JEE MAIN : CHAPTER WISE TEST PAPER-11

SUBJECT :- PHYSICS **DATE.....**
CLASS :- 11th **NAME.....**
CHAPTER :- MECHANICAL PROPERTIES OF MATTER **SECTION.....**

(SECTION-A)

1. The force required to stretch a steel wire of 1 cm^2 cross-section to 1.1 times of its length will be
($Y = 2 \times 10^{11}\ Nm^{-2}$)
(A) 2×10^6 N (B) 2×10^3 N
(C) 2×10^{-6} N (D) 2×10^{-7} N

2. A cube is subjected to a uniform volume compression. If the side of the cube decreases by 2%, the bulk strain is -
(A) 0.02 (B) 0.03 (C) 0.04 (D) 0.06

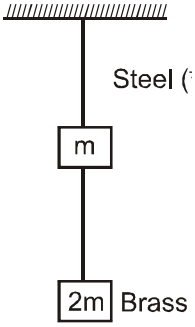
3. The mean density of sea water is ρ, and bulk modulus is B. The change in density of sea water in going from the surface of water to a depth h is :

(A) $\frac{\rho gh}{B}$ (B) $B\rho gh$

(C) $\frac{\rho^2 gh}{B}$ (D) $\frac{B\rho^2}{gh}$

4. A 50 kg motor rests on four cylindrical rubber blocks. Each block has a height of 4 cm and a cross-sectional area of 16 cm^2. The shear modulus of rubber is $2 \times 10^6\ N/m^2$. A sideways force of 500 N is applied to the motor. The distance that the motor moves sideways is
(A) 0.156 cm (B) 1.56 cm
(C) 0.312 cm (D) 0.204 cm

5. If the ratio of lengths, radii and Young's modulii of steel and brass wires in the figure are a, b, c respectively. Then the corresponding ratio of increase in their lengths would be :



(A) $\frac{2ac}{b^2}$ (B) $\frac{3a}{2b^2c}$

(C) $\frac{3c}{2ab^2}$ (D) $\frac{2a^2c}{b}$

6. A boy carries a fish in one hand and a bucket (not full) of water in the other hand. If he places the fish in the bucket, the weight now carried by him (assume that water does not spill):
(A) is less than before
(B) is more than before
(C) is the same as before
(D) depends upon his speed

7. A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to the lower end. The weight stretches the wire by 1mm. Then the elastic energy stored in the wire is ?
(A) 0.2 J (B) 10J (C) 20J (D) 0.1 J

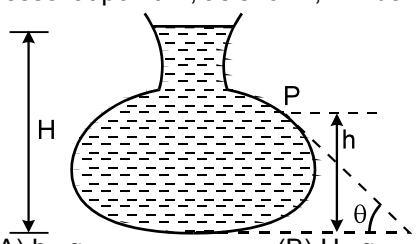
8. If tension is removed from wire (one time) then :
(A) It will break
(B) It's temperature will be decreased
(C) There be no change in its temperature
(D) It's temperature will increase

9. Soap has surface tension σ. We make a plane soap film and on the soap film we placed a loop of rubber band of total length *l*. The cross sectional area of the rubber band is S and its Young's modulus of elasticity is E. Now the film inside the loop is pierced. The rubber loop acquires a circular shape. Find the tension in the rubber loop.

(A) $2\sigma l$ (B) $\frac{E\sigma l\, s}{\pi Es + \sigma l}$

(C) $\frac{E\sigma l\, s}{\pi Es - \sigma l}$ (D) $Es - l\sigma$

10. Figure here shown the vertical cross-section of a vessel filled with a liquid of density ρ. The normal thrust per unit area on the walls of the vessel at point. P, as shown, will be



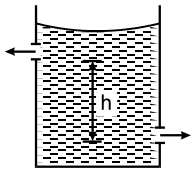
(A) $h\rho g$ (B) $H\rho g$
(C) $(H - h)\rho g$ (D) $(H - h)\rho g \cos\theta$

11. The compressibility of water is 46.4×10^{-6}/atm. This means that
(A) the bulk modulus of water is 46.4×10^{6} atm
(B) volume of water decreases by 46.4 one-millionths of the original volume for each atmosphere increase in pressure
(C) when water is subjected to an additional pressure of one atmosphere, its volume decreases by 46.4%
(D) When water is subjected to an additional pressure of one atmosphere, its volume is reduced to 10^{-6} of its original volume.

12. A soap bubble 50 mm in diameter contains air at a pressure (in excess of atmospheric) of 2 bar. Find the surface tension in the soap film.
(A) 1.25×10^{-2} N/m (B) 12.5×10^{-2} N/m
(C) 125×10^{-2} N/m (D) 1250 N/m

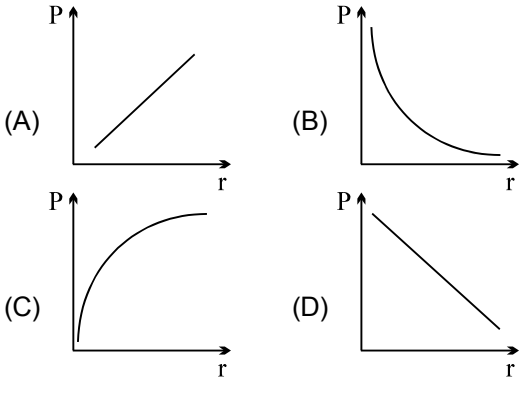
13. Two wires of the same material and length but diameter in the ratio 1 : 2 are stretched by the same force. The ratio of potential energy per unit volume for the two wires when stretched will be :
(A) 1 : 1 (B) 2 : 1 (C) 4 : 1 (D) 16 : 1

14. There are two identical small holes on the opposite sides of a tank containing a liquid. The tank is open at the top. The difference in height between the two holes is h. As the liquid comes out of the two holes, the tank will experience a net horizontal force proportional to:



(A) $h^{1/2}$ (B) h (C) $h^{3/2}$ (D) h^2

15. A spherical soap bubble is blown such that its radius increases at a constant rate. Which of following curves represents power required to increase surface energy of the bubble versus radius of drop.

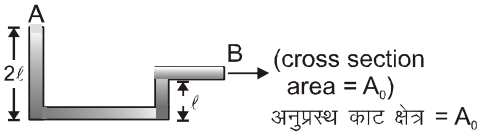


16. **STATEMENT-1 :** Consider an object that floats in water but sinks in oil. When the object floats in water, half of it is submerged. If we slowly pour oil on top of water till it completely covers the object, the object moves up.
STATEMENT-2 : As the oil is poured in the situation of statement-1, pressure inside the water will increase everywhere resulting in an increase in upward force on the object.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

17. A wire elongates by ℓ mm when a load W is hanged from it. If the wire goes over a pulley and two
(A) $\ell/2$ (B) ℓ (C) 2ℓ (D) zero

18. If a ball of steel (density p = 7.8 g cm^{-3}) attains a terminal velocity of 10 cm s^{-1} when falling in a water (Coefficient of Viscosity $\eta_{water} = 8.5 \times 10^{-4}$ Pa.s) then its terminal velocity in glycerine (p = 1.2 g cm^{-3}, η = 13.2 Pa.s.) would be, nearly :
(A) 6.25×10^{-4} cm s^{-1} (B) 6.45×10^{-4} cm s^{-1}
(C) 1.5×10^{-5} cm s^{-1} (D) 1.6×10^{-5} cm s^{-1}

19. A tube in vertical plane is shown in figure. It is filled with a liquid of density ρ and its end B is closed. Then the force exerted by the fluid on the tube at end B will be : [Neglect atmospheric pressure and assume the radius of the tube to be negligible in comparison to ℓ]

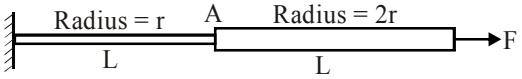


(A) 0
(B) $\rho g \ell A_0$
(C) $2\rho g \ell A_0$
(D) Cannot be determined

20. A beaker containing water is placed on the platform of a spring balance. The balance reads 1.5 kg. A stone of mass 0.5 kg and density 500 kg/m^3 is completely immersed in water without touching the walls of beaker. Now the balance reading will be -
(A) 2 kg (B) 1 kg
(C) 2.5 kg (D) 3 kg

(SECTION-B)

21. Two steel wires of same length but radii r and 2r are connected together end to end and tied to a wall as shown.



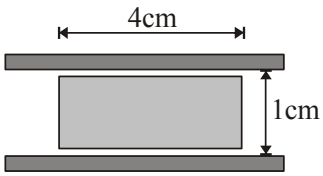
The force stretches the combination by 10 mm. How far does the midpoint A move. (in mm)

22. A uniform block of wood placed in water floats with exactly 2/3 of its volume submerged. Assume that the water has a density of 1×10^3 kg/m^3.The exact same block of wood, placed in oil, floats with $\frac{5}{6}$ of its volume submerged. Using this information, what is the density of the oil in kg/m^3?

23. A long cylindrical tank of radius 1m is being filled by a pipe of radius 2cm. The incoming water has a velocity of 1m/s. The tank has a hole of radius 1cm at the bottom. What is the height of water (in cm) in the tank in steady state ?

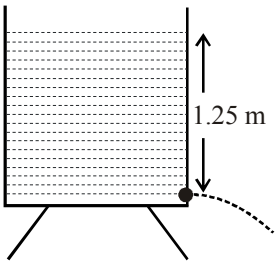
24. An air bubble of radius r = 3mm moves up in a viscous liquid with a constant velocity v = 0.7 cm/sec. If the density of the liquid is 1.75 gm/cc. Find the viscosity of liquid (in poise). Neglect the density of air in comparison to that of the liquid.

25. The figure below shows top view of a piston of weight 21 kg that slides inside a horizontal lubricated cylindrical pipe. The clearance between piston and pipe is 0.04 cm. If the piston decelerates at π m/s^2 when the speed is 21 m/s, what is the viscosity of the oil (in Pa-s) ? Assume Newton's Law and a linear velocity profile.

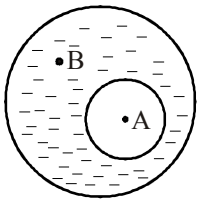


26. A cubical container is accelerating horizontally with acceleration $\frac{g}{\sqrt{3}}$ where g = gravitational acceleration and free surface of liquid present in the container makes angle θ with horizontal. Write value of cosec θ in OMR sheet.

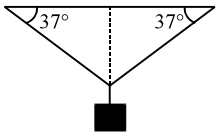
27. A large tank contains water upto a height of 1.25 m. A small hole near its bottom allows water to flow out. The area of the hole is 0.8 cm^2. What is the rate (in watt) at which the kinetic energy of the water is changing (at that moment) ?



28. There is an air bubble of radius R inside a drop of water of radius 3R. Find the ratio of gauge pressure at point A to gauge pressure at point B.



29. A block is hanged by means of two identical wires having cross section area A (1 mm^2) as shown in the diagram. If temperature is lowered by ΔT (10°C), find the mass (in kg) to be added to hanging mass such that junction remains at initial position. Given that co-efficient of linear expansion $\alpha = 2 \times 10^{-5}$ /°C and Young's modulus $Y = 5 \times 10^{11}$ N/m^2 for the wire.



30. Due to the excess pressure of surface tension find the change in the radius (in Å) of a liquid drop of radius 1 mm, surface tension 0.075 N/m and Bulk modulus $1.25 \times 10^{+8}$ N/m^2.