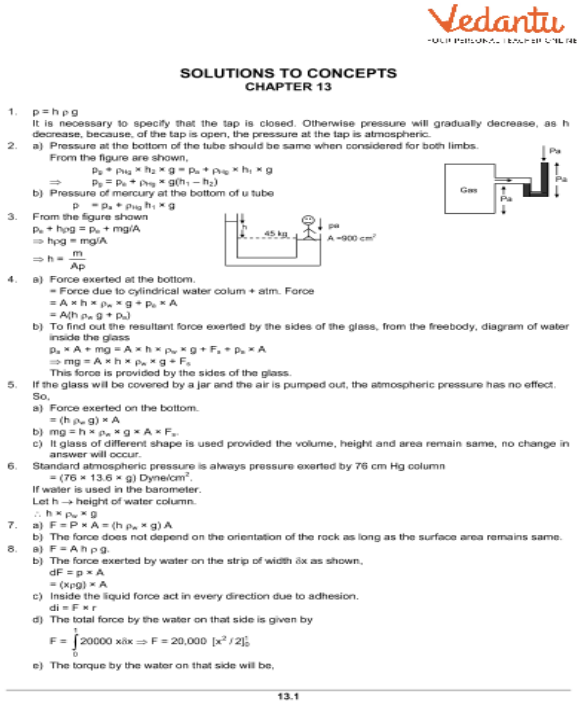
Year 13 Physics Course Manual Without Answers



SOLUTIONS TO CONCEPTS
CHAPTER 13

1. $p = h \rho g$
   It is necessary to specify that the tap is closed. Otherwise pressure will gradually decrease, as h decrease, because, of the tap is open, the pressure at the tap is atmospheric.
2. a) Pressure at the bottom of the tube should be same when considered for both limbs.
   From the figure are shown,
   $p_a + \rho_{Hg} \times h_2 \times g = p_a + \rho_{Hg} \times h_1 \times g$
   $\Rightarrow \quad p_a = p_a + \rho_{Hg} \times g(h_1 - h_2)$
   b) Pressure of mercury at the bottom of u tube
   $p = p_a + \rho_{Hg}\, h_1 \times g$
3. From the figure shown
   $p_a + h\rho g = p_a + mg/A$
   $\Rightarrow h\rho g = mg/A$
   $\Rightarrow h = \frac{m}{A\rho}$
4. a) Force exerted at the bottom.
   = Force due to cylindrical water colum + atm. Force
   $= A \times h \times \rho_w \times g + p_a \times A$
   $= A(h\, \rho_w\, g + p_a)$
   b) To find out the resultant force exerted by the sides of the glass, from the freebody, diagram of water inside the glass
   $p_a \times A + mg = A \times h \times \rho_w \times g + F_s + p_a \times A$
   $\Rightarrow mg = A \times h \times \rho_w \times g + F_s$
   This force is provided by the sides of the glass.
5. If the glass will be covered by a jar and the air is pumped out, the atmospheric pressure has no effect.
   So,
   a) Force exerted on the bottom.
   $= (h\, \rho_w\, g) \times A$
   b) $mg = h \times \rho_w \times g \times A \times F_s$.
   c) If glass of different shape is used provided the volume, height and area remain same, no change in answer will occur.
6. Standard atmospheric pressure is always pressure exerted by 76 cm Hg column
   $= (76 \times 13.6 \times g)$ Dyne/cm^2.
   If water is used in the barometer.
   Let h → height of water column.
   $\therefore \quad h \times \rho_w \times g$
7. a) $F = P \times A = (h\, \rho_w \times g)\, A$
   b) The force does not depend on the orientation of the rock as long as the surface area remains same.
8. a) $F = A\, h\, \rho\, g$.
   b) The force exerted by water on the strip of width δx as shown,
   $dF = p \times A$
   $= (x\rho g) \times A$
   c) Inside the liquid force act in every direction due to adhesion.
   $dl = F \times r$
   d) The total force by the water on that side is given by
   $F = \int_0^1 20000\, x\delta x \Rightarrow F = 20{,}000\ [x^2/2]_0^1$
   e) The torque by the water on that side will be,

13.1

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