Unit 6
FLUID DYNAMICS

Q1. Which of the following statements is false for an ideal fluid?
(a) Flow is steady
(b) Flow is irrotational
(c) Flow is incompressible
(d) Flow is viscous

Solution: (d)
Explanation:
Ideal fluid is a fluid in which there is no friction between layers of fluid. Ideal fluid is also known as non viscous fluid.
Ideal fluid has following properties:
(i) Flow is steady
(ii) Flow is irrotational
(iii) Flow is incompressible
(iv) Flow is non viscous

Q2. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q3. Which of the following is a scalar quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (a)
Explanation:
Pressure is a scalar quantity because it has only magnitude.

Q4. Which of the following is a scalar quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (c)
Explanation:
Mass is a scalar quantity because it has only magnitude.

Q5. Which of the following is a scalar quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (b)
Explanation:
Density is a scalar quantity because it has only magnitude.

Q6. Which of the following is a scalar quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (a)
Explanation:
Pressure is a scalar quantity because it has only magnitude.

Q7. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q8. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q9. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q10. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q11. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q12. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q13. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q14. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q15. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q16. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q17. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q18. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q19. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q20. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q21. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q22. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q23. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q24. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q25. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q26. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q27. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q28. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q29. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q30. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q31. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q32. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q33. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q34. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q35. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q36. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q37. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q38. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q39. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q40. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q41. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q42. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q43. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q44. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q45. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q46. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q47. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q48. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q49. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q50. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q51. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q52. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q53. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q54. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q55. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q56. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q57. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q58. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q59. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q60. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q61. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q62. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q63. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q64. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q65. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q66. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q67. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q68. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q69. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q70. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q71. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q72. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q73. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q74. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q75. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q76. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q77. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q78. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q79. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q80. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q81. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q82. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q83. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q84. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q85. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q86. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q87. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q88. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q89. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q90. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q91. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q92. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q93. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q94. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q95. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q96. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q97. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q98. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q99. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

Q100. Which of the following is a vector quantity?
(a) Pressure
(b) Density
(c) Mass
(d) Velocity

Solution: (d)
Explanation:
Velocity is a vector quantity because it has magnitude and direction.

EXERCISE

Select the correct answer of the following questions.

1) A 3m tall cylinder, full of water, has four identical small holes of height 2.1m, 2.3m and 2.4 meter. The speed of efflux is maximum from

a. 2.1 m high hole b. 2.4 m high hole

c. 2.3 m high hole d. 2.2 m high hole

2) A rain drop of radius 'r' falls in air with a terminal speed v_t. What is the terminal speed of a rain drop of radius 2r?

a. 2vt b. vt c. 4vt d. 2vt

3) Eight spherical rain drops of same mass and radius are falling down with a terminal velocity of 6 cm s^{-1}. If they coalesce to form one big drop, what will be its terminal speed? Neglect the buoyancy due to air.

a. 15 cm s^{-1} b. 6 cm s^{-1} c. 24 cm s^{-1} d. 32 cm s^{-1}

4) Water flows steadily through a horizontal pipe of a variable cross-section. If the pressure at another point where the velocity of fluid flow is 2v, consider 'ρ' as density of water.

a. $P - \frac{3}{2}\rho v^2$ b. $P + \frac{3}{2}\rho v^2$ c. $P - 2\rho v^2$ d. $P + 2\rho v^2$

5) The cylinder tube of a spray pump has a radius R, one end of which has 'n' number of fine uniform holes, each of radius r. If the speed of flow of the fluid in the tube is v, the speed of ejection of the liquid through the holes is

a. $\left(\frac{r}{nR}\right)^2 v$ b. $\left(\frac{nR}{r}\right)^2 v$ c. $\left(\frac{r}{R}\right)^2 v$ d. $\left(\frac{R}{r}\right)^2 v$

6) In a brief experiment on a model aeroplane in a wind tunnel, the flow speeds on the lower and upper surface of the wings are 'v' and $\sqrt{2}v$ respectively. If the density of air is 'r' and the surface area of the wing is given.

a. $\frac{1}{2}\rho v^2 A$ b. $\frac{1}{2}\rho v^2 A$ c. $\sqrt{2}\rho v^2 A$ d. $2\rho v^2 A$

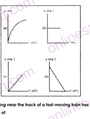
7) A rectangular tank is filled completely with water. When a hole at its bottom is unplugged, the tank is emptied in time T. If the tank is half filled with water, it will be emptied in time.

a. $\frac{T}{2\sqrt{2}}$ b. $\frac{T}{2}$ c. $\frac{T}{\sqrt{2}}$ d. $\frac{T}{4\sqrt{2}}$

8) Two capillary tubes A and B of equal radii $r_1 = r_2 = r$ and equal length $l_1 = l_2 = l$ are held horizontally. When the same pressure difference P is maintained across each tube, the rate of flow of water in each is Q. If the tubes are connected series and the same pressure difference P is maintained across the combination, the rate of flow through the combination will be

a. Q b. Q c. 2Q d. 2Q

9) For spherical objects of uniform density made of same material but of different radii. Which of the following graphs can best represents the relationship between terminal velocity and radius of the sphere. If each time flow allowed to fall through same fluid from different heights?



10) A person standing near the track of a fast-moving train has tendency to fall towards it because of

a. Vibration due to motion of train;

b. Gravitation force of attraction between person and trains.

c. The high speed of train.

d. Some other effect

11) With the increase of temperature viscosity

a. Increase b. Decrease c. Remains same d. Double

12) According to Stoke's law, drag force depends on

a. Initial velocity b. Final velocity

c. Instantaneous velocity d. Terminal velocity

13) The smooth or steady depth line flow is known as

a. Laminar flow b. Turbulent flow c. Both a and b d. None

14) Blood has a density

a. Nearly equal b. Greater than water c. Lesser than water d. None

15) The pressure will be low where the speed of the fluid is

a. Zero b. High c. Low d. Constant

16) Bernoulli's equation is based upon law of conservation of

a. Mass b. Momentum c. Energy d. None

17) The train drop falling from the sky reach the ground with

a. Constant terminal velocity b. Constant gravitational acceleration

c. variable acceleration d. Acceleration greater than g

Answers:

1.	(c)	**2.**	(c)	**3.**	(c)	**4.**	(c)	**5.**	(b)
6.	(b)	**7.**	(a)	**8.**	(c)	**9.**	(a)	**10.**	(c)
11.	(b)	**12.**	(c)	**13.**	(a)	**14.**	(a)	**15.**	(c)
16.	(c)	**17.**	(a)	-	-	-	-	-	-

Write the short answer of the following:

1) Smoke rises in a chimney faster when a breeze is blowing. Use Bernoulli principal to explain this phenomenon.

Answer

According to Bernoulli principal where the speed of the fluid is high, pressure will be low and vice versa.

When a breeze is blowing, This makes the stream lines of air closer to each other. So, speed of fluid is high at the top which reduces pressure at that point. As pressure is high at the bottom of chimney which results smoke rises in a chimney faster.

2) Why do many trailer trucks use wind deflectors on the top of their cabs? How do such devices reduce fuel consumption?

Answer

Trailer trucks use wind deflectors on the top of their cabs such that the air around the trailer trucks to be streamlined for high speeds. So, it helps for the smooth running of the trucks & the reduction of drag force. When drag force is reduced its considerable reduces fuel consumption.

3) Consider the cross section of the wing on an aeroplane. The wing is designed such that the air travels faster over the top than the bottom. Explain why there is net upward force on the wing due to Bernoulli's effect.

Answer

The aeroplane wings is designed in such a way to deflect the air so that the stream lines are closer together above the wing that below it. So, air is travelling faster through the upper side of wing than on the lower. So according to Bernoulli's effect, the pressure will be lower at the top than on the lower side. Due to pressure difference, the wing will be forced upward.

4) When a fast moving train passes a man standing on the platform, he feels as if he is being be drawn towards train. Explain your answer using Bernoulli's effect.

Answer

When fast moving train passes a man standing on the platform, then the speed of the fluid increases, since according to Bernoulli's effect where the speed is high the pressure will be low. So, Increase in speed results in decrease of the pressure, Hence a larger pressure behind the person, pushes him towards the train.

5) If you suddenly turn on your shower water of full speed, why the shower curtain pushed inward.

Answer

When you suddenly turn on your shower water of full speed, It reduces pressure there, so outside pressure becomes high which pushes the curtain inward.

6) A baseball moves fast an observer from left to right spinning counter clockwise. In which direction will the ball tend to deflect?

Answer

If the baseball spinning counter clockwise from left to right. The ball tends to deflect in upward direction, because it squeezes the air at the top, so therefore streamlines air closer which reduces pressure & increases the speed of the fluid. Hence a force exerts from high pressure to low pressure. So, the baseball will be deflected in upward direction.

7) A spherical body is dropped in two different fluids and their terminal velocity is found to be different. Give reasons.

Answer

Since terminal velocity is given by the expression

$$v_t = \frac{2r^2 g}{9\eta} \quad \text{---(1)}$$

From equation (1), it is clear that terminal velocity of the object depends on density of the object & viscosity of the fluid.

Since the viscosity of each fluid is different that is why terminal velocities are different.

8) A liquid passed through a pipe and it was found that the rate of influx was equal to the rate of efflux. What information do you get about the liquid?

Answer

According to the equation of continuity, $A_1v_1 = A_2v_2$ which shows that if area of the pipe is constant then the rate of influx will also be equal to rate of efflux.

9) An incompressible liquid is passed through a horizontal pipe and it is observe that the speed of a mass of liquid when emerges is greater than its speed when it enters the pipe. How can it be possible?

Answer

It is possible if the area of the pipe at the end where mass of liquid enters is greater resulting a low speed than the area of the pipe at the end where mass of liquid emerges out resulting higher greater speed according to equation of continuity.

10) Why does the pipe of paper squeezes when air is blown through it.

Answer

When air is blown through the pipe of paper, speed of air inside increases & hence pressure reduced. Since outside of atmospheric pressure is high which squeezes the pipe of paper.

11) When water falls from a tap, its cross-sectional area decreases as it comes down. Explain why?

Answer

When water falls from a tap, its cross-sectional area decreases & speed increases as mentioned by the equation of continuity.

12) Why a car has oblong shape design?

Answer

Cars are streamlined for giving an oblong shape to ensure that flow of air around the car is stream lined even when the car moves at a very high speed.

13) How do the pulations in pulse show the heart beat?

Answer

When heart pumps into the blood, it squeezes and pressure in arteries rise momentarily up to 120 (mg). After that the heart relaxes and to the pressure decreases to about 80mm. This periodic rise and fall of the pressure is called pulse.

14) Describe the working of an engine carburetor and paint spray?

Answer

The carburettor of a car uses a Venturi duct to feed the correct mixture of air and petrol to the cylinders. At a lower speed, the Venturi duct causes a pipe to the cylinders. At this stage it has low pressure and low velocity. A fast-moving duct air creates a low-pressure drawing petrol.

onlineabaq.com

Numerical Problems

1. Water flows through a 1 cm diameter pipe with a speed of 1 m/s. What should be the diameter of the nozzle if the water is to emerge at 2.1 m/s.

Data:

Diameter of the pipe d_1=1 cm = 0.01 m

Speed of water at this point v_1=1 m/s

Diameter of the nozzle d_2=?

Speed of water at this point v_2=2.1 m/s

Solution

From equation of continuity

$$A_1v_1 = A_2v_2$$

$$\Rightarrow \quad \pi r_1^2 v_1 = \pi r_2^2 v_2$$

$$\Rightarrow \quad \left(\frac{d_1}{2}\right)^2 v_1 = \left(\frac{d_2}{2}\right)^2 v_2$$

$$\Rightarrow \quad d_2 = \sqrt{d_1^2 \times \frac{v_1}{v_2}}$$

$$\Rightarrow \quad d_2 = \sqrt{(0.01)^2 \times \frac{1}{2.1}}$$

$$\boxed{d_2 = 2.2 \times 10^{-3}}$$

2. Water if flowing smoothly through a closed pipe system. At one-point speed of water is 3 m/s, while at another point 3m high, the speed is 4m/s. At lower point the pressure is 80k pa. Find the pressure at the upper point.

Data:

Speed of water at lower end v_1=3 m/s

Speed of water at higher end v_2=4m/s

Height of the pipe at higher end h_2=3 cm

Height of the pipe at lower end h_1=0 cm

Pressure of water at lower end p_1=80k 10^3 pa

Pressure of water at lower end p_2=?

Solution

From Bernoulli Equation

$$P_1 + \rho v_1^2 + \rho g h_1^2 = P_2 + \rho v_2^2 + \rho g h_2$$

$$\Rightarrow \quad P_2 = \times 1000 \times 16 + 1000 \times 9.8 \times 3$$

$$\Rightarrow \quad 80 \times 10^3 + \times 1000 \times 9 \times 0$$

$$\Rightarrow \quad P_2 = 8000 \times 29400 + 80 \times 1000 + 4500$$

$$\Rightarrow \quad P_2 = 37400 - 84500$$

$$\Rightarrow \quad \boxed{P_2 = 47.1Kpa}$$

3. An airplane wing is designed to that when the speed of the air across the top of the wing is 450 m/s, the speed of air below the wing is 410 m/s, what is the pressure difference between top and bottom of the wings?

Data:

Speed of the air at the top wing v_1=450 m/s

Speed of the air at the bottom wings v_2=410 m/s

Pressure difference between bottom & top

P1 – P2 = ?

Density of the air ρ = 1.29 kg/m3

Solution

$$P_1 - P_2 = \frac{1}{2}\rho v_2^2 - \frac{1}{2}\rho v_1^2$$

$$\Rightarrow \quad P_1 - P_2 = \frac{1}{2}\rho\left(v_2^2 - v_1^2\right)$$

$$\Rightarrow \quad P_1 - P_2 = \frac{1}{2} \times 1.29\left[(450)^2 - (410)^2\right]$$

$$\Rightarrow \quad \boxed{P_1 - P_2 = 22.18KP}$$

4. Water flows through pipe whose internal diameter is 2cm at a speed of 1 m/s. What should be the diameter of the nozzle if the water is to emerge at a speed of 4m/s.

Data:

Internal diameter of the pipe at one end d_1=2 cm = 0.02 m

Speed of water at this point v_1=1 m/s

Diameter of the nozzle d_2=?

Speed of emerging water v_2=4 m/s

Solution

From equation of continuity

$$A_1v_1 = A_2v_2$$

$$\pi r_1^2 v_1 = \pi r_2^2 v_2$$

$$\Rightarrow \quad \left(\frac{d_1}{2}\right)^2 v_1 = \left(\frac{d_2}{2}\right)^2 v_2$$

$$\Rightarrow \quad d_2 = \sqrt{\frac{d_1^2 \times v_1}{v_2}}$$

$$\boxed{d_2 = 0.01m}$$

5. Eight equal drops of oil are falling through air with a steady velocity of 0.1 m/s. If the drops recombine to form a single drop, what should be the new terminal velocity?

Data:

Terminal velocity of each drop v_t=0.1 m/s

Terminal velocity of drops when they combine to form a single drop v_t=?

Solution:

When drops combine to form a single drop then

$$r_1 = 2r_1$$

Since

$$v_t = \frac{2gr_1^2}{9\eta} \quad \text{.....(1)}$$

&

$$v_t = \frac{2gr_2^2}{9\eta} \quad \text{.....(2)}$$

Dividing equation(2) by (1)

$$\frac{v_t}{v_t} = \frac{\frac{2gr_2^2}{9\eta}}{\frac{2gr_1^2}{9\eta}}$$

$$\frac{v_t}{v_t} = \frac{r_2^2}{r_1^2}$$

$$\Rightarrow \quad v_t = v_t \times \frac{r_2^2}{r_1^2} \quad \text{.....(3)}$$

Putting the value in Equation (3)

$$v_t = (0.1)\times\left(\frac{2r_1}{r_1}\right)$$

$$\boxed{v_t = 0.4m/s}$$

6. Calculate the speed of efflux of kerosene oil from narrow hole of a tank, in which pressure is 4 atm. Density of kerosene oil is 0.72 kg/m³.

Data

Density of kerosene oil δ=0.72 kg/m³

Pressure P = 4 atm = 4 ×1.03 × 10^5 pa

Speed of efflux v = ?

Solution

Since

$$P = \frac{1}{2}\rho v^2$$

$$V = \sqrt{\frac{2 \times 4 \times 1.03 \times 10^5}{0.72}}$$

$$\boxed{V = 338m/s}$$

7. A small sphere of volume v falling in a viscous medium acquires a terminal velocity u. What will be the terminal velocity of a sphere of same material and volume 8v falling through the same medium?

Solution

Since

$$v_t = \frac{2gr_1^2}{9\eta} \quad \text{.....(1)}$$

As

$$v = \frac{4}{3}\pi r^3$$

$$r = \left(\frac{3v}{4\pi}\right)^{\frac{1}{3}}$$

Putting the value of r in Equation (1)

$$v_t = \frac{2g}{9\eta}\left(\frac{3v}{4\pi}\right)^{\frac{2}{3}} \quad \text{.....(2)}$$

Since $v' = 8V$ so new terminal velocity of the sphere is

$$v_t = \frac{2g}{9\eta}\left(\frac{3 \times 8v}{4\pi}\right)^{\frac{2}{3}}$$

$$v_t = \frac{2g}{9\eta}\left(\frac{6}{\pi}\right)^{\frac{2}{3}} \times v^{\frac{2}{3}}$$

$$v_t = \frac{2g}{9\eta} \times 1.54\left(\frac{4\pi r^3}{3}\right)^{\frac{2}{3}}$$

$$v_t = \frac{2g}{9\eta} \times 1.54\left(\frac{4 \times r^3}{3}\right)^{\frac{2}{3}} \times r^2$$

$$v_t = \frac{2g}{9\eta} \times 1.54 \times 2.6 \times r^2$$

$$v_t = \frac{2gr^2}{9\eta} \times 4$$

$$\boxed{v_t = 4v_t} \quad \text{.....(3)}$$

From Equation (3), it is clear that if volume becomes 8 times terminal velocity becomes 4 times of initial terminal velocity.

8. Determine the radius of a water drop falling through air with a terminal velocity of 0.012 m/s.

Data

Terminal velocity of the drop v=0.012 m/s

Viscosity of air η = 1.9 ×10-5 NSm-2

Density of air δ = 1.2 kg/m3

Density of water δ_{water}= 1x 10^3 kg/m3

Solution

Since

$$v_t = \sqrt{\frac{2gr^2}{9\eta}}$$

$$r = \sqrt{\frac{9\eta V_t}{2g}}$$

$$r = \sqrt{\frac{9 \times 0.019 \times 10 - 3 \times 0.012}{2 \times 1 \times 10^3 \times 9.8}}$$

$$\boxed{r = 0.31mm}$$

onlinesabaq.com

Objective Type Questions & Answers

Select the best answer for the following MCQs:

i) The study of fluids in motion is called,

(a) fluid statics (b) fluid dynamics (c) dynamics (d) none of these

ii) An object moving through fluid experiences a retarding force called.

(a) surface tension (b) frictional force

(c) drag force (d) gravitational force

iii) The drag force increases as the speed of the object.

(a) increases (b) decreases (c) remains constant (d) none of these

iv) S.I. unit of viscosity is.

(a) kg m^{-2} s^{-1} (b) kg m^{2} s^{-2} (c) kg m^{-1} s^{-1} (d) kg m^{-2} s^{-2}

v) The equation F = 6 nnrv is called.

(a) Stokes' law (b) Newton's law (c) Faraday's law (d) Lenz's law

vi) The fluid which is incompressible and non-viscous is called.

(a) viscous fluid (b) non-ideal fluid (c) ideal fluid (d) perfect fluid

vii) The irregular or unsteady flow of the fluid is called.

(a) turbulent flow (b) laminar flow (c) stream line flow (d) steady flow

viii) When the drag force on an object falling vertically downward becomes equal to its weight, the body will fall with constant velocity is called.

(a) drag velocity (b) terminal velocity

(c) average velocity (d) instantaneous velocity

ix) The terminal velocity of water droplet of radius 1×10^{-4} m & density 1000 kg m^{-3} descending through air of viscosity 19×10^{-6} kg m^{-1} s^{-1} is,

(a) 1.1 m s^{-1} (b) 2.2 m s^{-1} (c) 3.3 m s^{-1} (d) 4.4 m s^{-1}

x) If each particle of the fluid passing through a point follows the same path, then the flow is called.

(a) irregular flow (b) turbulent flow (c) stream line flow (d) none of these

xi) The terminal velocity of a spherical droplet is given by.

(a) $v_T = \frac{2\rho^2 g r^2}{9\eta}$ (b) $v_T = \frac{2\rho g r^2}{9\eta}$ (c) $v_T = \frac{2\rho g^2 r^2}{9\eta^2}$ (d) $v_T = \frac{2\rho^2 g^2 r^2}{9\eta^2}$

xii) The terminal velocity of a tiny droplet of radius r falling vertically downward through air is proportional to.

(a) $v_t \propto r$ (b) $v_t \propto r^2$ (c) $v_t \propto r^3$ (d) $v_t \propto 1/r$

onlinesabaq.com