PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

FRICTION IN SOLID AND LIQUIDS

Examples

1. Suppose a block of mass 1kg is placed over a rough surface and a horizontal force F is

applied on the block as shown in figure. What are the values of force of friction f f the force F is gradually increased . Give, that $\mu_s = 0.5, \mu_k = 0.4$ and $g = 10ms^{-2}$

A. 3N, 4N

B. 5N, 4N

C. 2N, 3N

D. 4N, 2N

Answer: B

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2. A block of wood of 1kg resting on an inclined plane a angle 30°, just starts moving down. If the coefficient of friction is 0.2, then find its velocity (in ms^{-1}) after 5s (take , g=$10ms^{-2}$)

A. $16.45ms^{-1}$

B. $15.35ms^{-1}$

C. $16.35ms^{-1}$

D. $15.45ms^{-1}$

Answer: C

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3. Find the pressure exerted below a column of water, open to the atmosphere, at depth

(i) 10 m " " (ii) 30 m

(Given, density of water $= 1 \times 10^3 kgm^{-3}, g = 10ms^{-2}$)

A. 2.013×10^5 pa, 4 atm

B. 3.013×10^4 pa, 3 atm

C. 2.013×10^4 pa, 2 atm

D. 2.013×10^2 pa, 4 atm

Answer: A

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4. Figure shows a hydraulic press with the larger piston of diameter 35cm at a height of 1.5 m relative to the smaller piston of diameter 10cm. The mass of the smaller piston is 20kg. What is the force exerted on the load by the

larger piston?

The density of oil in the press is $750kgm^{-3}$

(take , $g = 9.8ms^{-2}$)

A. $2.3 \times 10^{2}N$

B. $1.3 \times 10^{-3}N$

C. $1.3 \times 10^{3}N$

D. $1.3 \times 10^{-2}N$

Answer: C

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5. Water is flowing in a pipe of diameter 6 cm with an average velocity $7.5cm^{-1}.s^{-1}$ and its density is 10^3kgm^{-3}. What is the nature of flow ? Given coefficient of viscosity of water is $10^{-3}kgm^{-1}s^{-1}$.

A. Streamline

B. Turbulent

C. Both a and b

D. None of these

Answer: B

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6. Calculate the rate of flow of glycerine of density $1.25 \times 10^3 kgm^{-3}$ through the conical section of a pipe, if the radii of its ends are0.1 m and 0.04 m and the pressure drop across its length is $10Nm^{-2}$.

A. $6.43 \times 10^{-3} m^3 s^{-1}$

B. $6.43 \times 10^{-4} m^3 s^{-1}$

C. $6.43 \times 10^{-4} m^2 s^{-1}$

D. $6.43 \times 10^{3} m^3 s^{-1}$

Answer: B

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7. The flow of blood in a large artery of an anesthetised dog is diverted through a venturimeter. The wider part of the meter has a cross-sectional area equal to that of the artery, $A = 16mm^2$. The narrower part has an

area $a = 9mm^2$. The pressure drop in the artery is 24 Pa. What is the speed of the blood in the artery ?

A. $0.135ms^{-1}$

B. $0.095ms^{-1}$

C. $0.0125ms^{-1}$

D. $0.1125ms^{-1}$

Answer: B

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8. If the water emerge from an orifice in a tank in which the gauge pressure is $4 \times 10^5 Nm^{-2}$ before the flow starts, then what will be the velocity of the water emerging out ? Take density of water is $1000 kgm^{-3}$

A. $28.28 ms^{-1}$

B. $27.28 ms^{-1}$

C. $29.28 ms^{-1}$

D. $29.18 ms^{-1}$

Answer: A

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9. A plate of area $2m^2$ is made to move horizontally with a speed of $2m/s$ by applying a horizontal tangential force over the free surface of a liquid. If the depth of the liquid is 1m and the liquid in contact with the bed is stationary. Coefficient of viscosity of liquid is 0.01 poise. Find the tangential force needed to move the plate.

A. $4 \times 10^{-3} N$

B. $14 \times 10^2 N$

C. $4 \times 10^{-2} N$

D. 4 N

Answer: A

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10. Water is conveyed through a horizontal tube 8 cm in diameter and 4 kilometer in length at the rate of 20 litre/s Assuming only viscous resistance , calculate the pressure

required to maintain the flow . Coefficient of viscosity of water is 0.001 pa s

A. 45 cm

B. 50 cm

C. 59.68cm

D. 49.68 cm

Answer: C

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11. With what terminal velocity will an air bubble $0.8mm$ in diameter rise in a liquid of viscosity $0.15N - s/m^2$ and specific gravity 0.9? Density of air is $1.293kg/m^3$.

A. $-0.21cms^{-1}$

B. $+0.21cms^{-1}$

C. $-0.41cms^{-1}$

D. $+0.41cms^{-1}$

Answer: A

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Exercise 1

1. Maximum value of frictional force is called

A. Limiting frictional force

B. Static frictional force

C. Kinetic frictional force

D. Rolling frictional force

Answer: A

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2. A mass placed on an inclined place is just in equilibrium. If μ is coefficient of friction of the surface, then maximum inclination of the plane with the horizontal is

A. $\tan^{-1}\mu$

B. $\tan^{-1}(\mu/2)$

C. $\sin^{-1}\mu$

D. $\cos^{-1}\mu$

Answer: A

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3. A $30kg$ block rests on a rough horizontal surface A force of $200N$ is applied on the block The block acquires a speed of $4m/s$ starting from rest in $2s$ What is the value of coefficient of friction ? .

A. $\frac{10}{3}$

B. $\frac{\sqrt{3}}{10}$

C. 0.47

D. 0.184

Answer: C

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4. A block of weight of 5N is pushed against a vertical wall by a force 12N. The coefficient of friction between the wall and block is 0.6. The magnitude of the force exerted by the wall on

the block is

A. 12N

B. 5N

C. 7.2 N

D. 13 N

Answer: D

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5. The coefficient of friction between the tyres and road is 0.4. The minimum distance covered before attaining a speed of 8 ms^{-1} starting from rest is nearly (take, g=10 ms^{-2})

A. 8m

B. 4m

C. 10m

D. 16m

Answer: A

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6. A block of mass 2kg rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is

A. 9.8 N

B. $0.7 \times 9.8 \times \sqrt{3}N$

C. $9.8 \times \sqrt{3}N$

D. $0.7 \times 9.8N$

Answer: A

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7. A block of mass m is placed on the top of another block of mass M as shown in the figure . The coefficient of friction between them is μ

The maximum acceleration with which the block M may move so that m also moves along with it is

A. μg

B. $\mu \frac{M}{m} g$

C. $\mu \frac{m}{M} g$

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

Answer: A

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8. Thd dimensional formula of pressure is

A. $[M^{\circ} L^{\circ} T^{\circ}]$

B. $\left[ML^{-1}T^{-2}\right]$

C. $\left[M^{\circ}L^{1}T^{-2}\right]$

D. $\left[M^{\circ}L^{1}T^{\circ}\right]$

Answer: B

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9. The two thigh bones each of cross-sectional area $15cm^2$ support the upper part of a person of mass 70 kg. The pressure sustained by these thigh bones is

A. $2.5 \times 10^5 Nm^2$

B. $1.33 \times 10^5 Nm^2$

C. $4.66 \times 10^5 Nm^2$s

D. $2.33 \times 10^5 Nm^2$

Answer: D

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10. At a depth of 1000 m in an ocean (a) what is the absolute pressure? (b) what is the gauge pressure? (c) Find the force acting on

the window of area $20cm \times 20cm$ of a submarine at this depth, the interior of which is maintained at sea-level atmospheric pressure. The density of sea water is $1.03 \times 10^3 kgm^{-3}$, $g = 10ms^{-2}$. Atmospheric pressure = $1.01 \times 10^5 Pa$.

A. 40 atm

B. 52 atm

C. 32 atm

D. 62 atm

Answer: B

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11. Four vessels A, B, C, and D have different shape and hold different amount of water. Which of the following is correct?

A. $P_E > P_F > P_G > P_H$

B. $P_E < P_F < P_G < PH$

C. $P_E = P_F = P_G = P_H$

D. $P_E = P_F > P_G = P_H$

Answer: C

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12. Two liquids of densities 2ρ and ρ having their volumes in the ratio $3:2$ are mixed together. Density of the mixture will be

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

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

C. $\frac{8\rho}{5}$

D. $\frac{4\rho}{5}$

Answer: C

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13. An object of uniform density is allowed to float in water kept in a beaker. The object has triangular cross - section as shown in the figure. If the water pressure measured at the three point A, B and C below the object are P_A, P_B and P_C respectively . Then

A. $P_A > P_B > P_C$

B. $P_A > P_B < P_C$

C. $p_A = P_B = P_C$

D. $P_A = P_B < P_C$

Answer: C

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14. A piston of cross-section area 100 cm 2 is used in a hydraulic press to exert a force of 10^7 dynes on the water. The cross-sectional

area of the other piston which supports an object having a mass $2000kg$. 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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15. In the given figure , the velocity V_3 will be

A. $2ms^{-1}$

B. $4ms^{-1}$

C. $1ms^{-1}$

D. $3ms^{-1}$

Answer: C

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16. An ideal fluid flows through a pipe of circular cross-section made of two sections with diameters $2.5cm$ and $3.75cm$. The ratio of the velocities in the two pipes is

A. $9:4$

B. $3:2$

C. $\sqrt{3}:\sqrt{2}$

D. $\sqrt{2}:\sqrt{3}$

Answer: A

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17. Bernoulli's equation is a consequence of conservation of

A. Conservation of mass

B. Conservation of energy

C. Conservation of linear momentum

D. Conservation of angular momentum

Answer: B

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18. A horizontal pipeline carries water in a streamline flow. At a point along the pipe, where the cross- sectional area is $10cm^2$, the water velocity is $1ms^{-1}$ and the pressure is 2000 Pa. The pressure of water at another point where the cross-sectional area is $5cm^2$, is.....Pa. (Density of water $= 10^3 kg.\, m^{-3}$)

A. 4000 Pa

B. 2000 Pa

C. 1000 Pa

D. 500 pa

Answer: D

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19. If the velocity head of a stream of water is equal to 10 cm, then its speed of flow is approximately

A. $1.0ms^{-1}$

B. $1.4ms^{-1}$

C. $140ms^{-1}$

D. $10ms^{-1}$

Answer: B

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20. Water falls from a tap with $A_0 = 4m^2$, $A = 1m^2$ and h=2 m, the velocity v is

A. $2.5ms^{-1}$

B. $6.5ms^{-1}$

C. $4.5ms^{-1}$

D. $1.5ms^{-1}$

Answer: B

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21. The velocity of the wind over the surface of the wing of an aeroplane is $80ms^{-1}$ and under the wing $60ms^{-1}$. If the area of the

wing is $4m^2$, the dynamic lift experienced by the wing is [density of air $= 1.3kg.\, m^{-3}$]

A. 800 N

B. 1000 N

C. 4000 N

D. 3200 N

Answer: C

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22. Water from a tap emerges vertically downwards an intial speed of 1 m/s . The cross-sectional area of the tap is $10^{-4}m^2$. Assume that the pressure is contant throughout the stream of water and that the flow is steady . The cross-sectional area of the steam. 0.15 m below the tap is

A. $5.0 \times 10^{-4}m^2$

B. $1.0 \times 10^{-5}m^2$

C. $5.0 \times 10^{-5}m^2$

D. $2.0 \times 10^{-5} m^2$

Answer: C

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23. The pressure of water in a pipe when tap is closed is $5.5 \times 10^5 Nm^{-2}$. When tap gets open, pressure reduces to $5 \times 10^5 Nm^{-2}$. The velocity with which water comes out on opening the tap is

A. $10 ms^{-1}$

B. $5ms^{-1}$

C. $20ms^{-1}$

D. $15ms^{-1}$

Answer: A

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24. Water flows along horizontal pipe whose cross-section is not constant. The pressureis 1 cam of Hg, where the veloecity is 35 cm/s . At a

point where the velocity is 65cm/s then pressure will be

A. 0.89 cm of Hg

B. 0.62 cm of Hg

C. 0.5 cm of Hg

D. 1cm of Hg

Answer: A

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25. The velocity of efflux of a liquid through an orifice in the bottom of a tank does not depend upon

A. Density of liquid

B. height of the liquid column above orifice

C. Acceleration due to gravity

D. None of these

Answer: A

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26. A tank is filled to a height H. The range of water coming out of a hole which is a depth $H/4$ from the surface of water level is

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

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

C. $\sqrt{3}H$

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

Answer: B

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27. A container has a small hole at its bottom. Area of cross-section of the hole is A_1 and that of the container is A_2. Liquid is poured in the container at a constant rate Qm^3s^{-1}. The maximum level of liquid in the container will be

A. $\frac{Q^2}{2gA_1A_2}$

B. $\frac{Q^2}{2gA_1^2}$

C. $\frac{Q}{2gA_1A_2}$

D. $\frac{Q^2}{2gA_2^2}$

Answer: B

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28. The lift of an air plane is based on

A. Torricelli's theorem

B. Bernoulli's theorem

C. Law of gravitation

D. Continuity equation

Answer: B

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29. Air is blow through a pipe AB at a rate of $15 L \min^{-1}$. The cross sectional area of the broad protion of the pipe AB is $2 cm^2$ and that of the narrow protion is $0.5 cm^2$. The differnce in water level h is (density of air = $1.32 kgm^{-3}$)

A. 16mm

B. 15mm

C. 10mm

D. 3.2mm

Answer: B

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30. A large tank is filled with water (density $= 10^3 kgm^{-3}$). A small hole is made at a depth 10m below water surface . The range of water issuing out of the hole is R on ground . What extra pressure must be applied on the water surface so that the range become 2R

(take 1atm $= 10^5 Pa$ and $g = ms^{-2}$)

A. 1 atm

B. 2 atm

C. 4 atm

D. 3 atm

Answer: D

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31. The water level on a tank is 5m high. There is a hole of $1cm^2$ cross-section at the bottom of the tank. Find the initial rate with which water will leak through the hole. ($g = 10ms^{-2}$)

A. $10^{-3}m^3s^{-1}$

B. $10^{-4}m^3s^{-1}$

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

D. $10^{-2}m^3s^{-1}$

Answer: A

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32. A water tank placed on the floor has two small holes, pinched in the vertical wall, one above the other. The holes are $3.3cm$ and $4.7cm$ above the floor. If the jets of water issuing out from the holes hit the floor at the same point on the floor, then the height of water in the tank is

A. 10cm

B. 5cm

C. 20cm

D. 4.8cm

Answer: A

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33. There are two holes O_1 and O_2 in a tank of height H. the water emerging from O_1 and O_2 strikes the ground at the same points, as shown in figure, then

A. $H = h_1 + h_2$

B. $H = h_2 - h_1$

C. $H = \sqrt{h_1 h_2}$

D. None of these

Answer: A

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34. A tank is filled to a height H. The range of water coming out of a hole which is a depth $H/4$ from the surface of water level is

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

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

C. $\sqrt{3}H$

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

Answer: C

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35. There is a hole at the bottom of a large open vessel. If water is filled upto a height h, it

flows out in time t. if water is filled to a height 4h, it will flow out in time

A. $\frac{t}{4}$

B. 2t

C. 4t

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

Answer: B

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36. Units of coefficient of viscosity are

A. Nms^{-1}

B. Nm^2s^{-1}

C. $Nm^{-2}s$

D. `None of these

Answer: C

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37. As the temperature of water increases, its viscosity

A. Remains unchanged

B. Decreases

C. Increases

D. Increases or decreases depending on the external pressure

Answer: B

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38. The rate of flow of liquid in a tube of radius r, length l, whose ends are maintained at a pressure difference P is $V = \frac{\pi Q P r^4}{\eta l}$ where η is coefficient of the viscosity and Q is

A. 8

B. $\frac{1}{8}$

C. 16

D. $\frac{1}{16}$

Answer: B

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39. Two capillary tubes of the same length but different radii r1 and r2 are fitted in parallel to the bottom of a vessel. The pressure head is P . What should be the radius of a single tube that can replace the two tubes so that the rate of flow is same as before

A. $r_1 + r_2$

B. $\frac{r_1 r_2}{r_1 + r_2}$

C. $\frac{r_1 + r_2}{2}$

D. None of these

Answer: D

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40. A raindrop of radius 0.3 mm has a terminal velocity in air $1ms^{-1}$. The viscosity of air is 18×10^{-3} poise. The viscous force on it is

A. 101.37×10^{4} dyne

B. 101.73×10^{-2} dyne

C. 16.95×10^{-5} dyne

D. 16.95×10^{-4} dyne

Answer: B

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41. A spherical ball of radius 3×10^{-4}m and density $10^4 kg/m^3$ falls freely under gravity through a distance h before entering a tank of water. If after entering the water the velocity

of the ball does not change, find h the viscosity of water is $9.8 \times 10^{-6} N - s / m^2$

A. $1.65 \times 10^3 m$

B. $2.65 \times 10^2 m$

C. $3.65 \times 19^4 m$

D. $1.45 \times 10^2 m$

Answer: A

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42. Two rain drops of same radius r falling with terminal velocity v merge and from a bigger drop of radius R. The terminal velocity of the bigger drop is

A. $v\frac{R}{r}$

B. $v\frac{R^2}{r^2}$

C. v

D. 2v

Answer: B

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43. From amongst the following curves, which one shows the variation of the velocity v with t for a small sized spherical body falling vertically in long column of viscous liquid

A. 

B. 

C. 

D. 

Answer: D

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44. The terminal speed attained by an aluminium sphere of radius 1 mm falling through water at $20^{\circ}C$ will be close to

A. $9.2ms^{-1}$

B. $6.9ms^{-1}$

C. $4.6ms^{-1}$

D. $2.3ms^{-1}$

Answer: C

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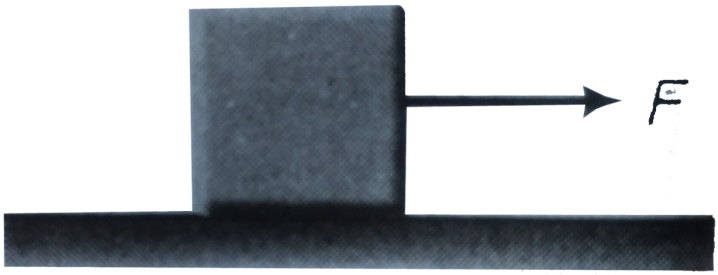
45. Suppose a block of mass $1kg$ is placed over a rough surface and a horizontal force F is applied on the block as shown in figure. Now, let us see what are the values of force of friction f and acceleration of the block a if the force F is gradually increased. Given that

$\mu_s = 0.5, \mu_k = 0.4$ and $g = 10m/s^2$



A. 16

B. 8

C. 4

D. 2

Answer: C

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46. If the terminal speed of a sphere of gold (density $= 19.5kg/m^3$) is $0.2m/s$ in a viscous liquid (density $= 1.5kg/m^3$), find the terminal speed of a sphere of silver (density $= 10.5kg/m^3$) of the same size in the same liquid

A. $0.4ms^{-1}$

B. $0.133ms^{-1}$

C. $0.1ms^{-1}$

D. $0.2ms^{-1}$

Answer: C

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47. Two equal drops of water are falling through air with a steady velocity v. If the drops coalesced, what will be the new velocity?

A. $(2)^{1/3}v$

B. $(2)^{3/2}v$

C. $(2)^{2/3}v$

D. $(2)^{1/4}v$

Answer: C

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48. A solid sphere falls with a terminal velocity V in CO_2 gas. If its is allowed to fall in vacuum

A. Terminal velocity of sphere = v

B. Terminal velocity of sphere lt v

C. Terminal velocity of sphere gt v

D. Sphere never attains terminal velocity

Answer: D

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49. Uniform speed of 2 cm diameter ball is $20cm/s$ in a viscous liquid. Then, the speed of 1 cm diameter ball in the same liquid is

A. $80cms^{-1}$

B. $40cms^{-1}$

C. $10cms^{-1}$

D. $5cms^{-1}$

Answer: D

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Exercise 2 Miscellaneous Problems

1. In a streamline flow

A. The speed of a particle always remains same

B. The velocity of a particle always remains same

C. The kinetic energies of all particles arriving at a given point are the same

D. The potential energies of all the particles arriving at a given point are the

same

Answer: C

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2. A viscous fluid is flowing through a cylindrical tube. The velocity distribution of the fluid is best represented by the diagram

A. 

B. 

C. 

D. None of these

Answer: C

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3. Which of the following diagrams does not represent a streamline flow?

A. 

B. 

C. 

D. 

Answer: D

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4. A hole is made at the bottom of the tank filled with water (density $= 1000 kgm^{-3}$). If the total pressure at the bottom of the tank is three atmospheres (1 atmosphere

$= 10^5 Nm^{-2}$), then the velocity of efflux is nearest to

A. $\sqrt{400} ms^{-1}$

B. $\sqrt{200} ms^{-1}$

C. $\sqrt{600} ms^{-1}$

D. $\sqrt{500} ms^{-1}$

Answer: A

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5. A cylinder of mass M and density d_1 hanging from a string, is lowered into a vessel of cross-sectional area A, containing a liquid of density $d_2(d_2 < d_1)$ until it is fully immersed. The increase in pressure at the bottom of the vessel is

A. $\frac{Md_2g}{d_1A}$

B. $\frac{Mg}{A}$

C. $\frac{Md_1g}{d_2A}$

D. zero

Answer: A

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6. A uniformly tapering vessel is filled with a liquid of density $900kgm^{-3}$. The force that acts on the base of the vessel due to the liquid (excluding atmospheric force) is ($g = 10ms^{-2}$)

A. 3.6 N

B. 7.2 N

C. 9.0 N

D. 12.6 N

Answer: B

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7. A tank if filled with water upto height H. When a hole is made at a distance h below the level of water. What will be the horizontal range of water jet ?

A. $2\sqrt{h(H-h)}$

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

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

D. $2\sqrt{h(H+h)}$

Answer: A

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8. A non - viscous liquid is flowing through a frictionless duct, cross section varying as shown in figure

Which of the following graph represents the variation of pressure p along the axis of tube ?

A. 

B. 

C. 

D. 

Answer: B

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9. A block is gently placed on a conveyor belt moving horizontal with constant speed After $t = 4s$ the velocity of the block becomes equal to velocity of the belt If the coefficient of friction between the block and the belt is $\mu = 0.2$, then the velocity of the conveyor belt is .

A. $8ms^{-1}$

B. $4ms^{-1}$

C. $6ms^{-1}$

D. $18ms^{-1}$

Answer: A

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10. The breaking strength of the cable used to pull a body is 40N. A body of mass 8kg is resting on a table of coefficient of friction $\mu = 0.20$. The maximum acceleration which can be produced by the cable is (take , $g = 10ms^{-2}$)

A. $6ms^{-2}$

B. $3ms^{-2}$

C. $8ms^{-2}$

D. $9ms^{-2}$

Answer: B

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11. In the shown arrangement mass of A=1kg, mass of B=2kg. Coefficient of friction between A and B=0.2kg

There is no friction between B and groud. The frictional force exerted by A on B equal

A. 2N

B. 3N

C. 4N

D. 5N

Answer: A

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12. A body of mass 10kg is placed on rough surface pulled by a force F making an angle of 30° above the horizontal . If the angle of friction is also 30°, then the minimum magnitude of force F required to move the body is equal to (take , g= $10ms^{-2}$)

A. 100N

B. $50\sqrt{2}N$

C. $100\sqrt{2}N$

D. 50N

Answer: D

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13. The U - tube in figure contains two different liquids in static equilibrium, water is the right arm and oil of unknown density ρ_x in the left. If l=135 mm and d=15 mm . Density of the oil is

A. $1000kgm^3$

B. $920kgm^3$

C. $895 kgm^3$

D. $900 kgm^3$

Answer: D

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14. In a vehicle lifter the enclosed gas exerts a force F on a small piston having a diameter of 8 cm. This pressure is transmitted to a second piston of diameter 24 cm. If the mass of the vehicle to be lifted is 1400 kg then value of F is

A. 1200 N

B. 1800 N

C. 1600 N

D. 700 N

Answer: C

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15. In the figure shown velocity of liquid which comes out is v, time of liquid to fall to ground is t and range on ground is R . If the vessel is

taken to a mountain, match the following , (consider all cases which might possible)

A. $A \to p, B \to q, C \to r$

B. $A \to r, B \to p, C \to q$

C. $A \to q, B \to p, C \to r$

D. $A \to r, B \to q, C \to p$

Answer: C

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16. A small metal sphere of radius a is falling with a velocity v through a vertical column of a viscous liquid. If the coefficient of viscosity of the liquid is η, then the sphere encounters an opposing force of

A. $6\pi\eta a^2 v$

B. $\frac{6\eta v}{\pi a}$

C. $6\pi\eta a v$

D. $\frac{\pi\eta v}{6a^3}$

Answer: C

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17. A flow of liquid is streamline, if the Reynolds' 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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18. Water from a tap emerges vertically downwards with initial velocity $4ms^{-1}$. The cross-sectional area of the tap is A. The flow is steady and pressure is constant throughout the stream of water. The distance h vertically below the tap, where the cross-sectional area of the stream becomes $\left(\frac{2}{3}\right)A$ is $\left(g = 10m/s^2\right)$

A. 2m

B. 1m

C. 0.5m

D. 4m

Answer: D

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19. Water flows in a streamline manner through a capillary tube of radius a. The pressure difference being P and the rate of flow is Q . If the radius is reduced to $a/2$ and

the pressure difference is increased to 2P, then find the rate of flow.

A. 4Q

B. Q

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

D. $\frac{Q}{8}$

Answer: D

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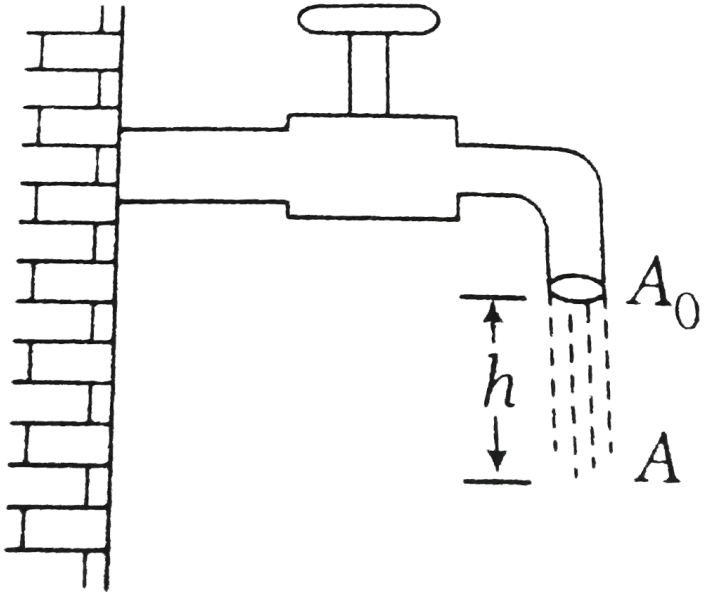
20. Figure shows how the stream of water emerging from a faucet necks donw as it falls. The area changes from A_0 to A through a fall of h. At what rate does the water flow from the tap ?



A. $A_0\sqrt{\frac{2ghA^2}{A_0^2-A^2}}$

B. $2A_0\sqrt{\frac{ghA^2}{A_0^2-A^2}}$

C. $A_0\sqrt{\frac{gh}{2}}$

D. $2A\sqrt{\frac{ghA_0^2}{A_0^2-A^2}}$

Answer: A

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21. A bent tube is lowered into the stream as shown in the figure below . The velocity of the

stream relative to the tube equal to v. The closed upper end of the tube located at the height h_0 . To what height h will the water jet spurt ?

A. $\frac{v^2}{2g}$

B. $\frac{v^2}{2g} + h_0$

C. $\frac{v^2}{2g} - h_0$

D. $\frac{v^2}{4g} - h_0$

Answer: C

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22. A body of mass m is placed on a rough surface with coefficient of friction μ inclined at θ. If the mass is in equilibrium , then

A. $\theta = \tan^{-1}\mu$

B. $\theta = \tan^{-1}\left(\frac{1}{\mu}\right)$

C. $\theta = \frac{\tan^{-1} m}{\mu}$

D. $\theta = \frac{\tan^{-1}\mu}{m}$

Answer: A

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23. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough . A block starting from rest at the top of the plane will again comes to rest at the bottom , if the coefficient of friction between the block and lower hald of the plane is given by

A. $\mu = \frac{1}{\tan\theta}$

B. $\mu = \frac{2}{\tan\theta}$

C. $\mu = 2\tan\theta$

D. $\mu = \tan\theta$

Answer: C

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24. A body of wight 50N placed on a horizontal surface is just moved by a force of 28.2N. The frictional force and normal reaction are

A. 2N, 3N

B. 5N, 6N

C. 10N, 15N

D. 20N, 30N

Answer: D

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