1. Atmospheric pressure and height.

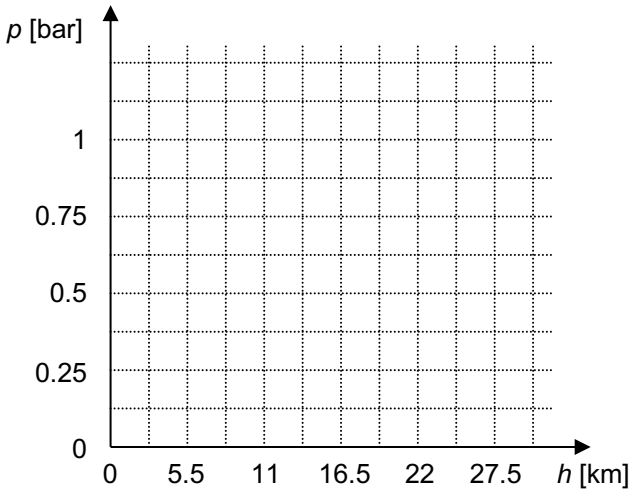
a) What is the atmospheric pressure at sea level, 5'500 m above sea level, 11'000 m above sea level, 16'500 m above sea level, and 22'000 m above sea level?

b) At what height above sea level is the atmospheric pressure 15.83 mbar?

c) Plot the relationship between atmospheric pressure and height in the diagram to the right.

d) Determine from the diagram the approximate value of atmospheric pressure at 2'750 m above sea level.

e) Determine from the diagram the height above sea level, at which the atmospheric pressure is 375 mbar.



2. Suction cups can only be used on a very smooth surface. Why? Why does a suction cup stick to the wall? Explain without using the word *suction*.

3. Vacuum packing has a great advantage in storing food: Air is removed and bacterial growth is inhibited. The contents are sealed in a plastic bag which fits tightly to the contents. Explain why atmospheric pressure is important in vacuum packaging.

4. The Magdeburg hemispheres (A = 1'170 cm^2) were pressed together with a force of 11.2 kN. The atmospheric pressure was 999 mbar.

a) What was the gauge pressure (difference in pressure between the inside of the sphere and atmospheric pressure?

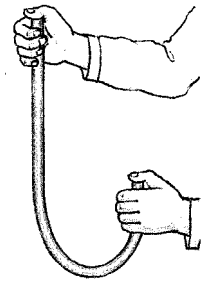
b) What was the pressure on the inside of the sphere?

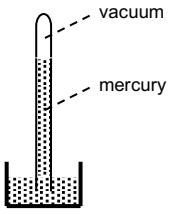
5. Fill a hose with water and close it at both ends with your thumbs. Then hold it as in the picture.

a) What happens if you open the lower end of the hose? Why?

b) What happens if you open the higher end of the hose (keeping the lower end open)? Why?

c) What would have happened on the moon (without atmospheric pressure)?



6. 

What is the height of the mercury column on Mount Everest (p = 335 mbar)?

7. A syringe is easily filled with water.

a) Explain the process without using the word *suction*.

b) Would it be possible to fill a syringe with water on the moon just as easily as on earth? Give reasons for your answer.

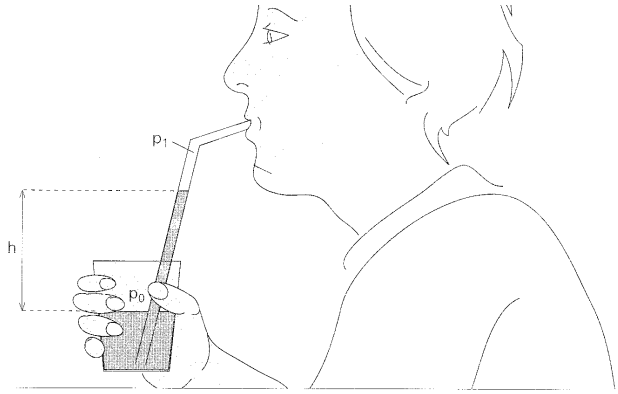
8. Drinking water through a straw at sea level.

a) Explain the process without using the word *suction*.

b) What is the atmospheric pressure p_0 at the surface of the water (outside the straw?

c) Calculate the fluid pressure at the surface of the water column inside the straw (h = 20.0 cm).

d) At the water surface the pressure must be the same inside and outside the straw. The pressure of the water column and the pressure p_1 in the upper part of the straw add up to equal the atmospheric pressure p_0.
What is the pressure p_1?



e) What is the gauge pressure in the upper part of the straw? (Difference between atmospheric pressure and pressure inside the upper part of the straw)

f) Would it be possible to drink through a straw on the moon? Give reasons for your answer.

solutions

1. a) 1'013 mbar, 506.5 mbar, 253.3 mbar, 126.6 mbar. 63.3 mbar b) 33'000 m above sea level
   d) ca. 750 mbar e) ca. 7'000 m above sea level
4. a) 957 mbar b) 42 mbar
6. 25 cm
8. b) 1.013 bar c) 1'958 Pa d) 99.3 kPa e) -1'958 Pa