1. a) The greater the force exerted perpendicular over a given area, the *greater* the pressure.
   b) The greater the area, over which a given perpendicular force is exerted, the *smaller* the pressure.
   c) If the force acting perpendicular to a given surface area is doubled, then the pressure is *double* the initial value.
   d) If the surface area is tripled and the exerted force remains constant, then the pressure is *a third of* the initial value.

2. By increasing the area over which the force is exerted the pressure is reduced. Thus the danger of breaking through the ice becomes less.

3. a) $A = s_1 \cdot s_2 = 5.8\ \text{cm} \cdot 9.0\ \text{cm} = \underline{52.2\ \text{cm}^2}$

   $A = s_1 \cdot s_2 = 0.058\ \text{m} \cdot 0.090\ \text{m} = \underline{0.00522\ \text{m}^2} = \underline{5.22 \cdot 10^{-3}\ \text{m}^2}$

   b) $V = s_1 \cdot s_2 \cdot s_3 = 5.8\ \text{cm} \cdot 9.0\ \text{cm} \cdot 19.5\ \text{cm} = \underline{1'018\ \text{cm}^3}$

   $V = s_1 \cdot s_2 \cdot s_3 = 0.058\ \text{m} \cdot 0.090\ \text{m} \cdot 0.195\ \text{m} = \underline{0.001018\ \text{m}^3} = \underline{1.018 \cdot 10^{-3}\ \text{m}^3}$

   c) $F_G = m \cdot g = 1.07\ \text{kg} \cdot 9.81\ \frac{\text{m}}{\text{s}^2} = \underline{\underline{10.5\ \text{N}}}$

   d) $p = \frac{F_N}{A} = \frac{10.5\ \text{N}}{5.22 \cdot 10^{-3}\ \text{m}^2} = \underline{\underline{2'011\ \text{Pa}}} = \underline{\underline{0.0201\ \text{bar}}} = \underline{\underline{20.1\ \text{mbar}}}$

4. $A = \frac{F_N}{p} = \frac{F_G}{p} = \frac{m \cdot g}{p} = \frac{45.3\ \text{kg} \cdot 9.81\ \frac{\text{m}}{\text{s}^2}}{15.2 \cdot 10^{-3} \cdot 10^5\ \text{Pa}} = \frac{45.3\ \text{kg} \cdot 9.81\ \frac{\text{m}}{\text{s}^2}}{15.2 \cdot 10^2\ \text{Pa}} = \underline{\underline{0.2924\ \text{m}^2}} = \underline{\underline{2'924\ \text{cm}^2}}$

5. a) The volume of the water doesn't change. Water is a liquid and liquids can hardly be compressed because the distances between particles are small.
   b) The volume of the balloon decreases. Air is a gas and gases are easily compressed because the distances between particles are large.
   c) The shape doesn't change. According to Pascal's principle the pressure in the water is the same at every point of the liquid.

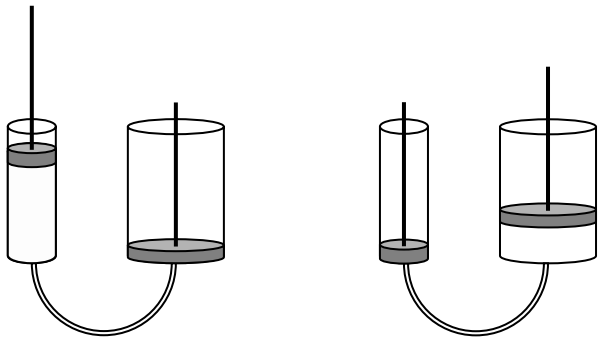
6. a) $p_{outside} = p_{tyre} - p_{inside}$ = 4.30 bar - 0.998 bar = <u>3.30 bar</u>

b) $F = p \cdot A = p \cdot \pi \cdot r^2 = 3.30 \cdot 10^5 \text{ Pa} \cdot \pi \cdot (3.7 \cdot 10^{-3} \text{ m})^2 =$ <u>14.2 N</u>

c) $p = \frac{F}{A} = \frac{F}{\pi \cdot r^2} \quad \Rightarrow \quad r = \sqrt{\frac{F}{\pi \cdot p}} = \sqrt{\frac{3.0 \text{ N}}{\pi \cdot 3.30 \cdot 10^5 \text{ Pa}}} = 1.7 \cdot 10^{-3} \text{ m} = 1.7 \text{ mm}$

$d = 2 \cdot r = 2 \cdot 1.7 \text{ mm} =$ <u>3.4 mm</u>

7. a)



The volume of the liquid remains the same. Therefore the piston on the right doesn't rise as high as on the left side.

b) $p = \frac{F_{left}}{A_{small}} = \frac{40.0 \text{ N}}{2.0 \text{ cm}^2} = \frac{40.0 \text{ N}}{2.0 \cdot 10^{-4} \text{ m}^2} =$ <u>200'000 Pa</u> = <u>2.0 bar</u>

c) $F_{right} = p \cdot A_{large} = 2.0 \cdot 10^5 \text{ Pa} \cdot 20.0 \text{ cm}^2 = 2.0 \cdot 10^5 \text{ Pa} \cdot 20.0 \cdot 10^{-4} \text{ m}^2 =$ <u>400 N</u>

d) F_{right} is ten times larger than F_{left}.

e) $V = A_{small} \cdot h_{left} = 2.0 \text{ cm}^2 \cdot 10.0 \text{ cm} =$ <u>20.0 cm^3</u>

f) $h_{right} = \frac{V}{A_{large}} = \frac{20.0 \text{ cm}^3}{20.0 \text{ cm}^2} =$ <u>1.0 cm</u>

g) $W_{left} = F_{left} \cdot s_{left} = 40.0 \text{ N} \cdot 0.10 \text{ m} =$ <u>4.0 J</u>

$W_{right} = F_{right} \cdot s_{right} = 400.0 \text{ N} \cdot 0.010 \text{ m} =$ <u>4.0 J</u>

8. a) Valve 1 is closed, valve 2 is open, the oil moves from the pump piston to the load piston. The load piston moves up a bit.

b) Valve 1 is open, Valve 2 is closed, the oil moves from the reservoir to the pump piston, the load piston rests.

c) Valve 2 is closed, the oil moves from the load piston to the reservoir, the load piston moves down.

d) The force acting on the load piston is larger than the force acting on the pump piston. The pressure is equal at every point of the liquid and therefore a large force exerted over a large area equals a small force exerted over a small area.