PHYSICS

AIMED AT STUDENTS PREPARING FOR JEE EXAMINATION

RACE

RACE 17

1. Suppose velocity of a cricket ball hit by a batsman is given by

$$\vec{v} = \left(2\hat{i} + 6\hat{j} + (\circ 0 - 10t)\hat{k}\right)m/s$$

Find the time (t) the acceleration of the ball is perpendicular to its velocity.

A. 1s

B. 2s

C. 3s

D. 4s

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2. A ball is thrown verticocally upwards with some speed. It reaches two points A and B one after another such that heights of A and B are one fourth and three-fourth of the maximum height attained. If the total time of flight if T. the maximum time taken by the ball to travel from A and B, is:-

A. $\left(\frac{\sqrt{3}+1}{4}\right)T$

B. $\left(\frac{\sqrt{3}-1}{2}\right)T$

C. $\left(\frac{\sqrt{3}+1}{2}\right)T$

D. $\frac{T}{\sqrt{2}}$

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3. A motor boat of mass m moves along a lake with velocity V_0. At $t = 0$, the engine of the boat is shut down. Magnitude of resistance force offered to the boat is equal to rV. (V is instantaneous speed). What is the total distance covered till it stops completely? [Hint: $F(x) = mV\frac{dV}{dx} = -rV$]

A. mV_0 / r

B. $3mV_0 / 2r$

C. $mV_0 / 2r$

D. $2mV_0 / r$

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4. A particle moving in a straight line has its velocit varying with time according to relation $v = t^2 - 6t + 8(m / s)$ where t is in seconds. The CORRECT statement(s) about motion of this particle is/are:-

A. Velocity changes its direction two times within first 3 sec

B. Displacement in first 2 second is equal to distance travelled

C. The farthest distance of particle from origin on negative x axis is at

$t = 3$ sec

D. Acceleration is increasing in the interval$t = 3$ sec to $t5$ sec.

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5. The XI^{th} class students of ALLEN designed a rocket. The rocket was launched from cycle stand of ALLEN straight up into the air. At $t = 0$, the rocket is at $y = 0$ with $V_y(t = 0) = 0$. The velocity of the rocket is given by: $V_y = (24t - 3t^2) m/s$ for $0 \leq t \leq t_b$ where t_b is the time at which fuel burns out. vertically upward direction is taken as positive. $(g = 10 m/s^2)$

The expression for the acceleration $a_y(t)$ valid at all times in the interval $0 < t < t_b$ is

A. $12t^2 - t^3$

B. $24 - 6t$

C. $24t - 6t^2$

D. $24 \equiv 6t - g$

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6. The XI^{th} class students of ALLEN designed a rocket. The rocket was launched from cycle stand of ALLEN straight up into the air. At $t = 0$, the rocket is at $y = 0$ with $V_y(t = 0) = 0$. The velocity of the rocket is given by: $V_y = \left(24t - 3t^2\right) m/s$ for $0 \leq t \leq t_b$ where t_b is the time at which fuel burns out. vertically upward direction is taken as positive. $\left(g = 10m/s^2\right)$

The displacement of the rocket till the fuel burns out $(t = t_b)$ is

A. 128 m

B. 486m

C. 203m

D. 242m

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The time taken for rocket to reach its maximum height is

A. 4 sec

B. 8 sec

C. 8.8 sec

D. 9.6 sec

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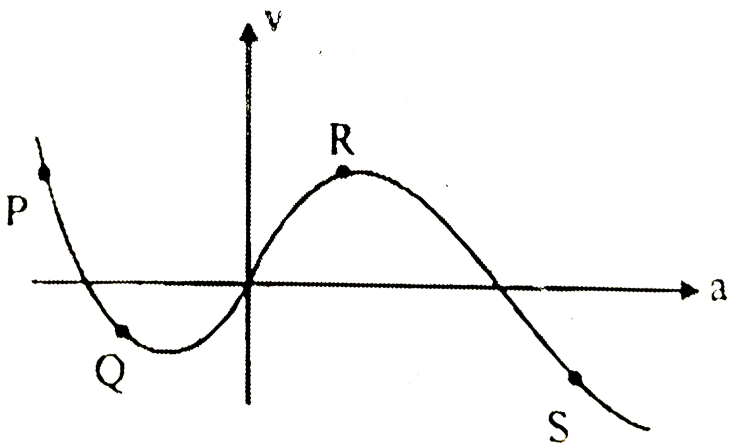
RACE 19

1. Acceleration-velocity graph of a moving particle is shown in figure. The particle is



A. speeding up at P

B. speeding up at Q

C. speeding up at S

D. speeding down at R

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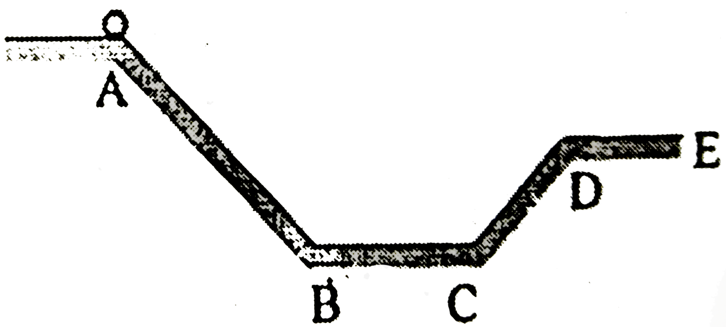
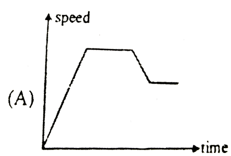
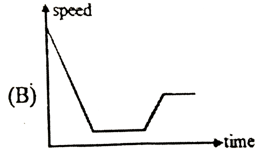
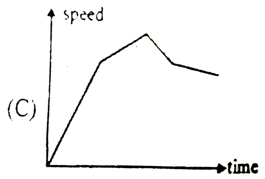
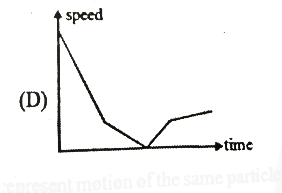
2. In the picture shown, a ball standing from rest rolls down a ramp AB,goes along at the horizontal bottom BC, and then backs up a smaller ramp CD, thereafter rolls on horizontal plance DE Ignore friction and air resistance. Which of the following figure shows variation in speed with time?



A. 

B. 

C. 

D. 

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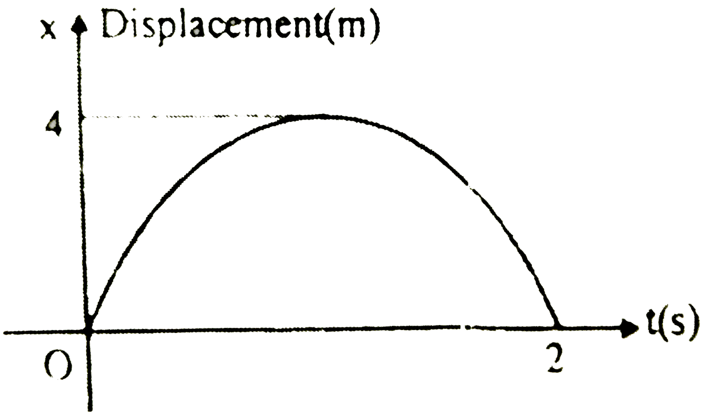
3. Figure shows a sine curve, as the displacement time curve of a particle executing rectilinear motion having equation $x = 45\left(\frac{\pi}{2}t\right)$. The velocit of particle at $t = \frac{2}{3}s$ is



A. πms^{-1}

B. $\sqrt{3}\pi ms^{-1}$

C. $\frac{\pi}{2}ms^{-1}$

D. None of these

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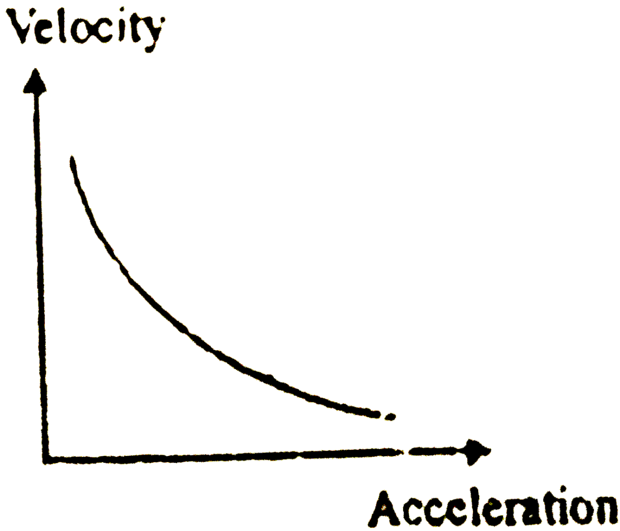
4. A physics student studies rectilinear motion of a body and prepares the following graph. Which of the following conclusions best suits the above graph?



A. The body is speeding up and its acceleration is decreasing.

B. The body is slowing down and its acceleration is increasing

C. The body is speeding up and its acceleration is increasing

D. The given graph cannot describe may physically realizable motion

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5. Match the following and write the correct pairs for the most generalized case

Column – I

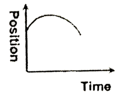
(A) Particle moving with constant speed

(B) Particle moving with increasing acceleration

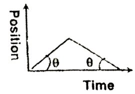
(C) Particle moving with constant negative acceleration

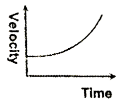
(D) Particle moving with zero acceleration

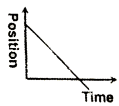
Column – II

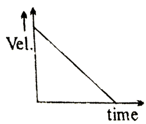
(P) 

(parabolic)

(Q) 

(R) 

(S) 

(T) 

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6. A particle moves on x-axis with a velocity which depends on time as per equation $v = t^2 - 8t + 15 (m/s)$ where time t is in seconds. Match the columns.

Column-I	Column-II
(A) At $t = 4s$	(P) acceleration is in positive direction.
(B) At $t = 2s$	(Q) acceleration is in negative direction.
(C) At $t = 6\ s$	(R) acceleration is zero.
(D) At $t = 5s$	(S) particle moves in positive direction.
	(T) particle moves in negative direction.

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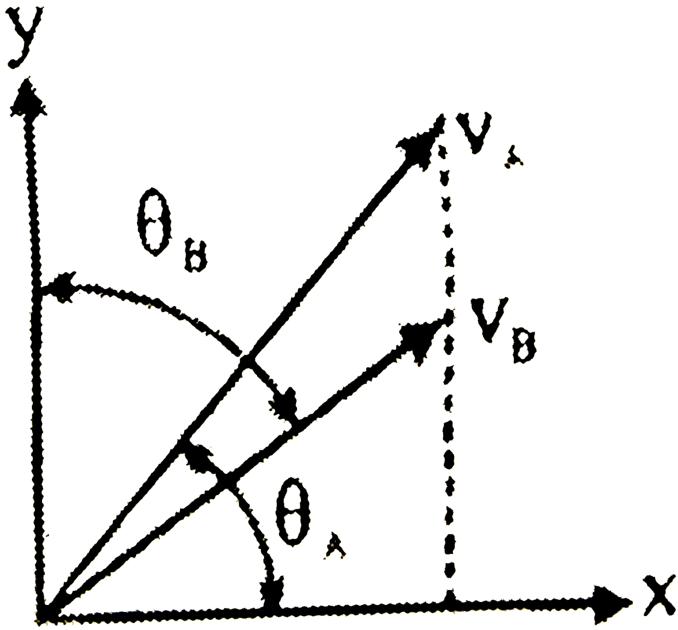
Race 21

1. Two projectiles are projected with velocity v_A, v_B at angles θ_A (from horizontal) and θ_B (from vertical) as shown in the figure below, such that $v_A > v_B$ but having same horizontal component of velocity. Which of the following is correct ?



A. $T_A > T_B$

B. $H_A > H_B$

C. $R_A > R_B$

D. $R_B > R_A$

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2. Which of the following get affected by horizontal air flow in an oblique projection ?

A. time of flight

B. horizontal range

C. maximum height

D. velocity at highest point

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3. A car is traveling on a straight level track with a uniform speed of 25 m/s. When the car is moving away from a gun at the same level at a distance of 1500 m the gun is fired at an angle of 45°. Find the distance of the car (kilometers) from the gun when it is hit.

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4. An Indian fighter plane flying horizontally with speed 800 km/hr releases a bomb (on Pakistan bunker) at a height of 78.4 m from the ground, when will the bomb strike the ground ? Give your answer in second. $\left[g = 9.8m/s^2\right]$

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PHYSICS

1. The graph shown the extension of is 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. If the cross sectional area of the wire is $1mm^2$, then the Young's modulus of the material of the wire.

A. $2 \times 10^{11} Nm^{-1}$

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

C. $\frac{1}{2} \times 10^{11} Nm^{-2}$

D. None of these

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2. Two wires of copper having the length in the ratio $2:1$ and their radii ratio as $1:2$ are stretched by the same force. The ratio of longitudinal strain in the two will be

A. $1:4$

B. $4:1$

C. $1:16$

D. $16:1$

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3. The bar shown in the figure is made of a single piece of material. It is fixed at one end and consists of two segments of equal length $\frac{L}{2}$ but different cross-section area A and 2A. What is the change in length of the system under the action of an axial force F. [consider the shape of joint to remain circular, Y is young's modulus]

A. $\frac{3FL}{4AY}$

B. $\frac{3FL}{8AY}$

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

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

4. A point mass m is suspended usin two wires of different material as shown in the figure. If corss-section of wire-1 and sore-2 are

$3mm^2$ and $\sqrt{3}mm^2$ respectively, which of the following is correct?

A. stress in wire $-1 >$ stress in wire-2

B. stress in wire $-1 <$ stress in wire-2

C. stress in wire -1= stress in wire-2

D. value of Young's modulus of both the wires is needed

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5. When a steel wire fixed at one end is pulled by a constant force F at its other end , its length increases by l.Which of the following statements is not correct?

A. Work done by the external forces is Fl

B. Some heat is prdoducedin the wire in the process.

C. The elastic potentital energy of the wire is Fl/2

D. The heat produced is equal to half of the elastic potential energy of the wire.

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6. Two bodies of masses 2 kg and 3 kg are connected by a metal wire of cross-section 0.04 mm^2 and are placed on a frictionless horizontal surface. Breaking stress of metal wire is 2.5 Gpa. The maximum force F that can be applied to 3kg block so that wire does not break is

A. 100N

B. 150N

C. 200N

D. 250N

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7. A substance breaks down under a stress of 10^5 Pa. If the density of the substance is $2 \times 10^3 \frac{kg}{m^3}$, find the minimum length of the wire made of this substance which will break under its own weight $\left(g = 10\frac{m}{s^2}\right)$

A. 10m

B. $2.5m$

C. 4m

D. 5m

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8. A rod of mass, m uniform corss sectional area A and length L is accelerated by applying force F as shown in figure on a smooth surface. If yougs' modulus of elasticity of the material of rod is Y. (Consider x as measured from the right end)

A. Tension in rod as a function of distance x is $\frac{Fx}{2L}$

B. Strain in rod is $\frac{F}{2AY}$

C. Elastic potential energy stored in the rod is $\frac{F^2L}{6AY}$

D. There is no stress in rod,.

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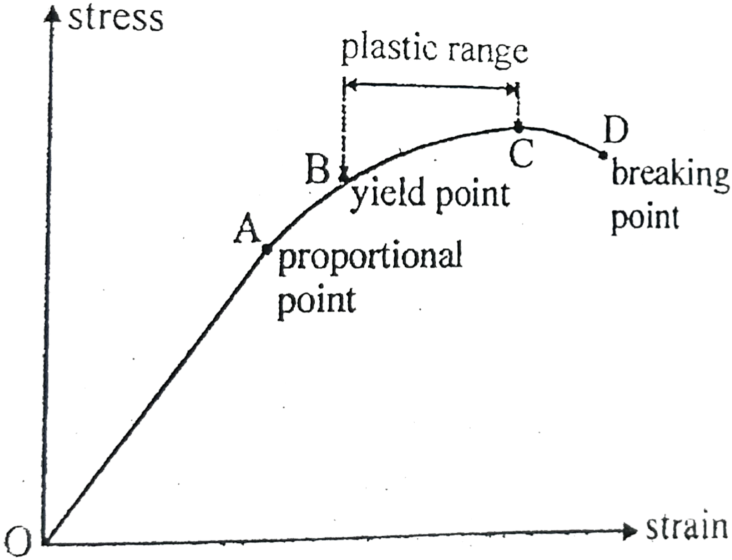
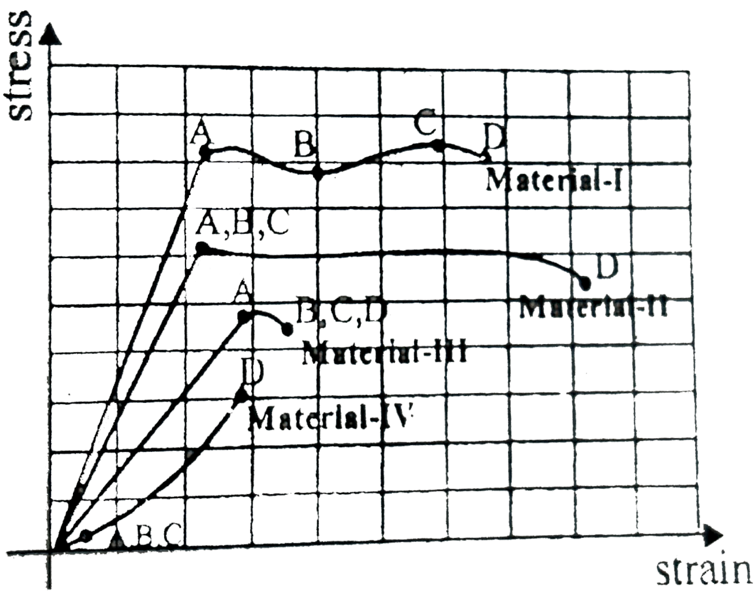
9. Figure shows the relationship between tensile stress and strain for a typical material. Below proportional point A, stress is directly proportional to strain which means Young's moudulus (Y) is a constant. In this region the material obeys Hooke's law.



Provided the strain is below the yield point 'B' the material returns to its original shape and size when the force is removed. Beyond the yield point, the material retains a permancnt deformation after the stress is removed. For stresses beyond the yeld point, the material exhibit plastic flow, which means that it continues to elongate for little increases in the stress. Beyond C a local constriction occurs. The material fractures at D (i.e. breaking point). The graph below shows the stress-strain curve for 4 different materials.



If you bough a new shoe which bites in the beginning and later on fits perfectly, then the material used to making the shoe is

A. Material-I

B. Material-II

C. Material-III

D. Material-IIV

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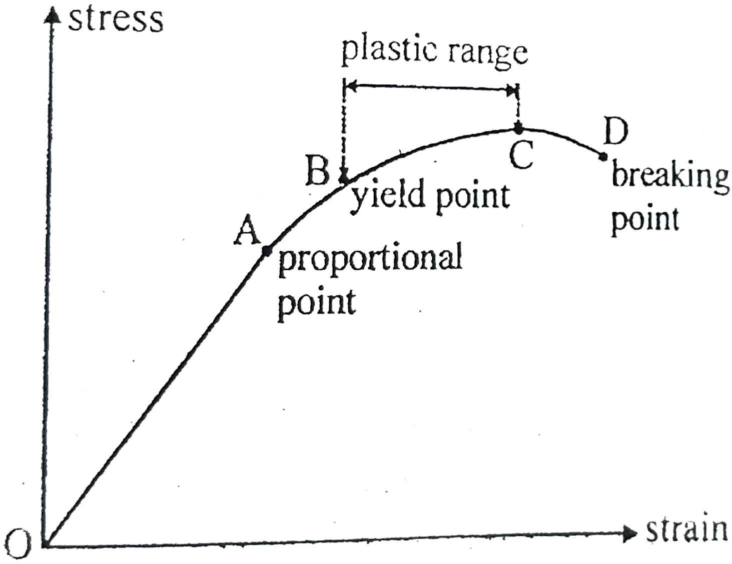

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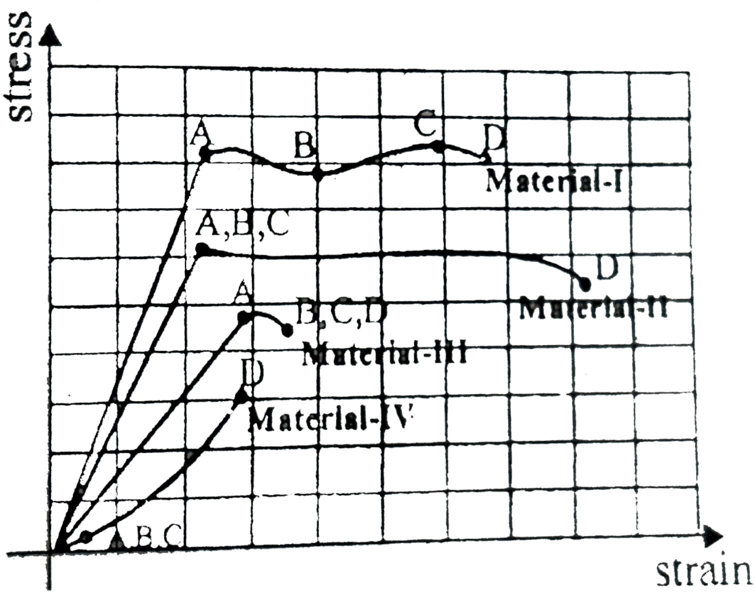

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A. Material-I

B. Material-II

C. Material-III

D. Material-IIV

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Basic Maths (Trigonometry)

1. Convert the angle from degree to radian :

$(a)\quad 30^\circ \qquad (b)\quad 45^\circ$

$(c)\quad 60^\circ \qquad (d)\quad 90^\circ$

$(e)\quad 120^\circ \qquad (f)\quad 135^\circ$

$(g)\quad 210^\circ \qquad (h)\quad 270^\circ$

$(i)\quad 315^\circ$

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2. Convert the following angle from radian to degree

$(a)\,\frac{\pi}{4}\text{red} \qquad (b)\,\frac{\pi}{6}\text{rad}$

$(c)\,\frac{\pi}{3}\text{rad} \qquad (d)\,\frac{3\pi}{4}\text{rad}$

$(e)\,\frac{7\pi}{6}\text{rad} \qquad (f)\,\frac{5\pi}{4}\text{rad}$

$(g)\,\frac{5\pi}{2}\text{rad} \qquad (h)\,\frac{7\pi}{4}\text{rad}$

$(i)\,\frac{5\pi}{6}$

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3. Find the value of following :-

$(a)\sin 150^\circ \quad (b)\sin 135^\circ$

$(c)\cos 120^\circ \quad (d)\tan 225^\circ$

$(e)\cos 240^\circ \quad (f)\sin 210^\circ$

$(g)\sin 315^\circ \quad (h)\sin 300^\circ$

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4. Find the value of the following :-

$(a)\sin\left(\frac{\pi}{6}\right) \quad (b)\cos\left(\frac{\pi}{4}\right)$

$(c)\tan\left(\frac{\pi}{3}\right) \quad (d)\cos\left(\frac{\pi}{2}\right)$

$(e)\cot\left(\frac{3\pi}{4}\right) \quad (f)\sin\left(\frac{5\pi}{6}\right)$

$(g)\sin\pi \quad (h)\cos\pi$

$(i)\sin\left(\frac{\pi}{2}\right) \quad (j)\sin\left(\frac{3\pi}{2}\right)$

$(k)\cos\left(\frac{3\pi}{2}\right)$

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5. Find the values of the following :-

$(a)\sin 390^\circ$ $(b)\cos 405^\circ$

$(c)\tan 420^\circ$ $(d)\cos 450^\circ$

$(e)\sin\left(2\pi + \frac{\pi}{6}\right)$ $(f)\cos\left(2\pi + \frac{\pi}{3}\right)$

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6. Find the values of the following :-

$(a)\sin(-30^\circ)$ $(b)\cos(-45^\circ)$

$(c)\sin(-60^\circ)$ $(d)\tan(-45^\circ)$

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7. Find the values of all the the T-Rations if :-

(a)$\cos t\widehat{a} = \frac{7}{25}$ $(b)\sin\theta = \frac{5}{13}$

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8. Calculate the value of following :-

$(a)\cos 75^\circ \quad (b)\sin 15^\circ$
$(c)\sin 75^\circ \quad (d)\cos 105^\circ$

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9. The values of $\sin\theta_1, \cos^2\theta_2$ and $\tan\theta_3$ are given as $0.5, \ -0.5$ and 3 (not in order), for some angles θ_1, θ_2 and θ_3. Choose incorrect statement.

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10. Statement 1 : For very small angle θ, we may use approximation $\sin\theta \approx \theta \approx \tan\theta.$ and $Statement2: F$ or $verysmall\angle$theta,` the hypotenuse and the base become approximately of the same length.

A. (1) Statement-1 is True, Statement-2 is True,

Statement-2 is a correct explanation for

Statement-1.

B. Statement-1 is True, Statement-2 is True,

Statemen-2 is not a correct explanation for

Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statemen-1 is False, Statement-2 is True.

Answer: A

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11. What is value of expression $2(\sin 15^\circ + \sin 75^\circ)^2$?

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12. Find the value of

$5(\sin 100^\circ \cos 27^\circ + \sin 27^\circ \cos 100^\circ)$.

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13. A normal human cye can see an object making an angle of 1.8° at the eye. What is the

approximate height of object which can be seen by an eye placed at a distance of 1 m from the object.

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14. The maximum and minimum values of expression $(4 - 2\cos\theta)$ respectively are

A. 4 and 0

B. 4 and 2

C. 6 and 0

D. 6 and 2

Answer: D

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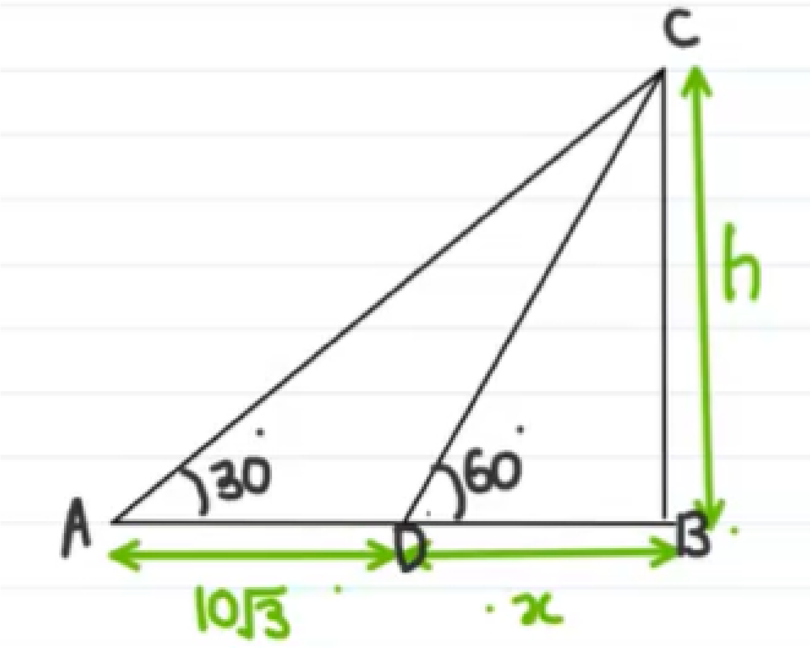
15. Angle of elevation is the angle which line of sight makes with the horizontal. Angle of elevation of the top of a tall building is 30° from a place A and becomes 60° from another place B that is $10\sqrt{3}$ m from A towards the building as shown in the figure. Height of the building is close to



A. 7.5 m

B. 10 m

C. 12.5 m

D. 15 m

Answer: D

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16. If $\tan\theta = \frac{24}{7}$ and $\sin\theta$ is negative then value of $\cos\theta$ will be

A. $\frac{7}{25}$

B. $-\frac{7}{25}$

C. $\frac{24}{25}$

D. $-\frac{24}{25}$

Answer: B

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17. Suggest suitable match between fuction given in the first column and its description given in the second column.

Column-I	Column-II
$(A)\sin(390^\circ)$	(P) Positive
$(B)\sin(-30^\circ)$	(Q) Negative
$(C)\cos 120^\circ$	(R) Zero
$(D)\tan(-120^\circ)$	(S) Modulus is greater

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18. Depending on in which quadrant an angle θ lies, functions $\cos\theta$ and $\sin\theta$ may be positive or negative. In the second column of the given lable are specified whether these functions are positive or negative and in the first column are specified quadrants.

Column-I	Column-II
(A) First	$(P)\sin\theta$ is positive
(B) second	$(Q)\sin\theta$ is negative
(C) Third	$(R)\cos\theta$ is negative
(D) Fourth	$(S)\tan\theta$ and $\sin\theta$ both are negative
	$(T)\sec\theta$ is negative and $\sin\theta$ is positive

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19. An airplane takes off at an angle 30° with the horizontal ground treveling at the speed of $180km/h$. If it continuous to fly with the same velocity in the same direction, how long will it take to reach an altitude of $9km$ above the ground?

A. 5 minutes

B. 6 minutes

C. 8 minutes

D. 9 minutes

Answer: B

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20. Position-time relationship of a particle executing simple harmonic motion is given by equation

$x = 2\sin\left(50\pi t + \frac{2\pi}{3}\right)$ where x is in meters and time t is in seconds.

What is the position of particle at t=0 ?

A. $\sqrt{2}m$

B. $\sqrt{3}m$

C. 1 m

D. 2m

Answer: B

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21. Position-time relationship of a particle executing simple harmonic motion is given by equation

$x = 2\sin\left(50\pi t + \frac{2\pi}{3}\right)$ where x is in meters and time t is in seconds.

What is the position of particle at t=1s ?

A. $\sqrt{2}m$

B. $\sqrt{3}m$

C. 1m

D. 2 m

Answer: B

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22. Position-time relationship of a particle executing simple harmonic motion is given by equation

$x = 2\sin\left(50\pi t + \frac{2\pi}{3}\right)$ where x is in meters and time t is in seconds.

What is the position of particle at t=0.5s ?

A. $\sqrt{2}m$

B. $\sqrt{3}m$

C. $-\sqrt{3}m$

D. 2 m

Answer: C

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1. For a straight line $y = \frac{4}{3}x - 4$. Choose correct alternate(s)

A. $\frac{dy}{dx} = \tan 53^\circ$

B. $\frac{dx}{dy} = \tan 37^\circ$

C. $x - \text{Intercept is } \ 3$

D. length of linne between x-axis and y-axis is 5 units

Answer: A::B::C::D

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2. The maximum & minimum value of $y = x + \frac{1}{x}$ in interval $\left[\frac{1}{3}, \frac{4}{3}\right]$

A. 2,-2

B. $\frac{10}{3}, 2$

C. $\infty, \ -\infty$

D. None of these

Answer: B

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3. Which of the following statements is/are correct?

A. $\frac{d}{dx}\left(x^2+2\right)^2 = 4x$

B. $\frac{d}{dx}\left(e^{-2x}\right) = -2e^{-2x}$

C. $\frac{d}{dx}\{\sin(ax+b)\} = a\cos(ax+b)$

D. $\frac{d}{dx}\left(x^3+3x+1\right)^2 = 2\left(3x^2+3\right)\left(x^3+3x+1\right)$

Answer: B::C::D

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4. Radius of a spherical balloon is increasing with respect to time at the rate of $2/\pi \quad m/s$. Find the rate of change in volume (in m^3/s) of the balloon when radius is 0.5 m?

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5. If derivative of $y = 8\sqrt{\sin x}$ is $\frac{dy}{dx} = \frac{k \cos x}{\sqrt{x}}$, what is numerical value of constant k?

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6. Given that $y = \sin 3x + \frac{4}{3}\cos 3x$. What is the maximum rate of change in y with respect to x ?

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7. Find the first derivatives

(i) If $y = x^{-1/3}, \quad \text{find } \dfrac{dy}{dx}$

(ii) If $x = t^6, \quad \text{find } \dfrac{dx}{dt}$

(iii) If $z = u^3, \quad \text{find } \dfrac{dz}{du}$

(iv) If $f = r^2 + r^{1/3}, \quad \text{find } \dfrac{df}{dr}$

(v) If $x = 2t^3 - 3t^2 + 5t - 6, \quad \text{find } \dfrac{dx}{dt}$

(vi) If $y = 3x^2$

(vii) If $y = x \ln x$

(viii) If $y = x \sin x$

(ix) If $y = \sin x \cos x$

(x) If $y = \sin^2 x + \cos^2 x$

(xi) If $y = \cos 2x$

(xii) If $v = \dfrac{4}{3}\pi r^3, \quad \text{find } \dfrac{dv}{dr}$

(xiii) If $s = 4\pi r^2, \quad \text{find } \dfrac{ds}{dr}$

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8. Differentiation of cos $\left(\sqrt{x}\right)$ with respect to x is

A. $-\sin\sqrt{x}$

B. $-\frac{1}{2\sqrt{x}}\sin\sqrt{x}$

C. $-\sqrt{x}\sin\sqrt{x}$

D. $-\frac{1}{\sqrt{x}}\sin\sqrt{x}$

Answer: B

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9. The pressure P and volume V of a gas are related as $PV^{3/2}=K$ where K is a constant. The percentage increase in the pressure for a diminution of 0.5% of the volume is

A. 0.25%

B. 0.75%

C. 1.50%

D. 0.50%

Answer: B

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10. Given a function $y = x^2 - 2\sqrt{x}$. What is rate of change in y with respect to x when x=l?

A. Zero

B. 1

C. 1.5

D. -1.5

Answer: B

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11. The height (in meters) at any time t (in seconds) of a ball thrown vertically varies according to equation $h(t) = -16t^2 + 256t$. How long after in seconds the ball reaches the hightest point

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12. An ideal gas is subjected to a thermodynamic process $PV^{2/5} = 0.40$ where P is in Pa and V is in m^3. What is the slope of the P-V curve with volume plotted against x-axis at V=1 m^3?

A. -1

B. -3.5

C. -2.5

D. None of these

Answer: A

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13. The slope of the tangent to the curve

$y = \ln(\cos x)$ at $x = \frac{3\pi}{4}$ is

A. 1

B. -1

C. $ln\sqrt{2}$

D. $\frac{1}{\sqrt{2}}$

Answer: A

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14. A stone is dropped into a quiet lake and waves move in circles spreading out radially at the speed of $0.5m/s$. At the instant when the radius of the circular wave is $\frac{4}{\pi}$ m, how fast is the enclosed area (in$m^{2/s}$) increasing ?

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15. The charge flowing throug a conductor beginning with time to=0 is given by the formula $q = 2t^2 + 3t + 1$ (coulombs). Find the current $i = \frac{dq}{dt}$ at the end of the 5th seconds.

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16. Differentiate the following w.r.t.x

A. $y = x^2 + 5$

B. $y = 2e^3$

C. $y = (x+5)^{-1/2}$

D. $y = 5x^{3/2}$

Answer: A::B::C

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17. Calculate $\frac{dy}{dx}$ for the following :-

A. $y = \cos x^3$

B. $y = \sin\left(\frac{x}{2}\right)$

C. $y = \log_e 2x$

D. $y = e^{-x}$

Answer: A::B::C

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18. If $y = e^x \sin x$ then calculate $\frac{dy}{dx}$

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19. Position of particle moving along x-axis is given as $x = 2 + 5t + 7t^2$ then calculate :

A. Velocity $\left(i.\ e\frac{dx}{dt}\right)$ of particle

B. Initial velocity $\left(i.\ e\frac{dx}{dt} \quad \text{att} = 0\right)$

C. Velocity at $t = 2\,\text{sec}$

D. Accleration $\left(i.\ e\frac{d^2x}{dt^2}\right)$ of particle

Answer: A::B::C::D

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20. A metallic disc is being heated. Its area (in m^2) at any time t (in sec) is given by $A = 5t^2 + 4t$. Calculate the rate of increase in area at $t = 3\,\text{sec}$.

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21. If the velocity of a paraticle moving along x-axis is given as $v = \left(4t^2 + 3t = 1\right)m\,/\,s$ then acceleration of the particle at $t = 1\,\text{sec}$ is :

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22. The displacement x of particle moving in one dimension, under the action of a constant force is related to the time t by the equation

$t = \sqrt{x} + 3$

where $x is \in meters$ and $t \in \sec onds$. Find

(i) The displacement of the particle when its velocity is zero , and

(ii) The work done by the force in the first $6 \sec onds$.

A. zero

B. 12m

C. 6m

D. 18m

Answer: A

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23. A car moves along a straight line whose equation of motion is given by

$s = 12t + 3t^2 - 2t^3$

where s is in metres and t is in seconds. The velocity of the car at start will be :-

A. 7 m/s

B. 9 m/s

C. 12 m/s

D. 16 m/s

Answer: C

Watch Video Solution

24. A particle moves along X-axis in such a way that its coordinate X varies with time t according to the equation $x = \left(2 - 5t + 6t^2\right)m$. The initial velocity of the particle is

A. -5 m/s

B. -3 m/s

C. 6 m/s

D. 2 m/s

Answer: A

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25. Relation between displacement x and time t is $x = 2 - 5t + 6t^2$, the initial acceleration will be :-

A. $-3ms^{-2}$

B. $12ms^{-2}$

C. $2ms^{-2}$

D. $-5ms^{-2}$

Answer: B

Watch Video Solution

26. The displacement 'x' of a particle moving along a straight line at time t is given by $x = a_0 + a_1 t + a_2 t^2$. The acceleration of the particle is :-

A. a_1

B. a_2

C. $2a_2$

D. $3a_2$

Answer: C

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27. If the distance covered by a particle is given by the relation $x = at^2$. The particle is moving with : (where a is constant)

A. constant acceleration

B. zero acceleration

C. variable acceleration

D. none of these

Answer: A

Watch Video Solution

28. The displacement of a particle is given by

$$x = a_0 + \frac{a_1 t}{3} - \frac{a_2 t^2}{2}$$

where a_0, a_1 and a_2 are constants. What is its acceleration ?

A. $a_1 - a_2$

B. $-a_2$

C. $+a_2$

D. $a_2 - a_1$

Answer: B

Watch Video Solution

29. If $y=\frac{x^2}{(x+1)}$ then $\frac{dy}{dx}$ is : $-$

A. $\frac{x(3x+2)}{(x+1)}$

B. $\frac{-x(x+2)}{(x+1)^2}$

C. $\frac{x(x+2)}{(x+1)^2}$

D. $\frac{x(x+2)}{(x+1)}$

Answer: C

Watch Video Solution

30. If $v=(t+2)(t+3)$ then acceleration $\left(i.\, e\frac{dv}{dt}\right)$ at t=1 sec.

A. $5m/s^2$

B. $7m/s^2$

C. $2m/s^2$

D. None of these

Answer: B

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31. If $y=\log_e x+\sin x+e^x$ then $\dfrac{dy}{dx}$ is

A. $\dfrac{1}{x}+\sin x+e^x$

B. $\dfrac{1}{x}-\cos x+e^x$

C. $\dfrac{1}{x}+\cos x+e^x$

D. $\dfrac{1}{x}-\sin x$

Answer: C

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32. $\dfrac{d}{dx}\left(e^{100}\right)$=.....................

A. e^{100}

B. 0

C. $100^{e^{99}}$

D. None of these

Answer: B

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33. $\frac{d}{dx}(\sin 120^{\circ})$=............

A. $\cos 120^{\circ}$

B. $120\cos 120^{\circ}$

C. 0

D. None of these

Answer: C

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34. If $y = x^3 \cos x \quad \text{then} \quad \frac{dy}{dx}$=.........................

A. $x^2(3 \cos x - x \sin x)$

B. $x^2(3 \cos x + x \sin x)$

C. $3x^2. \cos x + x^3 \sin x$

D. None of these

Answer: A

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35. If $v = (t^2 - 4t + 10^5)$m/s where t is in second. Find acceleration at t=1 sec.

A. 0

B. $2m / s^2$

C. $-2m / s^2$

D. None of these

Answer: C

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36. If $y = \sin x + \cos x \text{ then } \frac{d^2y}{dx^2}$ is :-

A. $\sin x - \cos x$

B. $\cos x - \sin x$

C. $-(\sin x + \cos x)$

D. None of these

Answer: C

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37. If $v \propto t^{5/2}$ then

A. $v \propto t^{3/2}$

B. $a \propto \sqrt{t}$

C. Both above

D. `v prop sqrt(t)

Answer: C

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38. If radius of a spherical bubble starts to increase with time t as $r = 0.5t$. What is the rate of change of volume of the bubble with time $t = 4s$?

A. 8π units/s

B. 4π units/s

C. 2π units/s

D. π units/s

Answer: A

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39. The radius of spherical bubble is changing with time. The rate of change of its volume is given by :

A. $4\pi r^2 \frac{dr}{dt}$

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

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

D. $\frac{8}{3}\pi r\frac{dr}{dt}$

Answer: A

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40. Given that $y = \frac{10}{\sin x + \sqrt{3}\cos x}$.Minimum value of y is

A. zero

B. 2

C. 5

D. $10/\left(1+\sqrt{3}\right)$

Answer: C

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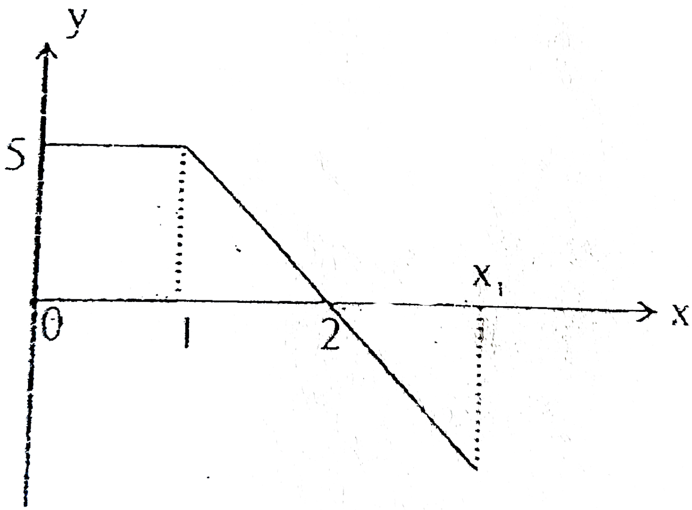
Basic Maths (Integration)

1. Find the value of x_1, so that $\int_0^{x_1} y dx = 5$



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2. Evaluate the following indefinite integrals.

(a) $\int \frac{dx}{\sqrt{x}}$

(b) $\int \frac{dx}{(2x+3)}$

(c) $\int \sin(2\pi x + 30^\circ) dx$

(d) $\int \sin x \cos x dx$

(e) $\int (3x^3 - 5x^2 + 2) dx$

(f) $\int \left(2e^{-x/3} dx\right.$

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3. Evaluate the following definite integrals.

(a) $\int_0^3 (x^2 + 1) dx$

(b) $\int_2^3 (x^3 - 4x^2 + 5x - 10) dx$

(c) $\int_0^{\pi/4} (\cos x - \sin x) dx$

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4. Integrate the following

(1) $\int x^{-\frac{3}{2}}dx$

(2) $\int \sin 60^{\circ} dx$

(3) $\int \frac{1}{10x}dx$

(4) $\int \left(2x^3 - x^2 + 1\right)dx$

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5. (5)Value of $\int_0^2 3x^2 dx + \int_0^{\pi/2} \sin x dx$is

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6. If the velocity of a particle moving along x-axis is given as $v = \left(3t^2 - 2t\right)$ and t=0, x=0 then calculate position of the particle at t=2sec.

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7. Integrate the following :

(i) $\int\left(t-\frac{1}{t}\right)^2 \mathrm{dt}$

(ii) $\int \sin(10t-50) \mathrm{dt}$

(iii) $\int e^{(100t+6)} \mathrm{dt}$

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8. Starting from rest, the acceleration of a particle is $a=2(t-1)$. The velocity (i.e.$v=\int \mathrm{a\,dt}$) of the particle at t=10 s is :-

A. 15 m/s

B. 25 m/s

C. 5 m/s

D. 80 m/s

Answer: D

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9. The intial velocity of a particle is u (at t=0) and the acceleration is given by f=at. Which of the following relations is valid ?

A. $v = u + at^2$

B. $v = u + \frac{at^2}{2}$

C. $v = u + \text{at}$

D. v=u

Answer: B

Watch Video Solution

10. An onject intially att rest moves along x-axis subjected to an acceleration which veries with time according to relation $a = 2t + 5$. Its velocity after 2 seconds will be :-

A. $18ms^{-1}$

B. $9ms^{-1}$

C. $12ms^{-1}$

D. $14ms^{-1}$

Answer: D

Watch Video Solution

11. The value of integral $\int_2^4 \frac{dx}{x}$ is :-

A. $3\log_e 2$

B. $\log_e 2$

C. $\log_e 4$

D. $2\log_e 8$

Answer: B

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12. Area bounded by curve $y = \sin x$, whit x-axis, when x varies from 0 to $\frac{\pi}{2}$ is :-

A. 1 unit

B. 2 units

C. 3 unit

D. 0

Answer: A

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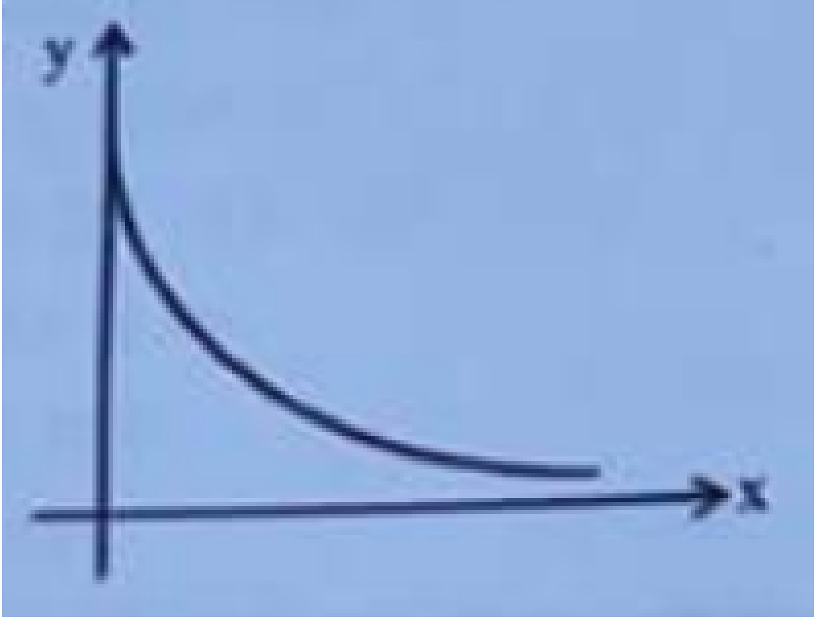
Basic Maths (Graphs))

1. Which of the following equation is best representation of following graph's?



A. $y = \frac{2}{x}$

B. $y = e^{-x}$

C. $y = \frac{1}{x^2}$

D. $y = x^2$

Answer: B

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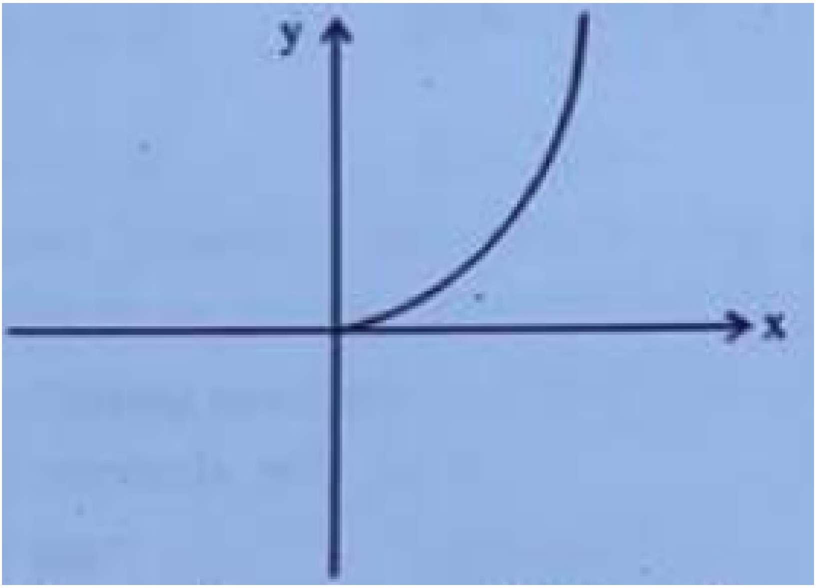
2. Which of the following equation is best representation of given graph's?



A. $y = x^2$

B. $x = y^2$

C. $y = e^x$

D. y=x

Answer: A

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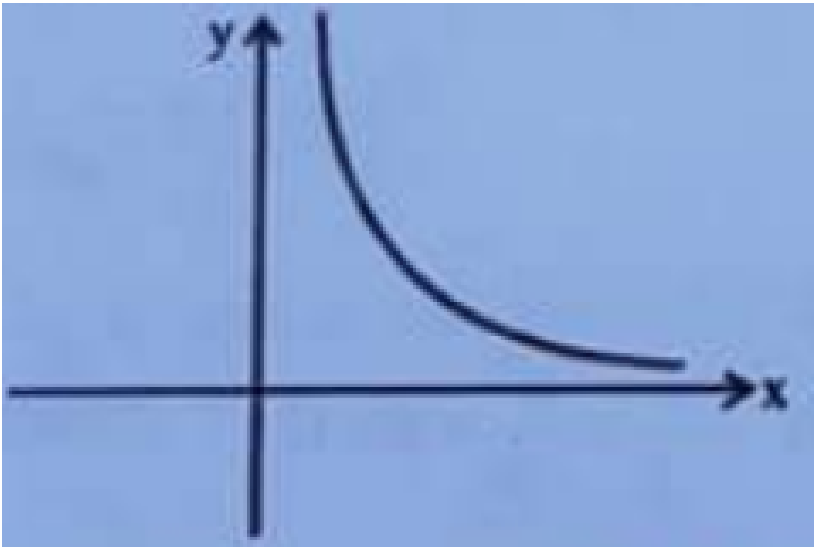
3. Which of the following equation is best representation of given graph's?



A. $y = e^{-x}$

B. $y = e^{x}$

C. $y = \frac{1}{x}$

D. None of these

Answer: C

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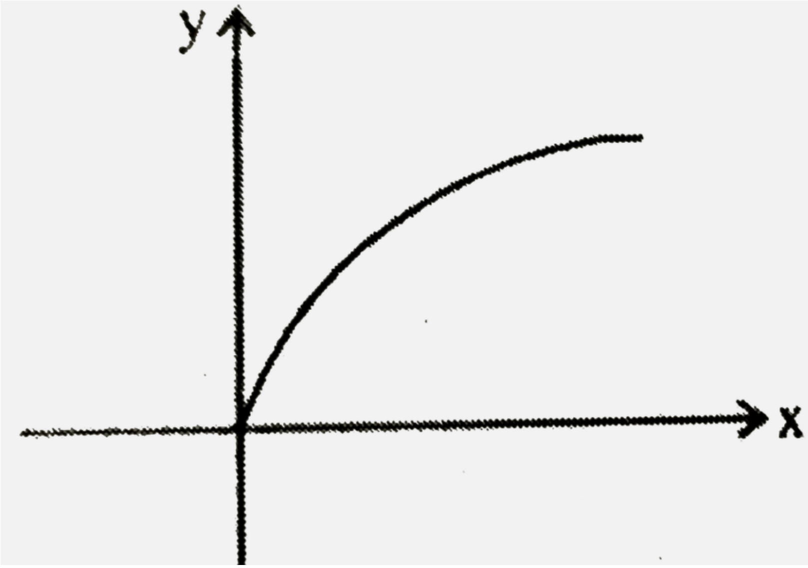
4. Which of the following is correct for given graph



A. $y = 2x^2$

B. $x = 2y^2$

C. $y = -2x^2$

D. $x = -2y^2$

Answer: B

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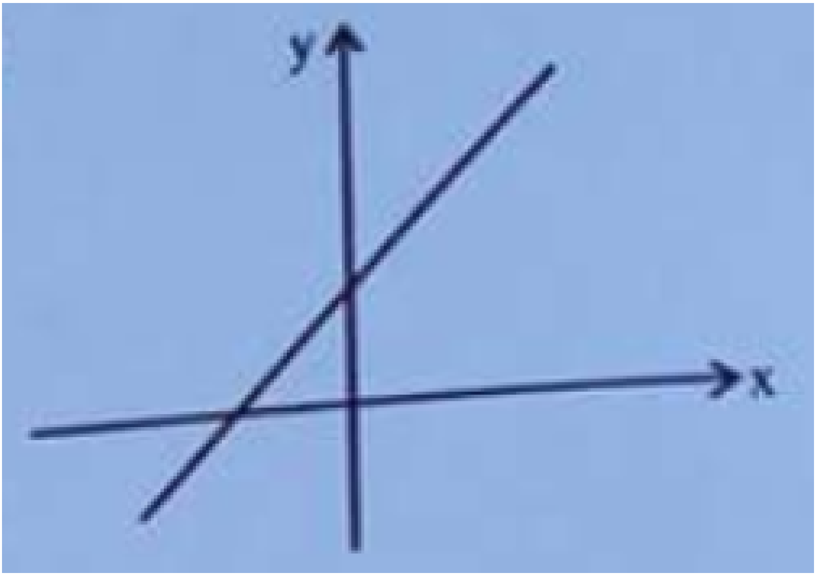
5. Which of the following equation is best representation of given graph's?



A. $y = x + 1$

B. $y = 2x - 1$

C. $y = -x - 1$

D. $y = -2x + 3$

Answer: A

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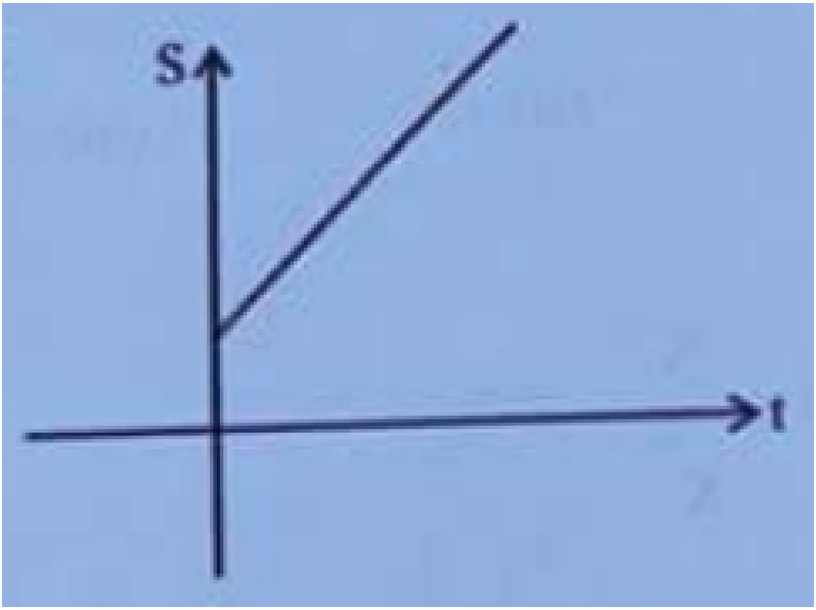
6. Which of the following equation is best representation of given graph's?



A. $S = 2t - 3$

B. $S = 2t + 3$

C. $S = 2t$

D. None of these

Answer: B

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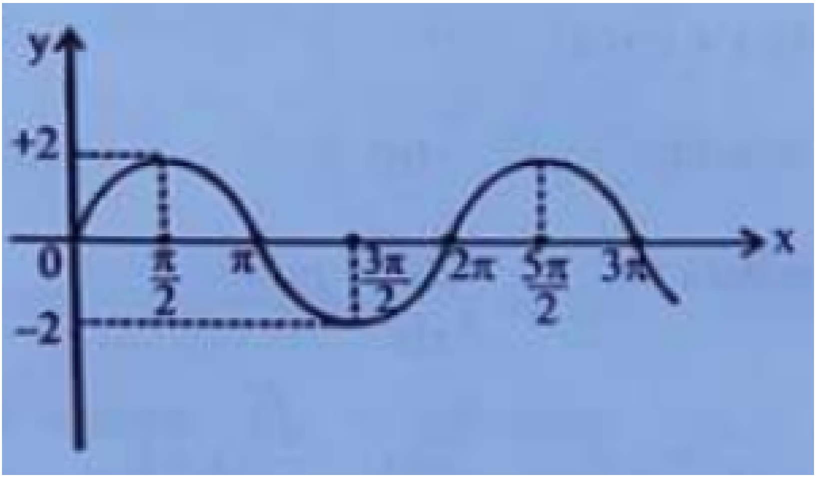
7. Which of the following equation is best representation of given graph's?



A. $y = 2\sin x$

B. $y = 2\cos x$

C. $y = \sin 2x$

D. $y = \cos 2x$

Answer: A

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8. Which of the following equation is best representation of given graph's? ltimg src="https://d10lpgp6xz60nq.cloudfront.net/physics_images/ALN_PHY_R04_E0

width="80%"gt

A. $x + y = 2$

B. $x^2 + y^2 = 4$

C. $x^2 + y^2 = 2$

D. $x^2 + y = 2$

Answer: B

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9. $y = 2x - 1$

A.

B.

C.

D.

Answer: A

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10. $y \propto x^2$

A.

B.

C.

D.

Answer: A

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11. $y = \sin x$

A.

B.

C.

D.

Answer: A

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12. y=5

A.

B.

C.

D.

Answer: D

View Text Solution

13. $y = 2x$

A.

B.

C.

D.

Answer: B

Watch Video Solution

14. $y = 2e^{x}$

A.

B.

C.

D.

Answer: B

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15. Which of the following statement is not correc for following straight line graph :-

A. Line (2) has negative y intercept

B. Line (1) has positive y intercept

C. Line (2) has positive slope

D. Line (1) has negative slope

Answer: D

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16. If velocity v varies with time(t) as $v = 2t - 3$, then the plot between v and t is best represented by :

A.

B.

C.

D.

Answer: B

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17. The slope of graph in figure at point A, B and C is m_A, m_B and m_C respectively, then :

A. $m_A > m_B > m(C)$

B. $m_A < m_B < m_C$

C. $m_A = m_B = m_C$

D. $m_A = m_C < m_B$

Answer: B

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18. The slope of straight line $\sqrt{3}y = 3x + 4$ is

A. 3

B. $\sqrt{3}$

C. $\frac{1}{\sqrt{3}}$

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

Answer: B

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19. If velocity v varies with time t as $v = 2t^2$, then the plot between v and t^2 will be given as :

A.

B.

C.

D.

Answer: A

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20. The equation of straight line shown in figure is :

A. $6x + 8y = 15$

B. $4x + 3y = 18$

C. $2y + 6x = 7$

D. $3y + 4x = 24$

Answer: D

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21. The equation $\sqrt{x} = 2y$, represents that graph between x and y is a :-

A. Straight line

B. Parabola

C. Hyperbola

D. Circle

Answer: B

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22. The co-ordinates of a particle moving in xy-plane vary with time as $x = \mathrm{at}^2, y = \mathrm{bt}$. The locus of the particle is :

A. Parabola

B. Circle

C. Straight line

D. Ellipase

Answer: A

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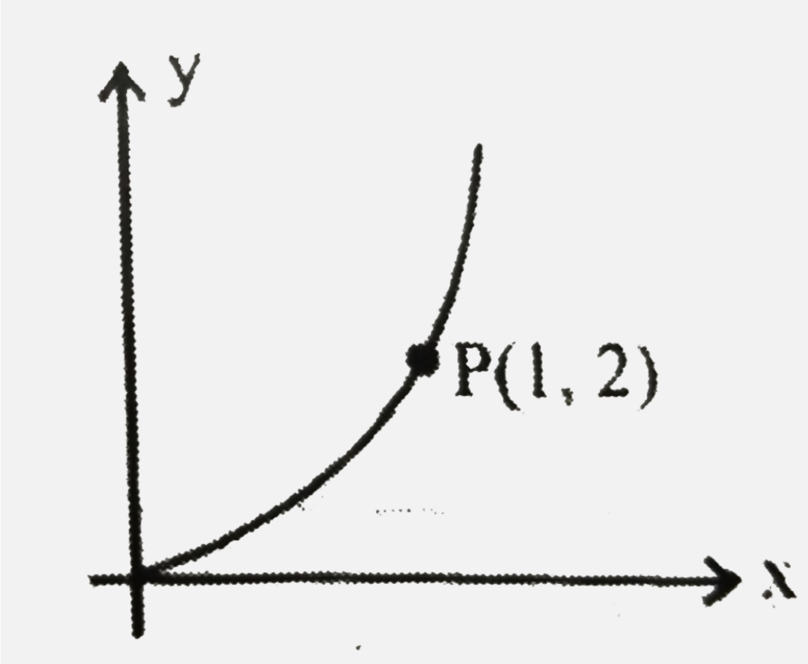
23. The equation of graph shown in figure is $y = 2x^2$. The slope of graph at point P is :



A. 1

B. 2

C. 3

D. 4

Answer: D

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24. At x=0, value of $\frac{dy}{dx}$ is :

A. 0

B. 1

C. -1

D. Infinite

Answer: D

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25. At point P, the value of $\frac{dy}{dx}$ is :

A. Zero

B. Positive

C. Negative

D. Infinite

Answer: A

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26. Magnitude of slope i.e. steepness of graph shown in figure

A. First increases and then decreases

B. First decreases and then increases

C. Decreases continuously

D. Increases continuously

Answer: B

Watch Video Solution

27. The graph of function $y = 1 + \cos x$ will be

A.

B.

C.

D. None of these

Answer: A

28. Graph of an exponential function $y = 2 + ae^{-x}$ is shown in figure. What is the value of a ?

29. Which of the following graph yield a straight line?

A. Graph : $\sqrt{y}$ versus x for the equation $y = 4x^2$

B. Graph : y versus $\sqrt{x}$ for the equation $y = 36\sqrt{x}$

C. Graph : y versus $1/x$ for the equation $y = (4/x) - 2$

D. Graph : K versus v for equation $K = hv - \phi_0$ where h and ϕ_0 are constants.

Answer: A::B::C::D

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30. An insect crawls startin form origin of a x-y plane along a line making angle of 30° with the positive x-direction at a speed of 2 cm/s. What is its distance from the x-axis 8 s after it starts crawling ?

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Basic Maths (Co-ordinate & Algebra)

1. Find the value of :-

(i)$\sqrt{4}$

(ii)$\sqrt{9}$

(iii)$\sqrt{16}$

(iv)sqrt(36)`

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2. Find the value of :-

(i)$\frac{1}{\sqrt{4}}$

(ii)$\frac{1}{\sqrt{16}}$

(iii)$\frac{1}{\sqrt{64}}$

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3. Solve the equation $2x^2 + 5x - 12 = 0$

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4. If $10a^2 - 27a + 5 = 0$, find values of a

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5. If $y^2 - 2y - 3 = 0$, find the values of y.

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6. Find the values of :-

(1)$(8)^{1/3}$

(2)$(64)^{1/2}$

(3)$4^{5/2}$

(4)$(36)^{3/2}$

(5)$(27)^{2/3}$

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7. Find the values of :-

(i)2^4

(ii)4^3

(iii)3^2

(iv)5^3

(v)9^4

(vi)7^3

Watch Video Solution

8. Solve the following :-

(i)$2+4-9$

(ii)$3+6-10$

(iii)$12-5-3$

(iv)$100-50+40$

(v)$5^3-3^4-2^2$

(vi)$6^4+2^2-8^3$

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9. Simplify :-

(i) $\frac{10}{4}$

(ii) $\frac{200}{50}$

(iii) $\frac{27}{24}$

(iv) $\frac{55}{22}$

(v) $\frac{64}{16}$

(vi) $\frac{8}{6}$

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10. Simplify :-

(i) $\frac{6}{\sqrt{2}}$

(ii) $\frac{\sqrt{3}}{3}$

(iii) $\sqrt{\frac{3}{4}}$

(iv) $\frac{6}{\sqrt{2}}$

(v) $\frac{\sqrt{5}}{10}$

(vi) $\sqrt{\frac{16}{2}}$

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11. Solve the following :-

(i) $\sqrt{\frac{\sqrt{2}}{3}} \times \sqrt{\frac{9}{2}}$

(ii) $\sqrt{\frac{5}{6}} \times \sqrt{\frac{3}{5}}$

(iii) $\sqrt{\frac{3}{5}} \div \sqrt{\frac{27}{125}}$

(iv) $\sqrt{\frac{4}{9}} \div \sqrt{\frac{64}{81}}$

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12. Solve the following :-

(i) $2 \times 4 \times 5$

(ii) $9 \times 3 \times 4$

(iii) $6 \times \frac{1}{5} \times 125$

(iv) $15 \times 6 \times \frac{1}{10}$

(v) $3 \times 4 \times \frac{1}{16} \times 15$

(vi) $20 \times 10 \times \frac{1}{500}$

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13. If a=10, b=4, c=6, d=9, find :-

(i) $\frac{ad}{bc}$

(ii) $ad \times bc$

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14. Find out area of triangle OAB and BCD shown in figure :-

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15. What is the distance OA for the square shown in figure :-

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16. Given $KE = \frac{1}{2}mv^2$. If $m = 10kg, v = 5m/s$ then find the value of KE?

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17. Calculate the value of x in the following equation :-

(i)$x^2 - 5x + 6 = 0$

(ii)$x^2 - 9x + 20 = 0$

(iii)$x^2 - 15x + 56 = 0$

(iv)$x^2 - 16x + 63 = 0$

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18. x-y relation is given by $y = x^n$ calculate the value of n in the following :-

(i)$y = \frac{x^2}{x^{2/3}}$

(ii)$y = \frac{x^{3/2}}{x^1}$

(iii)$y = \frac{x^{1/2}}{x^{1/2}}$

(iv)$y = \frac{x^{3/2}}{\sqrt{x}}$

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19. $4\sqrt{6} \times 3\sqrt{24}$= :-

A. (1) 124

B. (2)134

C. (3) 144

D. (4) 154

Answer: C

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20. If $y = \ \propto x^4$

When$x = 1000, y = y_1$

then find the value of x so that value of y can be $2y_1$,

A. 2000

B. 1190

C. 1410

D. 4000

Answer: B

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21. If $y\frac{x^2}{3} = \text{constant}$

when x=x_(1), $theny = 300, thenf \in dtheywhen$x=(8x_(1))/(27)`

A. 450

B. 375

C. 675

D. 405

Answer: C

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22. Givne $\frac{x}{y} = \frac{5}{6}$

now x is reduced by 62 and the ratio of x and y becomes $\frac{2}{3}$ then find x and y respectively :-

A. 310, 372

B. 392, 330

C. 500, 600

D. 250, 300

Answer: A

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23. Given, $P \propto T$ on increasing the value of T by $1^\circ C$, the value of P increases by $0.4\,\%$, then find initial value of T :-

A. 25

B. 250

C. 350

D. 2500

Answer: B

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24. If $x^3 = 9x$, then find all possible values of x :-

A. 0 & 3

B. 3 & -3

C. 3 only

D. 0, 3 & -3

Answer: D

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25. A river 3m deep and 40m wide is flowing at the rate of 2 km/hr. How much water will fall into the sea in 2 minutes :-

A. $2000m^3$

B. $4000m^3$

C. $8000m^3$

D. $16000m^3$

Answer: C

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26. A room is 12m long, 4m wide and 3m high, what will be the longest bar that can be placed in the room :-

A. 12m

B. 5m

C. 19m

D. 13m

Answer: D

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27. $\sqrt[3]{8^2}$ is equal to :-

A. $8^{4/3}$

B. $8^{3/2}$

C. $4^{2/3}$

D. $2^{2/3}$

Answer: D

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28. $\sqrt[5]{16} \times \sqrt[5]{2}$ is equal t :-

A. 2^2

B. 2

C. $2^{1/3}$

D. $2^{2/3}$

Answer: B

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29. If $x = \sqrt{2} - 1$ then find the value of $\left(\frac{1}{x} - x\right)^3$:-

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

B. $2\sqrt{2}-4$

C. 8

D. 27

Answer: C

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30. If m and n are the two natural number such that $m^n=25$, then find the value of n^m:-

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31. If $y-x=180^\circ$ then find the values of x and y.

A. $50^\circ, 130^\circ$

B. $60^\circ, 120^\circ$

C. $70^{\circ}, 110^{\circ}$

D. $80^{\circ}, 100^{\circ}$

Answer: A

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32. For shown situation find $\angle BCA$:-

A. 135°

B. 110°

C. 75°

D. 65°

Answer: D

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33. A cube of 2cm edge is cut off into 8 cubes of 1cm edge. What is teir total surface area?

A. $8cm^2$

B. $16cm^2$

C. $24cm^2$

D. $48cm^2$

Answer: D

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34. How many solid spherical balls of radius 2cm and b are constants. If $f(2) = 1 \quad \text{and} \quad f(-3) = 11,$

A. 4

B. 16

C. 32

D. 64

Answer: D

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35. A function has the form f(x)=ax+b, where a and b are constants. If $f(2) = 1 \text{ and } f(-3) = 11$, the function is defined by

A. $f(x) = 2x + 5$

B. $f(x) = 2x - 5$

C. $f(x) = -2x + 5$

D. $f(x) = -2x + 5$

Answer: C

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36. Use the approximation $(1+x)^n \approx 1+nx, |x| < < 1,$ to find approximate value for

(a) $\sqrt{99}$

(ii) $\frac{1}{1.01}$

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37. The unit of length convenient on the atomic scale is known a an angstrom and is denoted by $A = 10^{-10}m$. The radius of the hydrogen atom is about 0.5 A. What is the total atomic valume in m^3 of a mole of hydrogen atoms?

A. $3.15 \times 10^{-7}m^3$

B. $3.15 \times 10^{-9}m^3$

C. $3.15 \times 10^{-4}m^3$

D. $3.15 \times 10^{-20}m^3$

Answer: A

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38. What is the minimum possible possible perimeter for a rectangle whose area is $4m^2$?

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39. In the following graph, relation between two variables x and y is shown by a straight line.

Equation of the straight line is

A. $y = 1.2x + 4$

B. $y = 1.2x - 4$

C. $y = 2x - 8$

D. $y = 2x + 8$

Answer: C

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Basic Maths (VECTORS)

1. State whether the following relations are true or false

(1)$\overrightarrow{AB} = \overrightarrow{BA}$

(2)$\overrightarrow{AB} = -\overrightarrow{BA}$

(3)$\left|\overrightarrow{AB}\right| = \left|\overrightarrow{BA}\right|$

(4)$\left|\overrightarrow{AB}\right| = \left|-\overrightarrow{AB}\right|$

(5)$\hat{j} = \hat{k}$

(6)$\left|\hat{j}\right| = \left|\hat{k}\right|$

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2. State whether the following statements are true or false :-

(1) Magnitude of $\overrightarrow{P}$ can be -5 unit.

(2)$\left|\widehat{N}\right| = 1$

(3) Magnitude of any vector is a scalar.

(4) Unit vectors of a vector cannot be :\

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3. The magnitude of a vector cannot be :

A. positive

B. unity

C. negative

D. zero

Answer: C

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4. Which of the following group of foces cannot produce the resultant of 2N?

A. 2N and 4N

B. 1N and 3N

C. 5N and 10N

D. 10N and 11N

Answer: C

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5. Which of the following group of concurrent forces may be in equilibrium (R=0)?

A. $\begin{matrix} A & B & C \\ 10 & 20 & 40 \end{matrix}$

B. $\begin{matrix} A & B & C \\ 3 & 5 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C \\ 20 & 20 & 20 \end{matrix}$

D. $\begin{matrix} A & B & C \\ 40 & 30 & 5 \end{matrix}$

Answer: C

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6. Which of the following group of forces cannot produce zero resultan?

A. $\begin{matrix} A & B & C \\ 1.5 & 2.5 & 3.5 \end{matrix}$

B. $\begin{matrix} A & B & C \\ 3 & 5 & 4 \end{matrix}$

C. $\begin{matrix} A & B & C \\ 10 & 15 & 24 \end{matrix}$

D. $\begin{matrix} A & B & C \\ 20 & 5 & 10 \end{matrix}$

Answer: D

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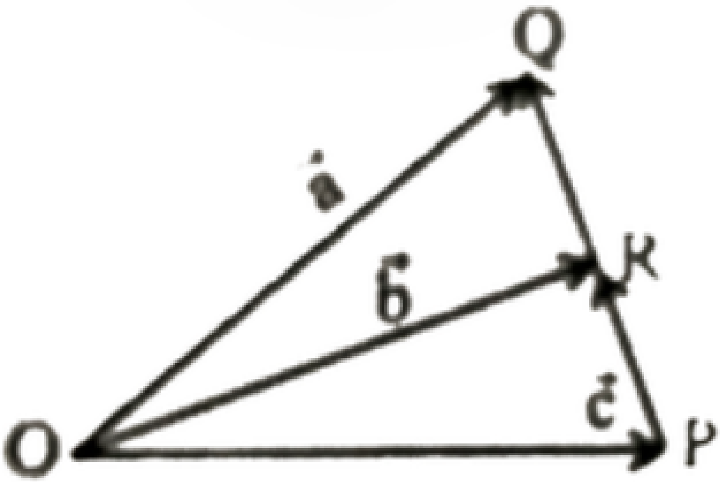
7. Figure shows three vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$. If $\overline{RQ} = 2\overline{PR}$, which of the following relation is correct :-



A. $2\vec{a} + \vec{c} = 3\vec{b}$

B. $\vec{a} + 3\vec{c} = 2\vec{b}$

C. $3\vec{a} + \vec{c} = 2\vec{b}$

D. $\vec{a} + 2\vec{c} = 3\vec{b}$

Answer: D

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8. 100 coplanar forces each equal to 10 n act on a body. Each force makes angle $\pi/50$ with the preceding force. What is the resultant of the forces.

A. 1000 N

B. 500 N

C. 250 N

D. Zero

Answer: D

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9. With respect to a rectangular cartesian coordinate system, three vectors are expressed as $\overrightarrow{a}=4\hat{j}, \overrightarrow{b}=-3\hat{i}$ and $\overrightarrow{c}=-\hat{k}$ where $\hat{i}, \hat{j}, \hat{k}$ are unit vectors of axis x,y and z then $\hat{r}$ along the direction of sum of these vector is :-

A. $\hat{r}=\frac{1}{\sqrt{3}}\left(\hat{i}-\hat{j}-\hat{k}\right)$

B. $\hat{r} = \frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

C. $\hat{r} = \frac{1}{3}\left(\hat{i} - \hat{j} + \hat{k}\right)$

D. $\hat{r} = \frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

Answer: A

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10. There are two force vectors, one of 5N and other of 12N. At what angle the two vectors be added to get resultant vector of 17 N, 7N and 13 N respectively :-

A. $0^\circ, 180^\circ \quad \text{and} \quad 90^\circ$

B. $0^\circ, 90^\circ \quad \text{and} \quad 180^\circ$

C. $0^\circ, 90^\circ \quad \text{and} \quad 90^\circ$

D. $180^\circ, 0^\circ \quad \text{and} \quad 90^\circ$

Answer: A

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11. Two equal forces are acting at a point with an angle of 60° between them. If the resultant force is equal to $40\sqrt{3}N$, The magnitude of each force is :-

A. 40 N

B. 20 N

C. 80 N

D. 30 N

Answer: A

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12. Two forces $3N$ and $2N$ are at an angle θ such that the resultant is R. The first force is now increased of $6N$ and the resultant become $2R$. The value of θ is

A. 30°

B. 60°

C. 90°

D. 120°

Answer: D

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13. The resultant of the vectors A and B is perpendicular to the vector A and its magnitude is equal to half the magnitude of vector B. The angle between $\overrightarrow{A}$ and $\overrightarrow{B}$ is :-

A. 120°

B. 150°

C. 135°

D. None of these

Answer: B

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14. Two force F_1 and F_2 are acting on a body. One force is double that of the other force and the resultant is equal to the greater force. Then the angle between the two forces is :-

A. $\cos^{-1}(1/2)$

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

C. $\cos^{-1}(-1/4)$

D. $\cos^{-1}(1/4)$

Answer: C

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15. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitude of $\vec{A} + \vec{B}$ is equal to n times the magnitude of $\vec{A} - \vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ is :-

A. $\cos^{-1}\left(\frac{n-1}{n+1}\right)$

B. $\cos^{-1}\left(\frac{n^2-1}{n^2+1}\right)$

C. $\sin^{-1}\left(\frac{n-1}{n+1}\right)$

D. $\sin^{-1}\left(\frac{n^2-1}{n^3+1}\right)$

Answer: B

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16. The maximum and minimum resultant of two forces acting at a point are 10N and 6N respectively. If each force is increased by 3N, find the resultant of new forces when acting at a paint at an angle of 90° with each-other :-

A. $\sqrt{146}N$

B. 11N

C. $\sqrt{70}N$

D. 8N

Answer: A

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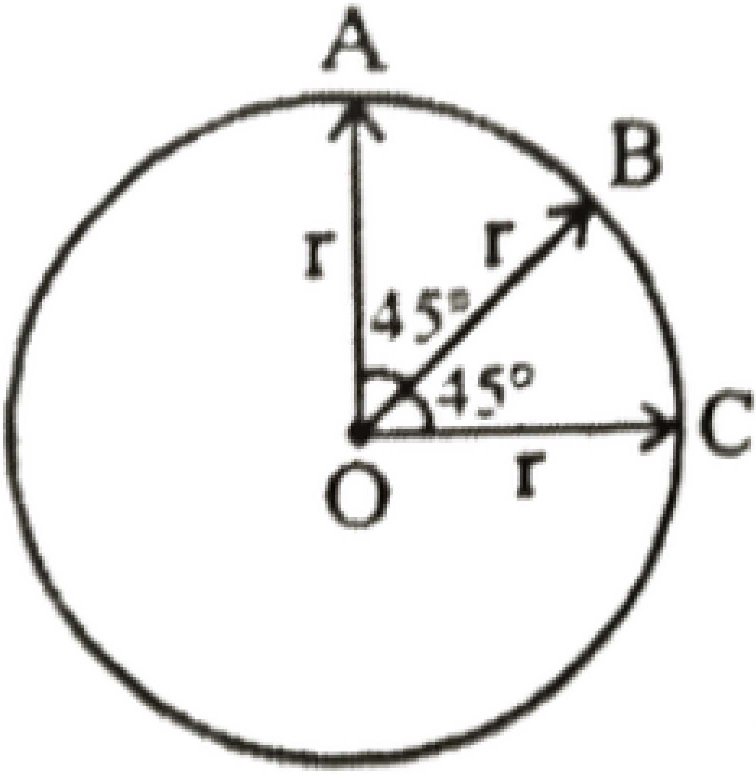
17. The resultant of the three vectors $\overline{OA}$, $\overline{OB}$ and $\overline{OC}$ shown in figure :-



A. r

B. 2r

C. $r(1+\sqrt{2})$

D. $r(\sqrt{2}-1)$

Answer: C

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18. If $\frac{\left|\vec{a}+\vec{b}\right|}{\left|\vec{a}-\vec{b}\right|}=1$, then angle between $\bar{a}$ and $\bar{b}$ is :-

A. 0°

B. 45°

C. 90°

D. 60°

Answer: C

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19. The magnitude of pairs of displacement vectors are give. Which pairs of displacement vectors cannot be added to give a resultant vector of magnitude 13 cm :-

$(i) 4cm, 12cm$ $(ii) 4cm, 8cm$

$(iii) 6cm, 8cm$ $(iv) 1cm, 15cm$

A. (ii, iv)

B. (i,ii)

C. (i, iii)

D. (ii, iii)

Answer: A

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20. I started walking down a road to day-break facing the sun. After walking for some time. I turned to my left, then I turned to the right once again. In which direction was I going then :

A. East

B. North-west

C. North-east

D. South

Answer: A

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21. $\vec{A}$, $\vec{B}$ and $\vec{C}$ are three orthogonal vectors with magnitudes 3, 4 and 12 respectively. The value of $\left|\vec{A} - \vec{B} + \vec{C}\right|$ will be :-

A. 11

B. 19

C. 13

D. can't be determined

Answer: C

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22. Given $\overrightarrow{a} + \overrightarrow{b} = 2\hat{i}$, if $\overrightarrow{b} = 3\hat{j} - \hat{k}$ then find out vector $\overrightarrow{a}$:-

A. $2\hat{i} + 3\hat{j} + \hat{k}$

B. $2\hat{i} - 3\hat{j} + \hat{k}$

C. $\hat{j} + \hat{k}$

D. $2\hat{i} - \hat{j} - \hat{k}$

Answer: B

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23. Whtch of the following statement is true :-

A. When the coordinate axes are trunslated the component of vector in a plane changes

B. When the coordinate axes are rotated through some angle components of the vector change but the vector's magnitude remains constant.

C. Sum of $\overrightarrow{a}$ and $\overrightarrow{b}$ is $\overrightarrow{R}$. If the magnitude of a alone is increased angle between $\overrightarrow{b}$ and $\overrightarrow{R}$ decreases.

D. The cross product of $3\hat{i}$ and $4\hat{j}$ is 12.

Answer: B

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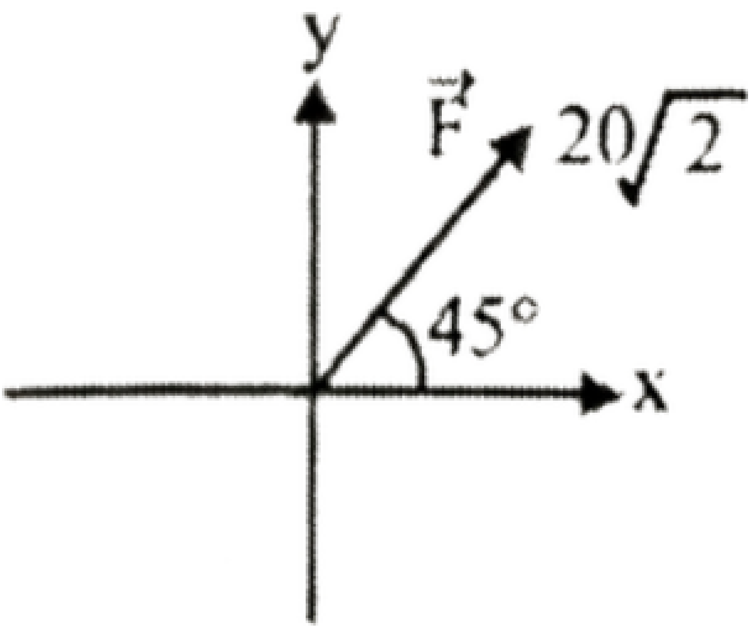
24. Write the vector $\overrightarrow{F}$ in terms of its component :-



A. $\overrightarrow{F} = 10\hat{i} + 10\hat{j}$

B. $\overrightarrow{F} = 20\hat{i} + 20\hat{j}$

C. $\overrightarrow{F} = 30\hat{i} + 30\hat{j}$

D. $\overrightarrow{F} = 40\hat{i} + 40\hat{j}$

Answer: B

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25. A vector is represented by $3\hat{i} + \hat{j} + 2\hat{k}$, Its length in XY plane is :-

A. 2

B. $\sqrt{14}$

C. $\sqrt{10}$

D. $\sqrt{5}$

Answer: C

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26. Resultant of two forces $\overrightarrow{F}_1$ and $\overrightarrow{F}_2$ has magnitude 50 N. The resultant is inclined to $\overrightarrow{F}_1$ at 60° and to $\overrightarrow{F}_1$ at 30° . Magnitudes of $\overrightarrow{F}_1$ and $\overrightarrow{F}_2$, respectively, are:

A. 25 N, $25\sqrt{3}N$

B. 20 N, $20\sqrt{3}N$

C. 20 N, 30N

D. 30 N, 40N

Answer: A

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27. α and β are the angle made by a vector from positive x & positive y-axes redpectively. Which set of α and β is not possible

A. $60^\circ, 60^\circ$

B. $45^\circ, 60^\circ$

C. $60^\circ, 45^\circ$

D. $30^\circ, 45^\circ$

Answer: D

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28. If $v = \left(3\hat{i} + 2\hat{j} + 6k\right)$ m/s and $m = \frac{2}{7}kg$ then find kinetic energy $\left(i.\ e.\ \frac{1}{2}mv^2\right)$

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29. Two force vectors each having magnitude 6N are oriented as 30° from positive of x-axis and other at 90° with the same axis. Find out their magnitude along with position from positive of x-axis :-

A. $6\sqrt{3}N, 30^\circ$

B. $6N, 60^\circ$

C. $6\sqrt{2}N, 60^\circ$

D. $6\sqrt{3}N, 60^\circ$

Answer: D

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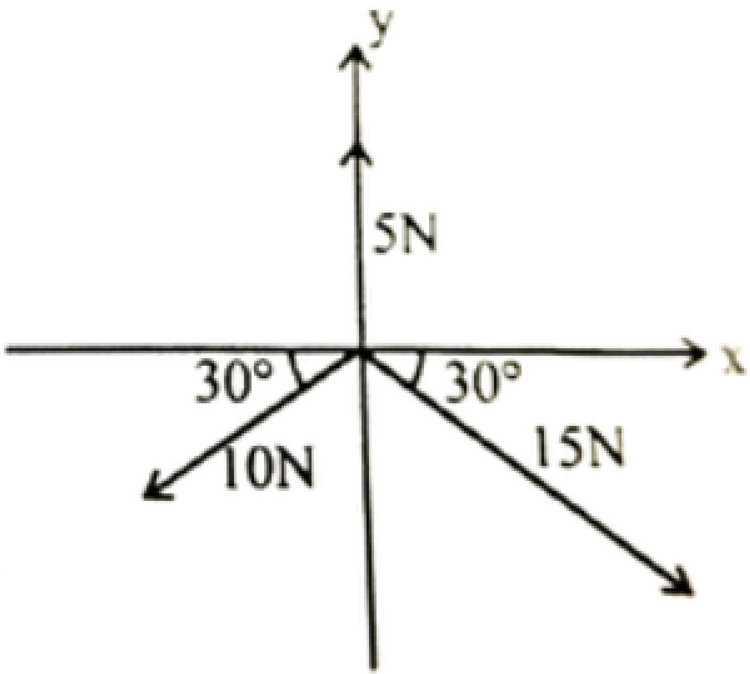
30. Find the magnitude of the resultant of shown forces :-



A. $5\sqrt{3}N$

B. 10N

C. $10\sqrt{3}N$

D. $5\sqrt{7}N$

Answer: A

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31. If $\overrightarrow{P} = \overrightarrow{KQ}$ (Here K is constant) them :-

A. $\overrightarrow{P} \mid \mid \overrightarrow{Q}$

B. $\overrightarrow{P} \mid \mid \overrightarrow{Q}$

C. $\overrightarrow{P} \perp \overrightarrow{Q}$

D. Both (1) and (2)

Answer: D

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32. The dot product of two vectors of magnitudes 3 units and 5 units cannot be :-

(i) -20 (ii) 16 (iii) -10 (br) 14

A. (i,iii)

B. (i,ii)

C. (i, iv)

D. (ii, iii, iv)

Answer: B

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33. If $\overrightarrow{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\overrightarrow{B} = -\hat{i} + 3\hat{j} + 4\hat{k}$ then projection of $\overrightarrow{A}$ on $\overrightarrow{B}$ will be

A. $\frac{3}{\sqrt{13}}$

B. $\frac{3}{\sqrt{26}}$

C. $\sqrt{\frac{3}{26}}$

D. $\sqrt{\frac{3}{13}}$

Answer: B

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34. If $\left|\widehat{A} \times \widehat{B}\right| = -\sqrt{3}\widehat{A}.\ \widehat{B}$, then $\left|\widehat{A} - \widehat{B}\right|$=......................

A. 0

B. 1

C. -1

D. $\sqrt{3}$

Answer: B

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35. Find the torque of a force $\overrightarrow{F} = 2\hat{i} + \hat{j} + 4\hat{k}$ acting at the point $\overrightarrow{r} = 7\hat{i} + 3\hat{j} + \hat{k}$:

A. $14\hat{i} - 38\hat{j} - 16\hat{k}$

B. $4\hat{i} + 4\hat{j} + 6\hat{k}$

C. $-14\hat{i} + 38\hat{j} - 16\hat{k}$

D. $11\hat{i} - 26\hat{j} + \hat{k}$

Answer: D

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36. What is the value of linear velocity, if $\overrightarrow{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\overrightarrow{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$?

A. $4\hat{i} - 13\hat{j} + 6\hat{k}$

B. $6\hat{i} - 2\hat{j} + 3\hat{k}$

C. $6\hat{i} - 2\hat{j} + 8\hat{k}$

D. $-18\hat{i}-13\hat{j}+2\hat{k}$

Answer: D

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37. The angle made by the vector $\overrightarrow{A}=\hat{i}+\hat{j}$ with x-axis is

A. 90°

B. 45°

C. 22.5°

D. 30°

Answer: B

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38. Correct relation is :

A. $\hat{j} \times \hat{k} = \hat{i}$

B. $\hat{i}.\ \hat{i} = 0$

C. $\hat{j} \times \hat{j} = 1$

D. $\hat{k}.\ \hat{i} = 1$

Answer: A

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39. Two vectors $\overrightarrow{A} = 3\hat{i} + 2\hat{j} + \hat{k}$ and $\overrightarrow{B} = 5\hat{j} - 9\hat{j} + P\hat{k}$ are perpendicular to each other. The value of 'P' is :-

A. 3

B. -3

C. -2

D. 2

Answer: A

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40. If the vectors $\left(\hat{i}+\hat{j}+\hat{k}\right)$ and $3\hat{i}$ from two sides of a triangle, then area of triangle is :

A. $\sqrt{3}$ unit

B. $2\sqrt{3}$ unit

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

D. $3\sqrt{2}$ unit

Answer: C

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41. The vector projection of a vector $3\hat{i}+4\hat{k}$ on y-axis is

A. 5

B. 4

C. 3

D. Zero

Answer: D

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42. Consider two vectors $\overrightarrow{F}_1 = 2\hat{i} + 5\hat{k}$ and $\overrightarrow{F}_2 = 3\hat{j} + 4\hat{k}$. The magnitude to thhe scalar product of these vectors is

A. 20

B. 23

C. $5\sqrt{33}$

D. 26

Answer: A

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43. When $\overrightarrow{A} \cdot \overrightarrow{B} = -\left|\overrightarrow{A}\right|\left|\overrightarrow{B}\right|$, then :-

A. $\overrightarrow{A}$ and $\overrightarrow{B}$ are perpendicular to each other

B. $\overrightarrow{A}$ and $\overrightarrow{B}$ act in the same direction

C. $\overrightarrow{A}$ and $\overrightarrow{B}$ act in the opposite direction

D. $\overrightarrow{A}$ and $\overrightarrow{B}$ can act in any direction

Answer: C

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44. The component of vector $A = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$ and the directioin of $\hat{i} - \hat{j}$ is

A. $a_x - a_y + a_z$

B. $a_x - a_y$

C. $\frac{a_X - a_y}{\sqrt{2}}$

D. $a_x + a_y + a_z$

Answer: C

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45. $\left(\overrightarrow{A}+2\overrightarrow{B}\right).\left(2\overrightarrow{A}-3\overrightarrow{B}\right)$:-

A. 0

B. $2AB\cos\theta-6B^2$

C. 8

D. $2A^2+Ab\cos\theta-6B^2$

Answer: D

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46. If $\overrightarrow{A}=3\hat{i}+4\hat{j}$ and $\overrightarrow{B}=6\hat{i}+8\hat{j}$, select correct alternatives :-

$(i)\overrightarrow{A}.\overrightarrow{B}=50$ $\quad$ $(ii)2A=B$

$(iii)\widehat{A}=\widehat{B}$ $\quad$ $(iv)\widehat{A}\times\overrightarrow{B}=\overrightarrow{0}$

A. (i, ii)

B. (ii, iii)

C. (i, iv)

D. (i, ii, iii, iv)

Answer: D

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47. The angle between the vectors $\left(\hat{i}+\hat{j}\right)$ and $\left(\hat{j}+\hat{k}\right)$ is

A. 90°

B. 180°

C. 0°

D. 60°

Answer: D

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48. $\overrightarrow{A}, \overrightarrow{B}$ and $\overrightarrow{C}$ are vectors each having a unit magneitude. If $\overrightarrow{A} + \overrightarrow{B} + \overrightarrow{C} = 0$, then $\overrightarrow{A} . \overrightarrow{B} + \overrightarrow{B} . \overrightarrow{C} + \overrightarrow{C} . \overrightarrow{A}$ will be:

A. 1

B. $-\frac{3}{2}$

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

D. 0

Answer: B

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49. $\overrightarrow{A}$ and $\overrightarrow{B}$ and vectors expressed as $\overrightarrow{A} = 2\hat{i} + \hat{j}$ and $\overrightarrow{B} = \hat{i} - \hat{j}$ Unit vector perpendicular to $\overrightarrow{A}$ and $\overrightarrow{B}$ is:

A. $\frac{\hat{i} - \hat{j} + \hat{k}}{\sqrt{3}}$

B. $\frac{\hat{i} + \hat{j} - \hat{k}}{\sqrt{3}}$

C. $\dfrac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$

D. $\hat{k}$

Answer: D

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50. The velocity of a particle is $v=6\hat{i}+2\hat{j}-2\hat{k}$ The component of the velocity parallel to vector $a=\hat{i}+\hat{j}+2\hat{k}$ invector from is

A. $6\hat{i}+2\hat{j}+2\hat{k}$

B. $2\hat{i}+2\hat{j}+2\hat{k}$

C. $\hat{i}+\hat{j}+\hat{k}$

D. $6\hat{i}+2\hat{j}-2\hat{k}$

Answer: B

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51. Two vectors $\overrightarrow{A} = 4\hat{i} + \alpha\hat{j} + 2\hat{k}$ and $\overrightarrow{B} = 2\hat{i} + \hat{j} + \hat{k}$ are parallel if :-

A. $\alpha = 0$

B. $\alpha = 1$

C. $\alpha = 2$

D. $\alpha = 4$

Answer: C

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52. If vector $\hat{i} + \hat{j} - \hat{k}$ and $2\hat{i} + 2\hat{j} + \lambda\hat{k}$ are parallel than find out the value of λ :-

A. -1

B. 1

C. -2

D. 2

Answer: C

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53. If $\overrightarrow{A} \times \overrightarrow{B} = \overrightarrow{C}$ then find out the correct one :-

A. $\overrightarrow{A}\,.\,\overrightarrow{B} = 0$

B. $\overrightarrow{A}\,.\,\overrightarrow{C} \neq 0$

C. $\overrightarrow{B}\,.\,\overrightarrow{C} \neq 0$

D. $\left(\overrightarrow{A} + \overrightarrow{B}\right).\,\overrightarrow{C} = 0$

Answer: D

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54. The position vectors of points A,B,C and D are $A = 3\hat{i} + 4\hat{j} + 5\hat{k}$, $B = 4hai + 5\hat{j} + 6\hat{k}$,$C = 7\hat{i} + 9\hat{j} + 3\hat{k}$, and $D = 4\hat{i} + 6\hat{j}$, then the displacement vectors AB and CD are

A. Same

B. Parallel

C. Perpendicular

D. Antiparallel

Answer: D

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55. If vector $\left(\hat{a} + 2\hat{b}\right)$ is perpendicular to vector $\left(5\hat{a} - 4\hat{b}\right)$, then find the angle between $\hat{a}$ and $\hat{b}$.

A. 60°

B. 90°

C. 45°

D. None

Answer: A

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56. If $\widehat{a}$ and $\hat{b}$ are non-collinear unit vectors and if $\left|\widehat{a}+\hat{b}\right|=\sqrt{3}$, then the value of $\left(2\widehat{a}-5\hat{b}\right).\left(3\widehat{a}+\hat{b}\right)$ is :-

A. $\frac{41}{2}$

B. $\frac{11}{2}$

C. $-\frac{11}{2}$

D. $-\frac{41}{2}$

Answer: C

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57. Vectors $\vec{A}$ and $\vec{B}$ are mutually perpendicular . Component of $\vec{A}+\vec{B}$ in the direction of $\vec{A}-\vec{B}$ will be:

A. $\dfrac{A^2+B^2}{\sqrt{A^2-B^2}}$

B. $\sqrt{A^2-B^2}$

C. $\dfrac{A+B}{A-B}$

D. $\dfrac{A^2-B^2}{\sqrt{A^2+B^2}}$

Answer: D

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Basic Maths (Units, Dimensions & Measurements)

1. Which one of the following is not a fundamental quantity ?

A. Temperature

B. Eleetric current

C. Pressure

D. Length

Answer: C

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2. Which unit is used for measuring nuclear area of cross-section ?

A. mm^2

B. Fermi

C. Barn

D. Curie

Answer: C

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3. Which of the following is not correct representation of a unit ?

A. Newton

B. Sec

C. a.m.u.

D. All of these

Answer: D

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4. Which of the following is not a fundamental unit in SI system ?

A. ampere

B. candela

C. kelvin

D. Pascal

Answer: D

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5. Which of the following is unitless quantity?

A. Velocity gradient

B. Pressure gradinet

C. Displecement gradient

D. Force gradient

Answer: C

Watch Video Solution

6. What can be the maximum distance of star which can be measured by using parallax method ?

A. 1 parsec

B. 1 AU

C. 100 ly

D. Infinite

Answer: B

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7. Two physical quantities A and B have different dimensions. Which mathematical operation given below is physically possible ?

A. $\sqrt{AB}$

B. $A(1 + B)$

C. $A - B$

D. $A + B$

Answer: A

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8. Which of the following equations is dimensionally incorrect ?

(E= energy, U= potential energy, P=momentum, m= mass, v= speed)

A. $E = U + \frac{P^2}{2M}$

B. $E = mv^2 + \frac{P^2}{m}$

C. $2E = \frac{U}{2} - \frac{1}{2}mv^2$

D. $E = \frac{P^2U}{2mv^2}$

Answer: D

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9. 1 joule of energy is to be converted into new system of units in which length is measured in 10 metre, mass in 10 kg and time in 1 minute. The numerical value of 1 J in the new system is :-

A. 36×10^{-4}

B. 36×10^{-3}

C. 36×10^{-2}

D. 36×10^{-1}

Answer: D

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10. The potential energy of a particle varies with distance x from a fixed origin as $U = \dfrac{A\sqrt{x}}{x^2 + B}$, where A and B are dimensional constants , then find the dimensional formula for AB.

A. $\left[ML^{7/2}T^{-2}\right]$

B. $\left[ML^{11/2}T^{-2}\right]$

C. $\left[M^2L^{9/2}T^{-2}\right]$

D. $\left[ML^{13/2}T^{-3}\right]$

Answer: B

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11. Which of the following relation cannot be deduced using dimensional analysis ? [the symbols have their usual meanings]

A. $y = A\sin(\omega t + kx)$

B. v=u+at

C. $k = \frac{1}{2}mv^2$

D. All of these

Answer: D

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12. Of the following quantities , which one has the dimensions different from the remaining three?

A. Energy per unit volume

B. Force per unit area

C. Product of voltage and charge per unit volume

D. Angular momentum per unit mass

Answer: D

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13. If momentum (p), area (A) and time$(t)$are taken to be fundamental quantities then energy has the dimensional formula

A. $\left[P^1 A^{-1} T^1\right]$

B. $\left[P^2 - A^1 T^1\right]$

C. $\left[P^1 A^{-1/2} T^1\right]$

D. $\left[P^1 A^{1/2} T^{-1}\right]$

Answer: D

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14. Which of the following specification is most accurate ?

A. $63.1 \times 10^2 m$

B. $6.31 \times 10^3 m$

C. 6310 m

D. $0.0631 \times 10^5 m$

Answer: C

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15. Let a, x, b be in $A. P$, a, y, b be in $G. P$ and a, z, b be in $H. P$. If $x = y + 2$ and $a = 5z$, then

A. $x = y < z$

B. $x = y > z$

C. $x < z < y$

D. $x > z > y$

Answer: C

Watch Video Solution

16. In an experiment the height of a small object is measured by a Vernier Calliper having least count 0.01 cm is found to be 7.38 cm, then the actual height of object may be :-

A. 7.40 cm

B. 7.3942 cm

C. 7.3792 cm

D. 7.3882 cm

Answer: C

Watch Video Solution

17. Two resistance are measured in ohm and is given as:-

$R_1 = 3\Omega \pm 1\% \& R_2 = 6\Omega \pm 2\%$

When they are connected in parallel, the percentage error in equivalent resistance is

A. 3%

B. 4.5%

C. 0.67%

D. 1.33%

Answer: D

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18. The percentage error in measurement of a physical quantity [m given by $m = \pi \tan\theta$] is minimum when

(Assume that error in θ remain constant)

A. $\theta = 45^\circ$

B. $\theta = 90^\circ$

C. $\theta = 60^\circ$

D. $\theta = 30^\circ$

Answer: A

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19. The number of significant digits in 0.001001 is :-

A. 6

B. 4

C. 7

D. 2

Answer: B

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20. The sides of a rectangle are $(10.5 \pm 0.2)cm$ and $(5.2 \pm 0.1)cm$. Calculate its perimeter with error limits .

A. $(31.4 \pm 0.6)cm$

B. $(31.4 \pm 0.3)cm$

C. $(51.6 \pm 0.6)cm$

D. $(51.6 \pm 0.3)cm$

Answer: A

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21. The Young modulus (Y) of a material is given by $Y = \frac{WL}{\pi r^2 l}$. If the percentage error in W, L, r and l are 0.5%, 1%, 3% and 4% respectively then maximum percentage error in Y is -

A. 7.5%

B. 9%

C. 11.5%

D. 13%

Answer: C

Watch Video Solution

22. Which of the following measurement is most precise?

A. 2.00 mm

B. 2.00 cm

C. 2.00 m

D. 2.00 km

Answer: A

Watch Video Solution

23. In a vernier calliper, N divisions of vernier scale coincide with (N-1) divisions of main scale (in which division represent 1mm). The least count of the instrument in cm. should be

A. N

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

C. $\frac{1}{10N}$

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

Answer: 3

Watch Video Solution

24. A vernier callipers having 1 main scale division $= 0.1cm$ to have a least count of $0.02cm$.If n be the number of divisions on vernier scale and m be the length of vernier scale, then.

A. n=10, m=0.5 cm

B. n=9, m=0.4 cm

C. n=10, m=0.8 cm

D. n=10, m=0.2 cm

Answer: 3

Watch Video Solution

25. A screw gauge gives the following reading when used to measure the diameter of a wire. Main scale reading $= 0mm$, circular scale reading $= 52$ divisions. Given that $1mm$ on main scale corresponds to 100 divisions of the circular scale. The diameter of the wire from the above data is

A. 0.026 cm

B. 0.005 cm

C. 0.52 cm

D. 0.052 cm

Answer: 4

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26. The diameter of a cylinder is measured using a vernier callipers with no zero error . It is found that the zero of the vernier scale lies between $5.10 \text{ and } 5.15cm$ of the main scale . The $24th$ division of the vernier scale exactly coincides with one of the main scale divisions . The diameter of the cylinder is

A. 5.112 cm

B. 5.124 cm

C. 5.136 cm

D. 5.148 cm

Answer: 2

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27. Two full turns of the circular scale of a screw gauge cover a distance of $1mm$ on its main scale. The total number of divisions on the circular scale is 50. Further, it is found that the screw gauge has a zero error of $-0.03mm$. While main scale reading of $3mm$ and the number of circular scale divisions in line with the main scale as 35. the dimeter of the wire is

A. 3.32 mm

B. 3.73 mm

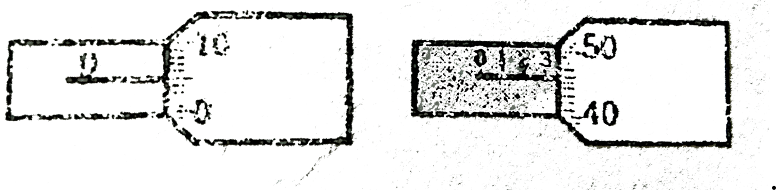
C. 3.67 mm

D. 3.38 mm

Answer: 4

Watch Video Solution

28. The circular scale of a micrometer has 200 divisions and pitch of $2mm$. Find the measured value of thickness of a thin sheet.



A. 3.41 mm

B. 6.41 mm

C. 3.46 mm

D. 3.51 mm

Answer: 2

Watch Video Solution

29. The vernier of a circular scale is divided into 30 divisons, which coincides with 29 main scale divisions. If each main scale division is $(1/2)^{\circ}$ the least count of the instrument is $(1^{\circ} = 60')$

A. 10'

B. 0.1'

C. 1'

D. 30'

Answer: 3

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30. A good analogy for understanding accuracy and precision is to imagine a basketball player shooting baskets. If the Player A shoots the ball close to or into the basket. and the Player B shoots the ball to the same location which may or may not be close to the basket.

(A) Player A is more accurate and less precise

(B) Player B is more accurate and less precise

(C) Player A is less accurate and more precise

(D) Player B is less accurate and more precise Select corect alternative

A. A,B

B. B,C

C. A,D

D. C,D

Answer: 3

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31. Suppose, you are to take the measurements of the mass of a 50.0-gram standard sample with a weighing balance. You get values of 47.5, 47.6, 47.5 and 47.7 grams with weighing machine-1 and 49.8, 50.5, 51.0, 49.6 with machine-2, then

(A) Machine 1 is more accurate and less precise

(B) Machine 2 is more assurate and less precise

(C) Machine 1 is less accurate and more precise

(D) Machine 2 is less accurate and more percise Select correct alternative.

A. A,B

B. B,C

C. A,D

D. C,D

Answer: 2

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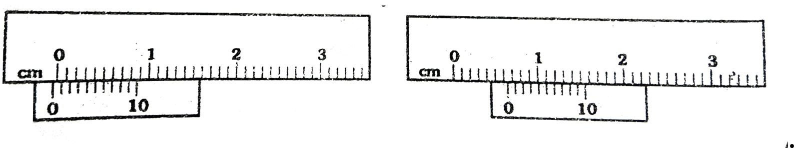
32. The main scale of a vernier callipers reads in millimeter and its vernier is divided into 10 divisions which coincides with 9 divisions of the main scale. The reading for shown situation is found to be $(x/10)$mm. Find the value of x.



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33. The pitch of a screw gauge is 1mm and there are 100 divisions on circular scale. While measuring the diameter of a wire, the linear scale reads 1 mm and 47th division on circular scale coincides with reference line. The length of the wire is 5.6 cm. Find the curved surface area of the wire in cm^2 to correct number of significant figures.

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Basic Maths (KINEMATICS)

1. A man covered following displacements. Find the net displacement of the person

(i) 25m west

(ii)$20m30^\circ$ east of south

(iii)$5\sqrt{3}m$ south

(iv) 10 m east

(v) $10m60^\circ$ north of west

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2. A person moves towards north with uniform speed of 15 m/s and cover 16 m. After this he moves towards east and covers 6 m and finallt covers 8 m distance with same speed in south. Find out

(i) Distance travelled by person

(ii) Displacement of person

(iii) Average velocity of person

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3. A particle moves in a circle of radius 1 m with speed of 1 m/s. After completing half cycle. Find out :-

(i) Displacement

(ii) Distance travelled

(iii) Average velocity

(iv) Average acceleration

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4. A man travels 200 km distance with the speed of 40 m/s and next 50 km with the speed of 10 m/s . Find the average speed of man.

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5. A man moves up on a 3 km long incline road with speed of 2m/s , then on a 3 km level road with speed of 3 m/s and moves down on a 3 km long incline road with 6 m/s. Find the average speed of man.

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6. A man drives his car uniformly at 30 km/h for three hour After it he covered next 90 km distance with uniform speed of 45 km/hr. Find the average speed of car.

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7. Distance between Kota and Jaipur is 240 km. Two persons A and B both start simultaneously from Kota to Kota to Jaipur. A travels half distance with 40 km/hr and remaining half distance with 60 km/hr. B travels with 40 km/hr for half time of journey and half time withy 60 km/hr. Find out

(i) Average speed of A and B

(ii) When and Who will reach the Jaipur first

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8. A particle is moving with constant speed v on a circular path of 'r' radius when it has moved by angle 60°, Find

(i) Displacement of particle

(ii) Average velocity

(iii) Average acceleration

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9. An ant is scramping on the stairs as shown in the figure. There are 10 statirs and each stairs has width of 8" and height of "6 find out

(i) Distance travelled by ant

(ii) Displacement of the ant

Watch Video Solution

10. A drunked person is 10 step away from a manhole. Suddenly he begins to walk towards the manhole. Suddenly he begins to walk towards the manhole. He walks two steps forward and one step beckward in one second. Find out

(i) The time after which the person will fall into the manhole?

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11. A man travels two-third part of his total distance with speed v_1 and rest one-third part with speed v_2. Find out the average speed of the man?

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12. A man travels half time of its journey with speed of 5m/s and for remaining half time he moves half of its total distance travelled, with speed of 3 m/s and remaining half distance with speed of 6 m/s. Find out the average speed of the man?

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Watch Video Solution

13. If body having initial velocity zero is moving with uniform acceleration $8m/\sec^2$ the distance travelled by it in fifth second will be

A. 1.25 m

B. 2.25 m

C. 6.25 m

D. 30.25 m

Answer: B

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14. A trian starts from rest from a station with acceleration $0.2\frac{m}{s^2}$ on a straight track and after attaining maximum speed it comes to rest on another station due to retardation of $0.4\frac{m}{s^2}$. If total time spent is half an hour, then distance between two stations is (Neglect length of train) :-

A. 216 km

B. 512 km

C. 728 km

D. 1296 km

Answer: A

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15. A body is moving with variable acceleartion (a) along a straight line. The average acceleration of body in time interval t_1 to t_2 is :-

A. $\dfrac{a[t_2 + t_1]}{2}$

B. $\dfrac{a[t_2 - t_1]}{2}$

C. $\dfrac{\int_{t_1}^{t_2} \text{a dt}}{t_2 + t_1}$

D. $\dfrac{\int_{t_1}^{t_2} \text{a dt}}{t_2 - t_1}$

Answer: D

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16. A particla starting from rest undergoes acceleration given by $a = |t - 2| \ \ \mathrm{m/s}^2$ where t is time in sec. Find velocity of particle after 4 sec. is :-

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17. A particle moves in a straight line and its position x at time t is given by $x^2 = 2 + t$. Its acceleration is given by :-

A. $\dfrac{-2}{x^3}$

B. $-\dfrac{1}{4x^3}$

C. $-\dfrac{1}{4x^2}$

D. $\dfrac{1}{x^2}$

Answer: B

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18. A car is moving with a velocity of 10 m/s. Suddenly driver sees a child at a distance of 30 m and he applies the brakes, it produced a uniform retardation in car and car stops in 5 second. Find (mass of car=1000 kg)

the stopping distance of car

will the car hit the child

the retardation in car

resistive force on car

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19. A body moving with uniform acceleration covers a distance of 14 m in first 2 second and 88 m in next 4 second. How much distance is travelled by it in 5^{th} second?

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20. A particle starts from rest with uniform acceleration a. Its velocity after 'n' second is 'v'. The displacement of the body in the last two second is

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21. A car starts from rest and moves with uniform acceleration for time t then it moves with uniform speed of 60 km/h for time 3t and comes to rest. Find the average speed of car in its total journey.

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22. A particle starts from rest accelerates at $2m/s^2$ for $10s$ and then goes for constant speed for $30s$ and then decelerates at $4m/s^2$ till it stops. What is the distance travelled by it.

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23. A body is projected vertically upward with speed 40m/s. The distance travelled by body in the last second of upward journey is [take $g = 9.8 \frac{m}{s^2}$ and neglect eggect of air rresistance]:-

A. 4.9 m

B. 9.8 m

C. 12.4 m

D. 19.6 m

Answer: A

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24. A body is thrown vertically upwards and takes 5 seconds to reach maximum height. The distance travelled by the body will be same in :-

A. 1^{st} and 10^{th} second

B. 2^{nd} and 8^{th} second

C. 4^{st} and 6^{th} second

D. Both (2) & (3)

Answer: A

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25. A ball is dropped from a height h above ground. Neglect the air resistance, its velocity (v) varies with its height (y) above the ground as :-

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

B. $\sqrt{2gh}$

C. $\sqrt{2gy}$

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

Answer: A

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26. A ball is thrown upward from edge of a cliff with an intial velocity of 6 m/s. How fast is it moving 1/2 s later ? $\left(g = 10\frac{m}{s^2}\right)$

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27. A body projected vertically upwards, reaches a height of 180 m. Find out $\left[g = 10ms^{-2}\right]$

(i) intial velocity of body

(ii) time taken by body to reach its maximum hight

(iii) the time for which the body remains in air

(iv) height of the body from the ground after 8 sec.

(v) velocity of body at t=8 sec

(vi) the time at which the body reach the height of 100 m

(vii) A man at height of 135 m from ground tries to catch the body but he will be able to catch the body again ?

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28. A particle is projected vertically upwards from the earth. It crosses the same point at t=2 sec and t=8 sec. Find out $\left[g=10ms^{-2}\right]$

(i) the time for which particle remains in air

(ii) intial velocity of particle

(iii) maximum height attained by the particle

(iv) height of the particle at t=2 sec and t=8 sec from earth

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29. A body is dropped from the top of a tower and it covers a 80 m distance in last two seconds of its journey. Find out $\left[g=10ms^{-2}\right]$

(i) height of the tower

(ii) time taken by body to reach the ground

(iii) the velocity of body when it hits the ground

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30. A particle when projected vertically upwards from the ground, takes time T to reach maximum height H. Find out

(i) The height of the particle from ground at $T/2, 2T/3, 4T/3, 5T/4$ and also find the ratio of K.E. to P.E. for particle at the same instant of time.

(ii) If the particle crosses a point at height $7H/16$ at time t_1 and t_2 then find t_1/t_2

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31. Water drops are falling from a tip at regular time intervals. When the fifth drop is near to fall from tap the first drop is at ground. If the top is fixed at height H from ground then find out

(i) the height of the second drop from ground

(ii) distance between the second and third drop

(iii) velocity of third drop

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32. A body is dropped from a tower. It covers 64% distance of its total height in last second. Find out the height of tower $\left[g = 10ms^{-2}\right]$

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33. A ball is projected in a manner such that its horizontal gange is n times of the maximum height. Then find out the ratio of potential energy to kinetic energy at maximum height.

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34. A ball is projected from ground in such a way that after 10 seconds of projection it lands on ground 500 m away from the point of projection. Find out :-

(i) angle of projection

(ii) velocity of projection

(iii) Velocity of ball after 5 seconds

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35. A body is projected at an angle of 45° with horizontal with velocity of $40\sqrt{2}m/s$. Find out

(i) Maximum height attained by body

(ii) Time of flight

(iii) Horizontal range

(iv) Velocity at maximum height

(v) The ratio of Kinetic energy to potential energy at highest point

(vi) The part equation of projectile, assuming point of projection as origin and consider x and y are horizontal and vertical distance in meter

(vii) The horizontal distance covered by body in 2 second

(viii) The vertical distance covered by body in 2 second

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36. A body is projected from ground with velocity u making an angle θ with horizontal. Horizontal range of body is four time to maximum height attained by body. Find out

(i) angle of projection

(ii) Range and maximum height in terms of u

(iii) ratio of kinetic energy to potential energy of body at maximum height

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37. A ball is thrown from a comer of room of length 20 m and height 5 m such that the ball moves along the length of room just touching the ceiling and drops on the other corner. Find out

(i) Angle of projection

(ii) Velocity of projection

(iii) Time of flight

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38. A hunter aims his gun and fires a bullet directly toward's a monkey sitting on a distance tree. At the intant the bullet leaves the barrel of the gun, the monkey drops from the tree :

(i) Will the bullet hit the aim ?

(ii) What Path of bullet will be appeared to monkey ?

(iii) If monkey does not drop from the tree will bullet hit the aim ?

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39. An aeroplane is flyind horizontally at a height of 2 km and with a velocity of 720 km/h. A bag containing ration is to be dropped to the Jawans on the ground then find out

(i) How far from the Jawans should the bag be released so that it falls directly over them

(ii) Time taken by bag to reach the ground

(iii) Velocity of bag when it reach the ground.

(iv) At which angle the bag will reaches the ground.

(v) What path of bag will be appeared to pilot

(vi) What path of bag will be appeared to Jawans.

(vii) Position of aeroplane when bag reaches to the Jawans. $\left(g = 10m/s^2\right)$

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40. Stone A is dropped but stone B and C are projected horizontally $(u_C > u_B)$ from top of tower of height h. then find out

(i) Which stone will reach the ground earlier

(ii) Relation between vertical velocity of stones when they hit the ground.

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41. Two particles move in a uniform gravitational field with an acceleration g. At the intial moment the particles were located at one point and moved with velocity $v_1 = 1 \quad ms^{-1}$ and $v_2 = 4 \quad ms^{-1}$ horizontally in opposite directions. Find the time interval after their velocity vectors become mutually perpendicular

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42. A particle projected from origin moves in x-y plane with a velocity $\vec{v} = 3\hat{i} + 6x\hat{j}$, where $\hat{i}$ and $\hat{j}$ are the unit vectors along x and y axis. Find the equation of path followed by the particle :-

A. $y = x^2$

B. $y = \frac{1}{x^2}$

C. $y = 2x^2$

D. $y = \frac{1}{x}$

Answer: A

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43. A golfer standing on level ground hits a ball with a velocity of $u = 52m/s$ at an angle α above the horizontal. If $\tan\theta = 5/12$, then the time interval for which the ball is at least 15 m above the ground (i.e. between A and B will be :(take $g = 10m/s^2$)

A. 1 sec

B. 2 sec

C. 3 sec

D. 4 sec

Answer: B

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44. A projectile is given an initial velocity $\hat{i} + 2\hat{j}$.The cartesin equation of its path is $(g = 10ms^{-2})$

A. $y = 2x - 5x^2$

B. $y = x - 5x^2$

C. $4y = 2x - 5x^2$

D. $y = 2x - 25x^2$

Answer: A

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45. A particle of mass 50 g is projected horizontally from the top of a tower of height 50 m with a velocity $20m/s$. If $g=10m/s^2$, then find the :-

A. Velocity at the instant t=2 s

B. Position at the instant t=3 s

C. Velocity just before hitting the ground

D. Change in velocity in 2 s

Answer: A::B::C::D

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46. L_1 metre train is moving with a velocity of v_1 m/s and another L_2 m/s in opposite dircetion. Find out (i) The time taken by two train to cross each other (ii) Distance travel by the each train during the crossing.

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47. A 150 m long train is moving in north direction with a velocity of 5m/s and a parrot is also moving in north direction with a velocity of 10 m/s, then find out (i) The time taken by parrot to cross the train (ii) Distance travel by the parrot during the crossing.

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48. A 100 m long train is moving with a velocity of 10 m/s, then find out the time taken by train to cross a bridge of length 150 m.

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49. A car is moving with a speed of 25 km/hour in the East. A bus is moving with a speed of $25\sqrt{3}$ km/hour in the North. What will be the relative velocity of the bus for the car's driver ?

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50. A car is moving towards east with a speed of $25 kmh^{-1}$. To the driver of the car, a bus appears to move towards north with a speed of $25\sqrt{3} kmh^{-1}$. What is the actual velocity of the bus ?

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51. The wind is blowing in south with velocity of 4 km/h and abserver is travelling with velocity of $4\sqrt{3}$ km/h in east. Find out the velocity of wind appeared to observer.

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52. An observer is travelling in west with velocity of 5 km/h and observes that wind is blowing in north with the velocity of $5\sqrt{3}$ km/h. Find out the actual velocity of wind.

Watch Video Solution

53. An observer is travelling in east with a velocity of 2 m/s and observes that wind is blowing in north with a velocity of 2m/s. If observer doubles his velocity then find out the velocity of wind appears to observer ?

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54. Rain is falling vertically downwards with a velocity of 2m//s. A person is runing to the North with a velocity of $2\sqrt{3}$m/s. Find out the velocity and direction of rain as appeared to the person.

Watch Video Solution

55. A person is walking to the east at 2 km/hr and the rain drops appear to him dropping vertically downwards at $2\sqrt{3}km/hr$. Find the actual velocity of rain.

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56. A swimmer takes 4 second in crossing some distance in downstream and taken 6 second in upstream for same distance then find the time taken by him to cover same distance in still water.

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57. A river is flowing from the west to the east at 5m/min. A swimmer on the southerm bank can swim at 10 m/min in still water. In what direction should he swim if (i) He wishes to cross the river in minimum time (ii) He wishes to cross te river through shortest route

View Text Solution

58. A man standing on a moving escalator, completes a certain distance in time t_1. If the escalator does not move then man covers this distance in time t_2 by walking.

(i) How much time will he take to cover the same distance if he move on the moving escalator in the same direction ?

(ii) How much time will he take to cover the same distance if he move on the moving escalator in the opposite direction ?

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59. Two cars A and B are moving in same direction with velocities 30 m/s and 20 m/s. When car A is at a distance d behind the car B, the driver of the car A applies brakes producing uniform retardation of $2m/s^2$. There will be no collision when :-

A. $d < 2.5\text{m}$

B. $d < 125\text{m}$

C. $d > 25\text{m}$

D. $d > 125\text{m}$

Answer: C

Watch Video Solution

1. There are two bodies A & B of same mass body A is at rest while body B is under going uniform motion, which is correct statements ?

A. Inertia of $A >$ inertia of B.

B. Inertia of $B >$ inertia of A.

C. Inertia of A = inertia of B.

D. Either $1^{st}, 2^{nd}$ or 3^{rd} depending upon the shape of body.

Answer: C

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2. Force applied on a body is given by ltbygt $F = (3t^2 - 2t + 10)$N where t is in seconds. Find impulse imparted in t=0 to t=2 sec.

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3. A particle is acted upon by a force given by $F = \left(12t - 3t^2\right)$N, where is in seconds. Find the change in momenum of that particle from t=1 to t=3 sec.

Watch Video Solution

4. A rocket of mass 20000 kg is ejecting the gases at the rate of 50 kg/sec with speed of 20 m/sec in gravity free space. Find the acceleration of rocket at 2 sec.

Watch Video Solution

5. A jet is releasing water at the rate of 6 kg/see with speed of 4 m/sec. Now this water strikes a block of mass 10 kg. find the force exerted on block & its acceleration ?

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6. A ball of mass 2 kg is moving with velocity 20 m/sec strikes with the surface and rebounds with same speed, if time of contact is 0.1 sec then calculate average force on the ball.

Watch Video Solution

7. A machine gun fires bullets of 50gm at the speed of 1000m/sec. If an average force of 200N is exerted on the gun, the maximum number of bullets fired per minute is:

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8. When a same force is applied on two different objects. It produces accelerations of $4\frac{m}{\sec^2}$ and $6\frac{m}{\sec^2}$. In these objects, if the same force is applied on the combination of these objects, calculate acceleration of combination.

Watch Video Solution

9. A body moving with uniform velocity is stopped in 0.25 second by applying a retarding force of 200 Newton. The intial momentum of the body will be :-

A. 50 N-s

B. 100 N-s

C. 150 N-s

D. Zero

Answer: A

Watch Video Solution

10. The exhaust velocity of gases with respect to a small rocket of mass 25 kg. is $28 \times 10^2 m/s$. At what rate the fuel must burn so that it may rise up with an acceleration of $9.8 m/s^2$?

A. 175 Kg

B. 1.75 Kg/s

C. 0.175 Kg/s

D. Zero

Answer: C

Watch Video Solution

11. The diameter of the top of a firebrigade pump is 5 cm. Water is thrown by this pump at a horizontal speed of 18 m/s on a wall. If water rebounds back from the wall, then the force exerted by water on wall will be :-

A. 2.35×10^5 dyne

B. 5.76×10^6 dyne

C. 6.36×10^7 dyne

D. 12.72×10^7 dyne

Answer: D

Watch Video Solution

12. At a place where the acceleration due to gravity is 10m sec^{-2} a force of 5 kg - wt acts on a body of mass 10 kg initially at rest. The velocity of the body after 4 second is

A. 5 m/s

B. 20 m/s

C. 10 m/s

D. 50 m/s

Answer: B

Watch Video Solution

13. Suppose a rocket with an intial mass M_0 eject a mass Δm in the form of gases in time Δt, then the mass of the rocket after time t is :-

A. $M_0 - \frac{\Delta m}{\Delta t}.t$

B. $M_0 - \frac{\Delta m}{\Delta t}$

C. $M_0 - \frac{\Delta m}{\Delta t}$

D. M_0

Answer: A

Watch Video Solution

14. A cart is moving with a velocity 20m/s. Sand is being dropped into the cart at the rate of 50 kg/min. The force required to move the cart with constant velocity will be :-

A. 50 N

B. 30.33N

C. 26.45N

D. 16.66N

Answer: D

Watch Video Solution

15. A body of mass m is projected with intial speed u at an angle θ with the horizontal. The change in momentum of body after time t is :-

A. m u $\sin\theta$

B. 2 m u $\sin\theta$

C. m g t

D. zero

Answer: C

Watch Video Solution

16. If impulse I varies time t as I$\left(kgms^{-1}\right) = 20t^2 - 40t.$

The change in momentum is minimum at :-

A. t=2 s

B. t=1 s

C. $t = \frac{1}{2}s$

D. $t = \frac{3}{2}s$

Answer: B

Watch Video Solution

17. The average force necessary to stop a hammer with momentum p (in N-s) in 0.5 s is :-

A. 2p N

B. p N

C. 4p N

D. $\frac{P}{2}N$

Answer: A

Watch Video Solution

18. Block a of mass 4 kg is to be kept at rest against a smooth vertical wall by applying a force F as shown in figure. The force required is :- $(g = 10m / s^2)$

A. $40\sqrt{2}N$

B. $20\sqrt{2}N$

C. $10\sqrt{2}N$

D. $15\sqrt{2}N$

Answer: A

Watch Video Solution

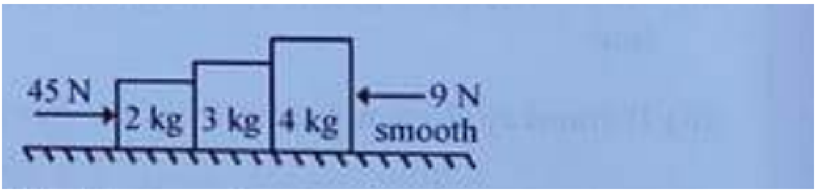
19. A man of mass 60 kg is in a lift and lift is accelerating upwards with acceleration $4m / s^2$. Calculate effective weight of man in lift.

Watch Video Solution

20. Effective weight of man of mass 50 kg in a lift is 600 N. Lift is accelerating upwards. Calculate acceleration of lift.

Watch Video Solution

21. Find interaction force between 3Kg and 4Kg block.



Watch Video Solution

22. On the pan of a spring balance , is placed a beaker containing water . How will the reading of spring balance change if we dip our finger in this water ?

A. increase

B. decrease

C. remain constant

D. depend upon the material o beaker

Answer: A

Watch Video Solution

23. A boy standing on a weighing machine notices his wight as 400 N. When he suddenly jumps upward the weight shown by the machine becomes 600 N. The acceleration with which the boy jumps up is : (Take $g = 10m / s^2$)

A. $5ms^{-2}$

B. $3.4ms^{-2}$

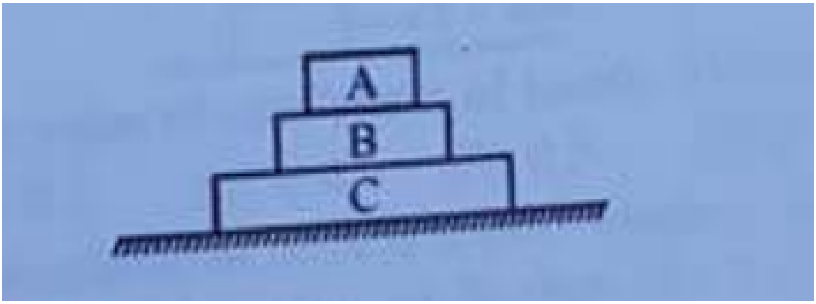
C. $6ms^{-2}$

D. $9.8ms^{-2}$

Answer: A

Watch Video Solution

24. Three blocks are placed as shown in figure. Mass of A, B and C are $m_1, m_2,$ and $m_3$respectively. The force exerted by block 'C' on 'B' is :-



A. $m_1 g$

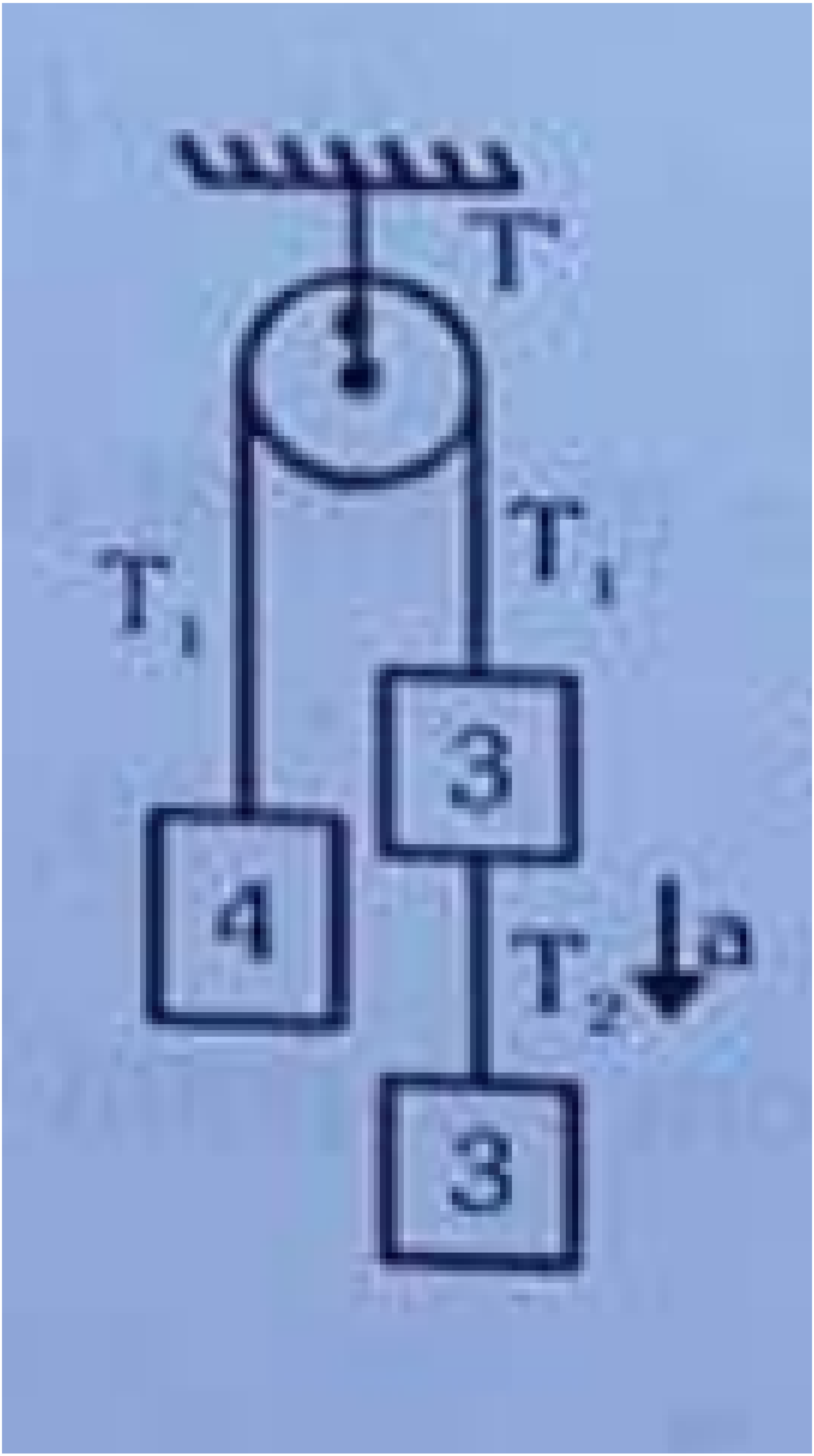
B. $(m_1 + m_2)g$

C. $m_2 g$

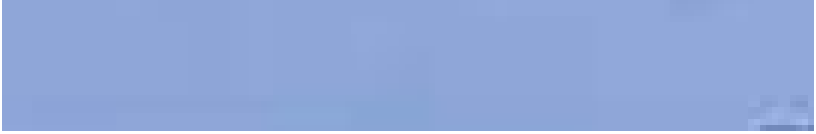
D. $(m_1 + m_2 + m_3)g$

Answer: B

Watch Video Solution

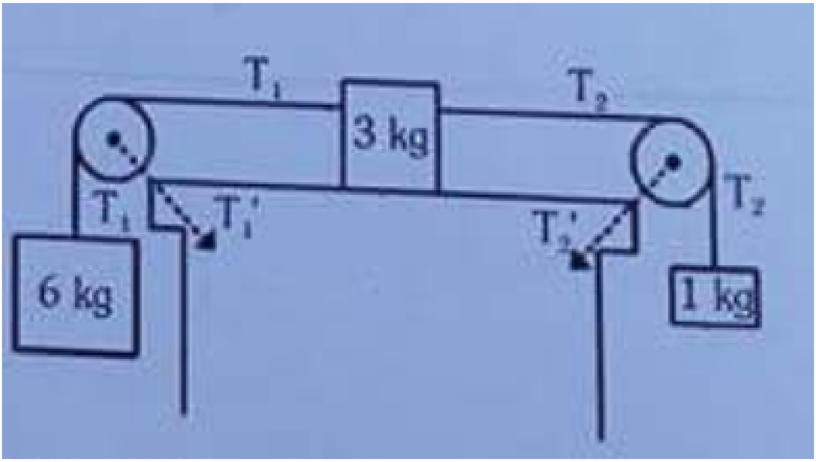


T
T1
T1
3
4
T2
a
3

25. 

Find a, T_1, T_2, T. (masses are in Kg)

Watch Video Solution

26. 

Calculate a, $T_1, T_2, T_1' \& T_2'$.

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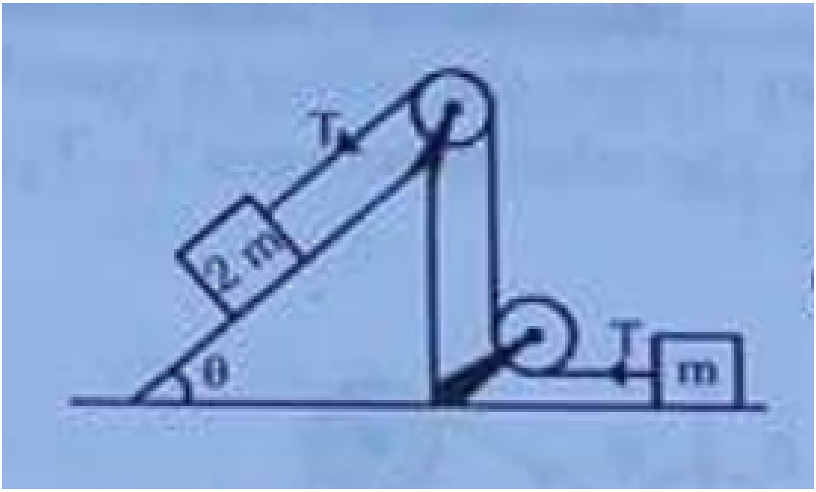
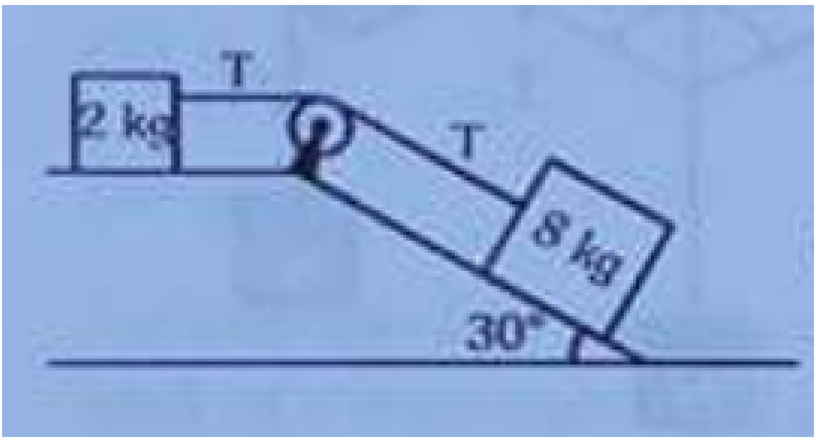
27. 

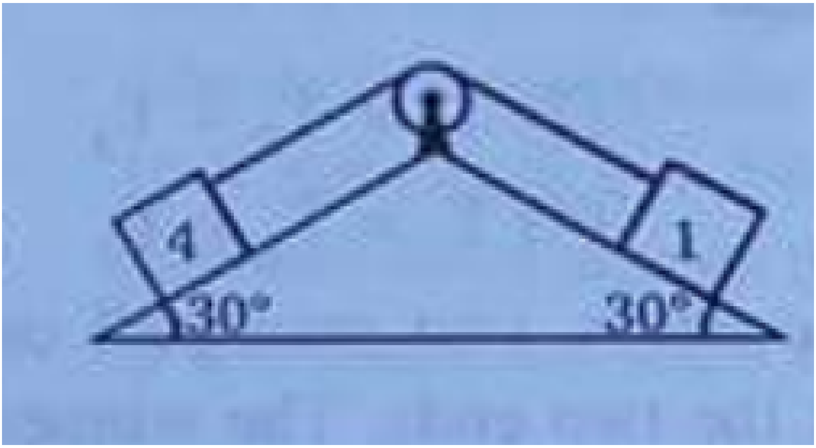
Calculate a & T.

Watch Video Solution

28. 

Calculate a & T.

Watch Video Solution

29. 

Calculate a & T.

(masses are in Kg)

Watch Video Solution

30. 80 railway wagons all of same mass 5×10^3kg are pulled by an engine with a force of 4×10^5N. The tension in the coupling between 30 th and st 31st wagon from the engine is :-

A. $400 \times 10^4 N$

B. $32 \times 10^4 N$

C. $20 \times 10^4 N$

D. $25 \times 10^4 N$

Answer: D

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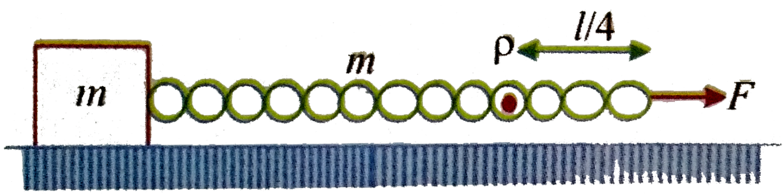
31. A block of mass m is pulled by a uniform chain of mass m tied to it by applying a force F at the other end of the chain.The tension at a point P which is at a distance of quarter of the length of the chain from the free end,will be



A. $\frac{7F}{8}$

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

C. $\frac{3F}{4}$

D. $\frac{6F}{7}$

Answer: A

Watch Video Solution

32. A sphere is accelerated upwards with the help of a cord whose braking strength is five times its weight. The maximum acceleration with which the sphere can move up without cord breaking is :-

A. 4g

B. 3g

C. 2g

D. g

Answer: A

Watch Video Solution

33. In a tug of war contest, two men pull on a horizontal rope at the two ends, The winner :-

A. exerts a force on the rope which is greater than the tension

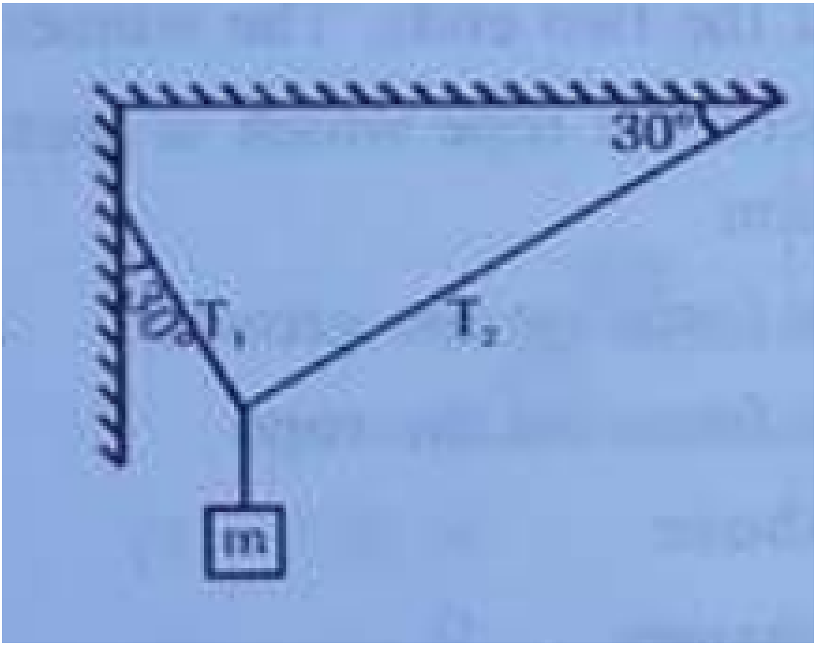
B. exerts greater force on the ground

C. exerts greater force on the rope

D. none of these

Answer: B

Watch Video Solution

34. 

Calculate $T_1 \& T_2$.

Watch Video Solution

35. A sparrow flying in air sits on a stretched telegraph wire If weight of the sparrow is W which of the following is true about the tension T produced in the wire ?

A. T=W

B. $T > W$

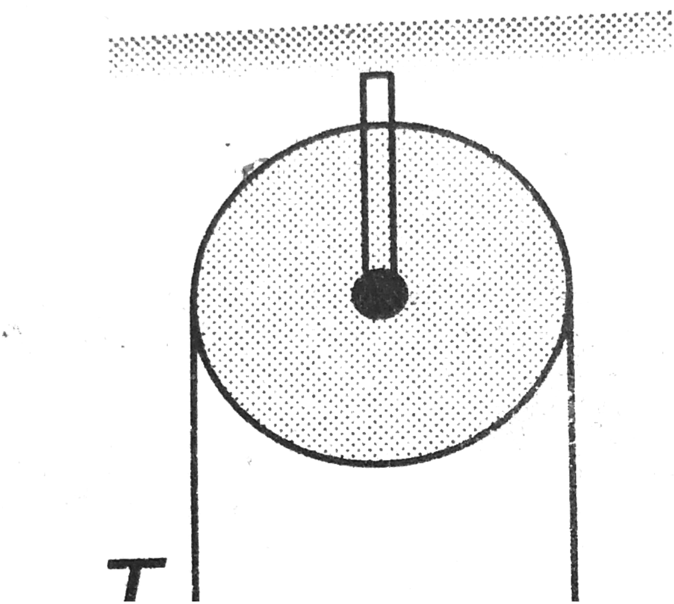
C. $T < W$

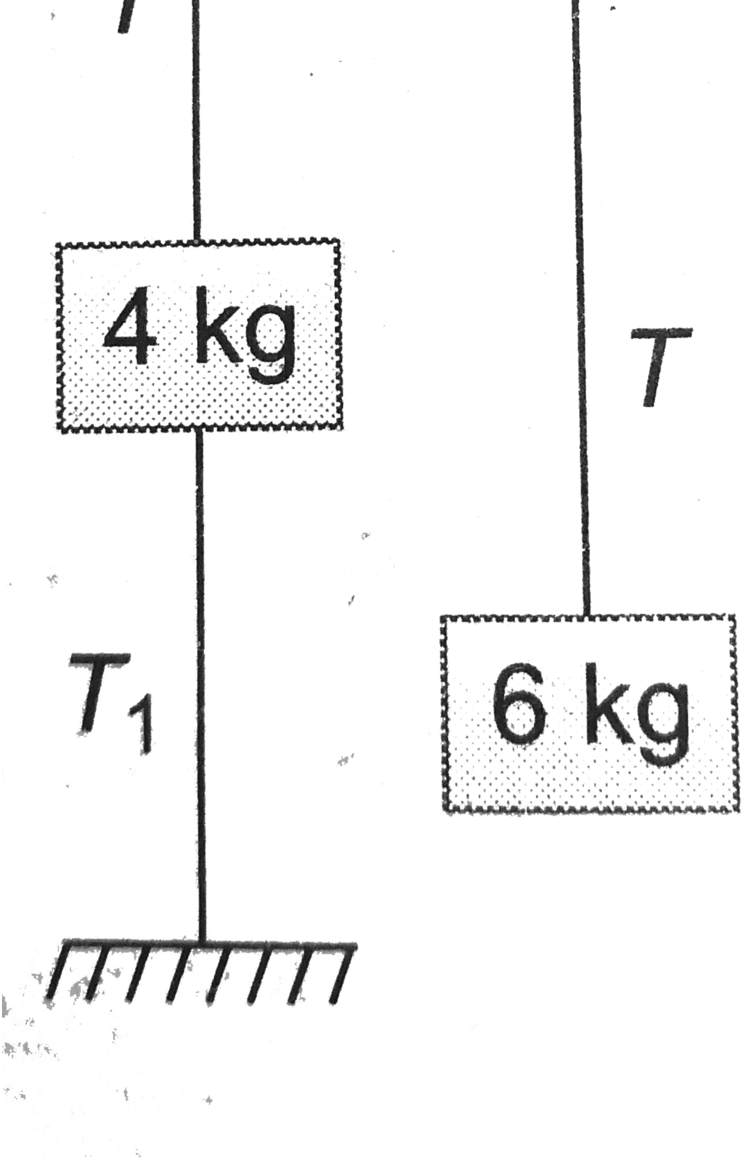
D. T=0

Answer: B

Watch Video Solution

36. Two bodies of mass 4kg and 6kg are attached to the ends of a string passing over a pulley. The 4kg mass is attached to the table top by another string. The tension in this string T_1 is equal to: Take





A. 10 N

B. 10.6 N

C. 25 N

D. 20 N

Answer: D

Watch Video Solution

37. A beaker is half filled with water. It is allowed to slip down an inclined plane with angle of inclination θ to the horizontal. The level of water in the beaker will be :-

A.

B.

C.

D.

Answer: D

View Text Solution

38. In the following figure, if the tension in the string AB is 51N, then the tension in the string BC will be :-

A. 10 N

B. 20 N

C. 30 N

D. 40 N

Answer: C

Watch Video Solution

39. In the above problem, the value of weight W will be :-

A. 59,16 N

B. 100.5

C. 93.9 N

D. 87.5 N

Answer: A

View Text Solution

40. In the following figure, the pulley is massless and frictionless. The relation between T_1, T_2 and T_3 will be :-

ltimg

src="https://d10lpgp6xz60nq.cloudfront.net/physics_images/ALN_PHY_R03_E0

width="80%"gt

A. $T_1 = T_2 \neq T_3$

B. $T_1 \neq T_2 = T_3$

C. $T_1 \neq T_2 \neq T_3$

D. $T_1 = T_2 = T_3$

Answer: D

Watch Video Solution

41. A bird is sitting in a large closed cage which is placed on a spring balance. It records a weight of 25 N. The bird (mass=0.5 kg) flies upward in the cage with an acceleration of $2m/s^2$. The spring balance will now record a weight of :-

A. 24 N

B. 25 N

C. 26 N

D. 27 N

Answer: C

Watch Video Solution

42. An iron black of mass m=500 kg is kept at the back of a truck moving at a speed $v_0 = 90kmh^{-1}$ The driver applies the brakes and slows down to a speed of $v = 54kmh^{-1}$ in 10 s. What constant force acts on the block during this time if the block not slide on the truck-bed :-

A. $-500N$

B. $300N$

C. $-400N$

D. None

Answer: A

Watch Video Solution

43. The concept of inertia is explained in :-

A. Newton's first law

B. Newton's second law

C. Newton's third law

D. All of these

Answer: A

Watch Video Solution

44. Select correct statement regarding pseudo force :-

A. It is electromagnetic in origin

B. Newton's 3rd law in applicable for it

C. It is a fundamental force

D. It is used to make Newton's law applicable in non-inertial frame

Answer: D

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Basic Maths (FRICTION)

1. Find value of pulling force F for which block just moves. Given coefficient of friction for surface is μ.

Watch Video Solution

2. Find value of pushing force F for which the body just moves.

Watch Video Solution

3. Find the minimum value of horizontal force (F) required on the block of mass m to keep it at rest on the wall. Given the coefficient of friction between the surfaces is μ.

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4. What is the maximum value of force, so that both the blocks will move together ?

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5. A block of mass 10 kg is kept over a rough surface and a force F=4t is applied on it. At what value of t the block will start moving :-

A. > 10 s

B. < 8 s

C. $= 9$ s

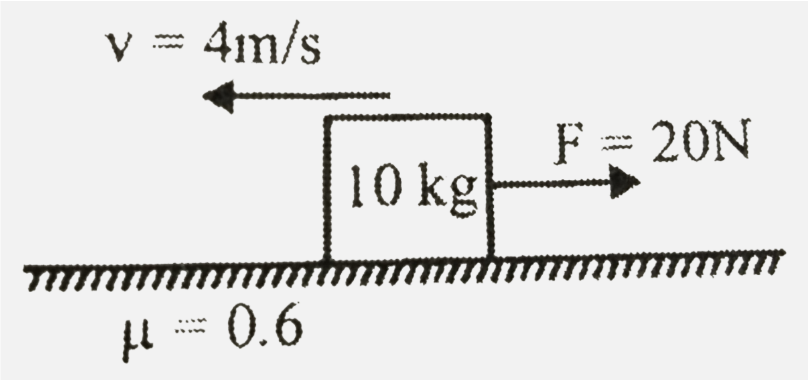
D. None

Answer: A

Watch Video Solution

6. A block of mass 10 kg is moving on a rough surface as shown in figure.

The frictional force acting on block is :-



A. 20 N

B. 60 N

C. 40 N

D. 80 N

Answer: B

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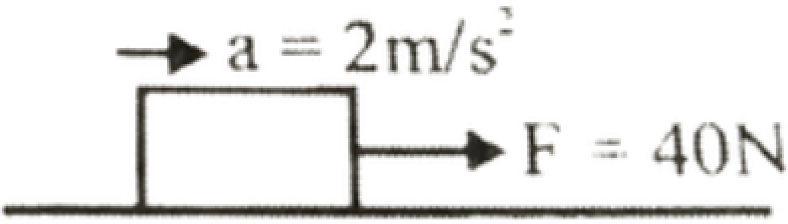
7. A block of mass 10 kg, moving with acceleration $2m/s^2$ on horizontal rough surface is shown in figure



A. 0.2

B. 0.4

C. 0.5

D. 0.1

Answer: A

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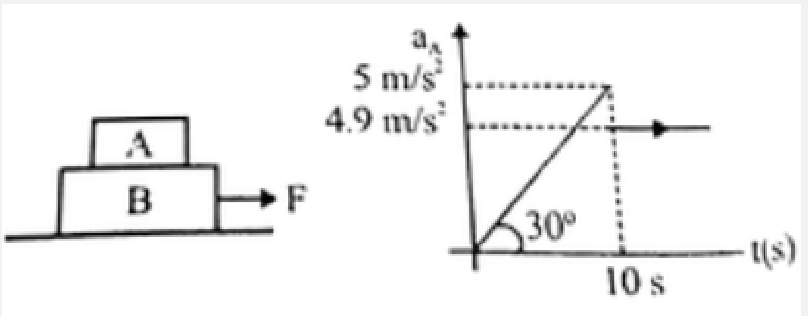
8. Acceleration of block A varies with time as shown in figure the value of coefficient of kinetic friction between block A and B is



A. 0.5

B. 0.6

C. 0.4

D. None of these

Answer: A

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9. Block of mass 10 kg is moving on inclined plane with constant velocity 10 m/s. The coedfficient of kinetic friction between incline plane and block is :-

A. 0.57

B. 0.75

C. 0.5

D. None of these

Answer: B

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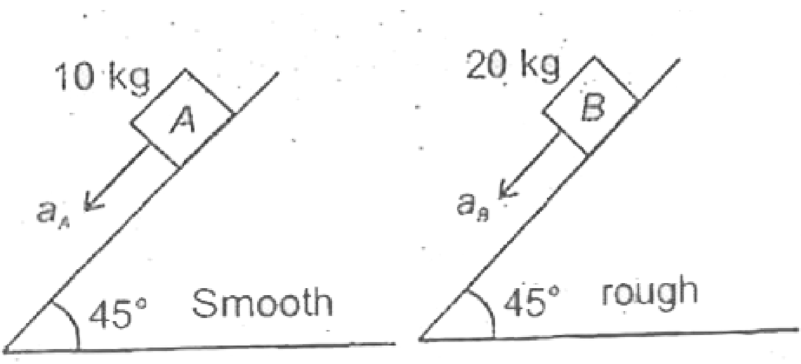
10. 

The ratio of acceleration of blocks A placed on smooth incline with block

B placed on rough incline is $2:1$. The coefficient of kinetic friction between block B and incline is

A. 0.5

B. 0.75

C. 0.57

D. None of these

Answer: A

Watch Video Solution

11.

Blocks shown in figure moves with constant velocity 10 m/s towards right. All surgaces in contact are rough. The friction force applied by B on A is :-

A. 0 N

B. 20 N

C. 10 N

D. insufficient data

Answer: A

Watch Video Solution

Basic Maths (WORK POWER & ENERGY)

1. A block of mass 2 kg is plased on a smooth horizontal surface. Two forces $F_1 = 20$ N and $F_2 = 5$ N start acting on the block in opposite directions as shown. If block gets displaced by 5 m in the direction of net force then work done by F_2 is :-

A. $-75J$

B. 75 J

C. $-25J$

D. 25 J

Answer: C

Watch Video Solution

2. A man of mass 50 kg is standing in an elevator. If elevator is moving up with an acceleration $\frac{g}{3}$ then work done by normal reaction of elevator floor on man when elevator moves by a distance 12 m is $\left(g = 10m/s^2\right)$:-

A. 2000 J

B. 4000 J

C. 6000 J

D. 8000 J

Answer: D

Watch Video Solution

3. A cubical vessel of height 1 m is full of water. What is the workdone in pumping water out of the vessel?

A. 5000 J

B. 10,000 J

C. 5 J

D. 10 J

Answer: A

Watch Video Solution

4. A man pulls a bucket of water from a depth of h from a well. If the mass of the rope and that of bucket full of water are m and M respectively, the work done by the man is :

A. $\left(\frac{M}{2}+m\right)gh$

B. $\left(\frac{M+m}{2}\right)gh$

C. $\left(M+\frac{m}{2}\right)gh$

D. $(M+m)gh$

Answer: C

Watch Video Solution

5. The potential energy of a particle of mass 1 kg moving along x-axis given by $U(x)=\left[\frac{x^2}{2}-x\right]J$. If total mechanical speed (in m/s):-

A. $\sqrt{5}$

B. $\sqrt{7}$

C. $\sqrt{3}$

D. None

Answer: A

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6. The potential energy of an object of mass m moving in xy plane in a conservative field is given by U = ax + by , where x and y are position coordinates of the object. Find magnitude of its acceleration :-

A. $\dfrac{\sqrt{a^2 + b^2}}{m}$

B. $\dfrac{a^2 + b^2}{m}$

C. $\sqrt{a^2 + b^2}$

D. None

Answer: A

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7. On a particle placed at origin a variable force $F = -ax$(where a is a positive constant) is applied. If U(0)=0, the graph between potential energy of particle U(x) and x is best represented by:-

A.

B.

C.

D.

Answer: B

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8. A particle located in one dimensional potential field has potential energy function $U(x) = \frac{a}{x^2} - \frac{b}{x^3}$, where a and b are positive constants. The position of equilibrium corresponds to x equal to

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

B. $\frac{2b}{3a}$

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

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

Answer: D

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9. The position (x) of a particle of mass 2 kg moving along x-axis at time t is given by $x=\left(2t^{3}\right)$ metre. Find the work done by force acting on it in time interval t=0 to t=2 is :-

A. 576 J

B. 584 J

C. 623 J

D. None

Answer: A

Watch Video Solution

10. The velocity (v) of a particle of mass m moving along x-axis is given by $v=\alpha\sqrt{x}$, where α is a constant. Find work done by force acting on particle during its motion from x=0 to x=2m :-

A. $m\alpha^2$

B. $m\alpha$

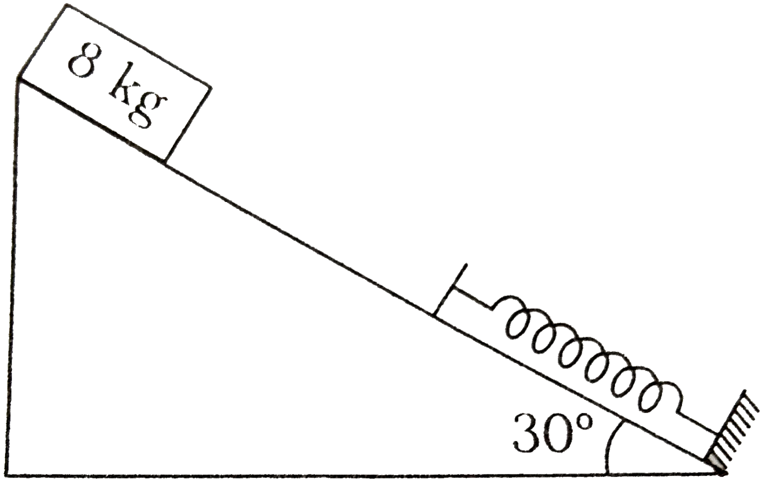
C. $\frac{m\alpha}{2}$

D. None

Answer: A

Watch Video Solution

11. A block of mass 8 kg is released from the top of an inclined smooth surface as shown in figure. If spring constant of spring is 200 Nm^(-1) and block comes to rest after compressing spring by 1 m then find the distance travelled by block before it comes to rest



A. 2.5 m

B. 3.5 m

C. 2.0 m

D. None

Answer: A

Watch Video Solution

12. The position (x) of body moving along x-axis at time (t) is given by $x = 3f^2$ where x is in matre and t is in second. If mass of body is 2 kg, then find the instantaneous power delivered to body by force acting on it at $t = 4$ s.

A. 288 W

B. 280 W

C. 290 W

D. None

Answer: A

Watch Video Solution

13. A block of mass m is released on the top of a smooth inclined plane of length x and inclination θ as shown in figure. Horizontal surface is rough. If block comes to rest after moving a distabce d on the horizontal surface, then coefficient of friction between block and surface is :-

A. $\dfrac{x \sin\theta}{2d}$

B. $\dfrac{x \cos\theta}{2d}$

C. $\dfrac{x \sin\theta}{d}$

D. $\dfrac{x \cos\theta}{d}$

Answer: C

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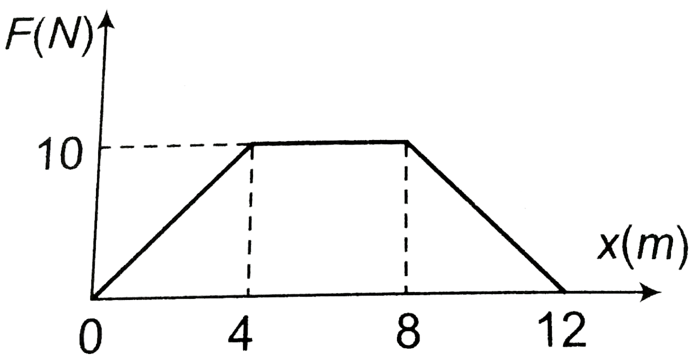

14.

A particle of mass 0.1 kg is subjected to a force which varies with distance as shown in figure. If it starts its journey from rest at $x = 0$, its velocity at $x = 12m$ is

A. 0 m/s

B. $20\sqrt{2}$ m/s

C. $20\sqrt{3}$ m/s

D. 40 m/s

Answer: D

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15. An unloaded bus can be stopped by applying brakies on straight road after covering a distance x. Suppose, the passenger add 50% of its weight as the load and the braking force remains unchanged, how far will the bus go after the application of the brakes ?(Velocity of bus in both case is same) (Consider negligible friction):-

A. Zero

B. 1.5 x

C. 2x

D. 2.5 x

Answer: B

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16. A body of mass m, accelerates uniformly from rest to V_1 in time t_1. The instantaneous power delivered to the body as a function of time t is.

A. $\frac{mv_1^2}{T_1^2}t$

B. $\frac{mv_1}{T_1^2}t$

C. $\left(\frac{mv_1}{T_1}\right)^2 t$

D. $\frac{mv_1^2}{T_1}t^2$

Answer: A

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17. A car of mass m has an engine which can deliver power P. The minimum time in which car can be accelerated from rest to a speed v is :-

A. $\frac{mv^2}{2P}$

B. Pmv^2

C. $2Pmv^2$

D. $\frac{mv^2}{2}P$

Answer: A

Watch Video Solution

18. The rate of doing work by force acting on a particle moving along x-axis depends on position x of particle and is equal to 2x. The velocity of particle is given by expression :-

A. $\left[\frac{3x^2}{m}\right]^{1/3}$

B. $\left[\frac{3x^2}{2m}\right]^{1/3}$

C. $\left(\frac{2mx}{9}\right)^{1/2}$

D. $\left[\frac{mx^2}{3}\right]^{1/2}$

Answer: A

Watch Video Solution

19. An object starts from rest and is acted upon by a variable force F as shown in figure. If F_0 is the initial value of the force, then the position of the object, where it again comes of rest will be :-

A. $\frac{2F_0}{\tan\alpha}$

B. $\frac{F_0}{\sin\alpha}$

C. $\frac{2F_0}{\cot\alpha}$

D. $\frac{F_0}{2\cos\alpha}$

Answer: A

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20. Which of the following force is not conservative :-

A. $\overline{F} = 3\hat{i} + 4\hat{j}$

B. $\overline{F} = 3x\hat{i} + 4y\hat{j}$

C. $\overline{F} = 3y\hat{i} + 4x\hat{j}$

D. $\overline{F} = 3x^2\hat{i} + 4y^2\hat{j}$

Answer: C

Watch Video Solution

Basic Maths (CIRCULAR MOTION)

1. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force equal to -$\left(K/r^2\right)$. Where K is constant. What is the total energy of the particle?

A. $-K/2r$

B. $\frac{K}{4}r$

C. $\frac{K}{r}$

D. None

Answer: A

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2. If a_r and a_t respresent radial and tangential acceleration, the motion of a particle will be circular is

A. (i, iii)

B. (ii, iii)

C. (iii, iv)

D. (ii, iv)

Answer: C

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3. A particle P is moving in a circle of radius 'a' with a uniform speed v. C is the centre of the circle and AB is a diameter. When passing through B the angular velocity of P about A and C are in the ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: B

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4. A motor car is travelling at $60m/s$ on a circular road of radius 1200m. It is increasing its speed at the rate of $4m/s^2$. The acceleration of the car is:

A. $3m/s^2$

B. $4m/s^2$

C. $5m/s^2$

D. $7m/s^2$

Answer: C

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5. The speed of a particle moving in a circle slows down at a rate of $3m/\sec^2$. At some instant the magnitude of the total acceleration is $5\frac{m}{\sec^2}$ and the particle's speed is 12 m/sec. The radius of circle will be :

A. 12 m

B. 24 m

C. 36 m

D. 48 m

Answer: C

Watch Video Solution

6. A point moves along a circle with speed v=at. The total acceleration of the point at a time when it has traced 1//8th of the circumference is:

A. $\frac{v}{8a}$

B. $2a\sqrt{4+\pi^2}$

C. a

D. $\frac{a}{2}\sqrt{4+\pi^2}$

Answer: D

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7. A particle of mass 'm' is moving along a circle of radius 'r'. At some instant, its speed is 'v' and it is gaining speed at a uniform rate'a', then, at the given instant, acceleration of the mparticle is :

A. along the radius

B. inclined to radius at $\theta = \sin^{-1}\frac{1}{\left[1+\frac{v^4}{a^2r^2}\right]^{1/2}}$

C. inclined to radius at $\theta = \frac{\cos^{-1}(ar)}{v^2}$

D. inclined to radius at $\theta = \frac{\tan^{-1}(v^2)}{ar}$

Answer: B

Watch Video Solution

8. Particle A and B are moving in coplanar circular paths centred at O. They are totating in the same sense. Time periods of rotation of A and B around O are T_A and T_B, respectively, with $T_B > T_A$. Time required for

B to make one ratation around O relative to A is :

A. $T_B - T_A$

B. $T_B + T_A$

C. $\frac{T_B T_A}{T_B + T_A}$

D. $\frac{T_B T_A}{T_B - T_A}$

Answer: D

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9. For a particle in uniform circular motion , the acceleration $\overrightarrow{a}$ at a point $p(R, \theta)$ on the circle of radiu R is (Here θ is measured from the $x - a\xi s$)

A. $\frac{v^2}{R}\hat{i} + \frac{v^2}{R}\hat{j}$

B. $-\frac{v^2}{R}\cos\theta\hat{i} + \frac{v^2}{R}\sin\theta\hat{j}$

C. $-\frac{v^2}{R}\sin\theta\hat{i} + \frac{v^2}{R}\cos\theta\hat{j}$

D. $-\frac{v^2}{R}\cos\theta\hat{i}-\frac{v^2}{R}\sin\theta\hat{j}$

Answer: D

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10. Railway tracks are banked at the curves so that :

A. the train may not fall down inwards

B. the weight of the train may be reduced

C. the necessary centripetal force to train may be obtained from the horizontal compoinent of the reaction force of railway tracks

D. no frictional force may be produced between the wheel and the track

Answer: C

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11. A spaceman in training is rotated in a seat at the end of a horizontal arm of length 5 m. If he can with stand acceleration upto 9 g, then what is the maximum number of revolution per second permissible? (Take, g = $10ms^{-2}$)

A. 13.5 rev/s

B. 1.35 rev/s

C. 0.675 rev/s

D. 6.75 rev/s

Answer: C

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12. The driver of a bus travelling with a speed 'v' suddenly observes a wall in front of his bus at a distance 'a'. Father of this driver, who was also a driver, had advised him to take circular turn to avoid hitting in such a situation. However, the driver in question decides otherwise by using his own wisdom. He applies brakes as hard as possible without taking a circular turn, then :

A. he is more likely to hit the wall

B. he is less likely to hit the wall

C. he is as likey to hit the wall

D. none of the above

Answer: B

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13. A coin is placed on the horizontal surface of a rotation disc. The distance of the coin from the axis is 1 m and coefficient of friction is 0.5. If the disc starts from rest and is given an angular acceleration $\frac{1}{\sqrt{2}}$ rad / $\sec^2$, the number of revolutions through which the disc turns before the coin slips is

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

B. $\frac{7}{4\pi}$

C. $\frac{5}{4\pi}$

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

Answer: B

Watch Video Solution

14. The minimum velocity (in ms^(-1))` with which a car driver must traverse a flat curve of radius 150m and coefficient of friction 0.6 to avoid skidding is

A. 60

B. 30

C. 15

D. 25

Answer: B

Watch Video Solution

15. A 2 kg stone at the end of a string 1 m long is whirled in a vertical circle. At some point its speed is 4m/s. The tension of the string is 51.6 newton. At this instant the stone is :

A. at the top of the circle

B. at the bottom of the circle

C. half way down

D. none of these

Answer: B

Watch Video Solution

16. A partcle rests on the top of a hemisphere of radius R. Find the smallest horizontal velocity that must be imparted to the particle if it is to leave the hemisphere without sliding down :

A. $\sqrt{gR}$

B. $\sqrt{2gR}$

C. $\sqrt{3gR}$

D. $\sqrt{5gR}$

Answer: A

Watch Video Solution

Basic Maths (COLLISION AND CENTRE OF MASS)

1. A disc of radius r is cut from a larger disc of radius 4r in such a way that the edge of the hole touches the edge of the disc. The centre of mass of the residual disc will be a distance from centre of larger disc :-

A. $\frac{r}{5}$

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

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

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

Answer: A

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2. Two particles of mass m_1 and m_2 are projected from the top of a tower. The particle m_1 is projected vertically downward with speed u and m_2 is projected horizontally with same speed. Find acceleration of CM of system of particles by neglecting the effect of air resistance.

A. g downward

B. $\frac{m_1 g}{m_1 + m_2}$downward

C. $\frac{m_2 g}{m_1 + m_2}$downward

D. Can't be predicated

Answer: A

Watch Video Solution

3. A man of mass m stands at the left end of a uniform plank of length L and mass M, which lies on a frictionaless surface of ice. If the man walks to the other end of the plank, then by what distance does the plank slide on the ice?

A. L

B. $\frac{ML}{m+M}$

C. $\frac{mL}{M}$

D. $\frac{mL}{m+M}$

Answer: D

Watch Video Solution

4. A cart of mass M is tied to one end of a massless rope of length 10m. The other end of the rope is in the hands of a man of mass $\frac{M}{2}$. The entire ststem is on a smooth horizontal surface. If the man pulls the cart by the rope then find the distance by which the man will slip on the horizontal surface before the man and the cart will meet each other.

A. $\frac{20}{3}m$

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

C. 0

D. None

Answer: A

Watch Video Solution

5. Two point masses m_1 and m_2 at rest in gravity free space are released from distance d. Find the velocity of the CM of the system at the time of collision of particles

A. Zero

B. 2

C. 3

D. None

Answer: A

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6. Two blocks of masses 5kg and 2kg are connected by a spring of negligible mass and placed on a frictionless horizontal surface. An impulse provides a velocity of 7m/s to the heavier block in the direction of the lighter block. The velocity of the centre of mass is :-

A. 4 m/s

B. 5m/s

C. 2m/s

D. 3m/s

Answer: B

Watch Video Solution

7. Two uniform thin rods each of length L and mass m are joined as shown in the figure. Find the distance of centre of mass the system from point O

A. L/4

B. L/2

C. L

D. 2L

Answer: A

Watch Video Solution

8. A shell at rest on a smootyh horizontal surface explodes into two fragments of masses m_1 and m_2. If just after explosion, m_1 move with speed u, then work done by internal forces during explosion is :-

A. $\frac{1}{2}(m_1 + m_2)\frac{m_2}{m_1}u^2$

B. $\frac{1}{2}(m_1 + m_2)u^2$

C. $\frac{1}{2}m_1 u^2\left(1 + \frac{m_1}{m_2}\right)$

D. $\frac{1}{2}(m_1 - m_2)u^2$

Answer: C

Watch Video Solution

9. A body of mass 2 kg moving with a velocity of 3 m/sec collides head on with a body of mass 1 kg moving in opposite direction with a velocity of 4 m/sec. After collision, two bodies stick together and move with a common velocity which in m/sec is equal to

A. (1//4) m/s

B. (1//3) m/s

C. (2//3) m/s

D. (3//4) m/s

Answer: C

Watch Video Solution

10. A ball is dropped on the ground from a height of $1m$. The coefficient of restitution is 0.6. The height to which the ball will rebound is

A. 0.6 m

B. 0.4 m

C. 0.36 m

D. 0.16 m

Answer: C

Watch Video Solution

11. A massive ball moving with speed v collieds with a tiny ball which is intially at rest having a mass very much smaller than the mass of the first ball. The collision is elastic, then immediately after the impact, the second ball will move with a speed approximately equal to :-

A. v

B. 2v

C. v/2

D. ∞

Answer: B

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12. Particles x (of mass 4 kg) and y (of mass 9 kg) move directly towards each otyher, collide and then separate. If Δv_x is the change in the velocity of x and Δv_y is the change in velocity of y then the magnitude of $\frac{\Delta v_x}{\Delta v_y}$ is :

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

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

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

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

Answer: A

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Basic Maths (ROTATIONAL MOTION)

1. A fan is rotating with a speed of 450 rec/minute. Afer being switched off it comes to rest in 10s. Assuming constant angular deceleration, calculate the number of recvolutions made by it before coming to rest.

A. 37.5

B. 37

C. 38.5

D. None

Answer: A

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2. A particle is moving with constant speed v along the line y = a in positive x -direction. Find magnitude of its angular velocity about orgine when its position makes an angle θ with x-axis.

A. $\frac{v\sin^2\theta}{a}$

B. $\frac{v\cos^2\theta}{a}$

C. $v\sin\theta$

D. None

Answer: A

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3. A disc rotating about its axis/s in 4 second. The angle rotated by it during these seconds (in radian) is :-

A. 100 π

B. 200 π

C. 300 π

D. 400 π

Answer: D

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4. A body rotating with uniform angular acceleration covers 100π (radian) in the first 5 s after the start. Its angular speed at the end of 5 s (in rad/s) is

A. 40 π

B. 30 π

C. 20π

D. 10π

Answer: A

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5. A wheel starting from rest is uniformly accelerated at $2re\frac{d}{s^2}$ for 20 seconds. It is allowed to rotate uniformly for the next 10 seconds and is finally brought to rest in next 20 seconds. The total angle rotated by the wheel (in radian) is :-

A. 600

B. 1200

C. 1800

D. 300

Answer: B

Watch Video Solution

6. A body rotates about a fixed axis with an angular acceleration of $3rad/s^2$ The angle rotated by it during the time when its angular velocity increases frm 10 rad/s to 20 rad/s (in radian) is

A. 50

B. 100

C. 150

D. 200

Answer: A

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7. Two particles of masses m and $2m$ are placed at separation L. Find the $M.I.$ about an axis passing through the center of mass and perpendicular to the line joining the point masses.

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

B. $\frac{mr^2}{2}$

C. $\frac{mr^2}{4}$

D. $\frac{3mr^2}{4}$

Answer: A

Watch Video Solution

8. For a disc of given density and thickness, its moment of inertia varies with radius of the disc as :

A. $1 \propto R^2$

B. $1 \propto R^4$

C. $1 \propto R^3$

D. $1 \propto R$

Answer: B

Watch Video Solution

9. If a disc of moment of inertia 1 and radius r is reshaped into a ring of radius nr, keeping its mass same, its moment of inertia becomes

A. $n^2 I$

B. $2n^2 I$

C. $\frac{n^2}{2} I$

D. I

Answer: B

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10. Two circular loops A and B of radii R and 2R respectively are made of the similar wire. Their moments of inertia about the axis passing through the centre of perpendicular to their plane are I_A and I_B respectively. The ratio $\frac{I_A}{I_B}$ is :

A. $\frac{1}{4}$

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

C. $\frac{1}{2}$

D. 1

Answer: B

Watch Video Solution

11. A thin uniform metallic triangular sheet of mass M has sides AB=BC=L.

What is its moment of inertia about axis AC lying in plane of sheet ?

A. $\frac{ML^2}{12}$

B. $\frac{2ML^2}{3}$

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

D. $\frac{ML^2}{6}$

Answer: A

Watch Video Solution

12. Four solid rigid balls reach of mass m and radius r are fixed on a rigid-ring of radius 2r and mass 2m. The system is whirled about 'O' as shown. The radius of gyration of the system is :

A. $r\sqrt{\frac{128}{5}}$

B. $r\sqrt{\frac{88}{5}}$

C. $r\sqrt{\frac{128}{30}}$

D. $r\sqrt{\frac{88}{30}}$

Answer: C

Watch Video Solution

13. The radius of gyration (K) of a rigid body changes with change of :-

A. Angular speed

B. Axis of rotation

C. Both (1) and (2)

D. Never changes

Answer: B

Watch Video Solution

14. Four spheres of diameter 2a and mass M are placed with their centres on the four corners of a square of side b. Then moment of inertia of the system about an axis about one of the sides of the square is :-

A. $Ma^2 + 2Mb^2$

B. Ma^2

C. $Ma^2 + 4Mb^2$

D. $\frac{8}{5}Ma^2 + 2Mb^2$

Answer: D

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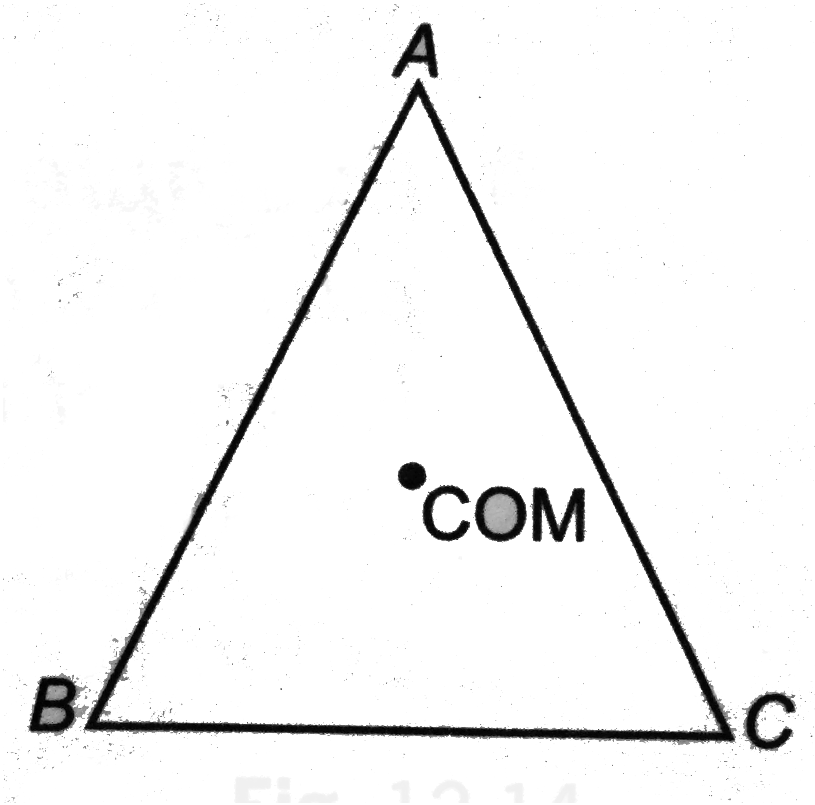
15.



Three rods each of mass m and length l are joined together to form an equilateral triangle as shown in figure. Find the moment of inertial of the system about an axis passig through its centre of mass and perpendicular to the plane of the particle.

A. $2mL^2$

B. $\frac{mL^2}{2}$

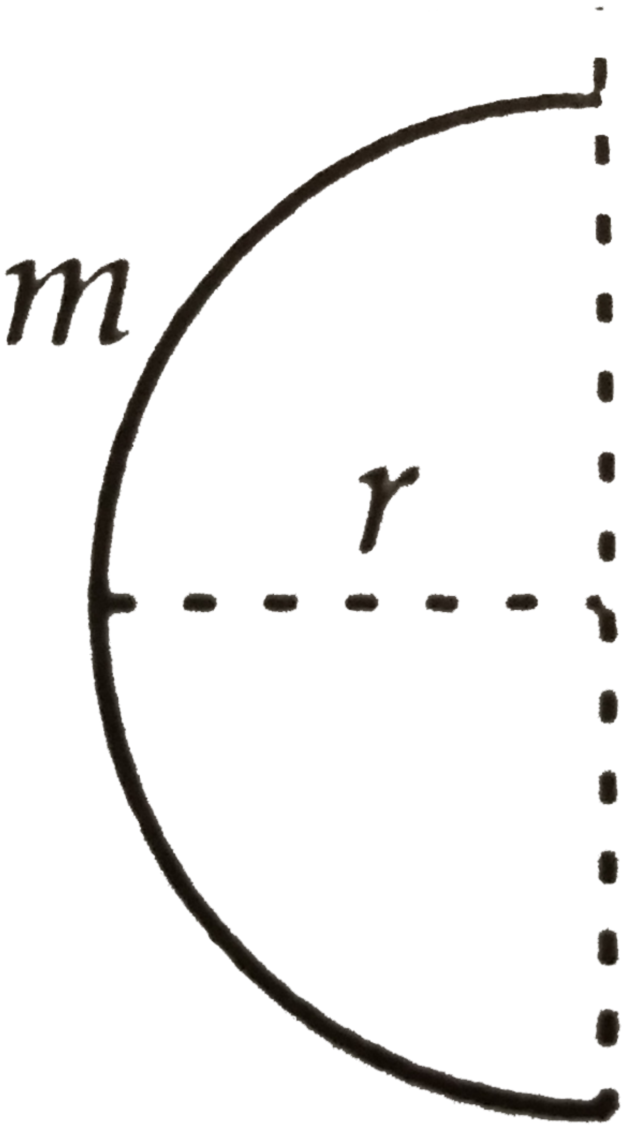
C. $\frac{mL^2}{3}$

D. $\frac{mL^2}{6}$

Answer: B

Watch Video Solution

16. A thin wire of length l and mass m is bent in the form of a semicircle as shown in the figure. Its moment of inertia about an axis joining its free ends will be



A. ml^2

B. Zero

C. $\frac{ml^2}{\pi^2}$

D. $\frac{ml^2}{2\pi^2}$

Answer: D

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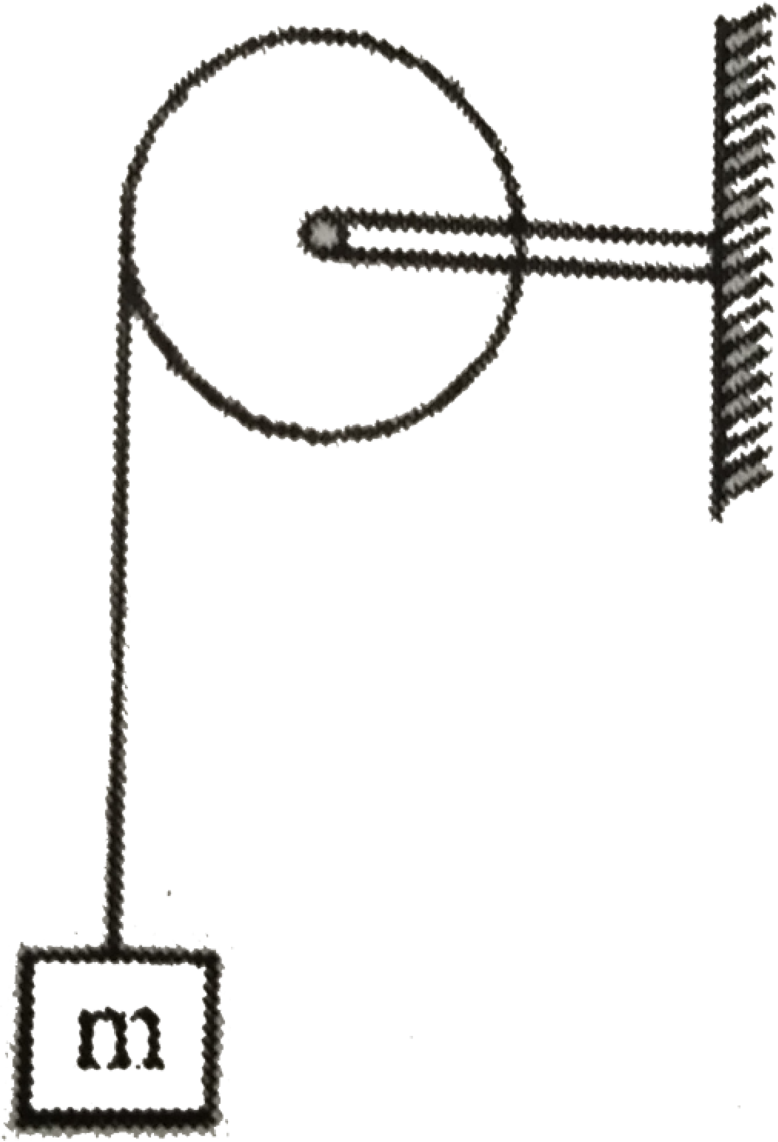
17. A disc of mass m and radius r is free to rotate about its centre as shown in the figure. A string is wrapped over its rim and a block of mass m is attached to the free end of the string. The system is released from rest. The speed of the block as it descends through a height h, is :-



A. $\sqrt{2gh}$

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

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

D. $\frac{1}{2}\sqrt{3gh}$

Answer: C

Watch Video Solution

18. A particle of mass m is projected with speed u at an angle θ with the horizontal. Find the torque of the weight of the particle about the point of projection when the particle is at the highest point.

A. mu $\sin\theta.\ \cos\theta$

B. m $u^2 \sin\theta \cos\theta$

C. $\frac{\text{mu} \quad \sin^2\theta}{2}$

D. $\frac{\text{mu}^2 \sin^2\theta}{2}$

Answer: B

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19. A cubical block of mass m and edge a slides down a rough inclned plane of inclination θ with a uniform speed. Find the torque of the normal force acting on the block about its centre.

A. $\frac{1}{2}\mathrm{mg\,a}\sin\theta$

B. $\mathrm{mga}\quad\tan\theta$

C. $\frac{1}{2}\mathrm{mga}\quad\cos\theta$

D. $\frac{1}{4}\mathrm{mga}\quad\sin 2\theta$

Answer: A

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20. The torpue of force $\overrightarrow{F}=-2\hat{i}+2\hat{j}+3\hat{k}$ acting on a point $\overrightarrow{r}=\hat{i}-2\hat{j}+\hat{k}$ about origin will be :

A. $8\hat{i}+5\hat{j}+2\hat{k}$

B. $-8\hat{i}-5\hat{j}-2\hat{k}$

C. $8\hat{i}-5\hat{j}+2\hat{k}$

D. $-8\hat{i}+5\hat{j}-2\hat{k}$

Answer: B

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21. Moment of a force of megnitude 20 N acting along positive x direction at point (3m 0, 0) about the point (0, 2, 0) (in N-m) is :-

A. 20

B. 60

C. 40

D. 30

Answer: C

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22. A disc is rotating with angular velocity ω. A force F acts at a point whose position vector with respect to the axis of rotation is r. The power associated with torque due to the force is given by

A. $\left(\vec{r} \times \vec{F}\right) . \vec{\omega}$

B. $\left(\vec{r} \times \vec{F}\right) \times \vec{\omega}$

C. $\vec{r} \times \left(\vec{F} . \vec{\omega}\right)$

D. $\vec{r} . \left(\vec{F} \times \vec{\omega}\right)$

Answer: A

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23. When a torque acting upon a system is zero, which of the following will be constant ?

A. Moment of velocity

B. Angular velocity

C. Kinetic energy

D. Moment of linear momentum

Answer: D

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24. Two men support a uniform rod of mass M and length L at its two ends. If one of them suddenly withdraws, find the force excerted by the rod on the other man

(a) immediately after withdrawl and

(b) when the rod makes angle θ with vertical.

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

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

C. $\frac{3W}{4}$

D. W

Answer: A

Watch Video Solution

25. The thin rod shown below has mases M and length L. A force F acts at one end as shown and the rod is free to rotate about the other end in horizontal plane. Initial angular acceleration of the rod is :

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

B. $\frac{2F}{36ML}$

C. $\frac{F}{ML}$

D. $\frac{F}{2ML}$

Answer: A

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26. Two equal and opposite forces are allplied tangentially to a uniform disc of mass M and radius R as shown in the figure. If the disc is pivoted at its centre and free to rotate in its plane, the angular acceleration of the disc is :

A. $\frac{F}{MR}$

B. $\frac{2F}{3MR}$

C. $\frac{4F}{MR}$

D. Zero

Answer: C

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27. A wheel having moment of inertia 4 kg m^2 about its axis, rotates at rate of 240 rpm about it. The torque which can stop the rotation of the wheel in one minute is :-

A. $\frac{5\pi}{7}Nm$

B. $\frac{8\pi}{15}Nm$

C. $\frac{2\pi}{9}Nm$

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

Answer: B

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28. For equilibrium of the system, value of mass m should be :-

A. 9 kg

B. 15 kg

C. 21 kg

D. 1 kg

Answer: B

29. Figure shows a rigid rod of length 1.0 m. It is pivoted at O. For what value m, the rod will be in equilibrium ? Find the force (F) exerted on the rod by the pivot. Neglect the weight of the rod.

30. A particle is moving along a straight line parallel to x-axis with constant velocity. Find angular momentum about the origin in vector form :

A. $+mv^2b\hat{k}$

B. $-mvb\hat{k}$

C. $-2mvb\hat{k}$

D. $-mvb\hat{j}$

Answer: B

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31. A simple pendulum of mass m and length L is held in horizontal position. If it is released from this position, then find the angular momentum of the bob about the point of suspension when it is vertically below the point of suspension.

A. $mL\sqrt{2gL}$

B. $mL\sqrt{gL}$

C. $mL\sqrt{3gL}$

D. none

Answer: A

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32. A particle is rotating in circle with uniform speed as shown. The angular momentum of the particle w.r.t. origin is :-

A. Constant in magnitude only

B. Constant in magnitude as well as direction

C. Constant in direction only

D. Variable in magnitude as well as direction

Answer: D

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33. A particle of mass m is moving with constant speed v on the line y=b in positive x-direction. Find its angular momentum about origin, when position coordinates of the particle are (a, b).

A. mvb

B. mvb/2

C. mvb/4

D. none

Answer: A

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34. A particle is moving along a straight line with increasing speed. Its angular momentum about a fixed point on this line :

A. Goes on increasing

B. Goes on decreasing

C. May be increasing or decreasing depending on direction of motion

D. Remains zero

Answer: D

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35. If radius of earth suddenly contracts by half of its initial value keeping mass constant, then what will be the time period of rotation of earth about it axis.

A. 6hr

B. 12hr

C. 3hr

D. 4hr

Answer: A

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36. Due to global warming, ice on polar caps is likely to melt in large quantity. Due to this effect :

A. Moment of inertia of earth shall decrease

B. Length of the day shall decrease

C. Angular velocity of earth shall decrease

D. Angular momentum of earth shall decrease

Answer: C

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37. A disc of mass 1 kg and radius 0.1 m is rotating with angular velocity 20 rad/s. What is angular velocity (in rad/s) if a mass of 0.5 kg is put on the circumference of the disc ?

A. 10

B. 20

C. 40

D. 30

Answer: A

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38. A metre stick is pivoted about its centre. A piece of wax of mass 20 g travelling horizontally and perpendicular to it at 5 m/s strikes and adheres to one end of the stick so that the stick starts to rotate in a horizontal circle. Given the moment of inertia of the stick and wax about the pivot is 0.02 kg m^2, the initial angular velocity of the stick is :

A. 1.58 rad/s

B. 2.24 rad/s

C. 2.50 rad/s

D. 5.00 rad/s

Answer: C

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39. Two discs of moment of inertia I_1 and I_2 and angular speeds ω_1 and ω_2 are rotating along the collinear axes passing through their center of mass and perpendicular to their plane. If the two are made to rotate combindly along the same axis the rotational $K.E.$ of system will be

A. $\dfrac{I_1\omega_1 + I_2\omega_2}{I_1 + I_2}$

B. $\dfrac{I_1\omega_1 - I_2\omega_2}{I_1 + I_2}$

C. $\dfrac{I_1\omega_1 + I_2\omega_2}{\omega_1 + \omega_2}$

D. $\dfrac{I_1\omega_1 - I_2\omega_2}{\omega_1 - \omega_2}$

Answer: B

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40. A particle of mass m has been thrown with intial speed u making angle θ with the horizontal ground. Find the angular momentum of the projectile about an axis perpendicular to the plane and passing through the point of projection when the projectile is

(a) At the highest point

(b) About to hit the ground

Watch Video Solution

41. An angular impulse of 20 Nms is applied to a hollow cylinder of mass 2 kg and radius 20 cm. The change in its angular speed is :

A. 25 rad/s

B. 2.5 rad/s

C. 250 rad/s

D. 2500rad/s

Answer: C

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42. Choose the correct statement.

A. A sphere can do pure rolling on smooth horizontal surface

B. A sphere can't do pure rolling on a fixed smooth wedge

C. Friction can act parallel or antiparallel to the direction of motion

D. All of these

Answer: D

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43. A thin uniform circular ring is rolling down an inclined plane of inclination 30° without slipping. Its linear acceleration along the inclined plane will be

A. g

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

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

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

Answer: D

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44. A solid sphere is thrown up a rough incline. The sphere rolls up without slipping and eventually comes down rolling without slipping. The direction of friction during upward and downward motion respectively is :-

A. Downward, upward

B. Upward, downward

C. Downward, downward

D. Upward, upward

Answer: D

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45. Two solid spheres of different mass, radii and denisty roll down a rough inclined plane under indentical situation. Their time to come down is independent o their :-

A. Mass

B. Radius

C. Density

D. All of these

Answer: D

Watch Video Solution

46. A thin circular ring first slips down a smooth incline then rolls down a rough incline of identical geometry from same height. Ratio of time taken in the two motion is :

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

B. 1

C. $\frac{1}{\sqrt{2}}$

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

Answer: C

Watch Video Solution

47. A solid sphere is rolling without slipping on a level surface dat a constant speed of $2.0ms^{-1}$ How far can it roll up a 30° ramp before it stops ?

A. 56 cm

B. 26 cm

C. 53 cm

D. 84 cm

Answer: A

Watch Video Solution

48. When a body is under pure rolling, the fraction of its total kinetic energy which is the purely rotational is 2/5. Identify the body.

A. Hollow sphere

B. Sphere

C. Ring

D. Disc

Answer: A

Watch Video Solution

49. When a point mass slips down a smooth incline from top, it reaches the bottom with linear speed v. If same mass in the form of disc rolls down without slipping a rough incline of identical geometry through same distance, what will be its linear velocity at the bottom ?

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

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

C. v

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

Answer: A

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50. A solid cylinder is rolling down on an inclined plane of angle θ. The minimum value of the coefficient of friction between the plane and the cylinder to allow pure rolling

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

B. $\tan\theta$

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

D. $3\tan\theta$

Answer: A

Watch Video Solution

51. A solid sphere rolls on horizontal surface without slipping. What is the ratio of its rotational to translation kinetic energy.

A. $\frac{2}{5}$

B. $\frac{5}{2}$

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

D. 0

Answer: A

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52. Two dises having masses in the ratio $1:2$ and radii in the ratio $1:8$ roll down without slipping one by one from an inclined plane of height h. The ratio of their linear velocities on reaching the ground is :-

A. $1:16$

B. $1:128$

C. $1:8\sqrt{2}$

D. $1:1$

Answer: D

Watch Video Solution

53. Which of the following (if mass and radius are assumed to be same) have maximum percentage of total K.E. in rotational form while pure rolling ?

A. Disc

B. Sphere

C. Ring

D. Hollow sphere

Answer: C

Watch Video Solution

54. A solid cylinder of mass M and radius R rolls down an inclined plane of height h. The angular velocity of the cylinder when it reaches the bottom of the plane will be :

A. $\frac{1}{2R}\sqrt{gh}$

B. $\frac{2}{R}\sqrt{gh}$

C. $\frac{2}{R}\sqrt{\frac{gh}{3}}$

D. $\frac{2}{R}\sqrt{\frac{gh}{2}}$

Answer: C

Watch Video Solution

55. A solid sphere of diameter 0.1 m and 5 kg is rolling down an inclined plane with a speed of 4 m/s. The total kinetic energy of the sphere is :

A. 28 J

B. 56 J

C. 84 J

D. 112 J

Answer: B

Watch Video Solution

56. The speed of a uniform solid cylinder after rolling down an inclined plane of vertical height H, from rest without sliding is :-

A. $\frac{\sqrt{gH}}{3}$

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

C. $\sqrt{gH}$

D. $\sqrt{\frac{4gH}{3}}$

Answer: D

Watch Video Solution

57. In case of pure rolling, what will be the velocity of point A of the ring of radius R?

A. V_{cm}

B. $\sqrt{2}V_{cm}$

C. $\frac{V_{cm}}{2}$

D. $2V_{cm}$

Answer: B

Watch Video Solution

58. When a body is rolling without slipping on a rough horizontal surface, the work done by friction is :

A. Always zero

B. May be zero

C. Always positive

D. Always negative

Answer: A

Watch Video Solution

59. An inclined plane makes an angle 30° with the horizontal. A solid sphere rolling down this inclined plane from rest without slipping has a linear acceleration equal to

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

B. $\frac{2g}{3}$

C. $\frac{5g}{7}$

D. $\frac{5g}{14}$

Answer: D

Watch Video Solution

60. What is the minimum coefficient of friction for a solid sphere to roll without slipping on an inclined plane of inclination θ ?

A. $\frac{2}{7}\tan\theta$

B. $\frac{1}{3}\tan\theta$

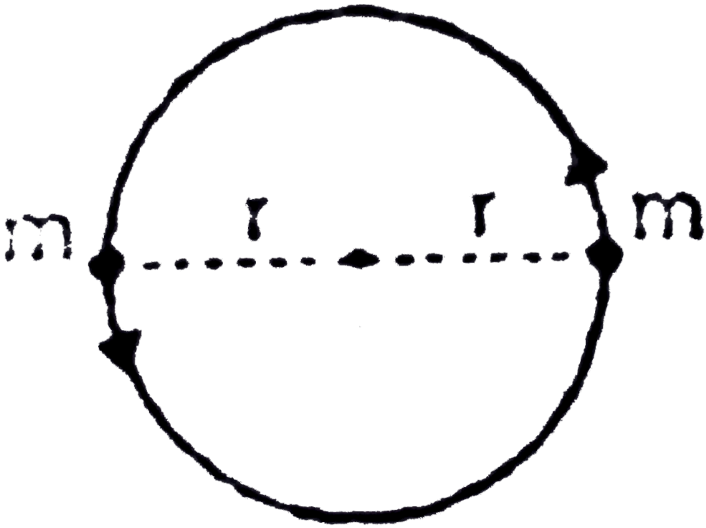
C. $\frac{1}{2}\tan\theta$

D. $\frac{2}{5}\tan\theta$

Answer: A

Watch Video Solution

1.



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. $\frac{1}{2R}\sqrt{\frac{1}{Gm}}$

B. $\sqrt{\frac{Gm}{2R}}$

C. $\frac{1}{2}\sqrt{\frac{Gm}{R}}$

D. $\sqrt{\frac{4Gm}{R}}$

Answer: C

Watch Video Solution

2. A particle is projected vertically upwards from the surface of the earth (radius R_e) with a speed equal to one fourth of escape velocity. What is the maximum height attained by it from the surface of the earth ?

A. $\frac{16}{15}R_e$

B. $\frac{R_e}{15}$

C. $\frac{4}{15}R_e$

D. None

Answer: B

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3. A mass of $6 \times 10^{24} kg$ is to be compressed in a sphere in such a way that the escape velocity from its surface is $3 \times 10^{8} m/s$. Find the radius of the sphere (in mm).

A. 9 mm

B. 8 mm

C. 7 mm

D. 6 mm

Answer: A

Watch Video Solution

4. Which of the following statements are true about acceleration due to gravity ?

(a) 'g' decreases in moving away from the centre if $r > R$

(b) 'g' decreases in moving away from the centre if $r < R$

(c) 'g' is zero at the centre of earth

(d) 'g' decreases if earth stops rotating on its axis

A. a & b

B. a, b & c

C. a & c

D. a, b, c & d

Answer: C

Watch Video Solution

5. The intensity of gravitational field at a point situated at a distance of 8000km form the centre of the earth is $6N/kg$. The gravitational potential at that point is -(in joule /kg)

A. -6

B. -4.8×10^7

C. -8×10^5

D. -4.8×10^{2}

Answer: B

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6. A satellite is to be geo-stationary, which of the following are essential conditions?

A. a & b

B. a, b & c

C. c & d

D. a, b, c & d

Answer: D

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7. Statement-1:A personfeels weightlessness in an artificial satellite of the earth . A person on thhe moon (natural satellite) feels his weight.

Statement-2: Artifical satellite is a freely falling body and on the moon surface. The weight is mainly due to Moon-s gravitational attraction.

A. Statement-1 is True, Statement-2 is True ,

Statement-2 is a correct explanation for

Statement-1

B. Statement-1 is True, Statement-2 is True ,

Statement -2 is not a correct explanation for

Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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8. Statement-1: Moon cannot be used as a satellite for communication.

Statement-2: Moon doesn't move in the equatorial plane of the earth.

A. Statement-1 is True, Statement-2 is True ,

Statement-2 is a correct explanation for

Statement-1

B. Statement-1 is True, Statement-2 is True ,

Statement -2 is not a correct explanation for

Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

Watch Video Solution

9. If suddenly the gravitational force of attraction between earth and satellite revolving around it becomes zero, then the satellite will

A. continue to move in its orbit with same velocity

B. move tangentially to the original orbit with same velocity

C. become stationary in its orbit

D. move towards the earth

Answer: B

Watch Video Solution

10. The kinetic energy needed to project a body of mass m from the earth surface (radius R) to infinity is

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

B. $2mgR$

C. mgR

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

Answer: C

Watch Video Solution

11. The change in the value of g at a height h above the surface of the earth is the same as at a depth d below the surface of earth. When both d and h are much smaller than the radius of earth, then which one of the following is correct?

A. $d = \frac{h}{2}$

B. $d = \frac{3h}{2}$

C. $d = 2h$

D. $d = h$

Answer: C

Watch Video Solution

12. The height at which the acceleration due to gravity becomes $\frac{g}{9}$ (where g =the acceleration due to gravity on the surface of the earth) in terms of R, the radius of the earth, is :

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

B. $\sqrt{2}R$

C. 2R

D. $\frac{R}{\sqrt{2}}$

Answer: C

Watch Video Solution

13. Two bodies of masses m and 4m are placed at a distance r. The gravitational potential at a point on the line joining them where the gravitational field is zero is:

A. $-\frac{6Gm}{r}$

B. $-\dfrac{9Gm}{r}$

C. zero

D. $-\dfrac{4Gm}{r}$

Answer: B

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14. Gravitational force between a point mass m and M separated by a distance is F. Now if a point mass 2m is placed next to m is contact with it. The force on M due to m and the total force on M are

A. 2F, F

B. F, 2F

C. F, 3F

D. F, F

Answer: C

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15. How much below the surface of the earth does the acceleration due to gravity (i) reduced to 36% (ii) reduces by 36% , of its value on the surface of the earth ? Radius of the earth = 6400 km .

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

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

C. $\frac{R}{6}$

D. 4 R

Answer: A

Watch Video Solution

16. The eccentricity of the earth's orbit is 0.0167, the ratio of its maximum speed in its orbit to its minimum speed is

A. 2.507

B. 1.0339

C. 8.324

D. 1.000

Answer: B

Watch Video Solution

17. A ball of mass m is fired vertically upwards from the surface of the earth with velocity nv_e, where v_e is the escape velocity and $n < 1$. Neglecting air resistance, to what height will the ball rise? (Take radius of the earth=R):-

A. R/n^2

B. $R/(1-n^2)$

C. $Rn^2/(1-n^2)$

D. Rn^2

Answer: C

Watch Video Solution

18. A thin of length L is bent to form a semicircle. The mass of rod is M. What will be the gravitational potential at the centre of the circle ?

A. $-\frac{GM}{L}$

B. $-\frac{GM}{2\pi L}$

C. $-\frac{\pi GM}{2L}$

D. $-\frac{\pi GM}{L}$

Answer: D

Watch Video Solution

19. Figure showns a planet in an elliptical orbit around the sun S. Where is the kinetic energy of the planet maximum?

A. P_1

B. P_2

C. P_3

D. P_4

Answer: D

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20. When a body is taken from the equator to the poles, its weight

A. Remains constant

B. Increases

C. Decreases

D. None

Answer: C

Watch Video Solution

21. The change in the gravitational potential energy when a body of a mass m is raised to a height nR above the surface of the earth is (here R is the radius of the earth)

A. $mgR\frac{n}{(n-1)}$

B. mgR

C. $mgR\frac{n}{(n+1)}$

D. $mgR\frac{n^2}{(n^2+1)}$

Answer: C

Watch Video Solution

22. The variation in the speed of the planet in their orbits about the sun can be explained on the basic of the conservation of :-

A. Angular kinetic energy

B. Linear momentum

C. Angular momentum

D. None of these

Answer: C

Watch Video Solution

23. The radii of circular orbits of two satellite A and B of the earth are $4R$ and R, respectively. If the speed of satellite A is $3v$, then the speed of satellite B will be

A. 5 v

B. 9 v

C. 6 v

D. none of these

Answer: C

Watch Video Solution

24. A satellite is moving around the earth's with speed v in a circular orbit of radius r. If the orbit radius is decreases by 1% , its speed will

A. increase by 1%

B. increase by 0.5%

C. decrease by 1%

D. decrease by 0.5%

Answer: B

Watch Video Solution

25. A small body of mass m falls to the earth from infintie distance away. What will be its velocity or reaching the earth? (Radius of the earth = R, acceleration due to gravity on the surface of the earth is g) :-

A. gR

B. 2gR

C. $\sqrt{gR}$

D. $\sqrt{2gR}$

Answer: D

Watch Video Solution

Basic Maths (Properties of Matter & Fluid Mechanics)(Elasticity)

1. A cable that can support a load W is cut into two equal parts .T he maximum load that can be supported by either part is

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

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

C. W

D. 2W

Answer: C

Watch Video Solution

2. Wires A and B are made from the same material. A has twice the diameter and three times the length of B. If the elastic limits are not reached, when each is stretched by the same tension, the ratio of energy stored in A to that in B is

A. $2:3$

B. $3:4$

C. $3:2$

D. $6:1$

Answer: B

Watch Video Solution

Watch Video Solution

3. The breaking stress for a wire of radius r of given material is F N/m^2.

The breaking stress for the wire of same material of radius 2r is:

A. F/4

B. F/2

C. F

D. 2F

Answer: C

Watch Video Solution

4. The bulk modulus of rubber is $9.1 \times 10^8 N/m^2$. To what depth a rubber ball be taken in a lake so that its volume is decreased by 0.1% ?

A. 25m

B. 91m

C. 200m

D. 500m

Answer: B

Watch Video Solution

5. A solid sphere of radius R made of a material of bulk modulus K is surrounded by a liquid in a cylindrical container. A massless pistion of area A floats on the surface of the liquid. When a mass M is placed on the piston to compress the liquid the fractional change in the radius of the sphere, $\delta R / R$, is ....

A. $\dfrac{Mg}{BA}$

B. $\dfrac{Mg}{3BA}$

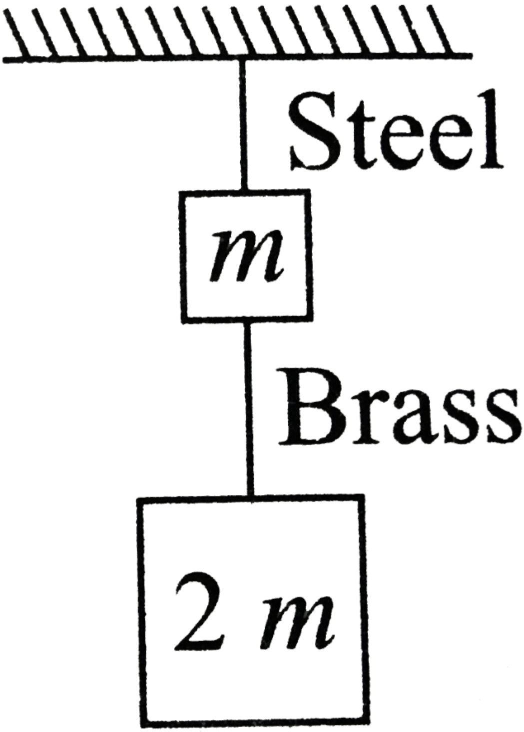
C. $\dfrac{3Mg}{4BA}$

D. $\dfrac{Mg}{4BAR}$

Answer: B

Watch Video Solution

6. If the ratio of lengths, radii and Young's moduli of steel and brass wires in the figure are a, b and c respectively then the corresponding ratio of increase in their lengths is



A. $\dfrac{2a^2c}{b}$

B. $\dfrac{3a}{2b^2c}$

C. $\dfrac{2ac}{b^2}$

D. $\dfrac{3c}{2ab^2}$

Answer: B

Watch Video Solution

7. The area of cross section of a steel wire $\left(Y = 2.0 \times 10^{11} N / m^2\right)$ is $0.1 cm^2$. The force required to double is length will be

A. 2×10^{12} N

B. 2×10^{11} N

C. 2×10^{10} N

D. 2×10^{6} N

Answer: D

Watch Video Solution

8. The presssure of a medium is changed from $1.01 \times 10^5 Pa$ to $1.165 \times 10^5 Pa$ and change in volume is 10% keeping temperature constant . The bulk modulus of the medium is

(a) $204.8 \times 10^5 Pa$ (b) $102.4 \times 10^5 Pa$ (c) $5.12 \times 10^5 Pa$

(d) $1.55 \times 10^5 Pa$

A. 15.5×10^5 Pa

B. 1.4×10^5 Pa

C. 1.55×10^5 Pa

D. 0.0155×10^5 Pa

Answer: C

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9. The rubber cord of a catapult has cross-section area 1 mm^2 and a total unstretched length 10 cm. It is stretched to 12 cm and then released to project a partical of mass 5 g. Calculate the velocity of projection (Y for rubber is $5 \times 10^8 N/m^2$)

A. 5 ms^{-1}

B. 10 ms^{-1}

C. 20 ms^{-1}

D. 40 ms^{-1}

Answer: C

Watch Video Solution

10. A heavy mass is attached to a thin wire and is whirled in a vertical circle. The wire is most likely to break

A. When the mass is at the highest point

B. When the mass is at the lowest point

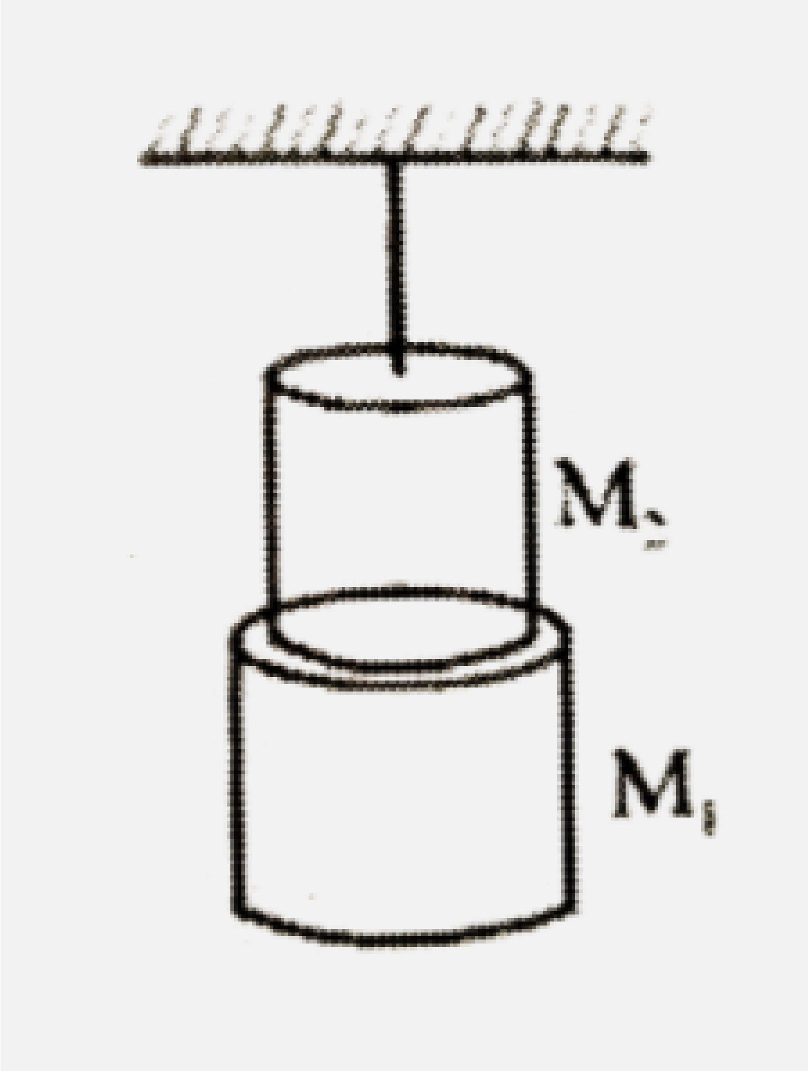
C. When the wire is horizontal

D. At an angle of $\cos^{-1}(1/3)$ from the upper vertical.

Answer: B

Watch Video Solution

11. The length of wire, when M_1 is hung from it, is l_1 and is l_2 with both M_1 and M_2 hanging. The natural length of wire is :-



A. $\frac{M_1}{M_2}(l_1 - l_2) + l_1$

B. $\frac{M_2 l_1 - M_1 l_2}{M_1 + M_2}$

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

D. $\sqrt{l_1 l_2}$

Answer: A

Watch Video Solution

12. The young's modulus of a wire of length (L) and radius (r) is Y. If the length is reduced to $\frac{L}{2}$ and radius $\frac{r}{2}$, then its young's modulus will be

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

B. Y

C. 2 Y

D. 4Y

Answer: B

Watch Video Solution

13. When a load of 5kg is hung on a wire then extension of 30 cm take place then work done will be :-

A. 7.5 J

B. 15 J

C. 0.5 J

D. 1.5 J

Answer: A

Watch Video Solution

14. Young's modulus of brass and steel are $10 \times 10^{10} N/m^2$ and $2 \times 10^{11} N/m^2$, respectively. A brass wire and a steel wire of the same length are extended by $1mm$ under the same force. The radii of the brass and steel wires are R_B and R_S respectively. Then

A. $R_S = \sqrt{2} R_B$

B. $R_S = \frac{R_B}{\sqrt{2}}$

C. $R_S = 4R_B$

D. $R_S = \frac{R_B}{4}$

Answer: B

Watch Video Solution

15. if ρ is the density of the meterial of a wire and σ is the breaking stress. The greatest length of the wire that can hang freely without breaking is

A. $\frac{2\sigma}{\rho g}$

B. $\frac{\rho}{\sigma g}$

C. $\frac{\rho g}{2\sigma}$

D. $\frac{\sigma}{\rho g}$

Answer: D

Watch Video Solution

16. The Young's modulus of the meterial of a wire is $2 \times 10^{10} Nm^{-2}$ If the elongation strain is 1% then the energy stored in the wire per unit volume is Jm^{-3} is

A. $0.5 \times 10^6 Jm^{-3}$

B. $10^6 Jm^{-3}$

C. $2 \times 10^6 Jm^{-3}$

D. $4 \times 10^6 Jm^{-3}$

Answer: B

Watch Video Solution

17. A cube of side 40 cm has its upper face displaced by 0.1 mm by a tangential force of 8 Kn. The shearing modulus of cube is :-

A. $2 \times 10^9 N - m^{-2}$

B. $4 \times 10^9 N - m^{-2}$

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

D. $4 \times 10^8 N - m^{-2}$

Answer: C

Watch Video Solution

18. The bulk modulus for an incompresssible liquid is

A. zero

B. unity

C. infinity

D. between 0 and 1

Answer: C

Watch Video Solution

19. A steal wire of cross-section area $3 \times 10^{-6} m^2$ can withstand a maximum strain of 10^{-3} .Young's modulus of steel is $2 \times 10^{11} Nm^{-2}$ .The maximum mass this wire can hold is

A. 40 kg

B. 60 kg

C. 80 kg

D. 100 kg

Answer: B

Watch Video Solution

20. The Young's modulus of the material of a wire is equal ot the

A. stress required to increase its length four times

B. stress required to produce unit stain

C. strain produced in it

D. half the strain produced in it

Answer: B

Watch Video Solution

Basic Maths (Properties of Matter & Fluid Mechanics)(Fluid Dynamics + Viscosity)

1. Blood is flowing at the rates of 200 $cm^3/\sec$ in a capillary of cross-sectional area $0.5m^2$. The velocity of flow, (in mm/sec) is:

A. 0.1

B. 0.2

C. 0.3

D. 0.4

Answer: D

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2. The cylindrical tube of a spray pump has a cross-section of $8cm^2$, one end of which has 40 fine holes each of area $10^{-8}m^2$. If the liquid flows inside the tube with a speed of $0.15m \min^{-1}$, the speed with which the liquid is ejected through the holes is.

A. $50ms^{-1}$

B. $5ms^{-1}$

C. $0.05ms^{-1}$

D. $0.5ms^{-1}$

Answer: B

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3. A cylindrical vessel of 92 cm height is kept filled upto to brim. It has four holes 1,2,3 and 4 which are respectively at heights of 20cm, 30cm, 46cm and 80cm from the horizontal floor. The water falling at the maximum horizontal distance from the vessel comes from :

A. hole 4

B. hole 3

C. hole 2

D. hole 1

Answer: B

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4. A cylindrical tank has a hole of 1 cm in its bottom. If the water is allowed to flow into the tank from a tube above it at the rate of $70cm/\sec$. then the maximum height up to which water can rise in the tank is

A. 2.5 cm

B. 5 cm

C. 10 cm

D. 0.25 cm

Answer: A

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Watch Video Solution

5. A tank containing water has an orifice in one vertical side. If the centre of orifice is 4.9 m below the surface level in the tank, the velocity of discharge is:

A. 4.9 metre/second

B. 9.8 metre/second

C. 2.45 metre/second

D. zero

Answer: B

Watch Video Solution

6. Air is streaming past a horizontal airplane wing such that its speed is 120 metre per sec over the upper surface and 90 metre per sec at the lowers surface. If the density of air is 1.3 kg per $metre^3$ and the wing is 10 metre long and has an average width of 2 metre, then the difference of the pressure on the two sides of the wing is :

A. 4095.0 pascal

B. 409.50 pascal

C. 40.950 pascal

D. 4.0950 pascal

Answer: A

Watch Video Solution

7. An air bubble of 1 cm radius is rising at a steady rate of $2.00ms^{-1}$ through a liquid of density $1.5gcm^{-3}$. Neglect density of air. If $g = 1000cms^{-2}$, then the coeffieciet of viscosity of the liquid is

A. 0.166×10^3 poise

B. 166×10^3 poise

C. 1.66×10^3 poise

D. 16.6×10^3 poise

Answer: C

Watch Video Solution

8. Sixty four spherical rain drops of equal size are falling vertically through air with a terminal velocity $1.5 ms^{-1}$. If these drops coalesce to form a big spherical drop, then terminal velocity of big drop is:

A. 8 ms^{-1}

B. 16 ms^{-1}

C. 24 ms^{-1}

D. 32 ms^{-1}

Answer: C

Watch Video Solution

9. A layer of glycerine of thickness 1 mm is present between a large surface and small surface of area $0.1m^2$. With what force the small surface is to be pulled, so that it can move with a velocity of 1 m/s ? (coefficient of viscosity $= 0.07g - m^{-1}s^{-1}$)

A. 70N

B. 7N

C. 700 N

D. 0.70N

Answer: B

Watch Video Solution

10. Water contained in a tank flows through an orifice of a diameter 2 cm under a constant pressure difference of 10 cm of water column. The rate of flow of water through the orifice is

A. 44 cc/sec

B. 4.4 cc/sec

C. 440 cc/sec

D. 4400 cc/sec

Answer: C

Watch Video Solution

11. A tiny sphere of mass m and density x is dropped in a jar of glycerine of density y. When the sphere aquires terminal velocity, the magnitude of the viscous force acting on it is :

A. $\frac{mgx}{y}$

B. $\frac{mgy}{x}$

C. $mg\left[1-\frac{y}{x}\right]$

D. $mg\left[1+\frac{y}{x}\right]$

Answer: C

Watch Video Solution

12. A small steel ball of mass m and radius r is falling under gravity through a viscous liquid of coefficient of viscosity η. If g is the value of acceleration due to gravity. Then the terminal velocity of the ball is proportional to (ignore buoyancy)

A. $\frac{mg\eta}{r}$

B. $mg\eta r$

C. $\frac{mgr}{\eta}$

D. $\frac{mg}{r\eta}$

Answer: D

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13. A sphere of brass released in a long liquid column attains a terminal speed v_0. If the terminal speed attained by a sphere of marble of the

same radius and released in the same liquid is nv_0, then the value of n will be (Given: The specific gravities of brass, marble and liquid are 8.5, 2.5 and 0.8, respectively)

A. $\frac{5}{17}$

B. $\frac{17}{77}$

C. $\frac{11}{31}$

D. $\frac{17}{5}$

Answer: B

Watch Video Solution

14. A river $10m$ deep is flowing at $5ms^{-1}$. The shearing stress between the horizontal layers of the river is ($\eta = 10^{-(3)}$ SI units)

A. $10^{-3}N/m^2$

B. $0.8 \times 10^{-3}N/m^2$

C. $0.5 \times 10^{-3}N/m^2$

D. $1N/m^2$

Answer: C

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15. Working of paint-gun and scent sprayer is based on :-

A. Bernoulli's principle

B. Boyle's law

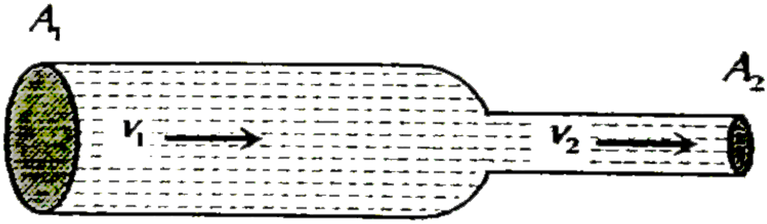
C. Faraday's law

D. Archimedes' principle

Answer: A

Watch Video Solution

16. A liquid flows in a tube from left to right as shown in figure. A_1 and A_2 are the cross-section of the portions of the tube as shown. Then the ratio of speeds v_1 / v_2 will be



A. A_1 / A_2

B. A_2 / A_1

C. $\sqrt{A_2} / \sqrt{A_1}$

D. $\sqrt{A_1} / \sqrt{A_2}$

Answer: B

Watch Video Solution

17. A manometer connected to a closed tap reads 4.5×10^5 pascal. When the tap is opened the reading of the manometer falls is 4×10^5 pascal. Then the velocity of flow of water is

A. $7ms^{-1}$

B. $8ms^{-1}$

C. $9ms^{-1}$

D. $10ms^{-1}$

Answer: D

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18. Two metal spheres are falling through a liquid of density $2 \times 10^3 kg/m^3$ with the same uniform speed. The material density of sphere 1 and sphere 2 are $8 \times 10^3 kg/m^3$ and $11 \times 10^3 kg/m^3$ respectively. The ratio of their radii is :-

A. $\frac{11}{8}$

B. $\sqrt{\frac{11}{8}}$

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

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

Answer: D

Watch Video Solution

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. 2Q

C. Q

D. Q/8

Answer: D

Watch Video Solution

20. A metal plate of area $10^3 \quad cm^2$ rests on a layer o oil 6 mm thick. A tangential force of 10^{-2} N is appled on it to move it with a constant velocity of 6 cm s^{-1} . The coefficient of viscosity of the liquid is :-

A. 0.1 poise

B. 0.5 posie

C. 0.7 poise

D. 0.9 poise

Answer: A

Watch Video Solution

Basic Maths (Properties of Matter & Fluid Mechanics)(Hydrostatics)

1. A tank 5 m high is half filled with water and then is filled to top with oil of density $0.85g/cm^3$ The pressure at the bottom of the tank, due to these liquids is

A. $1.85\frac{g(wt)}{cm^2}$

B. $89.25\frac{g(wt)}{cm^2}$

C. $462.5\frac{g(wt)}{cm^2}$

D. $500\frac{g(wt)}{cm^2}$

Answer: C

Watch Video Solution

2. The densit of a block of wood which flots on water with 0.1 of its volume above water is:

A. 0.9 g/cc

B. 0.19 g/cc

C. 0.1 g/cc

D. 0.15 g/cc

Answer: A

Watch Video Solution

3. Two solids A and B floats in water. It is observed that A floats with half of its volume immersed and B Floats with $2/3$ of its volume immersed. The ratio of densities of A and B is

A. $4:3$

B. $2:3$

C. $3:4$

D. $1:3$

Answer: C

Watch Video Solution

4. A ball whose density is $0.4 \times 10^3 kg/m^3$ falls into water from a height of 9 cm. To what depth does the ball sink ?

A. 9 cm

B. 6 cm

C. 4.5 cm

D. 2.25 cm

Answer: B

Watch Video Solution

5. A liquid X of density $3.36 g/cm^3$ poured in a U-tube which contains Hg. Another liquid Y is poured in left arm with heght 8 cm upper levels of X and Y are same. What is density of Y?

A. 0.8 gm/cc

B. 1.2 gm/cc

C. 1.4 gm/cc

D. 1.6 gm/cc

Answer: A

Watch Video Solution

6. A piece of solid weighs 120 g in air ,80 g in water and 60 kg in a liquid . The relative density of the solid and that of the liquid are respectively

A. 3, 2

B. 3, 3/2

C. 3/2, 2

D. 4, 3

Answer: B

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7. A body of uniform cross-sectional area floats in a liquid of density thrice its value. The portion of exposed height will be :

A. $2/3$

B. $5/6$

C. $1/6$

D. $1/3$

Answer: A

Watch Video Solution

8. A cubical box of wood of side 30 cm and mass 21.6 kg floats on water with two faces horizontal. The length of immersed part in water is : $(\rho_{\text{wood}} = 0.8g/cc)$

A. 30 cm

B. 12 cm

C. 6 cm

D. 24 cm

Answer: D

Watch Video Solution

9. A cube of edge length 10 cm is just balanced at the interface of two liquids A and B as shown in figure. If A and B has specific gravity 0.6 and 0.4 respectively, then mass of cube is :-

A. 240 g

B. 360 g

C. 480 g

D. 540 g

Answer: C

Watch Video Solution

10. The pressure of confined air is p. If the atmospheric pressure is P, then :-

A. P is equal to p

B. P is less than p

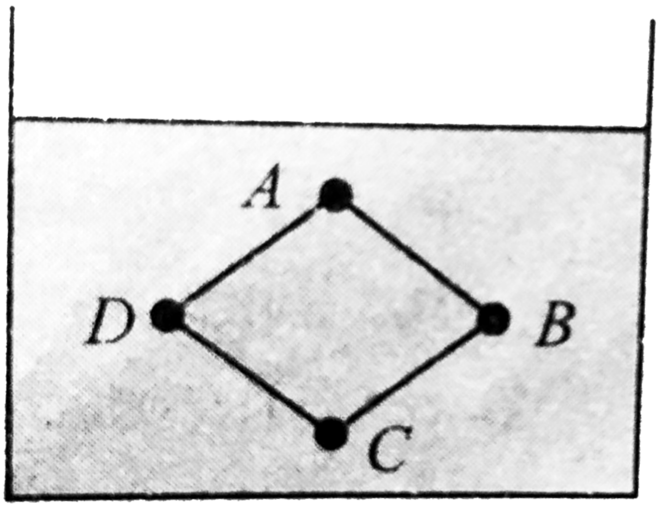
C. P is greater than p

D. P may be less or greater than p depending on the mass of the confined air

Answer: B

Watch Video Solution

11. Figure shows a container filled with a liquid of density ρ. Four points A, B, C and D lie on the vertices of a vertical square. Points A and C lie on a vertical line and points B and D lies on a horizontal line. Choose the correct statement(s) about the pressure at the four points.



A. $P_C = P_B$

B. $P_A < P_B = P_D < P_C$

C. $P_D = P_B = \dfrac{P_C - P_A}{2}$

D. $P_D = P_B = \dfrac{P_C + P_A}{2}$

Answer: C

Watch Video Solution

12. A cubical block is floating in a liquid with one fourth o its volume immersed in the liquid. If whole of the system accelerates upward with acceleration g/4, the fraction of volume immersed in the liquid will be :-

A. $1/4$

B. $1/2$

C. $3/4$

D. $2/3$

Answer: A

Watch Video Solution

13. A metallic sphere of mass 3 kg in air is held by a string so as to be completely immersed in a liquid of relative density 0.8. The relative density of metallic sphere is 10. The tension in the string is :-

A. 18.7 N

B. 42.5 N

C. 32.7 N

D. 27.6 N

Answer: D

Watch Video Solution

14. A cube made of material having a density of $900 kgm^{-3}$ floats between water of density $1000 kgm^{-3}$ and a liquid of density $700 kgm^{-3}$, which is immiscible with water. What part of the cube is inside the water?

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

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

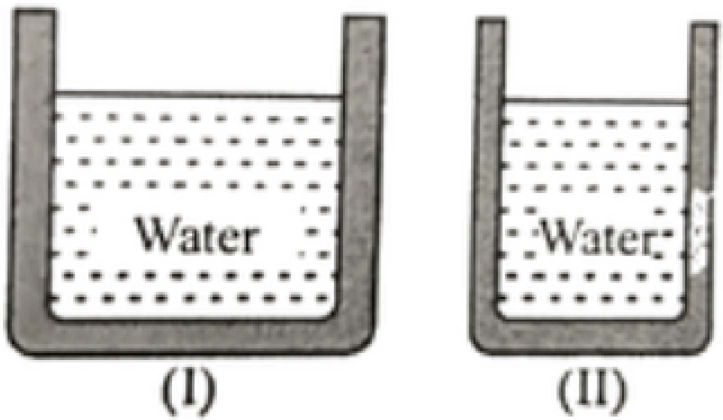
C. $\frac{3}{4}$

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

Answer: B

Watch Video Solution

15. From the following figure, the correct observation is :-



A. the pressure on the bottom of tank (I) is greater than at the bottom of (II)

B. the pressure on the bottom of tank (I) is smaller than at the bottom of (II)

C. the pressure depends on the shape of the container

D. the pressure on the bottom of (I) and (II) is the same

Answer: D

Watch Video Solution

16. The neck and bottom of a bottle are 3 cm and 15 cm in radius respectively. If the cork is pressed with a force 12 N in the neck of the bottle, then force exerted on the bottom of the bottle is :-

A. 30 N

B. 150 N

C. 300 N

D. 600 N

Answer: C

Watch Video Solution

17. An open U-tube contains mercury. When 11.2 cm of water is poured into one of the arms of the tube, how high does the mercury rise in the other arm from its initial level ?

A. 0.56 cm

B. 1.35 cm

C. 0.41 cm

D. 2.32 cm

Answer: C

Watch Video Solution

18. A block of wood floats in water with $(4/5)th$ of its volume submerged. If the same block just floats in a liquid, the density of liquid in (kgm^{-3}) is

A. 1250

B. 600

C. 400

D. 800

Answer: D

Watch Video Solution

19. A body weigh $50g$ in air and $40g$ in water. How much would it weigh in a liquid of specific gravity 1.5

A. 30 g

B. 35 g

C. 65 g

D. 45 g

Answer: B

Watch Video Solution

20. Two spheres of volume 250 cc each but of relative densities 0.8 an d 1.2 are connected by a string and the combination is immersed in a liquid. Find the tension T in the string. $\left(g = 10m/s^{2}\right)$

A. 5.0 N

B. 0.5 N

C. 1.0 N

D. 2.0 N

Answer: B

Watch Video Solution

Basic Maths (Properties of Matter & Fluid Mechanics)(Surface Tension)

1. Water rises to a height of $10cm$ in a glass capillary tube. If the area of cross section of the tube is reduced to one fourth of the former value what is the height of water rise now?

A. 20 cm

B. 5 cm

C. 2.5 cm

D. 7 cm

Answer: A

Watch Video Solution

2. Water rises to a height of $2cm$ in a capillary tube. If the tube is tilted 60° from the vertical, water will rise in the tube to a length of

A. 4 cm

B. 2 cm

C. $\frac{4}{\sqrt{3}} cm$

D. $1 cm$

Answer: A

Watch Video Solution

3. A wire of mass $1g$ is kept horizontally on the surface of water. The length of the wire that does not break the surface film is (surface tension of water is $70 dy \neq cm^{-1}$)

A. 3 cm

B. 4 cm

C. 7 cm

D. 14 cm

Answer: C

Watch Video Solution

4. The surface tension of two liquids are 30 and 60 dyne cm^{-1} respectively. The liquid drop form at the ends of two tube of the same radius. The ratio of the weight of the two drops is

A. $1:2$

B. $1:3$

C. $2:3$

D. $3:4$

Answer: A

Watch Video Solution

5. Two vertical glass plates 1 mm apart are dipped into water. How high will the water rise between the plates. If the surface tension of water is 70 dyne cm^{-1}

A. 1.43 cm

B. 1.63 cm

C. 2.86 cm

D. 3.86 cm

Answer: A

Watch Video Solution

6. A long cylindrical vessel has a small hole of diameter D at its bottom. This vessel can be lowered vertically in water to a depth h without any water entering the vessel. Given : A=surface tension, B=density of liquid, C=acceleration due to gravity. The value of h is

A. $\frac{A}{DBC}$

B. $\frac{2A}{DBC}$

C. $\frac{3A}{DBC}$

D. $\frac{4A}{DBC}$

Answer: D

Watch Video Solution

7. The excess pressure due to surface tension inside a spherical drop is $6 units$. If eight such drops combine, then the excess pressure due to surface tension inside the larger drop is

A. 3 units

B. 6 units

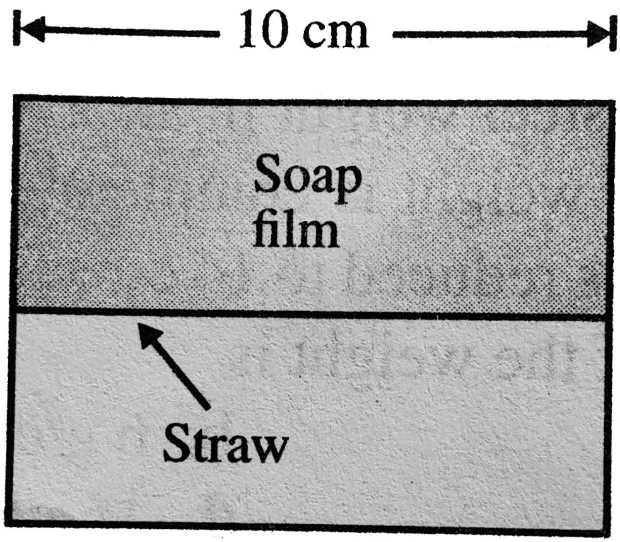
C. 12 units

D. 48 units

Answer: A

Watch Video Solution

8. A soap film of surface tension $3 \times 10^{-2} N/m$ formed in a rectangular frame can support a straw as shown in Fig. If $g = 10ms^{-2}$, the mass of the straw is



A. 0.006 g

B. 0.06 g

C. 0.6 g

D. 6 g

Answer: C

Watch Video Solution

9. Two soap bubbles, one of radius $50mm$ and the other of radius $80mm$, are brought in contact so that they have a common interface. The radius of the curvature of the common interface is

A. 114.6 mm

B. 125.6 mm

C. 133.3 mm

D. 154.6 mm

Answer: C

Watch Video Solution

10. Two soap bubbles one of radius 50 mm and the other of radius 80 mm are brought together so that they have a common interface.

(b) The radius of curvature of this interface attains which shape from smaller bubble towards larger bubble.

A. Convex

B. Concave

C. Plane

D. None

Answer: B

Watch Video Solution

11. A capillary tube of radius 0.25 mm is submerged vertically in water so that 25 mm of its length is outside water. The radius of curvature of the meniscus will be

(surface tension of water $= 75 \times 10^{-3}$ N/m)

A. 0.2 mm

B. 0.4 mm

C. 0.6 mm

D. 0.8 mm

Answer: C

Watch Video Solution

12. Liquid rises to a height of 2 cm in a capillary tube and the angle of contact between the solid and the liquid is zero. If the tube is depressed more now so that top of capillary is only 1 cm above the liquid, then the apparent angle of contact between the solid and the liquid is

A. 0°

B. 30°

C. 60°

D. 90°

Answer: C

Watch Video Solution

13. If a section of soap bubble (of radius R) through its centre is considered then force on one half due to surface thension is

A. $2\pi RT$

B. $4\pi RT$

C. $\pi R^2 T$

D. $\frac{4T}{R}$

Answer: B

Watch Video Solution

14. Work done in splitting a drop of water of 1 mm radius into 106 droplets is (Surface tension of water=$72 \times 10^{-3} J/m^2$)

A. 8.95×10^{-5} erg

B. 8.95×10^{-5} joule

C. 17.90×10^{-5} joule

D. 17.90×10^{-5} erg

Answer: B

Watch Video Solution

15. A soap film in formed on a frame of area $4 \times 10^{-3} m^2$. If the area of the film in reduced to half, then the change in the potential energy of the film is (surface tension of soap solution $= 40 \times 10^{-3} N/m)$

A. 32×10^{-5} J

B. 16×10^{-5} J

C. 8×10^{-5} J

D. 16×10^{-5} J

Answer: A

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16. The work done in increasing the size film with dimensions $8cm \times 3.75cm$ to $10cm \times 6cm$ is $2 \times 10^{-4} J$. The surface tension of the film in $\frac{N}{m}$ is

A. 1.65×10^{-2}

B. 3.3×10^{-2}

C. 6.6×10^{-2}

D. 8.25×10^{-2}

Answer: B

Watch Video Solution

17. A frame made of metalic wire enclosing a surface area A is covered with a soap film. If the area of the frame of metallic wire is reduced by $50\,\%$ the energy of the soap film will be changed by:

A. $100\,\%$

B. $75\,\%$

C. $50\,\%$

D. $25\,\%$

Answer: C

Watch Video Solution

18. The excess pressure inside one soap bubble is three times that inside a second bubble. The ratio of the volume of first bubble to that of the second

A. $1:9$

B. $1:3$

C. $3:1$

D. $1:27$

Answer: A

Watch Video Solution

19. The force required to lift a circular flat plate of radius 5 cm on the surface of water is: (Surface tension of water is 75 dyne/cm):-

A. 30 dyne

B. 60 dyne

C. 750 dyne

D. 750 π dyne

Answer: D

Watch Video Solution

20. Find the difference of air pressure (in $N - m^{-2}$) between the inside and outside of a soap bubble 5 mm in diameter, if the surface tension is $1.6 N - m^{-1}$:-

A. 2560

B. 3720

C. 1208

D. 10132

Answer: A

Watch Video Solution

21. It is easy to wash clothes in hot water because its :-

A. surface tension is more

B. surface tension is less

C. consumes less soap

D. none of these

Answer: B

Watch Video Solution

22. Surface tension of water is 0.072 Nm^{-1}. The excess pressure inside a water drop of diameter 1.2 mm is :-

A. 240 Pa

B. 120 Pa

C. 0.06 Pa

D. 60 Pa

Answer: A

Watch Video Solution

23. The surface tension of soap solution is $0.03 N / m$. The work done in blowing to from a soap bublle of surface area $40 cm^2$, (in J) , is

A. 1.2×10^{-4} J

B. 2.4×10^{-4} J

C. 12×10^{-4} J

D. 24×10^{-4} J

Answer: B

Watch Video Solution

24. A 10 cm long wire is placed horizontal on the surface of water and is gently pulled up with a force of 2×10^2 N to keep the wire in equilibrium. The surface tension, in Nm^{-1} of water is

A. 0.1

B. 0.2

C. 0.001

D. 0.002

Answer: A

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25. Work done in increasing the size of a soap bubble from a radius of $3cm$ to $5cm$ is nearly. (surface tension of soap solution $= 0.3Nm^{-1}$)

A. 4π mJ

B. 0.2π mJ

C. 2π mJ

D. 0.4π mJ

Answer: D

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26. If T is the surface tension of a liquid, the energy needed to break a liquid drop of radius R into 64 drops is :-

A. $6\pi R^2 T$

B. $\pi R^2 T$

C. $12\pi R^2 T$

D. $8\pi R^2 T$

Answer: C

Watch Video Solution

Basic Maths (Thermal Physics) (Temperature scales & thermal expansion)

1. At what temperature on celsius scale, the Farenheight scale reading is double of celsius scale reading?

A. $320^\circ F$

B. $300^{\circ} F$

C. $373^{\circ} F$

D. None

Answer: A

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2. A circular metallic disc of radius R has a small circular cavity of radius r as shown in figure. On heating the system :

A. R increases and r decreases

B. R decreases and r increases

C. Both R and r increases

D. Both R and r decreases

Answer: C

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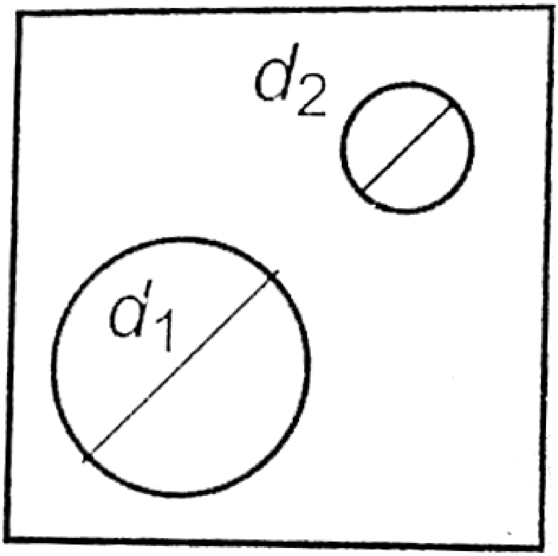
3. Two holes of unequal diameters d_1 and $d_2 (d_1 > d_2)$ are cut in metal sheet is heated



A. both d_1 and d_2 will decrease

B. both d_1 and d_2 will increase

C. d_1 will increase, d_2 will decrease

D. d_1 will decrease, d_2 will increase

Answer: B

Watch Video Solution

4. A beaker is completely filled with water at $4^{\circ} C$. It will overflow if

A. heated above $4^{\circ} C$

B. cooled below $4^{\circ} C$

C. both (1) & (2)

D. none of the above

Answer: C

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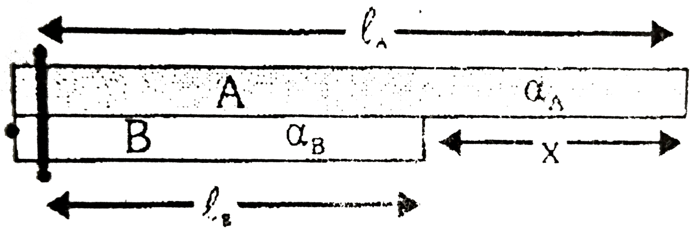
5. Bars of two different metals are bolted together , as shown in figure. The distance x does not change with temperature if :-



A. $\frac{l_A}{l_B} = \frac{\alpha_A}{\alpha_B}$

B. $\frac{l_A}{l_B} = \frac{\alpha_B}{\alpha_A}$

C. $\frac{l_A^2}{l_B^2} = \frac{\alpha_A}{\alpha_B}$

D. $\frac{l_A^2}{l_B^2} = \frac{\alpha_B}{\alpha_A}$

Answer: B

Watch Video Solution

6. A thin wire of length l when heated to a certain temperature increases its length by 1%. A sheet of the same material of area $2l \times l$ is heated to the same temperature then percentage increase in area will be :-

A. 4%

B. 2.5%

C. 2%

D. 1.5%

Answer: C

Watch Video Solution

7. On an X temperature scale, water freezes at $-125.0^\circ X$ and boils at $375.0^\circ X$. On a Y temperature scale, water freezes at $-70.0^\circ Y$ and boils at $-30.0^\circ Y$. The value of temperature on X-scale equal to the temperature of $50.0^\circ Y$ on Y-scale is

A. 455.0°X

B. -125.0°X

C. 1375.0°X

D. 1500.0°X

Answer: C

Watch Video Solution

8. If celsius temperature scale shows temperature of air 30°C. Find the temperature of air in fahrenheit & kelvin.

A. $90^\circ F$,303 K

B. $86^\circ F$, 300 K

C. $86^\circ F$, 303 K

D. $80^\circ F$, 303 K

Answer: C

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9. A glass thermometer is unmarked and has length of colum $L_{100^\circ} = 60cm L_{0^\circ} = 10cm.$ If L=50 cm, then temperature thermometer will be :-

A. $70^{\circ} C$

B. $80^{\circ} C$

C. $90^{\circ} C$

D. $100^{\circ} C$

Answer: B

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10. Two thermometers 'X' & 'Y' shows boiling point & freezing point of water as $220^{\circ} X$ & $20^{\circ} X$ and $120^{\circ} Y$ & $-40^{\circ} Y$ respectively. If 'X' shows $100^{\circ} X$. then find the reading in Y thermomter.

A. $25^{\circ} Y$

B. $50^{\circ} Y$

C. $20^{\circ} Y$

D. $24^{\circ} Y$

Answer: D

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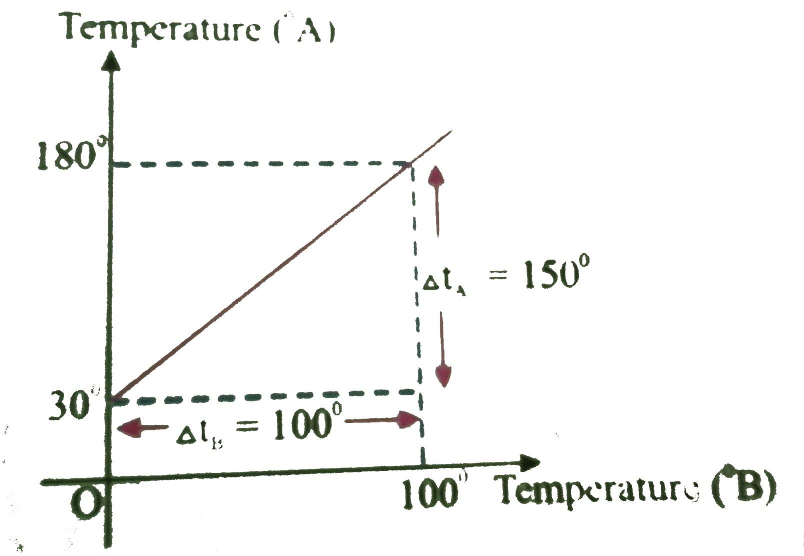
11. The graph between two temperature scales A and B is shown in Fig. Between upper fixed point and lower fixed point there are 150 equal divisions on scales A and 100 on scale B. The relation between the temperature in two scales is given by_



A. $\dfrac{t_A - 180}{100} = \dfrac{t_B}{150}$

B. $\frac{t_A - 30}{150} = \frac{t_B}{100}$

C. $\frac{t_A - 180}{150} = \frac{t_A}{100}$

D. $\frac{t_B - 40}{100} = \frac{t_A}{180}$

Answer: B

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12. A liquid with coefficient of volume expansion γ is filled in a container of a material having coefficient of linear expansion α . If the liquid overflows on heating, then

A. $\gamma = 3\alpha$

B. $\gamma > 3\alpha$

C. $\gamma < 3\alpha$

D. $\gamma > 3\alpha^2$

Answer: B

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13. 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. $\dfrac{C+S-3A}{3}$

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

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

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

Answer: B

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Basic Maths (Thermal Physics) (Calorimetry)

1. Two liquids A and B are at $30^\circ C$ and $20^\circ C$, respectively When they are mixied in equal masses, the temperature of the mixture is found to be $26^\circ C$. The ratio of their specific heat is

A. $3:2$

B. $1:1$

C. $2:3$

D. $4:3$

Answer: A

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2. A block of ice at $-12^\circ C$ is slowly heated and converted into steam at $100^\circ C$. Which of the following curves best represents the event ?

A.

B.

C.

D.

Answer: A

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3. The water equivalent of 20 g of aluminium (specific heat $0.2 \text{ cal}/g - {}^{\circ}C$), is :-

A. 40 g

B. 4 g

C. 8 g

D. 160 g

Answer: B

Watch Video Solution

4. 100 g of ice (latent heat 80 cal/g, at $0^\circ C$) is mixed with 100 g of water (specific heat $1 \text{ cal}/g - {}^\circ C$) at $80^\circ C$. The final temperature of the mixture will be :-

A. $0^\circ C$

B. $40^\circ C$

C. $80^\circ C$

D. $< 0^\circ C$

Answer: A

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5. If 10 g of ice at $0^\circ C$ is mixed with 10 g of water at $40^\circ C$. The final mass of water in mixture is (Latent heat of fusion of ice = 80 cel/g, specific heat of water $= 1ca\frac{l}{g}{}^\circ C$)

A. 10 g

B. 15 g

C. 18 g

D. 20 g

Answer: B

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6. A 10 g ice cube is dropped into 45 g of water kept in a glass. If the water was initially at a temperature of $28^{\circ} C$ and the temperature of ice $-15^{\circ} C$, find the final temperature (in $\hat{\ }(\circ)C$) of water.

(Specific heat of ice $= 0.5 \quad cal/g - {}^{\circ}C$ and $L = 80 \quad cal/g$)

A. 14

B. 7

C. 28

D. None

Answer: B

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7. 2g ice at $0^\circ C$ is mixed with 1 g steam at $100^\circ C$. Find the final temperature of the mixture.

A. $0^\circ C$

B. 50°

C. $100^\circ C$

D. $> 100^\circ C$

Answer: C

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8. Steam is passes into 22 g of water at $20^\circ C$. The mass of water that will be present when the water acquires a temperature of $90^\circ C$ (Latent heat of steam is $540 cal / g$) is

A. 24.8 gm

B. 24 gm

C. 36.6 gm

D. 30 gm

Answer: A

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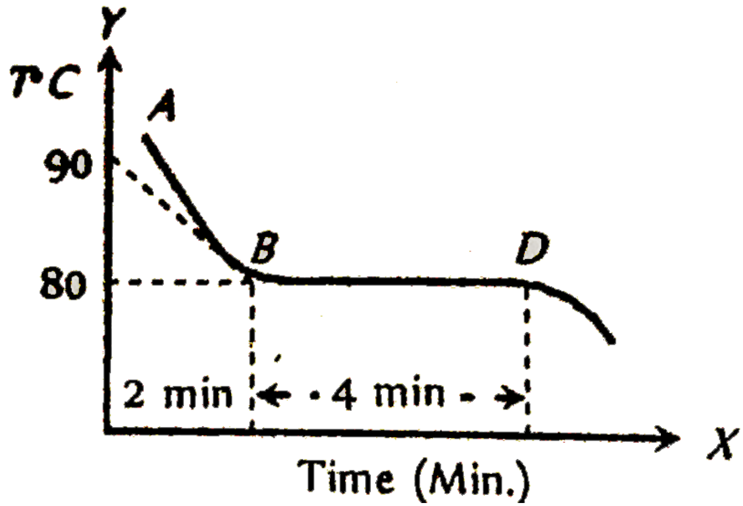
9. The figure given below shows the cooling curve of pure wax material after heating. It cools from A to B and solidifies along BD . If L and C are respective values of latent heat and the specific heat of the liquid wax, the ratio L / C is



A. 40

B. 80

C. 100

D. 20

Answer: D

Watch Video Solution

10. Ice at $-20^{\circ}C$ mixed with 200g water at $25^{\circ}C$. If temperature of mixture is $10^{\circ}C$ then mass of ice is -

A. 30 gm

B. 20 gm

C. 15 gm

D. 40 gm

Answer: A

Watch Video Solution

11. Calculate the time required to heat 20 kg of water from $10^{\circ}C$ to $35^{\circ}C$ using an immersion heater rated 1000 W. Assume that 80% of the power input is used to heat the water. Specific heat capacity of water $= 4200J/kg-k$

A. 40 min

B. 44 min

C. 36 min

D. 48 min

Answer: B

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12. $1kg$ ice at $0^{\circ}C$ is mixed with $1kg$ of steam at $100^{\circ}C$. What will be the composition of the system when thermal equilibrium is reached ? Latent heat of fusion of ice $= 3.36 \times 10^{6} Jkg^{-1}$ and latent heat of vaporization of water $= 2.26 \times 10^{6} Jkg^{-1}$

A. 335 g steam and 1665 g water

B. 400 g steam and 1600 g water

C. 465 g steam and 1335 g water

D. None of these

Answer: D

Watch Video Solution

13. Two tanks A and B contain water at $30^{\circ} C$ and $80^{\circ} C$ respectively calculate the amount of water that must be taken from each tank respectively to prepare 40 kg of water at $50^{\circ} C$

A. 24 kg, 16 kg

B. 16 kg, 24 kg

C. 20 kg, 20 kg

D. 30 kg, 10 kg

Answer: A

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Basic Maths (Thermal Physics) (Mode of Heat Transfer)

1. Three identical rods have been joined at a junction to make it a Y shape structure. If two free ends are maintained at $60^\circ C$ and the third end is at $0^\circ C$, then what is the junction temperature θ ?

A. $40^\circ C$

B. $50^\circ C$

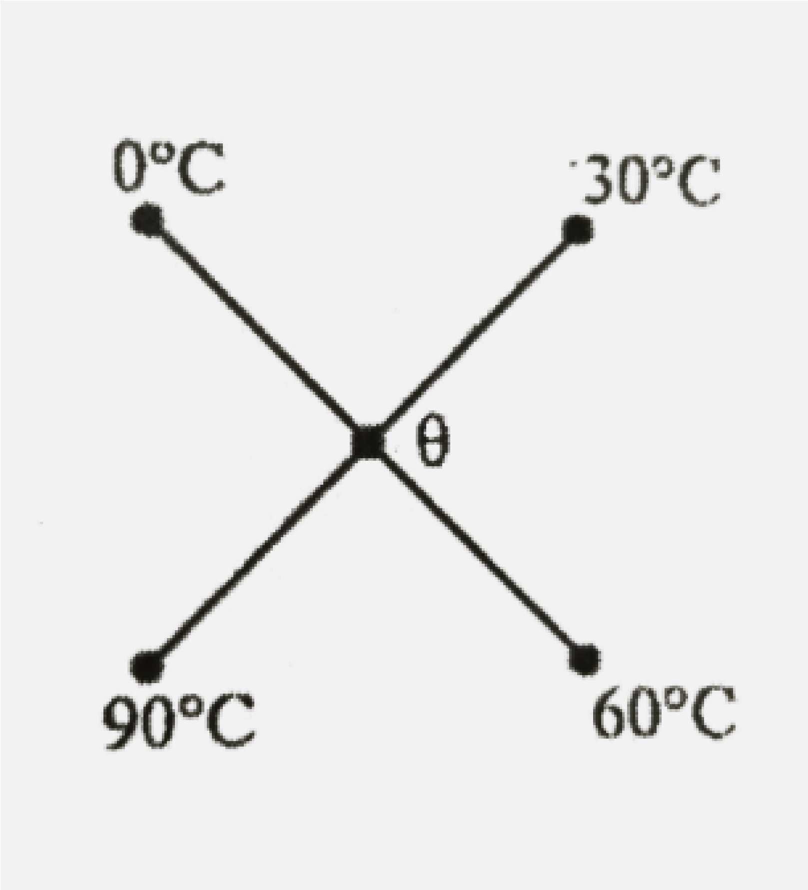
C. $30^\circ C$

D. $60^\circ C$

Answer: A

Watch Video Solution

2. Four rods of same material and having the same cross section and length have been joined, as shown. The temperature of the junction of four rods will be :



A. $20^\circ C$

B. $30^\circ C$

C. $45^\circ C$

D. $60^\circ C$

Answer: C

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3. Two electric lamps A and B radiate the same power. Their filaments have the same diemensions, and have emissivities. e_A and e_B. Their surface tempratures are T_A an T_B. The ratio T_A / T_B will be equal to

A. $\left(\frac{e_B}{e_A}\right)^{1/4}$

B. $\left(\frac{e_B}{e_A}\right)^{1/2}$

C. $\left(\frac{e_A}{e_B}\right)^{1/2}$

D. $\left(\frac{e_A}{e_B}\right)^{1/4}$

Answer: A

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4. Two stars emit maximum radiation at wavelength 3600 Å and 4800 Å respectively. The ratio of their temperatures is

A. $1:2$

B. $3:4$

C. $4:3$

D. $2:1$

Answer: C

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5. Assertion : Animals curl into a ball, when they feel very cold.

Reason : Animals by curling their body reduces the surface area.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True , Statement -2 is not a correct explanation for

Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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6. A heated body maitained at T K emits thermal radiation of total energy E with a maximum intensity at frequency v. The emissivity of the material is 0.5. If the temperature of the body be increased and maintained at temperature 3T K, then :-

(i) The maximum intensity of the emitted radiation will occur at frequency v/3

(ii) The maximum intensity of the emitted radiation will occur at frequency 3v.

(iii) The total energy of emitted radiation will become 81 E

(iv) The total energy of emitted radiation will become 27 E

A. i & ii

B. ii & iii

C. i & iv

D. i, ii & iv

Answer: B

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7. A metallic rod of cross-sectional area 20 cm^2, with the lateral surface insulated to prevent heat loss, has one end immersed in boiling water and the other in ice water mixture. The heat conducted through the rod melts the ice at the rate of 1 gm for every 84 sec. The thermal conductivity of the rod is $160Wm^{-1}K^{-1}$. Latent heat of ice=80 cal/gm, 1 ca=4.2 joule. What is the length (in m) of the rod?

A. 4

B. 8

C. 12

D. 16

Answer: B

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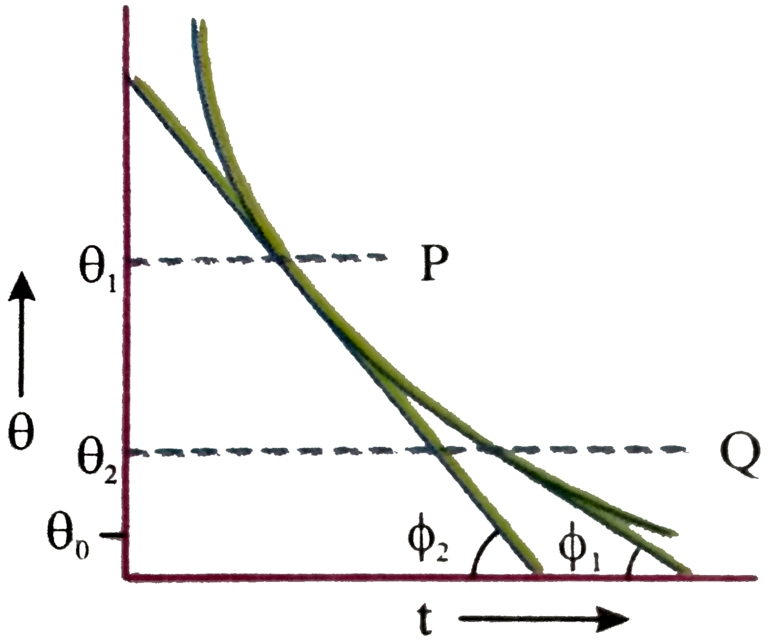
8. A body cools in a surrounding which is at a constant temperature of θ_0 Assume that it obeys Newton's law of cooling Its temperature θ is plotted against time t Tangents are drawn to the curve at the points $P(\theta = \theta_1)$ and $Q(\theta = \theta_2)$ These tangents meet the time axis at angle of ϕ_2 andϕ_1

as shown



A. $\dfrac{\tan\phi_2}{\tan\phi_1} = \dfrac{\theta_1 - \theta_0}{\theta_2 - \theta_0}$

B. $\dfrac{\tan\phi_2}{\tan\phi_1} = \dfrac{\theta_2 - \theta_0}{\theta_1 - \theta_0}$

C. $\dfrac{\tan\phi_1}{\tan\phi_2} = \dfrac{\theta_1}{\theta_2}$

D. $\dfrac{\tan\phi_1}{\tan\phi_2} = \dfrac{\theta_2}{\theta_1}$

Answer: B

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9. Ice starts forming in lake with water at $0^\circ C$ and when the atmospheric temperature is $-10^\circ C$. If the time taken for $1cm$ of ice be 7 hours. Find the time taken for the thickness of ice to change from $1cm$ to $2cm$

A. 7 hours

B. 14 hours

C. 28 hours

D. 21 hours

Answer: D

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10. The temperature of the two outer surfaces of a composite slab, consisting of two materials having coefficients of thermal conductivity K and 2K and thicknesses x and 4x, respectively are T_2 and $T_1 (T_2 > T_1)$. The rate of heat of heat transfer through the slab, in ? steady state is

$\left[\left(A\frac{T_2 - T_1}{x}\right]\right. f$, with f equal to :-

A. 1

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

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

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

Answer: D

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11. A sphere and a cube of same material and same total surface area are placed in the same evacuated space turn by turn after they are heated to the same temperature. Find the ratio of their initial rates of cooling in the enclosure.

A. $\sqrt{\frac{\pi}{6}} : 1$

B. $\sqrt{\frac{\pi}{2}} : 1$

C. $\sqrt{\frac{\pi}{3}} : 1$

D. $\frac{\pi}{\sqrt{3}} : 1$

Answer: A

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12. Suppose the sun expands so that its radius becomes 100 times its present radius and its surface temperature becomes half of its present value. The total energy emited by it then will increase by a factor of :

A. 10^4

B. 625

C. 256

D. 16

Answer: B

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Basic Maths (Thermal Physics) (Kinetic theory of gasess)

1. Figure shows the isotherms of fixed mass of an ideal gas at three temperatures T_A, T_B and T_C then.

A. $T_A > T_B > T_C$

B. $T_A < T_B < T_C$

C. $T_B < T_A < T_C$

D. $T_A = T_B = T_C$

Answer: B

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2. The pressure (P) and absolute temperature (T) of an ideal gas are related to each other as $P \propto \dfrac{1}{T^2}$. If temperature of gas is 300 K and its volume changes from V to 8 V, then find the final temperature of gas.

A. 600 K

B. 300 K

C. 373 K

D. 273 K

Answer: A

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3. Four molecules have speeds $2km/s$, $3km/s$, $4km/s$ and $5km/s$. The rms speed of these molecules in km/s is

A. $\frac{1}{2}\sqrt{15}km/s$

B. $\frac{1}{2}\sqrt{10}k\frac{m}{s}$

C. $2.5k\frac{m}{s}$

D. $\sqrt{\frac{15}{2}}k\frac{m}{s}$

Answer: D

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4. The ratio of number of collisions per second at the walls of containers by He and O_2 gas molecules kept at same volume and temperature is (assume normal incidence on walls)

A. $2:1$

B. $1:2$

C. $2\sqrt{2}:1$

D. $1:2\sqrt{2}$

Answer: C

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5. If hydrogen gas is heated to a very high temperature, then the fraction of energy possessed by gas molecules correspond to rotational motion :-

A. $\frac{3}{5}$

B. $\frac{2}{7}$

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

D. $\frac{2}{5}$

Answer: B

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6. The rms speed of helium gas at $27^{\circ}C$ and 1 atm pressure is 900 ms^{-1}. Then the rms speed of helium molecules at temperature $27^{\circ}C$ and 2 atm pressure is

A. 450 m/s

B. 900 m/s

C. 1800 m/s

D. 750 m/s

Answer: B

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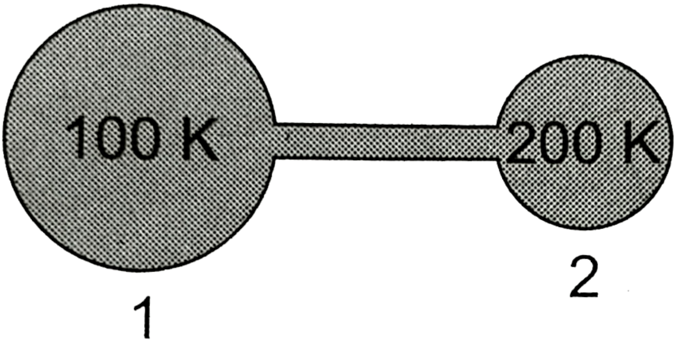
7. Figure shows two flasks connected to each other. The volume of the flask 1 is twice that of flask 2. The system is filled with an ideal gas at temperature $100K$ and $200K$ respectively. If the mass of the gas in 1 be m then what is the mass of the gas in flask 2



A. m

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

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

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

Answer: C

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8. One mole of a diatomic gas undergoes a process $P = P_0 / \left[1 + \left(V / V_0^3\right)\right]$ where P_0 and V_0 are constant. The translational kinetic energy of the gas when $V = V_0$ is given by

A. $\frac{5P_0V_0}{4}$

B. $\frac{3P_0V_0}{4}$

C. $\frac{3P_0V_0}{2}$

D. $\frac{5P_0V_0}{2}$

Answer: B

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9. An ideal gas has an initial pressure of 3 pressure units and an initial volume of 4 volume units. The table gives the final pressure and volume of the gas (in those same units) in four processes. Whish process starts and ends on the same isotherm

A. A

B. B

C. C

D. D

Answer: C

10. Statement-1 : At low pressure and high temperature real gas approaches the ideal gas behaviour.

and

Statement-2 : At low prossure and high temperature the molecules are negligible.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True , Statement -2 is not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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11. A vessel contains a mixture of nitrogen of mass 7 g and carbon dioxide of mass 11 g at temperature 290 K and perssure 1 atm.Find the density of the mixture.

A. 1.1 g/L

B. 1.2 g/L

C. 1.51 g/L

D. 1.6 g/L

Answer: C

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12. PV versus T graph of equal masses of H_2, He and O_2 is shown in Figure choose the correct alternative.

A. A corresponds to He, B to H_2 and C to O_2

B. A corresponds to H_2, B to He and C to O_2

C. A corresponds to He, B to O_2 and C to H_2

D. A corresponds to O_2, B to H_2 and C to He

Answer: A

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13. At $20^{\circ}C$ temperature, an argon gas at atmospheric pressure is confined in a vessel with a volume of $1m^3$ The effective hard spere diameter of argon atom is 3.10×10^{-10}m. determine mean free path.

A. 100 nm

B. 90 nm

C. 93.6 nm

D. 95 nm

Answer: C

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Basic Maths (Thermal Physics) (Thermodynamic process)

1. The pressure and volume of gas are changed as shown in the P-V diagram in the figure ahead. The temperature of the gas :

A. Increases as it goes from A to B

B. Increases as it goes from B to C

C. Remains constant during these changes

D. Decreases as it goes from D to A

Answer: A

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2. The efficiency of a Carnot's engine at a particular source and sink temperature is $\frac{1}{2}$ .When the sink temperature is reduced by $100^\circ C$, the engine efficiency, becomes $\frac{2}{3}$. Find the source temperature.

A. 600 K

B. 300 K

C. 373 K

D. None

Answer: A

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3. An ideal refrigerator runs between $-23^\circ C$ and $27^\circ C$. Find the heat regected to atomosphere for every joule of work input.

A. 6 J

B. 5 J

C. 4 J

D. 3 J

Answer: A

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4. Select the incorrect relation. (Where symboles have their usual meanings):-

A. $C_P = \frac{\gamma R}{\gamma - 1}$

B. $C_P - C_V = R$

C. $\Delta U = \frac{P_f V_f - P_i V_i}{1 - \gamma}$

D. $C_V = \frac{R}{\gamma - 1}$

Answer: C

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5. Select the incorrect statement about the specific heat of a gaseous system :

A. Specific heat at no heat exchange condition, $C_A = 0$

B. Specific heat at constant temperature, $C_T = \infty$

C. Specific heat at constant pressure, $C_P = \dfrac{\gamma R}{\gamma - 1}$

D. Specific heat at constant volume, $C_V = \dfrac{R}{\gamma}$

Answer: D

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6. Work done in the cyclic process shown in figure is :-

A. $4P_0V_0$

B. $-4P_0V_0$

C. $-\dfrac{22}{7}P_0V_0$

D. $-13P_0V_0$

Answer: C

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7. Following figure shows P-T graph for four processes A, B, C and D. Select the correct alternative

A. A-Isobaric process

B. B-Adiabatic process

C. C-Isochoric process

D. D-Isothermal process

Answer: C

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8. For polytropic process PV^n = constant, molar heat capacity (C_m) of an ideal gas is given by:

A. $C_V + \dfrac{R}{1+x}$

B. $C_P + \dfrac{R}{1+x}$

C. $C_V + \dfrac{R}{1-x}$

D. $C_P + \dfrac{R}{1-x}$

Answer: C

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9. For a certain process pressure of diatomic gas varies according to the relation $P = aV^{2n}$, where a is constant. What is the molar heat capacity of the gas for this process?

A. $\dfrac{17R}{6}$

B. $\dfrac{6R}{17}$

C. $\frac{13R}{6}$

D. $\frac{16R}{7}$

Answer: A

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10. The temperature inside and outside a refrigerator are 273 K and 300 K respectively. Assuming that the refrigerator cycle is reversible. For every joule of work done heat delivered to the surrounding will be nearly :-

A. 11 J

B. 22 J

C. 33 J

D. 50 J

Answer: A

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11. A box of negligible mass containing 2 moles of an ideal gas of molar mass M and adiabatic exponent γ moves with constant speed v on a smooth horizontal surface. If the box suddenly stops, then change in temperature of gas will be :

A. $\dfrac{(\gamma-1)Mv^2}{4P}$

B. $\dfrac{\gamma Mv^2}{2R}$

C. $\dfrac{Mv^2}{2(\gamma-1)R}$

D. $\dfrac{(y-1)Mv^2}{2R}$

Answer: D

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12. Two ideal gases A & B are going through adiabatic process. Choose the correct option.

A. both A & B are monoatomic

B. both A & B are diatomic

C. B is diatomic, A is monoatomic

D. B is monoatomic, A is diatomic

Answer: D

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13. One mole of hydrogen, assumed to be ideal, is adiabatically expanded from its initial state (P_1, V_1, T_1) to the final state (P_2, V_2, T_2). The decrease in the internal energy of the gas during this process will be given by

A. $C_V(T_1 - T_2)$

B. $C_P(T_1 - T_2)$

C. $\frac{C_P + C_V}{2}(T_1 - T_2)$

D. $(C_P - C_V)(T_1 - T_2)$

Answer: A

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14. One mole of an ideal gas undergoes a process whose molar heat capacity is 4R and in which work done by gas for small change in temperature is given by the relation dW=2RdT, then the ratio $\frac{C_P}{C_V}$ is

A. $\frac{7}{5}$

B. $\frac{5}{3}$

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

D. 2

Answer: C

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15. A gas expands such that its initial and final temperatures are equal. Also the process followed by the gas traces a straight line on the $P-V$ diagram

(i) The temperature of the gas remains constant throughout

(ii) The temperature of the gas first increases and then decreases

(iii) The temperature of the gas first decreases and then increases

(iv) The straight line has negative slope

A. i & ii

B. i & iii

C. ii & iv

D. ii & iii

Answer: C

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16. One mole of a monoatomic gas is carried along process ABCDEA as shown in the diagram. Find the net work done by gas :-

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

B. 1J

C. $\frac{1}{2}J$

D. 0J

Answer: C

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17. One mole of an ideal monoatomic gas at temperature T_0 expands slowly according to the law $\frac{p}{V}$ = constant. If the final temperature is $2T_0$, heat supplied to the gas is

A. $\frac{RT_0}{2}$

B. RT_0

C. $2RT_0$

D. $\frac{3}{2}RT_0$

Answer: C

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18. How many times a diatomic gas should be expanded adiabatically so as to reduce the root mean square velocity to half. :

A. 64

B. 32

C. 16

D. 8

Answer: B

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19. A gas undergoes following process :-

$Ab \rightarrow$ Compressed to half of the initial volume $(P \propto V)$

$Bc \rightarrow$ Isothermal expansion to intial volume

$CD \rightarrow$ Adiabatic process such that $P_D = P_A$ Select incorrect statement

A. Net heat is released

B. $\Delta U_{AB} < 0$

C. $\Delta U_{CD} > 0$

D. $\Delta U_{AC} > 0$

Answer: D

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20. A diatomic ideal gas is heated at constant at constant volume until the pressure is doubled and again heated of constant pressure until the volume is doubled. The average molar heat capacity for the whole process is

A. $\frac{13R}{6}$

B. $\frac{19R}{6}$

C. $\frac{23R}{6}$

D. $\frac{17R}{6}$

Answer: B

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21. In a Carnot engine when $T_2 = 0^\circ C$ and $T_1 = 200^\circ C$ its efficiency is η_1 and when $T_1 = 0^\circ C$ and $T_2 = -200^\circ C$. Its efficiency is η_2, then what is η_1 / η_2?

A. $1:15$

B. $1:1$

C. $1:2$

D. $1.73:1$

Answer: D

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Basic Maths (Dscillations) (Kinematics of SHM)

1. Two particles executing SHM of same frequency, meet at $x = + A/2$, while moving in opposite direction . Phase difference between the particles is

A. $\frac{\pi}{6}$

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

C. $\frac{5\pi}{6}$

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

Answer: D

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2. A particle is executing SHM with time period T Starting from mean position, time taken by it to complete $\frac{5}{8}$ oscillations is,

A. $\frac{T}{12}$

B. $\frac{T}{6}$

C. $\frac{5T}{12}$

D. $\frac{7T}{12}$

Answer: D

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3. A particle executes simple harmonic motion according to equation $4\frac{d^2x}{dt^2} + 320x = 0$. Its time period of oscillation is :-

A. $\frac{2\pi}{5\sqrt{3}}s$

B. $\frac{\pi}{3\sqrt{2}}s$

C. $\frac{\pi}{2\sqrt{5}}s$

D. $\frac{2\pi}{\sqrt{3}}s$

Answer: C

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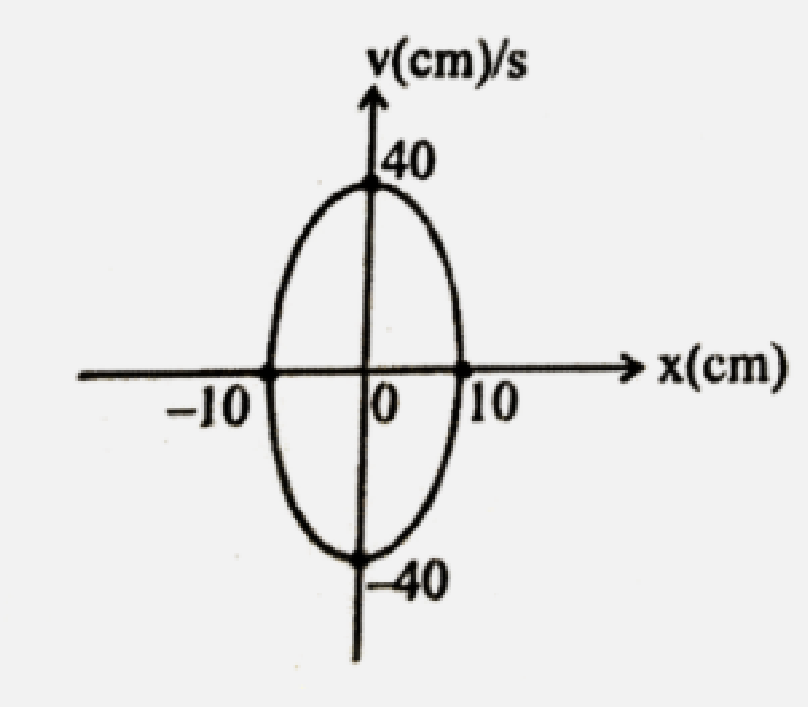
4. The plot of velocity (v) versus displacement (x) of a particle executing simple harmonic motion is shown in figure. The time period of oscillation of particle is :-



A. $\frac{\pi}{2}s$

B. πs

C. 2πs

D. 3πs

Answer: A

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5. Figure shows the position-time graph of an abject in SHM. The correct equation representing this motion is :-

A. $2\sin\left(\frac{2\pi}{5}t + \frac{\pi}{3}\right)$

B. $4\sin\left(\frac{\pi}{5}t + \frac{\pi}{6}\right)$

C. $4\sin\left(\frac{\pi}{6}t + \frac{\pi}{3}\right)$

D. $4\sin\left(\frac{\pi}{6}t + \frac{\pi}{6}\right)$

Answer: D

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6. A particle executes SHM according to equation $x = 10(cm)\cos\left[2\pi t + \frac{\pi}{2}\right]$, where t is in seconds. The magnitude of the velocity of the particle at $t = \frac{1}{6}s$ will be :-

A. 24.7 cm/s

B. 20.5 cm/s

C. 28.3 cm/s

D. 31.4 cm/s

Answer: D

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7. A particle of mass m in a unidirectional potential field have potential energy $U(x) = \alpha + 2\beta x^2$, where α and β are positive constants. Find its time period of oscillations.

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

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

C. $\pi\sqrt{\frac{m}{\beta}}$

D. $\pi\sqrt{\frac{\beta}{m}}$

Answer: C

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8. A particle executing S.H.M. has angular frequency $6.28s^{-1}$ and amplitude 10 cm find (a) the time period (b) the maximum speed (c) the maximum acceleration (d) the speed when the displacement is 6 cm from the mean postiton (e) the speed at $t=1/6$s assuming that the motion starts from rest at t=0

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9. A body makes angular simple harmonic motion of amplitude $\pi/10 rad$ and time period $0.05s$. If the body is at a displacement $\theta=\pi/10 rad$ at $t=0$, write the equation giving angular displacement as a function of time.

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10. The vertical motion of a ship at sea is described by the equation $\frac{d^x}{dt^2} = -4x$, where x is the vertical height of the ship (in meter) above its mean position. If it oscillates through a height of 1 m

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11. The equation of motion of a particle of mass $1g$ is $\frac{d^2x}{dt^2} + \pi^2 x = 0$, where x is displacement (in m) from mean position. The frequency of oscillation is (in Hz)

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

B. 2

C. $5\sqrt{10}$

D. $\frac{1}{5\sqrt{10}}$

Answer: A

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12. The time taken by a particle performing SHM to pass from point A and B where it is velocities are same is $2:3$. After another 2 s it returns to B. The time period oscillation is (in seconds)

A. 2

B. 4

C. 6

D. 8

Answer: D

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13. The phase difference between two $SHM y_1 = 10\sin\left(10\pi t + \frac{\pi}{3}\right)$ and $y_2 = 12\sin\left(8\pi t + \frac{\pi}{4}\right)$ to $t = 0.5s$ is

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14. A small mass executes linear SHM about O with amplitude a and period T. Its displacement from O at time $T/8$ after passing through O is:

A. $\frac{a}{8}$

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

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

D. $\frac{a}{\sqrt{2}}$

Answer: D

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15. Two SHM are represcnted by equations $y_1 = 6\cos\left(6\pi t + \frac{\pi}{6}\right), y_2 = 3\left(\sqrt{3}\sin 3\pi t + \cos 3\pi t\right)$

A. ratio of their amplitudes is 1

B. ratio of their time periods 1

C. ratio of their maximum velocities is 1

D. ratio of their maximum accleration is 1

Answer: A

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16. The phase difference between the displacement and acceleration of a particle execuliting simple harmonic motion is

A. 0

B. $\pi / 2$

C. π

D. 2π

Answer: C

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17. The acceleration of a particle moving along x-axis is $a = -100x + 50$. It is released from $x = 2$. Here a and x are in S.I units. The motion of particle will be:

A. periodic, oscillatory but not SHM

B. periodic but not oscillatory

C. oscillatory but not periodic

D. simple harmonic

Answer: D

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18. The acceleration of a certain simple harmonic oscillator is given by

$a = -(35.28 m/s^2)\cos 4.2t$

The amplitude of the simple harmonic motion is

A. 2.0 m

B. 8.4 m

C. 16.8 m

D. 17.64 m

Answer: A

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19. A particle executes simple harmonic motion with a period of $16s$. At time $t = 2s$, the particle crosses the mean position while at $t = 4s$, its velocity is $4ms^{-1}$ amplitude of motion in metre is

A. $\sqrt{2} / \pi$

B. $32\sqrt{2} / \pi$

C. $24\sqrt{2} / \pi$

D. $4 / \pi$

Answer: B

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20. Two particle P and Q describe $S.H.M.$ of same amplitude a same frequency f along the same straight line .The maximum distance between the two particles is $a\sqrt{2}$ The phase difference between the two particle is

A. zero

B. $\pi/2$

C. $\pi/6$

D. $\pi/3$

Answer: B

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Basic Maths (Oscillations) (Energy & spring pendulum)

1. If particle is excuting simple harmonic motion with time period T, then the time period of its total mechanical energy is :-

A. Zero

B. T/2

C. 2T

D. Infinite

Answer: D

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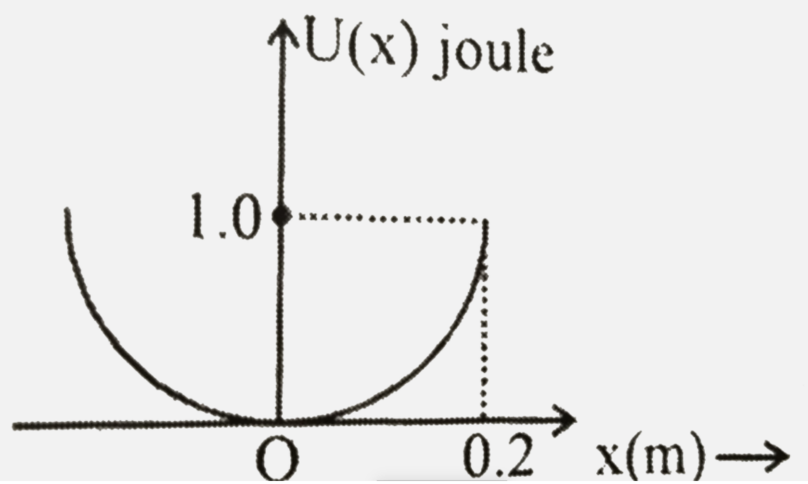
2. A particle of mass 4kg moves simple harmonically such that its PE (U) varies with position x, as shown. The period of oscillations is :-



A. $\frac{2\pi}{25}s$

B. $\frac{\pi\sqrt{2}}{5}$

C. $\frac{4\pi}{5}s$

D. $\frac{2\pi\sqrt{2}}{5}s$

Answer: D

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3. When a mass m attached to a spring it oscillates with period 4s. When an additional mass of 2 kg is attached to a spring, time period increases by 1s. The value of m is :-

A. 3.5 kg

B. 8.2 kg

C. 4.7 kg

D. 2.6 kg

Answer: A

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4. Assertion:- A spring of force constatn k is cut in to two piece having lengths in the ratio 1:2 The force constant of series combination of the two parts is $\frac{3k}{2}$

reason:- The spring connected in series are represented by $k = k_1 + k_2$

A. A

B. B

C. C

D. D

Answer: D

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5. A linear harmonic oscillator of force constant $2 \times 10^6 N/m$ and amplitude $0.01m$ has a total mechanical energy of $160J$. Its

A. maximum potential energy is 100 J

B. maximum kinetic energy is 100 J

C. maximum potential energy is 160 J

D. maximum potential energy is zero

Answer: B::C

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6. A particle moving on x - axis has potential energy $U = 2 - 20x + 5x^2$ joule along x - axis. The particle is relesed at $x = -3$. The maximum value of x will be (x is in metre)

A. 5 m

B. 3 m

C. 7 m

D. 8 m

Answer: C

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7. The potential energy of a particle executing SHM change from maximum to minimum in $5s$. Then the time period of SHM is:

A. 5 s

B. 10 s

C. 15 s

D. 20 s

Answer: D

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8. A particle of mass m performs SHM along a straight line with frequency f and amplitude A:-

A. The average kinetic energy of the particle is zero

B. The average potential energy is $m\pi^2 f^2 A^2$

C. The frequency of oscillation of kinetic energy is 2f

D. Velocity function leads acceleration by $\pi / 2$

Answer: B::C

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9. Which of the following is correct about a SHM, along a straight line?

A. Ratio of acceleration to velocity is constant.

B. Ratio of acceleration to potential energy is constant.

C. Ratio of acceleration to displacement from the mean position is constant.

D. Ratio of accleration to kinetic energy is constant.

Answer: C

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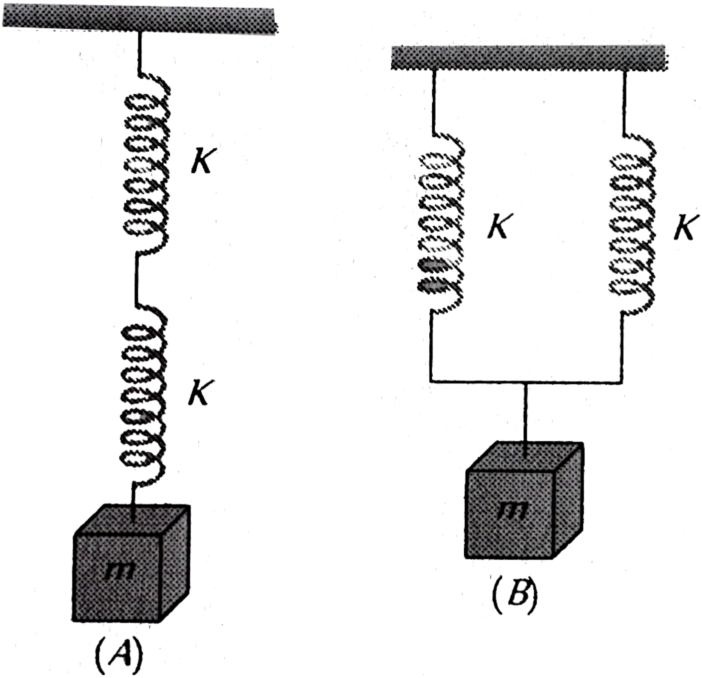
10. Two identical spring of constant K are connected in series and parallel as shown in figure. A mass is suspended from them. The ratio of their frequencies of vertical oscillations will be



A. $2:1$

B. $1:1$

C. $1:2$

D. $4:1$

Answer: C

Watch Video Solution

11. A force of 6.4 N stretches a vertical spring by 0.1m. Find the mass that must be suspended from the spring so that it oscillates with a period of

$\pi / 4$

second.

A. $\frac{\pi}{4} kg$

B. $\frac{4}{\pi} kg$

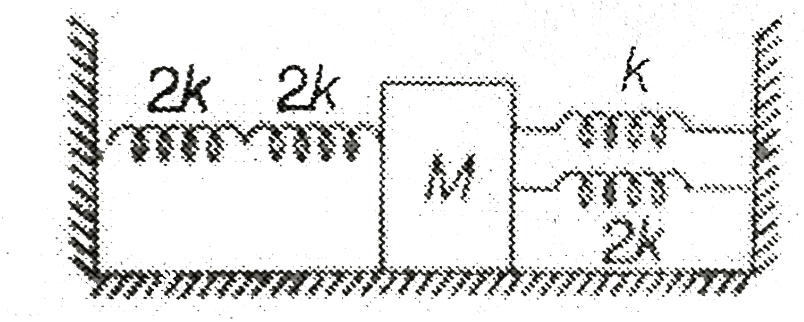
C. 1 kg

D. 10 kg

Answer: C

Watch Video Solution

12. Four massless springs whose force constants are 2k, 2k, k and 2k respectively are attached to a mass M kept on a frictionless plane (as shown in figure). If the mass M is displaced in the horizontal direction.



A. $\frac{1}{2\pi}\sqrt{\frac{k}{4M}}$

B. $\frac{1}{2\pi}\sqrt{\frac{4k}{M}}$

C. $\frac{1}{2\pi}\sqrt{\frac{k}{7M}}$

D. $\frac{1}{2\pi}\sqrt{\frac{7k}{M}}$

Answer: B

Watch Video Solution

13. A system is shown in the figure. The time period for small oscillations of the two bolcks will be :-

A. $2\pi\sqrt{\frac{3m}{k}}$

B. $2\pi\sqrt{\frac{3m}{2k}}$

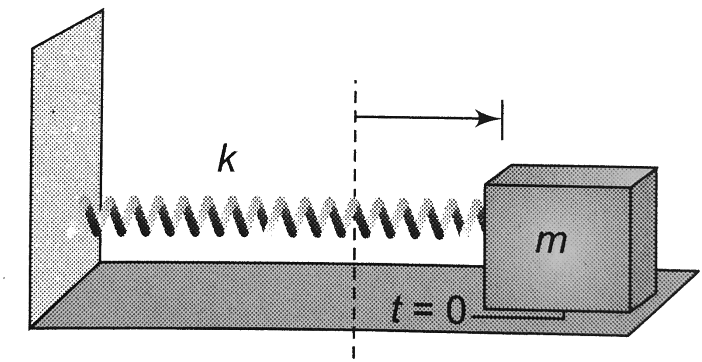
C. $2\pi\sqrt{\frac{3m}{4k}}$

D. $2\pi\sqrt{\frac{3m}{8k}}$

Answer: C

Watch Video Solution

14. In a horizontal spring - mass system mass m is released after being displaced towards right by some distance $t = 0$ on a friction-less surface. The phase angle of motion in radian when it is first time passing through equilibrium position is equal to



A. $\pi / 2$

B. π

C. $3\pi / 2$

D. 0

Answer: B

Watch Video Solution

15. A mass M is suspended from a light spring. An additional mass m added to it displaces the spring further by distance x then its time period is

A. $T = 2\pi\sqrt{\dfrac{mg}{x(M+m)}}$

B. $T = 2\pi\sqrt{\dfrac{(M+m)x}{mg}}$

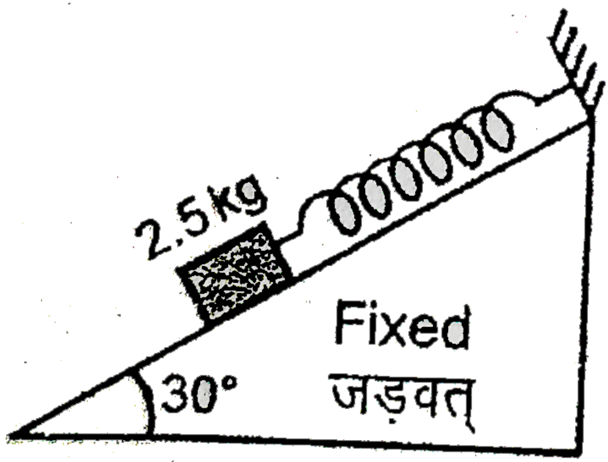
C. $T = \dfrac{\pi}{2}\sqrt{\dfrac{m}{x(M+m)}}$

D. $T = 2\pi\sqrt{\dfrac{M+m}{mgx}}$

Answer: B

Watch Video Solution

16. A smooth inclined plane having angle of inclination 30° with horizontal has a mass $2.5kg$ held by a spring which is fixed at the upper end as hwon in figure. If the mass is taken $2.5cm$ up along the surface of the inclined plane, the tension in the soring reduces to zero. If the mass is then released, the angular frequency of oscillation in radian per second is



A. 7

B. 14

C. 0.7

D. 1.4

Answer: B

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Basic Maths (Oscillations) (Simple pendulum and types of SHM)

1. Two pendulums of length 1.21 m and 1.0 m starts vibrationg. At some instant, the two are in the mean position in same phase. After how many vibrations of the longer pendulum, the two will be in phase ?

A. 10

B. 11

C. 20

D. 21

Answer: A

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2. The length of a simple pendulum is increased by 44%. The percentage increase in its time period will be

A. 96s

B. 58s

C. 82s

D. 72s

Answer: D

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3. A solid cylinder of denisty ρ_0, cross-section area A and length l floats in a liquid $\rho(> \rho_0$ with its axis vertical, as shown. If it is slightly displaced downward and released, the time period will be :

A. $2\pi\sqrt{\frac{l}{g}}$

B. $2\pi\sqrt{\frac{\rho_0 l}{\rho g}}$

C. $2\pi\sqrt{\frac{\rho l}{\rho_0 g}}$

D. $2\pi\sqrt{\frac{l}{2g}}$

Answer: B

Watch Video Solution

4. A 100 g mass stretches a particular spring by 9.8 cm, when suspended vertically from it. How large a mass must be attached to the spring if the period of vibration is to be 6.28 s?

A. 1000g

B. $10^5 g$

C. $10^7 g$

D. $10^4 g$

Answer: D

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5. When a block of mass m is suspended separately by two different springs have time period t_1 and t_2. If same mass is connected to parallel combination of both springs, then its time period is given by :-

A. $\frac{t_1 t_2}{t_1 + t_2}$

B. $\frac{t_1 t_2}{\sqrt{t_1^2 + t_2^2}}$

C. $\sqrt{\frac{t_1 t_2}{t_1 + t_2}}$

D. $t_1 + t_2$

Answer: B

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6. In forced oscillations , a particle oscillates simple harmonically with a frequency equal to

A. Frequency of driving force

B. Natural frequency of body

C. Difference of frequency of driving force and natural frequency

D. Mean of frequency of driving force and natural frequency

Answer: A

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7. A simple pendulum of length 40 cm oscillates with an angular amplitude of 0.04 rad. Find a. the time period b. the linear amplitude of the bob, c. The speed of the bob when the strig makes 0.02 rad with the vertical and d. the angular acceleration when the bob is in moemntary rest. Take $g = 10ms^{-2}$.

A. The time period

B. The linear amplitude of the bob

C. The speed of the bob when the string makes 0.02 rad with the vertical

D. The angular acceleration when the bob is in momentary rest (take $g = 10m/s^2$)

Answer: A::B::C::D

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8. The time period and the amplitude of a simple pendulum are 4 seconds and 0.20 meter respectively. If the displacement is 0.1 meter at time t=0, the equation on its displacement is represented by :-

A. $y = 0.2\sin(0.5\pi t)$

B. $y = 0.1\sin\left(0.5\pi t + \frac{\pi}{6}\right)$

C. $y = 0.1\sin\left(\pi t + \frac{\pi}{6}\right)$

D. $Y = 0.2\sin\left(0.5\pi t + \frac{\pi}{6}\right)$

Answer: D

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9. A simple pendulum of length 1m is attached to the ceiling of an elevator which is accelerating upward at the rate of $1m/s^2$. Its frequency is approximately :-

A. 2 Hz

B. 1.5 Hz

C. 5 Hz

D. 0.5 Hz

Answer: D

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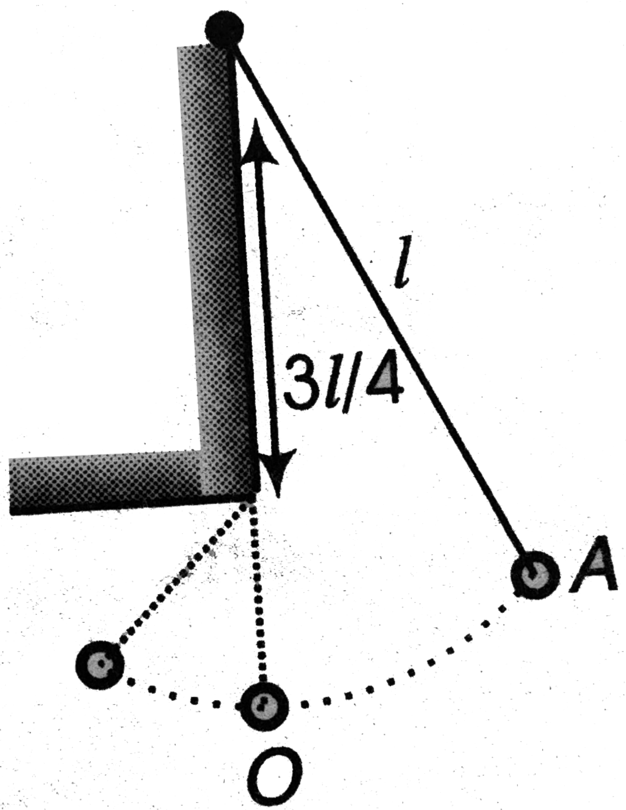
10. A pendulum has a period T for small osillations. An obstacle is placed directly beneath the pivot, so that only the lowest one - quarter of the string can follow the pendulum bob when it swings to the left of its resting position. The pendulum is released from rest at a certain point. How long will it take to return to that point again ? In answering this question, you may assume that the angle between the moving string and the vertical stays small throughout the motion.



A. T

B. T/2

C. 3T/4

D. T/4

Answer: C

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11. The bob of a simple pendulum is a spherical hollow ball filled with water. A plugged hole near the bottom of the oscillating bob gets suddenly unplugged. During observation, till water is coming out, the time period of lscillation would.

A. remain unchanged

B. increase towards a saturation value

C. first increase and then decrease to the original value

D. first decrease and then increase to the original value

Answer: C

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12. Choose the correct statement :-

A. Time period of a simple pendulum depends on amplitude.

B. Time shown by a spring watch varies with acceleration due to gravity g.

C. In a simple pendulum, time period varies linearly with the length of the pendulum.

D. The graph between length of the pendulum and time period is a parabola.

Answer: D

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13. A simple pendulum has a time period T in vacuum. Its time period when it is completely immersed in a liquid of density one-eight of the density of material of the bob is

A. $\sqrt{\frac{7}{8}}T$

B. $\sqrt{\frac{5}{8}}T$

C. $\sqrt{\frac{3}{8}}T$

D. $\sqrt{\frac{8}{7}}T$

Answer: D

Watch Video Solution

14. The time period of a simple pendulum in a stationary train is T. The time period of a mass attached to a spring is also T. The train accelerates at the rate $5m/s^2$. If the new time periods of the pendulum and spring be T_P and T_S respectively, then :-

A. $T_P = T_S$

B. $T_P > T_S$

C. $T_P < T_S$

D. Cannot be predicted

Answer: C

View Text Solution

15. The amplitude of damped oscillator becomes $\frac{1}{3}$ in $2s$. Its amplitude after $6s$ is $1/n$ times the original. The value of n is

A. 3^2

B. $\sqrt[3]{2}$

C. $\sqrt[3]{3}$

D. 3^3

Answer: D

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16. Amplitude of a damped oscillator decreases up to 0.6 times of its initial value in 5 seconds. In next 10 seconds, it decreases upto $'\alpha'$ times of its intial value where $'\alpha'$ is equal to ?

A. 0.729

B. 0.6

C. 0.7

D. 0.81

Answer: A

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17. A simple pendulm has a length L and a bob of mass M. The bob is vibrating with amplitude a .What is the maximum tension in the string?

A. mg

B. $mg\left[1+\left(\frac{a}{L}\right)^{2}\right]$

C. $mg\left[1+\left(\frac{a}{2L}\right)\right]^{2}$

D. $mg\left[1+\left(\frac{a}{L}\right)\right]^{2}$

Answer: B

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Basic Maths (Wave Motion & Dopplers Effect) (Fundamental)

1. Let speed of sound waves in hydrogen gas at room temperature is v_0. What will be the speed of sound waves in a room which contains an equimolar mixture of hydrogen and 'He' at same temperature :-

A. $\sqrt{\frac{5}{7}}v_0$

B. $\sqrt{\frac{7}{5}}v_0$

C. $\sqrt{\frac{2}{5}}v_0$

D. None

Answer: A

Watch Video Solution

2. If the intensity of sound is increased by a factor of 30, by how many decibels in the sound level increased :-

A. 14.77 Db

B. 14.50 dB

C. 14.0 Db

D. None

Answer: A

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3. A travelling wave pulse is given by

$$y = \frac{4}{3x^2 + 48t^2 + 24xt + 2}$$

where x and y are in metre and t is in second. The velocity of wave is :-

A. 4 m/s

B. 2 m/s

C. 8 m/s

D. 12 m/s

Answer: A

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4. The wave function of a pulse is given by $y = \frac{5}{(4x + 6t)^2}$ where x and y are in metre and t is in second :-

(i) Identify the direction of propagation

(ii) Determine the wave velocity of the pulse

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5. two particle of medium disturbed by the wave propagation are at $x_1 = 0$ and $x_2 = 1cm$. The respective displacement (in cm) of the particles can be given by the equation:

$y_1 = 2\sin 3\pi t$, $y_2 \sin(3\pi t - \pi / 8)$ the wave velocity is

A. 16 cm/sec

B. 24 cm/sec

C. 12 cm/sec

D. 8 cm/sec

Answer: B

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6. Two small boats are $10m$ apart on a lake. Each pops up and down with a period of 4.0 seconds due to wave motion on the surface of water. When one boat is at its highest point, the other boat is its lowest point.

Both boats are always within a single cycle of the waves. The speed of the waves is:

A. 2.5 m/s

B. 5.0 m/s

C. 14 m/s

D. 40 m/s

Answer: B

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7. A uniform rope of mass M=0.1kg and length L=10m hangs from the celling. $\left[g = 10m / s^2\right]$:-

A. Speed of the transverse wave in the rope increases linearly from top to the bottom

B. Speed of the transverse wave in the rope decreases linearly from bottom to the top

C. Speed of the transverse wave in the rop ramain constant along the length of the rope

D. Time taken by the transverse wave to travel the full length of the rope is 2 sec

Answer: D

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8. A uniform rope of length $12m$ and mass $6kg$ hangs vertically from a rigid support. A block of mass $2kg$ is attached to the free end of the rope. A transverse pulse of wavelength $0.06m$ is produced at the lower end of the rope. What is the wavelength of the pulse when it reaches the top of the rope?

A. 0.012m

B. 0.06m

C. 0.24m

D. 0.12m

Answer: D

Watch Video Solution

9. The displacement wave in a string is $y = (3cm)\sin 6.28(0.5x - 50t)$ where x is in centimetres and t in seconds. The velocity and wavelength of the wave is :-

A. 2 cm, 100 cms^{-1}

B. 10 cm, 50 cms^{-1}

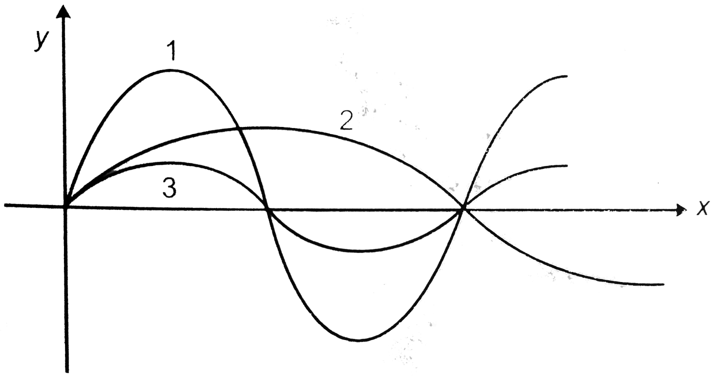
C. 20 cm, $2ms^{-1}$

D. 2 m, $100ms^{-1}$

Answer: A

Watch Video Solution

10. Graph shows three waves that are separately sent along a string that is stretched under a certain tension along x-axis. If ω_1, ω_2 and ω_3 are their angular frequencies, respectively, then:



A. $\omega_1 = \omega_3 > om\eta_2$

B. $\omega_1 > \omega_2\omega_3$

C. $\omega_1 > \omega_1 = \omega_2$

D. $\omega_1 = \omega_2 = \omega_3$

Answer: A

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Watch Video Solution

11. The following figure depicts a wave travelling in a medium. Which pari of particles are in phase:-

A. A and D

B. B and F

C. C and E

D. B and G

Answer: D

Watch Video Solution

12. A transverse periodic wave ona strin with a linear mass density of 0.200kg/m is described by the following equations

$y = 0.05 \sin(420t - 21.0x)$

where x and y in metres and t is in seconds. Tension in the string is

A. 32 N

B. 42 N

C. 66 N

D. 80 N

Answer: D

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13. Under similar conditions of temperature and pressure, In which of the following gases the velocity of sound will be largest :-

A. H_2

B. N_2

C. He

D. CO_2

Answer: A

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14. Which of the following is/are correct :-

A.

B.

C.

D.

Answer: C

View Text Solution

15. The velocity of sound in a gas at temperature $27^\circ C$ is V then in the same ahs its velocity will be $2V$ at temperature.

A. $54^\circ C$

B. $327^\circ C$

C. $927^\circ C$

D. $108^\circ C$

Answer: C

Watch Video Solution

16. The frequency of a tunning fork is 384 per second and velocity of sound in air is 352 m/s . How far the sound has traversed while fork completes 36 vibration

A. 33m

B. 16.5 m

C. 11 m

D. 22 m

Answer: A

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17. Ultrasonic, infrasonic and audio waves travel though a medium with speeds V_u, V_i and V_a respectively then :-

A. $V_u, V_i \text{ and } V_a$ are equal

B. $V_u > V_a > V_i$

C. $V_u < V_a < V_i$

D. $V_a < V_u \text{ and } V_u \approx V_i$

Answer: A

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18. Consider a wave represented by $y = \cos(500t - 70x)$ where y is in millimetres, x in metres and t in second. Which of following are true?

A. the wave is a standing wave

B. the speed of the wave is 50/7 ms^{-1}

C. the frequency of oscillation is $500 \times 2\pi$ Hz

D. two nearest points in the same phase have separation $20\pi / 7cm$

Answer: B::D

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19. The frequency of a man's voice is 300 Hz and its wavelength is 1 meter. If the wavelength of a child's voice is 1.5 m, then the frequency of the child's voice is"

A. 200 Hz

B. 150 Hz

C. 400 Hz

D. 450 Hz

Answer: A

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20. A light pointer fixed to one prong of a tuning fork touches gnetly a smoked vertical plate. The fork is set vibrating and the plate is allowed to fall freely. 8 complete oscilllations are counted when the plate falls through 10cm.What is the frequency of the tuning fork?

A. 112 Hz

B. 56 Hz

C. 8/7 Hz

D. 7/8 Hz

Answer: B

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21. Which of the following expressions is that of a simpleharmonic progressive wave ?

A. $A \sin \omega t$

B. $A \sin \omega t \cos kx$

C. $A \sin(\omega t - kx)$

D. $A \cos kx$

Answer: C

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22. If the density of air at NTP is $1.293 kg / m^3$ and $\gamma = 1.41$, then the velocity of sound in air at NTP is :

A. 102.3 m/s

B. 252.3 m/s

C. 332.3 m/s

D. 432.3 m/s

Answer: C

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23. Light can travel in vacuum whereas sound can not do so. Why?

A. speed of sound is vertymuch slower than light

B. light waves are electromagnetic in nature

C. sound waves are electromagnetic in nature

D. light waves are not electromagnetic in nature

Answer: B

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Basic Maths (Wave Motion & Dopplers Effect) (Superposition of waves interfarence, beats)

1. Four tuning forks of frequencies 200,201,204 and 206 Hz are sounded together. The beat frequency will be

A. 6

B. 12

C. 15

D. None of these

Answer: B

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2. S_1, S_2 are two choerent sources of sound located along x-axis separated by 4γ where γ is wavelength of sond emitted by them. Number of maximum located on the elliptical boundary around it will be :-

A. 16

B. 12

C. 8

D. 4

Answer: A

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3. Three waves producing displacement in the same direction of same frequency and of amplitudes $10\eta m, 4\eta m$ and 7η m arrive at a point with successive phase difference of $\pi/2$. The amplitude of the resultant wave is :--

A. $2\eta m$

B. $7\eta m$

C. $5\eta m$

D. 1

Answer: C

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4. Two coherent sources of different intensities send waves which interfere. The ratio of maximum intensity to the minimum intensity is 25. The intensities of the sources are in the ratio

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5. If two tuning fork A and B are sounded together they produce 4 beats per second. A is then slightly loaded with wax, they produce 2 beats when sounded again. The frequency of A is 256. The frequency of B will be

A. 250 Hz

B. 252 Hz

C. 260 Hz

D. 262 Hz

Answer: B

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6. When two progressive waves of intensity I_1 and I_2 but slightly different frequencies superpose, the resultant intensity flutuates between :-

A. $\left(\sqrt{I_1}+\sqrt{I_2}\right)^2 \text{ and } \left(\sqrt{I_1}-\sqrt{I_2}\right)^2$

B. $\left(\sqrt{I_1}+\sqrt{I_2}\right) \text{ and } \left(\sqrt{I_1}-\sqrt{I_2}\right)$

C. $(I_1+I_2) \text{ and } \left(\sqrt{I_1}-\sqrt{I_2}\right)$

D. $\frac{I_1}{I_2}\text{and}\frac{I_2}{I_1}$

Answer: A

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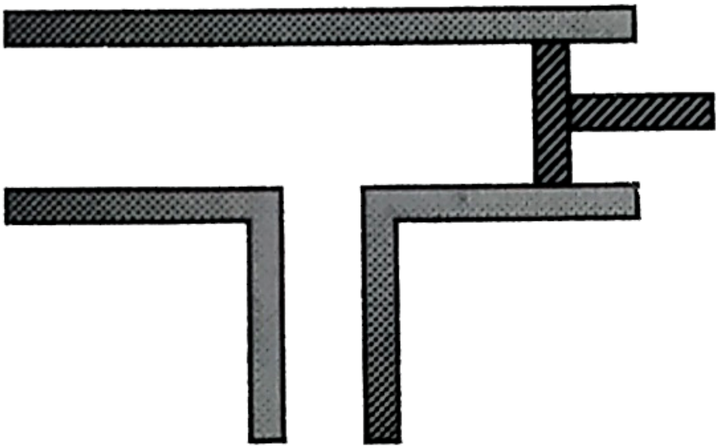
7. Vibrating tuning fork of frequency n is placed near the open end of a long cylindrical tube. The tube has a side opening and is fitted with a movable reflecting piston. As the piston is moved through $8.75cm$, the intensity of sound changes from a maximum to minimum. If the speed of sound is $350m/s$. Then n is



A. 500 Hz

B. 1000 Hz

C. 2000 Hz

D. 4000 Hz

Answer: B

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8. Two waves are given by $y_1 = a\sin(\omega t - kx)$ and $y_2 = a\cos(\omega t - kx)$.

The phase difference between the two waves is -

A. $(\lambda / 2\pi)\phi$

B. $\left(\frac{\phi + (\pi/2)}{2\pi}\right)\lambda$

C. $\frac{2\pi}{\lambda}\left(\phi - \frac{\pi}{2}\right)$

D. $\frac{2\pi}{\lambda}\phi$

Answer: B

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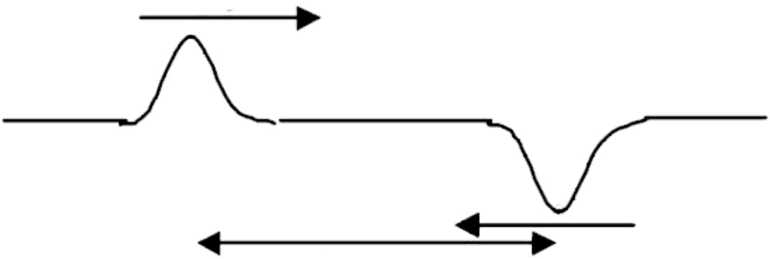
9. Two pulse in a stretched string whose centers are initially $8cm$ apart are moving towards each other as shown in the figure. The speed of each pulse is $2cm / s$. After $2\sec onds$, the total energy of the pulse will be



A. zero

B. purely kinetic

C. purely potential

D. partly kinetic and partly potential

Answer: B

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10. Two turning forks of frequencies n_1 and n_2 produces n beats per second. If n_2 and n are known, n_1 may be given by

A. $\frac{n_2}{n} + n_2$

B. $n_2 n$

C. $n_2 \pm n$

D. $\frac{n_2}{n} - n_2$

Answer: C

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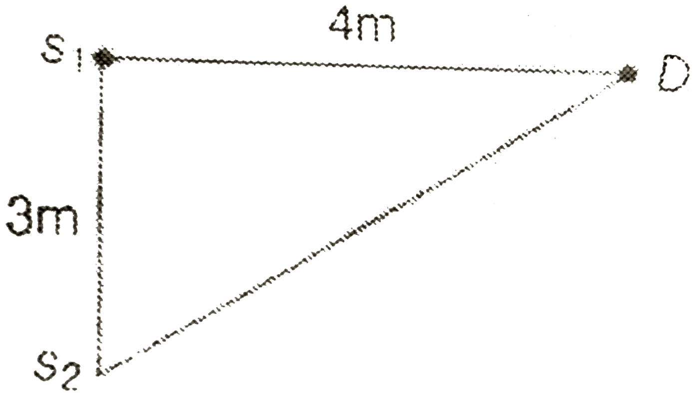
11. In the figure , the intensity of waves arriving at D from two coherent soucrces s_1 and $s_2 is I_0$. The wavelength of the wave is $\lambda = 4m$.

Resultant intensity at D will be



A. $4I_0$

B. I_0

C. $2I_0$

D. zero

Answer: C

Watch Video Solution

12. When a guitar is sounded with a 440 Hz tuning fork, a beat frequency of 5 Hz is heard. If the experiment is repeated with a tuning fork of 437

Hz, the beat frequency is 8 Hz. The string frequency (in Hz) is :-

A. 445

B. 435

C. 429

D. 448

Answer: A

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13. If two waves of same frequency and same amplitude superimpose and produce third wave of same amplitude, then waves differ in phase by –

A. π

B. $2\pi / 3$

C. $\pi / 3$

D. 3π

Answer: B

Watch Video Solution

14. Two waves are represented by: $y_1 = 4\sin 404\pi t$ and $y_2 = 3\sin 400\pi t$.

Then :

A. beat frequency is 4 Hz and the ratio of maximum to minimum intensity is 49 : 1

B. beat frequency is 2 Hz and the ratio of maximum to minimum intensity is 49 : 1

C. beat frequency is 2 Hz and the ratio of maximum to minimum intensity is 1 : 49

D. beat frequency is 4 Hz and the ratio of maximum to minimum intensity is 1 : 49

Answer: B

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15. 41 tuning forks are arranged such that every fork gives 5 beats with the next. The last fork has a frequency that is double of the first. The frequency of the first fork is :-

A. 200

B. 400

C. 205

D. 210

Answer: A

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Basic Maths (Wave Motion & Dopplers Effect) (Stationary waves & doppler effect, beats)

1. The frequency of a radar is 780 MHz. After getting reflected from an approaching aeroplane, the apparent frequency is more than the actual frequency by 2.6 kHz. The aeroplane has a speed of

A. 0.25 km/s

B. 0.5 km/s

C. 1.0 km/s

D. 2.0 km/s

Answer: B

Watch Video Solution

2. A locomotive approaching a crossing at a speed of 20 ms^{-1} sounds a whistle of frequency 640 Hz when 1 km from the crossing. There is no wind and the speed of sound in air is 330 ms^{-1}. What frequency is heard by an observer $\sqrt{3}$ km on the straight road from the crossing at right angle :-

A. 600 Hz

B. 630 Hz

C. 660 Hz

D. 720 Hz

Answer: C

Watch Video Solution

3. An aluminium rod having a length 100 cm is clamped at its middle point and set into longitudinal vibrations. Let the rod vibrate in its fundamental mode. The density of aluminium is 2600 kg/m^3 and its Young's modulus is $7.8 \times 10^{10} N/m^2$. The frequency of the sound produced is :-

A. 1250 Hz

B. 2740 Hz

C. 2350 Hz

D. 1685 Hz

Answer: B

Watch Video Solution

4. A column of air at $51^{\circ}C$ and a tuning fork produce 4 beats per second when sounded together. As the temperature of the air column is decreased, the number of beats per second tends to decrease and when the temperature is $16^{\circ}C$ the two produce 1 beat per second. Find the frequency of the tuning fork.

A. 100 Hz

B. 75 Hz

C. 150 Hz

D. 50 Hz

Answer: D

Watch Video Solution

5. A uniform string resonates with a tuning fork, at a maximum tension of 32 N. If it is divided into two segments by placing a wedge at a distance one fourth of length from one end, then resonance frequency will occur at a maximum value of tension :-

A. 2 N

B. 4 N

C. 8 N

D. 16 N

Answer: A

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6. If in a stationary wave the amplitude corresponding to antinode is 4 cm, then the amplitude corresponding to a particle of medium located exactly midway between a node and an antinode is :-

A. 2 cm

B. $2\sqrt{2}cm$

C. $\sqrt{2}cm$

D. 1.5 cm

Answer: B

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7. What is the phase difference between the displacement wave and pressure wave in sound wave :-

A. Zero

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

C. π

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

Answer: B

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8. A wire of length l having tension T and radius r vibrates with fundamental frequency f. Another wire of the same metal with length $2l$ having tension $2T$ and radius $2r$ will vibrate with fundamental frequency :

A. f

B. 2f

C. $\frac{f}{2\sqrt{2}}$

D. $\frac{f}{2}\sqrt{2}$

Answer: C

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9. Equation of a standing wave is generally expressed as $y = 2A \sin \omega t \cos kx$. In the equation quantity $\frac{\omega}{k}$ represents

A. the transverse speed of the particles of the string

B. the speed of either of the component wave

C. the speed of the stnding wave

D. a quantity that is independent of the properties of the string.

Answer: B

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10. Two vibrating strings of same material stretched under same tension and vibrating with same frequency in the same overtone have radii 2r and r. Then the ratio of their lengths is:

A. $1:2$

B. $1:4$

C. $1:3$

D. $2:3$

Answer: A

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11. The wave-function for a certain standing wave on a string fixed at both ends is $y(x,t) = 0.5\sin(0.025\pi x)\cos 500t$ where x and y are in centimeters and t is seconds. The shortest possible length of the string is :

A. 126 cm

B. 160 cm

C. 40 cm

D. 80 cm

Answer: C

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12. In a standing transerse wave on a string :

A. In one time period all the particles are simultaneously at rest once

B. All the particles must be at their positive extremes once in a time period

C. All the particles may be at their positive extremes simulanecously once in a time period.

D. All the particles are never at rest

Answer: B

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13. A string vibrates in 5 segments to a frequency of 480 Hz. The frequency that will cause it to vibrate in 2 segments will be

A. 96 Hz

B. 192 Hz

C. 1200 Hz

D. 2400 Hz

Answer: B

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14. A 2.0m long string with a linear mass density of $5.2 \times 10^{-3} kgm^{-1}$ and tension 52N has both of its ends fixed. It vibrates in a standing wave patten with four antinodes. Frequency of the vibraion is :-

A. 75 Hz

B. 150 Hz

C. 100 Hz

D. 50 Hz

Answer: C

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15. A wave is given by the equation

$y = 10 \sin 2\pi (100t - 0.02x) + 10 \sin 2\pi (100t + 0.02x)$

Find the loop length , frequency , velocity and maximum amplitude of the stationary wave produced.

A. 20 units and 30 units

B. 20 units and 25 units

C. 30 units and 20 units

D. 25 units and 20 units

Answer: B

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16. In case of closed organ pipe, which harmonin the p^{th} overtone will be

A. $2p+1$

B. $2p-1$

C. $p+1$

D. $p-1$

Answer: A

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17. An organ pipe of length L is open at one end and closed at other end. The wavelengths of the three lowest resonating frequencies that can be produced by this pipe are

A. 4L, 2L, L

B. 2L, L, L/2

C. 2L, L, 2L/3

D. 4L, 4L/3, 4L/5

Answer: D

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18. The first resonance length of a resonance tube is $40cm$ and the second resonance length is $122cm$. The third resonance length of the tube will be

A. 200 cm

B. 202 cm

C. 203 cm

D. 204 cm

Answer: D

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19. A man sitting in a moving train hears the whistle of the engine. The frequency of the whistle is 600 Hz

A. The apparent frequency as heard by him is smaller than 600 Hz

B. The apparent frequency is larger than 600 Hz

C. The frequency as heard by him is 600 Hz

D. none of the above

Answer: C

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20. A whistle of frequency 500 Hz tied to the end of a string of length 1.2 m revolves at 400 rev / min . A listener standing some distance away in the plane of rotation of whistle hears frequencies in the range (speed of sound = 340 m / s)

A. 436 to 586

B. 426 to 574

C. 426 to 584

D. 436 to 674

Answer: A

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21. A train moves towards a stationary observer with speed 34 m/s. The train sounds a whistle and its frequency registered by the observer is f_1. If the speed of train is reduced to 17 m/s, the frequency registered is f_2. If speed fo sound is 340 m/s, then the ratio f_1 / f_2 is :

A. 18/19

B. $1/2$

C. 2

D. 19/18

Answer: D

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22. If source and observer both are relatively at rest and if speed of sound is increased then frequency heard by observer will

A. Increases

B. Decreases

C. Can not be predicted

D. Will not change

Answer: D

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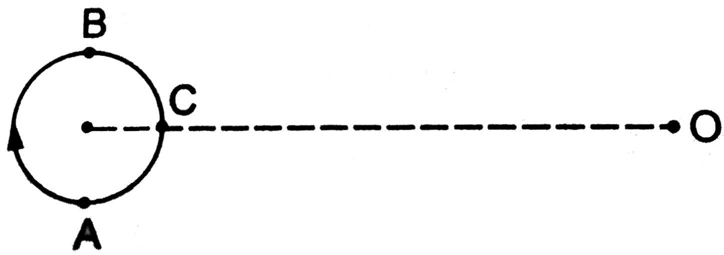
23. A small source of sound moves on a circle as shown in figure and an observer is sitting at O. Let v_1, v_2, v_3 be the frequencies heard when the source is at A,B and C respectively.



A. $n_1 > n_2 > n_3$

B. $n_2 > n_3 > n_1$

C. $n_1 = n_2 > n_3$

D. $n_2 > n_1 > n_3$

Answer: B

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24. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency?

A. 5%

B. 20%

C. zero

D. 0.5%

Answer: B

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25. The length of a sonometer wire is 1.25m and density $8 \times 10^3 kg/m^3$. It can bear a stress of $3.2 \times 10^8 N/m^2$ without exceeding the elastic limit. The fundamental frequency that can be produced in the wire, is :-

A. 100 Hz

B. 80 Hz

C. 200 Hz

D. 250 Hz

Answer: B

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