

- d. Water flows steadily through a horizontal tube which consists of two parts joined ends to end. One part is 21cm long and has diameter of 0.225 cm and the other is 7 cm long and has a diameter of 0.075 cm. If the pressure difference between the ends of the two tubes is 14cm of water, find the pressure difference between the ends of each part. 3

14. For ideal fluid, Bernoulli's principle is based on the law of energy conservation:

- a. State Bernoulli's theorem. 1
- b. Explain, in brief, the working principle of atomizer. 1
- c. It is dangerous to drive two bikes with high speed being in parallel on the road. Explain the reasons. 2
- d. Water from a tap emerges vertically downward with an initial speed of $1m/s$. The cross-sectional area of the tap is $10m^2$. Assume that the pressure is constant throughout the stream of water, and the flow is steady. What is the cross-sectional area of the stream 0.15m below the tap? 2
- e. In a normal adult, the average speed of blood through the aorta (of diameter 1.6cm) is $0.33m/s$. From the aorta, the blood goes into major arteries, which are 30 in numbers, each of 0.8cm diameter. Calculate the speed of blood through the arteries. 2
- f. Calculate the mass of an aero plane with the wings of area $55m^2$ flying horizontally. The velocity of air above and below the wings is $155m/s$ and $140m/s$ respectively. 2
- g. A helicopter of mass 2×10^4Kg has total wing area $400m^2$ and flying horizontally with average speed of $250m/s$. Find: (density of air = $1.29Kg\ m^{-3}$, $g = 10m\ s^{-2}$)
- i. Pressure difference between the lower and upper surfaces of the wings. 1
- ii. Velocity difference between the upper and lower surfaces of the wings. 1
- h. A helicopter of mass 2×10^4Kg has total wing area $400m^2$ and is flying horizontally with average speed of $250\ m/s$. Find:
- i. The pressure difference between the lower and upper surfaces of the wings. 2
- ii. Velocity difference between the upper and lower surfaces of the wings. 2
- [density of air = $1.3Kg\ m^{-3}$, $g = 10ms^{-2}$]
- i. Water flows steadily through a horizontal tube that consist of two parts joined end to end, one part is 21cm long and has a diameter of 0.225cm and the other is 7.0 cm long and has a diameter of 0.075cm. if the pressure difference between the end of the tube is 14cm of water, find the pressure difference between the ends of each part. 3

Additional questions:

Surface Tension

1. a. Although the interior and exterior pressure in a soap bubble is different, the bubble does not break. Why?
b. A tiny liquid drop is spherical but a large drop has oval shape. Why?
c. Our hairs spread when we dip into water but stick on the body when come out from the water. Why?
2. a. Explain the types of liquid meniscus in accordance with angle of contact.
b. How does the angle of contact of a liquid depend on temperature?
c. The angle of contact for a solid and liquid is less than 90° . Will the liquid wet the solid? Will the liquid rise in the capillary made of that solid?
3. A stretched layer of liquid possesses surface energy.
- a. Define surface energy. Derive an expression for it in soap bubble and in air bubble in to the liquid.
b. Prove that the surface energy and surface tension are numerically same. Explain the concept of the angle of contact, with necessary figure, when the surface of a liquid is convex if viewed from the above.