Shiksha Classes Bhandara
CHAPTER TEST

Subject : Physics **Topic : Properties of Matter** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 Four identical hollow cylindrical columns of steel support a big structure of mass 50000 kg. The inner and outer radii of each column are 30 and 60 cm. respectively. Assuming the load distribution to be uniform, calculate the compressional strain of each column. The Young's modulus of steel is 2.0×10^{11} Nm^{-2}.

(A) 7.2×10^{-7} (B) 15.2×10^{-7}

(C) 8.4×10^{-7} (D) 12.1×10^{-7}

Q.2 Compute the bulk modulus of water from the following data : Initial volume = 100.0 litre, Pressure increase = 100.0 atm. Final volume = 100.5 litre.

(A) $.03 \times 10^9$ Nm^{-2}. (B) 8.01×10^9 Nm^{-2}.

(C) 2.03×10^9 Nm^{-2}. (D) 5.33×10^9 Nm^{-2}.

Q.3 Water rises to height of 20 mm a capillary. If the radius of the capillary is made one third of its previous value of then what is the new value of the capillary rise ?

(A) 60mm (B) 40 mm

(C) 30mm (D) 10mm

Q.4 A hydraulic automobile lift is designed to lift car with a maximum mass of 3000 kg. The area of cross-section of the piston carrying the load is 425 cm^2. What maximum pressure would the smaller piston have to bear ?

(A) 6.92×10^5 Nm^{-2} (B) 1.92×10^5 Nm^{-2}

(C) 8.14×10^5 Nm^{-2} (D) 7.12×10^5 Nm^{-2}

Q.5 In Millikan's oil drop experiment, what is the terminal speed of an uncharged drop of radius 2.0×10^{-5} m and density 1.2×10^3 kg m^{-3}. Take the viscosity of air at the temperature of the experiment to be 1.8×10^{-5} Nsm^{-2}. How much is the viscous force on the drop at that speed ? Neglect buoyancy of the drop due to air.

(A) 3.93×10^{-19} N (B) 6.23×10^{-19} N

(C) 0.93×10^{-19} N (D) 1.13×10^{-19} N

Q.6 A metal plate 100 cm^2 in area rests on a layer of castor oil (η = 15.5 poise) 0.2 cm thick. Calculate the horizontal force required to move the plate with a speed of 3 cm/s.

(A) 1.213 N (B) 0.233 N

(C) 2.33 N (D) 5.133 N

Q.7 A block of silver of mass 4 kg. hanging from a string is immersed in a liquid of relative density 0.72. If relative density of silver is 10, then tension in the string will be [take g = 10 m/s^2]

(A) 37.12 N (B) 42 N

(C) 73 N (D) 21 N

Q.8 A vessel contains oil (density = 0.8 gm/cm^3) over mercury (density = 13.6 gm/cm^3). A uniform sphere floats with half its volume immersed in mercury and the other half in oil. Find the density of the material of sphere in gm/cm^3,

(A) 8.4 (B) 7.2

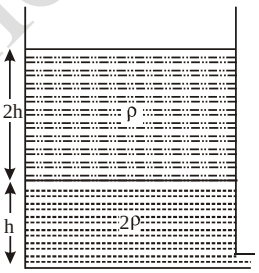
(C) 5.4 (D) 2.1

Q.9 Two capillary tubes are of the same diameters. One is dipped in a liquid of relative density 0.8 while the other in a liquid of relative density 0.6. If surface tensions of these liquids are 60 and 50 milli N/m, respectively, and the angles of the contact are equal, compare the rise of liquids in the capillary tubes.

(A) 9 : 10 (B) 7 : 10

(C) 3 : 10 (D) 1 : 10

Q.10 The velocity of the liquid coming out of a small hole of a vessel containing two different liquids of densities 2ρ and ρ as shown in figure is –



(A) $\sqrt{6gh}$

(B) $2\sqrt{gh}$

(C) $2\sqrt{2gh}$

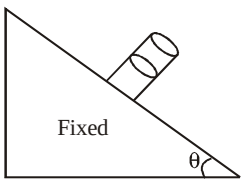
(D) $\sqrt{gh}$

Q.11 What is the pressure inside the drop of mercury of radius 3.00 mm at room temperature ? Surface tension of mercury at that temperature (20 °C) is 4.65×10^{-1} N m^{-1}. The atmospheric pressure is 1.01×10^5 Pa.

(A) 1.31×10^5 NM^{-2} (B) 0.0231×10^5 NM^{-2}

(C) 2.0131×10^5 NM^{-2} (D) 1.0131×10^5 NM^{-2}

Q.12 A cylindrical vessel filled with water is released on an inclined surface of angle θ as shown in figure.



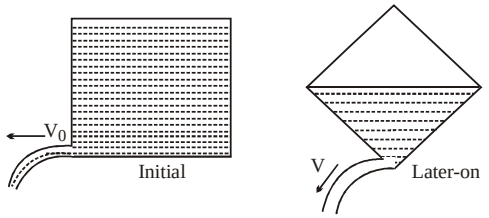
The friction coefficient of surface with vessel is μ (< tan θ).

Then the contact angle made by the surface of water with the incline will be –

(A) $\tan^{-1}\mu$ (B) $\theta - \tan^{-1}\mu$

(C) $\theta + \tan^{-1}\mu$ (D) $\cot^{-1}\mu$

Q.13 A square box of water has a small hole located in one of the bottom corner. When the box is full and sitting on a level surface, complete opening of the hole results in a flow of water with a speed v_0, as shown in figure. When the box is half empty, it is tilted by 45° so that the hole is at the lowest point. Now the water will flow out with a speed of –



(A) V_0 (B) $V_0/2$

(C) $V_0/\sqrt{2}$ (D) $V_0/\sqrt[4]{2}$

Q.14 A steel wire of length 4.7 m and cross section 3.0×10^{-5} m^2 stretches by the same amount as a copper wire of length 3.5 m and cross section 4.0×10^{-5} m^2 under a given load. What is the ratio of Young's modulus of steel to that of copper ?

(A) 2.14 (B) 1.79

(C) 3.12 (D) 5.14

Q.15 A litre of glycerine contracts 0.2l cm^3/Nm^2, What is the bulk modulus of glycerine ?

(A) 0.47×10^{10} N/m^2 (B) 1.47×10^{10} N/m^2

(C) 2.17×10^{10} N/m^2 (D) 5.18×10^{10} N/m^2

Q.16 When a 2.5 kg crown is immersed in water, it has an apparent weight of 22 N. What is the density of the crown?

(A) 8.3×10^3 kg m^{-3} (B) 0.3×10^3 kg m^{-3}

(C) 5.4×10^3 kg m^{-3} (D) 7.2×10^3 kg m^{-3}

Q.17 A block of iron is kept at the bottom of a bucket full of water at 2°C. The water exerts buoyant force on the block. If the temperature of water is increased by 1°C the temperature of iron block also increases by 1°C. The buoyant force on the block by water –

(A) will increase

(B) will decrease

(C) will not change

(D) many decrease or increase depending on the values of their coefficient of expansion

Q.18 The coefficient of viscosity η of a liquid is defined as the tangential force on a layer in that liquid per unit area per unit velocity gradient across it. Then a sphere of radius 'a', moving through it under a constant force F attains a constant velocity 'V' given by – (where K is a numerical constant)

(A) $KFa\eta$ (B) $K\frac{F}{a}\eta$

(C) $K\frac{F}{a\eta}$ (D) $K\eta\frac{a}{F}$

Q.19 Consider the following statements :

(i) Young's modulus is numerically equal to the stress which will double the length of a wire.

(ii) Viscosity of gases is greater than that of liquids.

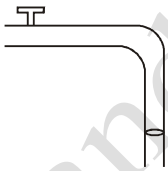
(iii) The surface tension of a liquid decreases due to the presence of insoluble contamination.

The number of above statements that are true is –

(A) one (B) two

(C) three (D) zero

Q.20 A steady stream of water falls straight down from a pipe as shown. Assume the flow is incompressible then –



(A) the pressure in the water is higher at lower points in the stream.

(B) the pressure in the water is lower at lower points in the stream.

(C) the pressure in the water is the same at all points in the stream.

(D) pressure variation will depend upon density and exit speed of the water.

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 An isolated and charged spherical soap bubble has a radius r and the pressure inside is atmospheric. If T is the surface tension of soap solution, then charge on drop is $X\pi r\sqrt{2rT\varepsilon_0}$. Find the value of X.

Q.22 A mosquito with 8 legs stands on water surface and each leg makes depression of radius 'a'. If the surface tension and angle of contact are 'T' and zero respectively, then the weight of mosquito is $X\pi Ta$. Find the value of X.

Q.23 If the work done in stretching a wire by 1mm is 2J, the work (in J) necessary for stretching another wire of the same material but double the radius and half the length by 1mm is –

Q.24 Two springs of equal lengths and equal cross-sectional areas are made of materials whose Young's modulus are in the ratio of 2:3. They are suspended and loaded with the same mass. When stretched and released, they will oscillate with time periods in the ratio of $\sqrt{X} : \sqrt{2}$. Find the value of X.

Q.25 The excess pressure inside one soap bubble is three times that inside a second bubble. The ratio of the volume of the first bubble to that of the second is (1/X). Find the value of X.