PHYSICS

BOOKS - CHETANA PUBLICATION

MECHANICAL PROPERTIES OF FLUIDS

Example

1. What do you mean by "fluid"?

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2. What is the value of shear modulus of a fluid?

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3. Name the comman examples of fluids.

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4. In case of the streamline flow of non-visocous and incompressible fluid, which of

the following statemetn is CORRECT ?

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5. Name the physical quantity under which a fluid can flow.

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6. State the properties of ideal fluid.

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7. Explain how normal forces act on a fluid at rest.

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8. State the properties of real fluid.

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9. Which branch of physics is called "hydrostatics"?

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10. Define pressure of the fluid, state its SI unit and dimension.

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11. Derive an expression for pressure exerted by a fluid at rest and at a depth of h below the free surface.

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12. Two different liquids of density ρ_1 and ρ_2 exert the same pressure at a certain point. What will be the ratio of the heights of the respective liquid columns?

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13. A swimmer is swimming in a swimming pool at 6 m below the surface of the water. Calculate the pressure on the swimmer due to water above. $\rho_1 = 1000kg/m^3, g = 9.8m/s^2$

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14. What is atmospheric pressure of air?

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15. What is the atmospheric pressure called ?

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16. What is vacuum?

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17. Explain the variation of atmospheric pressure due to height of the air column.

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18. What is gauge pressure?

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19. Write the formula the atmospheric pressure at a distance 'd' above the liquid surface.

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20. What is absolute pressure at a depth h below the surface of the liquid?

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21. Derive an expression for pressure inside a liquid as a function of depth below the water surface.

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22. Find the pressure 200 m below the surface of the ocean if pressure on the free surface of liquid is one atmosphere. (Density of sea water $= 1060 kg/m^3$) $g = 9.8 m/s^2$

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23. Find the pressure 200 above the surface of earth (sea level) is pressure on the sea level is $1.013 \times 10^5 N/m^2 \rho_a ir = 1275 kg/m^3$

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24. Explain the term hydrostatic paradox with the help of suitable diagram.

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25. State Pascal's law in fluid mechanics

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26. Which of the following is NOT an application of Pascal's law ?

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27. Explain the working hydraulic lift.

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28. Explain the working of hydraulic brakes.

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29. Explain experimental proof of Pascal's principle.

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30. A hydraulic brake system of a car of mass 1000 kg having speed of $50km/hr$. has a

cylindrical piston of radius of 0.5 cm. The slave cylinder has a radius of 2.5 cm. if a constant force of 100 N is applied on the brake what distance the car will travel before coming to stop?

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31. In a hydraulic lift, the input piston had surface area $30cm^2$ and the output piston has surface area of $1500cm^2$. if a force of 25 N is

applied to the input piston, calculate weight on output piston.

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32. In a hydraulic lift, the input piston has surface area $20cm^2$. The output piston has surface area of $1000cm^2$. if a force of 50N is applied to the input piston, it raises the output piston by 2m. Calculate weight of support on output piston and its work done.

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33. A hydraulic system consists of one cylinder that has a cross sectional area of $4m^2$, connected to another cylinder that has a cross-sectional area of $12m^2$. A force of 9 N is applied to the smaller cylinder. What force acts at the larger cylinder?

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34. Name the instrument which can measure pressure in fluid.

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35. Write a short note on mercury barometer.

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36. Explain the construction and working of an open tube manometer.

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37. Why is a low density liquid used as a manometric liquid in a physics laboratory!

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38. Explain in brief the surface tension property observed in liquid at rest.

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39. Define surface film.

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40. Define Cohesive force and Adhesive force.

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41. Define range of molecular force and sphere of influence.

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42. Explain surface tension on the basis of the molecular theory.

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43. Define surface tension. State its units and dimensions.

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44. Define surface tension. State its units and dimensions.

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45. Define surface energy. Give its S.I. unit and dimensions.

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46. Define surface energy per unit area. Give its S.I. unit and dimensions.

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47. Who do molecules of a liquid lying in surface film possess extra energy?

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48. Give any two applications of surface tensions.

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49. Why is the surface tension of paints and lubricating oils kept low?

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50. How much amount of work is done in forming a soap bubble of radius r?

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51. Derive the relation between surface tension and surface energy per unit area. (Feb.13)

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52. Show that surface tension of a liquid is numerically equal to surface energy per unit area.

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53. What is surface energy? Establish the relation between surface tension and surface energy.

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54. A beaker of radius 10 cm is filled with water. Calculate the force of surface tension on any diametrical line on its surface. Surface tension of water is $0.075 N/m$.

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55. Calculate the work done in blowing a soap bubble to a radius of 1 cm. The surface tension of soap solution is $2.5 \times 10^{-2} N/m$.

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56. Twenty seven droplets of water, each of radius 0.1 mm coalesce into a single drop. Find the change in surface energy. Surface tension of water is $0.072 N / m$.

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57. A drop of mercury of radius 0.2 cm is broken into 8 droplets of the same size. Find the work done if the surface tension of mercury is 435.5 dyne/cm.

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58. How much work is required to form a bubble of 2 cm radius from the soap solution having surface tension $0.07N/m$

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59. A rectangle wire frame of size $2cm \times 2cm$ is dipped in a soap solution and taken out. A soap film is changed to $3cm \times 3cm$. Calculate

the work done in the process. The surface tension of soap film is $3 \times 10^{-2} N/m$.

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60. Define angle of condact.Give characteristics of angle of condact.

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61. Define angle of contact. Draw the labelled diagram sharing angle of contact for - a liquid

which completely wet the solid.

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62. Define angle of contact. Draw the labelled diagram sharing angle of contact for - liquids which partially wet a solid surface

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63. Define angle of contact. Draw the labelled diagram sharing angle of contact for - a liquid

which does not wet the solid

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64. Explain formation of concave and convex surface of liquid on the basis of molecular force.

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65. Explain the completely wets situation when liquid completely wets the solid with zero

angle of contact.

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66. Explain the condition for convexity and concavity.

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67. Explain the shape of liquid drops on a solid surface with the help of diagram.

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68. Why two or more mercury drops form a single drop when brought in contact with each other?

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69. Explain the factors affecting the angle of contact.

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70. Explain the effect of presence of impurities on the surface tension of liquid.

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71. Explain the effect of temperature and contamination on surface tension.

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72. Explain the pressure difference across a curved-free surface of liquid.

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73. Derive Laplace's law for spherical membrane.

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74. Explain excess of pressure inside a liquid drop.

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75. An air bubble of radius 0.2 mm is situated just below the water surface. Calculate the gauge pressure. Surface tension of water = $7.2 \times 10^{-2} N/m.$

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76. What should be the diameter of a water drop so that the excess pressure inside it is $80N/m^2$? (surface tension of water = $7.2 \times 10^{-2} N/m$)

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77. What is capillarity? Give some applications of capillarity.

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78. Explain the cause of capillary action in a capillary tube.

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79. Explain the rise of liquid in the capillary on the basis of pressure difference.

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80. Derive an expression for capillary rise or fall using pressure difference. (Method I)

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81. Explain the fall of liquid in the capillary an the basis of pressure difference.

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82. Derive an expression for capillary rise or fall using forces. (method II)

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83. A capillary tube of radius 5×10^{-4}m is immersed in a beaker filled with mercury. The mercury level inside the tube is found to be 8×10^{-3} m below the level of reservoir. Determine the angle of contact between mercury and glass. Surface tension of mercury is $0.465 N/m$ and its density is $13.6 \times 10^{3} kg/m^{3}$. (g=$9.8 m/s^{2}$)

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84. Calculate the rise of water inside a clean glass capillary tube of radius 0.1 mm when immersed in water of surface tension $7 \times 10^{-2} N/m$. The angle of contact between water and glass is zero, density of water = $1000 kg/m^3, g = 9.8 m/s^2$

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85. A liquid rises to a height of 8 cm in a glass capillary of radius 0.01 cm. What will be the

height of liquid column in a glass capillary of radius 0.02 cm?

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86. A capillary tube of uniform bore is dipped vertically in water which rises by 6 cm in the tube. Find the radius of the capillary tube if the surface tension of water is 72 dyne/cm (g= $980 cm / s^2$).

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87. A capillary tube 0.14mm in diameter has its lower end immersed in a liquid of surface tension $0.054N/m$. If the density of a liquid is $860kg/m^3$, find the height to which the liquid rises in the tube.(Angle of contract of liquid with glass is 28° and $g = 9.8m/s^2$).

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88. The tube of a mercury barometer is 1 cm in diameter. What correction due to capillarity with effect of meniscus is to be applied to

barometer reading if surface tension of mercury is 435.5 dyne/cm and angle of contact of mercury with glass is 140°? (density of mercury = $13600 kg/m^3$)

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89. Calculate the density of paraffin oil, if glass capillary of diameter 0.25 mm dipped in paraffin oil of the surface tension $0.0245 N/m$ rises a height of 4 cm. (angle of contact of

paraffin oil with glass is 28° and $g = 9.8 m / s^2$

)

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90. Which branch of physics called as "hydrodynamics".

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91. Explain the term steady flow for ideal fluid.

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92. Explain the term flow line for ideal fluid.

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93. Explain the term streamline / flow lines for ideal fluid.

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94. Explain the term "flow tube".

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95. Explain the term "Laminer / Steamline flow".

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96. Explain the term "Turbulent flow".

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97. Explain critical velocity for ideal fluid.

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98. What is Reynold's number.

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99. What is viscosity in an ideal fluid.

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100. Explain viscous flow and non viscous flow with diagram.

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101. Explain dragging force with diagram?

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102. What is velocity gradient and state its SI unit and dimension.

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103. Derive an expression for coefficient of viscosity. State its SI unit and dimension.

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104. A horizontal force of 1 N is required to move a meal plate of area $10^{-2}m^2$ with a velocity of $2 \times 10^{-2}m/s$, when it rests on a

layer of oil 1.5×10^{-3} m thick. Find the coefficient of viscosity of oil.

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105. The relative velocity between two layers of fluid, separated by 0.1 mm is $2cm/s$. Calculate the velocity gradient.

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106. Calculate the force required to move a flat metal plate of area $25cm^2$ with a uniform velocity of $20m/s$ over the surface of a liquid 1 mm thick if the coefficient of viscosity (n) is $2Ns/m^2$

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107. State Stoke's law with the formula.

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108. A steel ball with radius 0.3mm is falling with velocity of $2m/s$ at a time t, through a tube filled with glycerin, having coefficient of viscosity $0.833Ns/m^2$. Determine viscous force acting on the steel ball at that time.

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109. Calculate the viscous force acting on a rain drop of diameter 1mm, falling with a uniform velocity $2m/s$ through air. The

coefficient of viscosity of air is $1.8 \times 10^{-5} Ns/m^2$.

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110. Derive an expression for terminal velocity of solid falling through viscous fluid.

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111. With what terminal velocity will an air bubble 0.4 mm in diameter rise in a liquid of

viscosity $0.1Ns/m^2$ and specific gravity 0.9? density of air is $1.29kg/m^3$?

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112. A spherical drop of oil falls at a constant speed of $4cm/s$ in steady air. Calculate the radius of the drop. The density of the oil is $0.9g/cm^3$, density of air is $1.0g/cm^3$ and the coefficient of viscosity of air is $1.8 \times 10^{-4} poise, (g = 980cm/s^2)$

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113. Explain the equation of continuity in fluid dynamics.

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114. What is volume flux and mass flux in equation of continuity in fluid mechanics.

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115. Obtain an expression for conservation of mass starting from the equation of continuity.

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116. A piston of cross sectional area $2cm^2$ pushes the liquid out of a tube whose area at the outlet is $40mm^2$. The piston is pushed at a rate of $2cm/s$. Determine the speed at which the fluid leaves the tube.

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117. The speed of water is $2m/s$ through a pipe of internal diameter 10 cm. What should be the internal diameter of nozzle of the pipe if the speed of water at nozzle is $4m/s$?

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118. State the Bernoulli equation for the steamline flow.

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119. State the application of Bernoulli's equation.

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120. Why does velocity increase when water flowing in broader pipe enters a narrow pipe?

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121. Why does the speed of a liquid increase and its pressure decrease when a liquid passes through constriction in a horizontal pipe ?

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122. Explain with the help of Bernoullis equation how the roof of house Blows off by stormy wind.

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123. Explain the working of an atomizer.

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124. Explain how with the help of Bernoulli's principle, aeroplane can be lifted.

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125. Explain the working ventury tube.

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126. With the help of Torricelli's law and Bernoulli's equation, derive the formula for speed of efflux.

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127. Derive an expression for Bernoulli equation.

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128. The given figure shows a streamline flow of a non-viscous liquid having density $1000kg/m^3$.The cross sectional area at point A is $2cm^2$ and at point B is $1mm^2$.The speed of liquid at the point A is $5cm/s$. Both points A and B are at the same horizontal level. Calculate the difference in pressure at A and B.

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129. Doors of a dam are 20 m below the surface of water in the dam. If one door is

opened, what will be the speed of the water that flows out of the door?($g = 9.8m/s^2$)

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130. Water flows through a tube as shown in the given figure. Find the difference in mercury level, if the speed of flow of water at point A is $2m/s$ and at point B is $5m/s$. ($g = 9.8m/s^2$)

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131. With what velocity does water flow out of an orifice in a tank with gauge pressure $4 \times 10^5 N/m^2$ before the flow starts? Density of water=$1000 kg/m^3$

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132. The pressure of water inside the closed pipe is $3 \times 10^5 N/m^2$. This pressure reduces to $2 \times 10^5 N/m^2$ on opening the valve of the

pipe. Calculate the speed of water flowing through the pipe $\left(\rho = 1000 kg/m^3\right)$.

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133. A water tank has a hole at a distance x m from free water surface. If the radius of the hole is 2 mm and velocity of efflux of water is $11 m/s$. Find V. $\left(g = 9.8 m/s^2\right)$

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134. Water is flowing through a horizontal pipe of varying cross-section. At a certain point where the velocity is $0.12m/s$, the pressure of water is 0.010 m of mercury. What is the pressure at a point where the velocity is $0.24m/s$?

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135. Distinguish between stream line flow and turbulent flow.

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Exercise

1. A needle of length 6 cm can stay afloat on water. Find weight of the needle. (Surface tension of water $0.075N/m$)

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2. Calculate the work done in blowing a soap bubble of radius 4 cm. The surface tension of

soap solution is $25 \times 10^{-3} N/m$.

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3. A square glass plate 4.5 cm long and 0.5 cm thick is suspended in a through containing water so that its length just touches the water surface, calculate the downward force due to surface tension acting on the plate. (Surface tension of water = 70 dyne/cm)

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4. Calculate the work done in increasing the radius of a soap bubble in air from 2 cm to 3 cm. The surface tension of soap solution is 25 dyne/cm.

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5. A liquid of density $700kg/m^3$ rises to a height of 12 mm in capillary tube of 2.7 mm diameter. If angle of contact is 30°, find the surface tension of liquid, $(g = 9.8m/s^2)$

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6. A liquid rises to height of 9 cm in a glass capillary of radius 0.02 cm. What will be the height of liquid column in a glass capillary of radius 0.03 cm?

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7. A capillary tube of diameter 0.6 mm dipped vertically into water. It rises to height of 6 cm in capillary tube, find the surface tension of

water. (Given: density of water $= 1000 kg/m^3, g = 9.8 m/s^2$).

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8. Eight droplets of mercury each of radius 1 mm coalesces into a single drop. Find the change in the surface energy. Surface tension of mercury is $0.465 J/m^2$

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9. Calculate the work done in breaking a mercury drop of radius 1mm into one thousand droplets of the same size. Surface tension of mercury is $525 \times 10^{-3} N/m$.

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10. Compare the amount of work done in blowing two soap bubbles of radii in the ratio $4:5$.

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11. When glass capillary tube of radius 0.4 mm is dipped into mercury, the level inside the capillary stands 1.24 cm lower than that outside. Calculate the surface tension of mercury. (Angle of contact of mercury with glass $= 135^\circ$, $g = 9.8 m/s^2$, density of mercury $= 13.6 \times 10^3 kg/m^3$)

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12. Surface tension of water at $0^\circ C$ is 75 dyne/cm, find the surface tension of water at $25^\circ C$. (alpha for water $= 0.0027/^\circ C$)

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13. Find the work done in blowing a soap bubble of radius 5cm.Surface tension of soap solution is 25 dyne/cm.

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14. A capillary tube of uniform bore is dipped vertically in water which rises by 7 cm in the tube. Find the radius of the capillary if the surface tension of water is $70 dy / cm$.

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15. Compare the amount of work done in blowing two soap bubbles of radii in the ratio $4 : 5$.

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16. A drop of mercury 2 mm in diameter breaks into a million small spherical droplets, all of same size. Calculate the work done. (S.T. of mercury = 0.46 N/m)

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17. A liquid of density $800kg/m^3$ flowing steadily in a tube of varying cross-section. If area of cross-section at A is $4cm^2$ and at B is

$2cm^2$, if speed of liquid at A is $10cm/s$, calculate:- the rate of flow at B

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18. A liquid of density $800kg/m^3$ flowing steadily in a tube of varying cross-section. If area of cross-section at A is $4cm^2$ and at B is $2cm^2$, if speed of liquid at A is $10cm/s$, calculate:- the difference in pressure at A and B.

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19. Water is flowing continously from a tap having a base of internal diameter $8 \times 10^{-3} m$. Calculate the diameter of the water stream at a distance of 2×10^{-1} below the tap. Assume that the water velocity as it leaves the tap is $4 \times 10^{-1} m / s.$

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20. Find the terminal velocity of a steel ball bearing of radius 0.1cm when it falls through a

tube filled with glycerine. ($\rho_{steel} = 8g/cm^3$, $a = 1.34g/cm^3$, r| = 9 poise)

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21. Select and write the most appropriate answer from the alternatives given for sub question.The molecules on the surface of the liquid have

A. minimum potential energy

B. maximum potential energy

C. minimum kinetic energy

D. maximum kinetic energy

Answer:

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22. The spherical shape of rain-drop is due to.....

A. gravity

B. atmospheric pressure

C. surface tension

D. density of liquid

Answer:

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23. Absorption of ink by filter paper is due to.....

A. cohesion

B. capillarity

C. adhesion

D. elasticity

Answer:

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24. The surface tension of liquid is $5N/m$. If a thin film of area $0.04m^2$ is formed on a loop, then its surface energy will be

A. $10 \times 10^{-2} J$

B. $4 \times 10^{-1} J$

C. $7 \times 10^{-1} J$

D. $12 \times 10^{-4} J$

Answer:

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25. The surface tension of liquid is $4N/m$. If a thin film of area $0.02m^2$ is formed on a loop, then its surface energy will be

A. $2.5 \times 10^{-2} J$

B. $1.5 \times 10^{-2} J$

C. $1.6 \times 10^{-1} J$

D. $2 \times 10^{-1} J$

Answer:

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26. At critical temperature, the surface tension of a liquid is.....

A. infinity

B. zero

C. remains same

D. first increases then decreases

Answer:

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27. The surface-tension of a liquid is T. The increase in its surface energy on increasing the surface area by A is.....

A. A^2T^2

B. A^2T

C. AT

D. AT^1

Answer:

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28. Water rises to a height of 2 cm in capillary tube held vertically. When the tube is tilted

60° from vertical, the length of the water column in the tube will be.....

A. 2 cm

B. 1cm

C. 3cm

D. 4cm

Answer:

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29. The surface tension of soap solution is $25 \times 10^{-3} N/m$. The excess of pressure inside the soap bubble of radius 0.5 cm is.....

A. $20 N/m^2$

B. $10 N/m^2$

C. $5 N/m^2$

D. $30 N/m^2$

Answer:

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30. A liquid does not wet the sides of solid if angle of contact is.....

A. 0°

B. 45°

C. 60°

D. 130°

Answer:

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31. n droplets of equal size of radius r coalesce to form a bigger drop of radius R. The energy liberated is equal to

A. $4\pi R^2 T\left[n^{\frac{1}{3}}-1\right]$

B. $4\pi r^2 T\left[n^{\frac{1}{3}}+1\right]$

C. $4\pi R^2 T\left[n^{\frac{2}{3}}-1\right]$

D. $4\pi r^2 T\left[n^{\frac{2}{3}}-1\right]$

Answer:

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32. Two bubbles A and B (A>B) are joined through a narrow tube, then

A. size of B will increase.

B. size of A will increase.

C. size of A will decrease.

D. size of B will increase until the pressure becomes equal.

Answer:

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33. Radius of soap bubble is r. The surface tension of soap solution is T. Keeping temperature constant, the radius of soap bubble is doubled. The energy necessary for this will be....

A. $24\pi r^2 T$

B. $8\pi r^2 T$

C. $12\pi r^2 T$

D. $16\pi r^2 T$

Answer:

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34. A capillary tube of radius r can support a liquid of weight $6.28 \times 10^{-4} N$. If the surface tension of liquid is $5 \times 10^{-2} N/m$, the radius of the capillary tube will be.....

A. $2.5 \times 10^{-4} m$

B. $2.0 \times 10^{-3} m$

C. $1.5 \times 10^{-2} m$

D. $2 \times 10^{-4} m$

Answer:

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35. The pressure just below the meniscus of water.....

A. is greater than just above it

B. less than just above it

C. is same as just above it

D. always equal to atmospheric pressure

Answer:

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36. A square frame of length L is immersed in a soap solution and taken out. The force experienced by the square plate is.....

A. TL

B. 2TL

C. 4TL

D. 8TL

Answer:

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37. When NaCl is dissolved into water, then its surface tension

A. decreases

B. no change

C. increases

D. first increases then decreases

Answer:

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38. Water rises to capillary tube to a height of 4 cm. If radius of the tube is one-fourth, the water will rise to a height of

A. 2 cm

B. 4 cm

C. 8 cm

D. 16 cm

Answer:

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39. A soap bubble has radius 2 cm. The work done to double the radius is (surface tension of soap solution is $30 \times 10^{-3} N/m$)

A. $1.1355 \times 10^{-4} J$

B. $zero$

C. $4.532 \times 10^{-4} J$

D. $2.261 \times 10^{-4} J$

Answer:

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40. The surface tension of water at $0^\circ C$ is 72 dyne/cm, surface tension of water at $30^\circ C$ is (α for water = $0.0025/^\circ C$)

A. 69.37 dyne/cm

B. 65.27 dyne/cm

C. 68.37 dyne/cm

D. 66.67 dyne/cm

Answer:

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41. The angle of contact between glass and mercury is

A. 0°

B. 30°

C. 90°

D. 135°

Answer:

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42. As the length of the capillary tube is insufficient the rise of liquid in it will be up to the top in the absence of.....

A. insoluble impurity

B. soluble impurity

C. gravity

D. critical temperature

A. insoluble impurity

B. soluble impurity

C. gravity

D. critical temperature

Answer:

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43. The correct relation is

A. $r = \frac{2T\cos\theta}{h\rho g}$

B. $r = \dfrac{h\rho g}{2T\cos\theta}$

C. $r = \dfrac{2Th\rho g}{\cos\theta}$

D. $r = \dfrac{T\cos\theta}{2h\rho g}$

Answer:

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44. Surface tension of soap solution is $2 \times 10^{-2} N/m$. The work done in producing a soap bubble of radius 2 cm is,

A. $64\pi \times 10^{-6} J$

B. $32\pi \times 10^{-6} J$

C. $16\pi \times 10^{-6} J$

D. $8\pi \times 10^{-6} J$

Answer:

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45. The angle of contact between glass and mercury is

A. 0

B. acute

C. obtuse

D. 90°

Answer:

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46. Angle of contact varies between

A. $0 \rightarrow \pi$

B. $0 \rightarrow -\pi$

C. $0 \rightarrow 2\pi$

D. $2\pi \rightarrow -2\pi$

Answer:

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47. Meniscus of Hg in capillary is

A. Concave

B. Convex

C. Plane

D. Plano Convex

Answer:

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48. If the surface tension of liquid is T, the work required to increase, its surface area by A is

A. $A \times T$

B. $A \times 2$

C. $3A \times 4$

D. $2A \times 4$

Answer:

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49. The surface tension of water in C.G.S. units is 30 dyne/cm. Its S.I. unit is.

A. $30N/m$

B. $3 \times 10^{-2} N/m$

C. $0.3 N/m$

D. $3 \times 10^{3} N/m$

Answer:

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50. The height of water in a capillary tube of radius 2 cm is 4cm. What should be the radius of capillary, if the water rises to 8 cm in tube?

A. 1cm

B. 0.1 cm

C. 2 cm

D. 4 cm

Answer:

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51. For tap water and clean glass, the angle of contact is

A. 0°

B. 90°

C. 140°

D. 8°

Answer:

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52. When there are no external forces, the shape of a liquid drop is determined by

A. Surface tension of the liquid

B. Density of a liquid

C. Viscosity of liquid

D. Temperature of air only

Answer:

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53. A capillary tube when immersed vertically in a liquid records a rise of 3 cm, if the tube is immersed in the liquid at an angle of 60° with

the vertical, then length of the liquid column along the tube will be

A. 2 cm

B. 3 cm

C. 6 cm

D. 8 cm

Answer:

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54. The spherical shape of rain-drop is due to.....

A. Surface tension of the liquid

B. capillary

C. Downward motion

D. acceleration due to gravity

Answer:

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55. Water rises in a capillary tube to a certain height such that the upward force due to surface tension is balanced by $75 \times 10^{-4} N$, forces due to the weight of the liquid. If the surface tension of water is $6 \times 10^{-2} N/m$, the inner-circumference of the capillary must be

A. $12.5 \times 10^{-2} m$

B. $11.5 \times 10^{-2} m$

C. $13.5 \times 10^{-2} m$

D. $14.5 \times 10^{-2} m$

Answer:

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56. What is the change in surface energy, when a mercury drop of radius R splits up into 1000 droplets of equal radius?

A. $8\pi R^2 T$

B. $16\pi R^2 T$

C. $24\pi R^2 T$

D. $36\pi R^2 T$

Answer:

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57. The dimensions of surface tension are

A. $\left[M^1L^0T^{-2}\right]$

B. $\left[M^1L^1T^{-2}\right]$

C. $\left[M^1L^{-2}T^0\right]$

D. $\left[M^1L^1T^{-1}\right]$

Answer:

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58. If W is the work done to blow a bubble of volume V, that to blow a bubble of double the volume is

A. $2^{\frac{1}{3}}W$

B. $2^{\frac{2}{3}}W$

C. $2^{\frac{4}{3}}W$

D. 2W

Answer:

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59. The work done in breaking a spherical drop of a liquid of radius R into 8 equal drops is

A. $\pi R^2 T$

B. $2\pi R^2 T$

C. $3\pi R^2 T$

D. $4\pi R^2 T$

Answer:

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60. A hydraulic lift is designed to lift heavy objects of maximum mass 2000 kg. The area of cross section of piston carrying the load is $2.25 \times 10^{-2} m^2$ What is the maximum pressure the smaller piston would have to bear?

A. $0.8711 \times 10^6 N/m^2$

B. $0.5862 \times 10^7 N/m^2$

C. $0.4869 \times 10^5 N/m^2$

D. $0.3271 \times 10^4 N/m^2$

Answer:

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61. Two capillary tubes of radii 0.3cm and 0.6 cm are dipped in the same liquid. The ratio of heights through which the liquid will rise in the tubes is

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer:

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62. The energy stored in a soap bubble of diameter 6 cm and $T = 0.04N/m$ is nearly.

A. $0.9 \times 10^{-3} J$

B. $0.4 \times 10^{-3} J$

C. $0.7 \times l0^{-3} J$

D. $0.5 \times l0^{-3} J$

Answer:

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63. Two hail stones with radii in the ratio of $1:4$ fall from a great height through the atmosphere. Then the ratio of their terminal velocity is

A. $1:2$

B. $1:12$

C. $1:16$

D. $1:8$

Answer:

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64. In Bernoulli's theorem, which of the following is conserved?

A. linear momentum

B. angular momentum

C. mass

D. energy

Answer:

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65. If Reynold's number for given ideal fluid flowing in the tube is 750, is the flow

A. streamline

B. turbulent

C. both streamline and turbulent

D. neither stream line nor turbulent

Answer:

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66. If pressure at half the depth of a lake is equal to $\frac{2}{3}$ pressure at the bottom of the lake then what is the depth of the lake.

A. 10 m

B. 20 m

C. 60 m

D. 30 m

Answer:

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67. A barometer kept in an elevator accelerating upward reads 76 cm. The air pressure in the elevator is

A. 76 cm

B. $< 76cm$

C. $> 76cm$

D. zero

Answer:

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68. There is a hole in the bottom of a tank having water. If total pressure at bottom is 3

atm, then the velocity of water flowing from hole is

A. $20m/s$

B. $30m/s$

C. $40m/s$

D. $50m/s$

Answer:

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69. Water falls from a tap, down the streamline

A. Area decreases

B. Area increases

C. velocity remains same

D. Area remains same

Answer:

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70. The working of an atomizer depends upon

A. Boyle's law

B. Bernoulli's theorem

C. Archimedes principle

D. Newton's law of viscous drag

Answer:

71. By sucking through a straw, a student can reduce the pressure in his lungs to 750 mm of Hg.$\left(density = 13.6g/cm^3\right)$. Using the straw, he can drink water from a glass upto a maximum depth of

A. 10 cm

B. 75 cm

C. 13.6 cm

D. 1.36 cm

Answer:

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72. The relative velocity between two layers of fluid, separated by 0.4 mm is $8cm/s$. What will be the velocity gradient?

A. $20s^{-1}$

B. $200s^{-1}$

C. $10s^{-1}$

D. $100s^{-1}$

Answer:

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73. Pascal's law is applied in which of the following cases?

A. Hydraulic brakes

B. Airpurfier

C. Ventury tube

D. Blood pressure gauge

Answer:

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74. Select and write the correct answer:- The energy stored in a soap bubble of diameter 4 cm and T = $0.02N/m$, is nearly

A. $2 \times 10^{-4}J$

B. $1 \times 10^{-4}J$

C. $4 \times 10^{-4}J$

D. $8 \times 10^{-4}J$

Answer:

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75. Select and write the correct answer:- Two capillary tubes of radii 0.1 cm and 0.2 cm are dipped in the same liquid. The ratio of heights through which the liquid will rise in the tubes is

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer:

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76. The dimensions of surface tension are

A. $\left[M^1L^0T^{-2}\right]$

B. $\left[M^1L^1T^{-2}\right]$

C. $\left[M^1L^{-2}T^0\right]$

D. $\left[M^1L^1T^{-1}\right]$

Answer:

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77. Water falls from a tap, down the streamline

A. Area decreases

B. Area increases

C. velocity remains the same

D. Area remains the same

Answer:

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78. State and explain Pascal 's law.

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79. What is an incompressible fluid ?

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80. How much amount of work is done in forming a soap bubble of radius r?

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81. Why is the surface tension of paints and lubricating oils kept low ?

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82. Why does velocity increase when water flowing in broader pipe enters a narrow pipe?

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83. Define surface tension. Write down its units and dimension.

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84. Find the pressure 200 m below the surface of the ocean if pressure on the free surface of liquid is one atmosphere. $\rho_w = 1060 kg/m^3$

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85. With what velocity does water flow out of an orifice in a tank with gauge pressure $4 \times 10^5 N/m^2$ before the flow starts? Density of water=$1000 kg/m^3$

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86. What is Reynold's number.

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87. Explain the working of an atomizer.

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88. Derive an expression for coefficient of viscosity. State its SI unit and dimension.

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89. A drop of mercury of radius 0.2 cm is broken into 8 droplets of the same size. Find

the work done if the surface tensions of mercury is 435.5 dyne/cm

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90. Derive an expression for terminal velocity of solid falling through viscous fluid.

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91. Distinguish between stream line flow and turbulent flow.

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