



PHYSICS

BOOKS - MAXIMUM PUBLICATION

MECHANICAL PROPERTIES OF FLUIDS

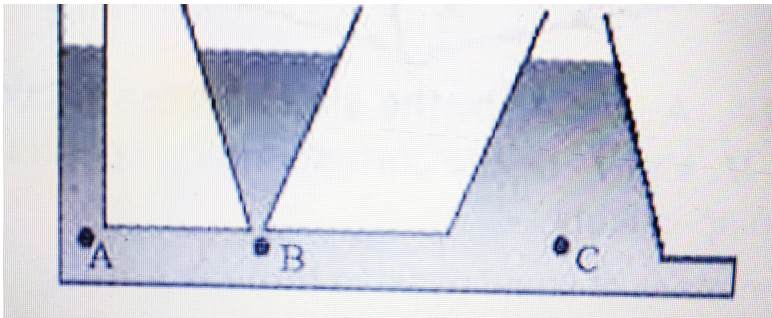
Exercise

1. When a surface is immersed in a liquid, what is the direction of pressure on the surface?



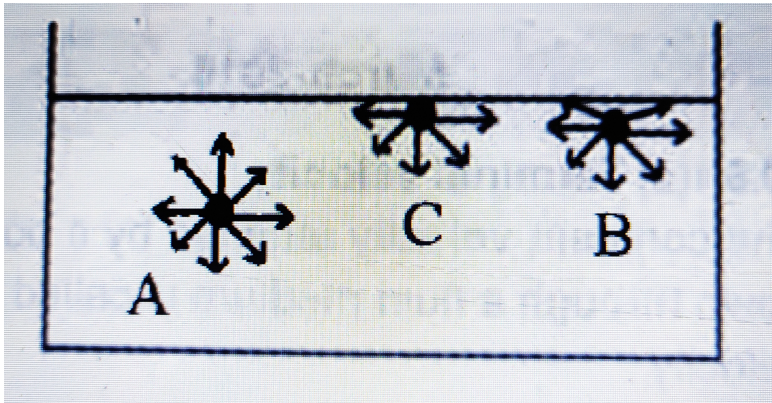
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2. In which points (see figure) pressure is maximum?



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3. What is the reason for surface tension?



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4. Show that surface tension is equal to surface energy per unit area.

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5. The velocity of water below which the flow remains a streamline flow is known as

- A. relative velocity
- B. terminal velocity
- C. critical velocity
- D. practical velocity

Answer:



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6. Bernoulli's equation for steady non viscous incompressible flow expresses the

- A. conservation of angular momentum
- B. conservation of density
- C. conservation of momentum
- D. conservation of energy

Answer:



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7. When cooking oil is heated in a frying pan, the oil moves around the pan more easily when it is hot. The main reason for this is that with rise in temperature, there is a decrease in

- A. surface tension
- B. viscosity
- C. angle of contact
- D. density

Answer:



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8. At what temperature density of air is maximum?



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9. Why do clouds float in the sky?



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10. A spinning cricket ball does not follow parabolic path.



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11. The deep water runs slow. Why?



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12. Why dust generally settles down in closed room?



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13. Why more viscous oil is used in summer than in winter in scooters?



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14. Why is sand drier than clay?



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15. Why cotton dress is preferred in summer?



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16. Why oil is poured to calm the sea?



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17. How plants draw water from ground?



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18. How do insects run on the surface of water?



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19. How ploughing a field helps to retain moisture?



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20. Hot soup tastes better than cold soup.

Why?



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21. Remya found that it piece of metal weights 210g in air and 180g when it is immersed in water. Determine the density of the metal piece.



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22. Hot soup tastes better than cold soup.

Why?



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23. Why straws are used to drink soft drinks?



[Watch Video Solution](#)

24. Why new earthen pots keeps water more cool than old earthen pots?





[Watch Video Solution](#)

25. Air is blown in between two pith balls suspended freely.

a) What will happen to the balls?

(i) They repel each other.

(ii) They attract each other.

(iii) They start oscillating.

(iv) They remain in their initial position.

(v) They fall on the ground.

b) Give your explanation.



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26. A child dipped two identical capillary tubes, one in a beaker containing mercury. He observed that water and mercury have risen through the tubes to a certain heights.

Name this phenomenon.



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27. A child dipped two identical capillary tubes, one in a beaker containing mercury. He observed that water and mercury have risen

through the tubes to a certain heights.

What difference did he observe in the shape of the meniscus of the two liquids in the tube?



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28. A child dipped two identical capillary tubes, one in a beaker containing mercury. He observed that water and mercury have risen through the tubes to a certain heights.

If he plots a graph connecting the radius of

the capillary tube and capillary height, what will be the shape of the graph?



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29. Bernoulli's theory is a consequence of energy conservation principle.

Using this theorem explain the working of atomiser.



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30. Surface tension is numerically equal to the surface energy.

Define surface tension.



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31. Derive an expression for the rise of the liquid in a capillary tube.



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32. Give reason for the following case:

It is easier to swim in sea water than in river water.



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33. Give reason for the following case:

The passengers are advised to remove ink from pen while going up in an aeroplane.



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34. A large tank containing water has a small hole near the bottom of the tank 1.5 m below the surface of water. What is the velocity of water flowing from the hole?



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35. A large tank containing water has a small hole near the bottom of the tank 1.5 m below the surface of water. Explain the principle used in deriving the velocity of water flowing from the hole.



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36. A large tank containing water has a small hole near the bottom of the tank 1.5 m below the surface of water. Where must a second hole to be drilled so that the velocity of water leaving this hole is half of water flowing through the first hole?



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37. Raindrops have an average size of 1 mm when it is formed at the upper atmosphere. Why the velocity of the raindrop is uniform?



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38. Derive an expression for the terminal velocity of a ball in terms of coefficient of viscosity of the medium.



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39. If the radius of a raindrop become half, then what happens to its terminal speed?



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40. Fill in the blanks using the word from the list appended with each statement. Viscosity of gases ... with temperature (increase /decrease)



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41. Fill in the blanks using the word from the list appended with each statement. For a fluid in steady flow the increase in flow speed at a constriction follows from ... (conservation of mass /Bernoulli's theorem)



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42. Fill in the blanks using the word from the list appended with each statement. The working of a hydraulic lift is based on ...

(Pascal's law /principle of Conservation of Energy)



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43. How do insects run on the surface of water?



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44. A child dipped two identical capillary tubes, one in a beaker containing mercury. He

observed that water and mercury have risen through the tubes to a certain heights.

Name this phenomenon.



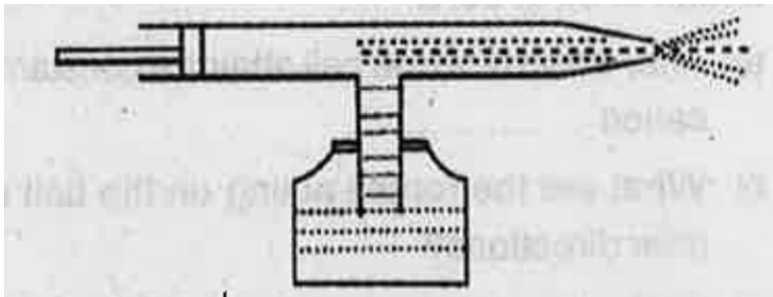
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45. A girl dips a thin capillary tube in water. Water rises through it. How does this rise vary with the diameter of the tube?



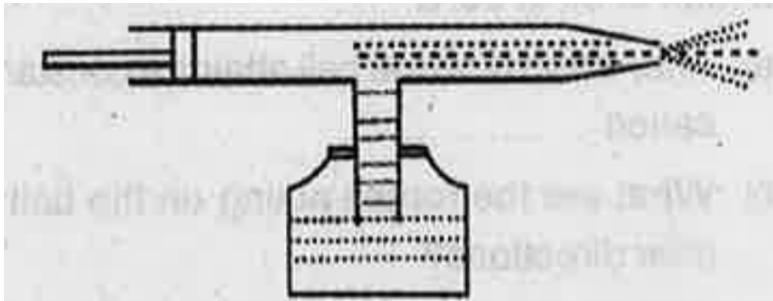
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46. The schematic diagram of a sprayer atomiser is given below. Name the principle of working of this device from the following :
(i)Surface tension (ii)Viscosity (iii)Bernoulli's principle (iv)Archimedes principle.



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47. The schematic diagram of a sprayer atomiser is given below. Write its mathematical expression.



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48. Wings of an aeroplane are curved outwards while flattened inwards. Why?

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49. During wind storms roofs of certain houses are blown off without damaging other part of the houses. Name the theory which explains this phenomenon.



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50. During wind storms roofs of certain houses are blown off without damaging other part of the houses. State the theorem.



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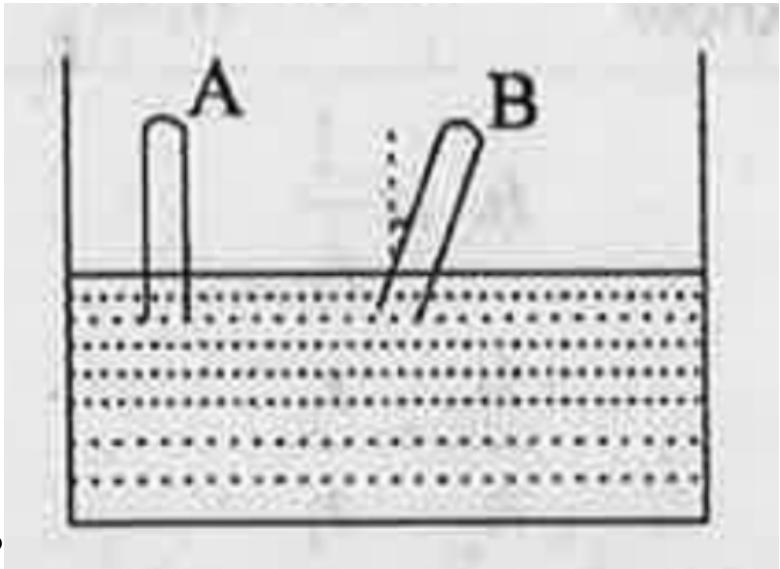
51. During wind storms, roofs of certain houses are blown off without damaging other part of the houses. Explain this phenomenon on the basis of this theorem.



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52. Two thin evacuated (one end closed) glass take A and B are carefully immersed in a

beaker containing Mercury such a way that there is no chance to get air into the tubes. A is stand vertically and B is making an angle θ with the vertical. Is any rise of mercury in the

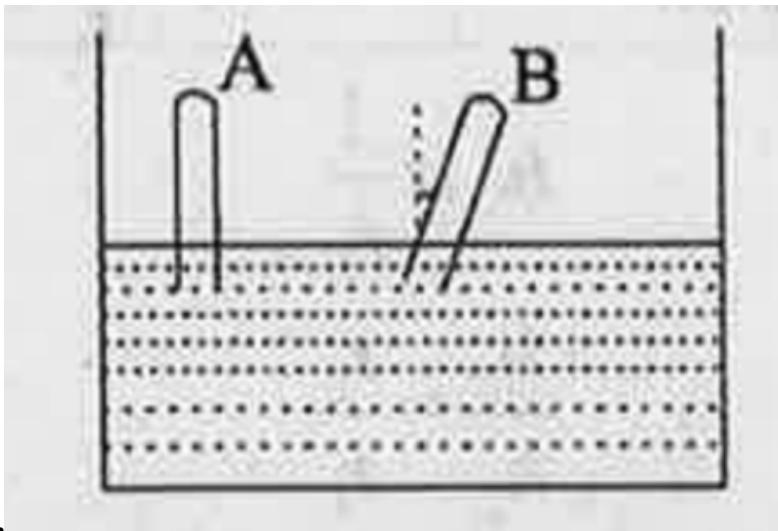


tubes?



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53. Two thin evacuated (one end closed) glass tubes A and B are carefully immersed in a beaker containing Mercury such a way that there is no chance to get air into the tubes. A is stand vertically and B is making an angle θ with the vertical. Is any height difference of Mercury levels in tube A and B? Justify your



answer.



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54. When the doctors measuring body pressure it is advisable to lie on a table. Why?



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55. A small metal sphere is falling through castor oil. Name the forces acting on the metal sphere.



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56. A small metal sphere is falling through castor oil. Which of these forces change? why?



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57. A small metal sphere is falling through castor oil. Name the velocity of the sphere when the unbalanced force on it is zero



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58. A small metal sphere is falling through castor oil. Write down the expression for terminal velocity in terms of coefficient of viscosity.



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59. A capillary tube when dipped into water, it is commonly observed that water will rise through the tube. Which of the following is responsible for this? (i) Gravitational force

(ii)Viscous force (iii)Nuclear force (iv)Surface tension (v)Elastic force



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60. Derive an expression for the rise of the liquid in a capillary tube.



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61. A capillary tube when dipped into water, it is commonly observed that water will rise

through the tube. If the radius of the tube becomes double, what happens to the height of the water column in the tube?



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62. Find the odd one out and justify your answer. Atomiser, Venturimeter, aeroplane, hydraulic lift. Explain the working of the odd one which you have selected in question.



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63. Mention one use of Venturimeter



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64. A capillary tube when dipped into water, it is commonly observed that water will rise through the tube. Which of the following is responsible for this? (i)Gravitational force (ii)Viscous force (iii)Nuclear force (iv)Surface tension (v)Elastic force



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65. When a capillary tube of radius r is dipped in water, the water rises through it up to a height h . To what height will water rise in a glass tube with a bore of radius 0.1 mm (take the angle of contact of Glass with 0° , surface tension is $S = 0.0728 \frac{N}{m}$)



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66. When a capillary tube of radius r is dipped in water, the water rises through it up to a

height h . If the length of the tube is less than the length of the capillary rise will it overflow?

Justify your answer.



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67. A steel ball of radius 1 mm is falling vertically through a tank of oil at $30^\circ C$. After sometime the ball attains a constant velocity called ...



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68. A small metal sphere is falling through castor oil. Name the forces acting on the metal sphere.



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69. A steel ball of radius 1 mm is falling vertically through a tank of oil at $30^{\circ}C$. Write down the expression for resultant force acting on the ball?



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70. A steel ball of radius 1 mm is falling vertically through a tank of oil at $30^\circ C$. If the density of oil is $2 \times 10^2 k \frac{g}{m^3}$, density of steel is $8 \times 10^2 K \frac{g}{m^3}$ and η of oil $2N \frac{S}{m^2}$, what will be the constant velocity attained by the ball?



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71. A $50kg$ girl wearing high heel balances on a single heel. The heel is circular with a diameter

1.0cm. What is the pressure exerted by the heel on the horizontal floor?



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72. Torricelli's barometer used mercury. Pascal duplicated it using French wine of density 984 kg m^{-3} . Determine the height of the wine column for normal atmospheric pressure.



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73. A U -tube contains water and methylated spirit separated by mercury. The mercury columns in the two arms are in level with 10.0cm of water in one arm and 12.5m of spirit in other.

What is the specific gravity of spirit?



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74. What is the pressure inside the drop of mercury of radius 3.00mm at room temperature? Surface tension of mercury at that temperature (20°C) is $4.65 \times 10^{-1}\text{Nm}^{-1}$. The atmospheric pressure is $1.01 \times 10^5\text{Pa}$. Also give the excess pressure inside the drop.



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75. During blood transfusion, the needle is inserted in a vein where the gauge pressure is 2000 Pa , at what height must the blood container be placed so that the blood may just enter the vein? Given : Density of whole blood = $1.06 \times 10^3 \text{ kgm}^{-3}$.



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76. Washing with water doesn't remove grease stains from clothes but addition of detergent

removes the molecules of greasy substances.

Which property of liquid causes the above effect?



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77. Washing with water doesn't remove grease stains from clothes but addition of detergent removes the molecules of greasy substances. A single drop of liquid is split into 8 identical drops. What will be the excess pressure in each drop?



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78. Washing with water doesn't remove grease stains from clothes but addition of detergent removes the molecules of greasy substances. How can the coefficient of viscosity of a highly viscous liquid be determined by Stokes' method?



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79. Water does not wet the feathers of ducks.

A physical quantity called angle of contact determines whether a liquid will spread on the surface of a solid or it will form droplets on it.

Define angle of contact.



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80. A wire ring of internal radius 3 cm and external radius 3.2 cm is rested on the surface of a liquid and is then raised. An extra pulling

force equivalent to the weight of 3.03 g is required before the film breaks than it is after. Calculate the surface tension of the liquid.



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81. Derive an expression for the rise of the liquid in a capillary tube.



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82. Hydraulic lift is a device used to lift heavy loads. State the principle behind the working of this device.



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83. The velocity of outflow of a liquid from an open tank is identical to that of a freely falling body. Name this law and the principle behind the law.



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84. The velocity of outflow of a liquid from an open tank is identical to that of a freely falling body. Name this law and the principle behind the law.



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85. Derive an expression for the terminal velocity of a ball in terms of coefficient of viscosity of the medium.



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86. Why new earthen pots keeps water more cool than old earthen pots?



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87. The rise or fall of liquid against gravitational force through fine tubes is known as capillarity. Give an example for capillarity from practical life.



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88. Derive an expression for the rise of the liquid in a capillary tube.



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89. Air is blown in between two pith balls suspended freely.

a) What will happen to the balls?

(i) They repel each other.

(ii) They attract each other.

(iii) They start oscillating.

(iv) They remain in their initial position.

(v) They fall on the ground.

b) Give your explanation.



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90. Say True or False : A block of wood is floating in water, its apparent weight is zero.



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91. Raindrops falling due to gravity do not acquire high velocity. Define the velocity of the raindrop when unbalanced force on it is zero.



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92. Why do bubbles of air rise up through water?



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93. The terminal velocity of a copper ball of radius 2mm falling through a tank of oil at $20^{\circ}c$ is $6.5cms^{-1}$. Calculate the viscosity of the oil at $20^{\circ}c$. (Hints: Density of oil is $1.5 \times 10^3kgm^{-3}$, density of copper is $8.9 \times 10^3kgm^{-3}$)



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94. Viscosity of gases With temperature, Whereas viscosity of liquids

..... With temperature. (Increases / decreases)



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95. Hot soup tastes better than cold soup.

Why?



[Watch Video Solution](#)

96. Surface tension changes with temperature.

What is the value of angle of contact for pure

water?



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97. Surface tension changes with temperature.

Calculate the work done in breaking water

drop of radius 1 mm to 1000 droplets. Surface

tension of water $= 72 \times 10^{-3} \frac{N}{m}$.



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98. Is pressure in a liquid, scalar or vector.



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99. State the law associated with liquid pressure.



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100. Hydraulic lift is a device used to lift heavy loads. State the principle behind the working of this device.



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101. Small drops of water assumes spherical shape due to surface tension. Define surface tension.



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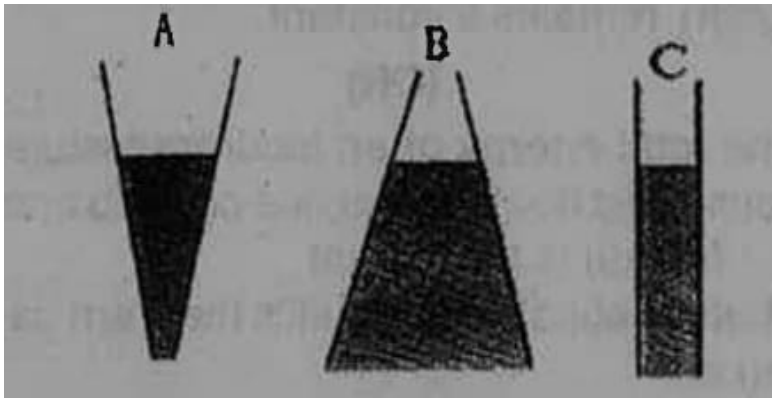
102. Mercury drops are spherical in shape .

a) Which property is responsible for the spherical shape of drops? Explain the property.



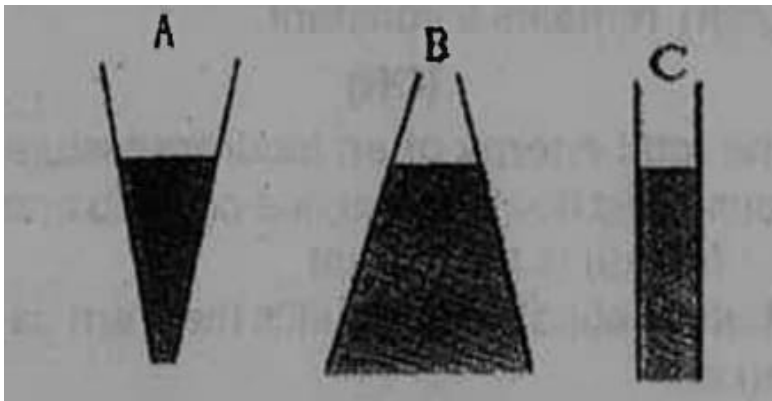
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103. Three vessels of different shapes are filled with water to the same height 'h' and their bottom parts are connected to manometers measuring the pressure. The water levels in all the vessels remain the same. . Identify the above phenomenon.



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104. Three vessels of different shapes are filled with water to the same height 'h' and their bottom parts are connected to manometers measuring the pressure. The water levels in all the vessels remain the same. . Predict the pressure level shown by the manometers.



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105. Blood pressure in humans is greater at the feet than at the brain. Explain why?



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106. Pick the odd one out. Dentist chair, hydraulic brake , hydraulic press, venturimeter.



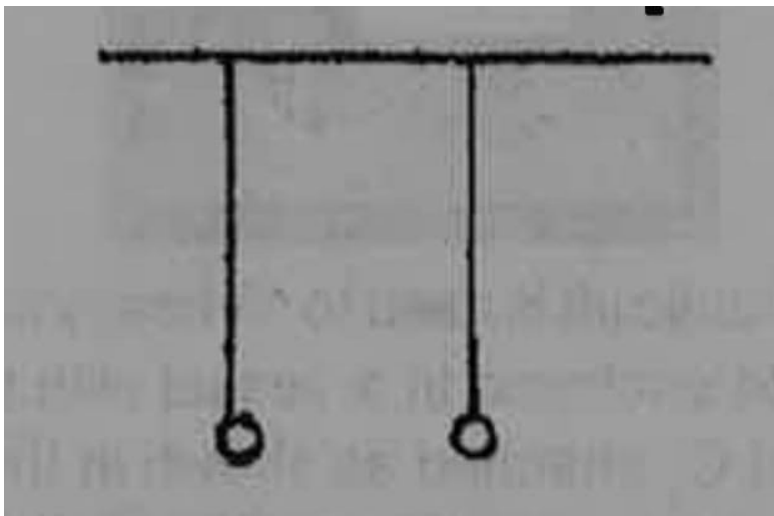
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107. Differentiate between streamline flow and turbulent flow.



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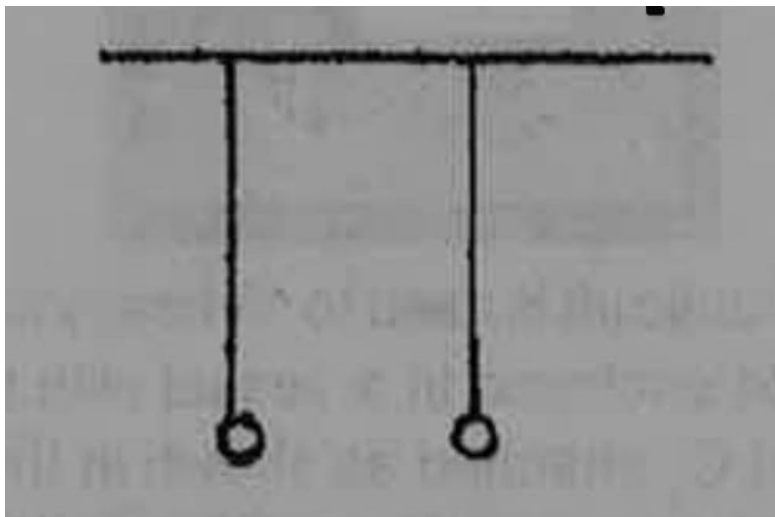
108. When air is blown in between the two balls, will they attract or repel?





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109. State the principle as to why these balls attract each other when air is blown between



them.



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110. Using Bernoulli's theorem, derive Torricelli's equation [Speed of Efflux]



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111. Find the odd one out and justify your answer. Atomiser, Venturimeter, aeroplane, hydraulic lift. Explain the working of the odd one which you have selected in question.



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112. When a thin tube is dipped in water, water rises in the tube through a height 'h' . Name the phenomenon.



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113. Derive an expression for the rise of the liquid in a capillary tube.



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114. Fill in the blanks: Venturimeter:
Bermoulli,s theorem, Hydraulic lift :



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115. The viscous force exists when there is a relative motion between the layers of the fluid.
State true or false: "The viscosity of gases decreases with an increase in temperature."



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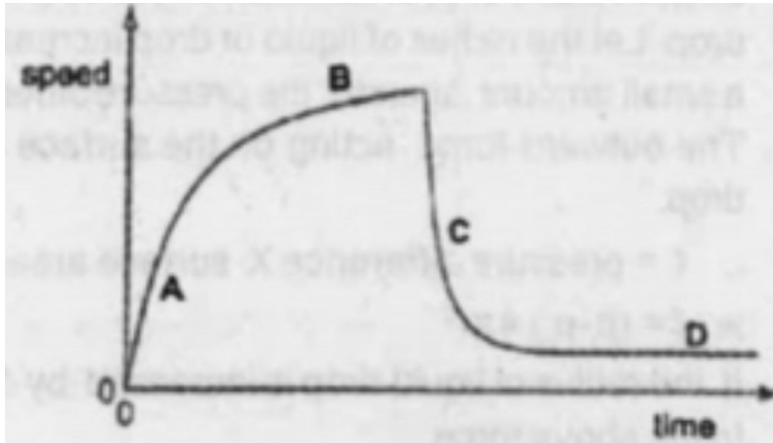
116. Derive an expression for the terminal velocity of a ball in terms of coefficient of viscosity of the medium.



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117. The viscous force exists when there is a relative motion between the layers of the fluid. The speed time graph of a falling sky diver is shown below. During the fall he opens his parachute. Which part of the graph shows the

sky diver falling with terminal velocity?



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118. There is always an excess of pressure inside drops and bubbles. State true or false:
"A drop of liquid under no external forces is always spherical in shape."



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119. Obtain an expression for excess of pressure inside a drop of radius r and surface tension S .



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120. There is always an excess of pressure inside drops and bubbles. Two soap bubbles A and B are blown at the end of a tube, as

shown below. Choose the correct answer:

When the block C is removed,

A. the size of A increases and that of B decreases.

B. the size of B increases and that of A decreases

C. no change occurs in their sizes

D. their sizes become equal

Answer: D



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121. A liquid surface behaves like a stretched elastic membrane. Name the liquid property for the above behavior.



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122. Surface tension changes with temperature. What is the value of angle of contact for pure water?



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123. Derive an expression for the rise of the liquid in a capillary tube.



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124. Hydraulic lift is a device used to lift heavy loads. State the principle behind the working of this device.



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125. Derive an expression for the rise of the liquid in a capillary tube.



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126. The antiseptics used for cuts and wounds in human flesh have low surface tension. In a capillary tube, water rises to a height. If the capillary tube is inclined at an angle 60° with the vertical, what will be the length of the water column in the tube?



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127. In case of fluids law of conservation of energy can be explained with Bernoulli's principle. State and prove Bernoulli's principle.



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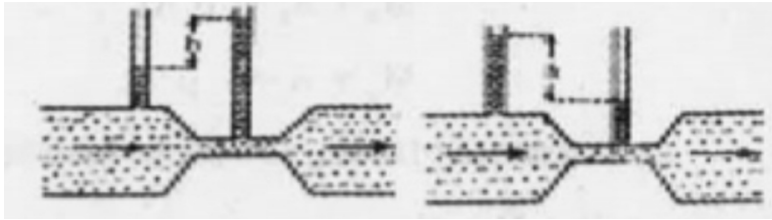
128. A steady flow of nonviscous liquids are shown in figures 1 and 2. Which one of the

figures

is

INCORRECT?

Why?



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129. What is the Si unit of pressure?



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130. What will happen to two soap bubbles of different radii, which are in contact with each

other? Why?



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131. In case of fluids law of conservation of energy can be explained with Bernoulli's principle. State and prove Bernoulli's principle.



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132. Give reason for the following case:

The passengers are advised to remove ink

from pen while going up in an aeroplane.



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133. A small metal sphere is falling through castor oil. Write down the expression for terminal velocity in terms of coefficient of viscosity.



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134. Raindrops falling due to gravity do not acquire high velocity. Define the velocity of the raindrop when unbalanced force on it is zero.



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135. Consider the flow of a liquid through a pipe of varying cross section. Write the equation of continuity of flow.



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136. A tank of $5m$ height is filled with water. Calculate the velocity of efflux through a hole, $3m$ below the surface of water.



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137. Surface tension is a property of liquids and it causes capillary rise in small tubes. What do you mean by surface tension?



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138. Derive an expression for the rise of the liquid in a capillary tube.



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139. Excess pressure inside a liquid drop is $60 \frac{N}{m^2}$?. What will be the excess pressure inside a liquid bubble of the same radius formed by the same liquid?



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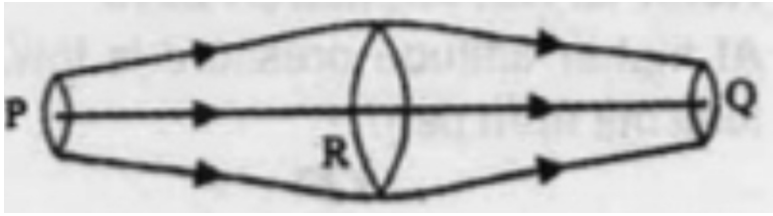
140. Hydraulic lift is a device used to lift heavy loads. State the principle behind the working of this device.



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141. A region of streamline flow of an incompressible fluid shown in the figure. By considering mass conservation in the fluid

flow, arrive at the 'equation of continuity'.



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142. The onset of turbulence in a fluid is determined by Reynold number. given as ...

A. $\frac{\rho \nu d}{2\eta} = Re$

B. $\frac{2\rho \nu d}{\eta} = Re$

C. $\frac{\rho \nu d}{\eta} = Re$

$$D. \frac{\rho v m}{d} = Re$$

Answer: B



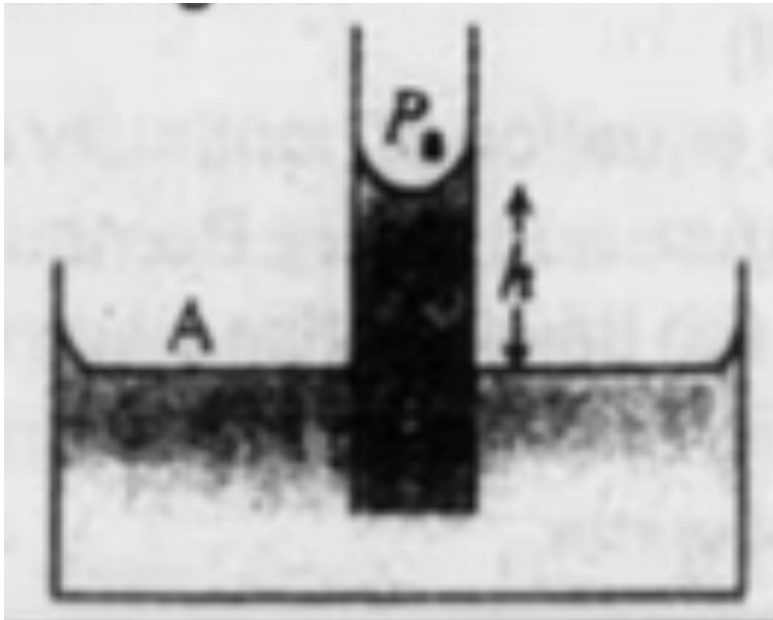
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143. Derive an expression for the rise of the liquid in a capillary tube.



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144. Schematic diagram of capillary rise in a narrow tube is shown in the figure. On the surface of the moon, the liquid in a capillary



- A. same height as on earth.
- B. less height as on earth.

C. more height than that on earth.

D. Infinite height

Answer: C



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