PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

MECHANICAL PROPERTIES OF FLUIDS

One Mark Questions And Answers

1. What is a fluid?

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2. Define fluid thrust.

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3. State Pascal's law.

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4. Define fluid pressure (Gauge pressure).

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5. Mention the S.I unit of pressure?

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6. Mention any one application of pascal's law.

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7. State Archimedes' principle.

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8. What is buoyancy or force of buoyancy ?

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9. Write the dimensional formula for Pressure

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10. How does liquid pressure depend on the depth of a point below the surface of a liquid

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11. An iron nail sinks whereas ships fleat. Give one reason for it.

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12. Relate atmospheric pressure in terms of barometric pressure.

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13. What portion of ice floats above the surface the water?

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14. What is one torricelli of pressure?

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15. Give an example for an incompressible substance.

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16. Give an example for a compressible substance .

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17. Define standard atmospheric pressure.

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18. Name the device to measure atmospheric pressure.

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19. Who invented Barometer?

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20. Write the equation connected to a hydralic lift?

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21. What is hydrodynamics?

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22. What is a streamline?

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23. What is a streamline motion?

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24. What is turbulent motion?

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25. Can two streamlines intersect each other, in a flowing liquid?

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26. Give the expression for pressure energy.

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27. State and explain Bernoulli's Principle.

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28. How does the velocity of streamline flow of a liquid, depend on the area of cross section?

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29. How does the pressure of liquid depend on the area 'of cross section of tube of flow?

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30. How does the pressure of liquid depend on the speed of flow?

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31. Give the mathematical representation of Bernoulli's theorem.

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32. What is an ideal fluid?

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33. When does the flow of the liquid become turbulent?

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34. Name any one device that works on Bernoulli's principle.

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35. What is a cohesive force?

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36. What is an adhesive force?

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37. Say whether molecular forces obey inverse square law of distance or not.

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38. Say whether molecular force is a saturated force or not.

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39. Define surface energy.

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40. Give the expression for surface tension of a liquid in a capillary tube.

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41. Define surface tension. Why there is no surface tension in gases ?

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42. Define angle of contact.

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43. Give an example of a liquid which wets glass.

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44. Give an example of a liquid which does not wet glass.

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45. Why drops and bubbles are spherical in shape?

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46. Why is a big drop of liquid oblate?

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47. Write the dimensional formula for surface tension.

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48. Write the SI unit of surface tension.

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49. Why does oil rise in a wick?

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50. What is a capillary tube?

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51. How are radius and rise of liquid in a capillary tube related?

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52. How does the surface tension of a liquid vary with temperature?

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53. What is the efect of adding detergents to water?

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54. What is meant by capillarity?

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Two Mark Questions And Answers

1. State the conditions for stable equilibrium for fleating bodies.

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2. Mention any one application of pascal's law.

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3. Write the equation of continaity.

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4. Give two limitations of Beruoulli's theorem.

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5. What is meant by critical velocity of a liquid? Explain the characteristic of turbulent motion.

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6. Mention any two applications of Bernoulli's theorem.

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7. Why bullets/missiles are cylindrical and given an initial spin.

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8. Why is that the life boat often collides with the mother ship?

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9. If 'H' is the height of liquid in a cylindrical container and 'h' is the height of orifice (hole) in the cylinder, then give the formula for

(i) Velocity of efflux and

(ii) Horizontal range of the jet.

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10. For what value of 'h' of orifice below the jet the range will be maximum ?

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11. What is magnus effect ?

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12. Name the two types molecular forces.

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13. Water sticks to glass whereas mercury does not. Explain.

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14. Distinguish between cohesive and adhesive forces.

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15. Give any two illustrations of surface tension.

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16. Pond skaters walk on the surface of water. Give reason for it.

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17. Explain the action of detergents.

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18. When it is raining, it is not advised to resist water drops falling on the tent from inside the

tent. Explain Why?

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19. What is meant by surface energy? Give the expression for surface energy.

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20. Give the expression for the energy evolved, when the surface area of the liquid is decreased.

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21. Give the expression for the excess pressure in a soap bubble.

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22. Give the expression for the excess pressure across curved surfaces facing opposite to each other

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23. Give the expression for the excess pressure across curved surfaces facing in the same direction.

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24. State Newton's law of viscosity of fluids in motion.

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25. Give Stokes formula and explain the symbols used.

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26. Give an expression for the terminal speed of a small spherical object in a homogenous surrounding fluid.

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27. What is meant by critical velocity of a liquid? Explain the characteristic of turbulent motion.

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28. State Stokes law.

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Three Mark Questions And Answers

1. Arrive at an expression for pressure at point due to a liquid.

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2. Distinguish between streamline and turbulent flows.

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3. State and explain Bernoulli's Principle.

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4. Explain the uplift of an air foil in the aircraft by using Bernoulli's theorem.

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5. Explain the flow of blood and heart attck by using the principle of Bernoulli's theorem.

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6. Show that terminal velocity of a sphere falling through a viscous medium is proportional to the square of its radius.

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Numericals With Solutions

1. A steel ball of radius $0.5 \times 10^{-2} m$ is dropped in a long jar containing olive oil of coefficient of viscosity $84 \times 10^{-3} Nsm^{-2}$ and

density $920 kgm^{-3}$. If the density of the solid ball is $7.8 \times 10^3 kgm^{-3}$ then calculate the terminal velocity attained by the steel ball.

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2. An air bubble of diameter $1 \times 10^{-3} m$ rises in water. Calculate the terminal velocity of the bubble.

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3. Calculate the critical velocity of water in a tube of diameter 0.25m. Given Reynold number =2500, density of water $= 10^3 kgm^{-3}$ and viscosity $= 10^{-3} Nsm^{-2}$.

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4. With what terminal velocity will an air bubble 0.8 mm in a diameter rise in a liquid of viscosity of $0.15 Nsm^{-2}$ and specific gravity 0.9? $\left(\rho_{\text{air}} = 1.2 kgm^{-3}\right)$.

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5. Two spherical raindrops of equal are falling vertically through air with a terminal velocity of $1ms^{-1}$. What would be the terminal speed if the two drops were to coalesce to form a large spherical drop.

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6. A plate of area $10m^2$ is made to move horizontally with a speed of $0.5ms^{-1}$ by applying a force over the surface a liquid. If the depth of the liquid is 2.5m, coefficient of viscosity of liquid is $10^{-3}Nsm^{-2}$, then calculate the horizontal force needed to move the plate.

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7. A solid sphere of radius R floats in water to a depth of $\left(\frac{R}{2}\right)$. Find the relative density of the material of the solid.

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8. When a bouler of mass 240kg is placed on a floating iceberg, it is found that the iceberg just sinks. What is the mass of iceberg? (Given R.D. of ice=0.90 and density of sea water=1.02).

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9. When a ship floats in water, its one fifth volume remains submerged. The maximum weight that can be placed on the ship is 10,000 tons. Calculate the weight the empty ship $(g = 10ms^{-2})$.

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10. A piece of iron of density $7.8 \times 10^3 kgm^{-3}$ and volume $10^{-4}m^3$ is fully immersed in water. Calculate (i) weight of the iron piece in air (ii)

upthrust of water on the iron piece (iii) apparent weight of the iron piece in water. Given $g = 10ms^{-2}$

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11. A metal cube of side 0.10 m, density $8500kgm^{-3}$ is suspended by a thread and completely immersed in a liquid of density $2000kgm^{-3}$. Find the tension in the sting $(g = 9.8ms^{-2})$.

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12. An injection syringe has a needle with an area of cross-section $1.96 \times 10^{-7} m^2$. The piston end of the syringe has an area of $3.14 \times 10^{-4} m^2$. If a force of 0.098N is applied then calculate the force on the blood vessel. What fraction of the total force applied is executed on the vessel.?

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13. A sample Of milk diluted with water has a density of $1050\ \mathrm{kgm}^{-3}$, If pure milk has a density of $1080 kgm^{-3}$, then find the percentage of water by vehmse in the milk.

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14. A gold crown adulterated with silver was found to weigh 0.540 kg in air and 0.498 kg in water. If the densities of gold and silver are $13900\mathrm{kgm}^{-3}$ and $10500\mathrm{kgm}^{-3}$, then calculate the mass of silver mixed with gold.

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15. Water is flowing through a cylindrical pipe of cross-sectional area $0.04\pi\ \mathrm{m}^2$ at a speed of $1.0\mathrm{ms}^{-1}$. If the diameter of the pipe is halved, then find the speed of flow of water through it.

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16. Water flows through a horizontal pipe of varying cross-seetions. The pressure of water

equals 0.1 m of mercury at a place where the velocity of flow is $0.4ms^{-1}$. What will be the pressure at another place, where the velocity of flow is $0.5ms^{-1}$.

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17. The reading of a barometer fitted with a closed pipe is $3.5 \times 10^5 Nm^{-3}$. When the valve ef the pipe is opened, the pressure read by barometer reduces to $3.0 \times 10^5 Nm^{-2}$.

Calculate the velocity of flow of water in the pipe.

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18. The velocity of flow of water in a horizontal pipe is $10.0ms^{-1}$. Calculate the velocity head of water, given $g = 9.8ms^{-1}$.

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19. For a pressure at 1.2 atm, calculate the pressure head of water.

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20. A water tank filed with water has a hole in its wall at a distance of 2.5 m below its free surface. Find the velocity of efflux of water from this office. If the diameter of the orifice is 5 mm, find the rate of flow of water $\left(g = 9.8ms^{-2}\right)$.

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21. An L-shaped tube is held in a stream. It has a small orifice at the upper end which is 0.106 m above the surface of water. If water in stream is flowing at $2.45ms^{-1}$ and entering at the other end of the tube, then find the height of the jet of water coming out from the orifice.

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22. A tank is filled with water upto a height H=1.00m. Water is allowed to come out of a hole in one of the walls at a depth h =0.20m below the surface of water. Calculate the range of the jet of water from the orifice.

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23. Calculate pressure inside a small air bubble of radius $10^{-4}m$ radius found just below the surface of water (given S.T. of water

$= 0.072 Nm^{-1}$ and $1\,\text{atm} = 1.013 \times 10^5 Pa$)

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24. A capilaary tube of radius 0.35cm is dipped in water. To what height will water inside the capilary raise? (Given S.T. of water $= 0.072 Nm^{-1}$, θ between water-glass contact $\theta = 0^\circ$)

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25. Calculate the amount of work done in spliting a water droplet of radius 0.5 mm into 8 million identical droplets. Given surface tension of water $= 0.072 Nm^{-2}$.

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26. Calculate the amount of work done is blowing a soap bubble to a radius of 0.05m by blowing the soap solution which has a surface tension of $0.03 Nm^{-2}$.

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27. Calculate the excess pressure inside a soap bubble of radius 1.0mm. (Given surface tension of soap solution $= 0.040 Nm^{-1}$).

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28. Calculate excess pressure inside an air bubble of radius 1.0 mm and just below the surface of water. What will be the pressure inside the soap bubble?

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29. Calculate the amount of work done in increasing the diameter of a soap bubble from 2cm to 5cm (Given, surface tension of the soap solution $= 3 \times 10^{-2} Nm^{-1}$)

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30. A flim of water if found between two straight parallel wires of length 0.10m each separated by 5×10^{-3}m. If their separation is

increased by $1 \times 10^{-3} m$, while maintaining their parallelism, how much work will have to be done? (S.T. of water is $7.2 \times 10^{-2} N m^{-2}$).

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31. Water rises in a capilaary tube to a height of 2.0cm. In another capilary tube of radius one third of the first, water remains at a partricular height inside it. Find the height of water in the second capillary.

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32. The high domes of ancient buildings have structural value. It arises from pressure difference on the two faces dur to curvature (as in soap bubbles). There is a dome of radius 5m and uniform thickness. The surface tension of its masonry structure is about $500 Nm^{-1}$. Treated as hemispherical, calculate the maximum load the done can support.

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33. The diameter of the vertical tubes of a U-tube are 10 mm and 4mm. The tubes are filled with water. What wil be the difference of heights of water coloumns in the tubes? (angle of contact $\theta = 0^\circ$)

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