NEET UG (2024)
Physics
Quiz-7

SECTION - A

1. Two substances of densities ρ_1 and ρ_2 are mixed in equal volume and the relative density of mixture is 4. When they are mixed in equal masses, the relative density of the mixture is 3. The values of ρ_1 and ρ_2 are

(1) $\rho_1 = 6$ and $\rho_2 = 2$
(2) $\rho_1 = 3$ and $\rho_2 = 5$
(3) $\rho_1 = 12$ and $\rho_2 = 4$
(4) None of these

2. The cross-sections of a pipe at two points A and B are in the ratio $1:4$. If the speed of water flowing through the pipe at point A is v, its speed at point B is-

(1) $4v$
(2) $v/4$
(3) $2v$
(4) $v/2$

3. Energy needed in breaking a drop of radius R into n drops of radii r is given by

(1) $4\pi T(nr^2 - R^2)$ (2) $\frac{4}{3}\pi(r^2 n - R^2)$
(3) $4\pi T(R^2 - nr^2)$ (4) $4\pi T(nr^2 + R^2)$

4. If T is the surface tension of soap solution, the amount of work done in blowing a soap bubble from a diameter D to 2D is

(1) $2\pi D^2 T$ (2) $4\pi D^2 T$
(3) $6\pi D^2 T$ (4) $8\pi D^2 T$

5. If work W is done in blowing a bubble of radius R from a soap solution, then the work done in blowing a bubble of radius $2R$ from the same solution is

(1) $W/2$ (2) $2W$
(3) $4W$ (4) $2\frac{1}{3}W$

6. What is ratio of surface energy of 1 small drop and 1 large drop, if 1000 small drops combined to form 1 large drop

(1) 100 : 1
(2) 1000 : 1
(3) 10 : 1
(4) 1 : 100

7. The work done in increasing the size of a soap film from 10 cm × 6 cm to 10 cm × 11 cm is (3×10^{-4} joule). The surface tension of the film is

(1) 1.5×10^{-2} N/m
(2) 3.0×10^{-2} N/m
(3) 6.0×10^{-2} N/m
(4) 11.0×10^{-2} N/m

8. A big drop of radius R is formed by 1000 small droplets of water, then the radius of small drop is

(1) $R/2$ (2) $R/5$
(3) $R/6$ (4) $R/10$

9. The surface tension of soap solution is (25×10^{-3} Nm^{-1}). The excess pressure inside a soap bubble of diameter 1 cm is

(1) 10 Pa (2) 20 Pa
(3) 5 Pa (4) None of the above

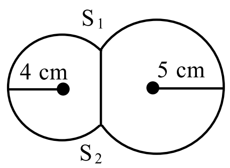
10. Pressure inside two soap bubbles are 1.01 and 1.02 atmospheres. Ratio between their volumes is

(1) 102 : 101 (2) (102) : (101)
(3) 8 : 1 (4) 2 : 1

11. A soap bubble in vacuum has a radius of 3 cm and another soap bubble in vacuum has a radius of 4 cm. If the two bubbles coalesce under isothermal condition, then the radius of the new bubble is

(1) 2.3 cm (2) 4.5 cm
(3) 5 cm (4) 7 cm

12. Two soap bubbles of radii r_1 and r_2 equal to 4 cm and 5 cm are touching each other over a common surface S_1S_2 (shown in figure). Its radius will be



(1) 4 cm (2) 20 cm
(3) 5 cm (4) 4.5 cm

13. Two capillaries made of same material but of different radii are dipped in a liquid. The rise of liquid in one capillary is 2.2 cm and that in the other is 6.6 cm. The ratio of their radii is

(1) 9 : 1
(2) 1 : 9
(3) 3 : 1
(4) 1 : 3

14. Water rises in a capillary tube when its one end is dipped vertically in it, is 3 cm. If the surface tension of water is 75×10^{-3} N/m, then the diameter of capillary will be
(1) 0.1 mm
(2) 0.5 mm
(3) 1.0 mm
(4) 2.0 mm

15. A capillary tube when immersed vertically in liquid records a rise of 3 cm. If the tube is immersed in the liquid at an angle of 60° with the vertical. The length of the liquid column along the tube is
(1) 9 cm
(2) 6 cm
(3) 3 cm
(4) 2 cm

16. **Assertion:** It is better to wash the clothes in cold soap solution.
Reason: The surface tension of cold solution is more than the surface tension of hot solution.
(1) Both **Assertion (A)** and **Reason (R)** are the true, and **Reason (R)** is a correct explanation of **Assertion (A)**.
(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.
(3) **Assertion (A)** is true, and **Reason (R)** is false.
(4) **Assertion (A)** is false, and **Reason (R)** is true.

17. **Assertion:** When height of a tube is less than liquid rise in the capillary tube, the liquid does not overflow.
Reason: Product of radius of meniscus and height of liquid in capillary tube always remains constant.
(1) Both **Assertion (A)** and **Reason (R)** are the true, and **Reason (R)** is a correct explanation of **Assertion (A)**.
(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.
(3) **Assertion (A)** is true, and **Reason (R)** is false.
(4) **Assertion (A)** is false, and **Reason (R)** is true.

18. **Assertion:** The impurities always decrease the surface tension of a liquid.
Reason: The change in surface tension of the liquid depends upon the degree of contamination of the impurity.
(1) Both **Assertion (A)** and **Reason (R)** are the true, and **Reason (R)** is a correct explanation of **Assertion (A)**.
(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.
(3) **Assertion (A)** is true, and **Reason (R)** is false.
(4) **Assertion (A)** is false, and **Reason (R)** is true.

19. **Assertion:** Hot soup tastes better than the cold soup.
Reason: Hot soup has high surface tension and it does not spread properly on our tongue.
(1) Both **Assertion (A)** and **Reason (R)** are the true, and **Reason (R)** is a correct explanation of **Assertion (A)**.
(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.
(3) **Assertion (A)** is true, and **Reason (R)** is false.
(4) **Assertion (A)** is false, and **Reason (R)** is true.

20. An iceberg of density 900 kg/m^3 is floating in water of density 1000 kg/m^3. The percentage of volume of ice-cube outside the water is
(1) 20% (2) 35%
(3) 10% (4) 25%

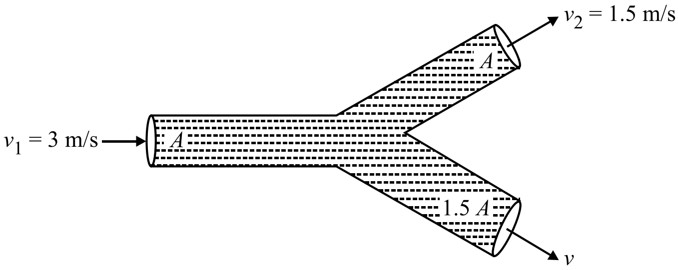
21. A triangular lamina of area A and height h is immersed in a liquid of density ρ in a vertical plane with its base on the surface of the liquid. The thrust on the lamina is
(1) $\frac{1}{2}A\rho gh$
(2) $\frac{1}{3}A\rho gh$
(3) $\frac{1}{6}A\rho gh$
(4) $\frac{2}{3}A\rho gh$

22. Two solids A and B float in water. It is observed that A floats with 1/2 of its body immersed in water and B floats with 1/4 of its volume above the water level. The ratio of the density of A to that of B is

(1) 4 : 3 (2) 2 : 3

(3) 3 : 4 (4) 1 : 2

23. An incompressible liquid flows through a horizontal tube as shown in the following fig. Then the velocity v of the fluid is



(1) 3.0 m/s (2) 1.5 m/s

(3) 1.0 m/s (4) 2.25 m/s

24. A large tank filled with water to a height 'h' is to be emptied through a small hole at the bottom. The ratio of time taken for the level of water to fall from h to $\frac{h}{2}$ and from $\frac{h}{2}$ to zero is

(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$

(3) $\sqrt{2}-1$ (4) $\frac{1}{\sqrt{2}-1}$

25. There is a hole of area A at the bottom of cylindrical vessel. Water is filled up to a height h and water flows out in t second. If water is filled to a height $4h$, it will flow out in time equal to

(1) t (2) $4t$

(3) $2t$ (4) $t/4$

26. A liquid is flowing in a horizontal uniform capillary tube under a constant pressure difference P. The value of pressure for which the rate of flow of the liquid is doubled when the radius and length both are doubled is

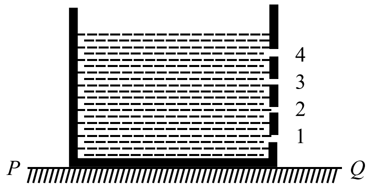
(1) P

(2) $\frac{3P}{4}$

(3) $\frac{P}{2}$

(4) $\frac{P}{4}$

27. A cylindrical vessel of 90 cm height is kept filled upto the brim. It has four holes 1, 2, 3, 4 which are respectively at heights of 20 cm, 30 cm, 45 cm and 50 cm from the horizontal floor PQ. The water falling at the maximum horizontal distance from the vessel comes from



(1) Hole number 4 (2) Hole number 3

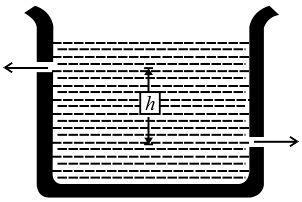
(3) Hole number 2 (4) Hole number 1

28. If two liquids of same masses but densities ρ_1 and ρ_2 respectively are mixed, then density of mixture is given by

(1) $\rho = \frac{\rho_1 + \rho_2}{2}$ (2) $\rho = \frac{\rho_1 + \rho_2}{2\rho_1\rho_2}$

(3) $\rho = \frac{2\rho_1\rho_2}{\rho_1 + \rho_2}$ (4) $\rho = \frac{\rho_1\rho_2}{\rho_1 + \rho_2}$

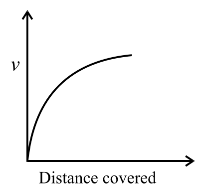
29. There are two identical small holes of area of cross-section a on the opposite sides of a tank containing a liquid of density ρ. The difference in height between the holes is h. Tank is resting on a smooth horizontal surface. Horizontal force which has to be applied on the tank to keep it in equilibrium is

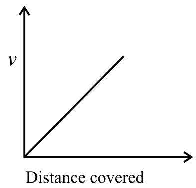


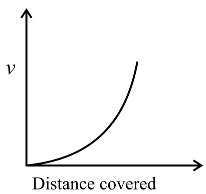
(1) $gh\rho a$ (2) $\frac{2gh}{\rho a}$

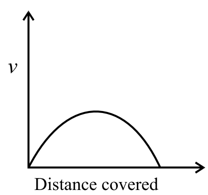
(3) $2\rho agh$ (4) $\frac{\rho gh}{a}$

30. A lead shot of 1 mm diameter falls through a long column of glycerine. The variation of its velocity v. with distance covered is represented by

(1) 

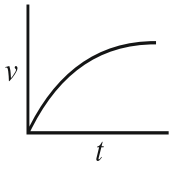
(2) 

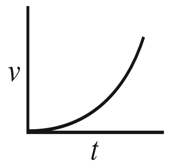
(3) 

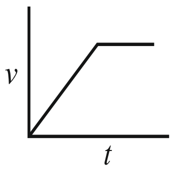
(4) 

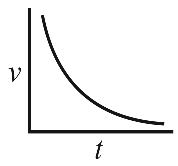
31. Bernoulli's equation is applicable in the case of:
(1) Streamlined flow of compressible fluids
(2) Streamlined flow of incompressible fluids
(3) Turbulent flow of compressible fluids
(4) Turbulent flow of incompressible fluids

32. A piece of cork starts from rest at the bottom of a lake and floats up. It velocity v is plotted against time t. Which of the following best represents the resulting curve?

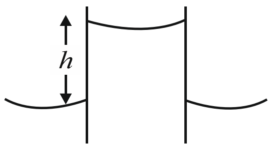
(1) 

(2) 

(3) 

(4) 

33. In a capillary rise experiment, radius of curvature of liquid surface is R. If approximate rise is h, then the surface tension of liquid is (Angle of contact is zero)



(1) $\frac{\rho g h R}{4}$ (2) $\frac{\rho g h R}{2}$
(3) Zero (4) $\rho g h R$

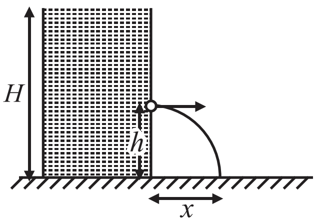
34. Eight raindrops each of radius R fall through air with terminal velocity 6 cms^{-1}. What is the terminal velocity of the bigger drop formed by coalescing these drops together?
(1) 18 cm s^{-1}
(2) 24 cm s^{-1}
(3) 15 cm s^{-1}
(4) 20 cm s^{-1}

35. A body of density ρ is dropped from rest from a height h into a lake of density $\sigma(\sigma > \rho)$. The maximum depth the body sinks inside the liquid is (neglect viscous effect of liquid)
(1) $\frac{h\rho}{\sigma-\rho}$ (2) $\frac{h\sigma}{\sigma-\rho}$
(3) $\frac{h\rho}{\sigma}$ (4) $\frac{h\sigma}{\rho}$

SECTION – B

36. A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and other is a circular hole of radius R at a depth $4y$ from the top. When tank is completely filled with water, the quantities of water flowing out per second from both holes area same. The R is equal to
(1) $\frac{L}{\sqrt{2\pi}}$ (2) $2\pi L$
(3) L (4) $\frac{L}{2\pi}$

37. A drum, placed on floor, is filled with a liquid of almost no viscosity to a height H. A small opening is made at a height h from the base. The liquid jet strikes the floor at a distance x from the wall of the drum, then maximum value of x is

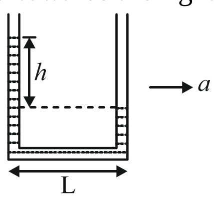


(1) $\frac{1}{2}(H-h)$ (2) H
(3) $\frac{1}{2}(H+h)$ (4) $\frac{hH}{x+h}$

38. Two stretched membranes of area 2 cm^2 and 3 cm^2 are placed in a liquid at the same depth. The ratio of pressures on them is
(1) 1 : 1 (2) 2 : 3
(3) 3 : 2 (4) $2^2 : 3^2$

39. Which of the following is conserved in Bernoulli's theorem?
(1) Mass (2) Momentum
(3) Energy (4) Density

40. When at rest a liquid stands at the same level in the tubes shown in figure. But as indicated a height difference h occurs when the system is given an acceleration a towards the right. Here h is equal to



(1) $\frac{aL}{2g}$ (2) $\frac{gL}{2a}$
(3) $\frac{gL}{a}$ (4) $\frac{aL}{g}$

41. A block of wood floats in water with 4/5 th of its volume submerged, but it just floats in another liquid. The density of liquid is (in kg/m^3)

(1) 750 (2) 800

(3) 1000 (4) 1250

42. The relative velocity of two consecutive layers is 8 cm/s. If the perpendicular distance between the layers is 0.1 cm, then the velocity gradient will be

(1) 8 sec^{-1}

(2) 80 sec^{-1}

(3) 0.8 sec^{-1}

(4) 0.08 sec^{-1}

43. A ball of density σ and radius r is dropped on the surface of a liquid of density ρ from certain height. If speed of ball does not change even on entering in liquid and viscosity of liquid is η, then the height from which ball dropped is-

(1) $2g\left[\dfrac{(\sigma-\rho)r}{9\eta}\right]^2$ (2) $\dfrac{2g(\sigma-\rho)^2r^2}{9\eta}$

(3) $\dfrac{2(\sigma-\rho)gr^2}{9\eta}$ (4) $2g\left[\dfrac{(\sigma-\rho)r^2}{9\eta}\right]^2$

44. If the terminal speed of a sphere of gold (density $19.5\ \text{kg/m}^3$) is $0.2\ \text{m/s}$ in a viscous liquid (density $=1.5\ \text{kg/m}^3$), find the terminal speed of a sphere of silver (density $=10.5\ \text{kg}/\text{m}^3$) of the same size in the same liquid.

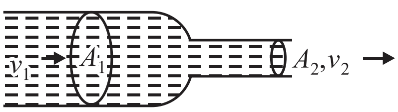
(1) 0.2 m/s

(2) 0.4 m/s

(3) 0.1 m/s

(4) 0.133 m/s

45. A liquid flows in the tube from left to right as shown in figure. A_1 and A_2 are the cross-section of the portion of the tube as shown. The ratio of speed v_1/v_2 will be-



(1) $\dfrac{A_1}{A_2}$ (2) $\dfrac{A_2}{A_1}$

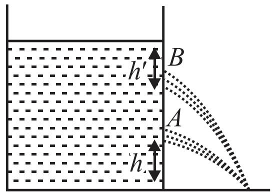
(3) $\sqrt{\dfrac{A_2}{A_1}}$ (4) $\sqrt{\dfrac{A_1}{A_2}}$

46. Two different liquids are flowing in two tubes of equal radius. The ratio of coefficients of viscosity of liquids is 52 : 49 and the ratio of their densities is 13 : 1, then the ratio of their critical velocities will be

(1) 4 : 49 (2) 49 : 4

(3) 2 : 7 (4) 7 : 2

47. A tank is filled with water and two holes A and B are made in it. For getting same range, ratio of h'/h is:



(1) 2 (2) 1/2

(3) 1/3 (4) 1

48. At what speed, the velocity head of water is equal to pressure head of 40 cm of mercury?

(1) 2.8 m/s (2) 10.32 m/s

(3) 5.6 m/s (4) 8.4 m/s

49. **Assertion (A):** Pressure is low in a region where velocity of air is high.

Reason (R): According Bernoulli's theorem if velocity increases, pressure decreases.

(1) Both **Assertion (A)** and **Reason (R)** are the true, and **Reason (R)** is a correct explanation of **Assertion (A)**.

(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.

(3) **Assertion (A)** is true, and **Reason (R)** is false.

(4) **Assertion (A)** is false, and **Reason (R)** is true.

50. Match **List-I** and **List-II** to find out the **correct** option.

List-I		List-II	
(I)	$\dfrac{v^2}{2g}+\dfrac{p}{\rho g}+z=$ constant	(A)	Total energy per unit mass
(II)	$\dfrac{\rho v^2}{2}+p+\rho gz=$ constant	(B)	Total energy per unit weight
(III)	$\dfrac{v^2}{2}+\dfrac{p}{\rho}+gz=$ constant	(C)	Total energy per unit volume

	(I)	(II)	(III)
(1)	(B)	(A)	(C)
(2)	(B)	(C)	(A)
(3)	(C)	(A)	(B)
(4)	(A)	(C)	(B)

Solution

1. **(1)** **[NCERT Pg No. 181]**

When substances are mixed in equal volume then density $=\dfrac{\rho_1+\rho_2}{2}=4$

$\Rightarrow \quad \rho_1+\rho_2=8$ ....(i)

When substances are mixed in equal masses then density $=\dfrac{2\rho_1\rho_2}{\rho_1+\rho_2}=3$

$\Rightarrow 2\rho_1\rho_2=3(\rho_1+\rho_2)$ ....(ii)

By solving (i) and (ii) we get $\rho_1=6$ and $\rho_2=2$.

2. **(2)** **[NCERT Pg No. 183]**

$$A_1V_1=A_2V_2$$

$$\frac{A_1}{A_2}=\frac{V_2}{V_1}$$

$$\frac{1}{4}=\frac{V_2}{V}$$

$$\boxed{V_2=\frac{V}{4}}$$

3. **(1)** **[NCERT Pg No. 194]**

Energy needed = Increment in surface energy

= (surface energy of n small drops) – (surface energy of one big drop)

$= n4\pi r^2T - 4\pi R^2T = 4\pi T(nr^2 - R^2)$

4. **(3)** **[NCERT Pg No. 195]**

Work done to increase the diameter of bubble from d to D

$W = 2\pi(D^2 - d^2)T = 2\pi[(2D)^2 - (D)^2]T = 6\pi D^2T$

5. **(3)** **[NCERT Pg No. 195]**

$W = 8\pi R^2T$ $\quad\therefore\ W \propto R^2$ (T is constant)

If radius becomes double then work done will become four times.

6. **(4)** **[NCERT Pg No. 194]**

Volume of liquid remain same i.e. volume of 1000 small drops will be equal to volume of one big drop

$$n\frac{4}{3}\pi r^3=\frac{4}{3}\pi R^3\Rightarrow 1000r^3=R^3\Rightarrow R=10r$$

$$\therefore\ \frac{r}{R}=\frac{1}{10}$$

$$\frac{\text{surface energy of one small drop}}{\text{surface energy of one big drop}}=\frac{4\pi r^2T}{4\pi R^2T}=\frac{1}{100}$$

7. **(2)** **[NCERT Pg No. 195]**

$W = T\cdot\Delta A$ $\qquad\therefore\quad T=\dfrac{W}{\Delta A}$

$$T=\frac{3\times10^{-4}}{2\times(110-60)\times10^{-4}}$$

(Soap film has two surfaces) $= 3\times10^{-2}$ N/m

8. **(4)** **[NCERT Pg No. 196]**

$$\frac{4}{3}\pi R^3=1000\times\frac{4}{3}\pi r^3$$

(As volume remains constant)

$$R^3=1000r^3\Rightarrow R=10r\Rightarrow r=\frac{R}{10}$$

9. **(2)** **[NCERT Pg No. 194]**

Excess pressure $\Delta P=\dfrac{4T}{r}$

$$=\frac{4\times2\times25\times10^{-3}}{1\times10^{-2}}=20\,\mathrm{N/m^2}=20\,\mathrm{Pa}$$

(as r = d/2)

10. **(3)** **[NCERT Pg No. 183]**

Outside pressure = 1 atm

Pressure inside first bubble = 1.01 atm

Pressure inside second bubble = 1.02 atm

Excess pressure ΔP_1 = 1.01 – 1 = 0.01 atm

Excess pressure ΔP_2 = 1.02 – 1 = 0.02 atm

$$\Delta P\propto\frac{1}{r}\Rightarrow r\propto\frac{1}{\Delta P}\Rightarrow\frac{r_1}{r_2}=\frac{\Delta P_2}{\Delta P_1}=\frac{0.02}{0.01}=\frac{2}{1}$$

Since $V=\dfrac{4}{3}\pi r^3$ $\quad\therefore\ \dfrac{V_1}{V_2}=\left(\dfrac{r_1}{r_2}\right)^3=\left(\dfrac{2}{1}\right)^3=\dfrac{8}{1}$

11. **(3)** **[NCERT Pg No. 195]**

$$r=\sqrt{r_1^2+r_2^2}=\sqrt{9+16}=5\,\mathrm{cm}$$

12. **(2)** **[NCERT Pg No. 195]**

$$r=\frac{r_1r_2}{r_1-r_2}=\frac{5\times4}{5-4}=20\,\mathrm{cm}$$

13. **(3)** **[NCERT Pg No. 197]**

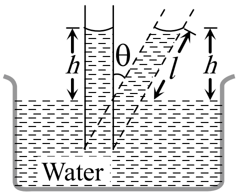
$$r\propto\frac{1}{h}\Rightarrow\frac{r_1}{r_2}=\frac{h_2}{h_1}=\frac{6.6}{2.2}=\frac{3}{1}$$

14. **(3)** **[NCERT Pg No. 196]**

$$T=\frac{rh\rho g}{2}\Rightarrow 75\times10^{-3}=\frac{3\times10^{-2}\times r\times10^3\times10}{2}$$

$$\Rightarrow r=\frac{1}{2}\,\mathrm{mm}\ \therefore D=2r=1\,\mathrm{mm}$$

15. **(2)** **[NCERT Pg No. 194]**



Vertical height of the water in the tube remains constant

So, $l = \dfrac{h}{\cos\theta} = \dfrac{3}{\cos 60^\circ} = 6\,\text{cm}$

16. **(4)** **[NCERT Pg No. 194]**

The soap solution, has less surface tension as compared to ordinary water and its surface tension decreases further on heating. The hot soap solution can, therefore spread over large surface area and also it has more wetting power. It is on account of this property that hot soap solution can penetrate and clean the clothes better than the ordinary water.

17. **(1)** **[NCERT Pg No. 197]**

$h = \dfrac{2T}{Rdg} \Rightarrow hR = \dfrac{2T}{Rdg} \quad \therefore hR = constant$

Hence when the tube is of insufficient length, radius of curvature of the liquid meniscus increases, so as to maintain the product hR a finite constant.

i.e. as h decreases, R increases and the liquid meniscus becomes more and more flat, but the liquid does not overflow.

18. **(4)** **[NCERT Pg No. 197]**

The presence of impurities either on the liquid surface or dissolved in it, considerably affect the force of surface tension, depending upon the degree of contamination. A highly soluble substance like sodium chloride when dissolved in water increase the surface tension. But the sparing soluble or substance like phenol when dissolved in water reduces the surface tension of water.

19. **(3)** **[NCERT Pg No. 194]**

With increase in temperature of liquid its surface tension decreases so that it tends to acquire larger area. Hence hot soup having low value of surface tension spread properly on our tongue & provides better taste than cold soup.

20. **(3)** **[NCERT Pg No. 181]**

Let the total volume of ice-berg is V and its density is ρ. If this ice-berg floats in water with volume V_{in} inside it then

$$V_{in}\sigma g = V\rho g \Rightarrow V_{in} = \left(\frac{\rho}{\sigma}\right)V$$

or $V_{out} = V - V_{in} = \left(\dfrac{\sigma - \rho}{\sigma}\right)V$

$$\Rightarrow \frac{V_{out}}{V} = \left(\frac{\sigma-\rho}{\sigma}\right) = \frac{1000-900}{1000} = \frac{1}{10}$$

$\therefore$ V_{out} = 10% of V

21. **(2)** **[NCERT Pg No. 182]**

Thrust on lamina = pressure at centroid × Area

$= \dfrac{h\rho g}{3} \times A = \dfrac{1}{3}A\rho gh.$

22. **(2)** **[NCERT Pg No. 181]**

Upthrust = weight of body

For A, $\dfrac{V_A}{2} \times \rho_W \times g = V_A \times \rho_A \times g \Rightarrow \rho_A = \dfrac{\rho_W}{2}$

For B,

$$\frac{3}{4}V_B \times \rho_W \times g = V_B \times \rho_B \times g \Rightarrow \rho_B = \frac{3}{4}\rho_W$$

(Since 1/4 of volume of B is above the water surface)

$$\therefore \quad \frac{\rho_A}{\rho_B} = \frac{\rho_W/2}{3/4\,\rho_W} = \frac{2}{3}$$

23. **(3)** **[NCERT Pg No. 187]**

If the liquid is incompressible then mass of liquid entering through left end, should be equal to mass of liquid coming out from the right end.

$\therefore M = m_1 + m_2 \Rightarrow Av_1 = Av_2 + 1.5Av$

$\Rightarrow \quad A \times 3 = A \times 1.5 + 1.5Av$

$\Rightarrow \quad v = 1\text{ m/s}$

24. **(3)** **[NCERT Pg No. 187]**

Time taken for the level to fall from H to H'

$$t = \frac{A}{A_0}\sqrt{\frac{2}{g}}\left[\sqrt{H} - \sqrt{H'}\right]$$

According to problem- the time taken for the level to fall from h to $\dfrac{h}{2}$

$$t_1 = \frac{A}{A_0}\sqrt{\frac{2}{g}}\left[\sqrt{h} - \sqrt{\frac{h}{2}}\right]$$

and similarly time taken for the level to fall from $\dfrac{h}{2}$ to zero $t_2 = \dfrac{A}{A_0}\sqrt{\dfrac{2}{g}}\left[\sqrt{\dfrac{h}{2}} - 0\right]$

$$\therefore \frac{t_1}{t_2} = \frac{1 - \frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{2}} - 0} = \sqrt{2} - 1.$$

25. **(3)** **[NCERT Pg No. 187]**

Time required to emptied the tank

$$t = \frac{A}{A_0}\sqrt{\frac{2H}{g}}$$

$$\therefore \frac{t_2}{t_1} = \sqrt{\frac{H_2}{H_1}} = \sqrt{\frac{4h}{h}} = 2 \quad \therefore t_2 = 2t$$

26. **(4)** **[NCERT Pg No. 188]**

From $V = \frac{P\pi r^4}{8\eta l} \Rightarrow P = \frac{V8\eta l}{\pi r^4}$

$$\Rightarrow \frac{P_2}{P_1} = \frac{V_2}{V_1} \times \frac{l_2}{l_1} \times \left(\frac{r_1}{r_2}\right)^4 = 2 \times 2 \times \left(\frac{1}{2}\right)^4 = \frac{1}{4}$$

$$\Rightarrow P_2 = \frac{P_1}{4} = \frac{P}{4}$$

27. **(2)** **[NCERT Pg No. 188]**

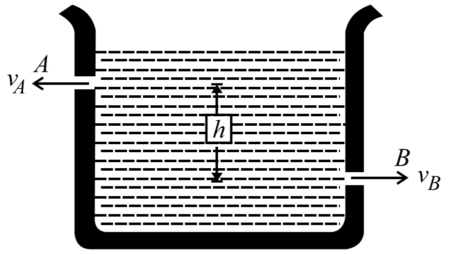
Horizontal range will be maximum when $h = \frac{H}{2} = \frac{90}{2}$ = 45 cm i.e. hole 3.

28. **(3)** **[NCERT Pg No. 183]**

$$\rho = \frac{\text{Total mass}}{\text{Total volume}} = \frac{2m}{V_1 + V_2} = \frac{2m}{m\left(\frac{1}{\rho_1} + \frac{1}{\rho_2}\right)}$$

$$\therefore \quad \rho = \frac{2\rho_1\rho_2}{\rho_1 + \rho_2}$$

29. **(3)** **[NCERT Pg No. 188]**



Net force (reaction)

$$= F = F_B - F_A = \frac{dp_B}{dt} - \frac{dp_A}{dt}$$

$$= av_B\rho \times v_B - av_A\,\rho \times v_A$$

$$\therefore \quad F = a\rho(v_B^2 - v_A^2)$$

According to Bernoulli's theorem

$$p_A + \frac{1}{2}\rho v_A^2 + \rho gh = p_B + \frac{1}{2}\rho v_B^2 + 0$$

$$\Rightarrow \frac{1}{2}\rho\left(v_B^2 - v_A^2\right) = \rho gh \Rightarrow v_B^2 - v_A^2 = 2gh$$

From equation (i), $F = 2a\rho gh$.

30. **(1)** **[NCERT Pg No.187]**

31. **(2)** **[NCERT Pg No. 191]**

Streamline flow is applicable for the streamlined flow of incompressible fluids.

32. **(1)** **[NCERT Pg No. 183]**

As the cork moves up, the force due to buoyancy remains constant. As its speed increases, the retarding force due to viscosity increases, being proportional to the speed. Thus, the acceleration gradually decreases. The acceleration is variable, and hence the relation between velocity and time is not linear.

33. **(2)** **[NCERT Pg No. 191]**

$P = P_0 - \rho gh$, P_0 = atmospheric pressure

$P_0 - P = \rho gh$ excess pressure of spherical surface

$$\frac{2T}{R} = \rho gh \qquad h = \frac{2T}{R\rho g}$$

34. **(2)** **[NCERT Pg No. 188]**

Terminal velocity $v_T = \frac{2}{9}\frac{R^2}{\eta}(\rho - \rho')g$

For the given material and liquid

$v_T \propto R^2$ (R = Radius of the raindrop)

When the eight raindrops combine together, let radius of new drop be R_1

Then, $\frac{4}{3}\pi R_1^3 = 8 \times \frac{4}{3}\pi R^3 \Rightarrow R_1 = 2R$

Thus $\frac{v_T}{v_{T_1}} = \left(\frac{R}{R_1}\right)^2 = \left(\frac{R}{2R}\right)^2$

$\frac{V_T}{V_{T_1}} = \frac{1}{4} \Rightarrow V_{T_1} = 4V_T = 4 \times 6 = 24 \text{ cm s}^{-1}$

(Given $V_T = 6 \text{ cm s}^{-1}$)

35. **(1)** **[NCERT Pg No. 181]**

Velocity of body just before touching the lake surface is,

$$v = \sqrt{2gh}$$

Retardation in the lake,

$$a = \frac{\text{upthrust} - \text{weight}}{\text{mass}}$$

$$= \frac{\sigma Vg - \rho Vg}{\rho V} = \left(\frac{\sigma - \rho}{\rho}\right)g$$

Maximum depth $d_{\max} = \frac{v^2}{2a} = \frac{h\rho}{\sigma - \rho}$

36. **(1)** **[NCERT Pg No. 183]**

$$Q_1 = Q_2$$

$$A_1 v_1 = A_2 v_2$$

$$L^2 \times \sqrt{2gy} = \pi R^2 \times \sqrt{2g.4y}$$

$$L^2 = 2\pi R^2$$

$$R = \frac{L}{\sqrt{2\pi}}$$

37. **(2)** **[NCERT Pg No. 188]**

$$x = vt = \sqrt{2g(H-h)}\sqrt{\frac{2h}{g}}$$

$$x = 2\sqrt{(H-h)h}$$

$$\frac{dx}{dh} = 2\frac{1}{dh}(Hh - h^2)^{1/2} = 2\times\frac{(H-2h)}{2\sqrt{H-h^2}}$$

For maximum $\frac{dx}{dh} = 0$

$H - 2h = 0$

$h = \frac{H}{2}$

$$x = 2\sqrt{Hh - h^2} = 2\sqrt{\frac{H^2}{2} - \frac{H^2}{4}}$$

$$x_{\max} = H$$

38. **(1)** **[NCERT Pg No. 188]**

Pressure is independent of area of cross section

39. **(3)** **[NCERT Pg No. 188]**

Energy remains conserved in Bernoulli's theorem.

40. **(4)** **[NCERT Pg No. 187]**

$$\tan\theta = \frac{a}{g} = \frac{h}{L}$$

$$\frac{a}{g} = \frac{h}{L} = h = \frac{aL}{g}$$

41. **(2)** **[NCERT Pg No. 191]**

$$\rho V_d g = \sigma V g$$

$$\rho V_d = \sigma V$$

$$\rho\frac{4}{5}V = \sigma V$$

$$1000\times\frac{4}{5} = \sigma$$

$$\sigma = 800$$

42. **(2)** **[NCERT Pg No. 191]**

$$\frac{dv}{dx} = \frac{8}{0.1} = 80s^{-1}$$

43. **(4)** **[NCERT Pg No. 192]**

$$v = \frac{2}{9}\frac{r^2 g(\sigma-\rho)}{\eta}$$

$$\because \quad v = \sqrt{2gh}$$

$$\sqrt{2gh} = \frac{2}{9}\frac{r^2 g(\sigma-\rho)}{\eta}$$

$$2gh = \left[\frac{2g}{9}\frac{r^2(\sigma-\rho)}{\eta}\right]^2$$

$$h = 2g\left[\frac{(\sigma-\rho)r^2}{9\eta}\right]^2$$

44. **(3)** **[NCERT Pg No. 192]**

$$v_T = \frac{2}{9}\frac{r^2 g(\sigma-\rho)}{\eta}$$

$$v_T \propto (\sigma-\rho)$$

$$\frac{0.2}{v_S} = \frac{19.5-1.5}{10.5-1.5}$$

v_S = 0.1 m/s

45. **(2)** **[NCERT Pg No. 188]**

AV = constant

$A_1v_1 = A_2v_2$

$$\frac{v_1}{v_2} = \frac{A_2}{A_1}$$

46. **(1)** **[NCERT Pg No. 188]**

Critical velocity $v = N_R\frac{\eta}{\rho r}$

$$\Rightarrow \frac{v_1}{v_2} = \frac{\eta_1}{\eta_2}\times\frac{\rho_2}{\rho_1} = \frac{52}{49}\times\frac{1}{13} = \frac{4}{49}.$$

47. **(4)** **[NCERT Pg No. 188]**

$$R = 2\sqrt{D(H-D)}$$

$$R_1 = R_2$$

$$2\sqrt{(y+h')h} = 2\sqrt{h'(y+h)}$$

$$\boxed{\frac{h'}{n} = 1}$$

48. **(2)** **[NCERT Pg No. 184]**

$$\frac{1}{2}\rho v^2 = \rho_{Hg} gh$$

$$\frac{1}{2}\times 10^3 \times \sigma^2 = 13.6\times 10^3 \times 10\times 40\times 10^{-2}$$

$$v^2 = 2\times 13.6\times 400\times 10^{-2}$$

v = 10.32 m/s

49. **(1)** **[NCERT Pg No. 184]**

According to Bernoulli theorem if velocity increases, pressure decreases.

50. **(2)** **[NCERT Pg No. 188]**

$\frac{v^2}{2g} = \frac{\frac{1}{2}mv^2}{mg}$ is energy per unit weight.

$\frac{\rho v^2}{2} = \frac{\frac{1}{2}mv^2}{m/e}$ is energy per unit volume.

$\frac{v^2}{2} = \frac{\frac{1}{2}mv^2}{m}$ is energy per unit mass.