

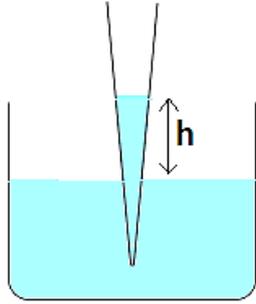
SUBJECTS	XI STD	WT - 16	JEE QP
PHYSICS	MECHANICAL PROPERTIES OF FLUIDS (FULL CHAPTER)		
CHEMISTRY	P-BLOCK ELEMENTS (FULL CHAPTER)		
MATHS	LIMITS (FULL CHAPTER)		
TOTAL MARKS – 300		DURATION – 3 Hrs	
EACH QUESTION CARRIES 4 MARKS. (-1 MARK) FOR WRONG ANSWER.			

### PHYSICS

- What is the shape of the meniscus when a non-wetting liquid is placed in a capillary tube?
  - Concave
  - Convex
  - Flat
  - Any of these depending on the radius of the tube
- Which of the following is not related to the Bernoulli's principle?
  - Blowing over a paper makes it rise
  - Operation of a venturimeter
  - Lift provided to an aeroplane by the air
  - Propelling force provided to an aeroplane by its propellers
- A certain number of spherical drops of a liquid of radius  $r$  coalesce to form a single drop of radius  $R$  and volume  $V$ . If  $T$  is the surface tension of the liquid, then
  - Energy =  $3VT\left(\frac{1}{r} - \frac{1}{R}\right)$  is released
  - Energy is neither released nor absorbed
  - Energy =  $4VT\left(\frac{1}{r} - \frac{1}{R}\right)$  is released
  - Energy =  $3VT\left(\frac{1}{r} + \frac{1}{R}\right)$  is absorbed
- The rise in the water level in a capillary tube of radius 0.07 cm when dipped vertically in a beaker containing water of surface tension  $0.07 \text{ Nm}^{-1}$  is ( $g = 10 \text{ ms}^{-2}$ )
  - 2 cm
  - 4 cm
  - 1.5 cm
  - 3 cm
- The excess pressure inside a soap bubble is twice the excess pressure inside a second soap bubble. The volume of the first bubble is 'n' times the volume of the second bubble, then 'n' is
  - 8
  - 4
  - 2
  - 0.125
- 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 the other is a circular hole of radius  $R$  at a depth  $4y$  from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both the holes are the same. Then  $R$  is equal to
  - $2\pi L$
  - $\frac{L}{\sqrt{2\pi}}$
  - $L$
  - $\frac{L}{2\pi}$



15. A glass capillary tube is of the shape of a truncated cone with an apex angle  $\alpha$  so that its two ends have cross sections of different radii. When dipped in water vertically, water rises in it to a height  $h$ , where the radius of its cross-section is  $b$ . If the surface tension of water is  $S$ , its density is  $\rho$ , and its contact angle with glass is  $\theta$ , the value of  $h$  will be ( $g$  is the acceleration due to gravity)



- a)  $\frac{2S}{b\rho g} \cos(\theta - \alpha)$                       b)  $\frac{2S}{b\rho g} \cos(\theta + \alpha)$   
c)  $\frac{2S}{b\rho g} \cos\left(\theta - \frac{\alpha}{2}\right)$                       d)  $\frac{2S}{b\rho g} \cos\left(\theta + \frac{\alpha}{2}\right)$

16. A raindrop with radius  $R = 0.2 \text{ mm}$  falls from a cloud at a height  $h = 2000 \text{ m}$  above the ground. Assume that the drop is spherical throughout its fall and the force of buoyance may be neglected, then the terminal speed attained by the raindrop is [Density of water  $\rho_w = 1000 \text{ kg m}^{-3}$  and Density of air  $\rho_a = 1.2 \text{ kg m}^{-3}$ ,  $g = 10 \text{ m/s}^2$ , Coefficient of viscosity of air  $= 1.8 \times 10^{-5} \text{ Nsm}^{-2}$ ]

- a)  $250.6 \text{ ms}^{-1}$                                       b)  $43.56 \text{ ms}^{-1}$   
c)  $4.94 \text{ ms}^{-1}$                                       d)  $14.4 \text{ ms}^{-1}$

17. The pressure acting on a submarine is  $3 \times 10^5 \text{ Pa}$  at a certain depth. If the depth is doubled, the percentage increase in the pressure acting on the submarine would be (Assume that atmospheric pressure is  $1 \times 10^5 \text{ Pa}$ , density of water is  $10^3 \text{ kgm}^{-3}$ ,  $g = 10 \text{ ms}^{-2}$ )

- a)  $\frac{200}{3} \%$     b)  $\frac{200}{5} \%$   
c)  $\frac{5}{200} \%$     d)  $\frac{3}{200} \%$

18. **Statement 1:** The stream of water flowing at high speed from a garden hose pipe tends to spread like a fountain when held vertically up, but tends to narrow down when held vertically down.

**Statement 2:** In any steady flow of an incompressible fluid, the volume flow rate of the fluid remains constant.

- a) Statement 1 is true, statement 2 is true; statement 2 is a correct explanation for statement 1  
b) Statement 1 is true, statement 2 is true; statement 2 is not a correct explanation for statement 1  
c) Statement 1 is true, statement 2 is false  
d) Statement 1 is false, statement 2 is true

19. **Statement – 1:** Surface area of a drop of liquid decreases to reduce energy.

**Statement – 2:** Molecules on the surface of a drop have more energy than the molecules in the interior.

- a) Statement 1 is true, statement 2 is true  
b) Statement 1 is true, statement 2 is false  
c) Statement 1 is false, statement 2 is true  
d) Statement 1 is false, statement 2 is false

20. Match the columns.

Column I		Column II	
A)	Capillaries of smaller radii	(p)	Flat meniscus
B)	Angle of contact is $90^\circ$	(q)	Greater height acquired by liquid in capillary tube
C)	Contact angle $> 90^\circ$	(r)	Meniscus is downward concave
D)	Mercury in glass tube	(s)	For mercury and glass pair

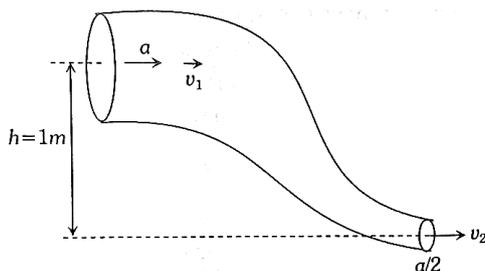
- a)  $A \rightarrow p$ ;  $B \rightarrow q$ ;  $C \rightarrow r$ ;  $D \rightarrow s$   
 b)  $A \rightarrow s$ ;  $B \rightarrow r$ ;  $C \rightarrow q$ ;  $D \rightarrow p$   
 c)  $A \rightarrow q$ ;  $B \rightarrow p$ ;  $C \rightarrow s$ ;  $D \rightarrow r$   
 d)  $A \rightarrow r$ ;  $B \rightarrow q$ ;  $C \rightarrow p$ ;  $D \rightarrow s$

21. The water is filled up to height of  $12\text{ m}$  in a tank having vertical sidewalls. A hole is made in one of the walls of a depth ' $h$ ' below the water level. The value of ' $h$ ' for which the emerging stream of water strikes the ground at the maximum range is \_\_\_\_\_ m.

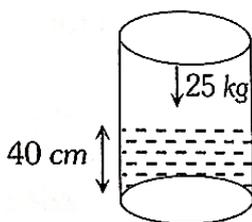
22. An ideal fluid of density  $800\text{ kgm}^{-3}$ , flows smoothly through a bent pipe (as shown in figure) that tapers in cross – sectional area from  $a$  to  $\frac{a}{2}$ . The pressure difference between the wide and narrow sections of

pipe is  $4100\text{ Pa}$ . At wider section, the velocity of fluid is  $\frac{\sqrt{x}}{6}\text{ ms}^{-1}$  for  $x =$  \_\_\_\_\_ .

(Given  $g = 10\text{ ms}^{-2}$ )



23. The area of cross – section of a large tank is  $0.5\text{ m}^2$ . It has a narrow opening near the bottom having area of cross-section  $1\text{ cm}^2$ . A load of  $25\text{ kg}$  is applied on the water at the top in the tank. Neglecting the speed of water in the tank, the velocity of the water, coming out of the opening at the time when the height of water level in the tank is  $40\text{ cm}$  above the bottom, will be \_\_\_\_\_  $\text{cms}^{-1}$  [Take  $g = 10\text{ ms}^{-2}$ ]



24. A small spherical ball of radius  $0.1\text{ mm}$  and density  $10^4\text{ kg m}^{-3}$  falls freely under gravity through a distance  $h$  before entering a tank of water. If after entering the water the velocity of ball does not change and it continues to fall with same constant velocity inside water, then the value of  $h$  will be \_\_\_\_\_ m.

(Given  $g = 10\text{ ms}^{-2}$ , viscosity of water =  $1.0 \times 10^{-5}\text{ Nsm}^{-2}$ )

25. Two soap bubbles  $A$  and  $B$  are kept in a closed chamber where the air is maintained at pressure  $8\text{ N/m}^2$ . The radii of bubbles  $A$  and  $B$  are  $2\text{ cm}$  and  $4\text{ cm}$ , respectively. Surface tension of the soap-water used to make bubbles is  $0.04\text{ N/m}$ . The value of  $n_B/n_A$ , is \_\_\_\_\_ where  $n_A$  and  $n_B$  are the number of moles of air in bubbles  $A$  and  $B$ , respectively. [Neglect the effect of gravity].



39. In graphite and diamond, the percentage of  $p$  – characters of the hybrid orbitals in hybridisation are respectively:

- a) 33 and 25  
 b) 67 and 75  
 c) 50 and 75  
 d) 33 and 75

40. Match List – I with List – II

List - I		List – II	
A)	Melting point [K]	(I)	Tl > In > Ga > Al > B
B)	Ionic Radius [ $M^{+3}/\text{pm}$ ]	(II)	B > Tl > Al $\approx$ Ga > In
C)	$\Delta_f H_f$ [kJmol $^{-1}$ ]	(III)	Tl > In > Al > Ga > B
D)	Atomic Radius [pm]	(IV)	B > Al > Tl > In > Ga

Choose the correct answer from the options given below:

- a) A – (III), B – (IV), C – (I), D – (II)  
 b) A – (II), B – (III), C – (IV), D – (I)  
 c) A – (IV), B – (I), C – (II), D – (III)  
 d) A – (I), B – (II), C – (III), D – (IV)

41. The incorrect statement regarding the structure of  $C_{60}$  is

- a) It contains 12 six – membered rings and 24 five – membered rings  
 b) The six-membered rings are fused to both six and five-membered rings  
 c) Each carbon atom forms three sigma bonds  
 d) The five-membered rings are fused only to six-membered rings

42. Consider the oxides of group 14 elements  $SiO_2$ ,  $GeO_2$ ,  $SnO_2$ ,  $PbO_2$ , CO and GeO. The amphoteric oxides are

- a)  $GeO$ , CO  
 b)  $SiO_2$ ,  $GeO_2$   
 c)  $SnO_2$ , CO  
 d)  $SnO_2$ ,  $PbO_2$

43. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence

- a)  $PbX_2 \ll SnX_2 \ll GeX_2 \ll SiX_2$   
 b)  $GeX_2 \ll SiX_2 \ll SnX_2 \ll PbX_2$   
 c)  $SiX_2 \ll GeX_2 \ll PbX_2 \ll SnX_2$   
 d)  $SiX_2 \ll GeX_2 \ll SnX_2 \ll PbX_2$

44. Given below are two statement:

**Statement I:** In group 13, the stability of +1 oxidation state increases down the group.

**Statement II:** The atomic size of gallium is greater than that of aluminium.

In the light of the above statements, choose the most appropriate answer from the options given below:

- a) Statement I is incorrect but Statement II is correct  
 b) Both Statement I and Statement II are correct  
 c) Both Statement I and Statement II are incorrect  
 d) Statement I is correct but Statement II is incorrect

45. Graphite is a soft solid lubricant extremely difficult to melt. The reason for this anomalous behavior is that graphite

- a) An allotropic form of diamond  
 b) Has molecules of variable molecular masses like polymers  
 c) Has carbon atoms arranged in large plates of rings of strongly bound carbon atoms with weak interplate bonds  
 d) A non-crystalline substance





65. Let  $x = 2$  be a root of the equation  $x^2 + px + q = 0$  and  $f(x) = \begin{cases} \frac{1 - \cos(x^2 - 4px + q^2 + 8q + 16)}{(x - 2p)^4}, & x \neq 2p \\ 0, & x = 2p \end{cases}$

Then,  $\lim_{x \rightarrow 2p^+} [f(x)]$ , where  $[ \cdot ]$  denotes greatest integer function, is

- a) 1                                      b) -1                                      c) 2                                      d) 0

66.  $\lim_{x \rightarrow \frac{1}{\sqrt{2}}} \frac{\sin(\cos^{-1} x) - x}{1 - \tan(\cos^{-1} x)}$  is equal to

- a)  $\sqrt{2}$                                       b)  $-\frac{1}{\sqrt{2}}$                                       c)  $\frac{1}{\sqrt{2}}$                                       d)  $-\sqrt{2}$

67. If  $\lim_{x \rightarrow 0} \left\{ 1 + x \log(1 + b^2) \right\}^{\frac{1}{x}} = 2b \sin^2 \theta, b > 0$  and  $\theta \in (-\pi, \pi]$ , then the value of  $\theta$  is

- a)  $\pm \frac{\pi}{2}$                                       b)  $\pm \frac{\pi}{3}$                                       c)  $\pm \frac{\pi}{6}$                                       d)  $\pm \frac{\pi}{4}$

68. Assertion (A):  $\lim_{x \rightarrow \alpha} \frac{\sqrt{1 - \cos 2(x - \alpha)}}{x - \alpha}$  does not exist

Reason (R):  $\lim_{x \rightarrow 0} \frac{|\sin x|}{x}$  does not exist

- 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

69. If  $[x]$  represents greatest integer  $\leq x$ , then  $\lim_{x \rightarrow 1} [|x - 1| + |x|]$

Assertion (A): doesn't exist.

Reason (R): RHL and LHL both are 1.

- 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

70. Match the following:

( $[x]$  denote greatest integer function  $\leq x$ )

Column - I		Column - II	
A)	$\lim_{x \rightarrow 5} \frac{x^2 - 9x + 20}{x - [x]}$	(i)	$\frac{x}{2}$
B)	$\lim_{n \rightarrow \infty} \frac{[x] + [2x] + \dots + [nx]}{n^2}$	(ii)	0
C)	$\lim_{x \rightarrow \frac{1}{2}^-} \frac{[x+1]}{x^2}$	(iii)	Does not exist
D)	$\lim_{x \rightarrow \frac{\pi}{2}} [\sin x]$	(iv)	4

- a) (A) - (ii), (B) - (i), (C) - (iv), (D) - (iii)  
 b) (A) - (iii), (B) - (i), (C) - (iv), (D) - (ii)  
 c) (A) - (i), (B) - (ii), (C) - (iv), (D) - (i)  
 d) (A) - (iv), (B) - (iii), (C) - (ii), (D) - (i)

71.  $\lim_{x \rightarrow 0} \left( \frac{(x + 2 \cos x)^3 + 2(x + 2 \cos x)^2 + 3 \sin(x + 2 \cos x)}{(x + 2)^3 + 2(x + 2)^2 + 3 \sin(x + 2)} \right)^{\frac{100}{x}}$  is equal to .....

72. Let  $\{x\}$  denote the fractional part of  $x$  and  $f(x) = \frac{\cos^{-1}(1 - \{x\}^2) \sin^{-1}(1 - \{x\})}{\{x\} - \{x\}^3}$ ,  $x \neq 0$ . If  $L$  and  $R$

respectively denotes the left-hand limit and the right-hand limit of  $f(x)$  at  $x = 0$ , then  $\frac{32}{\pi^2}(L^2 + R^2)$  is equal to .....

73. The value of the limit  $\lim_{x \rightarrow \frac{\pi}{2}} \frac{4\sqrt{2}(\sin 3x + \sin x)}{\left(2 \sin 2x \sin \frac{3x}{2} + \cos \frac{5x}{2}\right) - \left(\sqrt{2} + \sqrt{2} \cos 2x + \cos \frac{3x}{2}\right)}$  is.....

74. If  $\lim_{x \rightarrow 0} \frac{ax^2 e^x - b \log_e(1+x) + cx e^{-x}}{x^2 \sin x} = 1$ , then  $16(a^2 + b^2 + c^2)$  is equal to .....

75. Let  $m$  and  $n$  be two positive integers greater than 1. If  $\lim_{a \rightarrow 0} \left( \frac{e^{\cos(a^n)} - e}{a^m} \right) = -\left(\frac{e}{2}\right)$ , then the value of  $\frac{m}{n}$  is