PHYSICS

BOOKS - MODERN PUBLICATION PHYSICS (KANNADA ENGLISH)

PROPERTIES OF MATTER

Multiple Choice Questions Level I

1. An iron bar of length l and cross-section A is heated from $0^{o}C$ to $100^{o}C$. If the rod is so held

that it is not permitted to expand or bend, the force developed in it is :

A. directly proportional to length

B. inversely proportional to length

C. independent of length

D. inversely proportional to area of cross-section

Answer: C

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2. The isothermal bulk modulus of an ideal gas at a pressure P is :

A. P

B. γP

C. P/2

D. P/γ

Answer: A

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3. A thick rope of density p and length L is hung from a rigid support. The increase in lens of the rope due to its own weight is (Y is the Young's modulus).

A. $\frac{1}{4Y}pL^2g$

B. $\frac{1}{2Y}pL^2g$

C. $\frac{pL^2g}{Y}$

D. $\frac{pLg}{Y}$

Answer: B

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4. There is no change in the volume of a wire due to the change in its length on stretching. The Poisson's ratio of lhe material of the wire is :

A. $+\frac{1}{2}$

B. $-\frac{1}{2}$

C. $+\frac{1}{4}$

D. $-\frac{1}{4}$

Answer: B

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5. Two rods A and B of the same material and length have their radii r_1 and r_2. If they are rigidly fixed at one end and twisted at other end by the same couple, then the ratio of their angles of twist is :

A. $\frac{r_1^2}{r_2^2}$

B. $\frac{r_1^3}{r_2^3}$

C. $\frac{r_1^4}{r_2^4}$

D. $\frac{r_2^4}{r_1^4}$

Answer: D

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6. Two identical wires of iron and copper with their Young's modulus in the ratio 3 : 1 are suspended at same level. They are to be loaded so as to have same extension and hence level. Ratio of the weight is :

A. $1:3$

B. $2:1$

C. $3:1$

D. $4:1$

Answer: C

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7. A soap bubble (surface tension $= 30 \times 10^{-3} N.m^{-1}$) has radius 2 cm. The work done in doubling the radius is :

A. 0

B. $1.1305 \times 10^{-4} J$

C. $12.261 \times 10^{-4} J$

D. $4.403 \times 10^{-4} J$

Answer: D

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8. A capillary tube of radius r can support a liquid of weight 6.28×10^{-4} N. If the surface

tension of the liquid is 5×10^{-2} N/m. The radius of the capillary must be:

A. $2.5 \times 10^{-4} m$

B. $1.5 \times 10^{-3} m$

C. $2.0 \times 10^{-4} m$

D. $2.0 \times 10^{-3} m$

Answer: D

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9. The amount of work done in increasing the size of a soap film 10 cm x 6 cm to 10 cm x 10 cm is (surface tension T = 0·030 Nim) :

A. $2.4 \times 10^{-2} J$

B. $2.4 \times 10^{-4} J$

C. $4.2 \times 10^{-2} J$

D. $4.2 \times 10^{-4} J$

Answer: B

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10. In a surface tension experiment with a capillary tube water rises upto 0· 1 m. If the same experiment is repeated on an artificial satellite, which is revolving around the earth, water will rise in the capillary tube upto a height of :

A. 0.1 m

B. 0.2 m

C. 0.98 m

D. Full length of tube.

Answer: D

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11. A hole is near the bottom of a tank. The volume of liquid emerging from the hole does not depend upon :

A. height of liquid level above hole

B. area of hole

C. density of liquid

D. gravitational acceleration.

Answer: C

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12. The level of water in a tank is 5 m high. A hole of area 1 cm^2 is made at the bottom of the tank. The rate of leakage of water from the hole is : (g = 10 m/s^2)

A. $10^{-3}m^3/s$

B. $10^{-4}m^3/s$

C. $10^{-1}m^3/s$

D. $10^{-2}m^3/s$

Answer: A

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13. A cylindrical drum of height 200 cm is kept filled upto the brim. There are four holes 1, 2, 3, 4 which are respectively 40 cm, 100 cm, 140 cm, 180 cm from the horizontal floor AB. The water falling at maximum distance from the

vessel come from :

A. hole number 1

B. hole number 2

C. hole number 3

D. hole number 4

Answer: B

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14. A body is just floating on the surface of a liquid. The density of the body is same as that of the liquid. The body is slightly pushed down. What will happen to the body ?

A. start oscillating

B. sink to the bottom

C. come back to same position immediately

D. come back to the same position slowly.

Answer: B

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15. A cylinder is filled with water of density p upto a height h. If the beaker is at rest, the average pressure at the walls is:

A. 0

B. hpg

C. hpg/2

D. 6hpg

Answer: C

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16. A Cube made of material having density of $0.9 \times 10^3 kgm^{-3}$ floats between water and a liquid of density $0.7 \times 10^3 kg/m^3$ which is immiscible with water. What part of cube is immersed in water.

A. $\frac{1}{3}$

B. $\frac{3}{4}$

C. $\frac{2}{3}$

D. $\frac{3}{7}$

Answer: C

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17. A block of steel of size 5 cm x 5 cm x 5 cm is weighed in water. If the relative density of steel is 7, its apparent weight is:

A. $6 \times 5 \times 5 \times 5$ g

B. $4 \times 4 \times 4 \times 7g$

C. $4 \times 4 \times 4 \times 6g$

D. $5 \times 5 \times 5 \times 7g$

Answer: A

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18. The radius of a spherical soap bubble is 0·5 mm. If the surface tension of the soap solution be 30 dyne/ cm, the excess pressure is :

A. 1500 dyne/cm^2

B. 1000 dyne/cm^2

C. 2400 dyne $/ cm^2$

D. 1200 dyne $/ cm^2$

Answer: C

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19. A soap bubble of radius a is blown so that its diameter is doubled. If T is the surface tension of water, the energy required to do this, at constant temperature is :

A. $8\pi a^2 T$

B. $12\pi a^2 T$

C. $16\pi a^2 T$

D. $24\pi a^2 T$

Answer: D

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20. A vessel has a small hole at the bottom. Its radius is 0.4 mm. The height to which water can be put inside the vessel without any leakage (Surface tension = 72 dyne/cm, g = $9.8 m / s^2$) will be :

A. 3·67 cm

B. 0·367 cm

C. 0·0367 cm

D. zero.

Answer: A

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21. 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.

A. 10 m/s

B. 20 m/s

C. 30 m/s

D. 40 m/s

Answer: A

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22. The reading of a spring balance when a block is suspended from it in air is 60 N. This reading is changed to 40 N when the block is submerged in water. The specific gravity of the block must be therefore :

A. 3

B. 2

C. 6

D. $\frac{3}{2}$

Answer: A

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23. By what percentage should the pressure of a given mass of a gas be increased so as to decrease its volume by 10% at a constant temperature ?

A. 8·1%

B. 9·1%

C. 10·1%

D. 11-1%

Answer: D

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24. A material has Poisson ratio 0.5. If a rod of the material has a longitudinal strain 2×10^{-3}, the percentage change in volume is :

A. 0.6

B. 0.4

C. 0.2

D. zero.

Answer: D

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25. The breaking strength of a cable of diameter 2 cm is 2×10^5 N. What will be the breaking strength of a wire of the same material but having diameter 1 cm ?

A. 2×10^5 N

B. $1 \times 10^5 N$

C. $0.5 \times 10^5 N$

D. $0.25 \times 10^5 N$

Answer: C

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26. A long wire is stretched by 0.2 cm and energy density is 0.25 J m^{-3}, what will be the energy density when stretched by 1 cm ?

A. $\frac{1}{100} Jm^{-3}$

B. $\frac{1}{20} Jm^{-3}$

C. $\frac{5}{4} Jm^{-3}$

D. $\frac{25}{4} Jm^{-3}$

Answer: D

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27. One end of a uniform bar of weight W_1 is clamped to the ceiling and a weight W_2 is suspended to the other end. If the area of

cross-section is A, what is the stress at the mid-point of the rod ?

A. $\frac{W_1 + W_2}{A}$

B. $\frac{W_1 - W_2}{A}$

C. $\frac{\frac{W_1}{2} + W_2}{A}$

D. $\frac{\frac{W_2}{2} + W_1}{A}$

Answer: C

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28. Two rods of different materials having coefficient of linear expansion α_1 and α_2 and Young's modulus Y_1 and Y_2 respectively are fixed between two rigid walls. The rods are heated to same high temperature. If $\alpha_1 : \alpha_2$ :: 2 : 3 the thermal stress in two rods is the same. Then the rate Y_1 / Y_2 is :

A. $\frac{2}{3}$

B. $\frac{1}{1}$

C. $\frac{3}{2}$

D. $\frac{4}{9}$

Answer: C

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29. A log of wood floats in water with 1/5th of its volume above the surface of water. The density of wood is :

A. $0.8 \times 10^3 kgm^{-3}$

B. $8 \times 10^3 kgm^{-3}$

C. $0.08 \times 10^3 kgm^{-3}$

D. $10^3 kgm^{-3}$

Answer: A

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30. What should be the height 'h' to which a cylinderical vessel be filled by an isotropic liquid so that the force on its sides is equal to the force acting on its botom ? (r = radius) :

A. h=r

B. $h = r^2$

C. $h = 2r$

D. $h = r/2$

Answer: A

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31. A piston of cross-sectional area 100 cm^2 is used in a hydraulic press to exert a force of 107 dyne on the water. The cross-sectional

area of the other piston which supports a truck of mass 2000 kg is :

A. $9.8 \times 10^2 cm^2$

B. $9.8 \times 10^3 cm^2$

C. $1.96 \times 10^3 cm^2$

D. $1.96 \times 10^4 cm^2$

Answer: D

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32. A spherical ball of radius r and relative density 0.5 is floating in equilibrium in water with half of it immersed in water. The work done in pushing the ball down so that the whole of it is just immersed in water is :

A. $\frac{5}{12}\pi r^4 pg$

B. $\frac{1}{2}prg$

C. $\frac{4}{3}\pi r^3 pg$

D. $\frac{2}{3}\pi r^4 pg$

Answer: A

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33. A piece of metal of mass 17 g is tied to cork of mass 5 g and the combination floats without sinking in water. If relative density of cork is 0.25 and water 1, the relative density of metal is :

A. 2

B. 5

C. 8.5

D. 10.5

Answer: C

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34. A sphere of solid material of R.D. 8 has a concentric cavity and just sinks in water. Then ratio of the radius of the cavity to that of outer radius of the sphere must be:

A. $\frac{1}{2} \times (3)^{1/3}$

B. $\frac{1}{2}(5)^{1/3}$

C. $\frac{1}{2}(7)^{1/3}$

D. $\frac{(9)^{1/3}}{2}$

Answer: C

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35. The density of ice is x g cm^{-3} and that of water is y g cm^{-3}. What is the change in volume when m gram of ice melts ?

A. $m(y-x)c.\ c.$

B. $\frac{y-x}{m}c.\ c.$

C. $mxy(x-y)c.\ c.$

D. $m\left(\frac{1}{y}-\frac{1}{x}\right)c.\ c.$

Answer: D

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36. Water rises to a height of 10 cm in capillary tube and mercury falls to a depth of 3.42 cm in the same tube. If the density of mercury is 13.6

g cm^{-3} and angle of contact is 135°, the ratio of the surface tensions for water and mercury is :

A. $1:5.57$

B. $1:3.57$

C. $1:6.57$

D. $:1.1.57$

Answer: C

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37. A ball is rising through a liquid with constant speed. The ratio of density of liquid to that of material of ball is 3 : 1. The ratio of viscous force to the weight of the ball is:

A. $1:3$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: B

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38. A capillary tube is attached horizontally to a constant head arrangement. If the radius of the capillary tube is increased by 10%, the rate of flow of liquid changes by:

A. $+10\ \%$

B. $+46\ \%$

C. $-10\ \%$

D. $-46\ \%$

Answer: B

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39. Two pieces of wire A and B of the same material have their lengths in the ratio 1 : 2 and their diameters in the ratio 2 : 1 if they are stretched by same force. Their elongation will be in the ratio of :

A. $1:8$

B. $8:1$

C. $2:1$

D. $1:4$

Answer: A

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40. Find the temperature when the r.m.s. velocity of oxygen will be the same as that of hydrogen molecule at 27°C

A. 1600 K

B. 2400 K

C. 4800 K

D. 5400 K.

Answer: C

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41. A jar has a mixture of H_2 and O_2 gas in the ratio of 1: 5. The ratio of mean K.E. of H_2 and O_2 molecules is :

A. $1:1$

B. $1:5$

C. $1:4$

D. $4:1$

Answer: A

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42. A litre of ideal gas at 27°C is heated at the constant pressure to 297°C. Then the final volume is approximately :

A. 1·2 litre

B. 2·4 litre

C. 1·9 litre

D. 24 litre.

Answer: C

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43. Two gases A and B having same temperature T, same pressure P and same volume V are mixed. If the mixture is at same

temperature T and occupies a volume V then the pressure of the mixture is :

A. 2P

B. P

C. 4P

D. P/4

Answer: A

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44. If the mean free path fer a given molecule is 1.1×10^6 cm, what is radius of the molecules (Given number of molecules per $cm^3 = 2 \cdot 69 \times 10^{19}$).

A. $4 \cdot 362 \times 10^{-8}$ cm

B. $2 \cdot 181 \times 10^{-8}$ cm

C. 8.724×10^{-8} cm

D. None of these.

Answer: A

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45. At what temperature is the r .m.s.velocity of a hydrogen molecule equal to that of an oxygen molecule at 47^{o} C?

A. 80 K

B. 3 K

C. $-73K$

D. 20 K

Answer: D

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46. A vessel containing 1 mole of O_2 gas (molar mass 32) at a temperature T. The pressure of the gas is P. An identical vessel containing one mole of He gas (molar mass 4) at temperature 2 T has a pressure of :

A. P/8

B. 2P

C. P

D. 8P

Answer: B

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47. An object of weight Wand density p is dipped in dipped in a fluid of density p_1. Its apparent weight will be :

A. $W(p - p_1)$

B. $W\left(1 - \frac{p_1}{p}\right)$

C. $\frac{(p - p_1)}{W}$

D. $W(p_1 - p)$

Answer: B

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48. The graph as in Fig. shows the extension (ΔL) of a wire of length 1 m suspended from the top of a roof at one end and with a load W connected to the other end. Area of cross-section of the wire is $10^{-6} m^2$. Find Y in SI units:

A. $2 \times 10^6 N/m^2$

B. $2 \times 10^{11} N/m^2$

C. $5 \times 10^6 N/m^2$

D. $5 \times 10^{11} N/m^2$

Answer: B

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49. A spring of constant 5×10^3 N/m is stretched initially by 5 cm from the

unstretched position. Then the work required to stretch it further by another 5 cm is :

A. 6·25 Nm

B. 18·75 Nm

C. 1250 Nm

D. 25·00 Nm.

Answer: B

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50. Spherical balls of radius R are falling in a viscous fluid of viscosity h with a velocity v. The retarding viscous force acting on the spherical ball is :

A. directly proportional to R but inversely proportional to velocity v

B. inversely proportional to R but directly proportional to velocity v

C. inversely proportional to both radius Rand velocity v

D. directly proportional to both radius R and velocity v

Answer: D

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51. A wire fixed at the upper end stretches by length l by applying a force F. The work done in stretching is :

A. $\frac{F}{2l}$

B. $\frac{Fl}{2}$

C. $2Fl$

D. Fl

Answer: B

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52. The pressure of a medium is changed from 1.01×10^5 Pa to 1.165×10^5 Pa and change in volume is 10% keeping temperature constant. The Bulle modulus of the medium is:

A. $204.8 \times 10^5 Pa$

B. $51.2 \times 10^5 Pa$

C. $102.4 \times 10^5 Pa$

D. $1.55 \times 10^5 Pa$

Answer: D

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53. A 20 cm long capillary tube is dipped in water. The water rises up to 8 cm. If the entire arrangement is put in a freely falling elevator

the length of water column in a capillary tube will be :

A. 8 cm

B. 10 cm

C. 4 cm

D. 20 cm

Answer: D

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54. If S is stress and Y is Young's modulus of material of a wire, the energy stored per unit volume of the wire is :

A. 2.5^2Y

B. $\frac{S^2}{2Y}$

C. $\frac{2Y}{S^2}$

D. $\frac{S}{2Y}$

Answer: B

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55. A real gas behaves like an ideal gas if its :

A. pressure and temperature are both high

B. pressure and temperature are both low

C. pressure is high and temperature is low

D. pressure is low and temperature is high.

Answer: D

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56. In the figure shown an ideal liquid is flowing through the tube which is of unifonn area of cross-section. The liquid has velocities v_A and v_B, and pressure P_A and P_B at points A and B respectively. Then

A. $P_B = P_A$

B. $v_B = v_A$

C. $P_B < P_A$

D. $v_B > v_A$

Answer: B

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57. Volume versus tennperature graphs for a given mass of an ideal gas are shown in figure at two different values of constant pressure. What can be inferred about relation between P_1 and P_2 ?

A. $P_1 > P_2$

B. $P_1 = P_2$

C. $P_1 < P_2$

D. data is insufficient.

Answer: A

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58. Which of the following graphs represent the behaviour of an ideal gas ?

A. 

B. 

C. 

D. 

Answer: A

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59. A gas is filled in container at pressure P_0. If the mass of molecules is halved and their rms speed is doubled, then the resultant pressure would be :

A. $2P_0$

B. $4P_0$

C. $\frac{P_0}{4}$

D. $\frac{P_0}{2}$

Answer: A

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60. Pressure versus temperature graph of an ideal gas of equal number of moles of different volumes are plotted as shown in

figure. Choose the correct alternative.

A. $V_1 = V_2 = V_3 = V_4$

B. $V_4 > V_3 > V_2 > V_1$

C. $V_1 = V_2, V_3 = V_4$ and $V_2 > V_3$

D. $V_1 = V_2, V_3 = V_4$ and $V_2 > V_3$

Answer: C

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61. The heat capacity per mole of water is (R is universal gas constant) :

A. 9R

B. $\frac{9}{2}R$

C. $6R$

D. 5R

Answer: A

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62. Given is the graph between $\frac{PV}{T}$ and P for 1 g of oxygen gas at two different temperatures T_1 and T_2, as shown in figure. Given, density of oxygen = 1.427 kg m^{-3}. The value of PV/T at the point A and the relation between T_1 and T_2 are respectively

A. $0.259JK^{-1}$ and $T_1 < T_2$

B. $8.314gJmol^{-1}K^{-1}$ and $T_1 < T_2$

C. $0.259JK^{-1}$ and $T_1 > T_2$

D. $4.28gJK^{-1}$ and $T_1 < T_2$

Answer: C

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63. Consider two hollow glass sphers, one containing water and the other containg mercury. Each liquid fills about one tenth of the volume of the sphere. In zero gravity environment :

A. water and mercury float freely inside the spheres

B. water forms a layer on the glass while mercury floats

C. mercury forms a layer on the glass while water floats

D. water and mercury both form a layer on the glass.

Answer: B

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Multiple Choice Questions Level Ii

1. The binding energy of a hydrogen molecule is 4.75 eV. Energy required to dissociate 0.05% of hydrogen gas at NTP occupying volume 5.6 litres is:

A. 20 J nearly

B. 30 J nearly

C. 40 J nearly

D. 60 J nearly

Answer: D

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2. A thick rope of rubber of density $1.5kg/m^3$ and $Y = 5 \times 10^6 Nm^{-2}$ 8 metres in length when hung vertically will increase in length by : $(g = 10ms^{-2})$

A. 9.6×10^{-5} m

B. 9.6 m

C. $19.2 \times 10^{-3}m$

D. $19.2 \times 10^{-5} m$

Answer: A

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3. When load is applied to a wire the extension is 3 mm, the extension in the wire of same material, length but half the radius by the same load is :

A. 0.75 mm

B. 6 mm

C. 1.5 mm

D. 12.0 mm

Answer: D

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4. A spherical ball contracts in volume by 0.01 % when subjected to a uniform pressure of 100 atmospheres. The bulk modulus of

material is :

(one atmosphere = $10^5 Nm^{-2}$)

A. $10^{10} Nm^{-2}$

B. $10^{13} Nm^{-2}$

C. $10^{11} Nm^{-2}$

D. $2 \times 10^{11} Nm^{-2}$

Answer: C

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5. The figure below represents three soap bubbles A, B and C prepared by blowing the capillary tube with stop cocks S, S_1, S_2 and S_3. With stop-cock S closed and S_1, S_2, S_3 opened:

A. B will start collapsing with volumes of A and C increasing

B. C will start collapsing with volumes of A and B increasing

C. Volumes of A, B and C will become equal at equilibrium

D. C and A will both start collapsing with volume of B increasing.

Answer: D

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6. If the work done in blowing a bubble of radius R is W, then the work done in blowing a bubble of radius 2R from that solution is :

A. W/2

B. 2W

C. 4W

D. $2^{1/3}W$

Answer: C

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7. A horizontal pipe line carries water in a stream line flow. At a point along the pipe where cross-sectional area is 10 cm^2, the water

velocity is 1 m/s and the pressure is 2000 Pa. The pressure of water at another point where the cross-sectional area is 5 cm^2, is (density of water= $10^3 kg.\, m^{-3}$) :

A. 1000 Pa

B. 500 Pa

C. 3500 Pa

D. 1625 Pa

Answer: B

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8. A tank is filled with water upto a height H. Water is allowed to come out of a hole P in one of the walls at a depth h below the surface of water. Express the horizontal distance R in terms of H and h :

A. $R = \sqrt{[h(H-h)]}$

B. $R = \sqrt{\frac{h}{2}(H-h)}$

C. $R = 2\sqrt{\{h(H-h)\}}$

D. $R = 2\sqrt{\{h(H-h)\}}$

Answer: C

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9. In the above question, R is maximum when :

A. $h = H$

B. $h = 0$

C. $h = H/2$

D. $h = H/3$

Answer: C

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10. Eight equal drops of water are falling through air with a steady velocity of 10 cms^{-1} .If the drops combine to form a single drop big in size,then the terminal velocity of this big drop is

A. 20 cm/s

B. 30 cm/s

C. 40 cm/s

D. 60 cm/s

Answer: C

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11. A lead sphere of mass m falls in a viscous liquid with a terminal velocity v0. Another lead sphere of mass S m through the same liquid will fall with the terminal velocity:

A. v_0

B. $4v_0$

C. $8v_0$

D. $64v_0$

Answer: C

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12. Two tanks contain different liquids, one having density twice that of the other. Holes of cross-section ratio 2 : 1 are made at heights h_1 and h_2 below the levels of liquids in the tank

which have same heights from the bottom of the tanks. When mass flux is same, then the ratio of the heights h_2 to h_1 is :

A. 2

B. 4

C. 8

D. 16

Answer: D

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13. The greatest length of a steel wire that can be hung vertically without breaking (breaking stress for steel $= 7.9 \times 10^8$ N/m^2, density of steel wire $= 7.9 \times 10^3 kg/m^3$)

A. $9 \times 10^9 m$

B. $10^4 m$

C. $10^3 m$

D. $10^2 m$

Answer: B

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14. A body floats with one third of its volume outside water and 3/4 of its volume outside another liquid. The density of other liquid is :

A. 9/4g/cc

B. 4/9 g/cc

C. 8/3 g/cc

D. 2/9g/cc

Answer: C

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15. The work done to get 'n' smaller equal size spherical drops from a bigger size spherical drop of water is proportional to :

A. $1/n^{2/3}$-1

B. $1/n^{1/3} - 1$

C. $n^{1/3} - 1$

D. $n^{4/3} - 1$

Answer: C

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16. Two soap bubbles, each with a radius 'r' coalesce in a vacuum under isothermal conditions to form a bigger bubble of radius R. Then R is equal to :

A. $2^{-1/2}r$

B. $2^{1/3}r$

C. $2^{1/2}r$

D. $2r$

Answer: C

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17. Pressure inside two soap bubbles are 1.01 and 1.02 atmosphere. Ratio between their volumes is :

A. $102:101$

B. $(102)^3:(103)^3$

C. $8:1$

D. $2:1$

Answer: C

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18. A boat having a length 3 m and breadth 2 m is floating on a lake. The boat sinks by 1 cm when a man gets on it. The mass of the man is :

A. 60 Kg

B. 72 Kg

C. 12 Kg

D. 128 kg

Answer: A

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19. The length of a metal wire is l_1 when the tension is F_1 and is 12 when the tension is F_2. The original length of wire is:

A. $\frac{l_1 + l_2}{2}$

B. $\sqrt{F_1 F_2 l_1 l_2}$

C. $\frac{l_1F_2 + l_2F_1}{F_1 + F_2}$

D. $\frac{l_1F_2 - l_2F_1}{F_2 - F_1}$

Answer: D

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20. A wire of cross-section A is stretched horizontally between two clamps located 21 metre apart. A weight W kg is suspended from the mid point of the wire. If the mid point sags

vertically through a distance x < l the strain produced is :

A. $\frac{2x^2}{l^2}$

B. $\frac{x^2}{l^2}$

C. $\frac{x^2}{2l^2}$

D. None of these.

Answer: C

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21. In the above question the value of stress is

:

A. $\frac{Wl}{2xA}$

B. $\frac{Wl}{4xA}$

C. $\frac{2xW}{lA}$

D. $\frac{4xW}{lA}$

Answer: A

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22. If in the above question the Young's modulus of the material is Y, the value of extension x is :

A. $\left(\frac{Wl}{YA}\right)^{1/3}$

B. $\left(\frac{YA}{Wl}\right)^{1/3}$

C. $\frac{1}{l}\left[\frac{WA}{Y}\right]^{1/3}$

D. $l\left[\frac{W}{YA}\right]^{1/3}$

Answer: D

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23. AU-tube is partly filled with a liquid A. Another liquid B, which does not mix with A, is poured into one side until it stands a height h above the level of A on the other side, which has mean while risen a heigh l. The density of B relative to that of A is :

A. $\frac{l}{h+l}$

B. $\frac{l}{h+2l}$

C. $\frac{2l}{h+2l}$

D. $\frac{l}{h+2l}$

Answer: C

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24. A body of density D is droped gently on the surface layer of liquid of density 'd' and depth 'h'. If D > d, the downward acceleration of the body while sinking is :

A. g

B. $g\left(1-\frac{d}{D}\right)$

C. $g\left(1+\frac{d}{D}\right)$

D. $\frac{g.d}{D}$

Answer: B

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25. A vessel contains oil of density 0.8 g $/cm^3$ over mercury of density 13.6 g/cm^3. A homogeneous sphere floats with half of its volume in oil and other half immersed in mercury. The density of the material of the sphere in g $/cm^3$ is :

A. 3.3

B. 6.6

C. 7.2

D. 2.8

Answer: C

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26. A wooden ball of density p is dropped from rest from a height 'h' into the lake of water density $\sigma(\sigma > p)$. Neglecting viscosity, the

maximum depth to which the body sinks before returning to float is :

A. $\frac{hp}{p-\sigma}$

B. $\frac{h(p-\sigma)}{p}$

C. $\frac{h(\sigma-p)}{\sigma}$

D. $\frac{hp}{\sigma-p}$

Answer: D

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27. A ball of material of specific gravity d_1 falls from a height 'h' on the surface of a liquid of relative density d_2 such that $d_2 > d_1$. The time for which the body will be falling into the liquid is :

A. $\frac{d_1}{d_2}\sqrt{\frac{2h}{g}}$

B. $\frac{d_2}{d_1}\sqrt{\frac{2h}{g}}$

C. $\frac{d_1}{d_2 - d_1}\sqrt{\frac{2h}{g}}$

D. $\frac{d_2 - d_1}{d_2}\sqrt{\frac{2h}{g}}$

Answer: C

Watch Video Solution

28. A circular tub filled with liquid is uniformly tappering with base area $10^{-3}m^2$ and top area 2 x 10-3 m2. Its depth is 0.4 m as shown in fig. What is the thrust on its base? (g = 10 $ms^{-2}, p = 900kgm^{-3}$) .

A. 3.6 N

B. 7.2 N

C. 9 N

D. 14.4 N

Answer: A

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29. A number of tiny drops of water all of the same radius r cm combine to form a single drop of radius R cm. The rise in temperature of

water is given by (if σ = S.T. specific heat= 1 cal/g) :

A. $\frac{\sigma}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

B. $\frac{3\sigma}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

C. $\frac{3\sigma}{J}\left(\frac{1}{r^2}-\frac{1}{R^2}\right)$

D. $\frac{\sigma}{J}\left(\frac{1}{r^2}-\frac{1}{R^2}\right)$

Answer: B

Watch Video Solution

30. An incompressible liquid flows through a horizontal tube bifurcating at the end as shown

The areas are expressed in m2 and velocities in ms^{-1}. What is the value of v_0?

A. $3ms^{-1}$

B. $1.5ms^{-1}$

C. $1ms^{-1}$

D. $1.25ms^{-1}$

Answer: C

View Text Solution

31. A soap bubble 'A' of radius 0.03 m and another bubble 'B' of radius 0.04 m are brought together so that the combined bubble has a common interface of radius r, then the value of r is :

A. 0.06 m

B. 0.012 m

C. 0.12 m

D. 0.035 m

Answer: C

Watch Video Solution

32. A tank having cross-section 'A' is filled with water upto height h_1. What will be the time taken by water to come out of a hole of cross-section 'a' at the bottom to decrease the level from h_1 to h_2.

A. A. a . $\sqrt{2g}.\ (h_1 - h_2)$

B. $\frac{A}{a}\sqrt{\frac{2}{g}}\left(\sqrt{h_1} - \sqrt{h_2}\right)$

C. $\frac{A}{a}\sqrt{2g}\left(\sqrt{h_1} - \sqrt{h_2}\right)$

D. $\frac{A}{a}\sqrt{\frac{2}{g}}\left(\sqrt{h_1} - \sqrt{h_2}\right)$

Answer: B

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33. Two capillaries of radii r_1 and r_2 and lengths l_1 and l_2 are set in series. A liquid of

viscosity η is flowing through the combination under a pressure difference p. The rate of flow of the liquid is :

A. $\frac{\pi p}{8\eta}\left[\frac{l_1}{r_1^4}+\frac{l_2}{r_2^4}\right]$

B. $\frac{\pi p}{8\eta}\left[\frac{l_1}{r_1^4}+\frac{l_2}{r_2^4}\right]^{-1}$

C. $\frac{\pi p}{8\eta}\left[\frac{l_1}{r_1^4}+\frac{l_2}{r_2^4}\right]^{2}$

D. $\frac{\pi p}{8\eta}\left[\frac{l_1}{r_1^4}+\frac{l_2}{r_2^4}\right]^{-2}$

Answer: B

Watch Video Solution

34. Drops of a liquid of density D surface tension T are floating in a liquid of density 'd' with half of the drop in the liquid, then the radius of the drop is :

A. $\sqrt{\frac{6T}{g(2D-d)}}$

B. $\sqrt{\frac{3T}{g(2D-d)}}$

C. $\sqrt{\frac{2T}{g(2D-d)}}$

D. $\sqrt{\frac{T}{g(2D-d)}}$

Answer: B

Watch Video Solution

35. Statement I : Hot soup tastes better than the cold soup.

Statement II : Hot soup has high value of surface tension. So it does not spread properly on the tongue.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: C

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36. Statement I : Young's modulus of a wire made up steel can be increased by increasing its length.

Statement II: Young's modulus of a material depends on the dimensions of the material.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct

explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: D

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37. Statement I : The liquids rises higher in a capillary tube of smaller radius than in a tube of bigger radius.

Statement II : The height of a liquid in a

capillary tube is inversely proportional to diameter of capillary tube.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: A

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38. Statement I : Mean free path of a gas molecule varies inversely as the density of gas.

Statement II : Mean free path of gas molecule is defined as the average distance travelled by a molecule between two successive collisions.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation

for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: B

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39. Young's modulus of elasticity for a perfectly plastic body is zero.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: A

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40. Statement I : Smaller drops of liquid resist deforming forces better than bigger drops.

Statement II : The value of excess pressure inside a drop is directly proportional to surface tension.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: B

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41. Statement I : To float, a body must displace liquid whose weight is grater than weight of body itself.

Statement II : In case of floating, the body will experience no net downward force.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: C

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42. A rod AB of length 4 m and having negligible weight is suspended by two wires C and D of equal length from a rigid support as shown in Figure. Young's modulus of wire C is $2 \times 10^{11} N/m^2$ and that of wire D is $1.4 \times 10^{11} N/m^2$. The area of cross-section of wire C is 3 mm^2 and that of wire D is 6 mm^2. A mass M is suspended at any point on the rod AB.

Disstance of a point on rod AB from point A such that the mass M when suspended from that point will produce equal stresses in wire

C and D is :

A. $\frac{16}{5}$ m

B. $\frac{8}{3}m$

C. $\frac{7}{3}m$

D. $\frac{4}{3}m$

Answer: B

View Text Solution

43. A rod AB of length 4 m and having negligible weight is suspended by two wires C and D of equal length from a rigid support as shown in Figure. Young's modulus of wire C is $2 \times 10^{11} N/m^2$ and that of wire D is $1.4 \times 10^{11} N/m^2$. The area of cross-section of wire C is 3 mm^2 and that of wire D is 6 mm^2. A mass M is suspended at any point on the rod AB.

Distance of a point on rod A B from point A such that the mass M when suspended from that point will produce equal strains in wire C

and D is :

A. $\frac{4}{3}m$

B. $\frac{8}{3}m$

C. $\frac{7}{3}m$

D. $\frac{16}{5}m$

Answer: C

View Text Solution

44. A container of uniform cross sectional area A resting on the horizontal surface, holds two non-viscous and incompressible liquids of densities d and 2d, each of height H/2 as shown in the figure. The liquid of density d is open to the atmosphere having pressure P_0• A homogeneous solid cylinder of length $L(L < H/2)$, cross-sectional area A/5 is immersed such that it floats with its axis vertical at the liquid-liquid interface with lenght U4 in the denser liquid. The cylinder is then removed and the original arrangement is

restored. A tiny hole of area s(s < < A) is punched on the vertical side of the container at a height h (h < H/2). As a result of this, liquid start flowing out of the hole with a range x on the horizontal surface.

The density D of the material of the floating cylinder is

A. 5d/4

B. 3d/4

C. 4d/5

D. 4d/3

Answer: A

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45. A container of uniform cross sectional area A resting on the horizontal surface, holds two non-viscous and incompressible liquids of densities d and 2d, each of height H/2 as shown in the figure. The liquid of density d is open to the atmosphere having pressure P_0•

A homogeneous solid cylinder of length $L(L < H/2)$, cross-sectional area A/5 is immersed such that it floats with its axis vertical at the liquid-liquid interface with lenght U4 in the denser liquid. The cylinder is then removed and the original arrangement is restored. A tiny hole of area s(s < < A) is punched on the vertical side of the container at a height h (h < H/2). As a result of this, liquid start flowing out of the hole with a range x on the horizontal surface.

The total pressure at the bottom of the container is :

A. $P_0 + \frac{(6L + H)}{4} dg$

B. $P_0 + \frac{(L + 6H)}{4} dg$

C. $P_0 + \frac{(L + 6H)}{4} dg$

D. $P_0 - \frac{(L + 6H)}{4} dg$

Answer: B

View Text Solution

46. A container of uniform cross sectional area A resting on the horizontal surface, holds two non-viscous and incompressible liquids of densities d and 2d, each of height H/2 as shown in the figure. The liquid of density d is open to the atmosphere having pressure P_0• A homogeneous solid cylinder of length $L(L < H/2)$, cross-sectional area A/5 is immersed such that it floats with its axis vertical at the liquid-liquid interface with lenght U4 in the denser liquid. The cylinder is then removed and the original arrangement is

restored. A tiny hole of area s(s < < A) is punched on the vertical side of the container at a height h (h < H/2). As a result of this, liquid start flowing out of the hole with a range x on the horizontal surface.

The initial speed of efflux of the liquid at the hole is :

A. $v = \sqrt{\frac{g}{2}[3H + 4h]}$

B. $\sqrt{\frac{g}{2}[4H - 3h]}$

C. $\sqrt{\frac{g}{2}[3H - 4h]}$

D. $\sqrt{\frac{g}{2}[3H+4h]}$

Answer: C

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47. A container of uniform cross sectional area A resting on the horizontal surface, holds two non-viscous and incompressible liquids of densities d and 2d, each of height H/2 as shown in the figure. The liquid of density d is open to the atmosphere having pressure P_0•

A homogeneous solid cylinder of length $L(L < H/2)$, cross-sectional area A/5 is immersed such that it floats with its axis vertical at the liquid-liquid interface with lenght U4 in the denser liquid. The cylinder is then removed and the original arrangement is restored. A tiny hole of area s(s < < A) is punched on the vertical side of the container at a height h (h < H/2). As a result of this, liquid start flowing out of the hole with a range x on the horizontal surface.

The horizontal distance travelled by the liquid.

initially, is:

A. $\sqrt{(3H+4h)h}$

B. $\sqrt{(3h+4h)h}$

C. $\sqrt{(3H-4h)H}$

D. $\sqrt{(3H-4h)h}$

Answer: D

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48. A container of uniform cross sectional area A resting on the horizontal surface, holds two non-viscous and incompressible liquids of densities d and 2d, each of height H/2 as shown in the figure. The liquid of density d is open to the atmosphere having pressure P_0• A homogeneous solid cylinder of length $L(L < H/2)$, cross-sectional area A/5 is immersed such that it floats with its axis vertical at the liquid-liquid interface with lenght U4 in the denser liquid. The cylinder is then removed and the original arrangement is

restored. A tiny hole of area s(s < < A) is punched on the vertical side of the container at a height h (h < H/2). As a result of this, liquid start flowing out of the hole with a range x on the horizontal surface.

The maximum horizontal distance travelled by the liquid is :

A. $x_{\max} = \frac{H}{4}$

B. $x_{\max} = \frac{2H}{4}$

C. $x_{\max} = \frac{3H}{4}$

D. $x_{\max} = \frac{5H}{4}$

Answer: C

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49. A wooden block, with a coin placed on it top floats in water as shown in Fig. The distances l and h are shown there. After some time, the coin falls into the water. Then :

A. l decreases and h increases

B. I increases and h decreases

C. both l and h increases

D. both l and h decreases

Answer: D

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50. A U-tube is partially filled with water. Oil which does not mix with water is next poured into one side, until water rises by 25 cm on the other side. If the density of the oil is 0.8 g/cc,

the oil level will stand higher than the water level by :

A. 6.25 cm

B. 18 · 75 cm

C. 12 · 50 cm

D. 25 · 00 cm

Answer: C

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51. 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 1 mm. Then the elastic energy stored in the wire is :

A. 0.2 J

B. 10 J

C. 20 J

D. 0.1 J

Answer: D

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52. If two soap bubbles of different radii are connected by a tube then:

A. air flows from the bigger bubble to the smaller bubble till the sizes become equal

B. there is no flow of air

C. air flows from the smaller bubble to the bigger bubble

D. air flows from bigger bubble to the smaller bubble till the sizes are interchanged

Answer: C

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53. A particle is placed at the origin and a force F = kx is acting on it (where k is a positive constant). If U (0) = 0, the graph of U (x) versus

x will be (where U is the potential energy function) :

A. 

B. 

C. 

D. 

Answer: A

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54. A wire elongates by l mm when a load W is hanged from it. If the wire goes over a pulley and two weights W each are hung at the two ends, then the elongation of wire will be (in mm).

A. l

B. 2l

C. zero

D. $\frac{l}{2}$

Answer: A

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55. If the terminal speed of a sphere of gold (density 19·5 kg/m^3) is 0.2 m/s in a viscous liquid (density 1.5 kg/m^3), find the terminal speed of sphere of silver (density $10.5kg/m^3$) of same size in same liquid.

A. 0·2 m/s

B. 0·4 m/s

C. 0.1 m/s

D. 0·3 m/s

Answer: C

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56. Statement I : The stream of water flowing at high speed from a garden hose pipe tends to spread like a fountain when held vertically up , but tends to narrow down when held vertically down and

Statement 2 : In any steady flow of an

incompressible fluid, the volume flow rate of the fluid remains constant.

A. Statement-I is true, Statement-II is true and Statement-II is correct explanation for Statement-I.

B. Statement-I is true, Statement-II is true and Statement-II is not correct explanation of Statement-I.

C. Statement-I is true, Statement-II is false.

D. Statement-I is false, Statement-II is false.

Answer: A

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57. A glass tube of uniform internal radius (r) has a value separating the two identical ends. Initially, the valve is in a tightly closed position. End 1 has a hemispherical soap bubble as shown in figure. Just after opening the valve,

A. air from end 1 flows towards end 2. No. change in the volume of the soap bubbles

B. air from end 1 flows towards end 2. Volume of the scap bubble at end 1 decreases

C. no change occurs

D. air from end 2 flows towards end 1. volume of the soap bubble at end 1 increases

Answer: B

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58. A spherical solid ball of volume V is made of a material of density p1 It is falling through a liquid of density $p_2(p_2 < p_1)$. Assume the that the liquid applies a viscous force on the ball that is proportional to the square of its speed v, i.e., $F_{\text{viscous}} = -kv^2(k > 0)$. The terminal speed of the ball is

A. $dqrt\left(\frac{Vg(p_1-p_2)}{k}\right)$

B. $\frac{Vgp_1}{k}$

C. $\sqrt{\frac{Vgp_1}{k}}$

D. $\frac{Vg(p_1>p_2)}{k}$

Answer: A

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59. A jar is filled with twe non-mixing liquids 1 and 2 having densities p_1 and p_2 respectively. A solid ball, made of a material of density p_3 is

dropped in the jar. It comes to equilibrium in the position shown in the figure. Which of the following is true for p_1, p_2 and p_3?

A. $p_3 < p_1 < p_2$

B. $p_1 > p_3 > p_2$

C. $p_1 < p_2 < p_3$

D. $p_1 < p_3 < p_2$

Answer: D

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60. A capillary tube (A) is dipped in water. Another identical tube (B) is dipped in a soap-water solution. Which of the following shows the relative nature of the liquid columns in the two tubes ?

A. 

B. 

C. 

D. 

Answer: C

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61. Two wires are made of the same material and has the same volume. However wire 1 has cross-sectional area A and wire 2 has cross-sectional area 3A. If the length of wire 1 increases by ax on applying force F, how much force is needed to stretch wire 2 by the same amount ?

A. 4F

B. 6F

C. 9F

D. F

Answer: C

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62. A ball is made of a material of density p where $p_{\text{oil}} < p < P_{\text{water}}$ with p_{oil} and p_{water} representing the densities of oil and water,

respectively. The oil and water are immiscible. If the above ball is in equilibrium in a mixture of this oil and water, which of the following pictures represents its equilibrium position ?

A. 

B. 

C. 

D. 

Answer: C

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63. The potential energy function for the force between two atoms in a diatomic molecule is approximately given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$, where a and b are constants ans x is the distance between the atoms. If the dissociation energy of the molecule is $D = [U(x = \infty) - U_{at}$ equilibrium$]$, D is :

A. $\frac{b^2}{6a}$

B. $\frac{b^2}{2a}$

C. $\frac{b^2}{12a}$

D. $\frac{b^2}{4a}$

Answer: D

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64. When liquid medicine of density p is to be put in the eye, it is done with the help of a dropper. As the bulb on the top of the dropper is pressed, a drop forms at the opening of the dropper. We wish to estimate the size of the drop. We first assume that the drop formed at

the opening is spherical because that requires a minimum increase in its surface energy. To determine the size, we calculate the net vertical force due to the surface tension T when the radius of the drop is R. When this force becomes smaller than the weight of the drop, the drop gets detached from the dropper.

If the radius of the opening of the dropper is r, the vertical force due to the surface tension on the drop of radius R (assuming r << R) is :

A. $2\pi rT$

B. $2\pi RT$

C. $\frac{2\pi r^2 T}{R}$

D. $\frac{2\pi R^2 T}{r}$

Answer: C

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65. When liquid medicine of density p is to be put in the eye, it is done with the help of a dropper. As the bulb on the top of the dropper is pressed, a drop forms at the opening of the

dropper. We wish to estimate the size of the drop. We first assume that the drop formed at the opening is spherical because that requires a minimum increase in its surface energy. To determine the size, we calculate the net vertical force due to the surface tension T when the radius of the drop is R. When this force becomes smaller than the weight of the drop, the drop gets detached from the dropper.

If $r = 5 \times 10^{-4}$ m p $= 10^{3}$ kgm^{-3}, g = 10 ms^{-2}, T = 0.11 Nm^{-1}, the radius of the drop

when it detaches from the dropper is approximately :

A. $1.4 \times 10^{-3} m$

B. $3.3 \times 10^{-3} m$

C. $2.0 \times 10^{-3} m$

D. $4.1 \times 10^{-3} m$

Answer: A

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66. When liquid medicine of density p is to be put in the eye, it is done with the help of a dropper. As the bulb on the top of the dropper is pressed, a drop forms at the opening of the dropper. We wish to estimate the size of the drop. We first assume that the drop formed at the opening is spherical because that requires a minimum increase in its surface energy. To determine the size, we calculate the net vertical force due to the surface tension T when the radius of the drop is R. When this force becomes smaller than the weight of the

drop, the drop gets detached from the dropper.

After the drop detaches, its surface energy is :

A. $1.4 \times 10^{-6} J$

B. $2.7 \times 10^{-6} J$

C. $5.4 \times 10^{-6} J$

D. $8.1 \times 10^{-6} J$

Answer: B

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67. A bar of length l, breadth b and depth d is supported at its ends and is loaded at the centre by a load W. If Y is the Young's modulus of the material of the bar, then the depression δ at the centre is :

A. $\frac{Wl^3}{4bd^3Y}$

B. $\frac{Wb^3}{4dl^3Y}$

C. $\frac{Wd^3}{4lb^3Y}$

D. $\frac{Wl^3}{bd^3Y}$

Answer: A

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68. A manometer reads the pressure of a gas in an enclosure as shown in the figure.

The absolute and gauge pressure of the gas in cm of mercury is:

(Take atmospheric pressure= 76 cm of mercury)

A. 76, 20

B. 20, 76

C. 96, 20

D. 20, 96.

Answer: C

View Text Solution

69. A U tube contains water and methylated spirit separated by mercury. The mercury columns in the two arms are at the same level with 10 cm of water in one arm and 12.5 cm of spirit in other as shown in figure. The relative

density of the spirit is :

A. 0.6

B. 0.8

C. 1

D. 1.28

Answer: B

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70. A wooden block floats in a liquid with 40% of its volume inside the liquid. When the vessel containing the liquid starts rising upwards with acceleration a = g/2, the percentage of volume inside the liquid is :

A. 0.2

B. 0.6

C. 0.3

D. 0.4

Answer: D

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71. The density of a solid at normal pressure is p. When the solid is subjected to an excess pressure P_1, the density changes top'. If the bulk modulus of the solid is k, then the ratio $\frac{p'}{p}$ is

A. $1+\frac{p}{k}$

B. $1+\frac{k}{p}$

C. $\frac{p}{p+k}$

D. $\frac{k}{p+k}$

Answer: A

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72. Water at 20°C (coefficient of viscosity= 0.01 poise) flowing in a tube of diameter 1 cm with an average velocity of 10 emfs has the Reynold number:

A. 500

B. 1000

C. 2000

D. indeterminate due to insufficient data.

Answer: B

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Multiple Choice Questions Level Iii

1. Work done in increasing the size of a soap bubble from a radius of 3 cm to 5 cm is nearly

(surface tension of soap solution= 0.03 Nm^{-1}

)

A. $0.2\pi mJ$

B. $2\pi mJ$

C. $0.4\pi mJ$

D. $4\pi mJ$

Answer: C

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2. Water is flowing continuously from a tap having an internal diameter $8 \times 10^{-3} m$. The water velocity as it leaves the tap is 0.4 ms^{-1}. The diameter of the water stream at a distance 2×10^{-1} m below the tap is close to:

A. $7.5 \times 10^{-3} m$

B. $9.6 \times 10^{-3} m$

C. $3.6 \times 10^{-3} m$

D. $5.0 \times 10^{-3} m$

Answer: C

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3. A container with insulating walls is divided into equal parts by a partition fitted with a valve. One part is filled with an ideal gas at a pressure P and temperature T, whereas the other part is completely evacuated. If the valve is suddenly opened, the pressure and temperature of the gas will be:

A. $\frac{P}{2}, \frac{T}{2}$

B. P, T

C. $P, \frac{T}{2}$

D. $\frac{P}{2}, T$

Answer: D

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4. Two mercury drops (each of radius 'r') merge to form bigger drop. The surface energy of the bigger drop, if T is the surface tension is :

A. $4\pi r^2 T$

B. $2\pi r^2 T$

C. $2^{8/3}\pi r^2 T$

D. $2^{5/3}\pi r^2 T$

Answer: D

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5. If a ball of steel (density p = 7.8 g cm^{-3}) attains terminal velocity of 10 cms^{-1} when falling in a water (coefficient of viscosity $\eta_{\text{water}} = 8.5 \times 10^{-4}$ Pa.s) then its terminal

velocity in glycerine $(p = 1.2gcm^{-3}, \eta = 13.2Pa.\ s)$ would be, nearly :

A. $6.25 \times 10^{-4} cms^{-1}$

B. $6.45 \times 10^{-4} cms^{-1}$

C. $1.5 \times 10^{-5} cms^{-1}$

D. $1.6 \times 10^{-3} cms^{-1}$

Answer: A

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6. Consider the spring-mass system, with the mass submerged in water, as shown in the figure. The phase space diagram for one cycle of this system is:

A. 

B. 

C. 

D. 

Answer: B

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7. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of 1.5×10^{-2} N(see figure). The length of the slider is 30 cm and its weight is negligible. The surface tension of the liquid film is :

A. $0.025 Nm^{-1}$

B. $0.0125 Nm^{-1}$

C. $0.1Nm^{-1}$

D. $0.5Nm^{-1}$

Answer: A

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8. Assume that a drop of liquid evaporates by decrease in its surface energy, so that its temperature remains unchanged. What should be the minimum radius of the drop for this to be possible ? The surfrace tension is T, density

of liquid is p and L is its latent heat of vaporization.

A. $\sqrt{T/pL}$

B. T/pL

C. $2T/pL$

D. pL/T

Answer: C

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9. A uniform cylinder of length L and mass M having crosssectional area A is suspended, with its length vertical, from a fixed point by a massless spring, such that it is half submerged in a liquid of density σ at equilibrium position. The extension x_0 of the spring when it is in equilibrium is :

A. $\frac{Mg}{k}\left(1-\frac{La\sigma}{M}\right)$

B. $\frac{Mg}{k}\left(1-\frac{LA\sigma}{2M}\right)$

C. $\frac{Mg}{k}\left(1+\frac{LA\sigma}{M}\right)$

D. $\frac{Mg}{k}$

Answer: B

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10. There is a circular tube in a vertical plane. Two liquids which do not mix and of densities d_1 and d_2 are filled in the tube. Each liquid subtends 90^o angle at centre. Radius joining their interface makes an angle a with vertical.

ratio d_1 / d_2 is :

A. $\frac{1+\sin\alpha}{1-\cos\alpha}$

B. $\frac{1+\sin\alpha}{1-\sin\alpha}$

C. $\frac{1+\cos\alpha}{1-\cos\alpha}$

D. $\frac{1+\tan\alpha}{1-\tan\alpha}$

Answer: D

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11. An open glass tube is immersed in mercury in such a way that a length of 8 cm extends above the mercury level. The open end of the tube is then closed and sealed and the tube is raised vertically up by additional 46 cm. What will be length of the air column above mercury in the tube now ? (Atmospheric pressure = 76 cm of Hg)

A. 38 cm

B. 6 cm

C. 16 cm

D. 22 cm.

Answer: C

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12. On heating water, bubbles being formed at the bottom of the vessel detach and rise. Take the bubbles to be spheres of radius R and making a circular contact or radius r with the bottom of the vessel. If r < < R, and the surface tension of water is T, value of r just before

bubbles detach is : (density of water is P_w)

A. $R^2\sqrt{\frac{pwg}{T}}$

B. $R^2\sqrt{\frac{3p_wg}{T}}$

C. $R^2\sqrt{\frac{p_wg}{3T}}$

D. $R^2\sqrt{\frac{p_wg}{6T}}$

Answer:

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13. A pendulum made of a uniform wire of cross sectional area A has time period T. When an additional mass M is added to its bob, the time period changes to T_M If the Young's modulus of the material of the wire is Y then $\frac{1}{Y}$ is equal to

(g = gravitational acceleration)

A. $\left[\left(\frac{T_M}{T}\right)^2 - 1\right]\frac{Mg}{A}$

B. $\left[1 - \left(\left(\frac{T_M}{T}\right)^2\right]\frac{A}{Mg}$

C. $\left[1 - \left(\frac{T}{(T_M)^2}\right]\frac{A}{M_g}$

D. $\left[\left(\frac{T_M}{T}\right)^2 - 1\right]\frac{A}{Mg}$

Answer: D

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1. Which of the following substances has the highest elasticity ?

A. Rubber

B. Copper

C. Sponge

D. Steel.

Answer: D

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2. Three liquids of equal masses are taken in three identical cubical vessels A,B and C. Their densities are ρ_A, ρ_B and ρ_C respectively. But

$\rho_A < \rho_B < \rho_C$. The force exerted by liquid on the base of the cubical vessel is

A. the same in all the vessels

B. maximum in vessel A

C. maximum in vessel C

D. minimum in vessel C.

Answer: A

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3. Water is in streamline flow along a horizontal pipe with nonuniform cross-section. At a point in the pipe where the area of cross-section is 10 cm^2, the velocity of water is 1 ms^{-1} and the pressure is 2000 Pa. The pressure at another point where the cross-sectional area is 5 cm^2 is :

A. 1000Pa

B. 500Pa

C. 4000 Pa

D. 2000 Pa

Answer: B

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4. The following four wires of length L and radius r are made of the same material .Which of these will have the largest extension,when the same tension is applied?

A. L= 100cm, r=0.2mm

B. L=200cm, r=0.4mm

C. L=300cm,r=0.6mm

D. L=400cm,r=0.8mm.

Answer: A

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5. Eight equal drops of water are falling through air with a steady velocity of 10 cms^{-1} .If the drops combine to form a single drop big

in size,then the terminal velocity of this big drop is

A. 40 cm s^{-1}

B. 10 cm s^{-1}

C. $30cms^{-1}$

D. $80cms^{-1}$

Answer: A

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6. Two capillary tubes of diffemt diameters are dipped in water. The rise of water is :

A. the same in both tubes

B. greater in the tube oflarger diameter

C. greater in the tube of smaller diameter

D. independent of the diameter of the tube.

Answer: C

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7. Milk is an example for

A. inelastic gel

B. foam

C. elastic gel

D. emulsion.

Answer: D

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8. Spheres of iron and lead having same mass are completely immersed in water. Density of lead is more than that of iron. Apparent loss of weight is W_1 for iron sphere and W_2 for lead sphere. Then $\frac{W_1}{W_2}$ is :

A. 1

B. between 0 and 1

C. 0

D. > 1

Answer: D

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9. Two solids P and Q float in water. It is observed that P floats with half of its volume immersed and Q floats with $\frac{2^{rd}}{3}$ of its volume is immersed. The ratio of densities of P and Q is

A. $4/3$

B. $3/4$

C. $2/3$

D. $3/2$

Answer: B

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10. A flow of liquid is streamline if the Reynold number is

A. less than 1000

B. greater than 1000

C. between 2000 to 3000

D. between 4000 to 5000.

Answer: A

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11. In anomalous expansion of water, at what temperature, the density of water is maximum ?

A. $4^\circ C$

B. $< 4^\circ C$

C. $> 4^{\circ} C$

D. $10^{\circ} C$

Answer: A

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12. The ratio of hydraulic stress to the corresponding strain is known as

A. Bulk modulus

B. rigidity modulus

C. compressibility

D. Young's modulus.

Answer: A

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13. What is heated from $0^{o}C$ to $10^{o}C$, then its volume

A. increases

B. first decreases and then increases

C. decreases

D. does not change.

Answer: B

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14. A crane with a steel cable of length 11 m and radius 2.0 cm is employed to lift a block of concrete of mass 40 tons in building site. Young's Modulus of steel is 2.0×10^{11} Pa, what will be roughly the increase in the length

of the cable while lifting the block ? (Take g = $10ms^{-2}$)

A. 0.75 cm

B. 1.25 cm

C. 1.75 cm

D. 2.50 cm

Answer: C

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15. The dimensions of four wires of the same material are given below. In which wire the increase in length will be maximum when the same tension is applied ?

A. Length 100 cm, diameter 1 mm

B. Length 200 cm, diameter 2 mm

C. Length 300 cm, diameter 3 mm

D. Length 50 cm, diameter 0.5 mm.

Answer: D

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16. Under a constant pressure head, the rate of flow of orderly volume flow of liquid through a capillary tube is V, if the length of the capillary is doubled and the diameter of the bore is halved, the rate of flow would become

A. $V/4$

B. $V/8$

C. 16V

D. V/32

Answer: D

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17. The average energy of molecules in a sample of oxygen gas at 300K are $6.2J \times 10^{-21}$ J. The corresponding values at 600K are

A. $12.12 \times 10^{-21} J$

B. $8.78 \times 10^{-21} J$

C. $6.21 \times 10^{-21} J$

D. $12.42 \times 10^{-21} J$

Answer: D

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