PHYSICS

BOOKS - CAREER POINT

UNIT TEST 4

Physics

1. The masses and radii of the earth an moon are M_1 and R_1 and M_2, R_2 respectively. Their centres are at a distacne r apart. Find

the minimum speed with which the particle of mass m should be projected from a point mid-way between the two centres so as to escape to infinity.

A. $\sqrt{\frac{4G}{r}(M_e + M_m)}$

B. $\frac{4G}{r}\sqrt{(M_e + M_m)}$

C. $\sqrt{\frac{2G}{r}(M_e + M_m)}$

D. $\frac{2G}{r}\sqrt{(M_e + M_m)}$

Answer: A

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2. The mass of a satellite is $M/81$ and radius is $R/4$ where M and R are the mass and radius of the planet. The distance between the surfaces of planet and its satellite will be atleast greter than:

A. 1.25 R

B. 12.5 R

C. 10.5 R

D. 5 R

Answer: A

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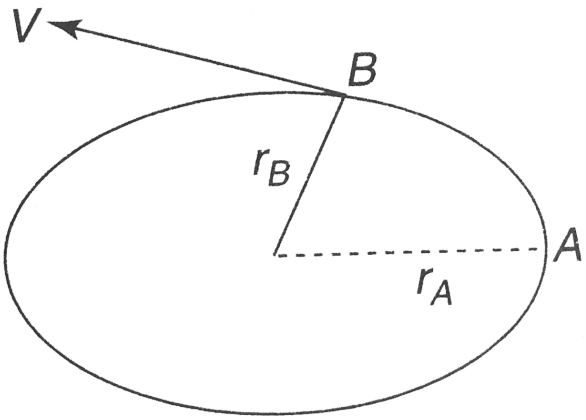
3. The orbital velocity of a satellite at point B with radius r_B is v. The radius of a point A is r_A. If the orbit is increased in radial distance so that r_A becomes $1.2r_A$ find the orbital

velocity at $(1.2r_A)$:



A. $\dfrac{vr_B}{r_A\sqrt{1.2}}$

B. $\dfrac{vr_A}{1.2r_B}$

C. $\dfrac{vr_B}{1.2r_A}$

D. $\dfrac{vr_A}{r_B\sqrt{1.2}}$

Answer: A

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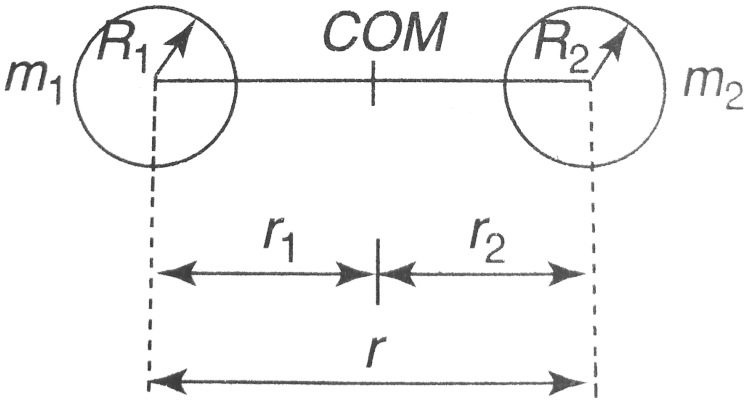
4. Binary stars of comparable masses rotates under the influence of each other's gravity at a distance $2\left[\frac{G}{\omega^2}\right]^{1/3}$ where ω is the angular velocity of each of the system. If difference between the masses of two stars is 6 units. Find the ratio of the masses of smaller to

bigger star.



A. $14:10$

B. $1:7$

C. $2:8$

D. $3:9$

Answer: B

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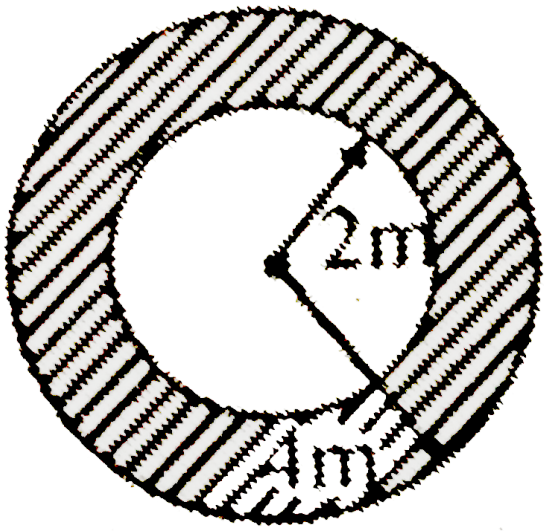
5. Consider a unigorm annular sphere of density p and internal radius 2m an external radius 4m. The graviational field strength at a point at a distance r=3 m, from the centre of shaper is :



A. $-\frac{32G\pi p}{9}$

B. $-4G\pi$

C. $-\frac{32G\pi p}{9}$

D. $\frac{76}{27}G\pi p$

Answer: D

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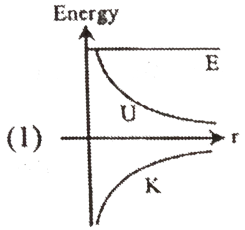
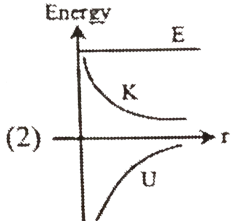
6. The correct graph representing the variation of total energy (E_t), kinetic energy

(E_k) and potential energy (U) of a satellite with its distance form the centre of earth is

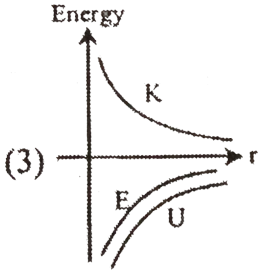
A.



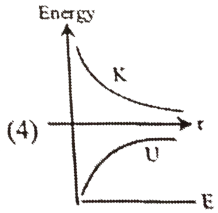
B.



C.



D.



Answer: C

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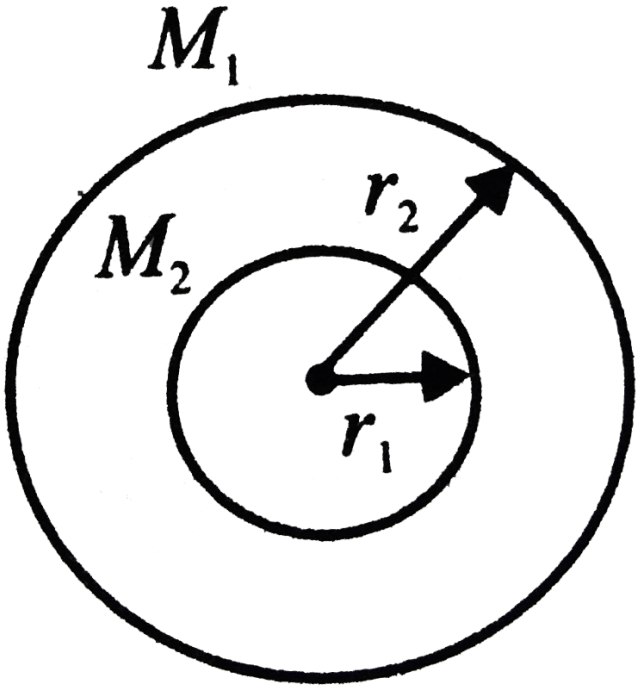
7. Two concentric shells of masses M_1 and M_2 are having radii r_1 and r_2. Which of the following is the correct expression for the

gravitational field on a mass m?



A. $F = \dfrac{G(M_1 + M_2)}{r_2}$, for $< r_1$

B. $E = \dfrac{G(M_1 + M_2)}{r_2}$, for $< r_2$

C. $E = \dfrac{GM_2}{r_2}$, for$r_1 < r < r_2$

D. $E = \dfrac{GM_1}{r_2}$, for$r_1 < r < r_2$

Answer: C

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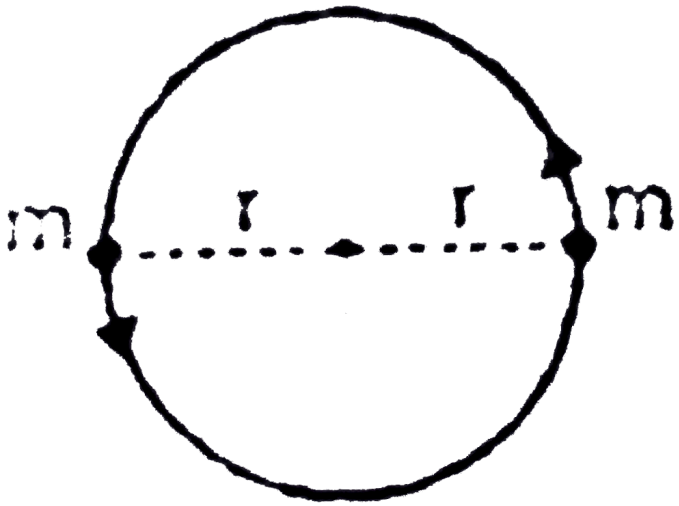

8.

Two particles of equal mass (m) each move in a circle of radius (r) under the action of their

mutual gravitational attraction find the speed of each particle.

A. $\frac{GM}{R}$

B. $\sqrt{\left[2\sqrt{2}\frac{GM}{R}\right]}$

C. $\sqrt{\left[\frac{GM}{R}\left(2\sqrt{2}+1\right)\right]}$

D. $\sqrt{\left[\frac{GM}{R}\left(\frac{\left(2\sqrt{2}+1\right)}{4}\right)\right]}$

Answer: D

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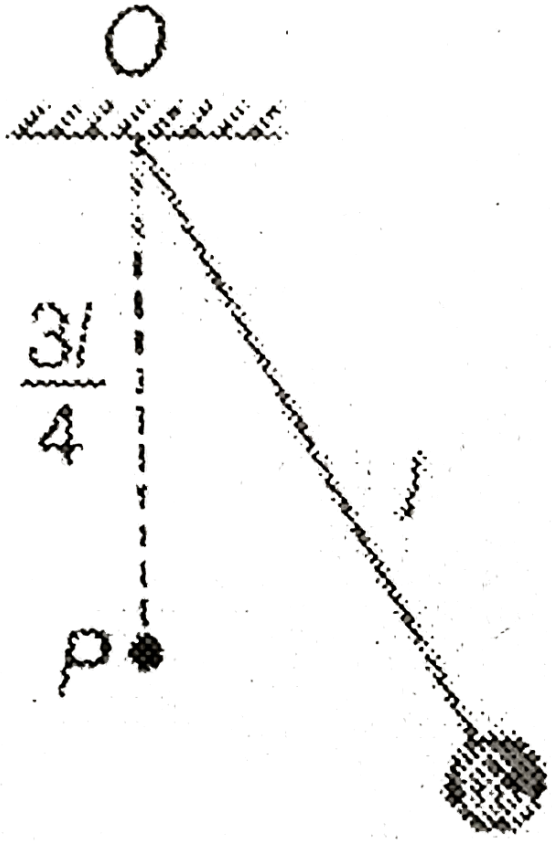
9. A pendulum has time period T for small oscillations. An obstacle P is situated below the point of suspension O at a distance $\frac{3l}{4}$. The pendulum is released from rest. Throughout the motion, the moving string makes small angle with vertical. Time after which the pendulum returns back to its initial

position is



A. T

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

C. `3T/5

D. 4T/5`

Answer: B

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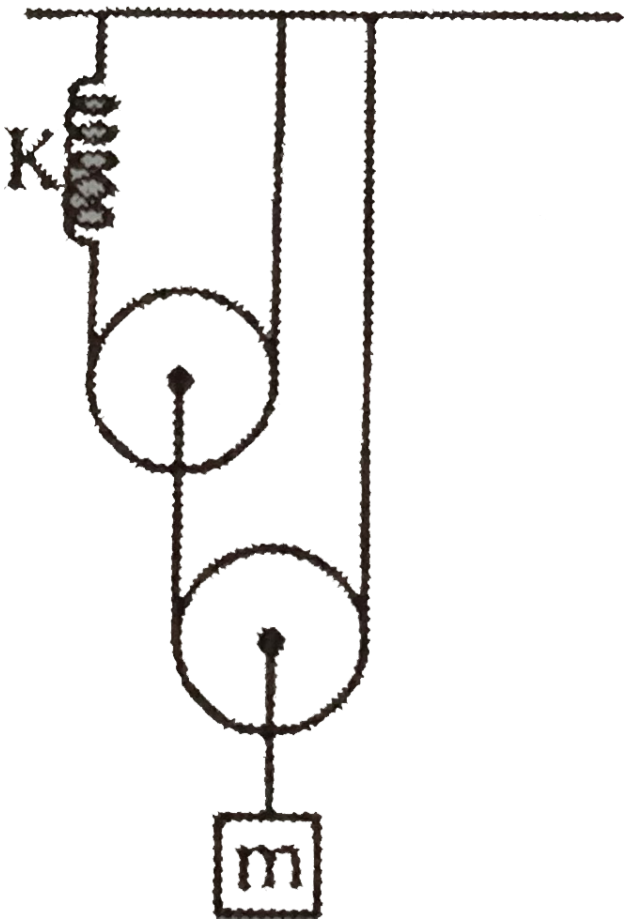
10. What is the period of small oscillations of the block of mas m if the springs are ideal

andpulleys are messless ?



A. $\frac{\pi}{2}\sqrt{\frac{m}{k}}$

B. $\frac{\pi}{2}\sqrt{\frac{m}{2k}}$

C. $\pi\sqrt{\frac{m}{2k}}$

D.

Answer: A

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11. A particle of mass m is located in a potential field given by U (x) = U_o (1-cos ax) where U_o and a are constants and x is distance from origin. The period of small oscillations is

A. $\sqrt{\frac{U_o}{ma^2}}$

B. $\sqrt{\frac{mU_o}{a^2}}$

C. $\sqrt{\frac{a}{mU_o}}$

D. $\sqrt{\frac{m}{U_o a^2}}$

Answer: D

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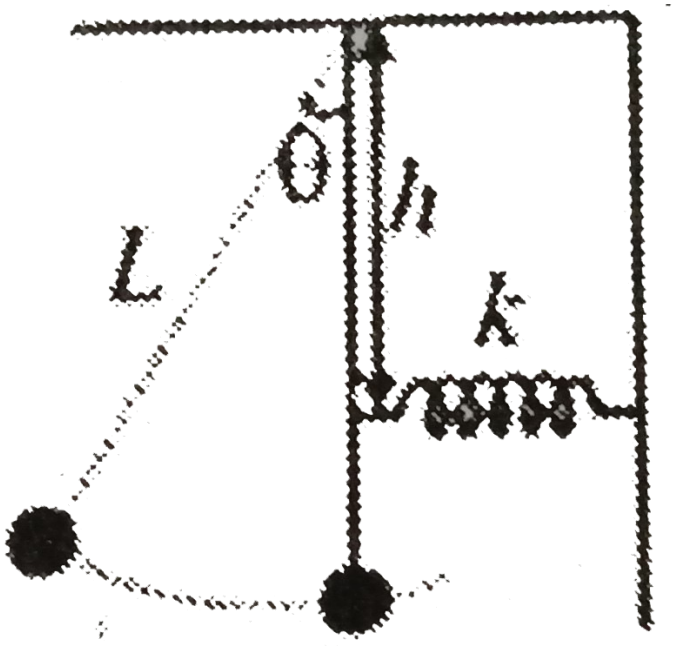
12. A pendulam of length L and bob of mass M has a speing of force constant K connected a speing of force constsnt K connected horizontally to it at a distance h below is point

of suspension. The rod is in equilibrium in vertical podition. The rod of length L. used for vertical suspension s rigid and massless. The frequency of vibration of the system for small values of θ is



A. $\frac{1}{2\pi L}\sqrt{gL+\frac{kh}{m}}$

B. $\frac{1}{2\pi L}\sqrt{\frac{mgL+k}{m}}$

C. $2\pi\sqrt{\frac{kL^2}{mgL+kh}}$

D. $\frac{1}{2\pi L}\sqrt{gL+\frac{kh^2}{m}}$

Answer: D

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13. A particle is performing S.H.M. Its total energy ie E When the displacement of the particle is half of its amplitude, its K.E. will be

A. E

B. E/4

C. E/2

D. E/4

Answer: B

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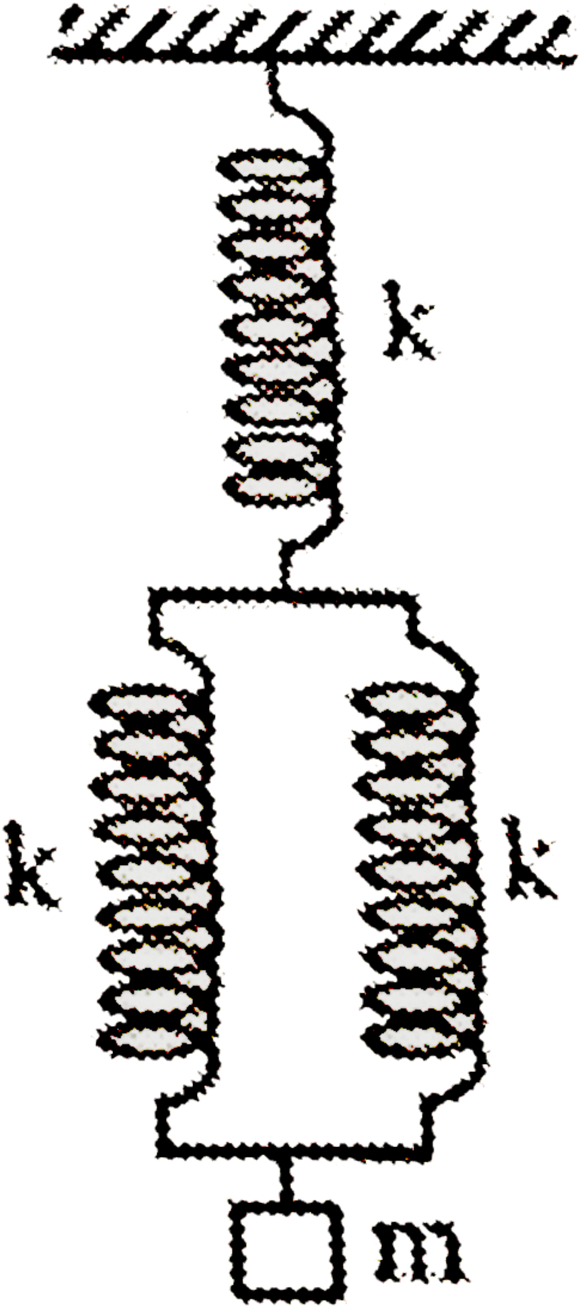
14. A body of mass m = 2kg hangs from three springs, each of spring constant 1875 N/m, as shown in the figure. If the mass is slightly

displaced and let go, the system will oscillate with time period


k
k
k
m

A. $\frac{\pi}{5}$ sec

B. $\frac{\pi}{25}$ sec

C. $\frac{2\pi}{5}$ sec

D. $\frac{2\pi}{25}$ sec

Answer: D

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15. The length of simple pendulum executing SHM is increased by 69% The percentage increase in the time period of the pendulum is

A. $30\ \%$

B. $11\ \%$

C. $21\ \%$

D. $42\ \%$

Answer: A

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16. If a spring has time period T, and is cut into (n) equal parts, then the time period of each part will be.

A. $T\sqrt{a}$

B. $T\sqrt{n}$

C. nT

D. T

Answer: B

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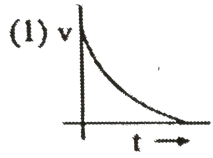
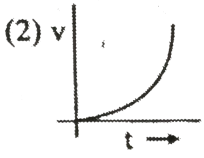
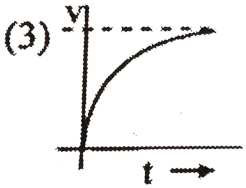
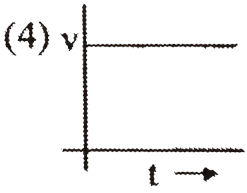
17. In viscosity experiment which one is the graph between, velocity of time for ball falling in viscous fluid .

A. 

B. 

C. 

D. 

Answer: C

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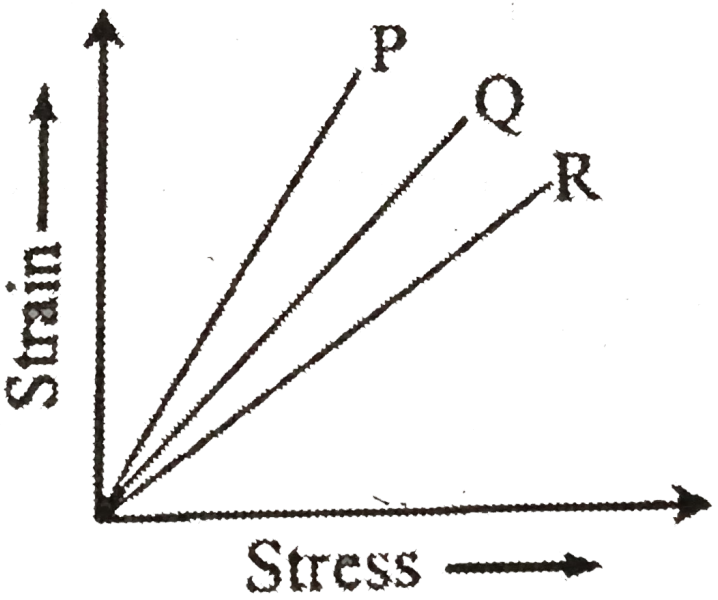
18. The strain-stress curves of three wires of different materials ar shown in the figure P,Q and R are the elastic limits of the wires. The figure shows that :



A. elasticity of wire P is maximum

B. elasticity of wire Q is maximum

C. tensile strength of R is maximum

D. none of the above

Answer: C

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19. Two soap bubbles, each of radius r, coaleses in vacuum under isotermal conditions to from 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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20. If the volume of a block os aluminium is decreased be 1% the pressure (stress) on is surface is increased by (Bulk moduals) of $Al = 7.5 \times 10^{10} Nm^{-2}$)

A. $7.5 \times 10^{10} Nm^{-2}$

B. $7.5 \times 10^{8} Nm^{-2}$

C. $7.5 \times 10^{6} Nm^{-2}$

D. $7.5 \times 10^{4} Nm^{-2}$

Answer: B

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21. An air bubble of radius r in water is at a depth h below the water surface at some instant. If P is atmospheric pressure, d and T

are density and surface tension of water respectivley . the pressure inside the bubble will be :

A. P+hdg-(4T/r)

B. P+hdg+(2T/r)

C. P+dhg-(2T/r)

D. P+hdg + (4T/r)

Answer: B

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22. The apparent coefficient of expansion of liquid, when heated in a copper vessel is C and when heated in a silver vessel is S. If A is the linear coefficient of expansion of Copper, linear expansion coefficient of silver is

A. $\frac{C+S-3A}{3}$

B. $\frac{C+3A-S}{3}$

C. $\frac{S+3A-C}{3}$

D. $\frac{C+S+3A}{3}$

Answer: B

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23. Several spherical deops of a liquid each of radius r coalesece to from a single drop of radius R. If T is the surface tension, then the energy liberated will be

A. $4\pi R^3 T\left(\frac{1}{r}-\frac{1}{R}\right)$

B. $2\pi R^3 T\left(\frac{1}{r}-\frac{1}{R}\right)$

C. $\frac{4}{3}\pi r^2 T\left(\frac{1}{r}-\frac{1}{R}\right)$

D. $2\pi RT\left(\frac{1}{R}-\frac{1}{r}\right)$

Answer: A

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24. Two blocks of wood of masses m_1 and m_2 and each of specific givity 0.5 are submerged at a depth of h_1 and h_2 in v vessel $(h_2 > h_1)$ filled with water, which is accelerated upwards with an acceleration g/2. The difference in time taken by the blocks to reach the surface, when frleased with zero velocity is

A. zero

B. $2\sqrt{\frac{(h_2 - h_1)}{2g}}$

C. $\sqrt{\frac{(h_2 - h_1)}{g}}$

D. $2\sqrt{\frac{(h_2 - h_1)}{3g}}$

Answer: D

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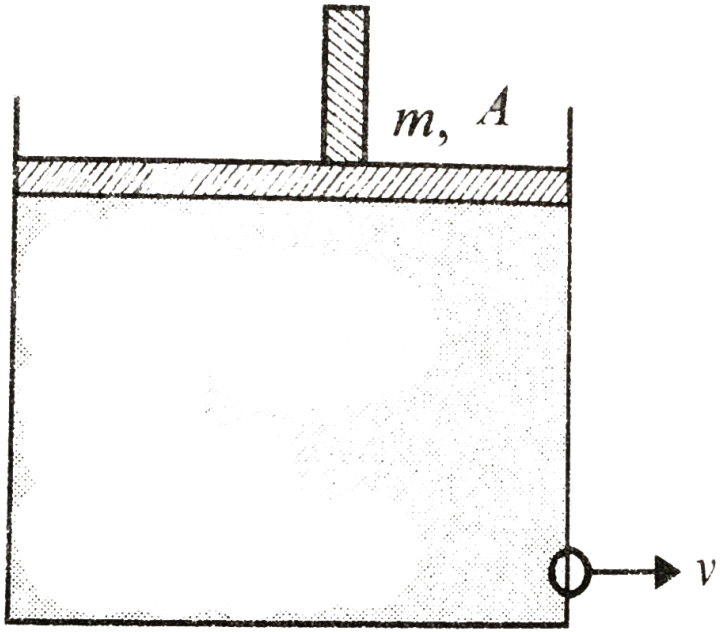
25. A cylindrical vessel contains a liquid of density ρ up to height h. The liquid is closed

by a piston of mass m and area of cross section A. There is a small hole at the bottom of the vessel. The speed v with which the liquid comes out of the hole is



A. $\sqrt{2gh}$

B. $\sqrt{2\left(gh+\frac{mg}{pA}\right)}$

C. $\sqrt{2\left(gh+\frac{mg}{A}\right)}$

D. $\sqrt{2gh+\frac{mg}{A}}$

Answer: B

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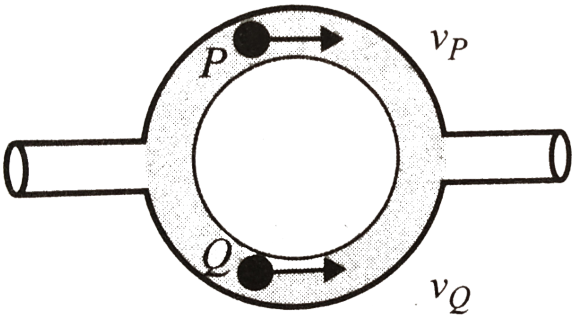
26. Figure shows a liquid flowing through a tube at the rate of $0.1m^3/s$. The tube is branched into two semicircular tubes of cross-sectional area $A/3$ and $2A/3$. The velocity of liquid at Q is (the cross section of the main

tube is $A = 10^{-2}m^2$ and $v_p = 20m/s$)



A. 5 m/s

B. 30 m/s

C. 35 m/s

D. None of these

Answer: A

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27. Water rises to a height h in a capillary tube of cross-sectional area A. the height to which water will rise in a capillary tube of cross-sectional area $4A$ will be

A. h

B. h/2

C. h/4

D. 4h

Answer: B

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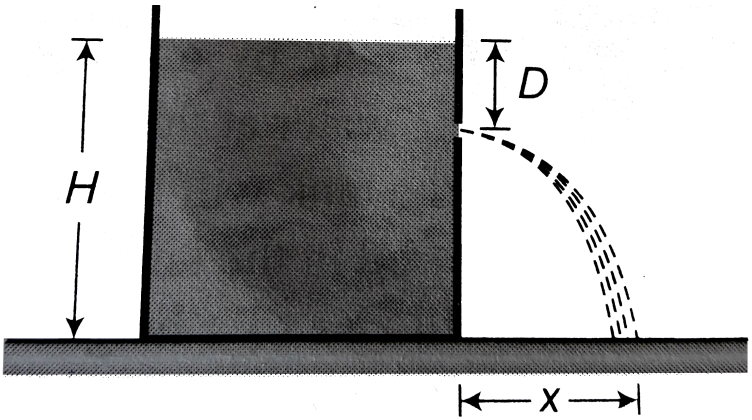
28. A tank is filled with water up to a height H. Water is allowed to come out of a hole P in one of the walls at a depth D below the surface of water. Express the horizontal

distance x in terms of H and D



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

B. $\frac{\sqrt{3}H}{2}$

C. H

D. None of these

Answer: C

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29. The total weight of a piece of wood is 6 kg in the floating state in water its 1/3 part remains inside the water on this floating solid what maximum weight is to be put such that the whole of the piece of wood is to be drowned in the water

A. 12 kg

B. 10 kg

C. 14 kg

D. 15 kg

Answer: A

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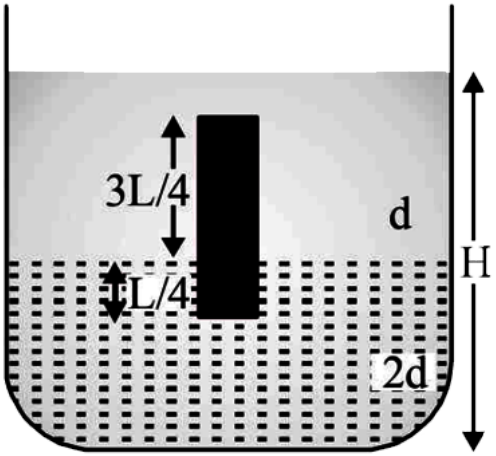
30. A homogeneous solid cylinder of length L(LltH/2), cross-sectional area A/5 is immersed such that it floats with its axis vertical at the liquid-liquid interface with length L/4 in the denser liquid as shown in the figure. The lower density liquid is open to atmosphere having

pressure P_0. Then density D of solid is given by



A. $\frac{5}{4}d$

B. $\frac{4}{5}d$

C. 4d

D. $\frac{d}{5}$

Answer: A

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