 1.054 bar f) 54 mbar