



PHYSICS

BOOKS - PEARSON IIT JEE

FOUNDATION

HYDROSTATICS

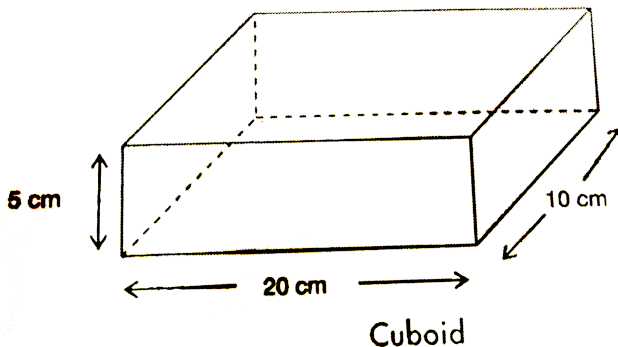
Example

1. A vessel of 100cm^2 cross sectional area contains water. The mass of water is 2 kg. Find

the pressure acting on the bottom surface.

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2. A cuboid has dimensions as shown. If the mass of the block is 2 kg, find the minimum and maximum pressure it exerts as the orientation of the body is changed.



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3. Nagarjun sagar dam is filled water till a height of 127 metres. If the mass of water per cubic centimeter is one gram, then find the difference in pressures acting at the following two points.

(i) Point exactly at a depth half that of the dam.

(ii) Point at the bottom of the dam.



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4. What is the relative density of liquid if the height of the water column and the height of a liquid column in a Hare's apparatus are 20 cm and 40 cm, respectively ?



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5. The height of the mercury column in a barometer at a place is 75 cm. If a liquid of unknown density is used the height of the liquid column is 150 cm, find its density.



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6. A body weight 20 N in water and 30 N in a liquid. The actual weight of the body is 40 N, then find the specific gravity of the liquid.



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7. A body weight 16 N in a liquid whose specific gravity is 6. Find the weight of the body in water if it weight 40 N in air.



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8. A body weight 20 N in water and 30 N in air. Find the density of the body. Take the density of water as 1.0gcm^{-3} .



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9. A body weight 20 N in water and its relative density is 3. Find the weight of the body in air.



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10. A cylindrical body of area of cross section 100cm^2 and length 20 cm is immersed in a liquid whose density is 1.5gcm^{-3} . If the density of the solid is 2gcm^{-3} , calculate the upthrust acting on the body.



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11. The weight of a constant immersion hydrometer is 15 gwt. When it is immersed in a liquid, few more lead shots were added to it so

that it floats at the same depth as in water. If the weight of the hydrometer now is 20 gwt, find its relative density.



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12. The depth of immersion of hydrometer in water is 10 cm. What will be the depth of immersion in a liquid whose density is 2gcm^{-3} ?



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13. The pressure of a gas of volume 22.4 l is 3 atm at certain temperature. Then find the pressure of the gas of volume 44.8 l at the same temperature.



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14. The pressure of a gas is doubled keeping its temperature constant. Find the ratio of the final volume of the gas to its initial volume.



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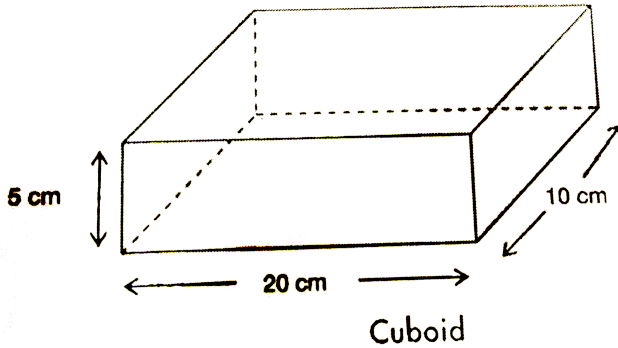
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Very Short Answer Type Questions

1. What is hydrostatics ?



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2. the vacuum above the mercury level in a barometer is called ____.



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3. Define thrust, what is its unit?



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4. The cause of surface tension is



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5. Pressure is a scalar or vector quantity.



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6. What is surface tension ?



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7. Give the expression for the pressure at a point inside a liquid.



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8. The specific gravity of a substance is the ratio of the density of the substance to the density of ____.



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9. State the three factors on which the pressure at a point inside a liquid depends.



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10. What is the use of Hare's apparatus ?



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11. What is the major reason for using mercury (rather than water) in barometers?



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12. The unit of thrust in S.I. system is _____.



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13. State the law of transmission of pressure (Pascal's Law) in fluids.



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14. A test tube floats to a depth 4 cm in water and to a depth 8 cm in a liquid. The relative density of the liquid is _____.



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15. Give the uses of a hydraulic press.



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16. The unit atmospheric pressure is:



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17. What is a barometer ? Mention the types of barometers.



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18. What is hydrometer ?



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19. If the length of the mercury column in a mercury barometer is 76 cm, what is the equivalent height of the water column ?



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20. _____ is used to measure the altitude in air crafts.



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21. Name any two factors on which the height of the mercury column in a Torricelli barometer depends.



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22. Name two factors on which the height of the mercury column in a Torricelli barometer depends.



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23. If the height of the mercury column is to decrease by 1 cm, what should be the corresponding change in the altitude ?



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24. Define upthrust.



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25. State the law of floatation.





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26. State Archimedes' principle.



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27. The pair of physical quantities having the same units are



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28. Write an expression for the relative density of a solid floating in a liquid in terms of the volume of the solid in the liquid and the total volume of the solid.



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29. The sudden fall in pressure due to a rise in humidity indicates



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30. State Bernoulli's principle.



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Short Answer Type Questions

1. Explain how fluids differ from solids.



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2. A liquid of mass 200 g exerts a pressure of 0.1 Pa at the bottom of container. What pressure would it exert if the area of cross section of the container is doubled ?



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3. Bring out the differences between liquids and gases ?



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4. Two identical tanks contain water and a liquid of density $0.8gcm^{-3}$. Pressure exerted by the liquid is equal to the pressure due to water column of 50 cm. Find the height of the liquid column in the tank ?



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5. State the law of transmission of pressure (Pascal's Law) in fluids.



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6. Due to the presence of certain impurities in mercury, its effective density is 12gcm^{-3} .

What is the barometer reading at sea level ?



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7. What are the disadvantages of a simple mercury barometer ?



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8. A body weight 20 N in a liquid whose relative density is 5. In water it weight 40 N. Find its weight in air ?



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9. What are the advantages of an aneroid barometer over a mercury barometer ?



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10. A solid of mass 100 g and density 2gcm^{-3} is immersed in water. Calculate the upthrust acting on it ?



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11. Explain the construction of Hope's apparatus with the help of a labelled diagram.



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12. Explain Plimsoll lines ?



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13. Why do few bodies float while other bodies sink in water ?



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14. What would you conclude if the heights of both liquids in a Hare's apparatus are equal ?



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Essay Type Questions

1. Enlist some of the important postulates of kinetic theory of matter ?



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2. Buoyant force acting on a body immersed in a fluid depends on:



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3. Explain the construction and working of Bramah press.



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4. Differentiate between contamination and pollution.



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5. A flying aeroplane has



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Level 1

1. Describe Barometer



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2. Hydraulic press is based upon



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3. Surface tension is due to

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4. Flying of rockets and jet planes is explained
on the basis of

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5. If water be used to construct a barometer, what would be the height of water column at a standard atmospheric pressure (76cm of mercury)?



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6. explain. Force acting on a unit area is called pressure.



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7. In the expression buoyant force or upthrust
 $= V \times \rho \times g$ ρ is the density of the liquid
displaced.



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8. The apparent weight of a floating body is
equal to _____.



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9. An object floats in water such that half of its volume is immersed in it. The specific gravity of the object is _____.



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10. At constant temperature, when the pressure of a given mass of gas is increased by two times, its volume _____.



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11. If x is the weight of an object in air and Y is its weight when completely immersed in water,

then $\frac{X}{X - Y}$



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12. A variable immersion hydrometer is immersed upto $\frac{1}{2}$ and $\frac{1}{3}$ of its volume in two given liquids, respectively. Then the ratio of the densities of the two liquids is _____.



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13. One of the limbs of a mercury manometer is connected to a gas cylinder. The mercury level in the limb connected to the gas cylinder is 10 cm higher than that in the other limb. Then the gauge pressure of the gas is ___ cm of Hg.



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14. A cuboid of dimensions $3m \times 2m \times 1m$ is placed on a surface such that the face with

maximum surface area is in contact. If the weight of the cuboid is $1kg_{wt}$, the pressure exerted by it on the surface is _____. (take $g = 10ms^{-2}$).



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Column A		Column B	
A. Liquidless barometer	()	a. Newton	
B. Guage Pressure	()	b. Hydraulic jack	
C. Pascal's law	()	c. Forms concave meniscus	
D. Pressure	()	d. Dust storm	
E. Thrust	()	e. Specific gravity of liquids	
F. Water	()	f. Aneroid barometer	
G. Fall in pressure due to a rise in temperature	()	g. Pascal	
H. Hydrometer	()	h. Pressure of gas present in a closed vessel	

15.



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16. Two metal plates 'A' and 'B' having the same breadth but different length l_1 and l_2 ,

respectively are placed at same depth inside water such that their breadth is held exactly in vertical positions. Then, the ratio of the pressure acting on 'A' and 'B' by water is ____.

A. $1 : 1$

B. $l_1 : l_2$

C. $l_2 : l_1$

D. $l_1 b : \frac{l_2}{b}$

Answer: A



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17. Explain the working principle of hydraulic press using Pascal's law.

A. Boyle's law

B. Charle's law

C. Archimedes' principle

D. Pascal's law

Answer: D



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18. 20 Pa pressure is applied on the head of a nail placed perpendicular to the surface of a wall. If the area of cross section of the tip of the nail is $\frac{1}{10}$ the area of cross section of the head, the pressure exerted at the wall is ____ Pa.

A. 20

B. 2

C. 200

D. 100

Answer: C



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19. The sudden fall in pressure due to a rise in humidity indicates

- A. a cyclone
- B. rainfall
- C. a dust storm
- D. dry weather

Answer: A



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20. As an air bubble comes from the bottom of a lake to the top, its radius _____

A. the pressure exerted by water on the bubble decreases as the height of the water column above it decrease.

B. the density of water increases as we move downwards.

C. at constant temperature, pressure inside the air bubble and volume of the bubble are inversely proportional to each other.

D. Both 1 and 3

Answer: D



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21. Which one of the following statements is true ?

A. The weight of a substance in air is always less than its weight in water.

B. The mass of a substance is equal to the mass of an equal volume of water.

C. The weight of a substance in water is always greater than its weight in some other liquid.

D. The weight of a substance in water is always less than its weight in air.

Answer: D



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22. No-liquid barometer is

- A. a mercury barometer
- B. an aneroid barometer
- C. a Fortin's barometer

D. Torricelli's barometer

Answer: B



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23. A cylindrical object floats in water such that $(3/4)$ th of its volume is immersed in water.

Its density is _____ kgm^{-3} .

A. 250

B. 0.75

C. 0.25

D. 750

Answer: D



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24. A piece of nail sinks in water but a boat floats in it because

A. there is no upthrust acting on the nail.

B. a nail is heavier than a boat .

C. a nail has a pointed end.

D. upthrust acting on the nail is less than its weight.

Answer: D



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25. An object of mass 100 kg is to be lifted by a 10 kg effort. The possible values of the area of cross sections of the pump piston and press

piston are ____ and ____, repectively, both in the same unit.

A. 100, 1

B. 10,1

C. 1100

D. 2, 20

Answer: D



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26. The weight of the liquid displaced by a body when the body is immersed in it is called,

A. apparent weight

B. upthrust

C. lateral pressure

D. relative density of the body

Answer: B



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27. Which one of the following statements is true ?

A. Water forms concave meniscus on account of high cohesive forces.

B. Mercury forms concave meniscus on account of more adhesive force than the cohesive forces.

C. Water forms convex meniscus on account of high adhesive forces than the cohesive forces.

D. Mercury forms convex meniscus on account of more cohesive force than adhesive force.

Answer: D



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28. Which one of the following physical quantities increases as we go deep into the sea ?

A. temperature

B. gravity

C. pressure

D. upthrust

Answer: C



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29. The apparent weight of an object on the surface of the moon, if the mass of the object

and liquid displaced are X and Y , respectively,

is

A. $\frac{X - Y}{g}$

B. $\frac{g}{6}(X - Y)$

C. $6g(X - Y)$

D. $\frac{6}{g}(X - Y)$

Answer: B



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30. The roof of a house blows out during a storm because

A. the wind blows with high velocity under the roof.

B. the weight of the roof is less than the weight of an equal volume of air.

C. the wind blows with high velocity over the roof, causing an upthrust on the bottoms side.

D. the wind blows with high velocity over the roof, causing low pressure under the roof.

Answer: C



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31. Pressure at a point inside a liquid does not depend on

A. density of the liquid

B. height of the liquid column above the point.

C. acceleration due to gravity

D. base area of the container.

Answer: D



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32. In a Bramah press a small force is used to spend a much larger force. This is accomplished by

A. increasing the area of cross section of the pump piston.

B. decreasing the area of cross section of the press piston.

C. increasing the area of cross section of the press piston.

D. increasing the load (weight) on the press piston.

Answer: C



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33. The pair of physical quantities having the same units are

- A. stress and pressure.
- B. thrust and pressure.
- C. weight and stress.
- D. weight and pressure.

Answer: A



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34. Arrange the following steps in proper sequence to determine the pressure exerted by a gas enclosed in a container using a manometer.

(a) Connect one end of the manometer to the container filled with gas.

(b) Both the limbs of the manometer are exposed to air, mercury level in both the limbs are equal due to atmospheric pressure.

(c) Determine the difference in level of the mercury in both the limbs of the manometer

(l).

(d) If the level of the mercury in the limb connected to the container is above the mercury level in the limb exposed to air, the pressure of the gas in the container is determined as atmospheric pressure $-h$.

(e) If the level of the mercury in the limb connected to the container is below the mercury level in the limb exposed to air, the pressure of the gas in the container is determined as atmospheric pressure $+h$.

(f) Note the level of the mercury in the limbs of the manometer.

A. a b c e f e

B. e b a d c f

C. b a c f d e

D. b c d a f e

Answer: C



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35. An air bubble rises up in water because,

A. there is no gravity in water.

B. pressure inside the bubble is less than the pressure outside it.

C. the upthrust acting on the bubble is more than the weight of the bubble.

D. air cannot dissolve in water.

Answer: C



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36. If the relative density of a solid is less than one, then

A. it sinks in water.

B. it floats in water.

C. it sinks in all the liquids

D. it floats in all the liquids

Answer: B



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37. Two test tubes A and B of same mass with equal areas of cross-section are used as variable immersion hydrometer. If the length of test 'A' is double that of 'B', then the range of densities that can be measured by 'A' is

A. more than the range of densities that can be measured using 'B'.

B. less than the range of densities that can be measured using 'B'.

C. equal to the range of densities that can be measured using 'B'.

D. Both b and c.

Answer: A



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38. A constant immersion hydrometer weighing 20 g sinks upto mark 'x' in water and this hydrometer has to weight 25 g to mark 'x' in a given liquid. Then the relative density of the liquid is ____.

A. 0.25

B. 1.25

C. 0.75

D. 2.00

Answer: B



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39. Similar objects are dropped into two different liquids A and B. The displacement of the objects in A and B in 5s is S_1 and S_2 , respectively. If density of the liquid A is greater

than the density of the liquid B, which among the following relation is correct ?

A. $S_1 = S_2$

B. $S_1 > S_2$

C. $S_1 < S_2$

D. Cannot be determined

Answer: C



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40. Consider a liquid contained in a vessel. The liquid solid adhesive force is very weak as compared to the cohesive force in the liquid. The shape of the liquid surface near the solid shall be

- A. equal to
- B. less than
- C. greater than
- D. less than or equal to

Answer: C



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41. If F_{CS} , F_{CL} , F_{CG} represents cohesive force of solids, cohesive force of liquid and cohesive force of gases, then the choose the correct answer.

A. $F_{CS} = F_{CL} = F_{CG}$

B. $F_{CS} > F_{CL} > F_{CG}$

C. $F_{CS} < F_{CL} < F_{CG}$

D. $F_{CS} > F_{CL} = F_{CG}$

Answer: B



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42. Gases do not have rigidity. Select the reason from the following .

- A. The cohesive force is negligible
- B. The adhesive force is very high
- C. The cohesive force is very high
- D. None of the above

Answer: A



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43. If P , V , and d are the pressure, Volume and density of a given mass of gas at constant temperature, choose the correct option.

A. $p \propto \frac{1}{d}$

B. $p \propto d$

C. $p \propto \frac{1}{v}$

D. Both a and c

Answer: B



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44. Arrange the following steps in proper sequence to determine the relative density of liquid by using a constant immersion hydrometer.

(a) The test tube is made to float in the given liquid.

(b) The weight of the test tube with lead shots in air is determined (W_1).

(c) The depth of the test tube immersed in water (h) is determined.

(d) The test tube is made to float in water.

(e) Lead shots are added or removed from the test tube such that the test tube is immersed to the same depth (h) in the given liquid.

(f) The relative density of the liquid is measured as $\frac{W_1}{W_1}$.

(g) The test tube is taken out from the given liquid and its weight (W_2) is measured.

A. b d c a e g f

B. b d c a e f g

C. b g f e a c d

D. b a d c e f g

Answer: A



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45. Assertion (A) : When wind blows at a very high speed over the roof of a hut, the roof is blown away.

Reason (R) : The pressure exerted by a fluid at

rest is transmitted unchanged equally in all directions.

A. A and R are correct and R is the correct explanation for A.

B. A and R are correct but R is not the correct explanation for A.

C. A is correct but R is wrong.

D. Both A and R are wrong.

Answer: B



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Level 2

1. When a Fortins barometer is used to measure the pressure on the surface of the earth and on the top of a building the main scale reading is found to be the same and the vernier scale reading is found to be 9 and zero, respectively. If one M.S.D. is 1 mm and number of vernier scale divisions is 10, calculate the height of the building. Take the average

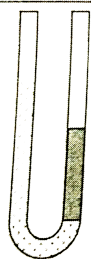
density of air as 1.3kgm^{-3} , and that of mercury as 13.6gcm^{-3}



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2. In the following figures, state which of the cases is possible, discuss giving reason in each case.

Mercury



A

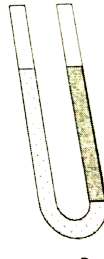
Water



B



C



D



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3. The 10% of total volume of the barometer liquid (mercury) contains impurities having an average density 5gcm^{-3} . When this faulty barometer is used to measure the atmospheric pressure it reads 80 cm of the liquid column. Determine the correct atmospheric pressure.



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4. The density of ice is 901kgm^{-3} . What percentage of ice lies below water ? The density of sea water is 1011kgm^{-3} . What fraction of an iceberg can be seen by us if the ice berg has the same density as that of ice ?



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5. A car is lifted by a hydraulic jack that consists of two pistons. The diameter of the larger piston is 2 m and that of the smaller

piston is 50 cm. If the force applied on the smaller piston is 240 N, find the weight of the car.



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6. An object of weight $500kg_{wt}$ is lifted by using a hydraulic press. The radii of the cross sections of the pump piston and press piston are 10 cm and 20 cm, respectively. Calculate the effort required to lift the object. Calculate

the displacement of the load if the effort is moved through a distance of 20 cm.



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7. It is advised not to stand near a running train. Why?



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8. A constant immersion hydrometer floats vertically in water when the weight of its float

is 30 g. When it is made to float in a liquid (miscible in water), the weight of its float is increased by 10 g. Find the weight of the hydrometer when it is floated in a mixture containing equal masses of water and the liquid.



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9. At the mouth of the tap area of cross-section is 2.0cm^2 and the speed of water is 3m/s . The area of cross-section of the water

column 80 cm below the tap is (use

$$g = 10 \text{ m/s}^2)$$



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10. When a metallic sphere is released from the surface of water filled in a container of uniform area of cross section it is found to reach the bottom of the container in 2 s. If the density of the material of the sphere is 4.9 gcm^{-3} , calculate the pressure exerted by the liquid at the bottom of the container.

Assume that only gravitational force and up-thrust act on the body.



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11. The relative density of pure gold is 19.3. When an ornament made of gold is immersed completely in water, the volume of the water displaced is 5 ml. If the mass of the ornament in air is 100 g, determine whether the ornament is made of pure gold.



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12. Why gas filled balloons rise up, only to a certain height ?



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13. A needle or a pin floats on the surface of water because of



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14. A man can lift a maximum weight of $30kg_{wt}$. In order to lift an object of weight 50 kg placed in a container, he pours a certain liquid into the container so that the object is completely immersed in it. What is the density of the liquid if he can just lift the object ? The volume of the liquid displaced is $10^{-2}m^3$.



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15. An effort applied on the small piston of a hydraulic jack lifts the load through a distance of 50 cm and the effort is displaced through 2 m. If the diameter of the larger piston is 28 cm, calculate the area of the cross section of the smaller piston.



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16. Suggest a method to fill water in a tank constructed at a height of 10 m from the

ground by using a vacuum pump instead of an electric pump.



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17. A pressure exerted by mercury at the bottom of a container of area of cross section 2cm^2 is 10 Pa. Determine the weight of the mercury in the container.



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18. A cuboid of dimensions $3m \times 2m \times 1m$ is placed on a surface such that the face with maximum surface area is in contact. If the weight of the cuboid is $1kg_{wt}$, the pressure exerted by it on the surface is _____. (take $g = 10ms^{-2}$).



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19. A body is immersed in a liquid of relative density 2.6. It is found that the weight of the

body in the liquid is two-thirds of its weight in air. Calculate the density of the body ?



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Level 3

1. A test tube of uniform cross-section is floated vertically in a liquid 'A' (density ρ_A) upto a mark on it when it is filled with 'x' ml of a liquid 'B' (density ρ_B). To make the test tube float in liquid B upto the same mark it is filled

with y ml of the liquid A. Find the mass of the test tube.



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2. An alloy of copper and zinc weight 320 g in water and 302 g in a liquid of density 1.4gcm^{-3} . If the density of copper is 8.9gcm^{-3} and that of the zinc is 7.4gcm^{-3} , find the measure of the masses of copper and zinc in the alloy.



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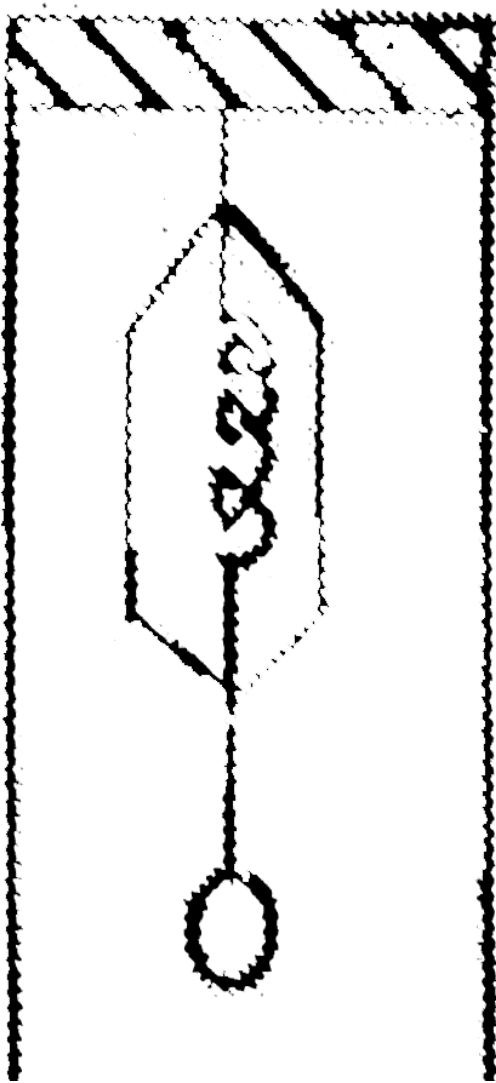
3. A bird is sitting on the floor of a wire cage and the cage is in the hand of a boy . The bird starts flying in the cage . Will the boy experience any change in the weight of the cage ?

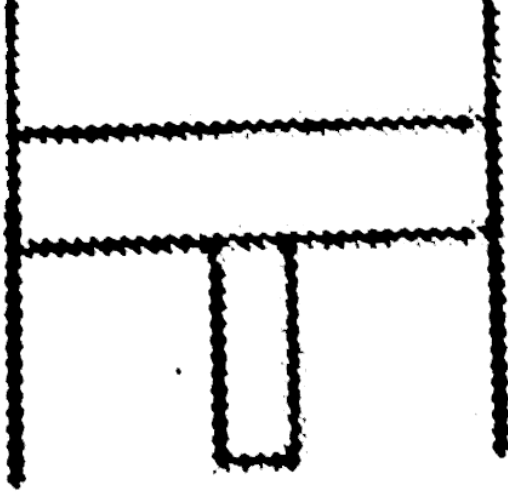


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4. An object suspended from a sensitive spring balance is placed inside a closed container. The other end of the container is closed by

means of an air tight piston. Will there be any change in the spring balance reading when the piston is moved the inward and outward direction ? Why ?





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5. How is the hair set well when oil is applied to it ?



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6. A rubber ball of mass 100 g and radius 5 cm is submerged in water to a depth of 1 m and released. To what height will the ball jump up above the surface of water ? (Take $g = 10ms^{-2}$)



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7. A cylindrical object floats in water such that $(3/4)$ th of its volume is immersed in water. Its density is _____ kgm^{-3} .



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8. The density of a given mass of a gas when 10 Pa pressure acts on it is 2kgm^{-3} . Calculate the density of the gas if the pressure is increased by 5 Pa at constant temperature.



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9. Two metallic spheres 'P' and 'Q' weighing 200 gwt and 150 gwt, respectively, balance each other when immersed in water. If the

relative density of 'P' is 2 find the specific gravity of 'Q'.



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10. A hydrometer stem has a length 30 cm. If the hydrometer is immersed in water , its floatation bulb just sinks. If the same hydrometer is immersed in a liquid having density of 500kgm^{-3} , two-third of the stem is immersed. Find the least specific gravity of a

liquid that can be measured using the hydrometer.



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Test Your Concepts Very Short Answer Type Questions

1. What is hydrostatics ?



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2. the vacuum above the mercury level in a barometer is called ____.



[Watch Video Solution](#)

3. Define thrust .What is its units ?



[Watch Video Solution](#)

4. The cause of surface tension is



[Watch Video Solution](#)

5. Pressure is a scalar or vector quantity.



[Watch Video Solution](#)

6. What is surface tension ?



[Watch Video Solution](#)

7. Give the expression for the pressure at a point inside a liquid.



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8. The specific gravity of a substance is the ratio of the density of the substance to the density of ____.



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9. State the three factors on which the pressure at a point inside a liquid depends.



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10. What is the use of Hare's apparatus ?



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11. What is the principle behind a mercury barometer?



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12. The unit of thrust in S.I. system is _____.





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13. State the law of transmission of pressure (Pascal's Law) in fluids.



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14. A test tube floats to a depth 4 cm in water and to a depth 8 cm in a liquid. The relative density of the liquid is _____.



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15. Give the uses of a hydraulic press.



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16. State the various units of atmospheric pressure.



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17. What is a barometer ? Mention the types of barometers.



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18. What is hydrometer ?



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19. If the length of the mercury column in a mercury barometer is 76 cm, what is the equivalent height of the water column ?



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20. _____ is used to measure the altitude in air crafts.



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21. Name any two factors on which the height of the mercury column in a Torricelli barometer depends.



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22. Name two factors on which the height of the mercury column in a Torricelli barometer depends.



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23. If the height of the mercury column is to decrease by 1 cm, what should be the corresponding change in the altitude ?



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24. Define upthrust and how is the upthrust experienced by a body affected if its volume is doubled keeping its mass constant?



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25. State the law of floatation.



Watch Video Solution

26. ARCHIMEDE'S PRINCIPLE





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27. The pair of physical quantities having the same units are



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28. Write an expression for the relative density of a solid floating in a liquid in terms of the volume of the solid in the liquid and the total volume of the solid.



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29. The sudden fall in pressure due to a rise in humidity indicates



Watch Video Solution

30. State Bernoulli's principle.



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31. Explain how fluids differ from solids.



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32. A liquid of mass 200 g exerts a pressure of 0.1 Pa at the bottom of container. What pressure would it exert if the area of cross section of the container is doubled ?



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33. Bring out the differences between liquids and gases ?



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34. Two identical tanks contain water and a liquid of density $0.8gcm^{-3}$. Pressure exerted by the liquid is equal to the pressure due to water column of 50 cm. Find the height of the liquid column in the tank ?



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35. State and prove Pascal's law of transmission of fluid pressure.



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36. Due to the presence of certain impurities in mercury, its effective density is 12gcm^{-3} . What is the barometer reading at sea level ?



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37. What are the disadvantages of a simple mercury barometer ?



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38. A body weight 20 N in a liquid whose relative density is 5. In water it weight 40 N. Find its weight in air ?



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39. What are the advantages of an aneroid barometer over a mercury barometer ?



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40. A solid of mass 100 g and density 2gcm^{-3} is immersed in water. Calculate the upthrust acting on it ?



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41. Explain Plimsoll lines ?



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42. Why do few bodies float while other bodies sink in water ?



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43. What would you conclude if the heights of both liquids in a Hare's apparatus are equal ?



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Test Your Concepts Essay Type Question

1. Enlist some of the important postulates of kinetic theory of matter ?



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2. Derive an expression for the buoyant force acting on a body completely submerged in a liquid of density ρ .



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3. Explain the construction and working of Bramah press.



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4. Explain flying of aeroplanes as an application of Bernoulli's principle



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Concept Application

1. Wind blowing horizontally over a paper makes it fly away. This can be explained on the basis of Bernoulli's principle.

A. True

B. False

C.

D.

Answer:



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2. When water is used as barometer liquid the height of the water column at sea level is 76 cm.



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3. explain. Force acting on a unit area is called pressure.



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4. In the expression buoyant force or upthrust
 $= V \times \rho \times g$ ρ is the density of the liquid displaced.



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5. The apparent weight of a floating body is equal to _____.



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6. An object floats in water such that half of its volume is immersed in it. The specific gravity of the object is _____.



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7. At constant temperature, when the pressure of a given mass of gas is increased by two times, its volume



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8. If x is the weight of an object in air and Y is its weight when completely immersed in water,

then $\frac{X}{X - Y}$



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9. A variable immersion hydrometer is immersed upto $\frac{1}{2}$ and $\frac{1}{3}$ of its volume in two given liquids, respectively. Then the ratio of the densities of the two liquids is _____.



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10. One of the limbs of a mercury manometer is connected to a gas cylinder. The mercury level in the limb connected to the gas cylinder is 10 cm higher than that in the other limb.

Then the gauge pressure of the gas is _____
cm of Hg.



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11. A cuboid of dimensions $3m \times 2m \times 1m$ is placed on a surface such that the face with maximum surface area is in contact. If the weight of the cuboid is $1kg_{wt}$, the pressure exerted by it on the surface is _____. (take $g = 10ms^{-2}$).



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12. A vertical off-shore structure is built to withstand a maximum stress of $10^9 Pa$. Is the structure suitable for putting upon top of an oil well in Bombay high? Take the depth of the sea to be roughly 3 km, and ignore ocean currents.



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13. Two metal plates 'A' and 'B' having the same breadth but different length l_1 and l_2 ,

respectively are placed at same depth inside water such that their breadth is held exactly in vertical positions. Then, the ratio of the pressure acting on 'A' and 'B' by water is ____.

A. $1 : 1$

B. $l_1 : l_2$

C. $l_2 : l_1$

D. $l_1 b : \frac{l_2}{b}$

Answer: A



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14. The principle involved in the pressing of bales of cotton by a hydraulic press is ___

A. Boyle's law

B. Charle's law

C. Archimedes' principle

D. Pascal's law

Answer: D



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15. 20 Pa pressure is applied on the head of a nail placed perpendicular to the surface of a wall. If the area of cross section of the tip of the nail is $\frac{1}{10}$ the area of cross section of the head, the pressure exerted at the wall is ____ Pa.

A. 20

B. 2

C. 200

D. 100

Answer: C



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16. The sudden fall in pressure due to a rise in humidity indicates

- A. a cyclone
- B. rainfall
- C. a dust storm
- D. dry weather

Answer: A



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17. As air bubble rises from bottom to the top of a water tank. the size of the bubble increases. It happens, because

A. the pressure exerted by water on the bubble decreases as the height of the water column above it decrease

B. the density of water increases as we move downwards.

C. at constant temperature, pressure inside the air bubble are volume of the bubble inversely proportional to each other.

D. Both 1 and 3

Answer: D



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18. Which one of the following statements is true?

A. The weight of a substance in air is always less than its weight in water.

B. The mass of a substance is equal to the mass of an equal volume of water.

C. The weight of a substance in water is always greater than its weight in some other liquid.

D. The weight of a substance in water is always less than its weight in air.

Answer: D



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19. Which barometer does not contain any liquid ?

A. a mercury barometer

B. an aneroid barometer

C. a Fortin's barometer

D. Torricelli's barometer

Answer: B



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20. A cylindrical object floats in water such that $(3/4)$ th of its volume is immersed in water.

Its density is _____ kgm^{-3} .

A. 250

B. 0.75

C. 0.25

D. 750

Answer: D



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21. A piece of nail sinks in water but a boat floats in it because

A. there is no upthrust acting on the nail.

B. a nail is heavier than a boat.

C. a nail has a pointed end.

D. upthrust acting on the nail is less than its weight.

Answer: D



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22. An object of mass 100 kg is to be lifted by a 10 kg effort. The possible values of the area of cross sections of the pump piston and press

piston are ____ and ____, repectively, both in the same unit.

A. 100, 1

B. 10, 1

C. 1, 100

D. 2, 20

Answer: D



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23. The weight of the liquid displaced by a body when the body is immersed in it is called

A. apparent weight

B. upthrust

C. lateral pressure

D. relative density of the body

Answer: B



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24. Which one of the following statements is true?

A. Water forms concave meniscus on account of high cohesive forces

B. Mercury forms concave meniscus on account of more adhesive force than the cohesive forces

C. Water forms convex meniscus on account of high adhesive forces than the cohesive forces

D. Mercury forms convex meniscus on account of more cohesive force than adhesive force

Answer: D



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25. Which one of the following physical quantities increases as we go deep into the sea ?

A. temperature

B.

C. pressure

D. upthrust

Answer: C



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26. The apparent weight of an object on the surface of the moon, if the mass of the object

and liquid displaced are X and Y , respectively,

is

A. $\frac{X - Y}{g}$

B. $\frac{g}{6}(X - Y)$

C. $6g(X - Y)$

D. $\frac{6}{g(X - Y)}$

Answer: B



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27. The roof of a house blows out during a storm because

A. the wind blows with high velocity under the roof.

B. the weight of the roof is less than the weight of an equal volume of air.

C. the wind blows with high velocity over the roof, causing an upthrust on the bottom side.

D. the wind blows with high velocity over the roof, causing low pressure under the roof.

Answer: C



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28. Pressure at a point inside a liquid does not depend on

A. density of the liquid.

B. height of the liquid column above the point.

C. acceleration due to gravity.

D. base area of the container.

Answer: D



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29. In a Bramah press a small force is used to spend a much larger force. This is accomplished by

A. increasing the area of cross section of the pump piston.

B. decreasing the area of cross section of the press piston.

C. increasing the area of cross section of the press piston.

D. increasing the load (weight) on the press piston

Answer: C



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30. The pair of physical quantities having the same units are

- A. stress and pressure.
- B. thrust and pressure
- C. weight and stress.
- D. weight and pressure.

Answer: A



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31. Arrange the following steps in proper sequence to determine the pressure exerted by a gas enclosed in a container using a manometer.

(A) Connect one end of the manometer to the container filled with gas.

(B) Both the limbs of the manometer are exposed to air, mercury level in both the limbs are equal due to atmospheric pressure

(C) Determine the difference in level of the mercury in both the limbs of the manometer
(t).

(D) If the level of the mercury in the limb connected to the container is above the mercury level in the limb exposed to air, the pressure of the gas in the container is determined as atmospheric pressure - h

(E) If the level of the mercury in the limb connected to the container is below the mercury level in the limb exposed to air, the pressure of the gas in the container is determined as atmospheric pressure + h

(F) Note the level of the mercury in the limbs of the manometer.

A. A B C E F E

B. E B A D C F

C. B A C F D E

D. B C D A F E

Answer: C



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32. An air bubble rises up in water because,

A. there is no gravity in water.

B. pressure inside the bubble is less than the pressure outside it.

C. the upthrust acting on the bubble is more than the weight of the bubble

D. air cannot dissolve in water

Answer: C



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33. If the relative density of a solid is less than one, then

- A. it sinks in water.
- B. it floats in water
- C. it sinks in all the liquids.
- D. it floats in all the liquids.

Answer: B



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34. Two test tubes A and B of same mass with equal areas of cross-section are used as variable immersion hydrometer. If the length of test tube 'A' is double that of 'B', then the range of densities that can be measured by 'A' is

A. more than the range of densities that can be measured using 'B'.

B. less than the range of densities that can be measured using 'B'.

C. equal to the range of densities that can be measured using 'B'.

D. Both (b) and (c).

Answer: A



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35. A constant immersion hydrometer weighing 20 g sinks upto mark 'x' in water and this hydrometer has to weight 25 g to mark 'x'

in a given liquid. Then the relative density of the liquid is ____.

A. 0.25

B. 1.25

C. 0.75

D. 2.00

Answer: B



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36. Similar objects are dropped into two different liquids A and B. The displacement of the objects in A and B in 5 s is S_1 and S_2 respectively. If density of the liquid A is greater than the density of the liquid B, which among the following relation is correct?

A. $S_1 = S_2$

B. $S_1 > S_2$

C. $S_1 < S_2$

D. Cannot be determined

Answer: C



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37. A convex meniscus is formed when the cohesive force is ___ the adhesive force

A. equal to

B. less than

C. greater than

D. less than or equal to

Answer: C



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38. If F_{CS} , F_{CL} , F_{CG} represents cohesive force of solids cohesive force of liquid and cohesive force of gases then the choose the correct answer

A. $F_{CS} = F_{CL} = F_{CG}$

B. $F_{CS} > F_{CL} > F_{CG}$

C. $F_{CS} < F_{CL} < F_{CG}$

$$D. F_{CS} > F_{CL} = F_{CG}$$

Answer: A



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39. Gases do not have rigidity. Select the reason from the following .

A. The cohesive force is negligible

B. The adhesive force is very high

C. The cohesive force is very high

D. None of the above

Answer: B



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40. If P , V , and d are the pressure, Volume and density of a given mass of gas at constant temperature, choose the correct option.

A. $p \propto \frac{1}{d}$

B. $p \propto d$

C. $p(\alpha) \frac{1}{V}$

D. Both (a) and (c)

Answer: A



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41. Arrange the following steps in proper sequence to determine the relative density of a liquid by using a constant immersion hydrometer.

(A) The test tube is made to float in the given

liquid

(B) The weight of the test tube with lead shot in air is determined (W_1)

(C) The depth of the test tube immersed in water (h) is determined.

(D) Lead shots are added or removed from the test tube such that the test tube is immersed to the same depth (h) in the given liquid.

(f) The relative density of the liquid is measured as $\frac{W_1}{W_1}$

(g) The test tube is taken out from the given liquid and its weight (W_2) is measured

A. B D C A E G F

B. B D C A E F G

C. B C F E A C D

D. B A D C E F G

Answer: B



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42. Assertion (A) : When wind blows at a very high speed over the roof of a hut, the roof is blown away.

Reason (R) : The pressure exerted by a fluid at rest is transmitted unchanged equally in all directions.

A. A and R are correct and R is the correct explanation for A.

B. A and R are correct but R is not the correct explanation for A.

C. A is correct but R is wrong

D. Both A and R are wrong.

Answer:





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Concept Application Level 2

1. When a Fortins barometer is used to measure the pressure on the surface of the earth and on the top of a building the main scale reading is found to be the same and the vernier scale reading is found to be 9 and zero, respectively. If one M.S.D. is 1 mm and number of vernier scale divisions is 10, calculate the height of the building. Take the average

density of air as 1.3kgm^{-3} , and that of mercury as 13.6gcm^{-3}



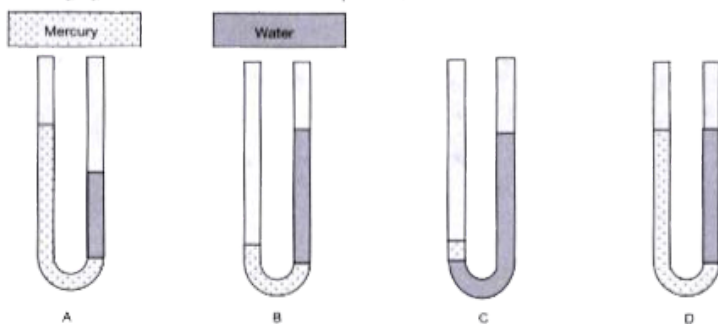
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2. In a Hare's apparatus when the air inside the tube is su c ked the difference in the level of water an d liquid in the container is found to be 3 cm and the difference in the tubes is fo u nd to be 4 cm. If th e level of water in tube is 16 cm. c.ilculate the relative density of the liquid. The den sity of liquid is m o re than the

density of water and the level of liquid in the container is more than that of water.

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3. In the following figures, state which of the casts is possible discuss giving reasons in each case.



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4. The 10% of total volume of the barometer liquid (mercury) contains impurities having an average density $5gcm^{-3}$. When this faulty barometer is used to measure the atmospheric pressure it reads 80 cm of the liquid column. Determine the correct atmospheric pressure.



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5. The density of ice is 901kgm^{-3} . What percentage of ice lies below water ? The density of sea water is 1011kgm^{-3} . What fraction of an iceberg can be seen by us if the ice berg has the same density as that of ice ?



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6. A car is lifted by a hydraulic jack that consists of two pistons. The diameter of the larger piston is 2 m and that of the smaller

piston is 50 cm. If the force applied on the smaller piston is 240 N, find the weight of the car.



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7. An object of weight $500kg_{wt}$ is lifted by using a hydraulic press. The radii of the cross sections of the pump piston and press piston are 10 cm and 20 cm, respectively. Calculate the effort required to lift the object. Calculate

the displacement of the load if the effort is moved through a distance of 20 cm.



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8. It is advised not to stand near a running train. Why?



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9. A constant immersion hydrometer floats vertically in water when the weight of its float

is 30 g. When it is made to float in a liquid (miscible in water), the weight of its float is increased by 10 g. Find the weight of the hydrometer when it is floated in a mixture containing equal masses of water and the liquid.



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10. A cylindrical object of the area of cross section 5 cm^2 floats (lateral side vertical) in water filled in a cylindrical container of the

area of cross section 15 cm^2 When the object is placed in water the level of the water in the container rises by 2 cm and the len



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11. When a metallic sphere is released from the surface of water filled in a container of uniform area of cross section it is found to reach the bottom of the container in 2 s. If the density of the material of the sphere is 4.9 gcm^{-3} , calculate the pressure exerted by

the liquid at the bottom of the container.

Assume that only gravitational force and upthrust act on the body.



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12. The relative density of pure gold is 19.3.

When an ornament made of gold is immersed completely in water, the volume of the water displaced is 5 ml. If the mass of the ornament in air is 100 g, determine whether the ornament is made of pure gold.



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13. Why gas filled balloons rise up, only to a certain height ?



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14. Why does a steel needle gently placed on the surface of water float on it instead of sinking?



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15. A man can lift a maximum weight of $30kg_{wt}$. In order to lift an object of weight 50 kg placed in a container, he pours a certain liquid into the container so that the object is completely immersed in it. What is the density of the liquid if he can just lift the object ? The volume of the liquid displaced is $10^{-2}m^3$.



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16. An effort applied on the small piston of a hydraulic jack lifts the load through a distance of 50 cm and the effort is displaced through 2 m. If the diameter of the larger piston is 28 cm, calculate the area of the cross section of the smaller piston.



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17. Suggest a method to fill water in a tank constructed at a height of 10 m from the

ground by using a vacuum pump instead of an electric pump.



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18. A pressure exerted by mercury at the bottom of a container of area of cross section 2cm^2 is 10 Pa. Determine the weight of the mercury in the container.



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19. A cuboid of dimensions $3m \times 2m \times 1m$ is placed on a surface such that the face with maximum surface area is in contact. If the weight of the cuboid is $1kg_{wt}$, the pressure exerted by it on the surface is _____. (take $g = 10ms^{-2}$).



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20. A body is immersed in a liquid of relative density 2.6. It is found that the weight of the

body in the liquid is two-thirds of its weight in air. Calculate the density of the body ?



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Concept Application Level 3

1. A test tube of uniform cross-section is floated vertically in a liquid 'A' (density ρ_A) upto a mark on it when it is filled with 'x' ml of a liquid 'B' (density ρ_B). To make the test tube float in liquid B upto the same mark it is filled

with y ml of the liquid A. Find the mass of the test tube.



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2. An alloy of copper and zinc weight 320 g in water and 302 g in a liquid of density 1.4gcm^{-3} . If the density of copper is 8.9gcm^{-3} and that of the zinc is 7.4gcm^{-3} , find the measure of the masses of copper and zinc in the alloy.



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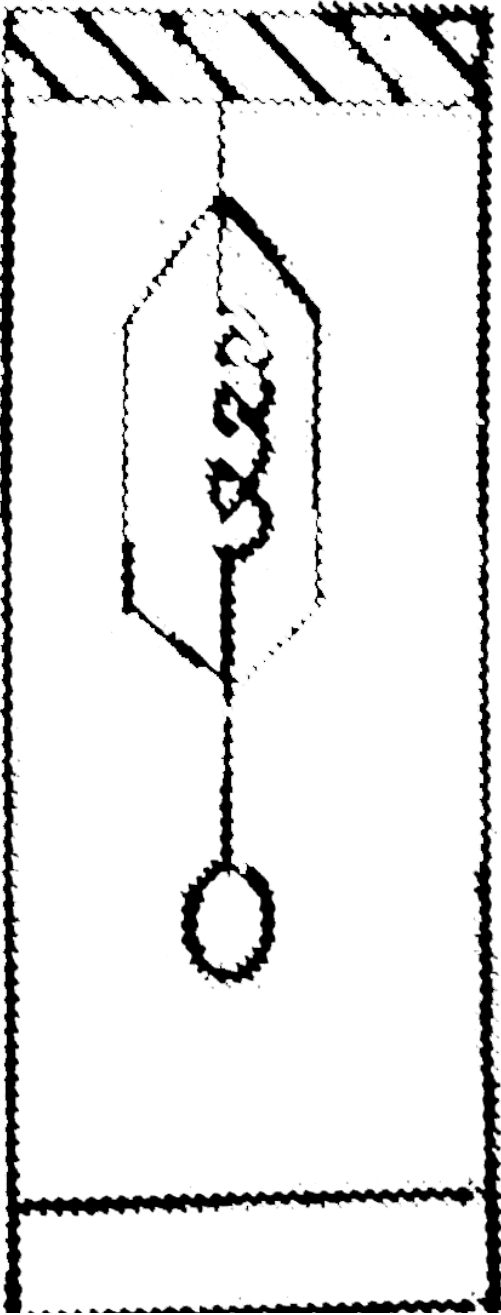
3. A person carries an air-tight box and a bird sits in it. If the bird flies inside, what happens to the weight of the box?



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4. An object suspended from a sensitive spring balance is placed inside a closed container. The other end of the container is closed by means of an air-tight piston. Will there be any change in the spring balance reading when

the piston is moved the inward and outward
direction ? Why ?





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5. How is the hair set well when oil is applied to it ?



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6. A rubber ball of mass 100 g and radius 5 cm is submerged in water to a depth of 1 m and released. To what height will the ball jump up above the surface of water ? (Take $g = 10ms^{-2}$)



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7. A cylindrical object floats in water such that $(3/4)$ th of its volume is immersed in water. Its density is _____ kgm^{-3} .





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8. The density of a given mass of a gas when 10 Pa pressure acts on it is 2kgm^{-3} . Calculate the density of the gas if the pressure is increased by 5 Pa at constant temperature.



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9. Two metallic spheres 'P' and 'Q' weighing 200 gwt and 150 gwt, respectively, balance each other when immersed in water. If the

relative density of 'P' is 2 find the specific gravity of 'Q'.



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10. A hydrometer stem has a length 30 cm. If the hydrometer is immersed in water , its floatation bulb just sinks. If the same hydrometer is immersed in a liquid having density of 500kgm^{-3} , two-third of the stem is immersed. Find the least specific gravity of a

liquid that can be measured using the hydrometer.



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