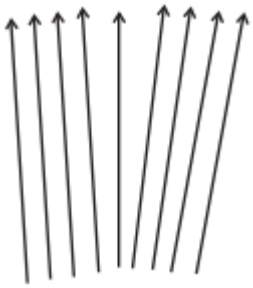
CBSE

MECHANICAL PROPERTIES OF FLUIDS WS 2

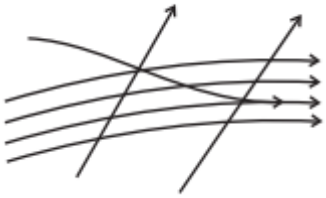
Class 11 - Physics

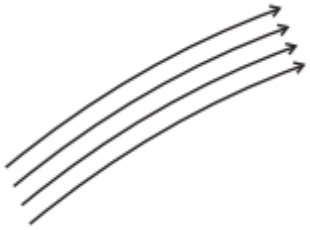
Section A

1. Which of the following diagrams (Fig.) does not represent a streamline flow? **[1]**

a) 

b)

c) 

d) 

2. At large flow velocities, the flow of fluid becomes: **[1]**

a) viscous

b) turbulent

c) compressible

d) laminar

3. An Incompressible fluid flows steadily through a cylindrical pipe which has radius 2 R at point A and R at a point B further along the flow direction. If the velocity at A is v, then that at B is **[1]**

a) v

b) $\frac{v}{2}$

c) 2v

d) 4v

4. In a streamline flow, **[1]**

i. the speed of a particle always remains same

ii. the velocity of a particle always remains same

iii. the kinetic energies of all the particles arriving at a given point are the same

iv. the potential energies of all the particles arriving at a given point are the same

a) Statement (iv) is correct.

b) Statement (ii) is correct.

c) Statement (i) is correct.

d) Statement (iii) is correct.

5. The radii of two drops are in the ratio of 3 : 2, their terminal velocities are in the ratio **[1]**

a) 3 : 2

b) 9 : 4

c) 2 : 9

d) 2 : 3

6. The rate of flow of water in a capillary tube of length l and radius r is V. The rate of flow in another capillary **[1]**

tube of length 2l and radius 2r for same pressure difference would be

a) 8V
b) 16V
c) 9V
d) 2V

7. A flow of liquid is streamlined if Reynold's number is: **[1]**

a) between 2000 and 3000
b) between 1000 and 2000
c) between 4000 and 5000
d) greater than 10000

8. Along a streamline, **[1]**

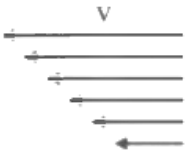
i. the velocity of a fluid particle remains constant
ii. the velocity of all fluid particles crossing a given position is constant
iii. the velocity of all fluid particles at a given instant is constant
iv. the speed of a fluid particle remains constant

a) Statement (i) is correct.
b) Statement (ii) is correct.
c) Statement (iv) is correct.
d) Statement (iii) is correct.

9. Flow is said to be steady if: **[1]**

a) the flow rate decreases 10% every second
b) the flow rate does not change with time
c) the flow rate increases with time
d) the flow rate decreases 20% every second

10. The velocity distribution given below represents **[1]**



a) liquid layer between two parallel glass plates where upper layer is moving to left.
b) flow of air past an aerofoil.
c) flow of any non-viscous fluid.
d) any flow with Reynold's number between 150 to 2050.

11. Two capillaries of lengths L and 2L and of radii R and 2R respectively are connected in series. The net rate of flow of fluid through them will (Given, rate of the flow-through single capillary, X = $\frac{\pi PR^4}{8\eta L}$) be **[1]**

a) $\frac{9}{8}$X
b) $\frac{7}{5}$X
c) $\frac{8}{9}$X
d) $\frac{5}{7}$X

12. in laminar flow: **[1]**

a) adjacent layers of fluid move in circle crossing each other and the flow is steady
b) adjacent layers of fluid do not slide smoothly past each other and the flow is unsteady
c) adjacent layers of fluid slide smoothly past each other and the flow is steady
d) adjacent layers of fluid slide smoothly past each other and the flow is unsteady

13. Critical velocity of the liquid **[1]**

a) increases when density increases
b) decreases when density increases

c) decreases when radius decreases

d) increases when radius increases

14. The streamline in a flow is a curve: **[1]**

a) whose perpendicular at any point is in the direction of the fluid velocity at that point.

b) which shows all points of equal pressure.

c) whose tangent at any point is in the direction of the fluid velocity at that point.

d) which shows all points of equal velocity.

15. Two rain drops of same radius r, falling with terminal velocity v merge and form a bigger drop of radius R. The terminal velocity of the bigger drop is **[1]**

a) 2v

b) $v\frac{R}{r}$

c) $v\frac{R^2}{r^2}$

d) v

16. **Assertion (A):** In steady flow, the velocity of each passing fluid particle remains constant in time. **[1]**
Reason (R): Each particle follows a smooth path and the paths of the particle do not cross each other.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

17. What is the laminar flow of a liquid? **[1]**

18. What are the different forms of energy possessed by a fluid in a streamlined flow? **[1]**

19. At what speed will the velocity of a stream of water be equal to 20 cm of mercury column? Take g = 10 ms^{-2}. **[1]**

20. A drop of water of radius 0.0015 mm is falling in air. If the coefficient of viscosity of air is 1.8×10^{-5} decapoise, what will be the terminal velocity of the drop? Given density of water = 10^3 kgm^{-3} and g = 9.8 ms^{-2}. Density of air can be neglected. **[1]**

21. On what factors does the critical speed of fluid flow depend? **[1]**

22. What should be the maximum average velocity of water in a tube of diameter 0.5 cm so that the flow is laminar? The viscosity of water is 0.00125 Nsm^{-2}. **[1]**

23. State conditions of equilibrium of floating bodies. **[1]**

24. What happens when the velocity of a liquid becomes greater than its critical velocity? **[1]**

25. When does the streamline flow become turbulent? **[1]**

26. What will be the nature of the graph between the velocity of fluid flow (v) and area of cross-section (a) of the pipe? **[1]**

27. Why does a stream of water from a faucet become narrow as it falls? **[1]**

28. Can two streamlines cross each other, why? **[1]**

29. What is the critical velocity of a liquid? **[1]**

30. Define the term fluid. **[1]**

31. What happens to the external energy maintaining the flow of a liquid when the flow becomes turbulent? **[1]**

32. Find the terminal velocity of a steel ball 2 mm in diameter falling through glycerine. Relative density of steel = 8, relative density of glycerine = 1.3 and viscosity of glycerine = 8.3 poise. **[1]**

33. Why It is easier to swim in sea water than in the river water? **[1]**

34. What do mean by a streamline and a tube of flow? **[1]**

Section B

35. **State True or False:** **[2]**

(a) Two streamlines can cross each other. **[1]**

(b) The greater is the crowding of streamline at a place greater is the velocity of the liquid particles at that place and vice-versa. **[1]**

36. i. Define streamline. **[2]**

ii. Write any two properties of streamlines.

37. What is the principle behind the up and down motion of a fish in water? **[2]**

38. Check the dimensional consistency of the Poiseuille's formula for the laminar flow in a tube : **[2]**

$Q = \frac{\pi R^4 (p_1 - p_2)}{8\eta l}$

39. What should be the average velocity of water in a tube of radius 0.005 m so that the flow is just turbulent? The viscosity of water is 0.001 Pa s. **[2]**

40. i. Draw stream lines for a clockwise spinning sphere. **[2]**

ii. Derive equation of continuity.

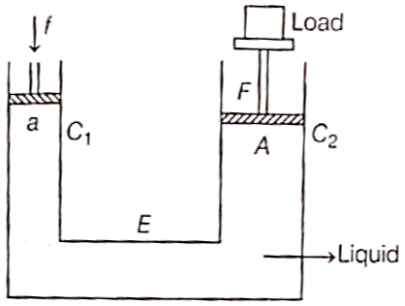
Section C

41. The flow rate of water is 0.58 L/mm from a tap of diameter of 1.30 cm. After some time, the flow rate is increased to 4 L/min. Determine the nature of the flow for both the flow rates. The coefficient of viscosity of water is 10^{-3}Pa - s and the density of water is 10^3 kg/m^3. **[3]**

Section D

Question No. 42 to 46 are based on the given text. Read the text carefully and answer the questions: **[5]**

Hydraulic lift is an application of Pascal's law. It is used to lift heavy loads. It is a force multiplier. So, when small forces applied on the smaller piston (acting downward) will be appearing as a very large force (acting upward) on the larger piston. As a result of it, a heavy load placed on the larger piston is easily lifted upwards.



42. Pascal's law states that pressure in a fluid at rest is the same at all points, if

a) they are at the same height and they are along same plane

b) they are along same plane

c) they are at the same height

d) they are along same line

43. Pressure is applied to an enclosed fluid as shown in the above figure. It is

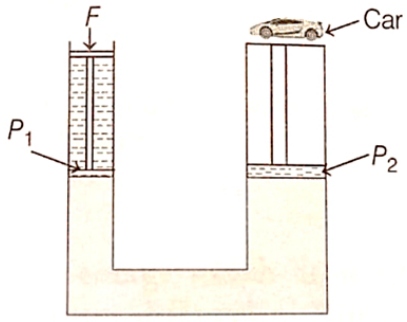
a) transmitted unchanged to every portion of the fluid and the walls of container

b) diminished and transmitted to the walls of the container

c) increased and applied to every part of the fluid

d) increased in proportion to the mass of the fluid and then transmitted

44. A hydraulic lift has 2 limbs of areas A and 2A. Force F is applied over limb of area A to lift a heavy car. If distance moved by piston P_1 is x, then distance moved by piston P_2 is



a) 2x
b) 4x
c) x
d) $\frac{x}{2}$

45. If work done by piston in the given figure on fluid is W_1, then work done by fluid in limbs on piston P_2 is

a) W_1
b) $\frac{W_1}{2}$
c) $4W_1$
d) $\frac{W_1}{4}$

46. Pressure at a point inside a liquid does not depend on

a) the nature of the liquid
b) the acceleration due to gravity at that point
c) total weight of fluid in the beaker
d) the depth of the point below the surface of the liquid

47. i. Define streamline. **[5]**
ii. Write any two properties of streamlines.
iii. Draw streamlines for a clockwise spinning sphere.
iv. Derive equation of continuity.

48. Explain the laws of floation with all possibilities of a body in a liquid. **[5]**

49. What is laminar flow of a liquid? Draw velocity profiles for the laminar flow of viscous and non-viscous liquids. **[5]**

Section E

50. **Fill in the blanks:** **[6]**

(a) The volume of a liquid flowing per second through a capillary tube under a constant pressure difference is directly proportional to the _____ power of radius. **[1]**

(b) The velocity of water in a river is _____ on the bank and _____ in the middle. **[1]**

(c) The maximum value of flow of liquid for which the motion remains streamlined is known as _____ velocity. **[1]**

(d) If the liquid flows over a horizontal surface in the form of layers of different velocities, then the flow of liquid is called _____. **[1]**

(e) For the model of a plane in a wind tunnel, turbulence occurs at a _____ speed for turbulence for an actual plane. (greater / smaller) **[1]**

(f) Greater the number of streamlines passing normally through a section of the fluid, _____ is the fluid velocity at that point. **[1]**