PHYSICS

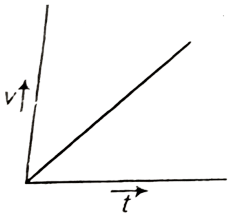
BOOKS - NCERT PHYSICS (HINGLISH)

MECHANICAL PROPERTIES OF FLUIDS

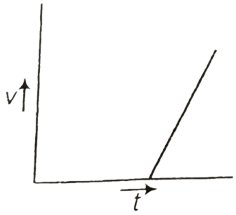
Multiple Choice Questions Mcqs

1. A tall cylinder is filled with viscous oil. A round pebble is dropped from the top with zero initial velocity. From the plot shown in figure, indicate the one that represents the velocity (v) of the pebble as a function of time (t)

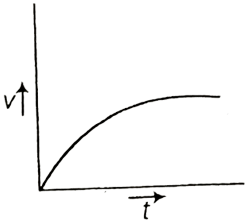
A.



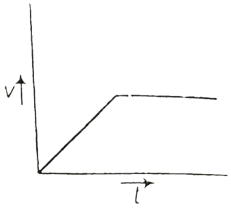
B.



C.



D.



Answer: C

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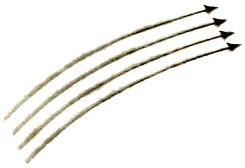
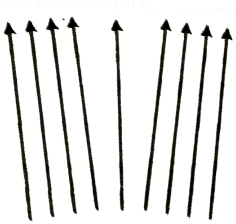
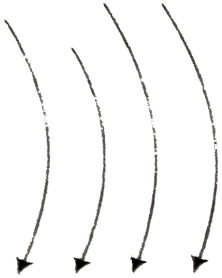
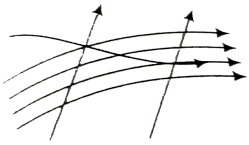
2. Which of the following diagrams does not represent a streamline flow?

A. 

B. 

C. 

D. 

Answer: D

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3. Along a streamline,

A. the velocity of a fluid particle remains constant

B. the velocity of all fluid particles crossing a given position is constant

C. the velocity of all fluid particles at a given instant is constant

D. the speed of a fluid particle remains constant

Answer: B

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4. An ideal fluid flows through a pipe of circular cross-section made of two sections with diameters $2.5cm$ and $3.75cm$. The ratio of the velocities in the two pipes is

A. $9:4$

B. $3:2$

C. $\sqrt{3}:\sqrt{2}$

D. $\sqrt{2}:\sqrt{3}$

Answer: A

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5. The angle of contact at the interface of water glass is 0° ethylalcohol-glass is 0° mercury glass is 140° and

methyliodide-glass is 30° A glass capillary is put in a through containing one of these four liquids. It is observed that the meniscus is convex. The liquid in the through is

A. water

B. ethyalcohol

C. mercury

D. methyliodide

Answer: C

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Multiple Choice Questions More Than One Options

1. For a surface molecule,

A. the net force on it is zero

B. there is a net downward force

C. the potential energy is less than that of a molecule inside

D. the potenital energy is more than that is molecule inside

Answer: B::D

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2. Pressure is a scalar quantity, because

A. it is the ratio of force of area and both force and area are vectors

B. it is the ratio of the magnitude of the force to area

C. it is the ratio of the componenet of the force normal to the area

D. it does not depend on the size of the area chosen

Answer: B::C

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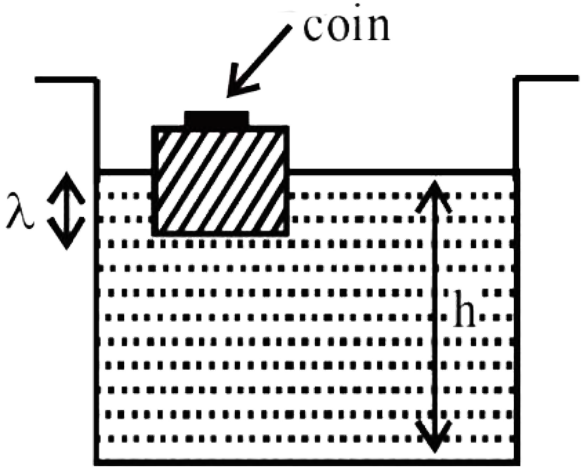
3. A wooden block, with a coin placed on its top, floats in water as shown in figure. The distance l and h are shown

here. After some time the coin falls into water. Then



A. l decreases

B. h decreases

C. l increases

D. h increases

Answer: A::B

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4. With increase in temperature the viscosity of

A. gases decreases

B. liquids increases

C. gases increases

D. liquids decreases

Answer: C::D

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5. Streamline flow is more likely for liquid with

A. high denisty

B. high viscosity

C. low density

D. low viscosity

Answer: B::C

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Very Short Answer Type Questions

1. Is viscosity a vector ?

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2. Is surface tension a vector ?

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3. Iceberg floats in water with part of it submerged. What is the fraction of the volume of iceberg submerged if the density of ice is $\rho_i = 0.917 gcm^{-3}$?

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4. A vessel filled with water is kept on a weighing pan and the scale adjusted of zero. A block of mass M and density ρ is suspended by a masselss spring of spring constant k. This block is submerged inside into the water in the vessel. What is the reading of the scale /

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5. A cubical block of density ρ is floating on the surface of water. Out of its height L, fraction x is submerged in water. The vessel is in an elevator accelerating upward with acceleration a. What is the fraction immersed ?

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Short Answer Type Questions

1. The sap in trees, which consists mainly of water in summer, rises in a system of capillaries of radius $r = 2.5 \times 10^{-5} m.$ The surface tension of sap is $T = 7.28 \times 10^{-2} Nm^{-1}$ and the angle of contact is 0°. Does surface tension alone ac count for the supply of water to the top of all trees ?

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2. The free surface of oil in a tanker, at rest, is horizontal if the tanker starts ac celerating the free surface will be titled by an angle θ. If the ac celeration is a ms^{-2} what will be the slope of the free surface ?

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3. Two mercury droplets of radii 0.1 cm and 0.2 cm collapse into one single drop. What amount of energy is released? The surface tension of mercury $T = 435.5 \times 10^{-3} Nm^{-1}$

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4. If a drop of liquid breaks into smaller droplets, it result in lowering of temperature of the droplets. Let a drop of radius R, breaks into N small droplets each of radius r. Estimate the drop in temperature.

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5. The surface tension and vapour pressure of water at $20^\circ C$ is $7.28 \times 10^{-2} Nm^{-1}$ and $2.33 \times 10^3 Pa$, respectively. What is the radius of the smallest spherical water droplet which can form without evaporating at $20^\circ C$?

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Long Answer Type Questions

1. (a) Pressure decreases as one ascends the atmosphere. If the density of air is ρ, What is the change in pressure dp over a differential height dh ? (b) Considering the pressure p to be proportional to the density, find the pressure p at a height h if the pressure on the sureface of the earth is p_0. (c) If $p_0 = 1.03 \times 10^5 Nm^{-2}$, $\rho_0 = 1.29 kgm^{-3}$ and $g = 9.8 ms^{-2}$, at what height will the pressure drop to $(1/10)$ the value at the surface of the earth ? (d) This model of the atmosphere works for relatively small distance. Identify the underlying assumption that limits the model.

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2. Surface tension is exhibited by liquids due to force of attraction between molecules of the liquid. The surface tension decreases with increase in temperature and vanishes at boiling point. Given that the latent heat o vaporisation for water $L_v = 540\text{k cal kg}^{-1}$, the mechanical equivalent of heat $J.\ 4.2\text{J cal}^{-1}$, density of water $\rho_w = 10^3 kgl^{-1}$, Avagardro's number $N_A = 6.0 \times 10^{26} K\text{mole}^{-6}$ and the molecular weight of water $M_A = 10$ kg for 1 k mole.

(a) Estimate the energy required for one molecules of water to evaporate.

(b) Show that the inter-molecular distance for water is $d = \left[\frac{M_A}{N_A} \times \frac{1}{\rho_w}\right]^{1/3}$ and find its values.

(c) 1 g of water in the vapour state at 1 atm occupies $1601 cm^3$. Estimate the inter-molecules distance at boiling

point, in the vapour state.

(d) During vaporisation a molecules overcomes a force F, assumed constant, to go from an inter-molecules distance d to d'. Estimate the value of F.

(e) Calculate F/d , which is a measure of the surface tension.

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3. A hot air balloon is a sphere of radius 8 m . The air inside is at a temperature of $60^\circ C$. How large a mass can the balloon lift when the outside temperature is $20^\circ C$? (Assume air is an ideal gas $R = 8.314 Jmole^{-1}K^{-1}, 1atm. = 1.013 \times 10^5 Pa$, the membrane tension is $5Nm^{-1}$)

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