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JEE MAIN MECHANICAL PROPERTIES OF FLUIDS — PYQS

Max. Marks: 156 **Questions:** 39

Section A (MCQ) — 28 questions

Q.1 A liquid of density 600 kg/m^3 flowing steadily in a tube of varying cross-section. The cross-section at a point A is 1.0 cm^2 and that at B is 20 mm^2. Both the points A and B are in same horizontal plane, the speed of the liquid at A is 10 cm/s. The difference in pressures at A and B points is _____ Pa.

[JEE Main 2026 (Online) 8th April Evening Shift]

(1) 18 (2) 144 (3) 36 (4) 72

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Q.2 A spherical liquid drop of radius R acquires the terminal velocity v_1 when falls through a gas of viscosity η. Now the drop is broken into 64 identical droplets and each droplet acquires terminal velocity v_2 falling through the same gas. The ratio of terminal velocities v_1/v_2 is _____.

[JEE Main 2026 (Online) 8th April Evening Shift]

(1) 4 (2) 0.25 (3) 32 (4) 16

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Q.3 A cylindrical vessel of 40 cm radius is completely filled with water and its capacity is 528 dm^3 (dm : decimeter). The vessel is placed on a solid block of exactly same height as vessel. If a small hole is made at 70 cm below the top of water level, then horizontal range of water falling on the ground in the beginning is _____ cm.

[JEE Main 2026 (Online) 6th April Evening Shift]

(1) $120\sqrt{2}$ (2) $140\sqrt{2}$

(3) $140\sqrt{3}$ (4) $120\sqrt{3}$

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Q.4 Eight mercury drops, each of radius r, coalesce to form a bigger drop. The surface energy released in this process is _____. (S is the surface tension of mercury).

[JEE Main 2026 (Online) 5th April Evening Shift]

(1) $8\pi r^2S$ (2) $16\pi r^2S$ (3) $64\pi r^2S$ (4) $4\pi r^2S$

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Q.5 A water spray gun is attached to a hose of cross sectional area 30 cm^2. The gun comprises of 10 perforations each of cross sectional area of 15 mm^2. If the water flows in the hose with the speed of 50 cm/s, calculate the speed at which the water flows out from each perforation. (Neglect any edge effects) [JEE Main 2026 (Online) 4th April Evening Shift]

(1) 100 m/s (2) 10 m/s

(3) 1000 m/s (4) 15×10^2 m/s

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Q.6 A liquid drop of diameter 2 mm breaks into 512 droplets. The change in surface energy is $\alpha \times 10^{-6}$ J. The value of α is _____. (Take surface tension of liquid = 0.08 N/m)

[JEE Main 2026 (Online) 2nd April Morning Shift]

(1) 10 (2) 7 (3) 8 (4) 11

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Q.7 The surface tension of a soap bubble is 0.03 N/m. The work done in increasing the diameter of bubble from 2 cm to 6 cm is $\alpha\pi \times 10^{-4}$ J. The value of α is _____. (Take π = 3.14)

[JEE Main 2026 (Online) 2nd April Evening Shift]

(1) 0.86 (2) 0.64 (3) 1.92 (4) 7.68

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Q.8 If an air bubble of diameter 2 mm rises steadily through a liquid of density 2000 kg/m^3 at a rate of 0.5 cm/s, then the coefficient of viscosity of liquid is _____ Poise. (Take g = 10 m/s^2)

[JEE Main 2026 (Online) 2nd April Evening Shift]

(1) 0.88 (2) 8.8 (3) 88.8 (4) 0.088

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Q.9 A cubical block of density ρ_b = 600 kg/m^3 floats in a liquid of density ρ_l = 900 kg/m^3. If the height of block is H = 8.0 cm, then height of the submerged part is _____ cm.

[JEE Main 2026 (Online) 24th January Evening Shift]

(1) 6.3 (2) 4.3 (3) 7.3 (4) 5.3

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Q.10 A small metallic sphere of diameter 2 mm and density 10.5 g/cm^3 is dropped in glycerine having viscosity 10 Poise and density 1.5 g/cm^3 respectively. The terminal velocity attained by the sphere is _____ cm/s.

($\pi = \frac{22}{7}$ and g = 10 m/s^2)

[JEE Main 2026 (Online) 23rd January Evening Shift]

(1) 1.0 (2) 1.5 (3) 3.0 (4) 2.0

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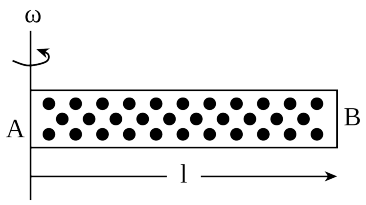
Q.11 A cylindrical tube AB of length l, closed at both ends contains an ideal gas of 1 mol having molecular weight M. The tube is rotated in a horizontal plane with constant angular velocity ω about an axis perpendicular to AB and passing through the edge at end A, as shown in the figure. If P_A and P_B are the pressures at A and B respectively, then (Consider the temperature is same at all points in the tube)

[JEE Main 2026 (Online) 22nd January Morning Shift]



(1) $P_B = P_A e^{\left(\frac{M\omega^2 l^2}{3RT}\right)}$ (2) $P_B = P_A$

(3) $P_B = P_A e^{\left(\frac{M\omega^2 l^2}{2RT}\right)}$ (4) $P_B = P_A e^{\left(\frac{M\omega^2 l^2}{RT}\right)}$

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Q.12 Given below are two statements :

Statement-I: Pressure of a fluid is exerted only on a solid surface in contact as the fluid-pressure does not exist everywhere in a still fluid.

Statement-II: Excess potential energy of the molecules on the surface of a liquid, when compared to interior, results in surface tension.

In the light of the above statements, choose the correct answer from the options given below

[JEE Main 2026 (Online) 22nd January Morning Shift]

(1) Statement-I is false but Statement-II is true

(2) Statement-I is true but Statement-II is false

(3) Both Statement-I and Statement-II are false

(4) Both Statement-I and Statement-II are true

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Q.13 When a part of a straight capillary tube is placed vertically in a liquid, the liquid rises up to certain height h. If the inner radius of the capillary tube, density of the liquid and surface tension of the liquid decrease by 1% each, then the height of the liquid in the tube will change by _____ %.

[JEE Main 2026 (Online) 22nd January Evening Shift]

(1) +3 (2) +1 (3) −1 (4) −3

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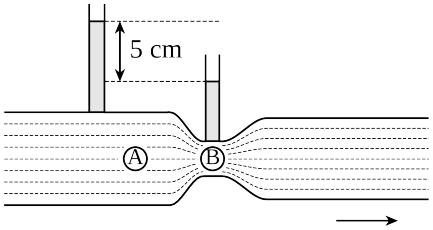
Q.14 Water flows through a horizontal tube as shown in the figure. The difference in height between the water columns in vertical tubes is 5 cm and the area of cross-sections at A and B are 6 cm^2 and 3 cm^2 respectively. The rate of flow will be _____ cm^3/s. (take g = 10 m/s^2)

[JEE Main 2026 (Online) 21st January Morning Shift]



(1) $100\sqrt{3}$ (2) $\frac{200}{\sqrt{3}}$

(3) $200\sqrt{6}$ (4) $200\sqrt{3}$

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Q.15 Surface tension of two liquids (having same densities), T_1 and T_2, are measured using capillary rise method utilizing two tubes with inner radii of r_1 and r_2 where $r_1 > r_2$. The measured liquid heights in these tubes are h_1 and h_2 respectively. [Ignore the weight of the liquid above the lowest point of meniscus]. The heights h_1 and h_2 and surface tensions T_1 and T_2 satisfy the relation :

[JEE Main 2026 (Online) 21st January Evening Shift]

(1) $h_1 > h_2$ and $T_1 = T_2$ (2) $h_1 < h_2$ and $T_1 = T_2$

(3) $h_1 > h_2$ and $T_1 < T_2$ (4) $h_1 = h_2$ and $T_1 = T_2$

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Q.16 A capillary tube of radius 0.1 mm is partly dipped in water (surface tension 70 dyn/cm and glass water contact angle ≈ 0°) with 30° inclined with the vertical. The length of water risen in the capillary is _____ cm. (Take g = 9.8 m/s^2)

[JEE Main 2025 (Online) 7th April Evening Shift]

(1) $\frac{82}{5}$ (2) $\frac{68}{5}$ (3) $\frac{57}{2}$ (4) $\frac{71}{5}$

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Q.17 Two liquids A and B have θ_A and θ_B as contact angles in a capillary tube. If $K = \cos\theta_A/\cos\theta_B$, then identify the correct statement:

[JEE Main 2025 (Online) 4th April Morning Shift]

(1) K is negative, then liquid A and liquid B have convex meniscus.

(2) K is negative, then liquid A and liquid B have concave meniscus.

(3) K is zero, then liquid A has convex meniscus and liquid B has concave meniscus.

(4) K is negative, then liquid A has concave meniscus and liquid B has convex meniscus.

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Q.18 Consider a completely full cylindrical water tank of height 1.6 m and of cross-sectional area 0.5 m^2. It has a small hole in its side at a height 90 cm from the bottom. Assume, the cross-sectional area of the hole to be negligibly small as compared to that of the water tank. If a load 50 kg is applied at the top surface of the water in the tank then the velocity of the water coming out at the instant when the hole is opened is:
($g = 10\ m/s^2$)

[JEE Main 2025 (Online) 3rd April Morning Shift]

(1) 2 m/s (2) 5 m/s (3) 3 m/s (4) 4 m/s

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Q.19 A solid steel ball of diameter 3.6 mm acquired terminal velocity 2.45×10^{-2} m/s while falling under gravity through an oil of density 925 kg m^{-3}. Take density of steel as 7825 kg m^{-3} and g as 9.8 m/s^2. The viscosity of the oil in SI unit is

[JEE Main 2025 (Online) 3rd April Evening Shift]

(1) 2.18 (2) 1.68 (3) 2.38 (4) 1.99

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Q.20 Two water drops each of radius 'r' coalesce to form a bigger drop. If 'T' is the surface tension, the surface energy released in this process is :

[JEE Main 2025 (Online) 2nd April Evening Shift]

(1) $4\pi r^2T[2 - 2^{1/3}]$ (2) $4\pi r^2T[1 + \sqrt{2}]$

(3) $4\pi r^2T[2 - 2^{2/3}]$ (4) $4\pi r^2T[\sqrt{2} - 1]$

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Q.21 Consider following statements:

A. Surface tension arises due to extra energy of the molecules at the interior as compared to the molecules at the surface, of a liquid.

B. As the temperature of liquid rises, the coefficient of viscosity increases.

C. As the temperature of gas increases, the coefficient of viscosity increases.

D. The onset of turbulence is determined by Reynolds number.

E. In a steady flow two stream lines never intersect.

Choose the correct answer from the options given below:

[JEE Main 2025 (Online) 28th January Morning Shift]

(1) B, C, D Only (2) C, D, E Only

(3) A, D, E Only (4) A, B, C Only

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Q.22 A 400 g solid cube having an edge of length 10 cm floats in water. How much volume of the cube is outside the water?
(Given: density of water = 1000 kg m^{-3})

[JEE Main 2025 (Online) 28th January Evening Shift]

(1) 400 cm^3 (2) 600 cm^3

(3) 1400 cm^3 (4) 4000 cm^3

Scan or tap for the full solution

Q.23 An air bubble of radius 0.1 cm lies at a depth of 20 cm below the free surface of a liquid of density 1000 kg/m^3. If the pressure inside the bubble is 2100 N/m^2 greater than the atmospheric pressure, then the surface tension of the liquid in SI unit is (use $g = 10\ m/s^2$)

[JEE Main 2025 (Online) 24th January Morning Shift]

(1) 0.02 (2) 0.05 (3) 0.25 (4) 0.1

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Q.24 The amount of work done to break a big water drop of radius 'R' into 27 small drops of equal radius is 10 J. The work done required to break the same big drop into 64 small drops of equal radius will be

[JEE Main 2025 (Online) 24th January Morning Shift]

(1) 20 J (2) 10 J (3) 5 J (4) 15 J

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Q.25 Given below are two statements:

Statement-I: The hot water flows faster than cold water

Statement-II: Soap water has higher surface tension as compared to fresh water

In the light of the above statements, choose the correct answer from the options given below

[JEE Main 2025 (Online) 23rd January Morning Shift]

(1) Both Statement-I and Statement-II are false
(2) Both Statement-I and Statement-II are true
(3) Statement-I is false but Statement-II is true
(4) Statement-I is true but Statement-II is false

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Q.26 Water flows in a horizontal pipe whose one end is closed with a valve. The reading of the pressure gauge attached to the pipe is P_1. The reading of the pressure gauge falls to P_2 when the valve is opened. The speed of water flowing in the pipe is proportional to

[JEE Main 2025 (Online) 23rd January Evening Shift]

(1) $(P_1 - P_2)^2$ (2) $\sqrt{P_1 - P_2}$
(3) $P_1 - P_2$ (4) $(P_1 - P_2)^4$

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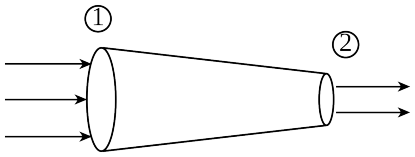
Q.27 A tube of length L is shown in the figure. The radius of cross section at the point (1) is 2 cm and at the point (2) is 1 cm , respectively. If the velocity of water entering at point (1) is 2 m/s, then velocity of water leaving the point (2) will be

[JEE Main 2025 (Online) 22nd January Evening Shift]



(1) 4 m/s (2) 6 m/s (3) 2 m/s (4) 8 m/s

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Q.28 A small rigid spherical ball of mass M is dropped in a long vertical tube containing glycerine. The velocity of the ball becomes constant after some time. If the density of glycerine is half of the density of the ball, then the viscous force acting on the ball will be (consider g as acceleration due to gravity)

[JEE Main 2025 (Online) 22nd January Evening Shift]

(1) 2Mg (2) $\frac{3}{2}$Mg (3) $\frac{Mg}{2}$ (4) Mg

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Section B (Numerical) — 11 questions

Q.29 The surface tension of a soap solution is 3.5×10^{-2} N/m. The work required to increase the radius of a soap bubble from 1 cm to 2 cm is $\alpha \times 10^{-6}$ J. The value of α is _____.
(π = 22/7)

[JEE Main 2026 (Online) 4th April Morning Shift]

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Q.30 A tub is filled with water and a wooden cube 10 cm × 10 cm × 10 cm is placed in the water. The wooden cube is found to float on the water with a part of it submerged in water. When a metal coin is placed on the wooden cube, the submerged part is increased by 3.87 cm. The mass of the metal coin is _____ gram.
(Take water density as 1 g/cm^3 and density of wood as 0.4 g/cm^3)

[JEE Main 2026 (Online) 2nd April Morning Shift]

Scan or tap for the full solution

Q.31 Sixty four raindrops of radius 1 mm each falling down with a terminal velocity of 10 cm/s coalesce to form a bigger drop. The terminal velocity of bigger drop is _____ cm/s.

[JEE Main 2026 (Online) 24th January Morning Shift]

Scan or tap for the full solution

Q.32 A soap bubble of surface tension 0.04 N/m is blown to a diameter of 7 cm. If (15000 − x) μJ of work is done in blowing it further to make its diameter 14 cm, then the value of x is _____.
(π = 22/7)

[JEE Main 2026 (Online) 24th January Evening Shift]

Scan or tap for the full solution

Q.33 The terminal velocity of a metallic ball of radius 6 mm in a viscous fluid is 20 cm/s. The terminal velocity of another ball of same material and having radius 3 mm in the same fluid will be _____ cm/s.

[JEE Main 2026 (Online) 21st January Evening Shift]

Scan or tap for the full solution

Q.34 A cube having a side of 10 cm with unknown mass and 200 gm mass were hung at two ends of a uniform rigid rod of 27 cm long. The rod along with masses was placed on a wedge keeping the distance between wedge point and 200 gm weight as 25 cm. Initially the masses were not at balance. A beaker is placed beneath the unknown mass and water is added slowly to it. At given point the masses were in balance and half volume of the unknown mass was inside the water.
(Take the density of unknown mass is more than that of the water, the mass did not absorb water and water density is 1 gm/cm^3.)
The unknown mass is _____ kg.

[JEE Main 2025 (Online) 8th April Evening Shift]

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Q.35 The excess pressure inside a soap bubble A in air is half the excess pressure inside another soap bubble B in air. If the volume of the bubble A is n times the volume of the bubble B, then, the value of n is _____. [JEE Main 2025 (Online) 3rd April Evening Shift]

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Q.36 A vessel with square cross-section and height of 6 m is vertically partitioned. A small window of 100 cm^2 with hinged door is fitted at a depth of 3 m in the partition wall. One part of the vessel is filled completely with water and the other side is filled with the liquid having density 1.5×10^3 kg/m^3. What force one needs to apply on the hinged door so that it does not get opened?
(Acceleration due to gravity = 10 m/s^2)

[JEE Main 2025 (Online) 2nd April Morning Shift]

Scan or tap for the full solution

Q.37 In a hydraulic lift, the surface area of the input piston is 6 cm^2 and that of the output piston is 1500 cm^2. If 100 N force is applied to the input piston to raise the output piston by 20 cm, then the work done is _____ kJ.

[JEE Main 2025 (Online) 29th January Morning Shift]

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Q.38 An air bubble of radius 1.0 mm is observed at a depth 20 cm below the free surface of a liquid having surface tension 0.095 J/m^2 and density 10^3 kg/m^3. The difference between pressure inside the bubble and atmospheric pressure is _____ N/m^2. (Take g = 10 m/s^2)

[JEE Main 2025 (Online) 23rd January Evening Shift]

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Q.39 Two soap bubbles of radius 2 cm and 4 cm , respectively, are in contact with each other. The radius of curvature of the common surface, in cm , is _____.

[JEE Main 2025 (Online) 22nd January Morning Shift]

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ANSWER KEY

Section A (MCQ) — 28 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	**4**	**4**	**2**	**2**	**2**	**2**	**3**	**2**	**4**	**4**	**3**
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	**1**	**2**	**4**	**2**	**1**	**4**	**4**	**4**	**3**	**2**	**2**
Ques.	23	24	25	26	27	28					
Ans.	**2**	**4**	**4**	**2**	**4**	**3**					

Section B (Numerical) — 11 questions

Ques.	29	30	31	32	33	34	35
Ans.	**264**	**387**	**160**	**11304**	**5**	**3**	**8**
Ques.	36	37	38	39			
Ans.	**150**	**5**	**2190**	**4**			