PHYSICS

BOOKS - AAKASH SERIES

APPENDICES (REVISION EXERCISE)

UNIT AND MEASUREMENT

1. The power of a motor is 200W. If the unit of length is halved, that of mass is doubled and that of time is aiso doubled, then the power of the motor in the new system is

A. 3200 w

B. 3200 new units

C. 12.5 new units

D. 12.5 W

Answer: B

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2. In CGS system the magnitude of the force is 100 dynes. In another system where the fundamental phyical quamtities are kilogram , meter , and minute, find the magnitude of the force.

A. 0.036

B. 0.36

C. 3.6

D. 36

Answer: C

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3. If the unit of force is 2N, that of length is 4m and that of velocity is $6ms^{-1}$, the unit of mass is

A. $\frac{2}{9}Kg$

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

C. $\frac{9}{2}kg$

D. $\frac{2}{5}kg$

Answer: A

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4. If the unit of mass is α kg, the unit of length is β metre and the unit of time is "γ' second, The magnitude of calorie in the new system is (1 Cal = 4.23)

A. $4.2\alpha^2\beta^2\gamma^{-2}$ new units

B. $4.2\alpha^{-1}\beta^{-2}\gamma^{-2}$ new units

C. $\alpha^{-1}\beta^{-2}\gamma^{-2}$ new units

D. $\frac{1}{4.2}\alpha^{-1}\beta^{-2}\gamma^{-2}$ new units

Answer: B

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5. If the mass of the electron $(9 \times 10^{-31}$ kg) is taken as unit of mass, the radius of the first Bohr orbit $(0.5 \times 10^{-10}$m) as unit of length and 500 newton as the unit of force, then the unit of time in the new system would be

A. $3 \times 10^{-22} s$

B. $15 \times 10^{-12} g$

C. $15 \times 10^{-20} s$

D. $45 \times 10^{-20} s$

Answer: A

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6. If a gas absorbs $200J$ of heat and expands by $500cm^3$ against a constant pressure of $2 \times 10^5 Nm^{-2}$, then the change in internal energy is

A. $1400Wm^2$

B. $8.4Wm^{-2}$

C. $140Wm^{-2}$

D. $4.2Wm^{-2}$

Answer: A

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7. Convert $1MW$ power on a new system having basic units of mass , length , and time as $10kg, 1dm,$ and 1 min , respectively .

A. 2.16×10^{10} units

B. 2×10^{4} unit

C. 2.16×10^{12} unit

D. 1.26×10^{12} unit

Answer: C

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8. If pressure P, velocity of light C and acceleration due to gravity g are chosen as fundamental units, then dimensional formula of mass is

A. pc^3g^{-4}

B. $pc^{-4}g^3$

C. pc^4g^{-3}

D. pc^4g^3

Answer: C

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9. 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 the radius the earth R, is:

A. dimensions 3 in c

B. dimensions 4 in g

C. dimensions 2 in d

D. dimensions 6 in c

Answer: D

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10. If young's modulus y, surface tension s and time T are the fundamental quantities then the dimensional formula of density is

A. $s^2 s^3 t^{-2}$

B. $s^3 y^3 T^{-2}$

C. $s^{-2} y^3 T^2$

D. $s^{-2} y^2 T^{3-}$

Answer: C

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11. Dimcnsional analysis of the relation (Energy) = $(\text{Pressure difference})^{3/2}(\text{Volume})^{3/2}$ gives the value of n as

A. 3

B. 2

C. $3/2$

D. $1/2$

Answer: C

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12. If P represents radiation pressure, C speed of light, and Q radiation energy striking unit area per second and x,y,z are non zero integers, then P^x Q^y C^z is dimensionless. The values of X,y and z are respectively

A. 1,1-1

B. 1,-1,1

C. $-1, 1, 1$

D. $1, 1, 1$

Answer: B

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13. The speed v of ripples on the surface of water depends on surface tension σ, density ρ and wavelength λ. The square of speed v is proportional to

A. $\left(\frac{\sigma}{\rho\lambda}\right)^{1/2}$

B. $\left(\frac{\rho}{\sigma\lambda}\right)^{1/2}$

C. $\left(\frac{\lambda}{\sigma\rho}\right)^{1/2}$

D. $(\rho g\sigma)^{1/2}$

Answer: A

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14. Assuming that the mass m of of the largest stone that can be moved by a flowing river depends upon the velocity v of the water, its density p and the acceleration due to gravity g.Then m is directly proportional to

A. $m \propto v^6$

B. $m \propto \sqrt{v}$

C. $m \propto g$

D. $m \propto \frac{1}{d^2}$

Answer: A

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15. If the time period $(T)$of vibration of a liquid drop depends on surface tension (S) , radius(r) of the drop , and density (ρ) of the liquid , then find the expression of T.

A. $T = K\frac{\sqrt{\rho r^3}}{S}$

B. $T = K\frac{\sqrt{\rho^{1/2} r^3}}{S}$

C. $T = K\frac{\sqrt{\rho r^3}}{S^{1/2}}$

D. $T = K\sqrt{\frac{\rho^{1/2} r^3}{S}}$

Answer: C

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16. Time (T), velocity (C) and angular momentum (h) are chosen as fundamental quantities instead of mass, length and time. In terms of these, the dimensions of mass would be:

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

B. $[M] = \left[T^{1}Ch^{-1}\right]$

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

D. $[M] = \left[TC^{-2}h\right]$

Answer: C

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17. Given that

$$\int \frac{dx}{\sqrt{2ax - x^2}} = a^n \sin^{-1}\left[\frac{x-a}{a}\right]$$

where, a = constant. Using dimensional analysis, the value of n is

A. 1

B. 0

C. -1

D. none of these

Answer: B

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18. Suppose, the torque acting on a body, is given by $\tau = KL + \frac{MI}{\omega}$ where L = angular momentum, I = moment of inertia & ω = angular speed. What is the dimensional formula for KM?

A. time^2

B. time^4

C. time^{-2}

D. time^{-4}

Answer: D

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19. A force F is given by $F = at + bt^2$, where t is time. The dimensions of a and b are

A. MLT^{-3} and ML^2T^4

B. MLT^{-3} and MLT^{4}

C. MLT^{-1} and MLT^{0}

D. MLT^{-4} and MLT^{-1}

Answer: B

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20. The number of particles crossing a unit area perpendicular to the $x - a\xi s$ in a unit time is given by $n = -D\left(\frac{n_2 - n_1}{x_2 - x_1}\right)$, where n_1 and n_2 are the number of particles per unit volume at $x = x_1$ and x_2 , respectively , and D is the diffusion constant. The dimensions of D are

A. M^0LT^3

B. $M^0L^2T^{-4}$

C. M^0LT^{-2}

D. ML^2T^{-1}

Answer: D

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21. Turpentine oil is flowing through a tube of length L and radius r. The pressure difference between the two ends of the tube is p , the viscosity of the coil is given by $\eta = \frac{p\left(r^2 - x^2\right)}{4vL}$, where v is the velocity of oil at a distance x from the axis of the tube. From this relation, the dimensions of viscosity η are

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

B. $\left[MLT^{-1}\right]$

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

D. $\left[M^0L^0T^0\right]$

Answer: A

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22. If n is the rigidity modulus, r is the radius , l is the length and C is the moment of the couple, then $\frac{2lc}{\pi n r^4}$ has the dimensions of

A. Angle

B. Mass

C. Length

D. Frequency

Answer: A

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23. If the depression d at the end of a loaded bar is given by $d = \frac{Mgl^3}{3yi}$ where M is the mass , l is the length and y is the young's modulus, then i has the dimensional formula

A. L^2

B. L^3T

C. ML^3

D. L^4

Answer: D

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24. Dimensional formula of the product of the two physical quantities P and Q is ML^2T^{-2}, the dimesional formula of P/Q is MT^{-2}. P and Q respectively are

A. Force, velocity

B. Momemtum , displacement

C. Force ,displacement

D. Work, velocity

Answer: C

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25. The potential energy of a particle varies with distance x from a fixed origin as $V = \frac{A\sqrt{X}}{X+B}$ where A and B are constants . The dimension of AB are

A. $M^{1}L^{5/2}T^{-2}$

B. $M^{1}L^{2}T^{-2}$

C. $M^{3/2}L^{5/2}T^{-2}$

D. $M^{1}L^{7/2}T^{-2}$

Answer: D

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26. A copper rod of mass m rests on two horizontal rails distance L apart and carries a current of I from one rail to the other. The coefficient of static friction between rod and rails is μ_s What are the (a) magnitude and (b) angle (relative to the vertical) of the smallest magnetic field that puts the rod on the verge of sliding?

A. C is dimensionless constant

B. B has dimensions of -1 in length

C. the dimensional formula of A is $ML^{-2}T^{-1}$

D. all the above are true.

Answer: D

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27. In the equation $\left(\frac{1}{p\beta}\right) = \frac{y}{k_B T}$, where p is the pressure, y is the distance, k_B is Boltzmann constant and T is the tempreture. Dimensions of β are

A. $M^{-1}L^{1}T^{2}$

B. $M^{0}L^{2}T^{0}$

C. $M^{1}l^{-1}T^{-2}$

D. $M^0 L^0 T^0$

Answer: C

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28. If the displacement y of a particle is y = A sin (pt + qx), then

A. L

B. LT^{-1}

C. T^{-1}

D. $L^{-1}T^{-1}$

Answer: C

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29. The thrust developed by a rocket-motor is given by $F = mv + A(P_1 - P_2)$ where m is the mass of the gas ejected per unit time, v is velocity of the gas, A is area of cross-section of the nozzle, P_1 and P_2 are the pressures of the exhaust gas and surrounding atmosphere.

The formula is dimensionally

A. Correct

B. Wrong

C. Some time wrong, sometimes correct

D. Data is not adequate

Answer: A

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30. If the time period t of the oscillation of a drop of liquid of density d, radius r, vibrating under surface tension s is given by the formula $t = \sqrt{r^{2b} s^c d^{a/2}}$. It is observed that the time period is directly proportional to $\sqrt{\frac{d}{s}}$. The value of b should therefore be :

A. $3/4$

B. $\sqrt{3}$

C. $3/2$

D. $2/3$

Answer: C

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31. If M is the magnetic moment, B is the magnetic induction and T is the time then MBT^2 has the dimensions of

A. Intensity of magnetization

B. Intensity of magnetic field

C. Moment of Inertia

D. Magnetic permeability

Answer: C

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32. A quantity X is given by $\varepsilon_0 L \frac{\Delta V}{\Delta T}$ where ε_0 is the permittivity of the free space, L is a length ΔV is a potential difference nad Δt is a time interval. The dimensional formula for X is the same as that of

A. resistance

B. charge

C. voltage

D. current

Answer: D

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33. In the relation: $P=\frac{\alpha}{\beta}e^{-\frac{\alpha Z}{k\theta}}, P$ is pressure Z is distance k is Boltzmann constant and θ is the temperature. The dimensional formula of β will be

A. $M^0L^0T^0$

B. $M^{-1}L^{-1}T^{-1}$

C. $M^0L^2T^0$

D. $M^{-1}L^1T^2$

Answer: C

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34. The length of a pendulum is measured as 1.01m and time for 30 oscillations is measured as one minute 3 seconds . Error in length is

0.01m and error in time is 3 secs. The percentage error in the measurement of acceleration due to gravity is

A. 1

B. 5

C. 10

D. 15

Answer: C

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35. The length of a rectangular plate is measured as 10 cm by a vernier scale of least count 0.01 cm and its breadth as 5 cm by the same scale. The percentage error in area is

A. 0.1%

B. 0.3%

C. 0.01%

D. 0.05%

Answer: B

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36. The length of a metallic sheet is measured as 10.0 cm using a metre scale of L.C. 0.1cm and its breadth is, measured as 1.00 cm using a vernier callipers of L.C. 0.01 cm, the error in area is

A. $\pm 0.01 cm^2$

B. $\pm 0.1 cm^2$

C. $\pm 0.11 cm^2$

D. $\pm 0.2 cm^2$

Answer: D

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37. The initial and final temperatures are recorded by using a thermometer as $(30.4 \pm 0.2)^{0}C$ and $(50.6 \pm 0.3)^{0}C$. The rise in temperature is

A. $20.2^{0}C$

B. $(20.2 \pm 0.1)^{0}C$

C. $(20.2 \pm 0.5)^{0}C$

D. $(20.2 \pm 0.3)^0 C$

Answer: C

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38. The mass of a beaker is (10.1 ± 0.1)g when empty and (17.3 ± 0.1)g when filled with a liquid. The mass of the liquid with possible limits of accuracy is

A. $(7.2 \pm 0.2)g$

B. $(7.2 \pm 0.1)g$

C. $(7.2 \pm 0.2)g$

D. $(7.2 \pm 0.3)g$

Answer: A

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39. Force and area are measured as 20N and $5m^2$ with errors 0.05 N and $0.0125m^2$. The maximum error in pressure is (SI units)

A. 4 ± 0.0625

B. 4 ± 0.05

C. 4 ± 0.125

D. 4 ± 0.02

Answer: D

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40. The measured mass the volume of a body are 2.42 and 4.7 cm^3 respectively with possible errors 0.01 g , and 0.1 cc. The find the maximum error in density.

A. 0.2%

B. 2%

C. 5%

D. 21.7%

Answer: D

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41. Using a screw gauge the diameter of a wire is found to be, 1.51 mm, 1.53mm, 1.48 mm, 1.49 mm, I.51mm, 1.54 mm. The true value of the diameter of the wire is (in mm)

A. 1.49

B. 1.52

C. 1.51

D. 0.151

Answer: C

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42. The length of a cylinder is measured with a meter rod having least count $0.1cm$. Its diameter is measured with Vernier calipers having least count $0.01cm$. Given that length is $5.0cm$ and radius is $2cm$. Find the percentage error in the calculated value of the volume.

A. 4%

B. 3%

C. 2%

D. 1%

Answer: B

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43. Two resistors of $10K\Omega$ and $20K\Omega$ are connected in series. If tolerance of each resistor is 10% then tolerance of the combination will be

A. 5%

B. $10\ \%$

C. $15\ \%$

D. $20\ \%$

Answer: B

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44. A student performs experiment with a simple pendulum and measure time period for 20 vibrations. If he measures time for 100 vibrations the error in the measurement of time period will be reduced by a factor of

A. 10

B. 20

C. 5

D. 80

Answer: C

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45. A physicist performs an experiment and takes 200 readings. He repeats the same experiment and now takes 800 readings. By doing so the probable error

A. remains the same

B. is four times

C. is halved

D. is reduced by a factor of 1/4

Answer: D

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46. In measuring 'g' using a simple pendulum a student makes a positive error of 1% in length of pendulum and a negative error of 3% in the value of time period. Percentage error in measurement of value of g is

A. 2%

B. 4%

C. 7%

D. 10%

Answer: C

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47. The resistance R of a wire is found by determining its length l and radius r. The percentage errors in measurement of l and r are respectively 1% and 2%. The percentage error in measurement of R is

A. 4%

B. 5%

C. $3\ \%$

D. $1, 5\ \%$

Answer: B

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48. In the measurement of a physical quantity (L), the formula used is $L = k(m \times n)$, where k is a constant and m and n are the quantities to be measured. If the % errors in m and n are respectively 3% and 5%. The % error in the measurement of L is

A. 2%

B. 5%

C. 8%

D. 3%

Answer: C

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49. In the measurement of volume of solid sphere using the formula $V = \frac{4}{3}\pi r^3$ if the error committed in the measurement of the radius r is 1.5%, the percentage error in the volume measurement is

A. $3\ \%$

B. $1.5\ \%$

C. $4.5\ \%$

D. $0.75\ \%$

Answer: C

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50. The diameter of a wire is measured as 0.25 cm using a screw gauge of least count 0.005 cm. The percentage error is

A. 1%

B. 2.5%

C. 5%

D. 2%

Answer: D

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51. The external and internal diameters of a hollow cylinder are determined with vernier callipers and the results are recorded as 4.23 ± 0.01 cm and 3.89 ± 0.01 cm. The thickness of the cylinder wall within the limits of error is

A. $0.34 \pm 0.01cm$

B. $0.34 \pm 0.02cm$

C. $0.34 \pm 0.04cm$

D. $0.17 \pm 0.01 cm$

Answer: D

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52. In an experiment the valno of refractive index of glass was found to be 1.54, 1.53, 1.44,1.54, 1.56 and 1.45 m in successive measurement. Calculate (i) the mean vlaue of refractive index (ii) absolute error of each measurement (iii) mean absolute error (iv) relative error and (v) percentage error.

A. $0.04, 4\%$

B. $0.03, 3\%$

C. $0.02, 2\%$

D. $0.01, 1\%$

Answer: B

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53. A physical quantity is represented by $X = M^a L^b T^{-c}$.If the percentage error in the measurement of M,L and T are $\alpha\,\%$, $\beta\,\%$ and $\gamma\,\%$ to respectively, what is the total percentage error in X?

A. $(a\alpha + b\beta - c\gamma)\ \%$

B. $(2a\alpha + b\beta_3 c\gamma)\ \%$

C. $(a\alpha - b\beta + c\gamma)\ \%$

D. $(a\alpha - b\beta - c\gamma)\ \%$

Answer: B

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54. A physical quantity Q is related to measurable quantities L,M and N as $Q=KL^{-2}M^{2}N^{3}$, where k is constant. If the % errors in the measurements of L, M and N are respectively 1%, 2% and 1%, then the % error in hc mcasurement of Q is

A. $9\ \%$

B. $4\ \%$

C. $2\ \%$

D. 1%

Answer: A

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55. The percentage errors in quantities P, Q, R and S are 0.5%, 1%, 3% and 1.5% respectively in the measurement of a physical quantity $A = \frac{P^3Q^2}{\sqrt{R}S}$.

The maximum percentage error in the value of A will be :

A. $6.0\ \%$

B. $7.5\ \%$

C. $8.5\ \%$

D. $6.5\ \%$

Answer: D

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56. In a simple pendulum experiment, length is measured as 31.4 cm with an accuracy of Imm. The time for 100 oscillations of pendulum is

112.0s with an accuracy of 0.1s. The percentage accuracy in g is

A. 1

B. 2

C. 1.3

D. 2.3

Answer: D

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57. One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). IF the size of the hydrogent molecule is about 1A. What is the ratio of molar volume to the atomic volume of a mole of hydrogen?

A. 10^4

B. 10^2

C. 10^3

D. 10^{-4}

Answer: A

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58. In an experiment the valno of refractive index of glass was found to be 1.54, 1.53, 1.44,1.54, 1.56 and 1.45 m in successive measurement. Calculate (i) the mean vlaue of refractive index (ii) absolute error of each measurement (iii) mean absolute error (iv) relative error and (v) percentage error.

A. 1.51, 0.04, 0.03,3%

B. 1.51, 0.4, 0.03, 3%

C. 15.1, 0.04,0.03,3%

D. 15.1, 0.04, 0.3,3%

Answer: A

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59. In an experiment to determine the value of acceleration due to gravity g using a simple pendulum , the measured value of lenth of the pendulum is 31.4 cm known to 1 mm accuracy and the time period for 100 oscillations of pendulum is 112.0 s known to 0.01 s accuracy . find the accuracy in determining the value of g.

A. $(25.03 \pm 0.58) cms^{-2}$

B. $(25 \pm 0.58) cms^{-2}$

C. $(25.3 + 0.1) cms^{-2}$

D. $(25.5 + 0.3) cms^{-2}$

Answer: A

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60. A rectangular metal slab of mass 33.333 g has its length 8.0 cm, breadth 5.0 cm and thickness 1mm. The mass is measured with accuracy up to 1 mg with a senstitive balance. The length and breadth are measured with a vernier calipers having a least count of 0.01 cm. The thickness is measured with a screwgauge of least count 0.01 mm. Calculate the percentage accuracy in density from above measurements.

A. 13%

B. 130%

C. 1.3%

D. 16%

Answer: C

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61. The initial and final temperatures are recorded as $(40.6 \pm 0.3)^\circ C$and $(50.7 \pm 0.2)^\circ C$. The rise in temperature is

A. $10.1^{\circ} C$

B. $(10.1 \pm 0.3)^{0} C$

C. $(10.1 \pm 0.5)^{\circ} C$

D. $(10.1 \pm 0.1)^{\circ} C$

Answer: C

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62. An electric kettle has two coils. When one of these is switched on, thje water in the kettle boils in 6 minutes. When the other coil is switched on, the water boils in 3 minutes. If the two coils are connected in series, the time taken to boil the water in the kettle is

A. 1 day

B. 1 sec

C. 10^{11} sec

D. 1 year

Answer: B

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63. The displacement covered by a body in time $(5.0 \pm 0.6) sis (40.0 \pm 0.4) m$. Calculate the speed of the body . Also determine the percentage error in the speed.

A. $13\ \%$

B. $10\ \%$

C. $5\ \%$

D. $3\ \%$

Answer: A

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64. The measured mass and volume of a body are 53.63 g and $5.8 cm^3$ respectively, with possible errors of 0.01 g and 0.1 cm^3. The maximum percentage error in density is about

A. $0.2\ \%$

B. $2\ \%$

C. $5\ \%$

D. $10\ \%$

Answer: B

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65. A student performs an experiment for determination of $g = \frac{4\pi^2 l}{T^2} l \approx 1m$ and the commits an error of "Deltal' For T he takes the time of n osciilations with the stop watch of least count Δt For which of the following data the measurement of g will be most accurate ?

(a) $\Delta L = 0.5 \Delta L = 0.1, n = 20$

(B) $\Delta L = 0.5 \Delta t = 0.1, n = 50$

(C) $\Delta L = 0.5, \Delta t = 0.02 n = 20$ (D) $\Delta L = 0.1 \Delta t = 0.05 n = 50$.

A. $\Delta L = 0.5, \Delta T = 0.1, n = 20$

B. $\Delta L = 0.5, \Delta T = 0.1, n = 50$

C. $\Delta L = 0.5, \Delta T = 0.01, n = 20$

D. $\Delta L = 0.5, \Delta T = 0.05, n = 20$

Answer: D

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66. An experiment is performed to obtain the value of acceleration due to gravity g by using a simple pendulum of length L. In this experiment time for 100 oscillations is measured by using a watch of 1 second least count and the value is 90.0 seconds. The length L is measured by using a meter scale of least count 1 mm and the value is 20.0 cm. The error in the determination of g would be:

A. $1.7\,\%$

B. $4.4\,\%$

C. $2.7\,\%$

D. $2.27\,\%$

Answer: A

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67. A student measured the diameter of a wire using a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is -

A. 5.320 cm

B. 5.3 cm

C. 5.32 cm

D. 5.3200 cm

Answer: A

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68. The radius of a sphere is 6.01 cm. Its volume to four significant figures is

A. $909.7cm^3$

B. $909cm^3$

C. $916cm^3$

D. $909.67cm^3$

Answer: B

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69. The volume of a sphere is $1.76 cm^3$. The total volume of 24 such spheres with due regard to the significant places is

A. $0.42 \times 10^2 cm^3$

B. $43 cm^3$

C. $42.42 cm^3$

D. $42.2 cm^3$

Answer: D

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70. The length of a rod is 22.4 m out of it 2.543m is cut out. The remaining length of the rod according to the idea of significant figures is

A. $19.8m$

B. $19.9m$

C. $20.0m$

D. $19.86m$

Answer: D

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71. Three pieces of silver have masses 2.3 kg, 41.15g and 30.19g. The total mass of correct significant figures is

A. $2.37032kg$

B. $2.370kg$

C. $2.37kg$

D. $2.4kg$

Answer: C

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72. The value of 117.4×0.0025 is

A. 0.2935

B. 0.294

C. 0.3

D. 0.29

Answer: C

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73. The sum of the given two numbers with regard to significant figures is $(5.0 \times 10^{-8}) + (4.5 \times 10^{-6})$ =

A. 4.55×10^{-6}

B. 4.5×10^{-6}

C. 4.6×10^{-6}

D. 4×10^{-6}

Answer: C

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74. The value of $\frac{\pi}{53.2}$ with due regard to significant figures is

A. 0.059

B. 0.05906

C. 0.0591

D. 0.06

Answer: B

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75. Find the product of 1.2, 2.54 and 3.257 with due regard to significant figures.

A. 9.934

B. 9.93

C. 9.9

D. $9, .9346$

Answer: B

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76. The mass of a body is measured as $2.00 \times 10^3 Kg$. Its significant figures is

A. 6

B. 3

C. 1

D. 2

Answer: D

Watch Video Solution

77. Two rods with lengths 12.321cm and 10.3 cm and placed side by side. The difference in their lengths is

A. $2.02cm$

B. $2.0cm$

C. $2cm$

D. $2.025cm$

Answer: B

Watch Video Solution

78. The length of a rectangular sheet is $1.5cm$ and breadth is $1.023cm$. Find the area of the face of a rectangular sheet to the correct number of significant figures.

A. $1.8045cm^2$

B. $1.804cm^2$

C. $1.805cm^2$

D. $1.8cm^2$

Answer: D

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79. The dimensions of a wooden block are $1.1m \times 2.36mx3.1m.$ The number of significant figures in its volume should be

A. 1

B. 2

C. 3

D. 4

Answer: C

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80. Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then error in the value of resistance of the wire is

A. Zero

B. 1%

C. 3%

D. 6%

Answer: A

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81. A student measures the thickness of a human hair by looking at it through a microscope of magnification 100. He makes 20 observations and finds that the average width of the hair in the field of view of the microscope is 3.5mm. What is the estimate on the thickness of hair?

A. 0.5 cm

B. 0.035 cm

C. $0.035 cm$

D. $3.5cm$

Answer: C

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82. Which of the following is the most precise device for measuring length

(i) a vernier calipers with 20 divisions on the sliding scale (ii) a screw gauge of pitch Imm and 100 divisions on the circular scale (iii) an optical instrument that can measure length to within a wavelength of light?

A. Vernier calipers

B. Screw guage

C. Optical instrument

D. All the above

Answer: C

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83. Which of the following sets cannot enter into the list of fundamental quantities in any system of units ?

A. length, mass and velocity

B. pressure, density and velocity

C. force, velocity and time

D. force, momentum and length

Answer: B

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84. A physical quantity P is described by the relation $P=a^{(1/2)}b^{(2)}c^{(3)}d^{(-4)}$. If the relative errors in the measurements a, b, c and d respectively, are 2%, 1%, 3%, and 5%, then the relative error in P will be :

A. 25%

B. 12%

C. 8%

D. 32%

Answer: D

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MOTION IN A STRAIGHT LINE

1. A particle transversed half of the distance with a velocity of V0. The remaining parts of the distance was covered with velocity V_l, for half of the time and with V2 for other half of the time. Find the mean velocity of the particle averaged and the whole time of motion.

A. $\dfrac{2v_0(v_1+v_2)}{v_1+v_2+2v_0}$

B. $\dfrac{v_0(v_1+v_2)+2v_1v_2}{2(v_1+v_2)}$

C. $\dfrac{v_1+v_2}{2}$

D. $\dfrac{v_0+2v_1v_2}{2v_1+v_2}$

Answer: B

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2. An express train moving at 30 m/s reduces its speed to 10 m/s in a distance of 240 m. If the breaking force is increased by 12.5% in the beginning find the distance that it travels before coming to rest

A. 270 m

B. 240 m

C. 210 m

D. 195 m

Answer: B

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3. A driver having a definite reaction time is capable of stopping his car over a distance of 30 m on seeing a red traffic signal, when the speed of the car is 72 km/hr andover a distance of 10 m when the speed is 36 km/hr. Find the distance over which he can stop the car if it were running at a speed of 54 km/hr. Assume that his reaction time and the deceleration of the car remains same in all the three cases.

A. 50 m

B. 8 m

C. 12 m

D. 42 m

Answer: B

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4. A body is moving along the +ve X-axis with uniform acceleration of $-4ms^2$ Its velocity at x = 0 is $10ms^{-1}$. The time taken by the body to reach a point at x = 12m is

A. (25, 3s)

B. (38, 4s)

C. (48,8s)

D. (1s, 28)

Answer: A

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5. Two cars 1 & 2 strating from rest are moving with speeds V_1 and $V_2 m/s (V_1 > V_2)$. Car 2 is ahead of car '1' by 'S' meters when the driver of car '1' sees car '2' . What minimum retardation should be given to car '1' avoid collision.

A. $\frac{V_1 - V_2}{S}$

B. $\frac{V_1 + V_2}{S}$

C. $\frac{(V_1 + V_2)^2}{2S}$

D. $\frac{(V_1 - V_2)^2}{2S}$

Answer: D

Watch Video Solution

6. A body starts with initial velocity u and moves with uniform accelelration . When the velocity has increased to 5u, the acceleration is reversed in direction, the magnitude remaining constant. Find its velocity when it returns to the strating point?

A. $-7u$

B. $-5u$

C. $-2u$

D. $2u$

Answer: A

Watch Video Solution

7. The position x of a particle varies with time t, as $x = at^2 - bt^3$. The acceleration of the particle will be zero at time t equals to

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

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

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

D. Zero

Answer: C

Watch Video Solution

8. The acceleration a in ms^{-2} of a particle is given by $a = 3t^2 + 2t + 2$, where t is the time. If the particle starts out with a velocity $v = 2ms^{-1}$ at $t = 0$, then find the velocity at the end of $2s$.

A. $12m/s$

B. $18m/s$

C. $27m/s$

D. $36m/s$

Answer: B

Watch Video Solution

9. The relation $3t = \sqrt{3x} + 6$ describe the displacement of a particle in one direction where x is in metres and t in sec.

The displacement, when velocity is zero is

A. 24 metres

B. 12 metres

C. 5 metres

D. Zero

Answer: B

Watch Video Solution

10. The displacement of a particle is given by x = $(t-2)^2$ where x is in metres and t in seconds. The distance covered by the particle in first 4 seconds is

A. 4 m

B. 8 m

C. 12 m

D. 16 m

Answer: B

Watch Video Solution

11. The velocity-time relation of an electron starting from rest is given by u = kt, where $k = 2m / s^2$. The distance traversed in 3 sec is:

A. 9m

B. 16 m

C. 27 m

D. 36 m

Answer: A

Watch Video Solution

12. The acceleration of a particle is increasing linerly with time t as bt. The particle starts from the origin with an initial velocity v_0. The distance travelled by the particle in time t will be

A. $v_0 t + \frac{1}{3} b t^2$

B. $v_0 t + \frac{1}{2} b t^2$

C. $v_0 t + \frac{1}{6} b t^3$

D. $v_0 t + \frac{1}{3} b t^3$

Answer: C

Watch Video Solution

13. A car accelerates from rest at a constant rate 'alpha' for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t, the maximum velocity acquired by the car is given by :

A. $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)t$

B. $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)t$

C. $\frac{\alpha\beta t}{\alpha+\beta}$

D. $\dfrac{(\alpha + \beta)t}{\alpha\beta}$

Answer: C

Watch Video Solution

14. On a two-lane road, car A is travelling with a speed of $36 kmh^{-1}$. Two cars B and C approach car A in opposite directions with a speed of $54 kmh^{-1}$ each. At a certain instant, when the distance AB is equal to AC, both being 1 km, B decides to overtake A before C does. The minimum required acceleration of car B to avoid an accident is

A. $1m/s^2$

B. $2m/s^2$

C. $3m/s^2$

D. $4m/s^2$

Answer: A

Watch Video Solution

15. Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T minutes. A man ccling with a speed of $20kmh^{-}$ in the direction A to B notices that a bus goes past him every 18 min in the direction of his motion, and every 6 min in the oppsite direction. What is the period T of the bus service and with what speed (assi,ed cpmstant) do the buses ply on the rod?

A. 9 min, 40 Kmph

B. 12 min, 10 Kmph

C. 12 min, 40 Kmph

D. 9 min, 60 Kmph

Answer: A

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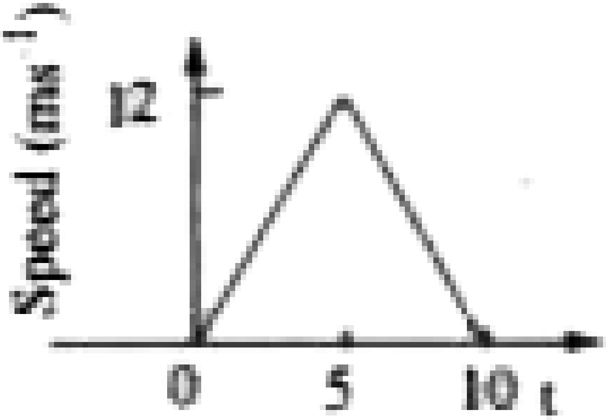
16. The speed-time graph of a particle moving along a fixed direction is shown in Fig. Then which of the following is wrong?



A. A) distance travelled by the particle in 10

sec is 60 m.

B. B) average speed in 10 sec is 6 m/s.

C. c) average speed between t=2, t=6 sec is

9m/s

D. D) average speed between t=2, t=6 sec is 6 m/s

Answer: D

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17. Two cars start in a race with velocities u_1 and u_2 and travel in a straight line with acceleration 'a' and b .If both reach the finish line at the same time,the range of the race is

A. $\dfrac{2(u_1 - u_2)}{(\beta - \alpha)^2}(u_1\beta - u_2\alpha)$

B. $\dfrac{2(u_1 - u_2)}{\beta + \alpha}(u_1\alpha - u_2\beta)$

C. $\dfrac{2(u_1 - u_2)^2}{(\beta - \alpha)^2}$

D. $\dfrac{2u_1u_2}{\beta\alpha}$

Answer: A

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18. STATEMENT-1 : For solution of volatile liquids, the partial vapour pressure of each component in the solution is directly proportional to its mole fraction.

STATEMENT-2 : Always there will be lowering of vapour pressure on addition of non-volatile solute to a solvent.

STATEMENT-3 : If there is dissociation of non-volatile then the V.P. of solution increases.

A. $1/2$

B. $3/4$

C. $5/3$

D. $5/8$

Answer: B

Watch Video Solution

19. The displacement x of a particle varies with time according to the relation $x = \frac{a}{b}\alpha - e^{-bt}\big)$ Then :

A. At $t = 1/b$ the displacment of the particle in nearly (1/3)(a/b)

B. The velocity and acceleration of the particle at t = 0 and a and -ab respectively

C. Both 1 and 2

D. At t = 1/b , the displacement of the particle is (3/5) (a/b)

Answer: B

Watch Video Solution

20. The acceleration (a) of a particle depends on displacement (s) as $a = 5 + s$. Initially

$s = 0, v = 5$, then velocity v corresponding to the displacement is given by

A. A) $v = 5 + s$

B. B) $v = \sqrt{5 + s}$

C. C) $v = \sqrt{s^2 + 10s}$

D. D) $v = s - 5$

Answer: A

Watch Video Solution

21. A train takes t sec to perform a journey , if travel for t/n sec with uniform acceleration then for $\left(\frac{n-3}{n}\right)t$ sec with uniform speed v and finally it comes to rest with uniform retardation. Then average speed of train is

A. $(3n-2)\frac{v}{2n}$

B. $(2n-3)\frac{v}{2n}$

C. $(3n-2)\frac{v}{3n}$

D. $(2n-3)\frac{v}{3n}$

Answer: B

Watch Video Solution

22. On fogy day two drivers spot in front of each other when 80 m apart, they were travelling 70 kmph and 60 kmph. Both apply brakes simultaneously which retards the car at the rate of $5m/s^2$. Which of the following statement is correct?

A. The collision will be averted

B. The collision will takes place

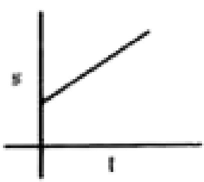
C. They will cross each other

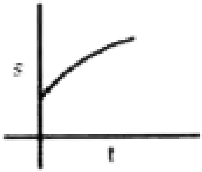
D. They will just collide

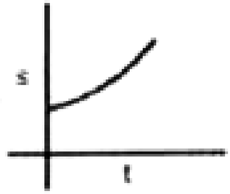
Answer: A

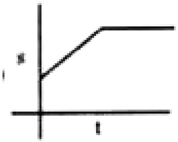
Watch Video Solution

23. A particle moving along straight line has velocity $v = \mu s$ where s is in the displacement . If $s = s_0$ then which of the following graph best represent s versus t

A. 

B. 

C. 

D. 

Answer: C

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24. A bird is tossing (flying to and fro) between two cars moving towards each other on a straight road . One car has speed of $27 kmh^{-1}$ while the other has the speed of $18 kmh^{-1}$. The bird starts moving from the first car towards the other and is moving with the speed of $36 kmh^{-1}$ when the two cars were separated by $36 km$. The total distance covered by the bird is

A. $28.8 km$

B. $38.8 km$

C. $48.8km$

D. $58.8km$

Answer: A

Watch Video Solution

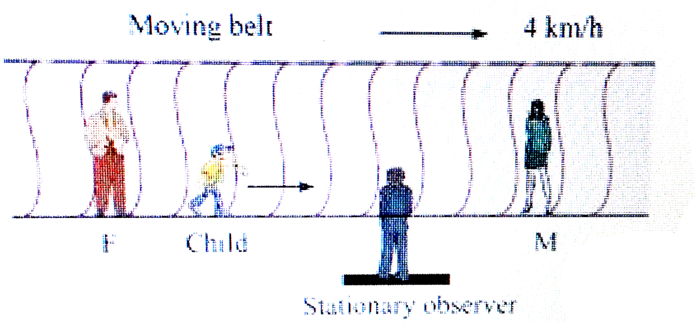
25. On a long horizontally moving belt (Fig.3.26), a child runs to and fro with a speed $9kmh^{-1}$ (with respect to the belt) between his father and mother located 50 m apart on the moving belt. The belt moves with a speed of $4kmh^{-1}$. For an observer on a stationary platform outside, what is the

(a) speed of the child running in the direction of motion of the belt ?

(b) speed of the child running opposite to the direction of motion of the belt ?

(c) time taken by the child in (a) and (b)?

Which of the anseres alter if motion is viewed by one of the parents ?



A. $4kmh^{-1}$

B. $5kmh^{-1}$

C. $9kmh^{-1}$

D. $13kmh^{-1}$

Answer: D

Watch Video Solution

26. A stone is dropped from a hill of height 180 m. Two seconds later another stone is dropped from a point P below the top of the hill . If the two stones reach the groud simultaneously, the height of P from the ground is $(g = 10ms^{-2})$

A. $100m$

B. $90m$

C. $80m$

D. $90m$

Answer: C

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27. Water drops fall from the roof a building 20 m high at regular time intervals. If the first drop strikes the floor when the sixth drop begins to fall, the heights of the second and fourth drops from the ground at that instant are $\left(g = 10ms^{-2}\right)$

A. $12.8m \text{ and } 3.2m$

B. $12.8m \text{ and } 7.2m$

C. $19.2m \text{ and } 0.8m$

D. $7.2m \text{ and } 16.8m$

Answer: D

Watch Video Solution

28. A body is dropped from a height of 16 m. The body strikes the ground and losses 25% of its velocity. The body rebounds to a height of

A. 12 m

B. 9 m

C. 4 m

D. 8 m

Answer: B

Watch Video Solution

29. The distance travelled by a falling body in the last second of its motion, to that in the last but one second is 7: 5, the velocity with which body strikes the ground is

A. $19.6m/s$

B. $39.2m/s$

C. $29.4m/s$

D. $49m / s$

Answer: B

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30. A ball dropped from a point P crosses a point Q in t seconds. The time taken by it to travel from Q to R, if PQ = QR.

A. t

B. $\sqrt{2}t$

C. $2t$

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

Answer: D

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31. Two balls are dropped from the same height at two different places A and B where the acceleration due to gravities are g_A and g_B. The body at 'B' takes 't' seconds less to reach the ground and strikes the ground with a velocity greater than at 'A' by $v m / s$. Then the value of v / t is

A. $\frac{1}{\sqrt{g_A g_B}}$

B. $2\sqrt{g_A g_B}$

C. $\frac{1}{g_A g_B}$

D. $\sqrt{g_A g_B}$

Answer: D

Watch Video Solution

32. A lead ball dropped into a lake from a diving board 5 m above the water hits the water with certain velocity and then sinks to the bottom with the same constant velocity. If it reaches the bottom in 3s after it is dropped the depth of the lake is $\left(g = 10ms^{-2}\right)$

A. 30 m

B. 15 m

C. 10 m

D. 20 m

Answer: D

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33. A body P is thrown vertically up with velocity $30ms^{-1}$ and another body Q is thrown up along the same vertically line with the same velocity but 1 second later from the ground. When they meet $(g = 10ms - 2)$

A. P travels for 2.5 s

B. Q travels for 3.5 s

C. P travels for 3.5 s

D. Q travels for 1 s

Answer: C

Watch Video Solution

34. A boy sees a ball go up and then down through a window 2.45 m high. If the total time that ball is in sight in 1s, the height above the window the ball rises is approximately

A. $2.45m$

B. $4.9m$

C. $0.3m$

D. $0.49m$

Answer: C

Watch Video Solution

35. A particle is projected vertically up and another is let fall to meet at the same instant. If they have velocities equal in magnitude when they meet, the distance travelled by them are in the ratio of

A. $1:1$

B. $1:2$

C. $3:1$

D. $2:3$

Answer: C

Watch Video Solution

36. A ball is projected from the bottom of a tower and is found to go above the tower and is caught by the thrower at the bottom of the tower after a time interval t_1. An observer at the top of the tower see the same ball go up above him and then come back at this level in a time interval t_2 . The height of the tower is

A. $\frac{1}{2} g t_1 t_2$

B. $\frac{g t_1 t_2}{8}$

C. $\frac{g}{8}\left(t_1^2-t_2^2\right)$

D. $\frac{g}{2}(t_1 - t_2)^2$

Answer: C

Watch Video Solution

37. A stone is dropeed from a height of10 cm above the top of a window 80 cm high. The time taken by the stone to cross the window is $(g = 9.8ms^{-2})$

A. $\frac{1}{7}s$

B. $\frac{3}{7}s$

C. $\frac{2}{7}s$

D. $\frac{4}{7}s$

Answer: C

Watch Video Solution

38. If a stone dropped from the top of a tower travels half, of the height of the tower during last second of its fall, the time of fall is (in seconds)

A. $3+\sqrt{2}$

B. $4+\sqrt{2}$

C. $2-\sqrt{2}$

D. $2+\sqrt{2}$

Answer: D

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39. 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

A. $\frac{2v(n-1)}{n}$

B. $\frac{v(n-1)}{n}$

C. $\frac{v(n+1)}{n}$

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

Answer: A

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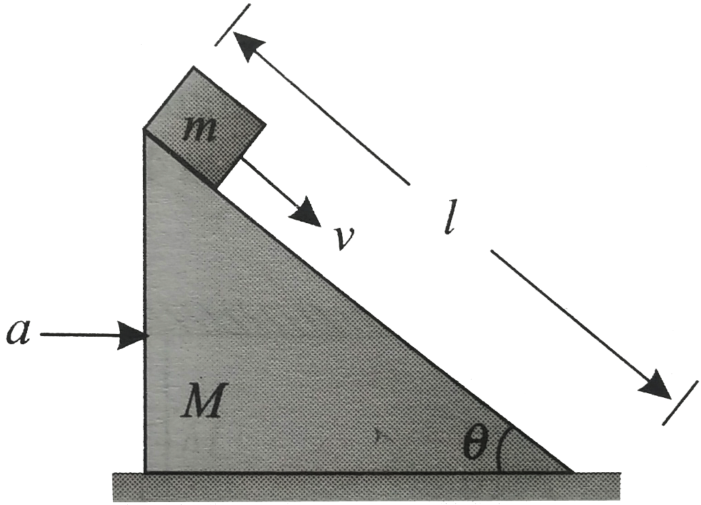
40. 

A smooth wedge of mass M is pushed with an acceleration $a = > an\theta$ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

`The horizontal force applied on the wedge is:

A. $1929m$

B. $1911m$

C. $2195m$

D. $2000m$

Answer: B

Watch Video Solution

41. Two balls are projected simultaneously with the same speed from the top of a tower-one upwards and the other downwards.If they reach the ground in 6s and 2s ,the height of the tower is

A. 120 m

B. 60 m

C. 80 m

D. 30 m

Answer: B

Watch Video Solution

42. An object falls from a bridge which is 45 m above the water. It falls directly into a small row - boat moving with constant velocity that was 12m from the point of impact when the object was released. What was the speed of the boat ?

A. $2m / s$

B. $3m / s$

C. $5m / s$

D. $4m / s$

Answer: D

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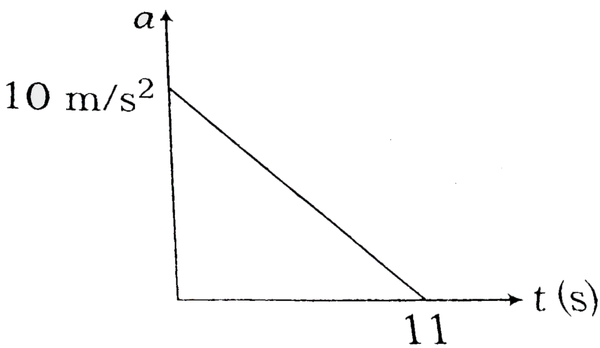
43. A particle starts from rest. Its acceleration (a) versus time (t) graph is as shown in the figure. The maximum speed of the particle will



be

A. 110 m/s

B. 55 m/s

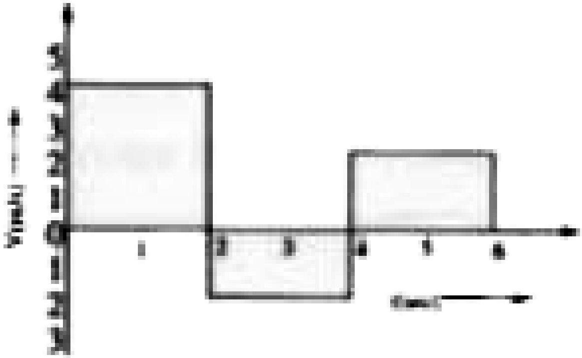
C. 550 m/s

D. 660 m/s

Answer: B

Watch Video Solution

44. The velocity time graph of a body moving in a straight line is shown in the figure. The displacement and distance travelled by the body in 6 sec are respectively.



A. 8 m, 16 m

B. 16 m, 8 m

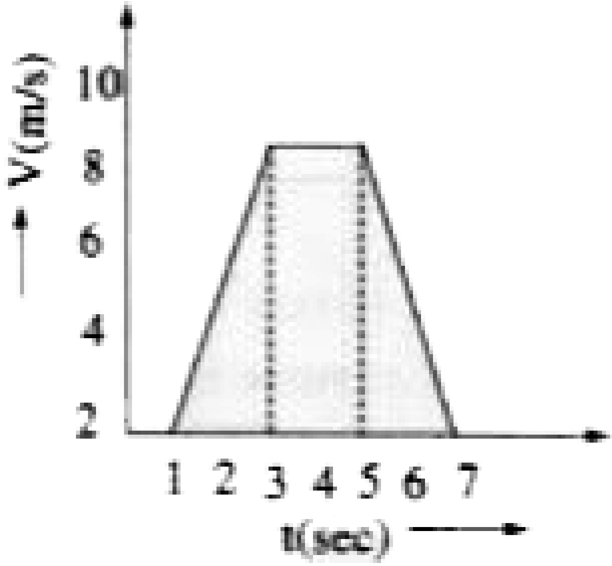
C. 16m, 16 m

D. 8 m, 8m

Answer: A

Watch Video Solution

45. For the velocity - time graph shown in figure below the distance covered by the body in last two seconds of its motion is what fraction of the total distance covered by it in all the total distance covered by it in all the seven seconds



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

B. $\frac{1}{4}$

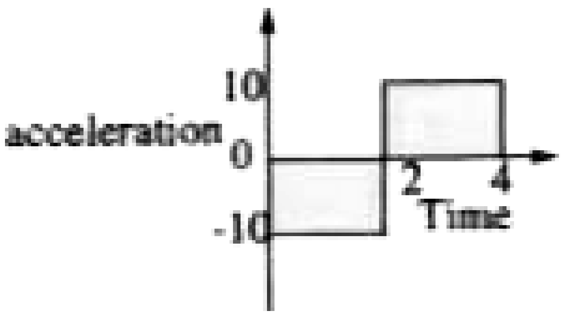
C. $\frac{1}{3}$

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

Answer: B

Watch Video Solution

46. A particle starts from rest at time t=0 and moves on a straight line with acceleration as plotted in fig. The speed of the particle will be maximum after time.



A. 1s

B. 2s

C. 3s

D. 4s

Answer: B

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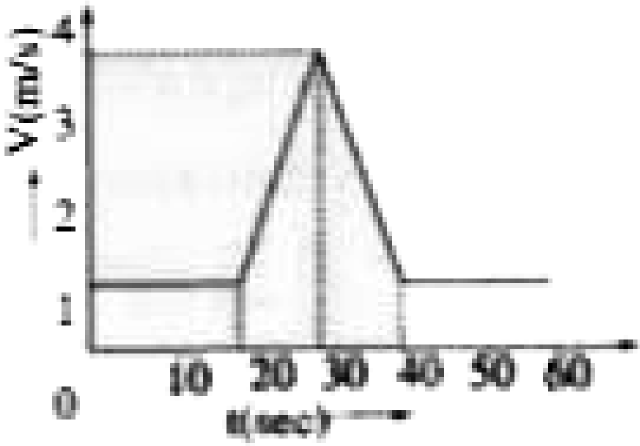
47. Velocity-time (v-t) graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is



A. 60 m

B. 50 m

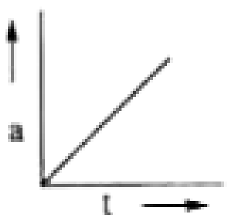
C. 30 m

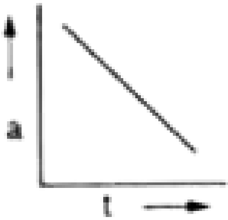
D. 40 m

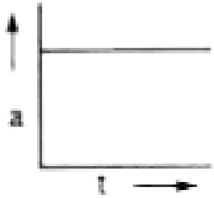
Answer: B

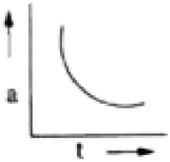
Watch Video Solution

48. The distance travelled by a body moving along a line in time t is proportional to t^3. The acceleration - time (a, t) graph for the motion of the body will be

A. 

B. 

C. 

D. 

Answer: A

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49. Two bodies begin a free fall from the same height at a time interval of Ns. If vertical separation between the two bodies is Lm after n seconds from the start of the first body, then n is equal to

A. $\sqrt{nN}$

B. $\frac{L}{gN}$

C. $\frac{L}{gN} + \frac{N}{2}$

D. $\frac{L}{gN} - \frac{N}{4}$

Answer: C

Watch Video Solution

50. A ball is thrown form the top of a tower in vertically upward direction. Velocity at a point h meter below the point of projection is twice of the velocity at a point h merer above the point of projection, Find the maximum height reached by the ball above the top of towe.

A. $2h$

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

C. $3h$

D. $\frac{5h}{3}$

Answer: D

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51. If water drops are falling at regular time intervals from ceiling of height H, then position of drop from the ceiling is (when n^{th} drop falling from the ceiling and r^{th} drop is in its way)

A. $\frac{(n-1)^2}{(n-r)^2}H$

B. $\frac{(n-r)^2}{(n-1)^2}H$

C. $\frac{(n-r)^2}{(n+1)^2}H$

D. $\frac{(n+1)^2}{(n+r)^2}H$

Answer: B

Watch Video Solution

52. A stone falling from the top of a vertical tower has descended x metre when another is dropped from a point y metre, below the top. If they fall from rest and reach the ground together, show that the height of the tower is

$$\frac{(x+y)^2}{4x}m.$$

A. $\frac{(x+y)^2}{4x}m$

B. $\frac{4(x+y)^2}{x}m$

C. $\frac{4x}{(x+y)^2}m$

D. $4x(x+y)^2m$

Answer: A

Watch Video Solution

53. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 s, the next 5 s and the next 5 s respectively. The relation between h_1, h_2 and h_3 is

A. $h_1 = \frac{h_1}{3} = \frac{h_3}{5}$

B. $h_2 = 3h_1 \text{ and } h_3 = 3h_2$

C. $h_1 = h_2 = h_3$

D. $h_1 = 2h_2 = 3h_3$

Answer: D

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54. A body is thrown vertically upward from a point A 125 m above the ground. It goes up to a maximum height of 250 m above the ground and passes through A on its downward journey. The velocity of the body when it is at a height of 70 m above the ground is $(g = 10m/s^2)$

A. $50ms^{-1}$

B. $60ms^{-1}$

C. $80ms^{-1}$

D. $20ms^{-1}$

Answer: B

Watch Video Solution

55. From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is n times that taken by it to reach the highest point of its path. The relation between H, u and n is:

A. $2gH = nu^2(n-2)$

B. $gH = (n-2)u^2$

C. $2gH = n^2u^2$

D. $gH = (n-2)^2u^2$

Answer: A

Watch Video Solution

56. A projectile moving vertically upwards with a velocity of 200 m/s breaks into two equal parts at the height of 490 m.one part starts moving vertically upwards with a velocity of 400 m/s.How much time after the break up wil the other part hit the ground?

A. $\sqrt{10}s$

B. $2\sqrt{10}s$

C. $5s$

D. $10s$

Answer: D

Watch Video Solution

57. A particle is projected vertically upwards with a velocity of 20m/sec. Find the time at which distance travelled is twice the displacement

A. $2+\sqrt{4/3}\text{sec}$

B. 1sec

C. $2+\sqrt{3/4}\text{sec}$

D. $3 \sec$

Answer: A

Watch Video Solution

58. A car is standing 200m behind a bus , which is also at rest . The two. Start moving at the same instant but with different forward accelerations. The bus has acceleration $2ms^{-2}$ and The car has acceleration $4ms^{-2}$ The car will catch up will the bus after time :

A. $\sqrt{120}s$

B. $15s$

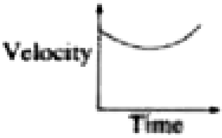
C. $10\sqrt{2}s$

D. $\sqrt{110}s$

Answer: C

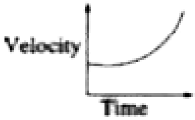
Watch Video Solution

59. Which graph corresponds to an object moving with a constant negative acceleration and a positive velocity ?

A. 

B. 

C. 

D. 

Answer: B

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MOTION IN A PLANE

1. Two vectors of equal magnitude P are inclined at some angle such that the difference in magnitude of resultant and magnitude of either of the vectors is 0.732 times either of the magnitude of vectors. If the angle between them is increased by half of its initial value then find the magnitude of difference of the vectors

A. 2P

B. $\sqrt{2}p$

C. $3p$

D. $\sqrt{3}p$

Answer: B

Watch Video Solution

2. Resultant of two vectors of magnitudes P and Q is of magnitude 'Q'. If the magnitude of $\overrightarrow{Q}$ is doubled now the angle made by new resultant with $\overrightarrow{P}$ is

A. 30°

B. 90°

C. 60°

D. 120°

Answer: B

Watch Video Solution

3. The two forces $2\sqrt{2}N$ and xN are acting at a point their resultant is perpendicular to $\hat{x}N$ and having magnitude of $\overrightarrow{6}N$. The angle between the two forces and magnitude of x are

A. $\theta = 120^\circ, x = \sqrt{2}N$

B. $\theta = 30^\circ, x = \sqrt{2}N$

C. $\theta = 150^\circ, x = \sqrt{3}N$

D. $\theta = 150^\circ, x = \sqrt{2}N$

Answer: A

Watch Video Solution

4. Three forces are acting on a particle of mass m intially in equilibrium. If the first two forces $(R_1 \text{ and } R_2)$ are perpendicular to each other and suddenly the third force (R_3) is removed, then the acceleration on the particle is

A. F_1 / m

B. $F_1 F_3 / m F_1$

C. $(F_2 - F_3) / m$

D. $\frac{F_2}{m}$

Answer: A

Watch Video Solution

5. The square of the resultant of two forces 4N and 3 N exceeds the square of the resultant of the two forces by 12 when they are mutually perpendicular. The angle between the vectors is

A. 30°

B. 60°

C. 90°

D. 120°

Answer: B

Watch Video Solution

6. The resultant of three vectors 1,2, and 3 units whose directions are those of the sides of an equilateral triangle is at what angle with respect to first vector?

A. 30° with the first vector

B. 15° with the first vector

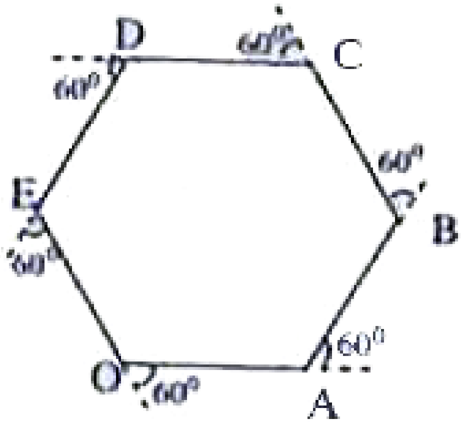
C. 100° with the first vector

D. 150° with the first vector

Answer: D

Watch Video Solution

7. A person moving on a motor cycle in a ground takes a turn through 60° on his left after every 50m. Then find the magnitude of displacement suffered by him after 9th turn



A. 100 m

B. 50 m

C. $50\sqrt{3}m$

D. $20m$

Answer: A

Watch Video Solution

8. What should be the angle between $\left(\vec{A}+\vec{B}\right)$ and $\left(\vec{A}-\vec{B}\right)$ such that the magnitude of the resultant is $\sqrt{3A^2+B^2}$?

A. 30°

B. 45°

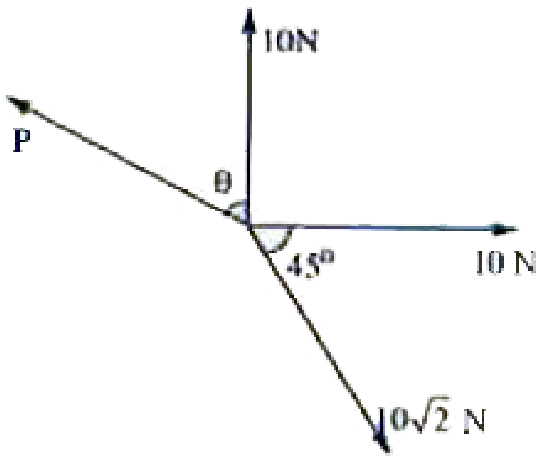
C. 60°

D. 90°

Answer: C

Watch Video Solution

9. If four forces act at a point 'O' as shown in the figure and if O is in equilibrium then the value of $'\theta'$ & 'P' are



A. $15^\circ, 10\sqrt{2}N$

B. $45^{\circ}, 10N$

C. $75^{\circ}, 10\sqrt{2}N$

D. $90^{\circ}, 20N$

Answer: D

Watch Video Solution

10. If a line makes angle $\frac{\pi}{3}$ and $\frac{\pi}{4}$ with x-axis and y-axis respectively, then the angle made by the line with z-axis is $\pi/2$ b. $\pi/3$ c. $\pi/4$ d. $5\pi/12$

A. 30°

B. 60°

C. 90°

D. 120°

Answer: B

Watch Video Solution

11. The components of a vector along the x- and y- directions are $(n+1)$ and 1, respectively. If the coordinate system is rotated by an angle $\theta = 60^{\circ}$, then the components change to n and 3. The value of n is

A. 2

B. 3

C. 2.5

D. 3.5

Answer: D

Watch Video Solution

12. A mass M kg is suspended by a weightless string. The horizontal force required to hold the mass at 60° with the vertical is

A. Mg

B. $Mg\sqrt{2}$

C. $Mg(\sqrt{3}+1)$

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

Answer: A

Watch Video Solution

13. Two particles having position vectors $r_1 = \left(3\hat{i} + 5\hat{j}\right)$ metres and $r_2 = \left(-5\hat{i} - 3\hat{j}\right)$ metres are moving with velocities $v_1 = \left(4\hat{i} + 3\hat{j}\right)m/s$ and $v_2 = \left(\alpha\hat{i} + 7\hat{j}\right)m/s$. If they collide after 2 seconds, the value of α is

A. 2

B. 4

C. 6

D. 8

Answer: D

Watch Video Solution

14. Four persons A, B, C and D initially at the corners of a square of side of length d. If every person starts moving with same speed v such that each one faces the other always, the person will meet after time

A. $\frac{d}{v}$

B. $\frac{\sqrt{2}d}{v}$

C. $\frac{d}{2v}$

D. $\frac{d}{\sqrt{2}v}$

Answer: A

Watch Video Solution

15. A particle moving with a velocity equal to $0.4ms^{-1}$ is subjected to an acceleration of $0.15ms^{-2}$ for 2 seconds in a direction at right angles to the direction of motion. The magnitude of the final velocity is

A. $0.3ms^{-1}$

B. $0.4ms^{-1}$

C. $0.5ms^{-1}$

D. $0.7ms^{-1}$

Answer: C

Watch Video Solution

16. Velocity of particle at time t=0 is $2ms^{-1}$.A constant acceleration of $2ms^{-2}$ act on the particle for 1 second at an angle of 60° with its initial velocity .Find the magnitude velocity and displacement of the particle at the end of t=1s.

A. $\sqrt{3}m / s$

B. $2\sqrt{3}m / s$

C. $4m / s$

D. $8m / s$

Answer: B

Watch Video Solution

17. A vertical disc has three grooves directed along chords AB, AC and AD. Three bodies begin to slide down the respective grooves from A simultaneously. If AB > AC > AD, the respective time intervals to reach the bottoms of the respective grooves t_1, t_2 and t_3 are

A. $t_1 > t_2 > t_3$

B. $t_1 < t_2 < t_3$

C. $t_1 > t_2 < t_3$

D. $t_1 = t_2 = t_3$

Answer: D

Watch Video Solution

18. A particle has an initial velocity $3\hat{i} + 3\hat{j}$ and acceleration of $0.41\hat{i} + 0.3\hat{j}$. Its speed after 10s is

A. 10 units

B. $7\sqrt{2}$ units

C. 7 units

D. 8.5 units

Answer: B

Watch Video Solution

19. Three particles start from the origin at the same time, one with a velocity v_1 along the x-axis, second along the y-axis with a velocity v_2 and third particle moves along the line x = y. The velocity of third particle, so that three may always lie on the same line is:

A. $\dfrac{a+b}{2}$

B. $\sqrt{ab}$

C. $\dfrac{ab}{a+b}$

D. $\dfrac{\sqrt{2}ab}{a+b}$

Answer: D

Watch Video Solution

20. A particle starts from the origin at t =0 with a velocity of $10.0\hat{j}$ m/s and moves in the X-Y plane with a constant acceleration of

$8.0\hat{i} + 2. \; - \hat{j} m / s$

What is the speed of the particle at that time?

A. $t = 2s$

B. $t = 4s$

C. $t = 3s$

D. $t = 1s$

Answer: A

Watch Video Solution

21. For a concave mirror, if real image is formed the graph between $\frac{1}{u}$ and $\frac{1}{v}$ is of the form

A. a,b,d are correct

B. a, b, c are correct

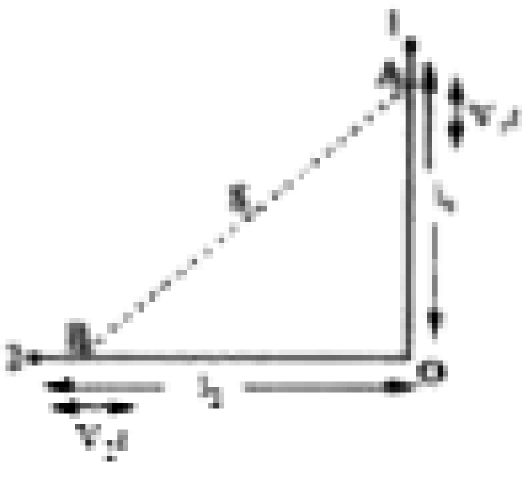
C. only a, d are correct

D. only b, d are correct

Answer: A

Watch Video Solution

22. Two particles A and B move with constant velocity $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$ along two mutually perpendicular straight lines towards intersection point O as shown in figure, At moment t = 0 particles were located at distance l_1 and l_2 respectively from O. Then minimu distance between the particles and time taken are respectively



A. $\dfrac{|l_1v_2 - l_2v_1|}{\sqrt{v_1^2 + v_2^2}}, \dfrac{l_1v_1 + l_2v_2}{v_1^2 + v_2^2}$

B. $\dfrac{|l_1v_1 - l_2v_2|}{\sqrt{v_1^2 + v_2^2}}, \dfrac{l_1v_2 + l_2v_1}{v_1^2 + v_2^2}$

C. $\dfrac{|l_1v_2 - l_2v_1|}{\sqrt{v_1^2 + v_2^2}}, \sqrt{\dfrac{l_1}{l_2}}, \dfrac{(l_1v_1 + l_2v_2)l_1}{\left(v_1^2 + v_2^2\right)l_2}$

D. $\dfrac{|l_1v_2 - l_2v_1|}{\sqrt{v_1^2 + v_2^2}}, \sqrt{\dfrac{l_1}{l_2}}, \dfrac{(l_1v_1 + l_2v_2)l_2}{\left(v_1^2 + v_2^2\right)l_1}$

Answer: A

Watch Video Solution

23. The distance between two moving particles at any time is α. If v be their relative velocity and v_1 and v_2 be the component of v along and perpendicular to a. The time when they are closest to each other are

A. $\dfrac{a(v+v_r)}{v}, a\left(1+\dfrac{v_r}{u}\right)^2$

B. $\dfrac{a}{v+v_r}, a\left(1+\dfrac{u}{v_r}\right)^2$

C. $\dfrac{av_r}{v}, \dfrac{av_r}{u^2}$

D. $\dfrac{av}{v_r}, \dfrac{au}{v_r^2}$

Answer: D

Watch Video Solution

24. A ship is moving due east with a velocity of 12 m/ sec, a truck is moving across on the ship with velocity 4 m/sec. A monkey is climbing the vertical pole mounted on the truck with a velocity of 3m/sec. Find the velocity of the monkey as observed by the man on the shore

A. 10 m/sec

B. 15 m/sec

C. 13 m/sec

D. 20 m/sec

Answer: C

Watch Video Solution

25. Two stones are projected from the top of a tower in opposite directions, with the same velocity V but at 30° & 60° with horizontal respectively. The relative velocity of first stone relative to second stone is

A. 2V

B. $\sqrt{2}V$

C. $\dfrac{2V}{\sqrt{3}}$

D. $\dfrac{V}{\sqrt{2}}$

Answer: B

Watch Video Solution

26. A motor car A is travelling with a velocity of 20 m/s in the north-west direction and another motor car B is travelling with a velocity of 15 m/s in the north-east direction.

The magnitude of relative velocity of B with respect to A is

A. $25m/s$

B. $15m/s$

C. $20m/s$

D. $35m/s$

Answer: A

Watch Video Solution

27. When two bodies approach each other with the different speeds, the distance between them decreases by 120 m for every one minute. If they are moving in direction, the distance between them increases by 90 m for very one minute. The speeds of the bodies are

A. $2ms^{-1}$ and $0.5ms^{-1}$

B. $3ms^{-1}$ and $2ms^{-1}$

C. $1.75ms^{-1}$ and $0.25ms^{-1}$

D. $2.5ms^{-1}$ and $0.5ms^{-1}$

Answer: C

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28. A boat going down stream crosses a float at a point A. $'t_1'$ minutes later the boat reverses its direction and in the next $'t_2'$ minutes it crosses the float at a distance L from the point A. The velocity of the river is

A. $2L/t_1$

B. $L/(t_1+2t_2)$

C. $2L/(2t_1+t_2)$

D. $L/2t_1$

Answer: D

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29. It is raining at a speed of $5ms^{-1}$ at an angle 37° to vertical, towards east. A man is moving to west with a velocity of $5ms^{-1}$. The angle with the vertical at which he has to hold the umbrella to protect himself from rain is

A. $\tan^{-1}(2)$ to west

B. $\tan^{-1}(2)$ to east

C. $\tan^{-1}(1/2)$ to south

D. $\tan^{-1}(1/2)$ to east

Answer: A

Watch Video Solution

30. Rain pouring down at an angle a with the vertical has a constant speed of 10 m/s. A woman runs against the rain with a speed of 8 m/s and sees that the rain makes an angle þ with the vertical. Find the relation between a and þ.

A. $\tan\beta = \dfrac{8 + 10\sin\alpha}{10\cos\alpha}$

B. $\tan\beta = \dfrac{8 + 10\cos\alpha}{10\sin\alpha}$

C. $\tan\beta = \dfrac{10\sin\alpha}{8 + 10\cos\alpha}$

D. $\tan\beta = \dfrac{10\cos\alpha}{8 + 10\sin\alpha}$

Answer: A

Watch Video Solution

31. A man runs along a horizontal road on a rainy day. His umbrella vertical in order to protect himself from the rain then rain actually

A. coming from front actually

B. coming from back to a man

C. falling vertically

D. either of 1,2 or 3

Answer: B

Watch Video Solution

32. The velocity of a boat in still water is 10 m/s. If water flows in the river with a velocity of 6 m/s what is the difference in times taken to cross the river in the shortest path and the shortest time. The width of the river is 80 m.

A. 1 s

B. 10s

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

D. $2s$

Answer: D

Watch Video Solution

33. A river is of width 120m which flows at a speed pf $8ms^{-1}$. If a man swims with a speed of $5ms^{-1}$ at an angle of 127° with the stream, his drift on reaching other bank is

A. 50 m

B. 150 m

C. 200 m

D. 300 m

Answer: B

Watch Video Solution

34. A boat takes 4 hrs to travel certain distance in a river in down stream and it takes 6 hrs to travel the same distance in upstream.

Then the time taken by the boat to travel the same distance in still water is

A. 4.8 hrs

B. 9.8 hrs

C. 24 hrs

D. 10 hrs

Answer: A

Watch Video Solution

35. A person rows a boat across a river making an angle of 60° with the downstream. Find the percentage time he would have saved, and he crossed the river in the shortest possible time.

A. 0.47

B. 0.01547

C. 0.1547

D. 0.1

Answer: C

Watch Video Solution

36. A boatman finds that he can save $6s$ in crossing a river by the quickest path than by the shortest path. If the velocity of the boat and the river be, respectively, $17ms^{-1}$ and $8ms^{-1}$, find the river width.

A. 675 m

B. 765 m

C. 567 m

D. 657 m

Answer: B

Watch Video Solution

37. A projectile is thrown at an angle of 30° with a velocity of 10m/s. the change in velocity during the time interval in which it reaches the highest point is

A. 10 m/s

B. 5 m/s

C. $5\sqrt{3}m / s$

D. $10\sqrt{3}m / s$

Answer: B

Watch Video Solution

38. A body projected obliquely with velocity $19.6ms^{-1}$ has its kinetic energy at the maximum height equal to 3 times its potential energy there. Its position after t second of projection from the ground is (h = maximum height)

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

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

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

D. h

Answer: D

Watch Video Solution

39. It is possible to project a particle with a given speed in two possible ways so that it has the same horizontal range 'R'. The product of time taken by it in the two possible ways is

A. R/g

B. $2R/g$

C. $3R/g$

D. $4R/g$

Answer: B

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Watch Video Solution

40. The range of a particle when launched at an angle of 15° with the horizontal is 1.5 km. What is the range of the projectile when launched at an angle 45° to the horizontal?

A. 3 km d

B. 4.5 km

C. 1.5 km

D. 2.5 km

Answer: C

Watch Video Solution

41. A ball A is projected from the ground such that its horizontal range is maximum. Another ball B is dropped from a height equal to the maximum range of A. The ratio of the time of flight of A to the time of fall of B is

A. $\sqrt{2}:1$

B. $1:2$

C. $1:1$

D. $1:\sqrt{2}$

Answer: C

Watch Video Solution

42. A particle is projected from the ground with velocity u making an angle θ with the horizontal. At half of its maximum heights,

A. Its horizontal velocity is ucos θ

B. Its vertical velocity is $\dfrac{u \sin \theta}{\sqrt{2}}$

C. its velocity is $u\left(\dfrac{1+\cos^2\theta}{2}\right)^{\frac{1}{2}}$

D. all the above are true.

Answer: D

Watch Video Solution

43. The maximum range of a projectile is 500m. If the particle is thrown up a plane, which is inclined at an angle of 30° with the same speed, the distance covered by it along the inclined plane will be

A. 200 m

B. 100 m

C. 400 m

D. 50 m

Answer: C

Watch Video Solution

44. A hose pipe lying on the ground shoots a stream of water upward at an angle 60° to the horizontal at a speed of $20ms^{-1}$. The water strikes a wall 20m away at a height of

$(g = 10ms^2)$

A. 14.64 m

B. 7.32 m

C. 29.28 m

D. 10 m

Answer: A

Watch Video Solution

45. From a point on the ground at a distance a from the foot of a pole, a ball is thrown at an angle of 45°, which just touches the top of the pole and strikes the ground at a distance of b, on the outer side of it. Find the height of the pole.

A. $2/3m$

B. $3/4m$

C. $1/2m$

D. $4/3m$

Answer: D

Watch Video Solution

46. A body is projected with a velocity u at an angle of 60° to the horizontal. The time interval after which it will be moving in a direction of 30° to the horizontal is

A. $u/(\sqrt{3}g)$

B. $\dfrac{\sqrt{3}u}{g}$

C. $\dfrac{\sqrt{3}u}{2g}$

D. $\dfrac{2u}{\sqrt{3}g}$

Answer: A

Watch Video Solution

47. A projectile is given an initial velocity of $(\hat{i}+2\hat{j})m/s$, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical. If $g=10m/s^2$, the equation of its trajectory is:

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

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

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

D. $4y = 2x - 25x^2$

Answer: B

Watch Video Solution

48. A body is projected with an angle θ. The maximum height reached is h. If the time of flight is 4 sec and $g = 10m/s^2$, then the value of h is

A. 40 m

B. 20 m

C. 5 m

D. 10m

Answer: B

Watch Video Solution

49. A body is projected horizontally from the top of a tower with a velocity of 10m/s. If it hits the ground at an angle of 45°, the vertical component of velocity when it hits ground in m/s is

A. $10\sqrt{2}$

B. $5\sqrt{2}$

C. 5

D. 10

Answer: D

Watch Video Solution

50. A body is projected at an angle θ so that its range is maximum. If T is the time of flight then the value of maximum range is (acceleration due to gravity= g)

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

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

C. $\frac{gT^2}{2}$

D. $\frac{g^2T^2}{2}$

Answer: C

Watch Video Solution

51. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a and b are constant and x and y are, respectively, horizontal and vertical distances of the projectile from the point of projection. The maximum height attained by the particle and the angle of projectile from the horizontal are.

A. $\frac{2a^2}{b}, \tan^{-1}(a)$

B. $\frac{b^2}{2a}, \tan^{-1}(b)$

C. $\frac{a^2}{b}, \tan^{-1}(2b)$

D. $\frac{a^2}{4b}, \tan^{-1}(a)$

Answer: D

Watch Video Solution

52. Two particles are projected simultaneously in the same vertical plane, from the same point, both with different speeds and at different angles with horizontal. The path followed by one, as seen by the other, is

A. parabola

B. horizontal straight line

C. vertical straight line

D. straight line making 45° with vertical

Answer: C

Watch Video Solution

53. A body of mass 2kg is projected from the ground with a velocity $20 ms^{-1}$ at an angle 30° with the vertical. If t_1 is the time in seconds at which the body is projected and t_2 is the time in seconds at which it reaches the ground, the change in momentum in $kgms^{-1}$ during the time $(t_2 - t_1)$ is

A. 40

B. $40\sqrt{3}$

C. $50\sqrt{3}$

D. 60

Answer: B

Watch Video Solution

54. A projectile has initially the same horizontal velocity as it would acquire if it had moved from rest with uniform acceleration of $3ms^{-2}$ for 0.5 min . If the maximum height reached by it is $80m$, then the angle of projection is $(g = 10ms^{-2})$.

A. $\tan^{-1}(3)$

B. $\tan^{-1}\left(\frac{3}{2}\right)$

C. $\tan^{-1}\left(\frac{4}{9}\right)$

D. $\sin^{-1}\left(\frac{4}{9}\right)$

Answer: C

Watch Video Solution

55. A body of mass m_1 projected vertically upwards with an initial velocity 'u' reaches a maximum height 'h'. Another body of mass m_2

is projected along an inclined plane making an angle 30° with the horizontal and with speed 'u'. The maximum distance travelled along the incline is

A. 2h

B. h

C. h/2

D. h/4

Answer: A

Watch Video Solution

56. The maximum distance to which a man can throw a ball by projecting it horizontally from a height h is h. The maximum distance to which he can throw it vertically up is

A. h

B. 2h

C. h/2

D. h/4

Answer: D

Watch Video Solution

57. A body projected at 45° with a velocity of 20 m/s has a range of 10m. The decrease in range due to air resistance is $(g = 10ms^{-1})$

A. 0

B. 10 m

C. 20 m

D. 30 m

Answer: D

Watch Video Solution

58. Two seconds after projection, a projectile is travelling in a direction inclined at 30° to the horizontal. After one more second, it is travelling horizontally. Find the magnitude and direction of its velocity.

A. $10\sqrt{3}ms^{-1}$

B. $20m/s$

C. $10m/s$

D. $20\sqrt{3}m/s$

Answer: D

Watch Video Solution

59. A stone is projected from the top of a tower with velocity $20ms^{-1}$ making an angle 30° with the horizontal. If the total time of flight is 5s and $g = 10ms^{-2}$

A. the height of the tower is 75 m.

B. the maximum height of the stone from the ground is 80 m

C. both of the above are true

D. none of the above is true

Answer: C

Watch Video Solution

60. A cricket fielder can throw the cricket ball with a speed v_0. If the throws the ball while running with speed u at an angle θ to the horizontal,

A. the effective angle to the horizontal at which the ball is projected in air as seen by a spectator is $\tan^{-1}\left(\frac{v_0 \sin\theta}{v_0\cos\theta + u}\right)$

B. time of flight is $\frac{2v_0\sin\theta}{g}$

C. the distance (horizontal range) from the point of projection at which ar ball will land

$$R = \frac{2v_0\sin\theta(v_0\cos\theta + u)}{g}$$

D. all the above are true.

Answer: D

Watch Video Solution

61. A boy can throw a stone up to a maximum height of 10 m. The maximum horizontal distance that the boy can throw the same stone up to will be:

A. 10 m

B. $10\sqrt{2}m$

C. $20m$

D. $20\sqrt{3}m$

Answer: C

Watch Video Solution

62. A particle is projected from the ground with an initial speed u at an angle θ with the horizontal. The average velocity of the particle between its point of projection and highest point of trajectory is

A. $\frac{v}{2}\sqrt{1+2\cos^2\theta}$

B. $\frac{v}{2}\sqrt{1+2\sin^2\theta}$

C. $\frac{v}{2}\sqrt{1+3\cos^2\theta}$

D. $v\cos\theta$

Answer: C

Watch Video Solution

63. A ball of mass 1 kg is projected with a velocity of $20\sqrt{2}$ m/s from the origin of an xy co-ordinate axis system at an angle 45° with x-axis (horizontal). The angular momentum [In SI units] of the ball about the point of projection after 2 s of projection is [take $g = 10m/s^2$] (y - axis is taken as vertical).

A. $0.1 rad/s$

B. $0.2 rad/s$

C. $0.3 rad/s$

D. $0.4rad/s$

Answer: B

Watch Video Solution

64. A two particles P and Q are separated by distance d apart. P and Q move with velocity v and u making an angle 60° and θ with line PQ the graph between their relative separation (8) when time t is shown in figure (2). The velocity v in terms of u

Fig (1)

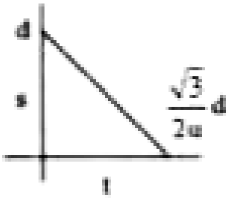


Fig (2)

A. $\sqrt{3}u$

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

C. u

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

Answer: B

Watch Video Solution

65. The direction of projectile at certain instant is inclined at angle α to the horizontal. After t sec, if it is inclined at an angle β then the horizontal component of velocity is

A. $\dfrac{g}{\tan\alpha - \tan\beta}$

B. $\dfrac{gt}{\tan\alpha - \tan\beta}$

C. $\dfrac{t}{g(\tan\alpha - \tan\beta)}$

D. $\dfrac{gt}{(\tan\alpha + \tan\beta)}$

Answer: B

Watch Video Solution

66. A particle is projected from a horizontal floor with speed $10 \frac{m}{s}$ at an angle 30° with the floor and striking the floor after sometime. State which is correct.

A. $\frac{\tan(\alpha_1 - \alpha_2)}{\tan(\alpha_1 + \alpha_2)}$

B. $\frac{\sin(\alpha_1 + \alpha_2)}{\sin(\alpha_1 - \alpha_2)}$

C. $\frac{\sin(\alpha_1 - \alpha_2)}{\sin(\alpha_1 + \alpha_2)}$

D. $\frac{\sin^2(\alpha_1 - \alpha_2)}{\sin^2(\alpha_1 + \alpha_2)}$

Answer: C

Watch Video Solution

67. If v_1 and v_2 be the velocities at the end of focal chord of projectile path and u is the velocity at the vertex of the path, then

A. $v_1^2 + v_2^2 = u^2$

B. $\frac{1}{v_1^2} + \frac{1}{v_2^2} = \frac{1}{u^2}$

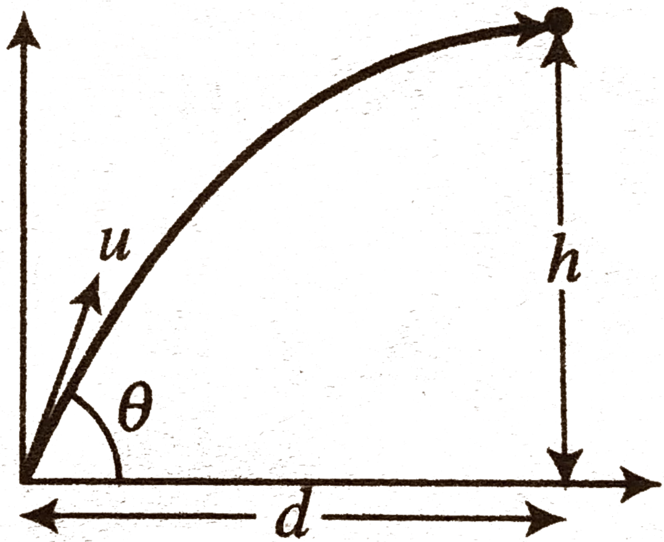
C. $\frac{1}{v_1} + \frac{1}{v_2} = \frac{1}{u}$

D. $u = v_1 + v_2$

Answer: B

Watch Video Solution

68. If a stone is to hit at a point which is at a distance d away and at a height h (Fig. 5.200) above the point from where the stone starts, then what is the value of initial speed u if the stone is launched at an angle θ ?



.

A. $\dfrac{d}{\sin\theta}\sqrt{\dfrac{g}{2(d\tan\theta - h)}}$

B. $\dfrac{d}{\cos\theta}\sqrt{\dfrac{g}{2(d\tan\theta - h)}}$

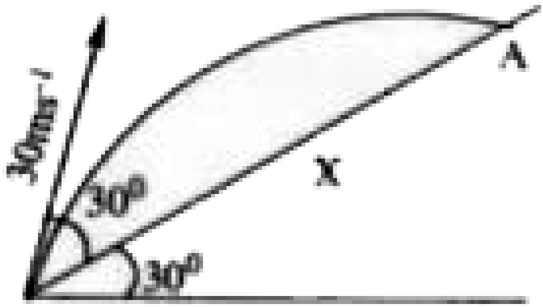
C. $\sqrt{\dfrac{gd^2}{h\cos^2\theta}}$

D. $\sqrt{\dfrac{gd^2}{(d-h)}}$

Answer: B

Watch Video Solution

69. An object in projected up the inclined at the angle shown in the figure with an initial velocity of $30ms^{-1}$. The distance x up the incline at which the object lands is



A. 600 m

B. 104 m

C. 60 m

D. 208 m

Answer: C

Watch Video Solution

70. A projectile is fired with a velocity u at right angles to the slope, which is inclined at an angle θ with the horizontal. Derive an expression for the distance R to the point of impact.

.

A. $\dfrac{2u^2}{g}\tan\theta$

B. $\dfrac{2u^2}{g}\sec\theta$

C. $\dfrac{2u^2}{g}\tan^2\theta$

D. $\dfrac{2u^2}{g}\tan\theta\sec\theta$

Answer: D

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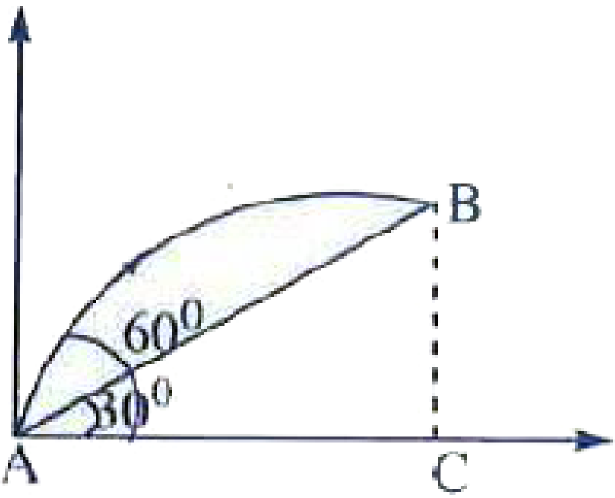
71. In figure shown below, the time taken by the projectile to reach from A to B is t then, the distance AB is equal to



A. $\dfrac{ut}{\sqrt{3}}$

B. $\dfrac{\sqrt{3}ut}{2}$

C. $\sqrt{3}ut$

D. $2ut$

Answer: A

Watch Video Solution

72. A fighter plane flying horizontally at an altitude of 1.5 km with speed 720 km h^{-1} passes diretly overhead an anti-aircraft gun. At what angle from the vertical should the gun he fired for the shell with muzzle speed 600 m s^{-1} to hit the plane. (Take g = 10 m s^{-1})

A. $\sin^{-1}\left(\frac{1}{3}\right), 16km$

B. $\cos^{-1}\left(\frac{1}{3}\right)$, $18km$

C. $\sin^{-1}\left(\frac{1}{3}\right)$, $6km$

D. $\cos^{-1}\left(\frac{1}{3}\right)$, $6km$

Answer: A

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73. At a certain height a body at rest explodes into two equal fragments with one fragment receiving a horizontal velocity of 10ms^−1. The time interval after the explosion for which the velocity vectors of the two fragments become perpendicular to each other is

A. 1s

B. 2s

C. 1.5s

D. 1.75s

Answer: B

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74. A stair case contains ten steps each 10cm high and 20 cm wide. The minimum horizontal velocity with which the ball has to be rolled off the upper most step, so as to hit directly the edge of the lowest steps is (approximately)

A. $42ms^{-1}$

B. $4.2ms^{-1}$

C. $24ms^{-1}$

D. $2.4ms^{-1}$

Answer: B

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75. In the above problem, the time taken by the displacement vectors of the two fragments to become perpendicular to each other is

A. 1s

B. 1.5 s

C. 2 s

D. 4 s

Answer: C

Watch Video Solution

76. In the above problem, this horizontal distance between the two fragments when their position vectors are perpendicular to each other is

A. 40 m

B. 20 m

C. 10 m

D. 5 m

Answer: A

Watch Video Solution

77. At a certain height a shell at rest explodes into two equal fragments. One of the fragments receives a horizontal velocity u. The time interval after which, the velocity vectors will be inclined at 120° to each other is

A. $\dfrac{u}{\sqrt{3}g}$

B. $\frac{\sqrt{3}u}{g}$

C. $\frac{2u}{\sqrt{3}g}$

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

Answer: A

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78. A bomb at rest at the summit of a cliff breaks into two equal fragments. One of the fragments attains a horizontal velocity of $20\sqrt{3}ms^{-1}$. The horizontal distance between the two fragments, when their displacement vectors is inclined at 60° relative to each other is $\left(g=10ms^{-2}\right)$

A. $40\sqrt{3}m$

B. $80\sqrt{2}m$

C. $120\sqrt{3}m$

D. $480\sqrt{3}m$

Answer: D

Watch Video Solution

79. From certain height 'h' two bodies are projected horizontally each with velocity v. One body is projected towards North and the other body is projected towards east. Their separation on reaching the ground.

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

B. $\sqrt{\frac{4v^2h}{g}}$

C. $\sqrt{\frac{v^2h}{g}}$

D. $\sqrt{\frac{8v^2h}{g}}$

Answer: B

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80. An object is projected horizontally from a top of the tower of height h. The line joining the point of projection and point of striking on the ground makes an angle 45° with ground, then with what velocity the object strikes the ground

A. $\sqrt{\frac{11gh}{2}}$

B. $\sqrt{\frac{9gh}{2}}$

C. $\sqrt{\frac{7gh}{2}}$

D. $\sqrt{\frac{5gh}{2}}$

Answer: C

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81. A particle 'P' is moving in a circle of radius 'a' with a uniform speed 'u' 'C' is the centre of the circle and AB is a diameter. 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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82. Starting from rest a wheel rotates with uniform angular acceleration $2\pi rads^{-2}$. After 4s, if the angular acceleration ceases to act, its angular displacement in the next 4s is

A. $8\pi rad$

B. $16\pi rad$

C. $24\pi rad$

D. $32\pi rad$

Answer: D

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83. A point moves along a circle having a radius $20cm$ with a constant tangential acceleration $5cm/s^2$. How much time is needed after motion begins for the normal acceleration of the point to be equal to tangential acceleration?

A. 1s

B. 2s

C. 4s

D. 6s

Answer: B

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84. A cyclist is riding with a speed of 27 kmh^{-1}. As he approaches a circular turn on the road of radius 80m, he applies brakes and reduces his speed at the constant rate of 0.50 ms^{-1} every second. The net acceleration of the cyclist on the circular turn is

A. $0.5m/s^2$

B. $0.8m/s^2$

C. $0.86m/s^2$

D. $1m/s^2$

Answer: C

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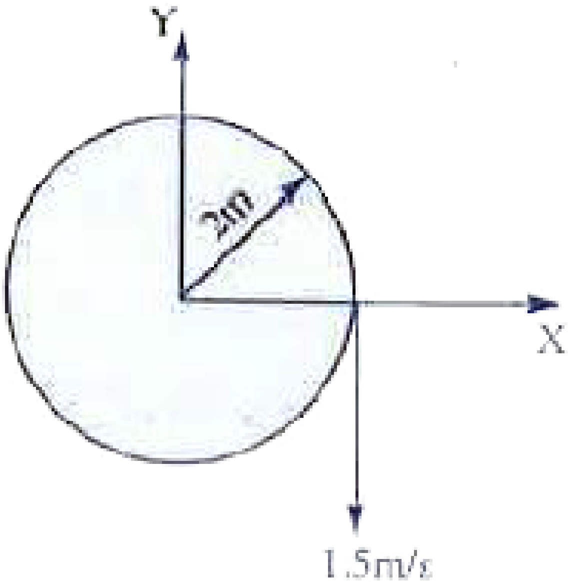
85. A particle is moving along a circular path in xy-plane. When it crosses x-axis, it has an acceleration along the path of $1.5m/s^2$, and is moving with a speed of 10m/s in -ve y -

direction. The total acceleration is



A. $50\hat{i} - 1.5\hat{j} m / s^2$

B. $10\hat{i} - 1.5\hat{j} m / s^2$

C. $-50\hat{i} - 1.5\hat{j} m / s^2$

D. $1.5\hat{i} - 50\hat{j} m / s^2$

Answer: C

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86. A particle moves on a circle of radius r with centripetal acceleration as function of time as $a_c = k^2rt^2$, where k is a positive constant. Find the following quantities as function of time at an instant :

(a) The speed of the particle

(b) The tangential acceleration of the particle

(c) The resultant acceleration, and

(d) Angle made by the resultant acceleration with tangential acceleration direction.

A. kr^2

B. kr

C. $kr\sqrt{k^2t^4+1}$

D. $kr\sqrt{k^2r^4-1}$

Answer: C

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87. A particle moves in a circular path such that its speed v varies with distance s as $v = \alpha\sqrt{s}$ where α is a positive constant. If the acceleration of the particle after traversing a distance s is $\left[\alpha^2\sqrt{x + \frac{s^2}{R^2}}\right]$ find x.

A. $\alpha\sqrt{\frac{1}{4} - \frac{S^2}{R^2}}$

B. $\alpha\sqrt{\frac{1}{4} + \frac{S^2}{R^2}}$

C. $\alpha\sqrt{\frac{1}{2} + \frac{S^2}{R^2}}$

D. $\alpha^2\sqrt{\frac{1}{2} + \frac{S^2}{R^2}}$

Answer: B

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LAW OF MOTION

1. A body of mass 1 kg is moving with velocity $30ms^{-1}$ due north. It is acted on by a force of 10 N due east for 4 seconds. Find the velocity of the body after the force ceases to act.

A. $50m/s, \tan^{-1}\left(\frac{3}{4}\right)$

B. $100m/s, \tan^{-1}\left(\frac{4}{3}\right)$

C. $50m/s, \tan^{1}\left(\frac{3}{5}\right)$

D. $100m/s, \tan^{-1}\left(\frac{4}{5}\right)$

Answer: A

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2. A force of 20 N acts on a body of mass 5kg at rest. What is the acceleration of the body? What is its velocity after 5 seconds if the same force acts? After 5 seconds if the force ceases to act how will the body move?

A. $4m/s^2, 20\frac{m}{s},$ uniformly velocity

B. $2m/s^2, 15\frac{m}{s},$ uniformly velocity

C. $2m/s^2, 10\frac{m}{s},$ uniformly velocity

D. $4m/s^2, 20\frac{m}{s},$ uniformly velocity

Answer: A

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3. A truck starts from rest and accelerates uniformly at $2.0ms^{-2}$. At t = 10 s , a stone is dropped by a person standing on the top of the truck (6 m high from the ground). What are th (a) velcity , and (b) acceleration of the stone at t = 11 s ? (Neglect air resistance).

A. 22.4 m/s at an angle of $\frac{\tan^{-1}1}{2}$ with the horizontal $10m/s^2$ vertically downwards

B. 22.4 m/s at an angle of $\frac{\tan^{-1} 1}{2}$ with the vertical , $10m / s^2$ vertically downwards

C. $10m / s^2$ at an angle of $\frac{\tan^{-1} 1}{2}$ with the horizontal,22.4 m/s vertically downwards

D. $10m / s^2$ at an angle of $\frac{\tan^{-1} 1}{2}$ with the horizontal,22.4 m/s vertically downwards

Answer: A

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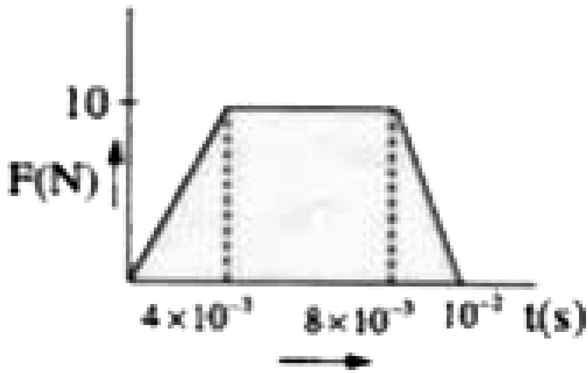
4. A particle of mass 70 g, moving at 50 cm/s , is acted upon by a variable force opposite to its direction of motion. The force F is shown as a function of time t



(a) its speed will be 50 cm/s after the force stops acting

(b) its direction of motion will reverse

(c) its average acceleration will be $1 m / s^2$ during the interval in which the force acts

its average acceleration will be $10 m / s^2$ during the interval in which the force acts

A. c, d are correct

B. b, c are true

C. a, b are true

D. a, c are true

Answer: C

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5. A ball of mass 400 gm is dropped from a height of 5m. A boy on the ground hits the ball vertically upwards with a bat with an average force of 100N so that it attains a vertical height of 20m. Find the time for which the ball remains in contact with the bat

A. 0.12 s

B. 0.24 s

C. 0.36 s

D. 0.48 s

Answer: A

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6. A batsman deflects a ball by an angle of 60° without changing its initial speed of 20 ms^{-1}. what is the impulse imparted to the ball if its mass is 0.15 kg?

A. 9 Js

B. 6 J s

C. 3 Js

D. 1 Js

Answer: C

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7. A body of mass 5 kg is at rest. Three force $F_1 = 10N$ due North $F_2 = 10N$ along East and $F_3 = 10\sqrt{2}N$ along N-W act on it simultaneously. The acceleration produced in the body is,

A. $4ms^{-2}$ along North

B. $2ms^{-2}$ along North

C. $4ms^{-2}$ along East

D. $2ms^{2}$ along East

Answer: A

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8. The momentum of a body in two perpendicular direction at any time 't' are given by $P_x = 2t^2 + 6$ and $P_y = \frac{3t^2}{2} + 3$. The force acting on the body at t= 2 sec is

A. 5 units

B. 2 units

C. 10 units

D. 15 units

Answer: C

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9. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - 2 \times 10^5 t$, where F is in newton and t in second. The force on the bullet becomes zero as soon as it leaves the barrel. What is the impulse imparted to the bullet?

A. 9 Ns

B. Zero

C. 0.9 Ns

D. 1.8 Ns

Answer: C

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10. A body of mass 5kg starts from the origin with an initial velocity of $\overline{U} = (30i + 40j)m/s$. A constant force of $F = \left(-\hat{i} - 5\hat{j}\right)N$ acts on the body . Find the time in which they- component of the velocity becomes zero .

A. 5 s

B. 20 s

C. 40 s

D. 80 s

Answer: C

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11. A 15Kg mass is accelerated from rest with a force of 100N. As it moves faster, friction and air resistance create an oppositely directed retarding force given by $F_B = A + BV$.

where $A = 25N$ and $B = 0.5\frac{N}{m/s}$.

At what velocity m/s does the acceleration equal to one half of the initial acceleration ?

A. $25ms^{-1}$

B. $50ms^{-1}$

C. $75ms^{-1}$

D. $100ms^{-1}$

Answer: B

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12. A cart loaded with sand moves along a horizontal floor due to a constant force F coinciding in direction with cart's velocity vector. In the process, the sand spills through a hole in the bottom with a constant rate $\mu kg / s$. Find the acceleration and velocity of the cart at the moment t, if at the initial moment $t = 0$ the cart with loaded sand had mass m_0 and its velocity was equal to zero. Friction is to be neglected.

A. $\frac{F}{m_0 - \mu t}$

B. $\dfrac{m_0 - \mu t}{F}$

C. $\dfrac{m_0 + \mu t}{F}$

D. $\dfrac{F}{m_0 + \mu t}$

Answer: A

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13. Two billiard balls each of mass 0.05 kg moving in opposite direction with speed $6ms^{-1}$ collide and rebound with the same speed . What is the impulse imparted in each ball due to the other ?

A. $0.5kgm/s$

B. $0.4kgm/s$

C. $1.2kgm/s$

D. $0.6kg/s$

Answer: D

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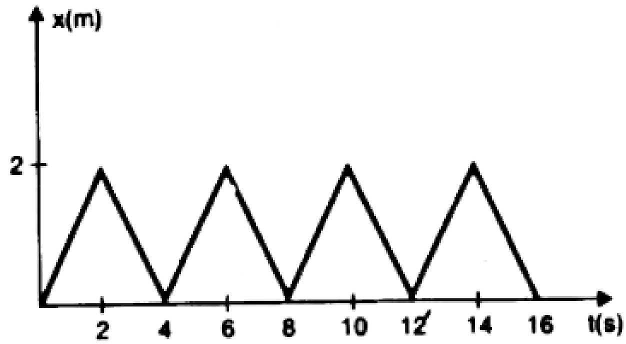
14. Figure 5.17 shows the position-time graph of a body of mass 0.04 kg . Suggest suitable physical context for this motion. What is the time between two consecutive impulses received by the body ? What is the magnitude of each impulse ?



A. $4\sec, 4 \times 10^{-4} kgm / s$

B. $2\sec, 8 \times 10^{-4} kgm / s$

C. $6\sec, 4 \times 10^{-4} kgm / s$

D. $8\sec, 8 \times 10^{-4} kgm / s$

Answer: B

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15. The driver of a three-wheeler moving with a speed of 36 km/h sees a child standing in the middle of the road and brings his vehicle to rest in 4.0 s just in time to save the child. What is the average retarding force on the vehicle ? The mass of the three-wheeler is 400 kg and the mass of the driver is 65 kg.

A. 1000 N

B. 1162 N

C. 4650 N

D. 465 N

Answer: B

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16. If the average velocity of a body moving with uniform acceleration under the action of a force is "v" and the impulse it receives during a displacement of "s" is "I", the constant force acting on the body is given by

A. $\dfrac{I \times v}{2s}$

B. $\dfrac{2I \times v}{s}$

C. $\dfrac{I \times v}{s}$

D. $\dfrac{I \times s}{v}$

Answer: C

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17. Five persons A, B, C, D & E are pulling a cart of mass 100kg on a smooth surface and cart is moving with acceleration $3m/s^2$ in east direction. When person A' stops pulling, it moves with acceleration $1m/s^2$in the west direction. When person 'B' stops pulling, it moves with accele-ration $24m/s^2$ in the north direction. The magnitude of acceleration of the cart when only A & B pull the cart keeping their directions same as the old direction is

A. $26m / s^2$

B. $3\sqrt{71}m / s^2$

C. $25m / s^2$

D. $30m / s^2$

Answer: C

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18. A box is put on a scale which is adjusted to read zero, when the box is empty. A stream of pebbles is then poured into the base from a height h above its bottom at a rate of n pebbles/s. Each pebble has a mass m. If the pebbles collide with the box such that they immediately come to rest after collision, then the scale reading at time t after the pebbles begin to fill the box is [neglect piling up of pebbles]

A. $mn\{\sqrt{2gh}) + gt\}$

B. $\left\{\sqrt{(2gh) + gt}\right\}$

C. $\dfrac{\left\{\sqrt{(2gh) + gt}\right\}}{mn}$

D. $mn\{(2gh) + gt\}$

Answer: A

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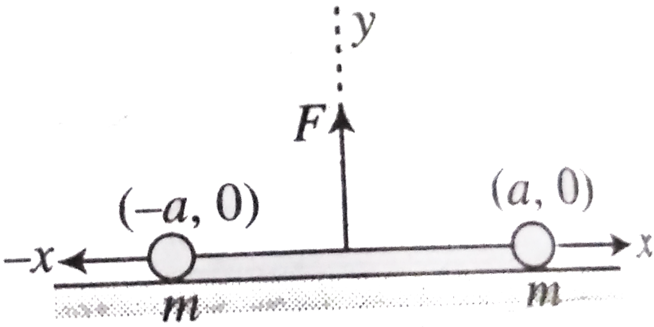
19. Two masses each equal to m are lying on x-axis at $(-a, 0)(+a, 0)$ respectively as shown in figure They are connected by a light string A force F is applied at the origin along vertical direction As a result the masses move toward each other without loosing contact with ground What is the acceleration of each mass? Assume the instantaneous position of the masses as$(-x, 0)$and $(x, 0)$



A. $\dfrac{F}{m}\dfrac{x}{\sqrt{a^2-x^2}}$

B. $\dfrac{F}{2m}\dfrac{x}{\sqrt{a^2-x^2}}$

C. $\dfrac{2F}{m}\dfrac{x}{\sqrt{a^2-x^2}}$

D. $\dfrac{2F}{m}\dfrac{\sqrt{a^2-x^2}}{x}$

Answer: B

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20. Water is flowing at a speed of $1.5 ms^{-1}$ through a horizontal tube of cross-sectional area $10^{-2} m^2$ and you are trying to stop the flow by your palm. Assuming that the water stops immediately after hitting the palm, the minimum force that you must exert should be (density of water = $10^3 kgm^{-3}$).

A. 15 N

B. 22.5 N

C. 33.7 N

D. 45 N

Answer: B

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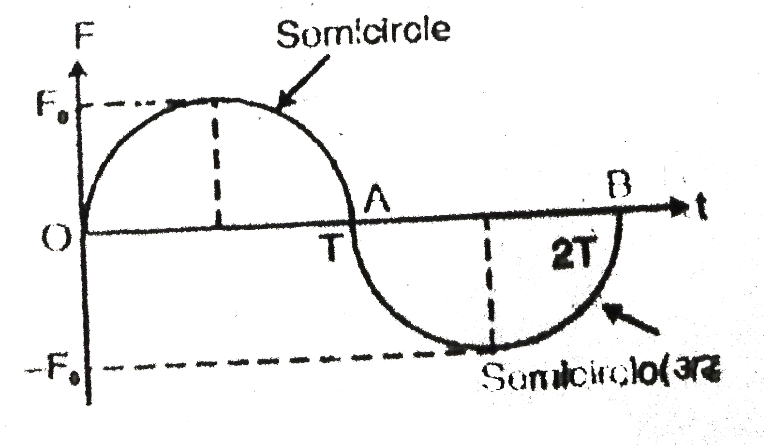
21. A unidirectional force F varying with time t as shown in the figure acts for a short duration 2T on a particle which is initially at rest. Then the velocity acquired by the body is:



A. $\dfrac{\pi F_0 T}{4m}$

B. $\dfrac{\pi F_0 T}{2m}$

C. $\dfrac{F_0 T}{4m}$

D. zero

Answer: D

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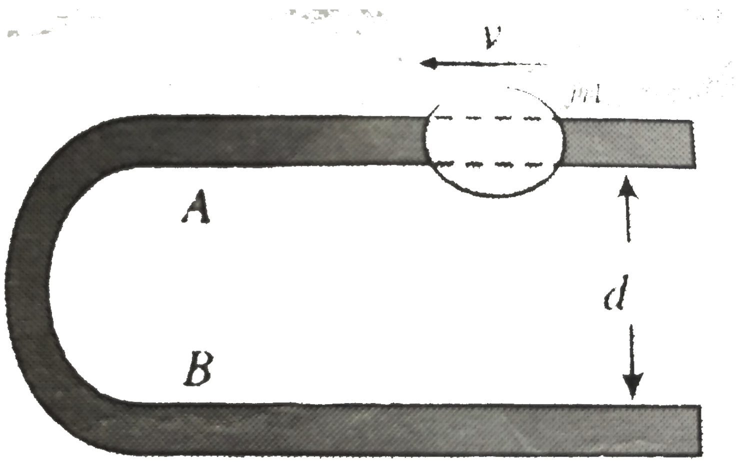
22. A U-shaped smooth wire has a semi-circular bending between A and B as shown in fig. A bead of mass m moving with uniform speed v through the wire enters the semiculcular bent at A and leaves at B. Find the average force exerted by the bead on the part AB of the wire.



A. 0

B. $\dfrac{4mv^2}{\pi d}$

C. $\dfrac{2mv^2}{\pi d}$

D. $\dfrac{mv^2}{\pi d}$

Answer: B

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23. Two particles of mases m_1 and m_2 in projectile motion have velocitie $\overrightarrow{v}_1$ and $\overrightarrow{v}_2$, respectively at time $t = 0$. they collide at time

t_0. Their velocities become $\vec{v}'_1$ and $\vec{v}'_2$ at time $2t_0$ while still moving in air. The value of

$$\left|\left(m_1\vec{v}'_1 + m_2\vec{v}'_2\right)\right| - \left|\left(m_1\vec{v}_1 + m_2\vec{v}_2\right)\right|$$

is

A. zero

B. $(m_1 + m_2)gt_0$

C. $2(m_1 + m_2)gt_0$

D. $\frac{1}{2}(m_1 + m_2)gt_0$

Answer: C

Watch Video Solution

24. A bomb falling freely bursts after 10 sec. ($g = 10ms^2$) into two fragments of masses in the ratio of 2:1. The velocity of heavier fragment immediately after the explosion is $200ms^{-1}$ vertically downwards. The velocity of the lighter fragment immediately after the explosion is

A. $50ms^{-1}$ upward

B. $75ms^{-1}$ upward

C. $100ms^{-1}$ upward

D. $400ms^{-1}$ upward

Answer: C

Watch Video Solution

25. An object initially at rest explodes into three equal fragments A, B and C.The momentum of A is $p\hat{i}$ and that of B is $\sqrt{3}p\hat{j}$ where p is $a + ve$ number. The momentum of C will be

A. $(1+\sqrt{3})$ P in a direction making 120°

with that of A

B. $(1+\sqrt{3})$ P in a direction making 150°

with that of B

C. $2P$ in a direction making 150° with that

of A

D. $2P$ in a direction making 150° with that

of B

Answer: D

Watch Video Solution

26. A shell of mass m is fired from a cannon at angle q to horizontal with a velocity V.The shell at the heighest point breaks into two fragments having masses in the ratio 2:3. The lighter fragment has a velocity zero immediately after explosion and falls vertically downward. the velocity of the other fragment just after explosion is

A. $5V \cos q$

B. $3V \cos q$

C. $\frac{3}{5}v\cos q$

D. $\frac{5}{3}v\cos q$

Answer: D

Watch Video Solution

27. A 500kg boat has an initial speed of $10ms^{-1}$ as it passes under a bridge. At that instant a 50 kg man jumps straight down into the boat from the bridge. The speed of the boat after the man and boat attain a common speed is

A. $\frac{100}{11} ms^{-1}$

B. $\frac{10}{11} ms^{-1}$

C. $\frac{50}{11} ms^{-1}$

D. $\frac{5}{11} ms^{-1}$

Answer: A

Watch Video Solution

28. A railway flat car, whose mass together with the artillery gun is M, moves at a speed V. The gun barrel makes an angle with the horizontal. A shell of mass m leaves the barrel at a speed v, relative to the barrel. The speed of the flat car in order that it may stop after the firing is

A. $\dfrac{mv\cos\alpha}{M-m}$

B. $\dfrac{mv}{M+m}$

C. $(M+m)v\cos\alpha$

D. $\frac{Mv\cos\alpha}{M+m}$

Answer: A

Watch Video Solution

29. A machine gun is mounted on a 200kg vehicle on a horizontal smooth road (friction negligible). The gun fires 10 bullets $/$s with a velocity of $500ms^{-1}$. If the mass of each bullet be 10g, what is the acceleration produced in the vehicle ?

A. $0.25m/\sec^2, 100N$

B. $0.5m/\sec^2, 50N$

C. $0.25m/\sec^2, 50N$

D. $0.5m/\sec^2, 100N$

Answer: C

Watch Video Solution

30. A gun of mass M fires a bullet of mass m, with a Kinetic energy E. The total kinetic energy in the firing process is

A. $\left[\frac{m+M}{M}\right]E$

B. $\frac{[m+M]E}{m}$

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

D. $\left(\frac{m}{M+m}\right)E$

Answer: A

Watch Video Solution

31. A gun of mass M. fires a shell of mass m horizontally and the energy of explosion is such as would be sufficient to project the shell vertically to a height $'h'$. The recoil velocity of the gun is

A. $\sqrt{\frac{2m^2gh}{M(M+m)}}$

B. $\sqrt{\frac{2m^2gh}{m(M+m)}}$

C. $\sqrt{\frac{2Mgh}{(M+m)}}$

D. $\sqrt{\frac{2mgh}{(M+m)}}$

Answer: A

Watch Video Solution

32. Two spacemen A and B are floating is gravity free space with zero velocity relative to each other. "A" has a mass of 120 kg and "B" has a mass of 90kg which includes a 5 kg radio box. "B" throws the box towards "A" with a velocity of 2m/x and A catches it. The change in velocity of each one is

A. $v_A = 11.8cm/s, v_B = 8cm/s$

B. $v_A = 8cm/s, v_B = 11.8cm/s$

C. $v_A = 10cm/s, v_B = 10cm/s$

D. $v_A = 9cm/s, v_B = 12cm/s$

Answer: B

Watch Video Solution

33. The first & second stage of two stage rocket separately weigh 100 kg and 10 kg and contain 800kg and 90kg fuel respectively. If the exhaust velocity of gases is 2 km/sec then find velocity of rocket (nearly) $(\log_{10} 5 = 0.6990)$ (neglect gravity)

A. $7.8 \times 10^3 m / s$

B. $9.3 \times 10^3 m / s$

C. $2.4 \times 10^3 m / s$

D. $6.1 \times 10^3 m / s$

Answer: A

Watch Video Solution

34. A projectile of mass M is fired so that the horizontal range is 4 km. At the highest point the projectile explodes in two parts of masses

M/4 and 3M/4 respectively and the heavier part starts falling down vertically with zero initial speed. The horizontal range (distance form point of fring) of the lighter part is :

A. $16km$

B. $1km$

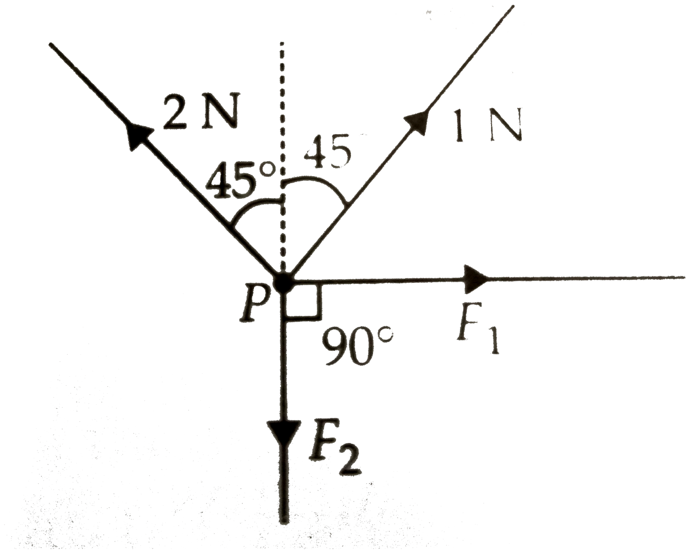
C. $10km$

D. $2km$

Answer: C

Watch Video Solution

35. There are four forces ,acting at a point P produced by strings as shown in figure. which is at rest. The forces F_1 and F_2 are



A. $\frac{1}{\sqrt{3}, \frac{3}{\sqrt{2}}}$

B. $1, 3$

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

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

Answer: A

Watch Video Solution

36. If 'O' is at equilibrium then the values of the tension T_1 and T_2 respectively.

A. 20N, 30N

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

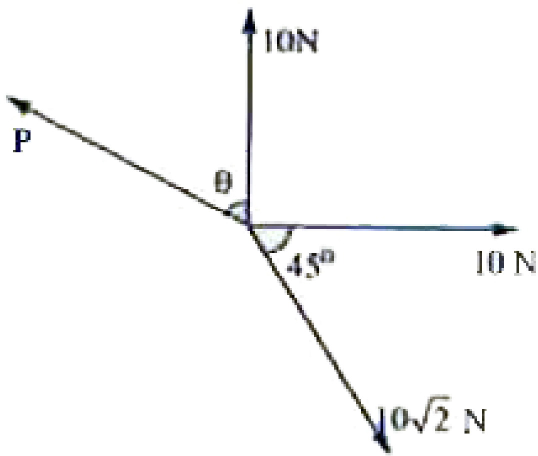
C. $20\sqrt{3}N, 20\sqrt{3}N$

D. $10N, 30N$

Answer: B

Watch Video Solution

37. If four forces act at a point 'O' as shown in the figure and if O is in equilibrium then the value of $'\theta'$ & 'P' are



A. $15^{\circ}, 10\sqrt{2}N$

B. $45^{\circ}, 10N$

C. $75^{\circ}, 10\sqrt{2}N$

D. $90^{\circ}, 20N$

Answer: D

Watch Video Solution

38. A block is kept on the floor of an elevator at rest. The elevator starts descending with an acceleration of 12 m/s^2. Find the displacement of the block during the first 0.2 s after the start. Take g=10 m/s^2.

A. 40 cm

B. 30 cm

C. 20 cm

D. 10 cm

Answer: C

Watch Video Solution

39. The displacement of a body is given by $s = \frac{1}{2}gt^2$ where g is acceleration due to gravity. The velocity of the body at any time t is

A. Both A & B are true

B. A is true & B is false

C. A is false & B is true

D. Both A & B are false

Answer: A

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40. The maximum tension a rope can withstand is 60 kg.wt. The ratio of maximum acceleration with which two boys of masses 20 kg and 30 kg can climb up the rope at the same time is

A. $1:2$

B. $2:1$

C. $2:3$

D. $3:2$

Answer: B

Watch Video Solution

41. A uniform rope of mass m hangs freely from a ceiling. A bird of mass M climbs up the rope with an acceleration a. The force exerted by the rope on the ceiling is

A. $Ma + mg$

B. $M(a + g) + mg$

C. $M(a + g)$

D. dependent on the position of bird on the rope

Answer: B

Watch Video Solution

42. Two bodies of masses 4 kg and 6 kg connected by means of a light string are lying on a smooth horizontal surface. A horizontal pulling force is applied on the lighter body. Two seconds later the string connecting the two masses is cut. After two more seconds if the velocity of the heavier mass is $2ms^{-1}$, the force initially applied is

A. $10N$

B. $25N$

C. $20N$

D. $40N$

Answer: A

Watch Video Solution

43. An empty plastic box of mass 5 kg is observed to accelerate up at the rate of $g/6$ when placed deep inside water. What mass of sand should be put inside the box so that it may accelerate dow at the rate of $g/6$?

A. $m/5$

B. $2m/5$

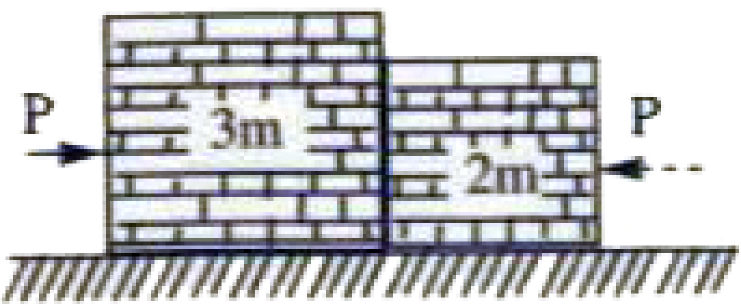
C. $3m/5$

D. $4m/5$

Answer: B

Watch Video Solution

44. Two blocks of masses '3m' and '2m' are in contact on a smooth table. A force P is first applied horizontally on block of mass '3 m' and then on mass '2m'. The contact forces between the two blocks in the two cases are in the ratio:



A. $1:2$

B. $2:3$

C. $3:2$

D. $5:3$

Answer: B

Watch Video Solution

45. In the arrangment shown in the figure, the ratio of tensions $T_1 : T_2 : T_3$ is:

A. $2:3:4$

B. $4:3:2$

C. $9:7:4$

D. $4:7:9$

Answer: D

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46. A monkey a mass 15 kg is climbing on a rope with one end fixed to the ceiling. If it wishes to go up with an acceleration of 1 m/s^2, how much force should it apply to the rope? If the rope is 5 m long and the monkey starts from rest, how much time will it take to reach the ceiling?

A. $120N$, $\sqrt{10}$ sec

B. $132N$, $\sqrt{10}$ sec

C. $153N$, $\sqrt{10}$ sec

D. $165N, \sqrt{10}$ sec

Answer: D

Watch Video Solution

47. A massless string passes around a frictionless pulley whose axis is horizontal. A monkey holds on to one end of the string and a body with the same mass as the monkey is attached to the other end. The monkey starts climbing upwards with an acceleration a. Then the other body moves

A. downward with an acceleration a

B. downward with a uniformly velocity

C. upward with an acceleration a

D. upward with an acceleration a/2

Answer: C

Watch Video Solution

48. A homogeneous rod of length L is acted upon by two forces F_1 and F_2 applied to its ends and directed opposite to each other. With what force F will the rod be stretched at the cross section at a distance l from the end where F_1 is applied?

A. $\frac{(F_2 - F_1)l}{L}$

B. $\frac{(F_2 - F_1)l}{L} + F_1$

C. $\frac{(F_2 + F_1)l}{2L}$

D. $\frac{(F_2^2 - F_1^2)l}{L}$

Answer: B

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49. A railway engine of mass 50 tons is pulling a wagon of mass 40 tons with a force of 4500N. The resistance force acting is 1N per ton. The tension in the coupling between the engine and the wagon is

A. 1600 N

B. 2000 N

C. 2500 N

D. 1500 N

Answer: B

Watch Video Solution

50. A chain consisting of 5 links each of mass 0.1 kg is lifted vertically up with a constant acceleration of $2.5 m / s^2$. The force of interaction between 1st and 2nd links as shown:

A. 6.15 N

B. 4.92 N

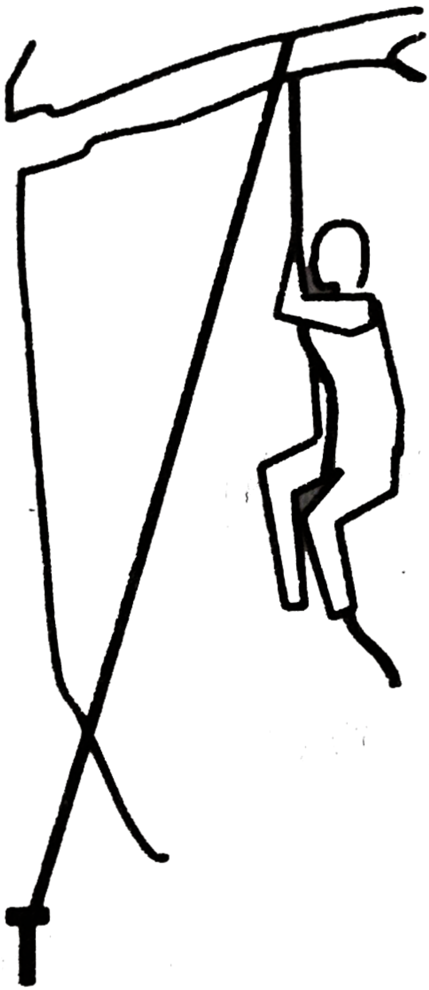
C. 9.84 N

D. 2.46 N

Answer: B

Watch Video Solution

51. A light rope fixed at one end of a wooden clamp on the ground passes over a tree branch and hangs on the other side. It makes an angle of 30^0 with the ground. A man weighing (60 kg) wants to climb up the rope. The wooden clamp can come out of the ground if an upward force greater than 360 N is applied it. Find the maximum acceleration in the upward direction with which the man can climb safely. Neglect friction at the tree branch. Take $g = 10\frac{m}{s^2}$



A. $1m / s$

B. $2m/s^2$

C. $3m/s^2$

D. $4m/s^2$

Answer: B

Watch Video Solution

52. Two masses 5 kg and 3 kg are suspended from the ends of an unstretchable light string passing over a frictionless pulley. When the masses are released, the thrust on the pulley is (g = $10ms^{-2}$)

A. $80N$

B. $37.5N$

C. $150N$

D. $75N$

Answer: D

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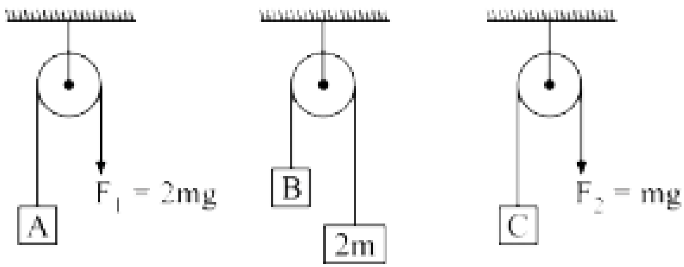
53. In the figure, blocks A, B and C of mass m each have acceleration a1, a2 and a3 respectively. F_1 and F_2 are external forces of magnitudes 2mg and mg respectively, then :



A. $a_1 = a_2 = a_3$

B. $a_1 > a_3 > a_2$

C. $a_1 = a_2, a_2 > a_3$

D. $a_1 > a_2, a_2 = a_3$

Answer: B

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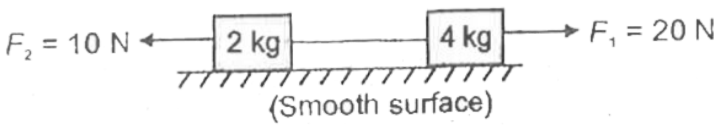
54. The tension in the string connected between blocks is



A. $\dfrac{15g}{4}$

B. $\dfrac{5g}{8}$

C. $\frac{10g}{3}$

D. $\frac{20g}{3}$

Answer: A

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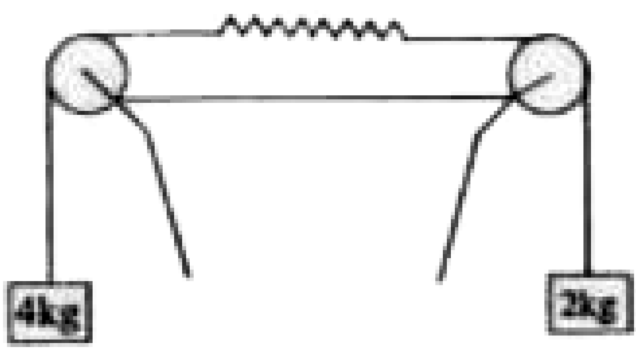
55. The reading in the spring balance is



A. $2.6kgwt$

B. $2kgwt$

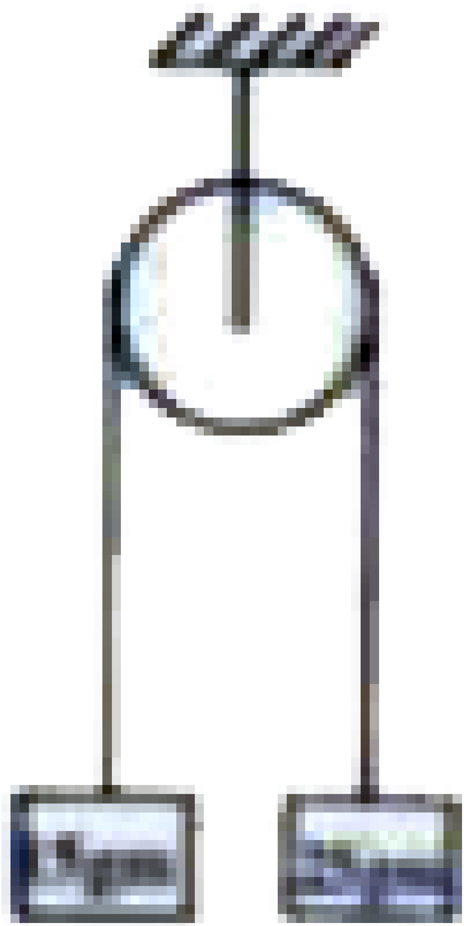
C. $6kgwt$

D. $4.3kgwt$

Answer: A

Watch Video Solution

56. Two bodies of masses 15gm and 25gm are connected by means of a string of length 40cm and mass 10 gm. The string is made to pass over a smooth massless pulley. Initially the two bodies are kept at the same level and released. By the time the heavier mass descends by 10cm, the acceleration of the system:



A. Remain constant

B. Decreases

C. Increases by a factor 1.5

D. increases by a factor 3

Answer: C

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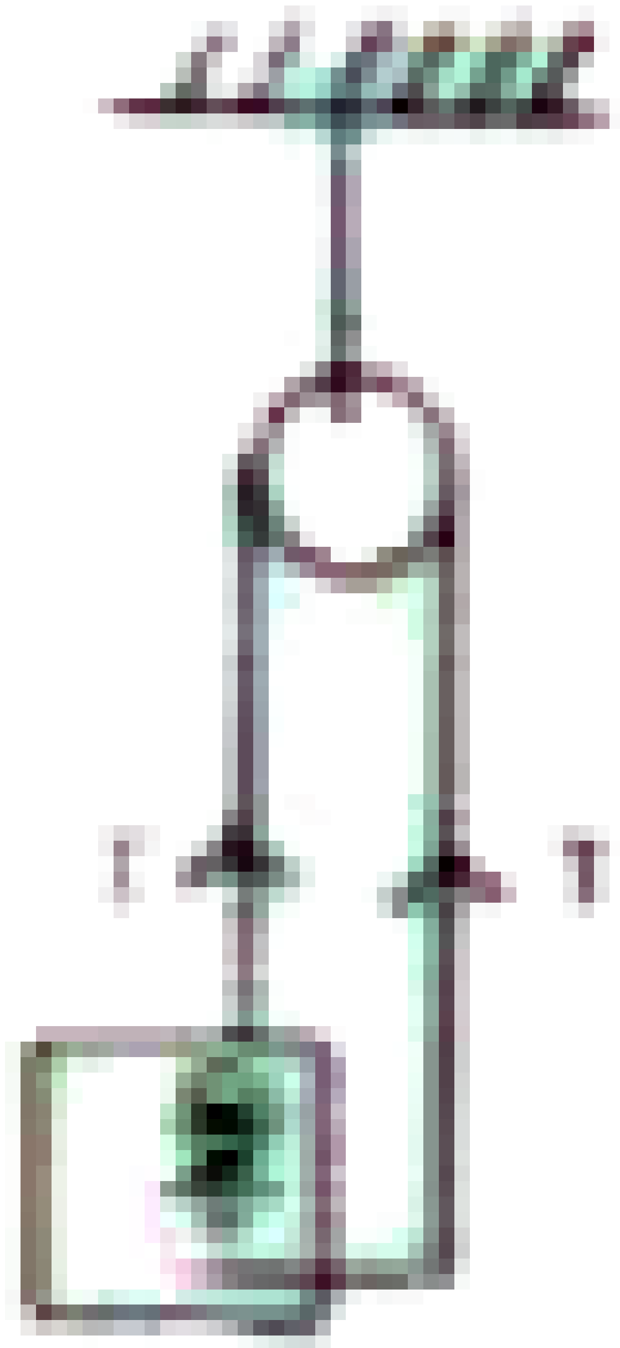
57. A man of mass 60 kg is standing on a weighing machine kept in a box of mass 30 kg as shown in the diagram, If the man manages to keep the box stationary find the reading of the weighing machine.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T

A. 150 N

B. 600 N

C. 300 N

D. 400 N

Answer: A

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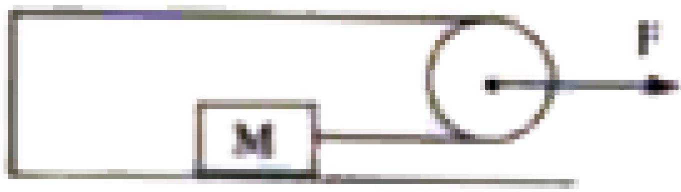
58. In the arrangement shown in the figure, the acceleration of the pulley is, (Ignore friction)



A. $\frac{F}{4M}$

B. $\frac{F}{M}$

C. Zero

D. $\frac{F}{2M}$

Answer: A

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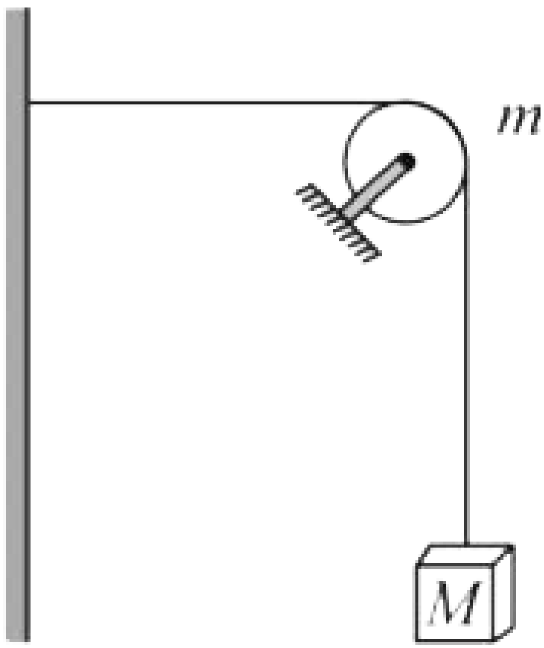
59. A string of negligible mass going over a clamped pulley of mass m supports a block of M as shown in the figure. the force on the pulley by the clamp is given by:



A. $\sqrt{2}Mg$

B. $\sqrt{2}mg$

C. $g\sqrt{(M+m)^2+m^2}$

D. $g\sqrt{(M+m)^2+M^2}$

Answer: D

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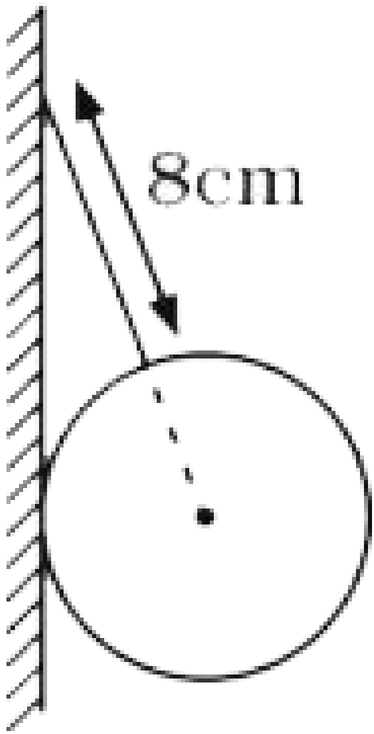
60. A uniform sphere of weight W and radius 5 cm is being held by string as shown in the figure. The tension in the string will be



A. $12\frac{w}{5}$

B. $5\frac{w}{12}$

C. $13\frac{w}{5}$

D. $13\frac{w}{12}$

Answer: D

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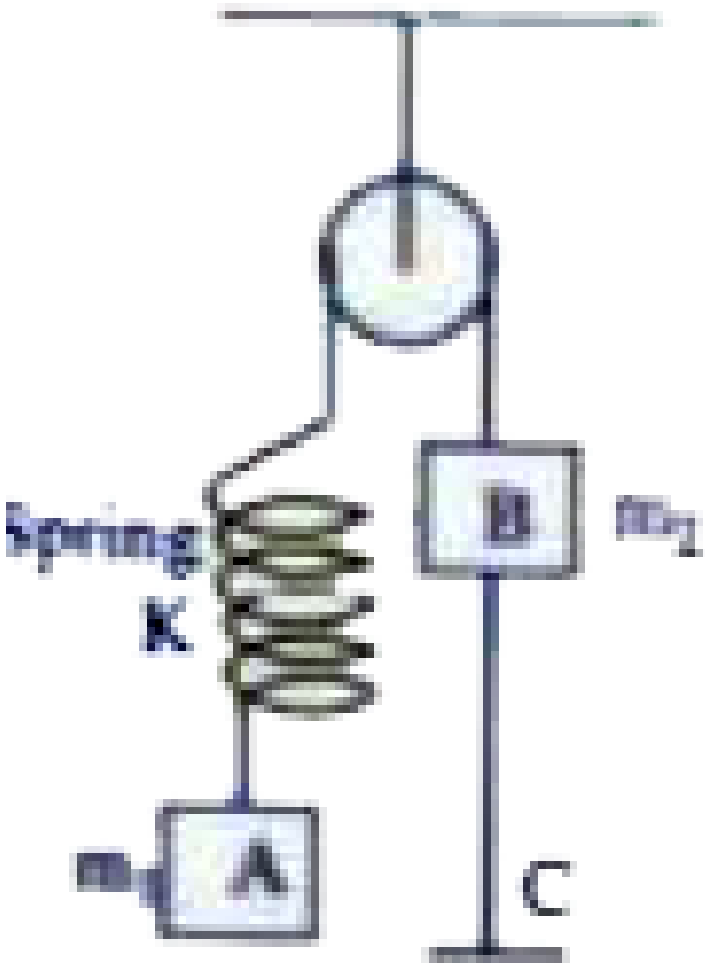
61. In the system shown in figure $m_1 > m_2$.

System is held at rest by thread BC. Just after the thread BC is burnt.



A. acceleration of m_1 will be equal to zero

B. acceleration of m_2 will be downwards

C. magnitude of acceleration of two blocks will be non-zero and unequal

D. magnitude of acceleration of both the blocks will be $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)g$

Answer: A

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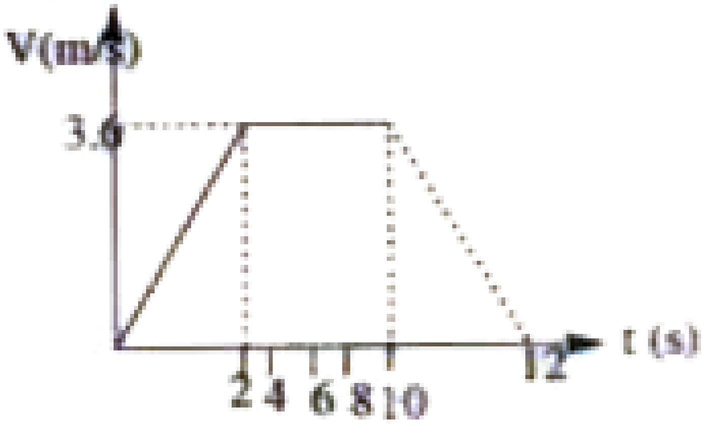
62. A lift is going up, the total mass of the lift and the passengers is 1500kg. The variation in the speed of lift is shown in fig. Then the tension in the rope at t = 1 s will be:



A. $17400 N$

B. $14700 N$

C. $12000 N$

D. $10000 N$

Answer: A

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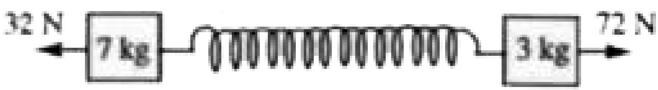
63. Two blocks of masses 7 kg and 3 kg are connected by a spring of stiffness $1000 N m^{-1}$ and placed on a smooth horizontal surface. They are acted by horizontal forces of 72 N and 32 N in opposite directions as shown in the figure. When accelerations of the blocks are equal and constant, the extension of the spring is



A. 4 cm

B. 5 cm

C. 6 cm

D. 8 cm

Answer: C

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64. A block of 2 kg is suspended from the ceiling through a massless spring of spring constant k=100 N/m. What is the elongation of the spring? If another 1 kg is added to the block, what would be the further elongation?

A. 0.2 m, 0.1 m

B. 0.1 m, 0.2 m

C. 0.3m , 0.1 m

D. 0.1 m, 0.3 m

Answer: A

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65. A body is placed on a smooth inclined plane of inclination 1 in x. The horizontal acceleration to be given to the inclined plane so that the body on it remains at rest with respect to inclined plane is

A. $g\sqrt{x^2 - 1}$

B. $\dfrac{g\sqrt{x^2 - 1}}{x}$

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

D. $\dfrac{g}{\sqrt{x^2 - 1}}$

Answer: D

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66. A block is placed on a smooth inclined plane at an angle $'\theta'$ to the horizontal. The acceleration must the plane be moved horizontally so that the block to fall freely is

A. $g\tan q$

B. $g\cot q$

C. $g\sin q$

D. $g\cos q$

Answer: B

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67. For what value of 'a' block slides up the Plane with an acceleration 'g' relative to the inclined plane.

A. $g\cos q$

B. $g\sin q$

C. $g\cot q$

D. $g(\sec q+\tan q)$

Answer: D

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68. A pendulum is hanging from the ceiling of a cage. When the cage is moving up with certain acceleration and when it is moving down with the same acceleration, the tensions in the string are T_1 and T_2 respectively. When the cage moves horizontally with the same acceleration, the tension in the string is,

A. $\sqrt{2\left(T_1^2 + T_1^2\right)}$

B. $\sqrt{\dfrac{T_1^2 + T_2^2}{2}}$

C. $\sqrt{2\left(T_1^2 - T_1^2\right)}$

D. $\sqrt{T_1^2 + T_1^2}$

Answer: B

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69. A train is moving forward at a velocity of 2.0m/s. At the instant the train begins to accelerate at $0.80m/s^2$ a passenger drops a coin which takes 0.50s to fall to the floor. Relative to a spot on the floor directly under the coin at release, it lands.

A. 1.1 m towards the rear of the train

B. 1.0 m towards the rear of the train

C. 0.10 m towards the rear of the train

D. 0.90 m towards towards the front of the train

Answer: C

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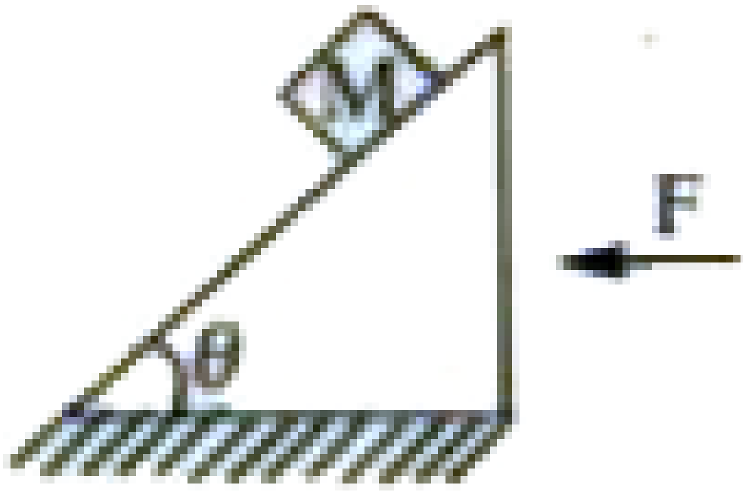
70. In given figure all surfaces are smooth. The ratio of forces exerted by the wedge on mass 'M' when force 'F' is not applied and when 'F' is applied such that 'M' is at rest with respect to wedge is:



A. 1

B. $1:2$

C. $\sec^2\theta$

D. $\cos^2\theta$

Answer: D

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71. A car is moving in a circular horizontal track of radius 10 m with a constant speed of $10ms^{-1}$. A plumb bob is suspended from the roof of the car by a light rigid rod. The angle made by the rod with the vertical is:

A. zero

B. 30°

C. 45°

D. 60°

Answer: C

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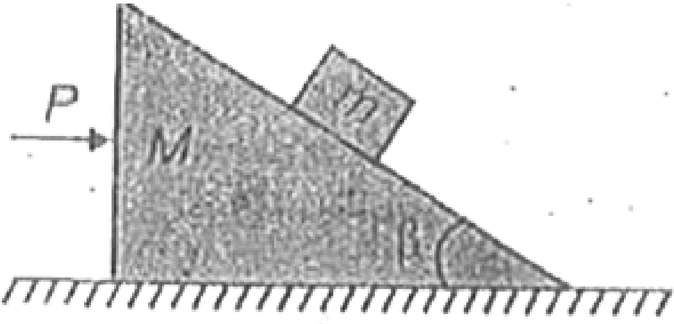
72. A block of mass m, is kept on a wedge of mass M, as shown in figure such that mass m remains stationary w.r.t. wedge. The magnitude of force P is



A. $(M+m)g\tan\beta$

B. $g\tan\beta$

C. $mg\cos\beta$

D. $(M+m)g\operatorname{cosec}\beta$

Answer: A

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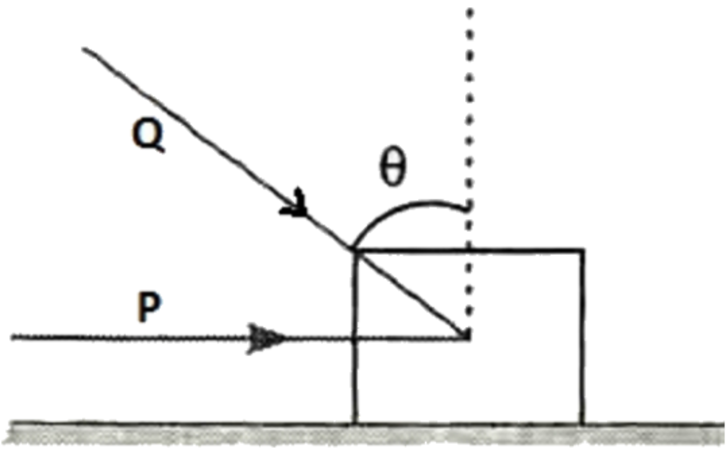
73. A block of mass m lying on a rough horizontal plane is acted upon by a horizontal force P and another force Q inclined at an angle θ to the vertical. The block will remain in equilibrium if the coefficient of friction between it and the surface is



A. $\dfrac{(P + Q\sin\theta)}{(mg + Q\cos\theta)}$

B. $\dfrac{P\cos\theta + Q}{mg - Q\sin\theta})$

C. $\left(\dfrac{P + Q\cos\theta}{mg + Q\sin\theta}\right)$

D. $\left(\dfrac{P\sin\theta - Q}{mg - Q\cos\theta}\right)$

Answer: A

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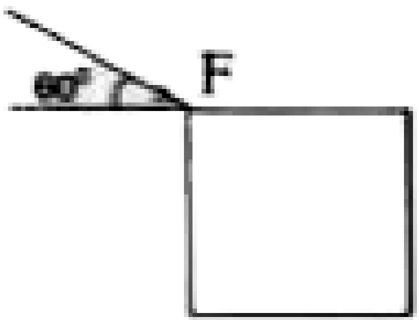
74. A block of mass $\sqrt{3}kg$ is kept on a frictional surface with $\mu = \dfrac{1}{2\sqrt{3}}$. The minimum force to be applied as shown to move the block is



A. 5 N

B. 20 N

C. 10 N

D. 20/3 N

Answer: B

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75. A cubical block of mass 'm' rests on rough horizontal surface. μ is coefficient of static friction between block and the surface. A force "mg" acting on cube at an angle " θ" with vertical side of cube pulls the block. If the block is to be pulled along the surface then the value of $\cot(\theta/2)$ is

A. less than μ

B. greater than μ

C. equal to μ

D. $\neg dependenton$mu`

Answer: B

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76. Two blocks of masses 3kg and 2kg are placed beside each other in contact with each other on a rough horizontal surface. A horizontal force of 20N is applied on 3kg. The coefficient of friction between blocks and the surface is 0.1 and $g = 10ms^{-2}$. The force of contact between the two blocks is

A. 6 N

B. 8 N

C. 10 N

D. 12 N

Answer: B

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77. A suitcase is gently dropped on a conveyor belt moving at a velocity of $3ms^{-1}$. If the coefficient of friction between the belt and the suitcase is 0.5, the displacement of the suitcase relative to conveyor belt before the slipping between the two is stopped, is $(g = 10ms^{-2})$

A. 2.7 m

B. 1.8 m

C. 0.9 m

D. 1.2 m

Answer: C

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78. An aeroplane requires a speed of 72 kmph for a take off with 150m run on the ground. The mass of the plane is 1500kg and the coefficient of friction between the aeroplane and the ground is 0.4. Assuming that the aeroplane acceleration uniformly during take off, find the minimum force exerted by the engine of the aeroplane for take off.

A. 8500 N

B. 7880 N

C. 9000 N

D. 6500 N

Answer: B

Watch Video Solution

79. A block of mass'm' is placed on floor of a lift which is rough. The coefficient of friction between the block and the floor is μ . When the lift falls freely, the block is pulled horizontally on the lift floor. The force of friction is

A. $\mu m g$

B. zero

C. $\frac{1}{2} \mu m g$

D. $2 \mu m g$

Answer: B

Watch Video Solution

80. A block is gently placed on a conveyor belt moving horizontally with constant speed. After t = 4s, the velocity of the block becomes equal to the velocity of the belt. If the coefficient of friction between the block and the belt is $\mu = 0.2$, then the velocity of the conveyor belt is $\left(g = 10ms^{-2}\right)$

A. $2ms^{-1}$

B. $4ms^{-1}$

C. $64ms^{-1}$

D. $8ms^{-1}$

Answer: D

Watch Video Solution

81. A body of mass 8kg is in limiting equilibrium over an inclined plane of inclination 30°. If the inclination is made 60°, the minimum force required to prevent the body from sliding down is $(g = 10ms^{-2})$

A. 80 N

B. $\frac{80}{\sqrt{3}}N$

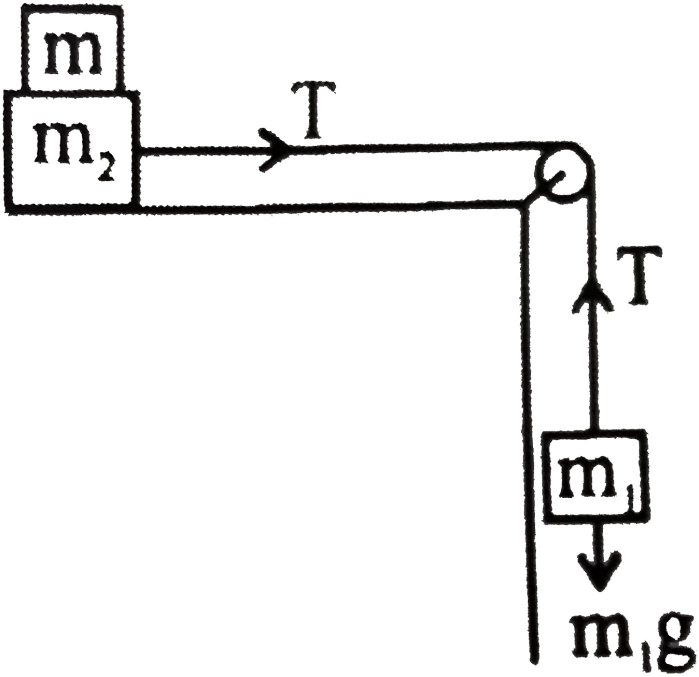
C. $\frac{40N}{\sqrt{3}}$

D. $40\sqrt{3}N$

Answer: B

Watch Video Solution

82. Two masses $m_1 = 5kg$ and $m_2 = 10kg$, connected by an inextensible string over a frictionless pulley, are moving as shown in the figure. The coefficient of friction of horizontal surface is 0.15. The minimum weitght m that should be put on top of m_2 to stop the motion is :-



A. 18.3 kg

B. 27.3 kg

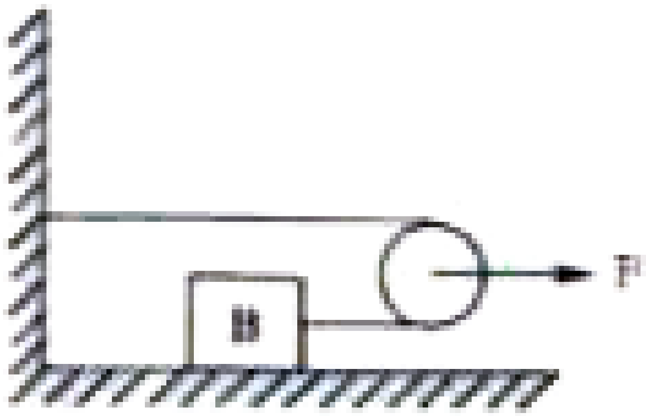
C. 43.3 kg

D. 10.3 kg

Answer: B

Watch Video Solution

83. A block B is pulled by a force of 18 N applied to a light pulley as shown in the figure. If the coefficient of friction is 0.4 and the acceleration of the block is 0.5 ms^{-2} , the mass of the block is $\left(g = 10m / s^{2}\right)$



A. 1kg

B. 2 kg

C. 3 kg

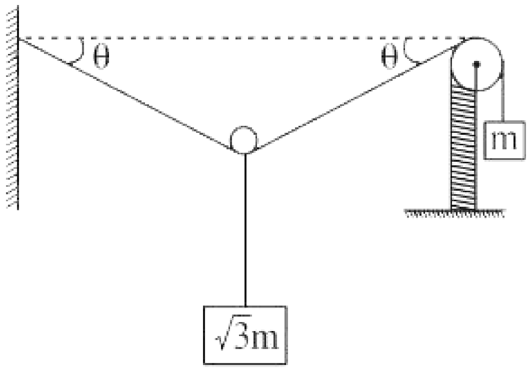
D. 1.5 kg

Answer: B

Watch Video Solution

84. The system is in equilibrium. Find the angle

θ



A. 2kg

B. 4 kg

C. 3 kg

D. 6 kg

Answer: A

Watch Video Solution

85. A boy is sitting on a horizontal platform in the shape of a disc at a distance of 5m from its centre. The boy begins to slip when the speed of wheel exceeds 10 rpm. The coefficient of friction between the boy and platform is:

$(g = 10 ms^{-2})$

A. $\pi^2 / 6$

B. $\pi^2 / 18$

C. $\pi / 6$

D. $\pi / 2$

Answer: B

Watch Video Solution

86. An aeroplane of mass M requires a speed v for take off. The length of runway is s and the coefficient of friction between the tyres and the ground is μ. Assuming that the plane accelerates uniformly during the take-off, the minimum force required by the engine of the plane for take off is:

A. $M\left(\frac{v^2}{2s}+\mu g\right)$

B. $M\left(\frac{v^2}{2s}-\mu g\right)$

C. $M\left(\frac{v^2}{s}+2\mu g\right)$

D. $M\left(\frac{v^2}{s} - 2\mu g\right)$

Answer: A

Watch Video Solution

87. A vehicle of mass 500 kg is moving with a velocity of $15ms^{-1}$. It is brought to rest by a retarding force. Find the distance moved by the vehicle before coming to rest, if the sliding friction between the tyres and the road is 3000N.

A. $18.75m$

B. $9.2m$

C. $10.5m$

D. $16.8m$

Answer: A

Watch Video Solution

88. A wooden block of mass M resting on a rough horizontal surface is pulled with a force T at an angle q to the horizontal. If m is coefficient of kinetic friction between the block and the surface, the acceleration of the block is

A. $\dfrac{T\cos\theta}{M} - \mu g$

B. $\dfrac{T}{m}(\cos\theta - \sin\theta) - \mu g$

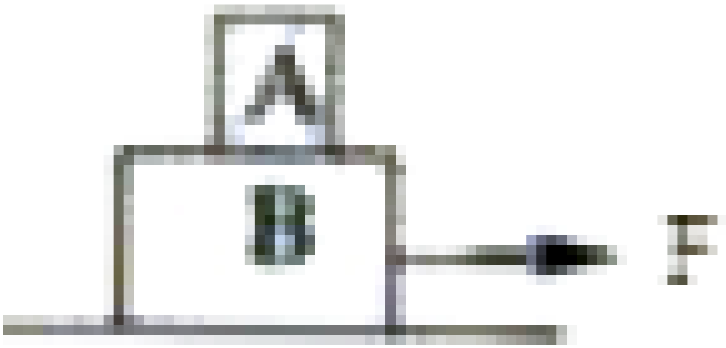
C. $\dfrac{T}{m}(\cos\theta - \mu\sin\theta) - \mu g$

D. $\dfrac{\mu T\cos\theta}{M} - \mu g$

Answer: C

Watch Video Solution

89. A 4 kg block A is placed at the top of 8 kg block B which rests on a smooth table. A just slips on B when a force of 20 N is applied on A. The maximum horizontal force F required to make both A & B move together is



A. 36 N

B. 5 N

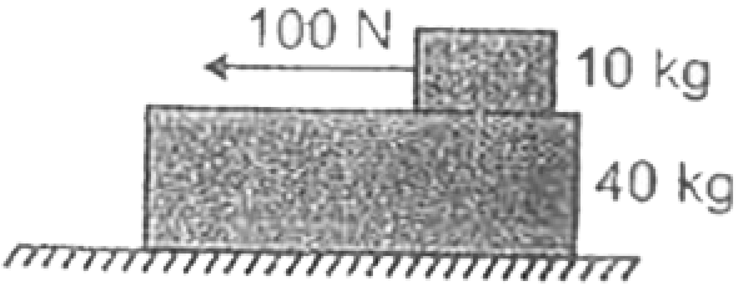
C. 40 N

D. 60 N

Answer: C

Watch Video Solution

90. A 40 kg slab rests on a frictionless floor. A 10 kg block rests on top of the slab. The coefficient of friction between the block and the slab is 0.40. The 10 kg block is acted upon by a horizontal force of 100 N. If $g = 10m/s^2$, the resulting acceleration of the slab will be



A. $3ms^{-2}$

B. $4ms^{-2}$

C. $1ms^{-2}$

D. $2ms^{-2}$

Answer: C

Watch Video Solution

91. A 2kg block is placed over a 4kg block and both are placed on a smooth horizontal surface. The coefficient of friction between the blocks is 0.20. The acceleration of the two blocks if a horizontal force of 12N is applied to the lower block is $(g = 10ms^{-2})$

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

B. $2ms^{-2}, 1ms^{-2}$

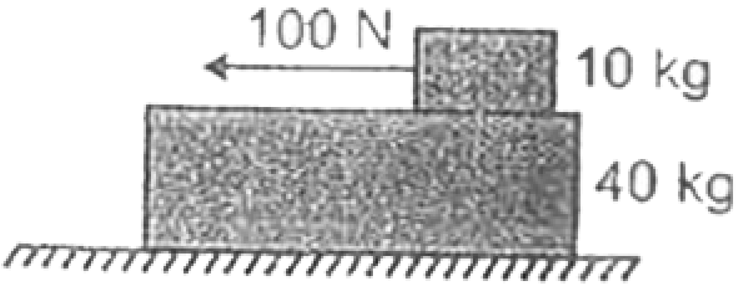
C. $3ms^{-2}, 1ms^{-2}$

D. $4ms^{-2}, 1ms^{-2}$

Answer: A

Watch Video Solution

92. A 40 kg slab rests on a frictionless floor. A 10 kg block rests on top of the slab. The coefficient of friction between the block and the slab is 0.40. The 10 kg block is acted upon by a horizontal force of 100 N. If $g = 10m/s^2$, the resulting acceleration of the slab will be



A. $0.98ms^{-2}$

B. $1.47ms^{-2}$

C. $1.52ms^{-2}$

D. $6.1ms^{2}$

Answer: A

Watch Video Solution

93. A block A of mass $2kg$ rests on another block B of mass $8kg$ which rests on a horizontal floor. The coefficient of friction between A and B is 0.2 while that between B and floor is 0.5.When a horizontal floor F of $25N$ is applied on the block B the force of friction between A and B is

A. zero

B. $3.9N$

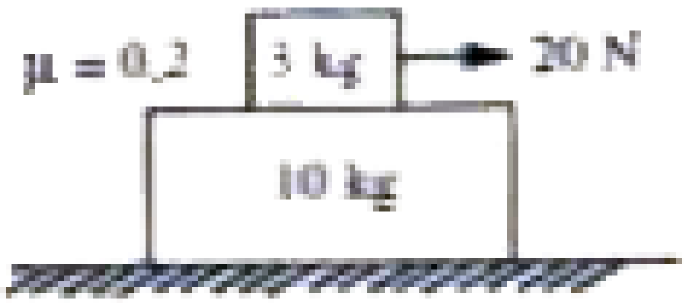
C. $5.0N$

D. $49.0N$

Answer: A

Watch Video Solution

94. A 3 kg block is placed over a 10 kg block and both are placed on a smooth horizontal surface. The coefficient of friction between the blocks is 0.2. If a horizontal force of 20 N is applied to 3 kg block, accelerations of the two blocks in ms^{-2} are $(g = 10ms^{-2})$



A. $\frac{13}{4}, 0.6$

B. $\frac{14}{3}, 3$

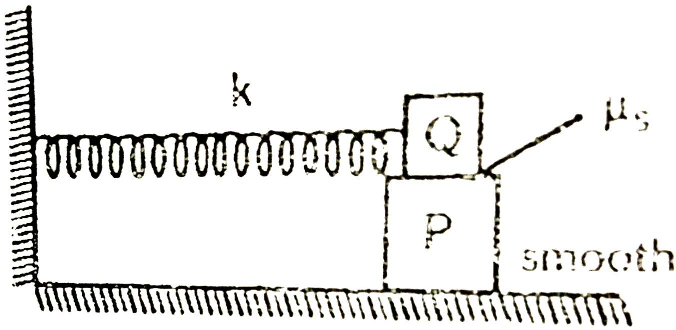
C. $\frac{13}{4}, 3$

D. $\frac{14}{3}, 0.6$

Answer: D

Watch Video Solution

95. A block P of mass is placed on a fricationless horizontal surface. Another block Q of same mass is kept on P and connected to the wall with the help of a spring of spring constant k as shown in the figure. μ_s is the coefficient of frication between P and Q. The block move together performing SHM of the amplitude A. The maximum value of the frication force between P and Q is



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

B. KA

C. $\mu_s mg$

D. zero +

Answer: A

Watch Video Solution

96. A 4g bullet is fired horizontally with a speed of 300 m/s into 0.8kg block of wood at rest on a table and gets embedded in the block. If the coefficient of friction between the block and the table is 0.3, how far will the block slide approximately ?

A. 0.19 m

B. 0.569 m

C. 0.758 m

D. 0.379 m

Answer: D

Watch Video Solution

97. A car having a mass of 1000 kg is moving at a speed of 30 metres/sec. Brakes are applied to bring the car to rest. If the frictional force between the tyres and the road surface is 5000 newtons, the car will come to rest in seconds.

A. $d = 150, t = 5$

B. $d = 120, t = 8$

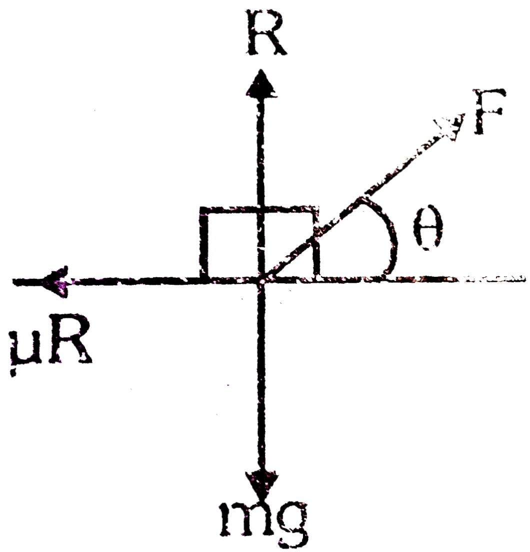
C. $d = 180, t = 6$

D. $d = 90, t = 6$

Answer: D

Watch Video Solution

98. A body of mass m rests on a horizontal floor with which it has a coefficient of static friction μ. It is desired to make the body move by applying a minimum possible force $\overrightarrow{F}$ as shown in the diagram. The values of θ and $F_{\min}$ shall be respectively equal to



A. $\theta = 0,\ F = \mu W$

B. $\theta = \tan^{-1}(\mu),\ F = \dfrac{\mu W}{\sqrt{1+\mu^2}}$

C. $\theta = \tan^{-1}\left(\dfrac{1}{\mu}\right),\ F = \dfrac{\mu W}{\sqrt{1+\mu^2}}$

D. $\theta = \tan^{-1}\left(\frac{\mu}{1+\mu}\right), F = \frac{\mu W}{1+\mu^2}$

Answer: B

Watch Video Solution

99. A block A of mass 4 kg is placed on another block B of mass 5 kg, and the block B rests on a smooth horizontal table. If the minimum force that can be applied on A so that both the blocks move together is 12N, the maximum force that can be applied on B for the blocks to move together will be:

A. 25 N

B. 30 N

C. 48 N

D. 27 N

Answer: D

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100. A particle of mass m is acted upon by a force F given by the emprical law $F = \frac{R}{t^2} v(t)$ If this law is to be tested experimentally by observing the motion starting from rest, the best way is to plot :

A. log v (t) given $\frac{1}{t}$

B. $v(t)$ against t^2

C. log v (t) given $\frac{1}{t^2}$

D. $\log v(t)$ against t

Answer: A

Watch Video Solution

101. A 70 kg man stands in contact against the inner wall of a hollow cylindrical drum of radius 3 m rotating about its vertical axis with 200 rev/min. The coefficient of friction between the wall and his clothing is 0.15 m What is the minimum rotational speed of the cylinder to enable the man to remain stuck to the wall (without falling) when the floor is suddenly removed ?

A. $\sqrt{g / \mu r}$

B. $g / \sqrt{\mu r}$

C. $\sqrt{\frac{\mu r}{g}}$

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

Answer: A

Watch Video Solution

102. A grinding machine whose wheel has a radius of $\frac{1}{\pi}$ is rotating at 2.5 rev/sec. A tool to be shar-pened is held against the wheel with a force of 40N. If the coefficient of friction between the tool and wheel is 0.2, power required is

A. 40 W

B. 4 W

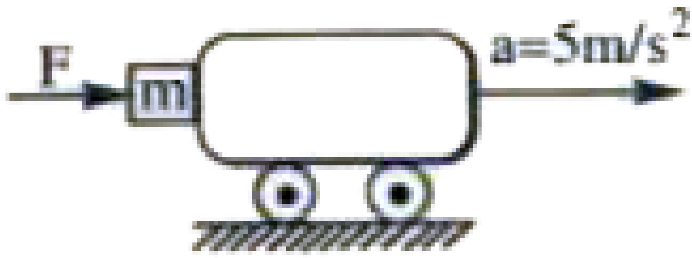
C. 8 W

D. 10 W

Answer: A

Watch Video Solution

103. In this figure the force should be applied on mass m = 5kg so that it just won't slip is (Given that car is moving with constant acceleration a = 5 m/s and $\mu = 0.4$



A. 170 N

B. 180 N

C. 250 N

D. 150 N

Answer: D

Watch Video Solution

104. A block sliding down a rough 45° inclined plane has half the velocity it would have had, the inclined plane been smooth. The coefficient of sliding friction between block and the inclined plane is

A. 0.5

B. 0.6

C. 0.8

D. 0.45

Answer: B

Watch Video Solution

105. A body is released from the top of an inclined plane of inclination (θ). fIt reaches the bottom with velocity (v), If keeping the length same the angle of inclination is doubled, what will be the velocity of the body on reaching the ground:-

A. v

B. $2v$

C. $(2\cos\theta)^{1/2}v$

D. $(2\sin\theta)^{1/2}v$

Answer: C

Watch Video Solution

106. A body is sliding down an inclined plane having coefficient of friction 1/3. If the normal reaction is three times that of the resultant downward force along the incline, the angle between the inclined plane and the horizontal is

A. $\tan^{-1}\left(\frac{1}{2}\right)$

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

C. $\tan^{-1}\left(\frac{2}{3}\right)$

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

Answer: C

Watch Video Solution

107. A box of mass $8kg$ placed on a rough inclined plane of inclination θ its downward motion can be prevented by applying an upward pull F and it can be made to slide upward appliying a force $2F$ .The coefficient of friction between the box and the inclined plane is

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

B. $3\tan\theta$

C. $\frac{1}{2}\tan\theta$

D. $2\tan\theta$

Answer: A

Watch Video Solution

108. A box of mass 4 Kg is placed on a rough inclined plane of inclination 60°. Its downward motion can be prevented by applying an upward pull F. And it can be made to slide upwards by applying a force 3F. The coefficient of friction between the box and inclined plane is

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

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

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

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

Answer: B

Watch Video Solution

109. A body is pushed up on a rough inclined plane making an angle 30° to the horizontal. If its time of ascent on the plane is half the time of its descent, find coefficient of friction between the body and the incined plane.

A. $\frac{\sqrt{3}}{5}$

B. $\sqrt{3/5}$

C. $\frac{3}{\sqrt{5}}$

D. $3/5$

Answer: A

Watch Video Solution

110. The upper half of an inclined plane with an angle of inclination theta, is smooth while the lower half is rough. A body starting from rest at the top of the inclined plane comes to rest at the bottom of the inclined plane. Then the coefficient of friction for the lower half is

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

B. $\mu = \tan\theta$

C. $\mu = \dfrac{2}{\tan\theta}$

D. $\mu = \dfrac{1}{\tan\theta}$

Answer: A

Watch Video Solution

111. A body is moving up an inclined plane of angle θ with an initial kinetic energy E. The coefficient of friction between the plane and body is μ. The work done against friction before the body comes to rest is

A. $\frac{\mu \cos \theta}{E \cos \theta + \sin \theta}$

B. $2\mu E \cos \theta$

C. $\frac{\mu E \cos \theta}{\mu \cos \theta - \sin \theta}$

D. $\frac{\mu E \cos \theta}{\mu \cos \theta + \sin \theta}$

Answer: D

Watch Video Solution

112. A block of mass M is pulled along a horizontal surface by applying a force at angle θ with the horizontal. The friction coefficient between the block and the surface is μ. If the block travels at a uniform velocity, find the work done by this applied force during a displacement d of the block.

A. $\dfrac{\mu mgd}{\cos\theta + \mu\sin\theta}$

B. $\dfrac{\mu mgd\cos\theta}{\cos\theta + \mu\sin\theta}$

C. $\dfrac{\mu mgd\sin\theta}{\cos\theta + \mu\sin\theta}$

D. $\dfrac{\mu g d \cos\theta}{\cos\theta - \mu\sin\theta}$

Answer: B

Watch Video Solution

113. A body is moving down along inclined plane of angle of inclination q. The coefficient of friction between the body and the plane varies as mu = 0.5x, where x is the distance moved down the plane. The body will have the maximum velocity when it has travelled a distance x given by

A. $x = 2\tan\theta$

B. $x = \dfrac{2}{\tan\theta}$

C. $x = \sqrt{2}\cot\theta$

D. $x = \dfrac{\sqrt{2}}{\cot\theta}$

Answer: A

Watch Video Solution

114. A block of mass m is placed on a surface with a vertical cross section given by $y = x^3/6$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is :

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

B. $\frac{1}{6}m$

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

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

Answer: B

Watch Video Solution

115. The force required to move a body up a rough inclined plane is double the force required to prevent the body from sliding down the plane. The coefficient of friction , when the angle of inclination of the plane is 60° is

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

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

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

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

Answer: C

Watch Video Solution

116. A rocket is fired vertically from the earth with an acceleration of 2g, where g is the gravitational acceleration. On an inclined plane inside the tocket, making an angle θ

with the horizontal, a point object of mass m is kept, the minimum coefficient of friction $\mu_{\min}$ between the mass and the inclined suface such that the mass does not move is:

A. $\tan 2\theta$

B. $\tan \theta$

C. $3 \tan \theta$

D. $2 \tan \theta$

Answer: B

Watch Video Solution

117. A particle describes a horizontal circle on the smooth surface of an inverted cone, the height of the plane of the circle above the vertex is 9.8 cm. Find the speed of the particle (g= $9.8m / s^2$) [See Fig.] (a) given in the answer section]

A. $0.49ms^{-1}$

B. $0.98ms^{-1}$

C. $1.96ms^{-1}$

D. $3.92ms^{-1}$

Answer: B

Watch Video Solution

118. A hemispherical bowl of radius R si set rotating about its axis of symmetry which is kept vertical. A small block kept in the bowl rotates with the bowl without slipping on its surface. If the surfaces of the bowl is smooth, and the angle made by the radius through the block with the vertical is θ, find the angular speed at which the bowl is rotating.

A. $\sqrt{\dfrac{g}{R\cos\theta}}$

B. $\sqrt{\dfrac{g\cos\theta}{R}}$

C. $\sqrt{\dfrac{g\sin\theta}{R}}$

D. $\sqrt{\dfrac{g}{R\sin\theta}}$

Answer: A

Watch Video Solution

119. Length of a simple pendulum is 2m and mass of its bob is 0.2 kg. If the tension in the string exceeds 4N, it will break. If the bob is whirled in horizontal plane, the maximum angle the string can make with vertical during rotation is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

Watch Video Solution

120. A particle of mass m is suspended from a ceiling through a string of length L. The particle moves in a horizontal circle of radius r. Find a. the speed of the particle and b. the tension in the string. Such a system is called a conical pendulum.

A. $\frac{rg}{\sqrt{L^2 - r^2}}$

B. $\frac{r\sqrt{g}}{\left(L^2 - r^2\right)^{\frac{1}{4}}}$

C. $\frac{r\sqrt{g}}{\left(L^2 - r^2\right)^{\frac{1}{2}}}$

D. $\frac{mgL}{\left(L^2 - r^2\right)^{\frac{1}{2}}}$

Answer: B

Watch Video Solution

121. A chain of 100 links is 1m long and has a mass of 2kg. With the ends fastened together it is set rotating at 3000 rpm, in a horizontal plane. The centripetal force on each link is

A. $3.14N$

B. $31.4N$

C. $314N$

D. $3140N$

Answer: C

Watch Video Solution

122. Three point masses each of mass'm' are joined together using a string to form an equilateral triangle of side 'a'. The system is placed on a smooth horizontal surface and rotated with a constant angular velocity 'ω'

about a vertical axis passing through the centroid. Then the tension in each string is

A. $ma\omega^2$

B. $3ma\omega^2$

C. $\frac{ma\omega^2}{3}$

D. $\frac{ma\omega^2}{\sqrt{3}}$

Answer: C

Watch Video Solution

123. One end of a massless spring of spring constant 100 N/m and natural length 0.5 m is fixed and the other end is connected to a particle of mass 0.5 kg lying on as frictionless horizontal table. The spring remains horizontal. If the mass is made to rotate at an angular velocity of 2 rad/s, find the elongation of the spring.

A. 4 cm

B. 3 cm

C. 1 cm

D. 2 cm

Answer: C

Watch Video Solution

124. There is a small hole in a table. A string of length lm passes through it. Two bodies of masses 70g and 100 g are attached at its ends. The lOOg mass hangs freely at a depth of 60 cm from the table. If this mass is to be in equilibrium, the other mass should rotate in a circle with a frequency equal to

A. $4\pi / 140 Hz$

B. $\pi / 140 Hz$

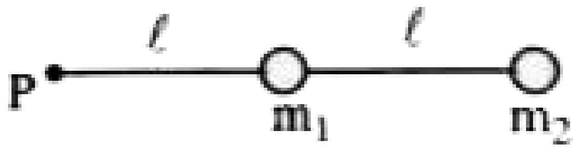
C. $\pi / \sqrt{140} Hz$

D. $\frac{\sqrt{140}}{4\pi} Hz$

Answer: D

Watch Video Solution

125. Two particles of masses m_1 and m_2 are connected to a string and the system is rotated in a horizontal plane with 'P' as center. The ratio of tension in the two parts of string is



A. $\dfrac{m_1}{m_1 + m_2}$

B. $\dfrac{m_1 + m_2}{m_1}$

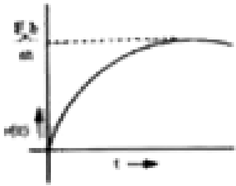
C. $\dfrac{m_1 + 2m_2}{2m_2}$

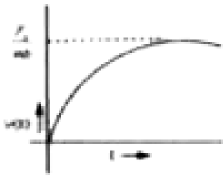
D. $\dfrac{2m_1}{m_1 + m_2}$

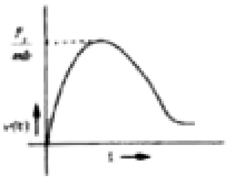
Answer: C

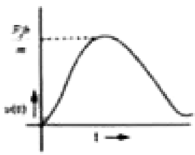
Watch Video Solution

126. A particle of mass m is at rest at the origin at time t = 0. It is subjected to a force F(t) = $F_0 e^{-bt}$ in the $\times$ dicection. Its speed v(t) is depicted by which of the following curves?

A. 

B. 

C. 

D. 

Answer: B

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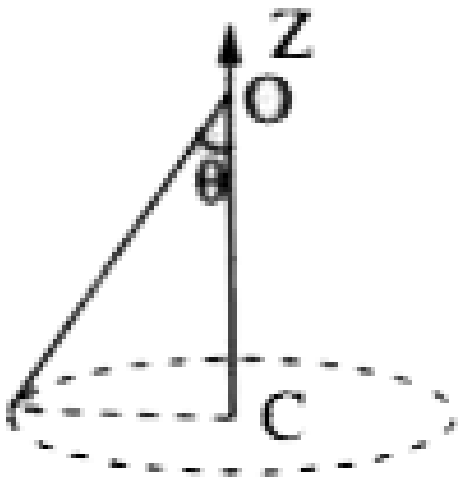
127. A conical pendulum of length 1 m makes an angle $\theta = 45^\circ$ w.rt Z-axis and moves in a circle in the XY plane. The radius of the circle is 0.4 m and its center is vertically below O. The speed of the pendulum, in its circular path, will be : (Take $g = 10 ms^{-2}$)



A. $0.4m/s$

B. $2m/s$

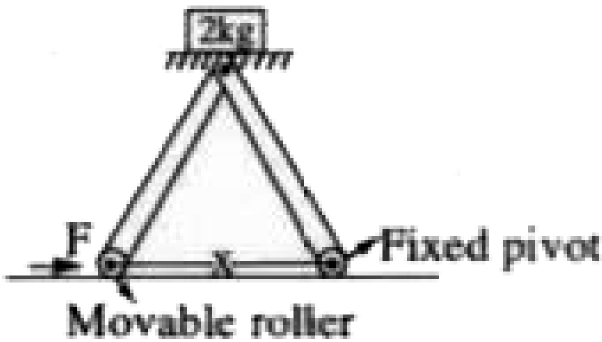
C. $0.2m/s$

D. $4m/s$

Answer: B

Watch Video Solution

128. The machine as shown has 2 rods of length 1 m connected by a pivot at the top. The end of one rod is connected to the floor by a stationary pivot and the end of the other rod has a roller that rolls along the floor in a slot. As the roller goes back and forth, a 2 kg weight moves up and down. If the roller is moving towards right at a constant speed, the weight moves up with a



A. speed which is $\frac{3}{4}$ th of that of the roller

when the weight is 0.4 m above the

ground

B. constant speed

C. decreasing speed

D. increasing speed

Answer: C

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