PHYSICS

BOOKS - S CHAND PHYSICS (ENGLISH)

COMPETITION CARE UNIT

UNITS, DIMENSIONS

1. Einstein was awarded Nobel prize for

A. Special theory of relativity

B. General theory of relativity

C. Photo electric effect

D. for developing tensors.

Answer: c

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2. The principle of inertia was first stated by

A. Newton

B. Galileo

C. Kepler

D. Bruno

Answer: b

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3. The time taken by light to travel from sun to earth is approximately

A. 8 light years

B. 8 seconds

C. 8 minutes

D. 8 hours

Answer: c

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4. The unit of universal gas constant is

A. J mol^{-1}

B. J $K^{-1}\mathrm{mol}^{-1}$

C. J mol K^{-1}

D. N $K^{-1}\mathrm{mol}^{-1}$

Answer: b

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5. One Planck length is equal to

A. 10^{-12} m

B. 10^{-25} m

C. 10^{-35} m

D. 10^{-40} m

Answer: c

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6. One parsec is equal to

A. 10^{-7} m

B. 10^{-6} m

C. 3.08×10^{16} m.

D. 3.08×10^{-16} m .

Answer: c

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7. 1 radian is approximately equal to

A. 50°

B. 57.3°

C. 180°

D. 90°

Answer: b

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8. 1° A is equal to

A. A) 10^{-8} m

B. B) 10^{-10} m

C. C) 10^{-6} m

D. D) 10^{-12} m .

Answer: b

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9. Astronomical unit (AU) is the distance betweene arth and the sun, 1 AU is equal to

A. 9.46×10^{15} m

B. 1.496×10^{11} m

C. 3×10^{10} m

D. 3×10^{16} m .

Answer: a

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10. S.I. unit of temperature is

A. degree kelvin

B. degree celsius

C. kelvin

D. rankline

Answer: c

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11. Which of the following is not a unit of length ?

A. fermi

B. parsec

C. light year

D. poise

Answer: d

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12. Which of the following is a unit of energy ?

A. J/s

B. Watt-day

C. g cm / s^2

D. kilowatt

Answer: b

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13. The S.I. unit of pressure is

A. dyne/cm^2

B. atmosphere

C. pascal

D. cm of Hg

Answer: c

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14. If $x = at + bt^2$, where x is in meter and t in hours (hr) then the unit of b is

A. m

B. m/hr

C. m/hr^2

D. m^2 / hr

Answer: c

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15. Candela is the unit of

A. acoustic intensity

B. electric intensity

C. luminous intensity

D. magnetic intensity.

Answer: c

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16. Express the number appearing in the following statements in standard form. (i) 1 micron is equal to \frac{1}{{1000000}}

- 10^{-9} m
- 10^{-12} m
- 19^{-6} m
- 10^{-15} m

Answer: c

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17. If the unit of length is x meter then an area of $1m^2$ will become

A. x

B. 1/x

C. x^2

D. $1/x^2$

Answer: d

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18. The damping force on an oscillator is directly proportional to the velocity. The units of the constant to proportionality are

A. kg s^{-1}

B. kg s

C. kg ms^{-1}

D. kg ms^{-1}

Answer: a

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19. What is the S.I. unit of Stefan-Boltzmann's constant ?

A. $Wm^{-2}K^{-4}$

B. $Wm^{2}K^{4}$

C. WK^{-4}

D. erg $s^{-2}K^{-4}$

Answer: a

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20. One second is defined as

A. 1650763.73 periods of krypton clock

B. 652189.63 periods of krypton clock

C. 1650765.73 periods of cesium clock

D. 9192631770 periods of cesium clock.

Answer: d

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21. One nanometre is equal to

A. 10^{9} mm

B. 10^{-6} cm

C. 10^{-7} cm

D. 10^{-9} cm.

Answer: c

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22. How many wavelength of Kr^{86} are there is one metre

1553164.13

1650763.73

2348123.73

652189.63

A. 1553164.13

B. 1650763.73

C. 2348123.73

D. 652189.63

Answer: b

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23. A certain physical quantity is calcualted from the formula $\frac{\pi}{3}(a^2 - b^2)$ h where h, a and b are all lengths. The quantity being calculated is

A. velocity

B. length

C. area

D. volume

Answer: d

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24. In the Van der Waals equation $\left(P + \frac{a}{V^2}\right)(V - b)$ = constant, the unit of a is

A. dyne/cm^5

B. dyne/cm^4

C. dyne/cm^3

D. dyne/cm^2

Answer: b

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25. The error in the measurement of the radius of a sphere is 1%. The error in the measurement of volume is

A. 0.01

B. 0.03

C. 0.05

D. 0.08

Answer: b

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26. While measuring the acceleration due to gravity by a simple pendulum, a student makes a positive error of 1% in the length of the pendulum and a negative error of 3% in the value and a of time period. His percentage error in the measurement of g by the relation $g = 4\pi^2 (l / T^2)$ will be

A. A) 0.02

B. B) 0.04

C. C) 0.07

D. D) 0.1

Answer: c

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27. Percentage erros in the measurement of mass and speed are 2% and 3% respectively. The error in the estimation of kinetic energy obtained by measuring mass and speed will be:

A. 0.11

B. 0.08

C. 0.05

D. 0.01

Answer: b

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28. The density of a cube is measured by measuring its mass and the length of its sides. If the maximum errors in the measurement of mass and length are 3% and 2%, respectively, then find the maximum error in the measurement of the density of cube.

A. 0.09

B. 0.07

C. 0.05

D. 0.01

Answer: a

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

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

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

D. None of the above

Answer: b

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30. The least count of a stop watch is 1/5 second. The time of 20 oscillations of a pendulum is measured to be 25 seconds. The maximum percentage error in the measurement of time will be

A. 0.1%

B. 0.008

C. 0.018

D. 0.08

Answer: b

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31. An experiment measured quantity a, b, c and then x is calculated from $x = ab^2 / c^3$. If the percentage error in a, b, c are $\pm$ 1%, $\pm$ 3% and $\pm$ 2% respectively, the percentage error in x can be,

A. A) $\pm$ 13%

B. B) $\pm$ 7%

C. C) $\pm$ 4%

D. D) $\pm$ 1%

Answer: a

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32. If the radius of the earth were to shrink by 1%, its mass remaining the same, the acceleration due to gravity on the earth's surface would

A. decrease by 1%

B. remain unchanged

C. increase by 1%

D. increase by 2%

Answer: d

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33. The length and breadth of a metal sheet are 3-124 m and 3.002 m respectively. The area of this sheet upto four correct significant figure is

A. $9.37m^2$

B. $9.378m^2$

C. $9.3782m^2$

D. $9.378248m^2$

Answer: b

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34. The dimensional formula of mc^2 is :

A. $[MLT^{-1}]$

B. $[ML^0T^0]$

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

D. $[M^{-1}L^3T^6]$

Answer: c

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35. The dimensional formula of pressure gradient is

A. $[MLT^{-2}]$

B. $[ML^2T^{-2}]$

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

D. $[MLT^{-1}]$

Answer: c

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36. Which of the following has the same dimensions as those of angle ?

A. $\dfrac{E}{M^5 G}$

B. $\dfrac{EJ^2}{M^5 G^2}$

C. $EM^5 G^{-1}$

D. $EJ^2 M^5 G^2$

Answer: b

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37. The dimensional formula of kinetic energy is the same as that of

A. pressure

B. work

C. momentum

D. force.

Answer: b

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38. Specific gravity has... dimensions in mass, ... Dimensions in length and .. Dimensions in time.

A. A) 0, 0, 0

B. B) 0, 1, 0

C. C) 1, 0, 0

D. D) 1, 1, 3

Answer: a

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39. Which one of the following have same dimensions :

A. Potential energy and force

B. Torque and force

C. Torque and potential energy

D. Planck's constant and momentum.

Answer: c

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40. Which of the following have same dimensions

A. angular momentum and linear momentum

B. work and power

C. work and torque

D. torque and pressure.

Answer: c

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41. Which of the following functions of A and B may be performed if A and B posses different dimensions

A. $A + B$

B. $A - B$

C. A / B

D. $A \leq^{AB}$

Answer: c

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42. the dimensional formula for planck's constant and angular momentum are

A. $[MLT]$

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

C. $[ML^3T^2]$

D. $[ML^0T^4]$

Answer: b

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43. The dimensional formula for surface tension is

A. $[ML^0T^{-2}]$

B. $[MLT^{-1}]$

C. $[M^2L^{-1}T]$

D. $[M^0L^0T^2]$

Answer: a

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44. The gravitational force F between two masses m_1 and m_2 separeted by a distance r is given by

$$F = \frac{Gm_1m_2}{r^2}$$

Where G is the universal gravitational constant. What are the dimensions of G ?

A. $M^{-1}L^2T^{-3}$

B. $M^{-1}L^3T^{-2}$

C. ML^3T^{-2}

D. ML^2T^{-3}

Answer: b

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45. The dimensional formula for coefficient of viscosity is

A. ML^2T^{-2}

B. $ML^{-1}T^{-1}$

C. MLT^{-2}

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

Answer: b

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46. Which of the following has energy unit ?

A. Rate of doing work

B. Watt

C. Products of pressure and volume

D. Potential gradient.

Answer: c

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47. if p represents radiation pressure, c represent speed of light and Q represents radiation energy striking a unit area per second, then non-zero integers x,y and z such that $p^x Q^y c^z$ is dimensionless are.

A. $x = 1, y = 1, z = -1$

B. $x = 1, y = -1, z = 1$

C. $x = -1, y = 1, z = 1$

D. $x = 1, y = 1, z = 1$

Answer: b

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48. Which of the following do not have same dimensions ?

A. Force, surface tension

B. Angle, shear strain

C. Pressure, stress

D. Planck,s constant, angular momentum

Answer: a

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49. The dimensional formula of coefficient of shear modules is

A. $ML^{-1}T^{-3}$

B. $ML^{-1}T^{-2}$

C. $ML^{-2}T^{-2}$

D. $ML^{2}T^{-2}$

Answer: b

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50. The dimesions of $\frac{1}{2}\varepsilon_0 E^2$ (ε_0 is the permittivity of the space and E is electric field),is

A. MLT^{-1}

B. ML^2T^{-2}

C. $ML^{-1}T^{-2}$

D. ML^2T^{-1}

Answer: c

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51. Which of the following quantities has the S.I. unit kg $m^2s^{-3}A^{-2}$?

A. resistance

B. inductance

C. capacitance

D. magnetic flux.

Answer: a

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52. Which of the following physical quantities have into same dimensions ?

A. momentum and impulse

B. pressure and Young's modulus

C. energy and angular momentum

D. force constant and moment of inertia

Answer: a,b

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53. $L, C,$ and R represent the physical quantities inductance, capacitance and resistance respectively. The combinations which have the dimensions of frequency are

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

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

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

D. $\frac{C}{L}$

Answer: a, b, c

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54. The dimensions of the quantities, in one (or more) of the following pairs are the same. Identify the pair(s)

A. Torque and work

B. Angular momentum and work

C. Energy and Young's modulus

D. Light year and wavelength

Answer: a, d

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55. A highly rigid cubical block A of mass M and side L is fixed rigidly on the another cubical block of same dimensions and of modulus of rigidity ρ such that the lower face of A completely covers the upper face of B. The lower face of B is rigidly held on a horizontal surface. A small force F is applied perpendicular to one of the side faces of A. After the force is withdrawn, block A executes small oscillations, the time period of which is given by

A. $2\pi\sqrt{M\rho L}$

B. $2\pi\sqrt{(M\rho / L)}$

C. $2\pi\sqrt{(ML / \rho)}$

D. $2\pi\sqrt{(M / \rho L)}$

Answer: d

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56. In the formula $x = 3yz^2$, x and y have dimensions of capacitance and magnetic induction respectively, then find the dimensions of y.

A. $M^{-3}L^{-2}T^{-2}A^{-4}$

B. ML^{-2}

C. $M^{-3}L^{-2}A^4T^8$

D. $M^{-3}L^{-2}A^4T^4$

Answer: c

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57. The pair (s) of physical quantities that have same dimension, is (are) :

A. Reyonld number and coefficient of fricttion

B. Latent heat and gravitational potential

C. Currie and frequency of a light

D. Planck's constant and torque

Answer: a,b, c

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58. The dimensions of self inductance are

A. $MLT^{-2}A^{-2}$

B. $ML^{2}T^{-1}A^{-1}$

C. $ML^{2}T^{-2}A^{-2}$

D. $ML^{2}T^{-2}A^{-1}$

Answer: c

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59. The dimensional formula for latent heat is

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

B. MLT^{-2}

C. $M^0L^2T^{-2}$

D. ML^2T^{-1}

Answer: a

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60. The velocity of a body which has fallen under gravity varies as $g^a h^b$ where g is the acceleration due to gravity at a place and h is the height through which the body has fallen, a and b are given by

A. a = 1, b = 1/2

B. a = b = 1

C. a = 1/2, b = 1

D. a = 1/2, b = 1/2

Answer: d

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61. An equation is given as $\left(p+\frac{a}{V^2}\right)=b\frac{\theta}{V}$,where $p=$ pressure $V=$ volumen and $\theta=$ absolute temperature. If a and b are constants, then dimensions of a will be

A. ML^5T^{-2}

B. $M^{-6}L^5T^2$

C. $ML^{-5}T^{-1}$

D. $ML^{-5}T^{-1}$

Answer: a

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62. the speed of light c, gravitational constant G, and Planck's constant h are taken as the fundamental units in a system. The dimension of time in this new system should be,

A. $G^{1/2}h^{1/2}C^{-5/2}$

B. $G^{1/2h^{1/2}C^{1/2}}$

C. $G^{1/2}h^{1/2}C^{-3/2}$

D. $G^{1/2}h^{1/2}C^{1/2}$

Answer: a

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63. The position of particle at time t is given by, $x(t) = (v_0/ \propto)(1 - e^{-ut})$ where v_0 is a constant $\propto > 0$. The dimension of v_0 and $\propto$ are,

A. M^0LT^{-1} and T^{-1}

B. M^0LT^0 and T^{-1}

C. M^0LT^{-1} and LT^{-2}

D. M^0LT^{-1} and T

Answer: a

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64. In a particular system, the unit of length, mass and time are chosen to be 10cm, 10 g and 0.1s respectively. The unit of force in this system will be equivalent to

A. 0.1 N

B. 1N

C. 10 N

D. 100 N

Answer: c

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65. The dimensions of $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ are the same as that of

A. velocity

B. time

C. capacitance

D. distance

Answer: a

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66. Suppose force = n $\times$ velocity then the diemsional formula of n is

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

B. ML^0T^{-1}

C. MLT^{-1}

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

Answer: b

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67. If speed of light c, accleratio due to gravity g and pressure p are taken as fundamental units, the dimension of gravitational constant (G) are

A. $c^0 g p^{-3}$

B. $c^2 g^3 p^{-2}$

C. $c^0 g^2 p^{-1}$

D. $c^2 g^2 p^{-2}$

Answer: c

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68. Dimensions of Ohm are same as

(where, h is Planck's constant and e is charge)

A. h / e

B. h^2 / e

C. h / e^2

D. h^2 / e^2

Answer: c

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69. Plancks' constant has the dimensions of

A. force

B. energy

C. linear momentum

D. angular momentum

Answer: d

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70. Suppose the dimensional formula for acceleration, velocity length are $\alpha\beta^{-2}, \alpha\beta^{-1}$ and $\alpha\gamma$. Then the dimensional formula for the coefficient of friction is

A. $\alpha\beta/\gamma$

B. $\alpha\gamma/\beta$

C. $\alpha^0\beta^0\gamma$

D. $\alpha^0\beta^0\gamma^{-1}$

Answer: d

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VECTORS AND SCALARS [Selected from Previoius Years Engg. & Med. & IIT Exam Qns]

1. Which of the following is a scalar quantity ?

A. velocity

B. Acceleration

C. Speed

D. Area

Answer: c

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2. Which of the following is a vector quantity ?

A. Mass

B. Quantity of heat

C. Small angle

D. Time

Answer: c

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3. Volume is

A. Scalar

B. vector

C. neither scalar nor vector

D. both scalar and vector

Answer: a

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4. Surface area is,

A. scalar

B. vector

C. neither scalar nor vector

D. both scalar and vector

Answer: b

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5. Which is the only vector quantity out of the following ?

A. Current flowing in a metal

B. Electrostatic potential

C. Charge of a gold leaf electroscope

D. Moment of a spinning body

Answer: d

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6. Which of the following equation is definitely wrong ?

A. $\vec{A} + \vec{B} = \vec{C}$

B. $\vec{A} + \vec{B} = \vec{C}$

C. $\vec{A} = \vec{C} + \vec{D}$

D. $\vec{B} + \vec{C} = \vec{E}$

Answer: b

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7. The maximum number of components into which a vector can be resolved in its own plane is

A. two

B. three

C. four

D. more than four

Answer: d

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8. Given that $\vec{x} + \vec{y} = \vec{z}$ and $x + Y = z$, Then the angle between $\vec{x}$ and $\vec{y}$ is

A. 0

B. π

C. $\pi/2$

D. $\pi/4$

Answer: a

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9. If $\left|\vec{A} + \vec{B}\right| = \left|\vec{A} - \vec{B}\right|$, then the angle between $\vec{A}$ and $\vec{B}$ will be

A. π

B. $\pi/2$

C. $\pi / 4$

D. 0 (zero)

Answer: b

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10. The maximum number of rectangular components into which a vector in space can be resolved into is

A. two

B. three

C. four

D. any number

Answer: b

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11. The angle between the two vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ is

A. Between 0° and 180°

B. 90° only

C. 0° only

D. 180° only

Answer: a

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12. Which of the following is a scalar quantity ?

A. electric current

B. electric field

C. acceleration

D. linear momentum

Answer: a

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13. If $\vec{a} \cdot \vec{b}$ =ab then the angle between $\vec{a}$ and $\vec{b}$ is

A. $\pi/2$

B. π

C. zero

D. any angle between zero and π

Answer: c

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14. If $\left|\vec{a} \times \vec{b}\right| = ab$ then the angle between $\vec{a}$ and $\vec{b}$ is

A. $\pi/2$

B. π

C. zero

D. any angle between zereo and π

Answer: a

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15. The vector sum of two forces is perpendicular to their vector differences .In that case , the forces

A. equal to each other

B. equal to each other in magnitude

C. not equal to each other in magnitude

D. can not be predicted

Answer: b

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16. Two vectors of equal magnitudes having a sum of resultant equal to either of them, than the angel between them will be

A. 30°

B. 60°

C. 90°

D. 120°

Answer: d

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17. The angle between $\vec{a} \times \vec{b}$ and $\vec{b} \times \vec{a}$ is

A. Zero

B. π

C. $\pi / 2$

D. $\pi/4$

Answer: b

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18. If the sum of two unit vectors is a unit vector, then the magnitude of their difference is :

A. $\sqrt{3}$

B. $\sqrt{2}$

C. $\sqrt{5}$

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

Answer: a

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19. If $\widehat{n}$ is a unit vector in the direction of the vector $\overrightarrow{A}$, then

A. $\widehat{n} = \dfrac{A}{|A|}$

B. $\widehat{n} = A|A|$

C. $\widehat{n} = \dfrac{|(A)|}{A} \widehat{n} = \widehat{n} \times A$

D. $\widehat{n} = \widehat{n} \times A$

Answer: a

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20. If $\overrightarrow{A} = \overrightarrow{B} + \overrightarrow{C}$, and the magnitudes of $\overrightarrow{A}, \overrightarrow{B}, \overrightarrow{C}$ are 5,4, and 3 units, then the angle between $\overrightarrow{A}$ and $\overrightarrow{C}$ is

A. $\cos^{-1}(3/5)$

B. $\cos^{-1}(4/5)$

C. $\dfrac{\pi}{2}$

D. $\sin^{-1}(3/4)$

Answer: a

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21. The maximum number of components into which a vector can be resolved in its own plane is

A. 2

B. 3

C. 4

D. more than 4

Answer: a

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22. The minimum number of vectors of equal magnitude needed to produce zero resultant is

A. 2

B. 3

C. 4

D. more than 4

Answer: a

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23. Given that $\vec{a} + \vec{b} = \vec{a} - \vec{b}$,. This can be true when

A. $\vec{a} = \vec{0}$

B. $\vec{b} = \vec{0}$

C. $\vec{a}$ and $\vec{b}$ are parallel

D. $\vec{a}$ and $\vec{b}$ are perpendicular

Answer: b

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24. If $\overrightarrow{a} \cdot \overrightarrow{b} = \left|\overrightarrow{a} \times \overrightarrow{b}\right|$, then this angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ is,

A. Zero

B. $\pi/2$

C. $\pi/4$

D. π

Answer: c

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25. The projection vector of $\overrightarrow{a}$ on $\overrightarrow{b}$ is

A. $\overrightarrow{a} \cdot \hat{b}$

B. $\overrightarrow{a} - \overrightarrow{b}$

C. $\overrightarrow{b} \cdot \overrightarrow{a}$

D. $\widehat{a} \cdot \hat{b}$

Answer: a

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26. The angle between two vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ is $\pi/2$. Then $\left|\widehat{a} \times \hat{b}\right|$ is

A. zero

B. $ab\sin\theta$

C. $\sin\theta$

D. 1

Answer: d

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27. Given that $\overrightarrow{a} \cdot \overrightarrow{b} = 0$ and $\overrightarrow{a} \times \overrightarrow{c} = 0$ Then the angle between $\overrightarrow{b}$ and $\overrightarrow{c}$ is

A. 0°

B. 45°

C. 90°

D. 180°

Answer: c

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28. There are n coplanar vectors each of magnitude m and each vector is inclined to the preceeding vector at an angle $2\pi / n$. Then the magnitude of their resultant is

A. n m

B. m^2

C. m/n

D. zero

Answer: d

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29. Given that $\overrightarrow{a}$ and $\overrightarrow{b}$ are two non zero vectors, then the value of $\left(\overrightarrow{a}+\overrightarrow{b}\right)\times\left(\overrightarrow{a}-\overrightarrow{b}\right)$ is,

A. 0

B. a^2-b^2

C. $\overrightarrow{a}\times\overrightarrow{b}$

D. $-2\overrightarrow{a}\times\overrightarrow{b}$

Answer: d

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30. The linear velocity of rotating body is given by $\vec{v} = \vec{\omega} \times \vec{r}$ where $\vec{\omega}$ is the angular velocity and $\vec{r}$ is the radius vector. The angular velocity of body $\vec{\omega} = \hat{i} - 2\hat{j} + 2\hat{k}$ and this radius vector $\vec{r} = 4\hat{j} - 3\hat{k}$, then $\left|\vec{v}\right|$ is

A. $\sqrt{29}$ units

B. $\sqrt{31}$ units

C. $\sqrt{37}$ units

D. $\sqrt{41}$ units

Answer: a

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31. The position vectors os a particle is $r = (a\cos\omega t)\hat{i} + (a\sin\omega t)\hat{j}$. The velocity of particle is

A. parallel to the position vector

B. perpendicular to the position vector

C. directed towards the origin

D. directed away from the origin

Answer: b

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32. The length of the sum of the vectors $\overrightarrow{a} = 3\hat{i}$ and $b = 4\hat{j}$ is

A. 3

B. 4

C. 5

D. none of these

Answer: c

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33. If $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$ is aunit vector then c is

A. $\sqrt{0.89}$

B. 0.2

C. 0.3

D. $\sqrt{0.11}$

Answer: d

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34. 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. 15° witht the first vector

Answer: a

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35. If the angle between the vector $\vec{A}$ and $\vec{B}$ is theta , the value of the product $\left(\vec{B}\times\vec{A}\right).\vec{A}$ is equal to -

A. A^2B

B. zero

C. $A^2B\sin\theta$

D. $A^2B\cos\theta$

Answer: b

Watch Video Solution

Dynamics (UNIFORMLY ACCELERATED MOTION)

1. A particle is in motion for somoe time, which of the following can be zero ?

A. Distance

B. Displacement

C. Speed

D. None of these

Answer: b

Watch Video Solution

2. Which of the following statement is true about a particle moving with uniform velocity ?

A. It has a non-uniform speed

B. It has uniform acceleration

C. Its acceleration is zero

D. It has a variable acceleration

Answer: c

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3. A particle moves along the circumference of a circle of radius r when its completes one rotation.

A. Distance travelled is zero and displacement is $2\pi r$

B. distance and displacement are zero

C. distance is $2\pi r$ but displacement is zero

D. distance and displacement are $2\pi r$ each

Answer: c

Watch Video Solution

4. Which of the following is not a unit of speed ?

A. ms^{-1}

B. mih^{-1}

C. kmh^{-1}

D. knoth^(-1)`

Answer: d

Watch Video Solution

5. The area enclosed by the position-time graph of a stationary body,

A. gives its speed

B. gives its velocity

C. gives its acceleration

D. has no physical significance

Answer: d

Watch Video Solution

6. The speedometer of an automobile measures

A. instantaneous velocity

B. instantaneous speed

C. both instantaneous speed and velocity

D. average speed

Answer: b

Watch Video Solution

7. If a car at rest, accelerates uniformly to a speed of $144km/h$ in $20s$, it covers a distance of

A. 20 cm

B. 400 m

C. 1440 cm

D. 2980 cm

Answer: b

Watch Video Solution

8. A man runs along the straight road for half the distance with velocity v_1 and the remaining half distance with velocity v_2. Then the average velocity is given by

A. $v_1 v_2$

B. v_2^2 / v_1^2

C. $(v_1 + v_2) / 2$

D. $2 v_1 v_2 / (v_1 + v_2)$

Answer: d

Watch Video Solution

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

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

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

D. zero

Answer: c

Watch Video Solution

10. A particle moves along with X-axis. The position x of particle with respect to time t from given by $x = b_0 + b_1 t + b_2 t^2$. The acceleration of particle is

A. a_0

B. a_1

C. $2a_a$

D. a_2

Answer: c

Watch Video Solution

11. A person travels along a straight road for the first half with a velocity v_1 and the second half time with a velocity v_2. Then the mean velocity $\overrightarrow{v}$ is given by

A. $\bar{v} = \frac{v_1 + v_2}{2}$

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

C. $\bar{v} = \sqrt{v_1 v_2}$

D. $\bar{v} = \sqrt{\frac{v_2}{v_1}}$

Answer: a

Watch Video Solution

12. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β, to come to rest. If the total time elapsed is t seconds. Then evalute the maximum velocity aquired by the car is

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

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

C. $\left(\frac{\alpha - \beta}{\alpha\beta}\right)t$

D. $\left(\frac{\alpha\beta}{\alpha + \beta}\right)t$

Answer: d

Watch Video Solution

13. A train accelerates from rest at a constant rate α for some time and then it retards to rest at the constant rate β. If the total distance covered by the train is s, then the velocity of the train is

A. $\left[\dfrac{\alpha+\beta}{2\alpha\beta}\times s\right]^{1/2}$

B. $\left[\dfrac{\alpha-\beta}{2\alpha\beta}\times s\right]^{1/2}$

C. $\left[\dfrac{\alpha\beta}{\alpha+\beta}\times s\right]^{1/2}$

D. $\left[\dfrac{\alpha\beta}{\alpha-\beta}\times s\right]^{1/2}$

Answer: c

Watch Video Solution

14. The acceleration of a moving body can be found from

A. area under velocity time graph

B. area under distance-time graph

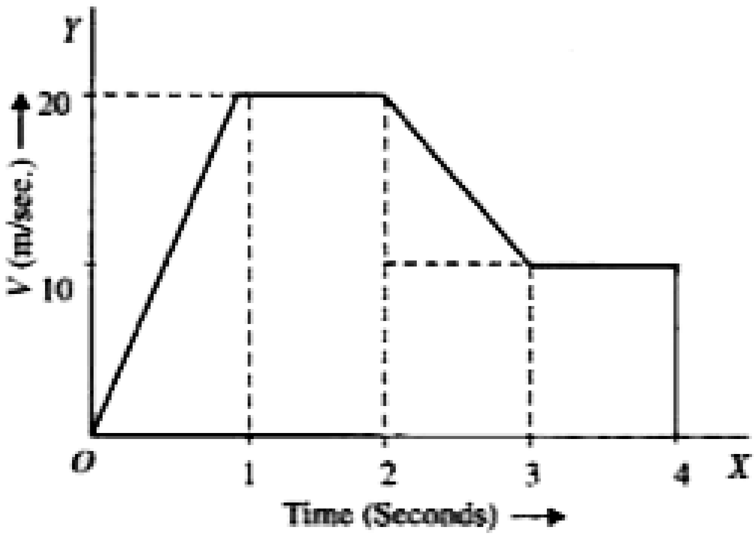
C. shape of the velocity-time graph

D. Slope of distance-time graph

Answer: c

Watch Video Solution

15. The variataion of velocity of a particle moving along a straight line is illustrated in the following Fig. 3.1. The distance traversed by the particle in 4 seconds is



A. 60 m

B. 25 m

C. 55 m

D. 30 m

Answer: c

Watch Video Solution

16. A particle is moving eastwards with velocity of $5m/s$. In $10\sec$ the velocity changes to $5m/s$ northwards. The average acceleration in this time is.

A. zero

B. $1/\sqrt{2}\frac{m}{\sec^2}$ towards north-west.

C. $1/\sqrt{2}\frac{m}{\sec^2}$ towards north-east.

D. $1/\sqrt{2}\frac{m}{\sec^2}$ towards north.

Answer: b

Watch Video Solution

17. A particle starting from rest, move with uniform acceleratin. It covers a distance x_1 during third second and x_2 in the fifth second. Then the ratio x_1 / x_2 is

A. $3/5$

B. $5/9$

C. $9/25$

D. $25/81$

Answer: b

Watch Video Solution

18. A car starts from rest moves with uniform acceleration a_1 for t_1 second and then retards uniformly at a rate a_2 for t_2 second. Then t_1 / t_2 is equal to

A. a_1 / a_2

B. a_2 / a_1

C. a_2^2 / a_1

D. $2a_1 / a_2$

Answer: b

Watch Video Solution

19. A car can be stopped within a distance of s when its speed is v. What is the minimum distance within which the car can be stopped during the same time when its speed is nv ?

A. ns

B. s/n

C. $n^2 s$

D. s / n^2

Answer: c

Watch Video Solution

20. A body starts from rest and travels with uniform acceleration the time taken by the body to cover the whole distance is t. Then the time taken the body to cover the second half of the distance is

A. $t\sqrt{2}$

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

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

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

Answer: b

Watch Video Solution

21. A train starting from rest, and moving with uniform acceleration α, acquires a speed v. Then its comes to a stop with uniform retardation β. Then the average velocity of the train is

A. $v/2$

B. $v/4$

C. $(\alpha+\beta)t/2$

D. $(\alpha+\beta)t/\alpha\beta$

Answer: a

Watch Video Solution

22. The maximum acceleration that can be produced by the engine of a vehicle is $5ms^{-2}$ and the maximum retardation is brake can produce is $10ms^{-2}$. Then the minimum time during which it can cover a distance of 60 m is

A. 6 s

B. 5 s

C. 36 s

D. 24 s.

Answer: a

Watch Video Solution

23. Starting from rest a body moves with uniform acceleration and acquires a velocity v after n seconds. Then its displacement in the last two seconds is

A. $2v(n+1)/n$

B. $2v(n-1)/n$

C. $2v(n+1)^2/n$

D. $v(n-1)^2 n$

Answer: b

Watch Video Solution

24. A body starts from rest and moves with a uniform acceleration. The ratio of the distance covered in the nth sec to the distance covered in n sec is

A. $\frac{2}{n} - \frac{1}{n^2}$

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

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

D. $\frac{2}{n} + \frac{1}{n^2}$

Answer: a

Watch Video Solution

25. A particle is moving at $5ms^{-1}$ towards east In one second its velocity changes to $5ms^{-1}$ towards north. Assuming the acceleration to be uniform, the change in velocity will be directed at

A. 135° to east

B. 135° to north

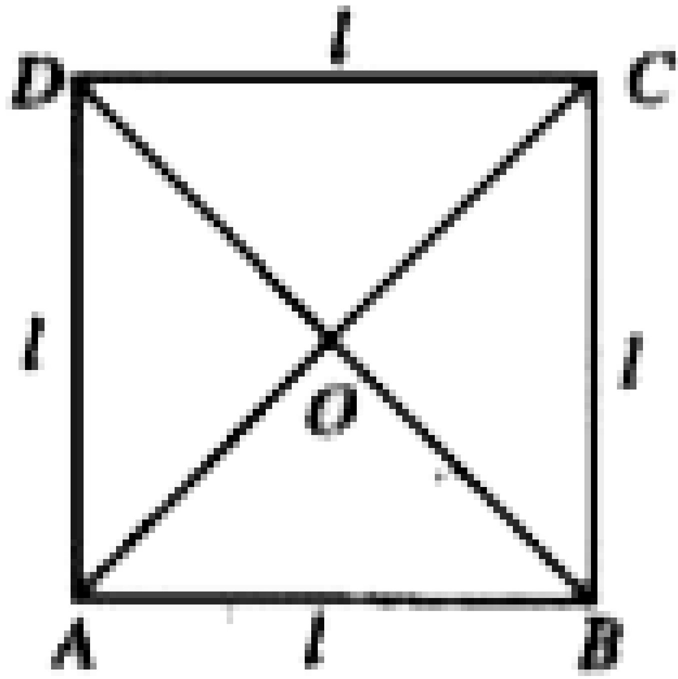
C. 45° to east

D. 90° to east

Answer: a

Watch Video Solution

26. Four children are standing at the corners A, B, C and D of a square of side l. They simultaneously start running such that A runs towards B, B towaards C, C runs towards D and D runs towards A, each with a velocity v.They will meet after a time



A. $\sqrt{2}l / v$

B. l / v

C. $l / \sqrt{2}v$

D. $4l / v$

Answer: b

Watch Video Solution

27. A simple pendulum hangs from the roof of a train whose string is inclined towards the rear of the train. Then the train is

A. at rest

B. moving with uniform velocity

C. moving with uniform acceleration

D. moving with uniform retardation.

Answer: c

Watch Video Solution

28. A body A starts from rest with an acceleration a_1. After 2 seconds, another body B starts from rest with an acceleration a_2. If they equal distance in the 5th second, after the start of A, then the ratio the 5th second, after the start of A, then ratio $a_1 : a_2$ is equal to

A. $5 : 9$

B. $5:7$

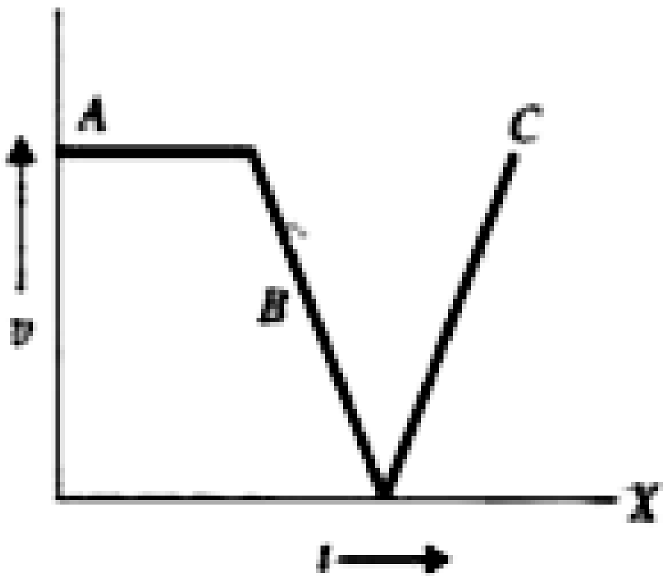
C. $9:5$

D. $9:7$

Answer: a

Watch Video Solution

29. The velocity time graph of a body is shown in fig. 3.3. it implies that at point B



A. the force is zero

B. there is a force towards motion

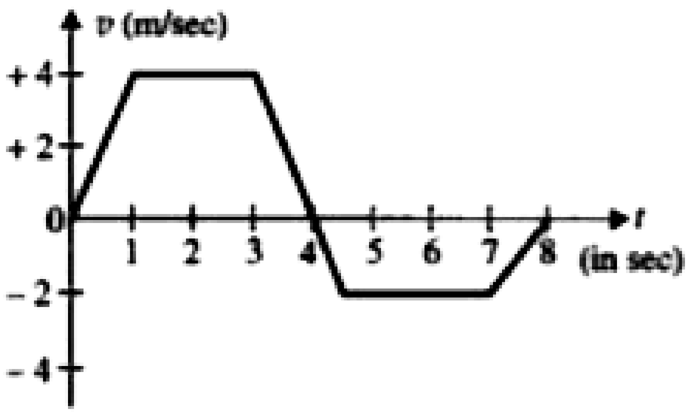
C. there is force which oppose motion

D. none of the above

Answer: c

Watch Video Solution

30. The velocity-time graph of a linear motion is shown below . The displacement from the origin after 8 seconds is



A. 18 m

B. 6 m

C. 8 m

D. 16 m

Answer: b

Watch Video Solution

31. A taxi leaves the station X for station Y every 10 minutes. Simultaneously, a taxi also leaves the station Y for station X every 10 minutes. The taxies moves at the same same constant speed and go from X to Y or vice versa in 2 hours. How many taxies coming from the otehr side will meet each taxi on route from Y to X ?

A. 24

B. 23

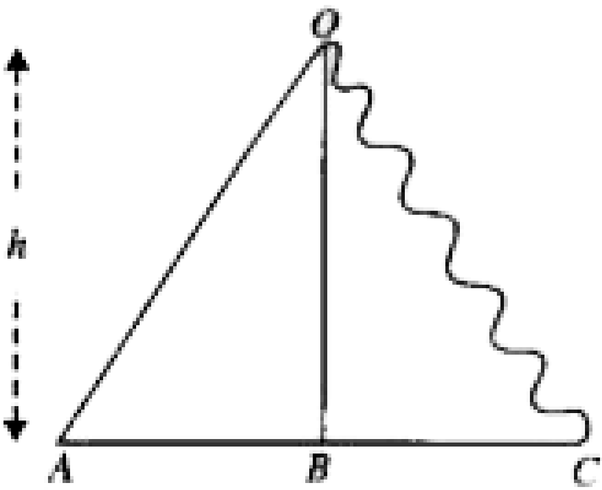
C. 12

D. 11

Answer: b

Watch Video Solution

32. Three different balls of masses m_1, m_2 and m_3 are allowed to roll form rest on three firctionless parth OA, OB and OC respectively from O. The height of O above the ground is h. The respective speeds S_1, S_2 and S_3 of $m_1, m_2,$ and m_3 at the bottom A, B and C are



A. $\frac{S_1}{m_1}\frac{S_2}{m_2}=\frac{S_3}{m_3}$

B. $m_1S_1^2 = m_2S_2^2 = m_3S_2^3$

C. $S_2 < S_1 < S_3$

D. $S_1 < S_2 < S_3$

Answer: b

Watch Video Solution

33. For a body thrown vertically upwards, if the air resistance is taken into consideration, then the time of rise is

A. equal to time of fall

B. less than time of fall

C. greater than time of fall

D. (3/2) times the time of fall

Answer: b

Watch Video Solution

34. A wooden ball and an iron ball are dropped from the same height h in vaccum. If their radii are the same then the time taken by then to reach the ground are

A. approximately equal

B. exactly equal

C. not equal

D. zero

Answer: b

Watch Video Solution

35. An air tight cage with are parrot sitting in it is suspended from the spring balance. The parrot starts flying. The reading of the spring balance will

A. increase

B. decrease

C. not change

D. be zero

Answer: c

Watch Video Solution

36. The distance travelled by a body falling from reset in the frist, second and third seconds are in the ratio

A. $1:2:3$

B. $1:3:5$

C. $1:4:9$

D. none of the above

Answer: b

Watch Video Solution

37. A stone is thrown vertically upwards with an initial velocity u form the top of a tower, recahes the ground with a velocity 3u. The height of the tower is

A. $\frac{3u^2}{g}$

B. $\frac{4u^2}{g}$

C. $\frac{6u^2}{g}$

D. $\frac{9u^2}{g}$

Answer: b

Watch Video Solution

38. A body is released form the top of a tower of height h meters. It takes t seconds to reach the ground. Where is the ball at the time t/2 sec ?

A. at h/2 meter from the ground

B. at h/4 meter from the ground

C. depends upon the mass and volume of the ball

D. at 3h/4 meter from the ground.

Answer: d

Watch Video Solution

39. A body released from a great height and falls freely towards the earth. Another body is released from the same height exactly one second later. Then the separation between the two bodies, two seconds after the release of the second body is

A. 4.9 m

B. 9.8 m

C. 19.6 m

D. 24.5 m

Answer: d

Watch Video Solution

40. The ball is dropped from a bridge $122.5m$ above a river, After the ball has been falling for 2 s, a second ball is thrown straight down after it. What must its initial velocity be so that both hit the water at the same time ?

A. 49 m/sec

B. 55.5 m/sec

C. 26.1 m/sec

D. 9.8 m/sec

Answer: c

Watch Video Solution

41. A body dropped from a height h with initial velocity zero, strikes the ground with a velocity 3 m/s. Another body of same mass dropped from the same height h with an initial velocity of 4m/s. Find the final velocity of second mass with which it strikes the ground.

A. $3ms^{-1}$

B. $4ms^{-1}$

C. $5ms^{-1}$

D. $12ms^{-1}$

Answer: c

Watch Video Solution

42. A body falling from the rest has a velocity v after it falls through a heigh h. The distance it has to fall down further for its velocity to become double, will be

A. 3h

B. 6h

C. 8 h

D. 10 h

Answer: a

Watch Video Solution

43. A wooden block of mass 10 gm is dropped from the top of a cliff 100 m high. Simultaneously a bullet of mass 10 gm is fired from the foot of the cliff upward with a velocity 100 m/s . The bullet and the wooden will meet each other after a time in seconds

A. 10

B. 0.5

C. 1

D. 7

Answer: c

Watch Video Solution

44. A ball A is thrown vertically upwards with speed u. At the same instant another ball B is related from rest at height h. At time t, the speed of A relative to B is

A. u

B. $u - \quad >$

C. $u - 2 >$

D. $\left(u^2 - 2gh\right)^{1/2}$

Answer: a

Watch Video Solution

45. A bomb is dropped from an aeroplane moving horizontal at constant speed. When air resistance is taken into consideration, then the bomb

A. flies with the aeroplane

B. falls on earth ahead of the aeroplane

C. falls on earth behind aeroplane

D. falls on earth exactly below the aeroplane

Answer: c

Watch Video Solution

46. A stone is thrown vertically upwards. When stone is at a height half of its maximum height, its speed is $10m/s$, then maximum height attained by the stone is $(g = 10m/s^2)$

A. 8 m

B. 10 m

C. 15 m

D. 20 m

Answer: b

Watch Video Solution

47. A bal is thrown vertically upwards from the ground. It crosses a point at the height of 25 m twice at an interval of 4 secs. The ball was thrown with the velocity of

A. 20 m/s

B. 25 m/s

C. 30 m/s

D. 35 m/s

Answer: c

Watch Video Solution

48. A body, thrown upwards with some velocity, reaches the maximum height of 20 m. Another body with double the mass thrown up, with double intial velocity will each a maximum height of

A. 40 m

B. 80 m

C. 120 m

D. 160 m

Answer: b

Watch Video Solution

49. The height of a tower is h meter, A body is thrown from the top of tower vertically upwards with some speed, it takes t_1 seconds to reach the ground. Another body thrown from the top of tower with same speed downwards and takes t_2 seconds to reach the ground. If third body, released from same place takes 't' second to reach the ground, then

A. $t = \dfrac{t_1 + t_2}{2}$

B. $t = \dfrac{t_1}{t_2}$

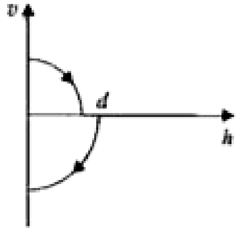
C. $\dfrac{2}{t} = \dfrac{1}{t_1} + \dfrac{1}{t_2}$

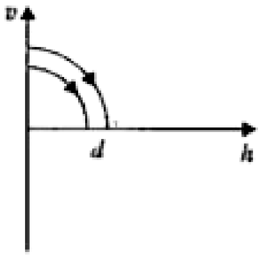
D. $t = \sqrt{(t_1 t_2)}$

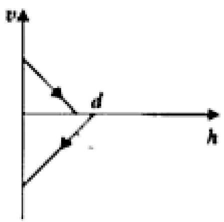
Answer: d

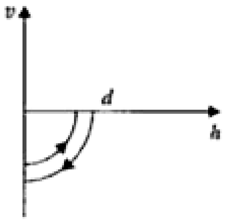
Watch Video Solution

50. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height d/2. Neglecting subsequent motion and air resistance, its velocity v varies with the heiht h above the ground as

A. 

B. 

C. 

D. 

Answer: a

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51. A man in a lift throws a ball vertically upwards with a velocity v and catches it (i) after t_1 second when the lift is ascending with an upward acceleration of 'a' and (ii) after t_2 second when the lift is descending downward with the same acceleration 'a'. THe velocity of the ball v is

A. g $t_1 t_2$

B. (1/2) g $t_1 t_2$

C. 2 g $t_1 t_2 / t_1 + t_2$

D. g $t_1 t_2 / t_1 + t_2$

Answer: d

Watch Video Solution

52. A body falls freely form rest. It covers as much distance in the last second of its motion as covered in the first three seconds. The body has fallen for a time of

A. 3 s

B. 5 s

C. 7 s

D. 9s

Answer: b

Watch Video Solution

53. A man throw rings into air one after the other at an interval of one second. The next ring is thrown when the velocity of the ring thrown earlier is zero. The height to which the ring rise is $(\text{take} g = 10 m s^{-2})$

A. 15 m

B. 5 m

C. 10 m

D. 20 m

Answer: b

Watch Video Solution

54. A bird flies with a speed of 10 km/h and a car moves with uniform speed of 8 km/h. Both starts from B towards A (BA = 40 km), at the same instant. The bird having reached A, flies back immediately to meet the approaching car. As soon as it reaches the car it flies back to A. Thus the bird repeats till both the car and the bird reach A simultaneously. The total distance flown hy the bird is [see Fig. 3.7]

A. 80 km

B. 40 km

C. 50 km

D. can not be determined

Answer: d

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55. A train of 150 m length is going towards north direction at a speed of 10 m/s. A bird flies at a speed of 5 m/s towards south direction parallel to the railway track. The time taken by the bird to cross the train is equal to

A. 20 sec

B. 16 sec

C. 12 sec

D. 10 sec

Answer: d

Watch Video Solution

56. Two trains, each 50 m long are travelling in opposite direction with velocity 10 m/s and 15 m/s. The time of crossing is

A. 2s

B. 4s

C. $2\sqrt{3}s$

D. $4\sqrt{3}$ s

Answer: b

Watch Video Solution

57. The first and the second runners in a 100 m dash have a gap of half metre at the mid way stage. By what percentage should the second runner increase his speed just to win the race, assuming that the first runner goes steady ?

A. 0.01

B. 0.0102

C. 0.02

D. 0.0202

Answer: d

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58. Two stones are thrown from the same point with velocity of 5 ms^{-1} one vertically upwards and the other vertically downwards. When the first stone is at the highest point the relative velocity of the second stone with respect to the first stone is,

A. $5ms^{-1}$

B. $0ms^{-1}$

C. $10ms^{-1}$

D. $-5ms^{-1}$

Answer: c

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Dynamics (PROJECTILE MOTION)

1. During a projectile motion, if the maximum height equals the horizontal range, then the angle of projection with the horizontal is.

A. 45°

B. $\theta = \tan^{-1}(0.25)$

C. $\theta = \tan^{-1} 4$

D. 60°

Answer: c

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2. A marble A is dropped vertically. Another identical marble B is projected horizontally from the same point at the same instant

A. A will reachthe ground earlier than B.

B. B will reach the ground earlier than A.

C. Both A and B reach the ground at the same instant.

D. None of the above

Answer: c

Watch Video Solution

3. An object is thrown along a direction inclined at an angle of 45° with the horizontal direction. The horizontal range of the object is equal to

A. vertical height

B. twice the vertical

C. thrice the vertical height

D. four times the vertical height

Answer: d

Watch Video Solution

4. At the top of the trajectory of a projectile, the directions of its velocity and acceleration are

A. perpendicular to each other

B. parallel to each other

C. inclined to each other at an angle of 45°

D. anit-parallel to each other

Answer: a

Watch Video Solution

5. A particle moves in a plane with a constant acceleration in a direction different from the initial velocity. The path of the particle is

A. straight line

B. arc of circle

C. parabola

D. ellipse

Answer: c

Watch Video Solution

6. A gun fires two bullets at 60° and 30° with horizontal. The bullets strike at same horizontal distance. The ratio of the maximum height for the two bullets is in the ratio

A. $2:1$

B. $3:1$

C. $4:1$

D. $1:1$

Answer: b

Watch Video Solution

7. It is possible to project a particle with a given velocity in two possible ways so as to make it pass through a point at a distance r from the point of projection. The product of times taken to reach this point in the two possible ways is then proportional to

A. r

B. r^2

C. $1/r$

D. $1/r^2$

Answer: a

Watch Video Solution

Watch Video Solution

8. The range of 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 of 45° to the horizontal

A. 1.5 km

B. 3.0 km

C. 6.0 km

D. 0.75 km

Answer: b

Watch Video Solution

9. A projectile has a maximum range of 16 km. At the highest point of its motion, it explodes into two equal masses. One mass drops vertically downward. The horizontal distance covered by the other mass from the time of explosion

A. 8 km

B. 16 km

C. 24 km

D. 32 km

Answer: b

Watch Video Solution

10. The co-ordintes of a mving particle at any time t are given by

$x = ct^2$ and $y = bt^2$

The Speedof the particle is given by

A. $t(c+b)$

B. $2t\sqrt{(c^2-b^2)}$

C. $t\sqrt{(c^2+b^2)}$

D. $2t\sqrt{(c^2 + b^2)}$

Answer: d

Watch Video Solution

11. The horizontal range of projectile is $4\sqrt{3}$ times the maximum height achieved by it, then the angle of projection is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: a

Watch Video Solution

12. A bomb is dropped from an aeroplane flying horizontally with a velocity 720 km/hr at an altitude of980 m. The bomb will hit the ground after a time

A. 1 sec

B. 7.2 sec

C. 14.15 sec

D. 0.15 sec

Answer: c

Watch Video Solution

13. A body is thrown with a velocity of 9.8 m/s making an angle of 30° with the horizontal. It will hit the ground after a time

A. 3 s

B. 2s

C. 1.5 s

D. 1 s

Answer: d

Watch Video Solution

14. A large number of bullets are fired in all directions with the 'same speed $v_{\circ}$. The maximum area on the ground on which these bullets will spread is

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

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

C. $\pi^2 \frac{v^2}{g^2}$

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

Answer: a

Watch Video Solution

15. The velocity of projection of a body is increased by 2%. Other factors remaining unchanged, what will be the percentage change in the maximum height attained ?

A. 0.04

B. 0.02

C. 0.03

D. 0.05

Answer: a

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16. A plane flying horizontally at $100ms^{-1}$ releases an object which reaches the ground in $10s$. At what angle with horizontal it hits the ground ?

A. 100 cm

B. 50 cm

C. 40 cm

D. 20 cm

Answer: b

Watch Video Solution

17. If a body 'A' of mass M is thrown with velocity V at an angle of 30° to the horizontal and another body B of the same mass is thrown with the same speed at an angle of 60° to the horizontal, the ratio of horizontal ranges of A to B will be

A. $1:3$

B. $1:1$

C. $1:\sqrt{3}$

D. $\sqrt{3}:1$

Answer: b

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18. A particle is thrown with a speed is at an angle θ with the horizontal. When the particle makes an angle ϕ with the horizontal, its speed changes to v, then

A. $v = v_0 \cos\theta$

B. $v = v_0 \cos\theta \cdot \cos\phi$

C. $v = v_0 \cos\theta \cdot \sec\phi$

D. $v = v_0 \sec\theta \cdot \cos\phi$

Answer: c

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19. Maximum height of a bullet when fired at 30° with horizontal is 11 m. Then height when it is fired at 60° is

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20. A boy aims a gun at a bird from a point, at a horizontal distance of 100 m. If the gun can impart a velocity of 500 m/sec to the bullet, at what height above the bird must be aim his gun in order to hit it ?

A. 400 m/s

B. 200 m/s

C. 800 m/s

D. 256 m/s

Answer: a

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21. An aeroplane moving horizontally with a speed of 180 km/hr drops a food packet while flying at height of 490 m. The horizontal range is

A. 180 m

B. 980 m

C. 500 m

D. 670 m

Answer: c

Watch Video Solution

22. A particle is thrown at an angle of 15° with the horizontal and the range is 1.5 km. What is the range when it is projected at 45° ?

A. 1.5 km

B. 6 km

C. 4.5 km

D. 3 km

Answer: c

Watch Video Solution

23. Two projectiles are projected with the same velocity. If one is projected at an angle of 30° and the other at 60° to the horizontal, then ratio of maximum heights reached, is

A. $3:1$

B. $1:3$

C. $1:2$

D. $2:1$

Answer: b

Watch Video Solution

24. A body is projected at such an angle that the horizontal range is three times the greatest height. The-angle of projection is

A. $25^\circ 8'$

B. $33^\circ 7'$

C. $42^\circ 8'$

D. $53^\circ 8'$

Answer: d

Watch Video Solution

25. Two projectiles are fired from the same point with the same speed at angles of projection 60° and 30° respectively. Which one of the following is true ?

A. their range will be same

B. their maximum height will be the same

C. their landing velocity will be same

D. their time of flight will be same

Answer: a

Watch Video Solution

26. The angle which the velocity vector of a projectile thrown with a velocity v at an. angle θ to the horizontal Will make with the horizontal after time t of its being thrown up is

A. θ

B. $\tan^{-1}(\theta/t)$

C. $\tan^{-1}\left(\frac{v\cos\theta}{v\sin\theta - gt}\right)$

D. $\tan^{-1}\left(\frac{v\sin\theta - gt}{v\cos\theta}\right)$

Answer: d

Watch Video Solution

27. Maximum range for a projectile motion is given as R, then height will be

A. R

B. 2 R

C. R/4

D. R/2

Answer: C

Watch Video Solution

28. The time of flight of projectile on an upward inclined plane depends upon.

A. angle of projection

B. angle of inclination of the plane

C. air resistance

D. a and b both

Answer: d

Watch Video Solution

29. A ball is rolled oof along the edge of table (horizontal) with velocity 4 m/s . IT hits the ground after time 0.4 s. Which one of the following is wrong ?

A. the height of the table is 0.8 m

B. it hits the ground at an angle of 60° with the vertical

C. it covers a horizontal distance 1.6 m from the table

D. it hits the ground with vertical velocity 4 m/s.

Answer: b

Watch Video Solution

30. If a projectile having horizontal range of 24 m acquires a maximum height of 8 m, then its initial velocity and the angle of projection are

A. $5\sqrt{g}, \sin^{-1}(0.6)$

B. $5\sqrt{g}, \sin^{-1}(0.8)$

C. $24\sqrt{g}, \sin^{-1}(0.6)$

D. $8\sqrt{g}, \sin^{-1}(0.8)$

Answer: c

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31. If the friction of air causes a vertical retardation equal to 10% of the acceleration due to gravity then the maximum height and time to reach the maximum height will be decreased by $\left(g = 10ms^{-2}\right)$

A. 10%, 10%

B. 9%, 10%

C. 9%, 9%

D. 10%, 9%

Answer: c

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Dynamics (Laws of motion)

1. We can derive Newton's

A. third and first laws from the second law

B. 2nd and 1st laws from the 3rd law.

C. 2nd and 3rd law from the 1st law.

D. any two laws from any one law,

Answer: a

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2. A man is at rest in the middle of apond on perfectly smooth ice. He can get himself to the shore by making use of Newton's

A. first law

B. second law

C. third law

D. all the laws

Answer: c

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3. Newton's second law gives the measure of

A. acceleration

B. force

C. momentum

D. angular momentum

Answer: b

Watch Video Solution

4. Inertia is that property of a body by virtue of which the body is

A. unable to change by itself the state of rest

B. unable to change by itself the state of uniform motion

C. unable to change by itself the direction of motion

D. unable to change by itself the state of rest and of uniform linear motion

Answer: d

Watch Video Solution

5. A man getting down a running bus falls forward because

A. due to inertia of rest, road is left behind and man reaches forward

B. due to inertia of motion upper part of body continues to be in motion in forward direction. While feet come to rest as soon as they touch the road

C. he leans forwards as a matter of habit

D. of the combined effect of all the three factors stated in (a), (b) and (c)

Answer: b

Watch Video Solution

6. The distance x covered in time t by a body having initial velocity v_0 and having a constant acceleration a is given by

$x = v_0 t + (1/2) a t^2$

This result follows from

A. Newton's first law

B. Newton's second law

C. Newton's third law

D. none of the above

Answer: d

Watch Video Solution

7. A rope of length L is pulled by a constant force F. What is the tension in the rope at a distance x from the end where the force is applied ?

A. FL/x

B. $F(L - x)/L$

C. $FL/(L - x)$

D. $Fx/(L-x)$

Answer: b

Watch Video Solution

8. A man weighing 60 kg is standing on a trolley weighing 240 kg. The trolley is resting on a frictionless horizontal rails. If the man starts walking on the trolley along the rails at speed 1m/s, then after 4 seconds, his displacement relative to the ground will be

A. 6 m

B. 4.8 m

C. 3.2 m

D. 2.4 m

Answer: c

Watch Video Solution

9. A boy sitting on the topmost berth in the compartment of a train which is just going to stop on railway station, drops an apple aiming at the open hand of his brother sitting vertically below his hands at a distance of about 2 meter. The apple will fall

A. Prescisely on the hand of his brother.

B. Slightly away from the hand of his brother in the direction of motion of the train

C. slightly away from the hand of his brother opposite to the direction of motion of the train

D. none of the above

Answer: b

Watch Video Solution

10. A cannon after firing recoils due to

A. conservation of energy

B. backward thrust of gases produced

C. Newton's third law of motion

D. Newton's first law of motion

Answer: c

Watch Video Solution

11. A body of mass 2kg is acted by two forces each of magnitude 1 newton, making an angle of 60° with each other. The net acceleration of the body $(\text{in} m / s^2)$ is

A. 0.5

B. 1

C. $\sqrt{3} / 2$

D. $\sqrt{2} / 3$

Answer: c

Watch Video Solution

12. A force of 6 N acts on a body at rest and mass 1 kg. During this time, the body attains a velocity of 30 m/s. The time for which the force acts on the body is

A. 10 sec

B. 8 sec

C. 7 sec

D. 5 sec

Answer: d

Watch Video Solution

13. When one swims across a flowing river, maximum energy is spent in

A. firsst 1/3 of the distance

B. second 1/3 of the distance

C. last 1/3 of the distance

D. equal energy is spent throughout

Answer: a

Watch Video Solution

14. If a force of 250 N acts on a body, the momentum acquired is 125 Km m/s, what is the period for which force acts on the body ?

A. 0.2 sec

B. 0.5 sec

C. 0.4 sec

D. 0.25 sec

Answer: b

Watch Video Solution

15. A 10 N force is applied on a body which produces in it an acceleration of 1 m/s^2. The mass of other body is

A. 10 kg

B. 5 kg

C. 15 kg

D. 20 kg

Answer: a

Watch Video Solution

16. A weightless rod is acted upon by upward parallel forces of 2 newton and 4 newton magnitudes at ends A and B respectively. The total length of the rod AB = 3metere. TO keep the rod in equilibrium a force of 6 newton act in the following manner.

A. downward at any point between A and B

B. downward at the mid-point of AB

C. downward at a point C such that AC = 1 metre

D. downward at a point D such that BD = 1 metre

Answer: d

Watch Video Solution

17. The average force necessary to stop a hammer with 25 N-sec momentum is 0.05 sec expressed in N is

A. 500

B. 125

C. 50

D. 25

Answer: a

Watch Video Solution

18. A block of mass M is pulled along horizontal firctionless surface by a rop of mass m. Force P is applied at one end of rope. The force which the rope exerts on the block is

A. $\frac{P}{M-m}$

B. $\frac{P}{M(m+M)}$

C. $\frac{\text{PM}}{(m+M)}$

D. $\frac{\text{PM}}{M-m}$

Answer: c

Watch Video Solution

19. A force vector applied on a mass is represented as $F = 6i - 8j + 10k$ and acceleration with 1 m/s^2. What will be the mass of the body ?

A. $10\sqrt{2}$ kg

B. $2\sqrt{10}$ kg

C. 10 kg

D. 20 kg

Answer: a

Watch Video Solution

20. On a planet X a man throws a 500 gm mass with a respect of 20 m/s and catches it as it comes down 20 second later. The weight of the mass is

A. 1 newton

B. 10^4 newton

C. 10 newton

D. none of the above

Answer: a

Watch Video Solution

21. A pendulum bob is suspended inside a lift moving upward with constant velocity. If mass of the bob is 50 g then its weight inside the compartment is

A. zero

B. 0.1 N

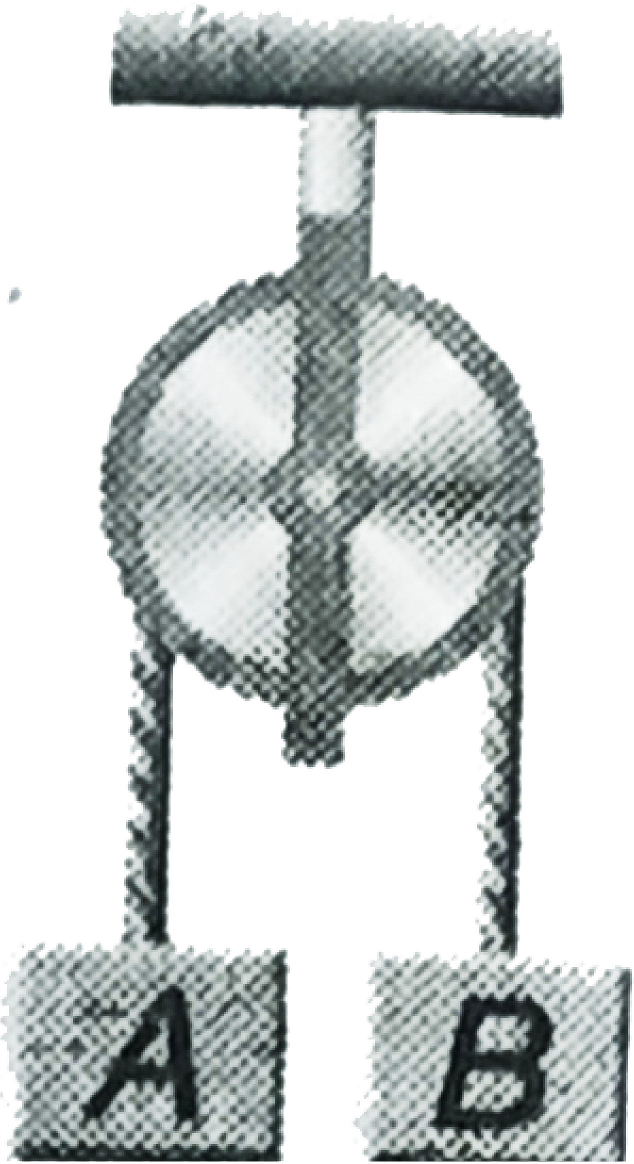
C. 0.5 N

D. 0.05 N

Answer: d

Watch Video Solution

22. Three equal weight A, B and C of mass $2kg$ each are hanging on a string passing over a fixed frictionless pulley as shown in the figure. The tension in the string connecting weights B and C is approximately



A. zero

B. 13 newton

C. 3.3 newton

D. 19.6 newton

Answer: b

Watch Video Solution

23. A body of mass 5 kg is moving with a velocity of 20 m/s. If a force of 100 N is applied on it for 10 s in the same direction as its velocity, what will be the velociy of the body ?

A. 200 m/s

B. 220 m/s

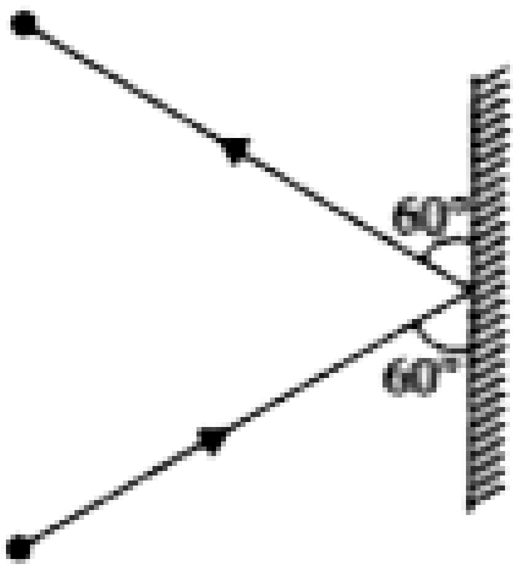
C. 240 m/s

D. 260 m/s

Answer: b

Watch Video Solution

24. A 3 kg ball strikes a heavy rigid wall with a speed of 10 m/s at an angle of 60°. It gets reflected with the same speed and angle as shown in Fig. 15.3.11. It the ball is in contact with the wal for 0.20 s, what is the average force exerted on the ball by the wall ?



A. zero

B. 150 N

C. 150 $\sqrt{3}$ N

D. 300 N

Answer: c

Watch Video Solution

25. An open knife edge of mass M is dropped from a height h on a wooden floor. If the blade penetrates S into the wood, the average resistance offered by the wood to the blade is

A. M g

B. M g $\left(1+\frac{h}{s}\right)$

C. M g $\left(1-\frac{h}{S}\right)$

D. M g $\left(1+\frac{h}{S}\right)^2$

Answer: b

Watch Video Solution

26. A man of mass 90 kg is standing in an elevator whose cable broke suddenly. IF the elevator falls freely, the force exerted by the floor on the man is

A. 90 N

B. 90 g N

C. 0 N

D. any negative value

Answer: c

Watch Video Solution

27. A machine gun fires n bullets per second and the mass of each bullet is m. If v is the speed of each bullet, then the force exerted on the machine gun is

A. m n g

B. m n v

C. m n v g

D. (m n v)/g

Answer: b

Watch Video Solution

28. A ship of mass 3×10^7 kg initially at rest is pulled by a force of 5×10^4 N through a distance of 3 m. Assuming that the resistance due to water is neglible, what will be the speed of ship ?

A. 0.1 m/s

B. 1.5 m/s

C. 5 m/s

D. 0.2 m/s

Answer: a

Watch Video Solution

29. An impulse is supplied to a moving object with the force at an angle of 120° with respect to velocity vector. The angle between the impulse vector and the change in momentum vector is

A. 120°

B. 0°

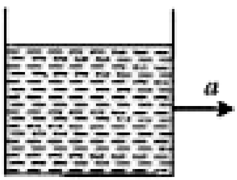
C. 60°

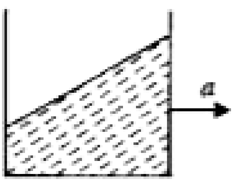
D. 240°

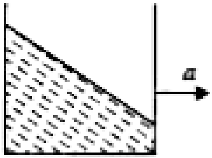
Answer: b

Watch Video Solution

30. A vessel containing water is given a constant acceleration a towards the right,a straight horizontal path. Which of the following diagram represents the surface of the liquid.

A. 

B. 

C. 

D. none of these

Answer: c

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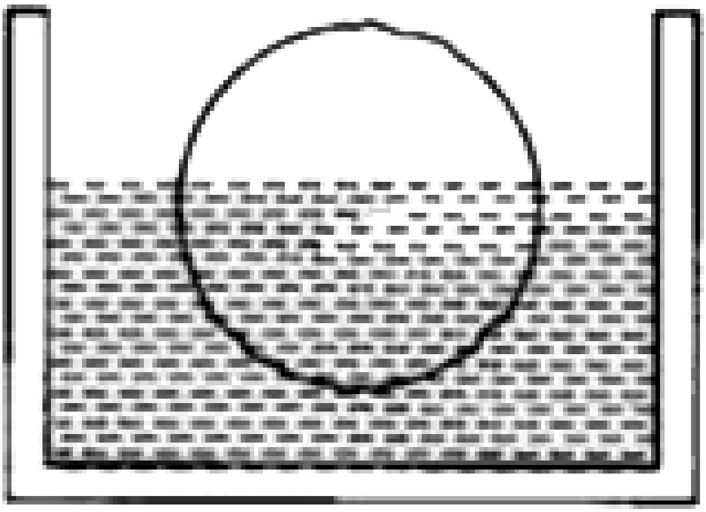
31. A body floats in a liquid contained in a beaker. If the whole system as shown in fig. 15.3.13 falls freely under gravity then the upthrust on the body due to liquid is



A. zero

B. equal to the weight of liquid displaced

C. equal to the weight of the body in air

D. equal to the weight of the immersed portion of the body

Answer: a

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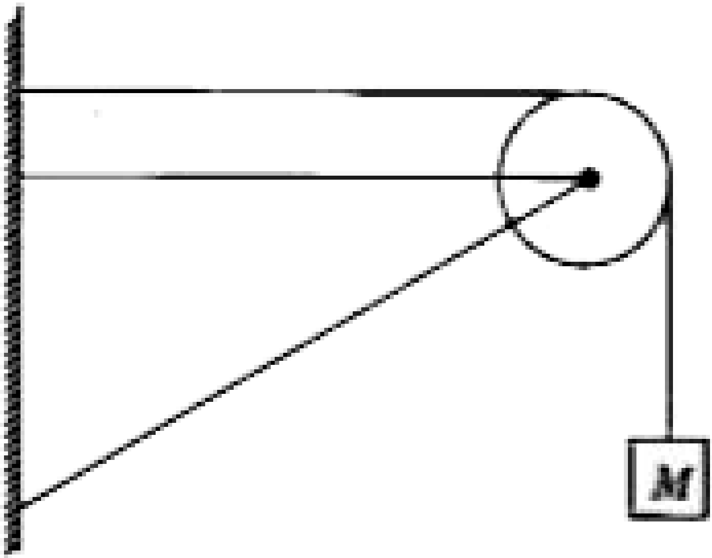
32. A string of negligible mass going over a clamped pulley of mass M as shown in Fig. 3.14. The force on pulley by the clamb is given by



A. 2 mg

B. $\sqrt{2}$ mg

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

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

Answer: b, c

Watch Video Solution

33. A ship of mass 3×10^7 kg initially at rest is pulled by a force of 5×10^4N through a distance of 3 m. Assume that the resistance due to water is nigligible, the speed of the ship is

A. 1.5 m/s

B. 60 m/s

C. 0.1 m/s

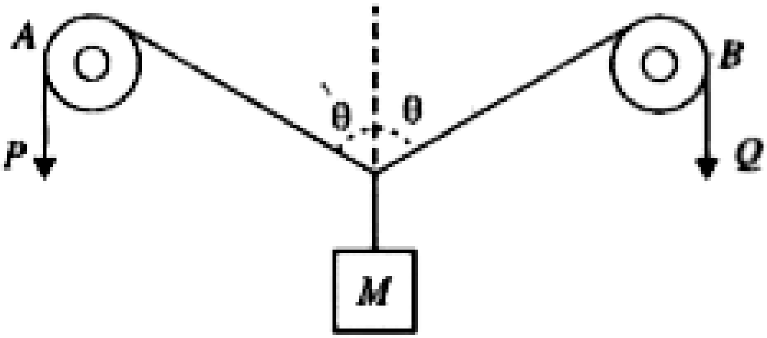
D. 5 m/s

Answer: c

Watch Video Solution

34. In the arrangement shown in Fig. 15.3.15 the ends P and Q of an unstretchable string move downwards with uniform speed U. Pulleys A nd

B are fixed. Mass M moves upwards with a speed.



A. 2 U $\cos\theta$

B. U $\cos\theta$

C. 2 $U/\cos\theta$

D. $U/\cos\theta$

Answer: d

Watch Video Solution

35. A person slides freely down a frictionless inclined plane while his bag falls down vertically from the same height. The final speed of man (v_m) and the bag (v_B) should be such that

A. $v_M < v_B$

B. $v_M = v_B$

C. $v_M > v_B$

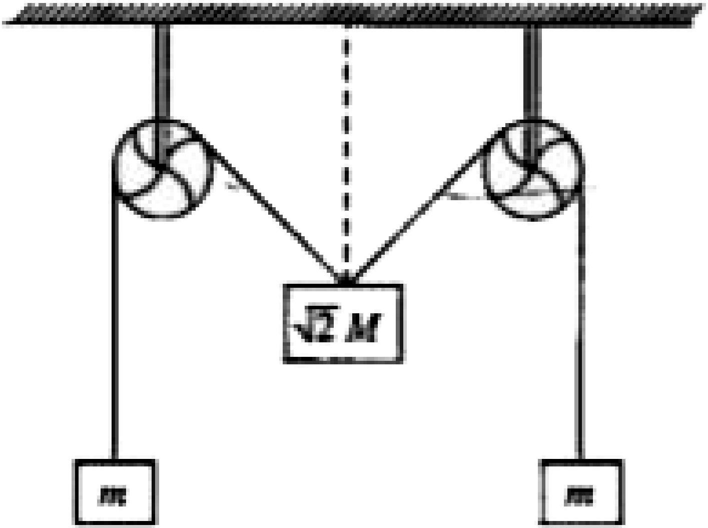
D. they depen on masses

Answer: b

Watch Video Solution

36. The pulley and strings shown in fig 15.3.16 are smooth and of negligible mass. For the system to remiain in equilibrium the angle θ

should be



A. zero

B. 30°

C. 45°

D. 60°

Answer: c

Watch Video Solution

1. A rigid body moves a distance of 10m along a straight line under the action of a force 5N. If the work done by this force on the body is 25 joules, the angle which the force makes with the force makes with the direction of motion of the body is:

A. 30°

B. 45°

C. 60°

D. 75°

Answer: c

Watch Video Solution

2. A particale moves under the effect of a force $F = Cx$ from $x = 0$ to $x = x_1$. The work down in the process is

A. cx_1^2

B. $\frac{1}{2}cx_1^2$

C. $x = x_1$

D. none of above

Answer: b

Watch Video Solution

3. The kinetic energy acquired by a mass m after travelling a fixed distance from rest under the action of constant force is

A. directly proportional $\sqrt{m}$

B. inversely proportional to $\sqrt{m}$

C. directly proportional to m.

D. independent of m.

Answer: d

Watch Video Solution

4. The same retarding force is applied to stop a train. IF the speed is doubled then the distance will be

A. the same

B. doubled

C. half

D. four times

Answer: d

Watch Video Solution

5. A light and a heavy body have equal momentum. Which one has greater K.E. ?

A. the light body

B. both have equal K.E.

C. the heavy body

D. data given in incomplete

Answer: a

Watch Video Solution

6. A light and a heavy body have equal momentum. Which one has greater K.E. ?

A. the heavy body

B. the light body

C. both have equal momentum

D. data given incomplete

Answer: a

Watch Video Solution

7. If the unit of force and length be ecah increased by four times, then the unit of energy is increased by

A. 16 times

B. 8 times

C. 2 times

D. 4 times

Answer: a

Watch Video Solution

8. A sphere of mass m moving with a constant velocity u hits another stationary sphere of the same mass. If e is the coefficient of restitution, then ratio of velocities of the two spheres after collision will be

A. $\frac{1-e}{1+e}$

B. $\dfrac{1+e}{1-e}$

C. $\dfrac{e+1}{e-1}$

D. $\dfrac{e-1}{e+1}$

Answer: a

Watch Video Solution

9. A particle of mass 0.1 kg is subjected to a force which is directly proportional to the distance x. the work done by the force is directly proportional to

A. x

B. x^3

C. $x^{3/2}$

D. x^2

Answer: d

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10. When a body starts to roll on an inclined plane, its potential energy is converted into

A. Translational kinetic energy only

B. Translational and rotational kinetic energy

C. Rotational energy only

D. None

Answer: b

Watch Video Solution

11. A boy comes running and sits on a rotating platform. What is conserved ?

A. Linear momentum

B. Kinetic energy

C. Angular momentum

D. None of the above

Answer: d

Watch Video Solution

12. An inelastic ball is dropped from a height of 100 m. Due to earth 20% of its energy is lost. To what height the ball will rise ?

A. 80 m

B. 40 m

C. 60 m

D. 20 m

Answer: a

Watch Video Solution

13. Two bodies of masses m and 4 m are moving with equal K.E. The ratio of their linear momentum is

A. $4:1$

B. $1:1$

C. $1:2$

D. $1:4$

Answer: c

Watch Video Solution

14. 1 kg body explodes into three fragements. The ratio of their masses is $1:1:3$. The fragments of same mass move perpendicular to each other with speed 30 m/s. The speed of heavier part is

A. $\frac{10}{\sqrt{2}}$ m/s

B. $10\sqrt{2}$ m/s

C. $20\sqrt{2}$ m/s

D. $30\sqrt{2}$ m/s

Answer: b

Watch Video Solution

15. A bomb of 12 kg explodes into two pieces of masses 4 kg and 8 kg. The velocity of 8 kg mass is 6 m/sec. The kinetic energy of the other mass is

A. 48 J

B. 32 J

C. 24 J

D. 288 J

Answer: d

Watch Video Solution

16. A long spring is stretched by 2 cm, its potential energy is U. IF the spring is stretched by 10 cm, the potential energy stored in it will be

A. U/25

B. U/5

C. 5 U

D. 25 U

Answer: d

Watch Video Solution

17. A motor car needs an engine of 7500 watt to keep it moving with a constant velocity of 20 m/s on horizontal road. The force of friction between the car tyres and the ground is

A. 375 dyne

B. 375 newton

C. 1.5×10^5 newton

D. 1.5×10^5 dyne

Answer: b

Watch Video Solution

18. Two masses 1g and 9g are moving with equal kinetic energies. The ratio of the magnitudes of their respective linear momenta is

A. $1:9$

B. $9:1$

C. $1:3$

D. $3:1$

Answer: c

Watch Video Solution

19. If momentum of a certain body is increased by 50% then increase in the K.E. of the body will be

A. 0.25

B. 0.5

C. 1

D. 1.25

Answer: d

Watch Video Solution

20. A bag P (mass M) hangs by a long thread and bullet (mass m) comes horizontally with velocity v and gets caught in the bag. Then for the combined (bag + bullet) system

A. momentum is $\dfrac{mvM}{M+m}$

B. kinetic energy is $\dfrac{mv^2}{2}$

C. momentum is $\dfrac{mv(M+m)}{M}$

D. Kinetic energy is $\dfrac{m^2v^2}{2(M+m)}$

Answer: d

Watch Video Solution

21. A particle is projected making angle 45° with horizontal having kinetic energy K. The kinetic energy at highest point will be : -

A. $\dfrac{K}{2}$

B. $\dfrac{K}{\sqrt{2}}$

C. K

D. zero

Answer: a

Watch Video Solution

22. The potential energy between two atoms in a molecule is given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$, where a and b are positive constants and x is the distance between the atoms. The atom is in stable equilibrium when

A. $x = 0$

B. $x = (a/2b)^{1/6}$

C. $x = (2a/b)^{1/6}$

D. $x = (11a/5b)^{1/6}$

Answer: c

Watch Video Solution

23. Two identical balls A and B moving with velocities + 0.5 m/s and -0.3 .m/s respectively collide head-on elastically. The velocities of the ball A and B after collision will be respectively

A. $+0.5m/s$ and $+0.3m/s$

B. $-0.3m/s$ and $+0.5m/s$

C. `+ 0.3 m//s and + 0.5 m//s

D. $-0.5m/s$ and $+0.3m/s$

Answer: b

Watch Video Solution

24. Water is falling on the blades of turbine at a rate of 100 kg/s from a certain spring. IF the height of the spring be 100 m, the power transferred to the turbine will be

A. 100 W

B. 1 kW

C. 10 kW

D. 100 kW

Answer: d

Watch Video Solution

25. Work done in time t on a body of mass m which is accelerated from rest to a speed v in time t_1 as a function of time t is given by

A. $\frac{1}{2}m\frac{v}{t_1}t^2$

B. $m\frac{v}{t_1}t^2$

C. $\frac{1}{2}\left(\frac{mv}{t_1}\right)^2t^2$

D. $\frac{1}{2}m\frac{v^2}{t_1^2}t^2$

Answer: d

Watch Video Solution

26. The force acting on a body is inversely proportional to the distance (x) covered. The work done is proportional to

Watch Video Solution

27. A ball is dropped from a height h on the ground If the coefficient of restitution is e, the height to which the ball goes up after it rebounds for the `nth time is

A. he^{2n}

B. he^{n}

C. $\frac{e^{2n}}{h}$

D. $\frac{h}{e^{2n}}$

Answer: a

Watch Video Solution

28. A body of mass m accelerates uniformly from rest to v_1 in time t_1. As a function of time t, the instantaneous power delivered to the body is

A. $(m_1 v_1 t / t_1)$

B. $(m v_1^2 t / t_1)$

C. $(m v_1^2 t / t_1^2)$

D. $(m v_1 t^2 / t_1)$

Answer: c

Watch Video Solution

29. A ball his the floor and rebounds after inelastic collision. In this case

A. The momentum of the ball just after the collision is the same as that just before the collision.

B. the mechanical energy of the ball remains the same in the collision

C. the total momentum of the ball and the earth is conserved

D. the total energy of the ball and earth is conserved

Answer: c

Watch Video Solution

30. A wind - powered generator converts wind energy into electrical energy . Assume that the generator convents a fixed fraction of the wind energy intercepted by to blades into electrical energy for wind speed V , the electrical power output will be propertional to

A. v

B. v^2

C. v^3

D. v^4

Answer: c

Watch Video Solution

31. A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to

A. $t^{1/2}$

B. $t^{3/4}$

C. $t^{3/2}$

D. t^{2}

Answer: c

Watch Video Solution

32. A shell is fired from a cannon with a velocity V at an angle θ with the horizontal direction. A the highest point i its path, it explodes into two pieces of equal masses. One of the pieces retraces its path to the cannon. The speed of the other priece immediately after the explocison is

A. $3v\cos\theta$

B. $2v\cos\theta$

C. $3/2.\ v\cos\theta$

D. $\sqrt{3}/2.\ v\cos\theta$

Answer: a

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33. A ship of mass 3×10^7 kg initially at rest is pulled by a force of 5×10^4 N through a distance of 3 m. Assuming that the resistance due to water is neglible, what will be the speed of ship ?

A. 1.5 m/sec

B. 60 m/sec

C. 0.1 m/sec

D. 5m/sec

Answer: c

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34. A uniform chain of length L and mass M is lying on a smooth table and one third of its length is hanging vertically down over the edge of the table. If g is acceleration due to gravity, the work required to pull the hanging part on the table is

A. M g L

B. Mg L /3

C. M g L/9

D. M g L/18

Answer: d

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35. Two masses 1g and 9g are moving with equal kinetic energies. The ratio of the magnitudes of their respective linear momenta is

A. $4:1$

B. $\sqrt{2}:1$

C. $1:2$

D. $1:16$

Answer: c

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FRICTION

1. The frictional force between two surfaces is independent of

A. Nature of the surface

B. Size of the body

C. Area of contact

D. Mass of the body

Answer: B and D

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2. Frictional forces are considered to act in a direction

A. perpendicular to surfaces in contact

B. parallel to surfaces in contact

C. parallel to normal reaction

D. inclined 45° to normal reaction

Answer: b

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3. While walking on ice, one should take small steps to avoid sliping. This is because smaller steps ensure

A. friction of ice is large

B. larger normal reaction

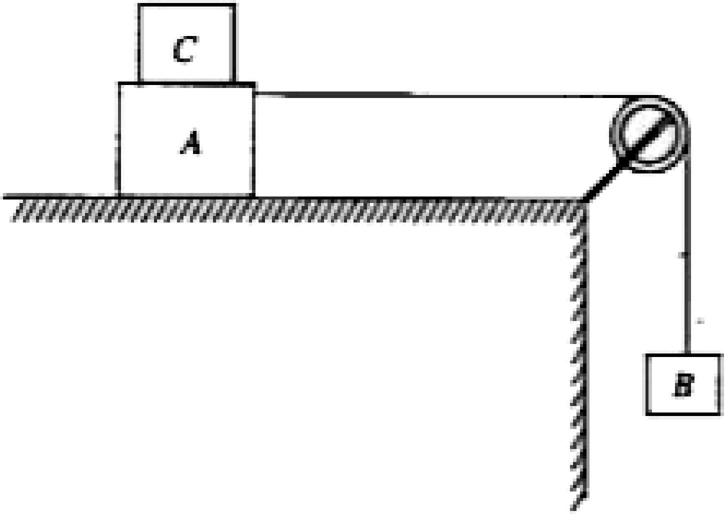
C. friction of ice is small

D. smaller normal reaction

Answer: c

Watch Video Solution

4. Two masses A and B of 10 kg and 5 kg respectively are connected with a string passing over a frictionless pulley fixed at the corner of a table as shown in Fig. 15.4.1. The co-efficient of friction of A with the table is 0.2 The minimum mass of C that may by placed on A to prevent it from moving is equal to



A. 1 5 kg

B. 10 kg

C. 4 kg

D. 0 kg

Answer: a

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5. A 40kg slab rest on a frictionless floor as shown in . A 10kg blocks rests on the top of the slab. The static coefficient of friction between the block and the slab is 0.60, while kinetic friction is 0.40. The 10kg block is acted upon by a horizontal force of 100N. What is the resulting acceleration of the slab ?

A. $0.98m/s^2$

B. $1.47m/s^2$

C. $1.52m/s^2$

D. $6.1m/s^2$

Answer: a

Watch Video Solution

6. Consider, a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between the tyre and the road is 0.5, the shortest distance in which the car can be stopped is (Take $g = 10 / s^2$)

A. 30 m

B. 40 m

C. 72 m

D. 20 m

Answer: b

Watch Video Solution

7. A body of mass 100 g is sliding from an inclined plane of inclination 30°. What is the frictional force experienced if $\mu = 1.7$?

A. $1.7 \times \sqrt{2} \times \left(1 / \sqrt{3}\right) N$

B. $1.7 \times \sqrt{3} \times (1 / 2) N$

C. $1.7 \times \sqrt{3}$ N

D. $1.7 \times \sqrt{2} \times (1/3)$ N

Answer: b

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8. If a block moving up at $\theta = 30^\circ$ with a velocity 5m/s, stops after 0.5 sec, then what is μ

A. 0.5

B. 1.25

C. 0.6

D. None of the above

Answer: c

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9. A 20 kg block is initially at rest. A 75 N force is required to set the block in motion. After the motion a force of 60 N is applied to keep the block moving with constant speed. The coefficient of static friction is

A. 0.6

B. 0.52

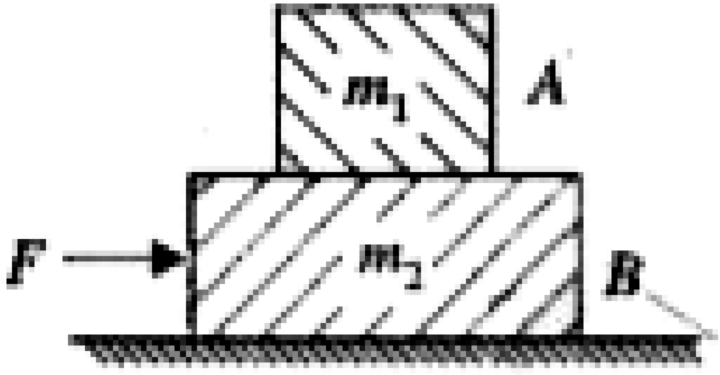
C. 0.44

D. 0.35

Answer: d

Watch Video Solution

10. A block A of mass 4 kg is placed on another block B of mass 5 kg and the block rests on a smooth horizontal table. For sliding the block A on B, a horizontal force of 12 N is required to be applied on it. The maximum horizontal force that can be applied on B so that both A and B move together and the acceleration produced by this force is



A. 25 N, 5 m/s^2

B. 27 N, 3 m/s^2

C. 30 N, 8 m/s^2

D. cannot be calculated from the given data.

Answer: b

Watch Video Solution

11. Starting from rest, a body slides down a 45° inclined plane in twice the

time it itakes to slide the same distance in the absence of friction.

They the coefficient of friction between the body and the inclined plane is

A. $1/4$

B. $2/3$

C. $3/4$

D. $\sqrt{3}/2$

Answer: c

Watch Video Solution

12. If a cyclist moving with a speed of 4.9 m/s on a level can take a sharp circular turn of radius 4 m, then coefficient between the cycle tyres and road is

A. 0.41

B. 0.51

C. 0.61

D. 0.71

Answer: c

Watch Video Solution

13. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain that can hang over one edge of the table is

A. 0.2

B. 0.25

C. 0.35

D. 0.15

Answer: a

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14. A block slides with a velocity of 10 m/sec. on a rough horizontal surface. It comes to rest after covering of 50 m. If g is 10 $m/\sec^2$, then the coefficient of dynamic friction between the block and surface is

A. 1

B. 10

C. 2

D. 0.1

Answer: d

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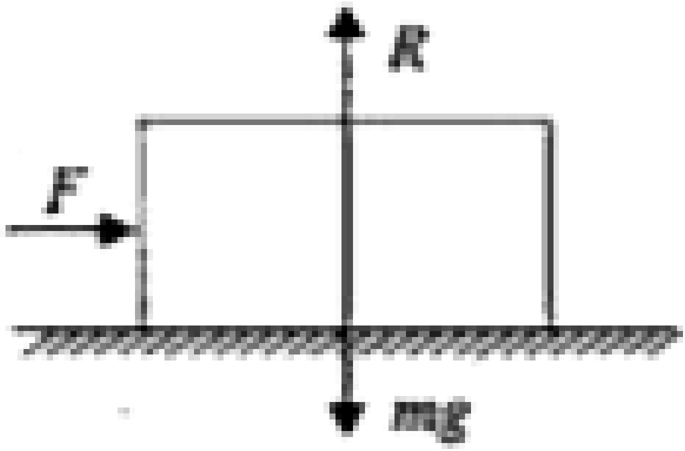
15. A block of mass 2 kg is placed on the floor. The coefficient of static friction is 0.4. A force F of 2.5 N is applied on the block as shown in Fig. 15.4.4. The force of friction between the block and the floor is

$(g = 9.8m / s^2)$



A. 1.5 N

B. 0.5 N

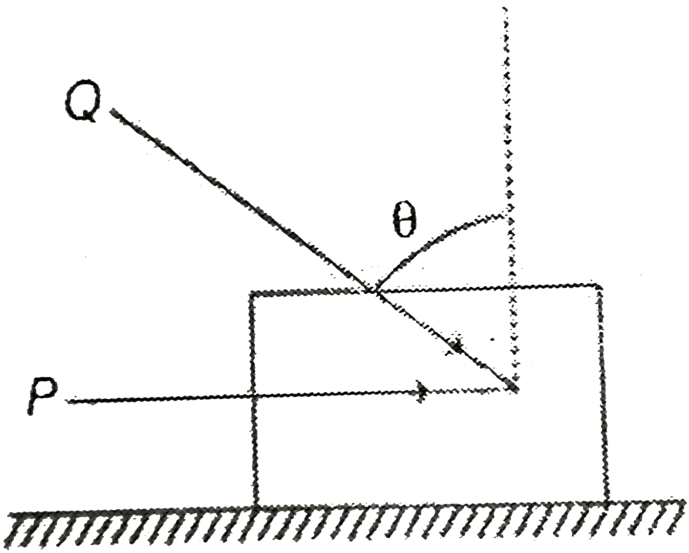
C. 2.5 N

D. None of the above

Answer: c

Watch Video Solution

16. 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 minimum value of coefficient of friction of friction between the block and the surface for which the block will remain in equilibrium is



A. $(P+Q\sin\theta)/(mg+Q\cos\theta)$

B. $(P\cos\theta+Q)/(mg-Q\sin\theta)$

C. $(P+Q\cos\theta)/(mg+Q\sin\theta)$

D. $(P\sin\theta-Q)/(mg-Q\cos\theta)$

Answer: a

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17. When two surfaces are coated with a lubricant, then they

A. stick to each other

B. slide upon each other

C. roll upon each other

D. none of the these

Answer: b

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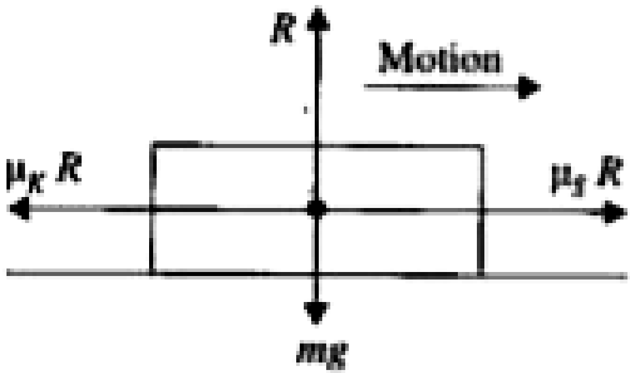
18. For a body on a horizontal surface, coefficients of static and kinetic frictions are 0.4 and 0.2 respectively. When the body is in uniform motion on the surface, a horizontal force equal in magnitude to limiting friction is applied on it. The acceleration produced is



A. 0.4g

B. 0.1 g

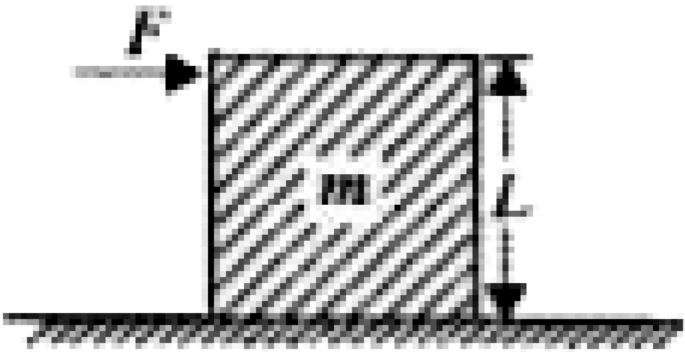
C. 0.2 g

D. 0.6 g

Answer: c

Watch Video Solution

19. A cubical box of side L rests on a rough horizontal surface with coefficient of friction p. A horizontal force F is a applied on the block as shown in Fig. 15.4.6. If the coefficient of friction is sufficiently high so that the block does not slide before toppling, the minimum force required to topple the block is



A. infinitesimal

B. mg/4

C. mg/2

D. mg $(- 1\mu)$

Answer: c

Watch Video Solution

20. A block of mass 3 kg rests on a rough inclined plane making an angle of 30°. With the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is

A. 9.8 N

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

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

D. 0.7×9.8 N

Answer: a

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21. A cylinder rolls up an inclined plane, reaches some height and then rolls down (without slipping thoughout these motions) .The directions of the firctional force acting on the cylinder are

A. up the incline while ascending and down the incline while descending

B. up the incline while ascending as well as descending

C. down the incline while ascending and up the incline while descending

D. down the incline while ascending as well as descending

Answer: b

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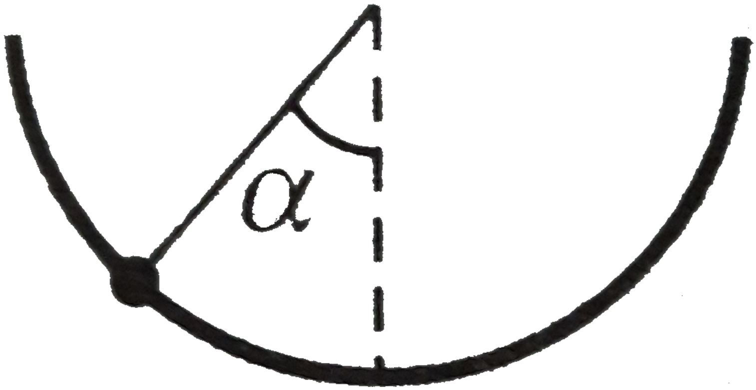
22. An insect crawls up a hemisherical surface very slowly .The coefficient of friction between the insert and the surface is $1/3$ If the line joining the center of the hemisherical surface of the insert makes on angle a with the verticle , find the maximum possible value of a



A. $\cot\alpha = 3$

B. $\sec\alpha = 3$

C. cosec $\alpha = 3$

D. None

Answer: a

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MOTION IN FLUIDS

1. A piece of ice having a stone frozen in it floats in a glass vessel filled with water. How will the level of water in the vessel change when the ice melts?

A. the level will rise

B. the level will not change

C. the level will drop

D. some water will flow out

Answer: c

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2. A wooden cube just floats inside water when a 200 gm mass is placed on it. When the mass is removed, the cube is 2 cm above the water level. The size of the cube is

A. 5 cm

B. 10 cm

C. 15 cm

D. 20 cm

Answer: b

Watch Video Solution

3. About floaring in a water tank is carrying a number of large stones. If the stories were unloaded into water what will happen to water level?

A. rise

B. fall

C. remain unchanged

D. rise till half the number of stones are unloaded and then begin to fall.

Answer: b

Watch Video Solution

4. A body of volume 100 cc. is immersed completely in water contained in a jar. THE weight of water and jar before immersion of the body was 700 gm. After immersion weight of water and jar will be

A. 500 gm

B. 700 gm

C. 100 gm

D. 800 gm

Answer: d

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5. With increase in temperature the viscocity of

A. gases decreases and liquid increases

B. gases increases and liquid decreeases

C. both gases and liquid increases

D. both gases and liquid decreases

Answer: b

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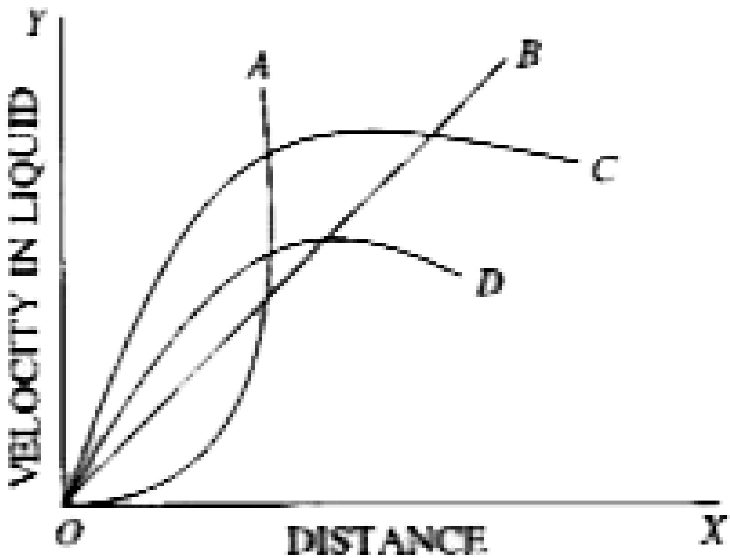
6. A small spherical solid ball is dropped in a viscous liquid. It journey in the liquid is best described in the Fig. 15.5.1 by



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7. The viscous drag on a spherical body moving with a speed v is proportional to

A. $\sqrt{v}$

B. v

C. $1/\sqrt{v}$

D. v^2

Answer: b

Watch Video Solution

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

A. V/4

B. 16 V

C. V/8

D. V/32

Answer: d

Watch Video Solution

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

A. 5 cm/s

B. 10 cm/s

C. 40 cm/s

D. 80 cm/s

Answer: a

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10. The terminal velocity v of a small steel ball of radius r falling under gravity through a column of viscous liquid of coefficient of viscosity η depends on mass of the bass m, acceleration due to gravity g, coefficient of viscosity η and radius r. Which of the following relations is dimensionally correct ?

A. $v_T \propto \frac{mgr}{\eta}$

B. $v_T \propto$ m g η r

C. $v_T \propto \frac{mg}{r\eta}$

D. $v_T \propto \frac{\eta mg}{r}$

Answer: c

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11. Bernoulli's principle is based on the law of conservation of

A. mass

B. momentum

C. energy

D. none of the above

Answer: C

Watch Video Solution

12. The terminal velocity of small sized spherical body of radius r falling veertically in a viscous liquid is given by a following proportionality

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

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

C. r

D. r^2

Answer: d

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13. When a large bubble rises from the bottom of a lake to the surface, its radius doubles, The atmospheric pressure is equal to that of a column of water of height H. The depth of the lake is

A. H

B. 2 H

C. 7 H

D. 8 H

Answer: c

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14. An inverted vessel (ball) lying at the bottom of a lake, 47.6 m deep, has 50 c.c. of air trapped in it. The bell is brought to the surface of the lake.

The volume of the trapped air will now be (Atmospheric pressure is 70 cm of Hg, density of HG - 13.6 g cm^{-3})

A. 350 c.c.

B. 300 c.c.

C. 250 c.c.

D. 200 c.c.

Answer: b

Watch Video Solution

15. A metallic sphere floats in an immiscible mixture of water $(\rho_W = 10^3 kg/m^3)$ and a liquid $(\rho_1 = 13.5 \times 10^3 kg/m^3)$ such that is (4/5) th portion is in water and (1/5) th portion in the liquid. The density of metal is

A. $4.5 \times 10^3 kg/m^3$

B. $4.0 \times 10^3 kg/m^3$

C. $3.5 \times 10^3 kg / m^3$

D. $1.9 \times 10^3 kg / m^3$

Answer: c

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16. Motion of a liquid in a tube is describe by

A. Bernoullis theorem

B. Poiseuille's equation

C. Stoke's law

D. Archimedes principle.

Answer: b

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17. A cylinider is filled with non viscous liquid of density d to a height h_0 and a hole is made at a height h_1 from the bottom of the cylinder. The velocity issuing out of the hole is

A. $\sqrt{2gh_0}$

B. $\sqrt{2g(h_0 - h_1)}$

C. $\sqrt{dgh_1}$

D. $\sqrt{dgh_0}$

Answer: b

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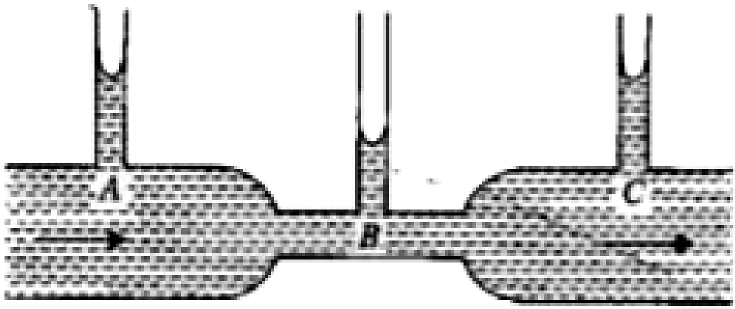
18. In the Fig. 15.5.2 below in shown the flow of liquid through a horizontal pipe. Three tubes A, B and C are connected to the pipe. The radii of the tube, A, B and C at the junction are respectively 2 cm, 1 cm , and 2 cm. It can be said that the



A. height of the liquid in the tube A is maximum

B. height of the liquid in the tubes A and B is the same

C. height of the liquid in all the three tubes is the same

D. height of the liquid in the tubes A and C is the same

Answer: d

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19. Two spheres of equal masses but radii R and 2 R are allowed to fall in a liquid, the ratio of their terminal velocities is

A. $1:4$

B. $1:2$

C. $1:32$

D. $2:1$

Answer: d

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20. A vessel contains oil (density = 0.8 gm/cm^2) over mercury (density = 13.6 gm/cm^2). A homogeneous sphere floats with half of its volume immersed in mercury and the other half in oil. The density of material of the sphere in gm/cm^3 is

A. 3.3

B. 6.4

C. 7.2

D. 2.8

Answer: c

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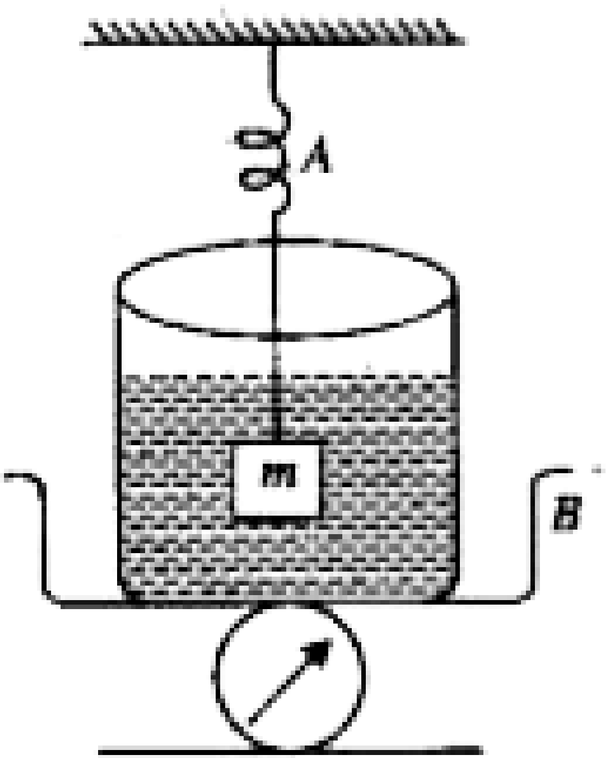
21. The spring balance A read 2 kg with a block m suspended from it. A balance B reads 5 kg when a beaker with liquid is put on the pan of the balance. The two balances are now so arranged that the hanging is inside the liquid in the beaker as shown in Fig. 15.5.3. In this situation



A. the balance A will read more than 2 kg

B. the balance B will read more than 5 kg

C. the balance A will read less than 2 kg and B will more than 5 kg

D. the balance A and B will read 2 kg and 5 kg respectively.

Answer: b, c

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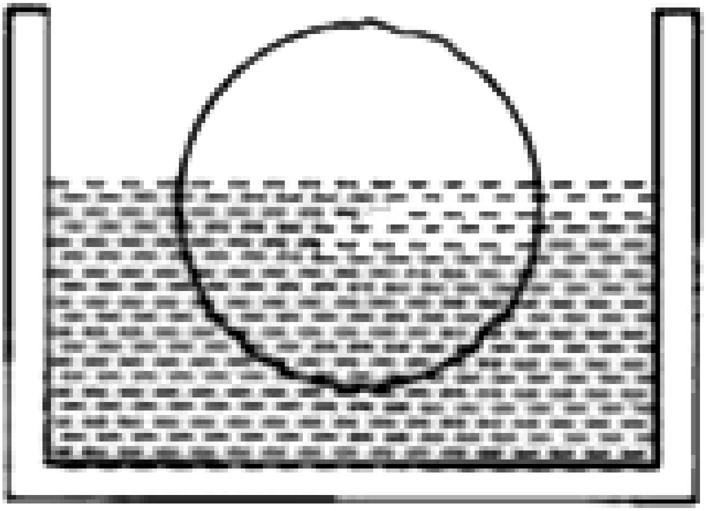
22. A body floats in a liquid contained in a beaker. If the whole system as shown in fig. 15.3.13 falls freely under gravity then the upthrust on the body due to liquid is



A. Zero

B. equal to weight of liquid displaced.

C. equal to weight of the body in air,

D. equal to the weight of the immersed body

Answer: a

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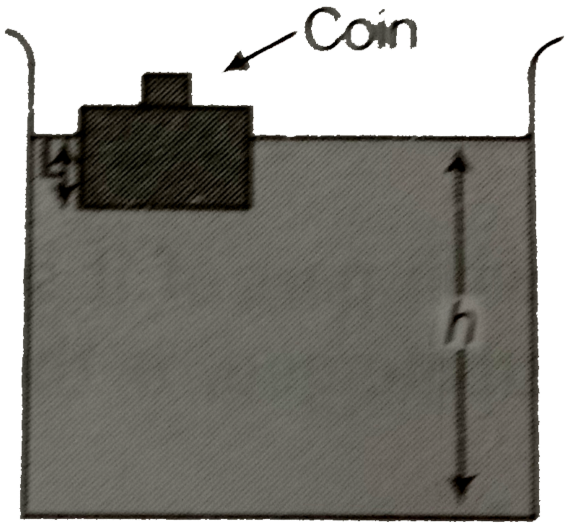
23. A wooden block with a coin placed on its top, floats in water as shown in figure.



The distance l and h are shown in the figure. After sometime, the coin falls into the water. Then,

A. l decreases and h increases

B. l increases and h decreases

C. both l and h increase

D. both l and h decrease

Answer: d

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24. A large open tank has two holes in the wall. One is square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth of 4y from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then R is equal to

A. $L/\sqrt{(2\pi)}$

B. $2\pi L$

C. L

D. $L/2\pi$

Answer: a

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25. A hemispherical portion of a radius R is removed from the bottom of a cylinder of radius R. The volume of the remaining cylinder is V and its mass is M. It is suspended by a string in a liquid of density ρ where it stays vertical . The upper surface of the cylinder is at a depth of h below the liquid surface. THe force on the bottom of the cylinder by the liquid is

A. M g

B. $Mg - V\rho$ g

C. $Mg + \Pi R^2 hg\rho$

D. $\rho g \left(V + \Pi R^2 h\right)$

Answer: d

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UNIFORM CIRCULAR MOTION

1. A particle revolves round a circular path with uniform speed. The acceleration of the particle is

A. along the circumference of the circle.

B. along the tangent

C. along the radius

D. zero

Answer: c

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2. A body of mass m is moving in a circle of radius r with a constant speed v. The work done by the centripetal force in moving the body over half the circumference of the circle is

A. mv^2 / r

B. zero

C. mv^2/r

D. r^2/mv^2

Answer: b

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3. A mass is supported on a frictionless horizontal surface. It is attached to a string and rotates about a fixed centre with a angular velocity ω_0. If the length of the string and angular velocity are doubled, the tension in the string which was initially T_0 is now

A. T_0

B. $T_0/2$

C. $4T_0$

D. $8T_0$

Answer: d

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4. Certain extremely dense neutron stars are believed to be rotating at about 1 rev/sec. If such a star has a radius of 20 km, the acceleration of an object in m//sec^(2)` on the equator of the star will be

A. 8×10^{5}

B. 20×10^{3}

C. 12×10^{6}

D. 4×10^{8}

Answer: a

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5. A particle rests on the top of a hemishpere of radius R. Find the smallest horizontal velocity that must be imparted to the particle if it is yo leave the hemisphere without sliding down it.

A. $\sqrt{gR}$

B. $\sqrt{2gR}$

C. $\sqrt{3gR}$

D. $\sqrt{5gR}$

Answer: a

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6. A particle is moving in a circle with uniform speed. IT has constant

A. velocity

B. Acceleration

C. kinetic energy

D. displacement

Answer: c

Watch Video Solution

7. A car moving on a horizontal road may be thrown out of the road in taking a turn

A. by the gravitational force

B. due to the lack of proper centripetal force

C. due to the rolling frictional force between the tyre and road

D. due to the reaction of the ground

Answer: b

Watch Video Solution

8. A particle is taken round a circle by the application of force. The work done by the force is

A. positive non-zero

B. negative non-zero

C. zero

D. none of the above

Answer: c

Watch Video Solution

9. The ride is circus rides along a circular track in a vertical plane. The minimum velocity at the highest point of the track will be

A. $\sqrt{(2gR)}$

B. $\sqrt{(5gR)}$

C. $\sqrt{(3gR)}$

D. $\sqrt{(gR)}$

Answer: d

Watch Video Solution

10. A particle is moving in a circular path with a constant speed. If θ Is the angular displacement, then starting from $\theta = 0$, the maximum and minimum change in the linear momentum will occur when value of θ is respectively

A. 45° and 90°

B. 90° and 180°

C. 180° and 360°

D. 90° and 270°

Answer: c

Watch Video Solution

11. 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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12. A car sometimes overturns while taking a turn. When it overturns, it is

A. the inner wheel which leaves the ground first

B. the outer wheel which leaves the ground first

C. both the wheel leaves the ground simultaneously

D. either wheel which leaves the ground first

Answer: a

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13. Keeping the banking angle same, to increase the maximum speed with which a vehicle can travel on the curved road by 10%, the radius of curvature of the road has to be changed from 20 m to

A. 16 m

B. 18 m

C. 24.2 m

D. 30.5 m

Answer: c

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14. For traffic moving at 60 km/hour along a circular track of radius 0.1 km, the correct angle of banking is

A. $\left\{(60)^2/0.1\right\}$ km

B. $\tan^{-1}\left[\frac{(50/3)^2}{100 \times 9.8}\right]$

C. $\tan^{-1}\left[\frac{100 \times 9.8}{(50/3)^2}\right]$

D. $\tan^{-1}\sqrt{(60 \times 0.1 \times 9.8)}$

Answer: b

Watch Video Solution

15. A 1 kg stone at the end of 1 m long string is whirled in a vertical circle at constant speed of 4 m/sec. The tension in the string is 6 N when the stone is at $\left(g = 10m/\sec^2\right)$

A. top of the cirlce

B. bottom of the circle

C. half way down

D. none of the above

Answer: a

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16. A car when passes through a convex bridge with velocity v exerts a force on it which is equal to

A. $mg + \frac{mv^2}{r}$

B. $\frac{mv^2}{r}$

C. $mg - \frac{mv^2}{r}$

D. none of these

Answer: a

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17. Two particles of equal masses are revolving in circular paths of radii, r_1 and r_2 respectively with the same period . The ratio of their centripetal force is -

A. r_1 / r_2

B. $\sqrt{r_2/r_1}$

C. $(r_1/r_2)^2$

D. $(r_2/r_1)^2$

Answer: a

Watch Video Solution

18. A particle of mass M is moving in a horizontal circle fo radius R with unifomr speed V. When it moves from one point to a diameterically opposite point, its

A. kinetic energy change by $MV^2/4$

B. momentum does not change

C. momentum changes by 2 MV

D. kinetic energy changes by MV^2

Answer: c

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19. 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 of length 1 m. The angle made by the rod with track is

A. zero

B. 30°

C. 45°

D. 60°

Answer: c

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20. The driver of a car travelling at velocity v suddenly sees a braood with in front of him at a distance a, He should

A. brake sharply

B. turn sharply

C. (a) & (b) both

D. none of the above

Answer: a

Watch Video Solution

21. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration a_c is varying with time t as $a_c = k^2 r t^2$, where k is a constant. The power delivered to the particle by the force acting on its is

A. $2\pi m k^2 r^2 t$

B. $m k^2 r^2 t$

C. $\left(m k^4 r^2 t^5\right) / 3$

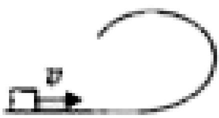
D. zero

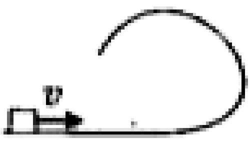
Answer: b

Watch Video Solution

22. A small block is shot into each of the four track as shown in Fig 15.7.1. Each of the track rises to the same height. The speed with which the block enters the track is the same in all cases. At the highest point of the track, the normal reaction is maximum in

A. 

B. 

C. 

D. 

Answer: a

Watch Video Solution

23. A car has linear velocity v on a circular road of radius r. IF r it incrasing its speed at the rate of a ms^{-2}, then the resultant acceleration will be

A. $\sqrt{\left(v^2/r\right)^2 + a^2}$

B. $\sqrt{\left(v^2/r\right)^2 - a^2}$

C. $\left(v^2/r\right)^2 + a$

D. $\left(v^2/r\right)^2 - a^2$

Answer: a

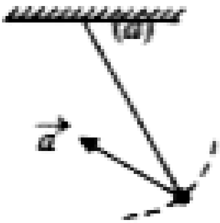
Watch Video Solution

24. A simple pendulum is oscillating without damping. When the displacement of the bob is less than maximum, its acceleration vector $\vec{a}$

is correctly shown in

A.

B.



C.

D.

Answer: c

Watch Video Solution

25. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed w the ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

A. w and q

B. w, q and m

C. q and m

D. w and m

Answer: C

Watch Video Solution

UNIFORM CIRCULAR MOTION (ROTATIONAL MOTION AND MOMENT OF INERTIA)

1. A mass is revolving in a circle which is in the plane of paper. The direction of angular acceleration is

A. upward the radius

B. towards the radius

C. tangential

D. at right angle to angular velocity.

Answer: C

Watch Video Solution

2. When a mass is rotating in a plane about a fixed point its angular momentum is directed along

A. the radius

B. the tangent to orbit

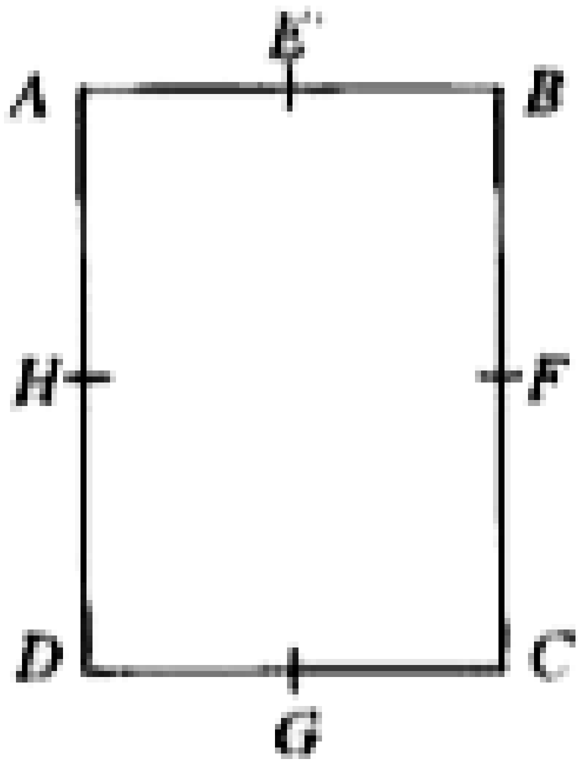
C. line at an anlage of 45° to the plane of rotation

D. the axis of rotation

Answer: D

Watch Video Solution

3. IN a retangle ABCD (BC = 2AB). The moment of inertia along which aixs will be minimum



A. BC

B. BD

C. HF

D. EG

Answer: D

Watch Video Solution

4. IN which case use of angular velocity is useful

A. when the body is rotating

B. when the body moves in a straight line

C. when the body is changing its direction of motion

D. none of the these

Answer: A

Watch Video Solution

5. The moment of inertia of a body about a given axis is 1.2 kg $\times \quad \text{metre}^2$. Initially, the body is at rest. In order to produce a rotating kinetic energy of 1500 joules, an angular acceleration of 25 radian/ $\sec^2$ must be applied about that axis for a duration of

A. 4 sec

B. 2 sec

C. 8 sec

D. 10 sec

Answer: B

Watch Video Solution

6. The position of center of mass of a system of particles does not depend upon the

A. masses of the particles

B. forces on the particles

C. positions of the particles

D. relative distance between the particles

Answer: B

Watch Video Solution

7. A solid cylinder of mass M and radius R rolls down an inclined plane without slipping. THE speed of its centre of mass when it reaches the bottom is

A. $\sqrt{(2gh)}$

B. $\sqrt{4/3.\ gh}$

C. $\sqrt{3/4.\ gh}$

D. $\sqrt{(4g/h)}$

Answer: B

Watch Video Solution

8. The moment of inertia of a hoop of radius R and mass M, about any tangent

A. $\left[3mR^2\right]/2$

B. $\left[mR^2\right]/2$

C. MR^2

D. $\left[MR^2\right]/4$

Answer: A

Watch Video Solution

9. The torque acting on a body is the rotational, analogue of

A. mass of the body

B. linear kinetic energy of the body

C. linear velocity of the body

D. force in linear motion

Answer: D

Watch Video Solution

10. The ratio rotational and translational kinetic energies of a sphere is

A. $2/9$

B. $2/7$

C. $2/5$

D. $7/2$

Answer: B

Watch Video Solution

11. Let g be the acceleration due to gravity at the earth's surface and K the rotational kinetic energy of the earth. Suppose the earth's radius decreases by 2%. Keeping all other quantities constant, then

A. g decreases by 2% and K decreases by 4%

B. g decreases by 4% and K decreases by 2%

C. g decreases by 4% and K decreases by 4%

D. g decreases by 4% and K increases by 4%

Answer: B

Watch Video Solution

12. A body is rolling without slipping on a horizontal plane. If the rotational energy of the body is 40% of the total kinetic energy, then the body might be

A. cylinder

B. hollow sphere

C. solid cylinder

D. ring

Answer: A

Watch Video Solution

13. If the moment of inertion of a disc about an axis tangentially and parallel to its surface by I, then what will be the moment of inertia about the axis tangential but perpendicular to the surface

A. $\frac{6}{5}I$

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

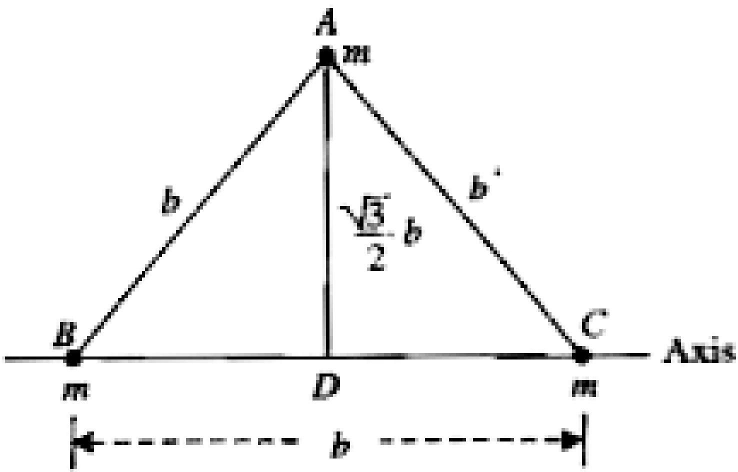
C. $\frac{3}{2}I$

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

Answer: A

Watch Video Solution

14. Three point masses each of mass m are placed at the corners of an equilateral triangle of side b. The moment of inertia of the system about an axis coinciding with one side of the triangle is



A. $3mb^2$

B. mb^2

C. $(3/4)mb^2$

D. $(2/3)mb^2$

Answer: C

Watch Video Solution

15. A flywheel rotating about a fixed axis has a kinetic energy of $360J$ when its angular speed is $30 \text{ rad}/s$. The moment of inertia of the wheel about the axis of rotation is

A. 0.6 kg $\times \text{metre}^2$

B. 0.15 kg $\times \text{metre}^2$

C. 0.8kg $\times \text{metre}^2$

D. 0.75 kg $\times \text{metre}^2$

Answer: D

Watch Video Solution

16. Two spheres of masses 2 M and M are intially at rest at a distance R apart. Due to mutual force of attraction, they approach each other. When they are at separation R/2, the acceleration of the centre of mass of sphere would be

A. $0m/s^2$

B. gm/s^2

C. $3gm/s^2$

D. $12gm/s^2$

Answer: A

Watch Video Solution

17. A wheel is rotating at 900 rpm about its axis. When the power is cut off, it comes to rest in 1 min. The angular retardation (in rad s^{-2}) is

A. $\pi/2$

B. $\pi / 4$

C. $\pi / 6$

D. $\pi / 8$

Answer: A

Watch Video Solution

18. Two bodies of masses m_1 and $m_2 (m_1 > m_2)$ respectively are tied to the ends j of a string which passes over a light frictionless pulley. The masses are intitially at rest and released. What is the acceleration of the centre of mass ?

A. $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2$

B. $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)$ g

C. g

D. zero

Answer: A

Watch Video Solution

19. A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω. Two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring will now rotate with an angular velocity of

A. $\dfrac{\omega(M-2m)}{(M+2m)}$

B. $\dfrac{\omega M}{(M+2m)}$

C. $\dfrac{\omega M}{(M+m)}$

D. $\dfrac{\omega(M+2m)}{M}$

Answer: B

Watch Video Solution

20. Two particles A and B intiallly at rest, move towards each other under a mutual force of attraction. AT the instant when the speed of A is v and the speed of B is 2 v, the speed of the centre of mass of the system is

A. zero

B. v

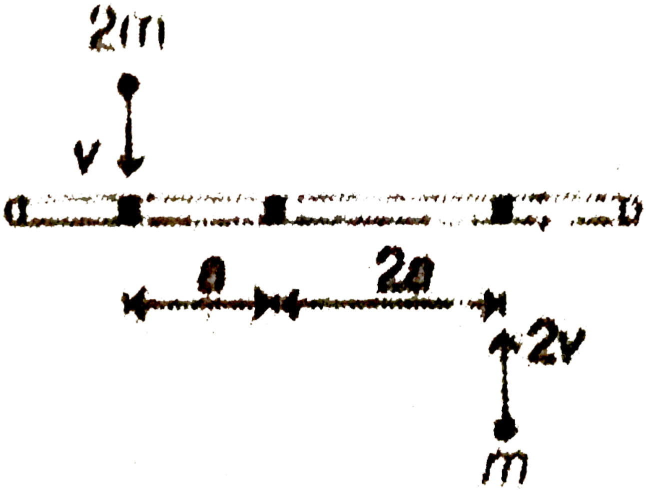
C. 1.5 v

D. 3 v

Answer: A

Watch Video Solution

21. A uniform rod of length 6a and mass 8m lies on a smooth horizontal table. Two particle of masses m and 2m , moving in the same horizontal plane but in opposite directions with speeds 2v and v respectively strike and rod normally as shown in figure and stick to the rod. Denoting angular velocity (about the centre of mass), total energy and transnational velocity of centre of mass by ω, E and v_c respectively after the collision.



A. $v_c = 0$

B. $\omega = \frac{3}{5}\frac{v}{a}$

C. $\omega = \frac{v}{5a}$

D. $E = \frac{3}{5}mv^2$

Answer: A::C::D

Watch Video Solution

22. Two particles A and B, initially at rest, moves towards each other under a mutual force of attraction. At the instant when the speed of A is v and the speed of B is 2 v, the speed of centre of mass is

A. zero

B. v

C. 1.5 v

D. 3 v

Answer: A

Watch Video Solution

23. One quarter sector is cut from a uniform circular disc of radius R. The sector has mass M. IT is made to rotate about a line perpendicular to its plane and passing through the centre of the original disc. Its moment of inertia about the axis of rotation is

A. $MR^2/2$

B. $MR^2/4$

C. $MR^2/8$

D. $\sqrt{2}MR^2$

Answer: A

Watch Video Solution

24. A tube of length L is filled completely with an incompressible liquid of mass M and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity ω. The force exerted by the liquid at the other end is

A. $\frac{M\omega^2 L}{2}$

B. $M\omega^2 L$

C. $\frac{M\omega^2 L}{4}$

D. $\frac{M\omega^2 L^2}{2}$

Answer: A

Watch Video Solution

25. A mass M moving with a constant velocity parallel to the X-axis. Its angular momentum with respect to the origin

A. zero-

B. remains constant

C. goes increasing

D. goes on decreasing

Answer: B

Watch Video Solution

GRAVITATION

1. The gravitational force between two stones of mass 1 kg each separted by a distance of 1 metre in vaccum is

A. zero

B. 6.675×10^{-5} newton

C. 6.675×10^{-11} newton

D. 6.75×10^{-8} newton

Answer: C

Watch Video Solution

2. Two particles of equal mass go around a circle of radius R under the action of their mutual gravitational attraction. The speed v of each particle is

A. $\frac{1}{2R}\sqrt{\left(\frac{1}{Gm}\right)}$

B. $\sqrt{\left(\frac{Gm}{2R}\right)}$

C. $\frac{1}{2}\sqrt{\left(\frac{Gm}{R}\right)}$

D. $\sqrt{\left(\frac{4Gm}{R}\right)}$

Answer: C

Watch Video Solution

3. Force of gravitational attraction is least -

A. at the equator

B. at the poles

C. at a point in between equator and any pole

D. none of the above.

Answer: A

Watch Video Solution

4. If the radius of earth is reduced to 2%, keeping mass constant, then weight of the body on its surface

A. decreases

B. increase

C. remains same

D. is more than that at pole

Answer: B

Watch Video Solution

5. If the gravitational force had varied as $r^{-5/2}$ instead of r^{-2} the potential energy of a particle at a distance 'r' from the centre of the earth would be proportional to

A. r^{-1}

B. r^{-2}

C. $r^{-3/2}$

D. $r^{-5/2}$

Answer: C

Watch Video Solution

6. An earth satellite is moving around the earth in circular orbit. IN such case what is conserved

A. velocity

B. linear momentum

C. angular momentum

D. none of the above

Answer: A

Watch Video Solution

7. If the radius of earth were to decrease by 1%, its mass remaining the same, the acceleration due to gravity on the surface of the earth will

A. increase by 1%

B. decrease by 2%

C. decrease by 1%

D. increase by 2%

Answer: D

Watch Video Solution

8. A satellite is moving around the earth with speed v in a circular orbit of radius r. IF the orbit radius is decreased by 1%, its speed will

A. increase by 1%

B. increase by 0.5 %

C. decrease by 1%

D. decrease by 0.5 %

Answer: B

Watch Video Solution

9. A body of mass m rises to height h = R/5 from the earth's surface, where R is earth's radius. If g is acceleration due to gravity at earth's surface, the increase in potential energy is

A. m g h

B. (4/5) m g h

C. (5/6) m g h

D. (6/7) m g h

Answer: C

Watch Video Solution

10. IF the earth stops rotating, the value of 'g' at the equator will

A. increase

B. remain same

C. decrease

D. None of this

Answer: A

Watch Video Solution

11. The escape velocity on the surface of the earth is 11.2 km/s. If mass and radius of a planet is 4 and 2 times respectively than that of earth, what is the escape velocity from the planet ?

A. 11.2 km/sec

B. 1.112 km/sec

C. 15.8 km/sec

D. 22.4 km/sec

Answer: C

Watch Video Solution

12. IF the change in the value of g at the height h above the surface of the earth is the same as at a depth x below it, then (both x and h being much smaller than the radius of the earth)

A. x = h

B. x = 2 h

C. x = h/2

D. $x = h^2$

Answer: B

Watch Video Solution

13. The period of revolution of planet A round from the sun is 8 times that of B. The distance of A from the sun is how many times greater then tht of B from the sun ?

A. 2

B. 3

C. 4

D. 5

Answer: C

Watch Video Solution

14. There is no atmosphere on the moon because

A. it is closer to the earth

B. it revolves round the earth

C. it gets light from the sun

D. the escape velocity of gas molecules is lesser then their mean square velocity here

Answer: D

Watch Video Solution

15. The radius of a planet is 1/4th of R_c and its acc accleration due to gravity is 2 g. What would be the value of escape velocity on the planet, if escape velocity on earth is V.

A. $\frac{V}{\sqrt{2}}$

B. $V\sqrt{2}$

C. $2V$

D. $V/2$

Answer: A

Watch Video Solution

16. A satellite of the earth is revolving in a circular orbit with a uniform speed v. If gravitational force suddenly disappears, the satellite will

A. continue to move with velocity v along the original orbit

B. move with a velocity v, tangentially to the original orbit.

C. fall down with increasing velocity

D. ultimately come to rest somewhere on the original orbit.

Answer: B

Watch Video Solution

17. The escape velocity from earth is 11.2 km per sec. If a body is to be projected in a direction making an angle 45° to the vertical, then the escape velocity is

A. 11.2×2 km/sec

B. 11.2 km/sec

C. $11.2 \times \frac{1}{\sqrt{2}}$ km/sec

D. $11.2 \times \sqrt{2}$ km/sec

Answer: B

Watch Video Solution

18. If the length of a simple pendulum is increased by 2%, then the time period

A. increases by 2%

B. decreases by 2%

C. increases by 1%

D. decreases by 1 %

Answer: C

Watch Video Solution

19. The period of a satellite in a circular orbit of radius R is T. What is the period of another satellite in a circular orbit of radius 4 R ?

A. 4 T

B. T/8

C. T/4

D. 8 T

Answer: D

Watch Video Solution

20. If the radius of the earth were to shrink by 1%, its mass remaining the same, the acceleration due to gravity on the earth's surface would

A. decreases

B. remains unchanged

C. increase

D. blank

Answer: C

Watch Video Solution

21. If g be the acceleration due to gravity of the earth's surface, the gain is the potential energy of an object of mass m raised from the surface of the earth to a height equal to the radius R of the earth is

A. (1/2) m g R

B. 2 m g R

C. m g R

D. (1/4) m g R

Answer: A

Watch Video Solution

22. A gestationary satellite is orbiting the earth at a height 6 R above the surface of earth, where R is the radius of the earth. The time period of another statellight at a height of 2.5 R from the surface of earth in hours is

A. $6\sqrt{2}$ hr

B. 6 hr

C. $5\sqrt{2}$ hr

D. 10 hr

Answer: A

Watch Video Solution

23. A relerence frame atteched to the Earth

A. isan inertial frame by definition

B. cannot be an inertial frame because the earth is revolving round the sun

C. is an inertial frame because Newton's laws are applicable in this frame

D. cannot be inertial frame because the earth is rotating about its own axis.

Answer: B::D

Watch Video Solution

24. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. if the gravitational force of attraction between the planet and the star is proportational to $R^{-5/2}$, then

(a) T^2 is proportional to R^2

(b) T^2 is proportional to $R^{7/2}$

(c) T^2 is proportional to $R^{3/3}$

(d) T^2 is proportional to $R^{3.75}$.

A. R^3

B. $R^{7/2}$

C. $R^{3/2}$

D. $R^{3.75}$

Answer: B

Watch Video Solution

25. A geo-stationary satellite orbits around the earth in a circular orbit of radius 36000 km. Then, the time period of a spy satellite orbiting a few hundred kilometers above the earth's surface (R_("Earth") = 6400 " km")` will approximately be

A. 1/2 hr

B. 1 hr

C. 2 hr

D. 4 hr

Answer: C

Watch Video Solution

PROPERTIES OF MATTER (ELASTICITY)

1. Hooke's law essentially defines

A. stress

B. strain

C. yield point

D. elastic limit.

Answer: D

Watch Video Solution

2. The dimensional formula for modulus of rigidity is

A. M L T

B. $ML^{-2}T^{3}$

C. $ML^{-1}T^{-1}$

D. $ML^{-1}T^{-2}$

Answer: C

Watch Video Solution

3. A ball falling in a lake of depth 200m shown 0.1% decrease in its volume at the bottom .What is the bulk modulus of the materialof the ball

A. $19.6 \times 10^{8} N/m^{2}$

B. $19.6 \times 10^{-10} N/m^{2}$

C. $19.6 \times 10^{-10} N/s^{2}$

D. $19.6 \times 10^{-8} N / m^2$

Answer: A

Watch Video Solution

4. Two wires A and B are of the same maeterial. Their lengths are in the ratio 1 : 2 and the diameters are in the ratio 2 : 1. IF they are pulled by the same force, their increases in length will be in the ratio

A. $2:1$

B. $1:4$

C. $1:8$

D. $8:1$

Answer: C

Watch Video Solution

5. On stretching a wire, the elastic energy stored per unit volume is,

A. F dl/2 Al

B. F A/2l

C. Fl/2A

D. F l/2

Answer: A

Watch Video Solution

6. A cube at temperature 0° C is compressed equal from all sides by an external pressure P. BY what amount should its temperature be raised to bring it back to the size it had before the external pressure was applied. The bulk modulus of the material of the cube is K and the coefficient of linear expansion is α.

A. $P/K\alpha$

B. $P/3K\alpha$

C. $3\pi\alpha / K$

D. $3K / P$

Answer: C

Watch Video Solution

7. Which of the following affecs the elasticity of a substance

A. hammering and annaling

B. chang in temperature

C. impurity in substance

D. all of these

Answer: B

Watch Video Solution

8. A long spring is stretched by 2 cm and the potential energy is V. IF the spring is stretched by 19 cm, its potential energy will be

A. 361V/4

B. V/5

C. 5 V

D. 25 V

Answer: A

Watch Video Solution

9. Energy of a stretched wire is

A. half of load $\times$ strain

B. load $\times$ strain

C. stress $\times$ strain

D. half of stress $\times$ strain

Answer: D

Watch Video Solution

10. An indian ruber cord L meter long and area of cross-secion A metre is suspended vertically. Density of rubber is ρ kg/ metre^3 and Young's modulus of rubber is Y newton/ metre^2. IF the cord extends by l metre under its own. Weight, then extension l is

A. $L^2\rho g / Y$

B. $L^2\rho g / 2y$

C. $L^2)\rho g / 4Y$

D. $Y / L^2\rho g.$

Answer: B

Watch Video Solution

11. Two rods A and B of the same material and length have radii r_1 and r_2 respective. When they are rigidly fixed at one end and twisted by the same torque applied at the other end, the ratio $\left[\frac{\text{the angle of twist at the end of A}}{\text{the angle of twist at the end of B}}\right]$ equal to

A. $r_1^2 / r_2^2)$

B. r_1^3 / r_2^3

C. r_2^4 / r_1^4

D. r_1^4 / r_2^4

Answer: C

Watch Video Solution

12. A spherical ball contracts in volume by 0.01 % when subjected to a normal uniform pressure of 100 atmosphers. The bulk modulus of its material in dynes/ cm^2 is

A. 10×10^{12}

B. 100×10^{12}

C. 1×10^{12}

D. 2.0×10^{11}

Answer: C

Watch Video Solution

13. A wire is stretched by 10 mm when it is pulled bya certain force. Another wire of the same material but double the length and double the diameter is stretched by the same force. The elongation of the second wire is

A. 5 mm

B. 10 mm

C. 20 mm

D. 40 mm

Answer: A

Watch Video Solution

14. An iron of length l and having cross-section A is heated form $0^{\circ}C$ to 100°C. IF his bar is held so that it is not permitted to expand or bend, the gigantic force that is developed is

A. directly proportional to the length of the bar

B. inversely proportional to the length of the bar

C. independent of the length of the bar

D. inversely proportional too the cross-section of the bar

Answer: A

Watch Video Solution

15. The normal density of gold is ρ and its bulk modulus is K. The increase is density of a lump of gold when a pressure P is applied uniformly on all sides is

A. ρ P/K

B. ρ K/P

C. P/ρ K

D. $K/\rho P$

Answer: A

Watch Video Solution

16. A steel wire of length 20 cm and uniform cross section 1 mm^2 is tied rigidly at both the ends. The temperature of the wire is altered from 40° C to $20^\circ C$ Coefficient of linear expansion for steel $\alpha = 1.1 \times 10^{-5} l^\circ C$ and Y for steel is $2.0 \times 10^{11} N/m^2$. The change in tension of the wire is

A. 2.2×10^6 newton

B. 16 newton

C. 8 newton

D. 44 newton

Answer: D

Watch Video Solution

17. Let Y_g and Y_r represent Young's modulus for glass and rubber respectively. It is said that glass is more elastic than rubber. Therefore , it follows

A. $Y_g = Y_r$

B. $Y_g < Y_r$

C. $Y_g > Y_r$

D. $Y_g / Y_r = 0$

Answer: C

Watch Video Solution

18. The Young's modulus of brass and steel are respectively $10 \times 10^{10} N/m^2$. And $2 \times 10^{10} N/m^2$ A brass wire and a steel wire of the same length are extended by 1 mm under the same force, the radii of brass and steel wires ar R_B and $R_S$respectively. Then

A. $R_S = \sqrt{2}R_B$

B. $R_S = R_B/\sqrt{2}$

C. $R_S = 4R_B$

D. $R_S = R_B/4$

Answer: B

Watch Video Solution

19. One end of a uniform wire of length L and of weight W is attached rigidly to a point in the roof and a weight W_1 is suspended from its lower end. IF S is the area of cross-section of the wire, the stress in the wire at a height 3L/4 from its lower end is

A. W_1 / S

B. $\left(W_1 + \frac{W}{4}\right)S$

C. $\frac{W_1 + \frac{3W}{4}}{S}$

D. $(W_1 + W)S$

Answer: C

Watch Video Solution

20. A wire of length L and cross-sectional area A is made of a material of Young's modulus Y. IF the wire is stretched by an amount x, the workdone is

A. $\frac{YAx^2}{2L}$

B. $\frac{YAx}{2L^2}$

C. $\frac{YAx}{2L}$

D. $\frac{YAx^2}{L}$

Answer: A

Watch Video Solution

21. When an elastic material with Young's modulus Y is subjected to a stretching stress, the elastic energy stored per unit volume of the material is

A. $Ys/2$

B. $s^2Y/2$

C. $s^2/2Y$

D. $s/2Y$

Answer: C

Watch Video Solution

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

A. length 50 cm and diamter 0.5 mm

B. length 100 cm and diameter 1 mm

C. length 200 cm and diameter 2 mm

D. length 300 cm and diameter 3 mm

Answer: A

Watch Video Solution

PROPERTIES OF MATTER (SURFACE TENSION)

1. A iron needle slowly placed on the surface of water floats on it because

A. when inside water, it will displace water more than its weight

B. the density of the material of the needle is less than that of water,

C. its surface tension

D. of its shape

Answer: C

Watch Video Solution

2. A needle can float on clear water but sinks when some detergent is added to it. This happens because

A. addition of detergent increases the density of water

B. addition of detergent reduces the density of water

C. addition of detergent reduces the surface tension of water

D. addition of detergent increases the surface tension of water.

Answer: C

Watch Video Solution

3. A liquid does not wet the solid surface if the angle of contact is

A. zero

B. less than 90°

C. more than 90°

D. 90°

Answer: B

Watch Video Solution

4. The work done to blow a scap bubble of radius. R (surface tension T)

A. $4\pi r^2 T$

B. $\pi r^2 T$

C. $2\pi r^2 T$

D. $8\pi r^2 T$

Answer: D

Watch Video Solution

5. A drop of oil is placed on the surface of water. Which of the following statement is correct.

A. it will remain on it as a sphere

B. it will spread as a thin layer

C. it will partly be as spherical droplets and partly as thin film

D. it will float as a distorted drop on the water surface

Answer: B

Watch Video Solution

6. At critical temperature, the surface tension of a liquid

A. is zero

B. is infinity

C. is the same as that at any other temperature

D. cannot be determined

Answer: A

Watch Video Solution

7. Two spherical soap bubbles of radii r_1 and r_2 in vaccum coalesce under isothermal conditions. The resulting bubble has a radius R such that

A. $(r_1 + r_2)/2$

B. $R = [r_1 r_2]/r_1 + r + (2)$

C. $R = \sqrt{\left(r_1^2 + r_2^2\right)}$

D. $R = r_1 + r_2$

Answer: C

Watch Video Solution

8. Energy needed in breaking a drop of radius R into n drops of radius r, is where T is surface tension and P is atmospheric pressure.

A. $\left(4\pi r^2 n - 4\pi R^2\right)T$

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

C. $\left(4\pi R^2 - 4\pi r^2\right)nT$

D. $\left(4\pi R^2 - n4\pi r^2\right)P$

Answer: A

Watch Video Solution

9. There is a horizontal film of soap solution. On it a thread is placed in the form of a loop. The film is pierced inside the loop and the thread becomes a circular loop of radius R. If the surface tension of the loop be T, then what will be the tension in the thread?

A. $\pi R^2 / T$

B. $\pi R^2 / T$

C. $2\pi RT$

D. R T

Answer: D

Watch Video Solution

10. Soap helps in cleaning the clothes because

A. it reduces the surface tension of solution

B. it gives strength to solution

C. it absorbs the dirt

D. chemical of soap cleans

Answer: A

Watch Video Solution

11. When two capillary tubes of different diameters are dipped vertically, the rise of the liquids is

A. same in both the tubes

B. more in tube of larger diameter

C. less in tube of smaller diameter

D. more in the tube of smaller diameter

Answer: D

Watch Video Solution

12. Workdone to blow a bubble of volume V is W. The workdone is blowing a bubble of volume 2 V will be

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

B. 2 W

C. $(4)^{1/3}$ W

D. 4 W

Answer: C

Watch Video Solution

13. The work done is increasing the size of a soap film from 10 cm $\times$ 6 cm to 10 cm $\times$ 11 cm is 3×10^{-4} joule. The surface tension of the film is

A. 1.5×10^{-2} N/m

B. 3.0×10^{-2} N/m

C. 6.0×10^{-2} N/m

D. 11.0×10^{-2} N/m

Answer: A

Watch Video Solution

14. An incompressible fluid flows steadily through a cylinder pipe which has radius 2 R at point A and radius R at point B further along the flow direction. IF the velocity at point A is v, its velocity at a point B will be

A. 2 v

B. v

C. v/2

D. 4v

Answer: D

Watch Video Solution

15. By inserting a capillary tube into a depht l in water, the water rises to a height h. If the lower end of the capillary is closed inside water and the capillary is closed inside water and the capillaryis taken out and closed and opened, to what height the water will remain in the tube ? Here $l > h$

A. zero

B. $l + H$

C. 2 h

D. h

Answer: D

Watch Video Solution

16. Water rises to a height Of 10 cm in a capillary tube, and mercuryfalls to a depth of 3.42 cm in the same capillary tube. IF the density of mercury is 13.6 and the angle of contact is 135°, the ratio of surface tension for water and mercury is

A. $1:0.5$

B. $1:3$

C. $1:6.5$

D. $1.5:1$

Answer: C

Watch Video Solution

17. A square wire fram of size L is dipped in a liquid. On taking out a membrane is formed. Ifthe surface tension of the liquid is T, the force acting on the frame will be

A. 2 T L

B. 4 T L

C. 8 T L

D. 10 T L

Answer: C

Watch Video Solution

18. In a surface tension experiment with capillary tube water rises upto 0.1 m. If the same experiment is repeated on an artifical satellite, while is revolving around the earth, water will rise in the capillary tube upto a height of

A. 0.1 m

B. 0.2 m

C. 0.98 m

D. full length of capillary tube

Answer: D

Watch Video Solution

19. Two unequal soap bubbles are formed one on each side of a tube closed in the middle by a tap. What happens when the tap is opened to put the two bubbles in communication?

A. no air passes in any direction as the pressures are the same on two sides of the tap

B. larger bubbles shrinks and smaller bubble increases in size till they become equal in size

C. smaller bubbles gradually collapses and the bigger one increases in size

D. none of these

Answer: C

Watch Video Solution

20. The radii of two soap bubbles are r_1 and $r_2(r_2 < r_1)$. They meet to produce a double bubble. The radius of their common interface is

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

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

C. $\frac{r_1 r_2}{r_1 - r_2}$

D. $r_2 - r_1$

Answer: C

Watch Video Solution

21. Two capillary tubes of radii 0.2 cm and 0.4 cm are dipped in the same liquid.The ratio of heights through which liquid will rise in the tube is

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: D

Watch Video Solution

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

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

B. $l/n^{2/3} - 1$

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

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

Answer: C

Watch Video Solution

23. A 10 cm long wire is placed horizontal on the surface of water and is gently pulled up with a force of 2×10^{-2} N to keep the wire in equilibrium. The surface tension, in Nm^{-1} of water is

A. 0.002

B. 0.001

C. 0.2

D. 0.1

Answer: C

Watch Video Solution

PROPERTIES OF MATTER (CALORIMETRY, CHANGE OF STATE & KINETIC THEORY OF GASES)

1. Boiling water is changing into steam. Under this condition the specific heat of water is

A. zero

B. one

C. infinite

D. less the one

Answer: C

Watch Video Solution

2. Steam is passed through the water contained in a beaker. The water can boil, when the steam is at

A. atmospheric pressure

B. pressure height than the atmosphere

C. pressure lower than the atmosphere

D. any pressure

Answer: B

Watch Video Solution

3. compared to burn due to air at 100° a burn due to steam at $100^{\circ}C$ is

A. more dangerous

B. less dangerous

C. equally dangerous

D. none of the above

Answer: A

Watch Video Solution

4. Ratio of C_P and C_v depends upon temperature according to the following relation

A. $\gamma\alpha$ T

B. $\gamma\alpha 1/T$

C. $\gamma\alpha\sqrt{T}$

D. $\gamma\alpha T^{o}$

Answer: D

Watch Video Solution

5. A large iceberg melts at the base but not at the top because

A. the base of the iceberg remains in warmer surroundings

B. ice at base contains impurities

C. due to high pressure ice at the base lowers its melting point

D. ice at the top is different kind

Answer: C

Watch Video Solution

6. The study of physical phenomenon at temperature below liquid nitrogen is called

A. refrigeration

B. conduction

C. cryogenics

D. radiation

Answer: C

Watch Video Solution

7. With rise in boiling point of water, the latent heat of steam

A. increases

B. decreases

C. does not change

D. sometimes increases and sometimes decreases

Answer: B

Watch Video Solution

8. Hygrometers are instruments for measuring

A. the amount of oxygen in air

B. the density of air

C. the expansion of water vapour with temperature

D. the amount of water vapour in the atmosphere

Answer: D

Watch Video Solution

9. For hydrogen gas $C_p - C_v = a$ and for oxygen gas $C_p - C_v = b$. So, the relation between a and b is given by

A. $a = 16$ b

B. $16a = b$

C. $a = 4b$

D. $a = b$

Answer: D

Watch Video Solution

10. If water in a closed bottle is taken up to the moon and open, the water gets

A. freezed

B. boiled

C. dissociated into O_2 and H_2

D. evaporated

Answer: B

Watch Video Solution

11. A lead ball moving with velocity v strikes a wall and stops. iF 50% of its energy is converted into heat, then what will be the increase in temperature ? Specific heat of lead is s

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

B. $\frac{v^2}{4Js}$

C. $\frac{v^2 s}{J}$

D. $\frac{v^2 s}{2J}$

Answer: B

Watch Video Solution

12. if 1 g of system is mixed with 1 g of ice, then the resultant temperature of the mixture is

A. 270° C

B. $230^{\circ} C$

C. 100° C

D. $50^{\circ} C$

Answer: C

Watch Video Solution

13. A gas at pressure p_0 is contained in a vessel. If the masses of all the molecules are halved and their speeds doubled, the resulting pressure would be

A. $4P_0$

B. $2P_0$

C. P_0

D. $P_0 / 2$

Answer: B

Watch Video Solution

14. A sealed container with negligible thermal cofficient of expansion contains helium (a monatomic gas). When it is heated from 300 to 600 K, the average kinetic energy of the helium atom is

A. halved

B. left unchanged

C. doubled

D. become $\sqrt{2}$ times

Answer: C

Watch Video Solution

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

A. 8.1%

B. 9.1%

C. 10.1%

D. 11.1%

Answer: D

Watch Video Solution

16. The temperature of gas is produced by

A. the potential energy of its molecules

B. the kinetic energy of its molecules

C. the attractive force between its molecules

D. the repulsive force between its molecules

Answer: B

Watch Video Solution

17. A polyatomic gas with n degrees of freedom has a mean energy per molecules given by

A. $\frac{nkT}{N}$

B. $\frac{nkT}{2N}$

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

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

Answer: C

Watch Video Solution

18. If masses of all molecule of a gas are halved and their speed doubled then the ratio of initial and final pressure will be

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer: B

Watch Video Solution

19. The root mean square velocity of the gas molecule is 300 m/s. What will be the root mean square speed of he molecule if the atomic weight is doubled and absolute temperature is halved ?

A. 300 m/s

B. 150 m/s

C. 600 m/s

D. 75 m/s

Answer: B

Watch Video Solution

20. The mean translational K.E. per unit volume E and the pressure P of a perfect gas are related as

A. P = E/2 V

B. P = 2 E/3V

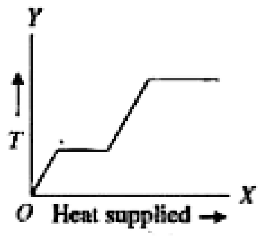
C. P = 3/2 EV

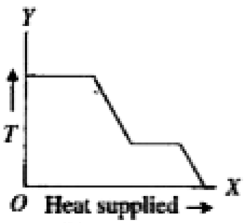
D. P = 3 E/2 V

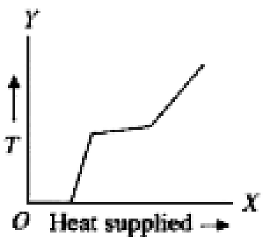
Answer: B

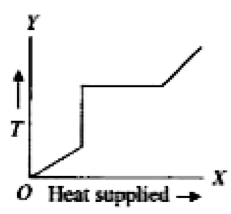
Watch Video Solution

21. A block of ice at $-8^\circ C$ is slowly heated and converted to steam at $100^\circ C$. Which of the following curves represents the phenomena qualitatively?

A. 

B. 

C. 

D. 

Answer: A

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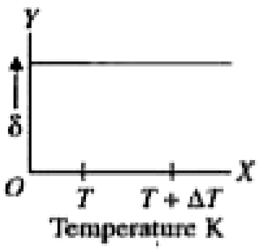
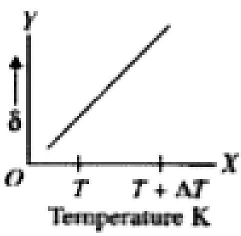
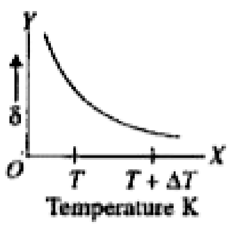
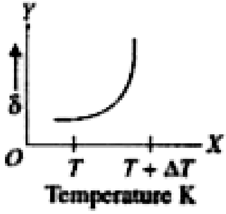
22. An ideal gas is initially at temperature T and volume V. ITS volume is increased by ΔV due to an increase in temperature ΔT, pressure remaining constant. The quantity $\delta = \Delta V / V \Delta T$ varies with temperature as

A. 

B. 

C. 

D. 

Answer: C

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23. When an ideal diatomic gas is heated at constant pressure the fraction of the heat energy supplied which increases the internal energy of the gas is

A. $2/5$

B. $3/5$

C. $5/7$

D. `3//7

Answer: C

Watch Video Solution

Watch Video Solution

24. If one mole of a monoatomic gas $(\gamma = 5/3)$ is mixed with one mole of a diatomic gas $(\gamma = 7/5)$, the value γ for the mixture is

A. 1.40

B. 1.50

C. 1.53

D. 3.07

Answer: C

Watch Video Solution

25. The temperature of argon kept in a vessel is raised by $1^\circ C$ at a constant volume. The total heat supplied to the gas is a combination of translational and rotational energies. Their respective shares are

A. 60% and 40%

B. 40% and 60%

C. 50% and 50%

D. 100% and 0%

Answer: D

Watch Video Solution

26. The temperature at which root mean square velocity of molecules of helium is equal to root mean square velocity of hydrogen at NTP

A. $273^{\circ} C$

B. 273 K

C. $246^{\circ} C$

D. 844 K

Answer: C

Watch Video Solution

27. At the same temperature the mean kinetic energies of molecular of hydrogen and oxygen are in the ratio

A. $1:1$

B. $1:16$

C. $8:1$

D. $16:1$

Answer: A

Watch Video Solution

28. For accuracy of gas thermometer, the gas should be filled at

A. low pressure and high temperature

B. high pressure and low temperature

C. low pressure

D. high temperature

Answer: A

Watch Video Solution

29. For measuring temperature near absolute zero, the thermometer used is

A. thermo-electric thermometer

B. radiation thermometer

C. magnetic thermometer

D. resistance thermometer

Answer: C

Watch Video Solution

30. Recently, the phenomenon of super conductivity has been observed at $95^{\circ} K$. This temperature is nearly equal to

A. $-288^{\circ} F$

B. $-146^{\circ} F$

C. $-368^{\circ} C$

D. $+178^{\circ} C$

Answer: A

Watch Video Solution

INTERNAL ENERGY

1. The internal energy U is a unique function of any state because change in U

A. does not depend upon path

B. depends upon path

C. corresponds to an adiabatic process

D. corresponds to an isothermal process

Answer: A

Watch Video Solution

2. Assertion Internal energy of an ideal gas does not depend on voume of gas

Reason Internal energy depends only on temperature of gas

A. viscosity

B. density

C. temperature

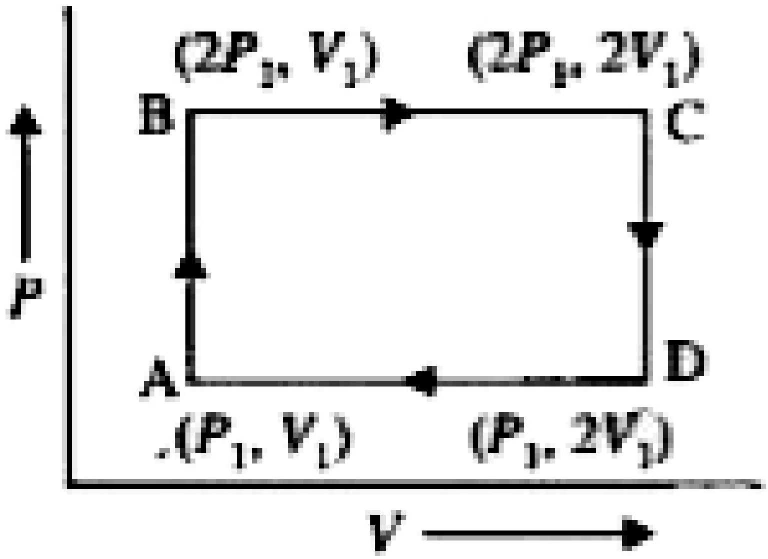
D. thermal conductivity

Answer: C

Watch Video Solution

3. An ideal non-atomic gas is taken round the cycle ABCDA in the P-V diagram where the coordinates of the points are :

$A(P_1, V_1), B(2P_1, V_1), C(2P_1, 2V_1)$ and $D(P_1, 2V_1)$ The work done during the cycle is



A. P_1V_1

B. $2P_1V_1$

C. $1/2P_1V_1$

D. zero

Answer: A

Watch Video Solution

4. A given system undergoes a change in which up workdone by the system equal the decrease in its internal energy. The system must have undergone an

A. isothermal changes

B. adiabatic change

C. isobaric change

D. isochoric change

Answer: B

Watch Video Solution

5. The first law of thermodynamic is a special case of

A. Newton's law

B. the law of conservation of energy

C. Charle's law

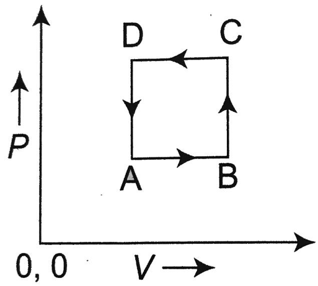
D. the law of heat exchange.

Answer: B

Watch Video Solution

6. Choose the correct option:

In following figs. Variation of volume by change of pressure is shown in Fig. A gas is taken along the path $ABCDA$. The change in internal energy of the the gas will be:



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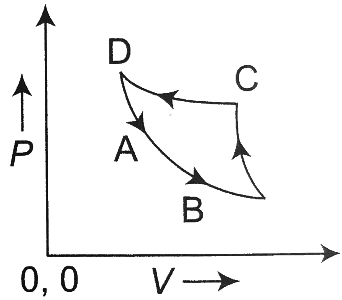

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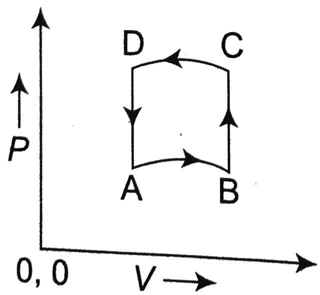

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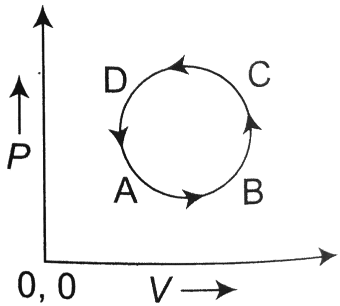

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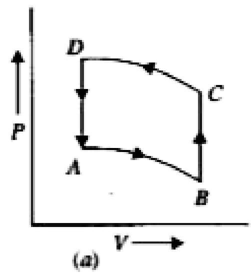
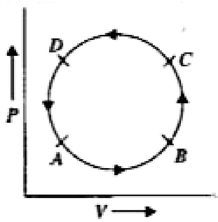
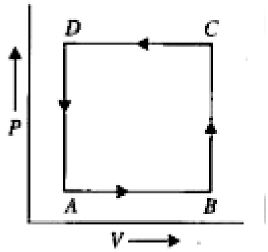
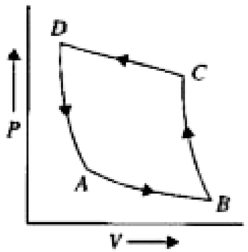
A. 

B. 

C. 

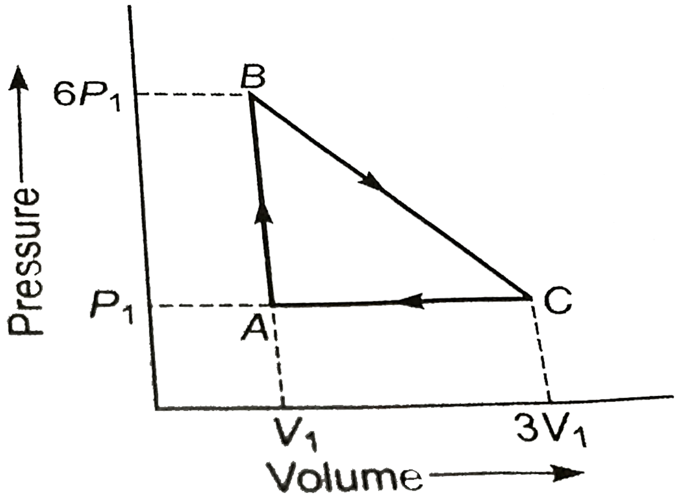
D. 

Answer: D

Watch Video Solution

7. An ideal gas is taken around the cycle ABCA as shown in P-V diagram.

The net work done during the cycle is equal to :



A. zero

B. 3 PV

C. 6 PV

D. 9 PV

Answer: D

Watch Video Solution

8. Which of the following is not a thermodynamic coordinate ?

A. P

B. T

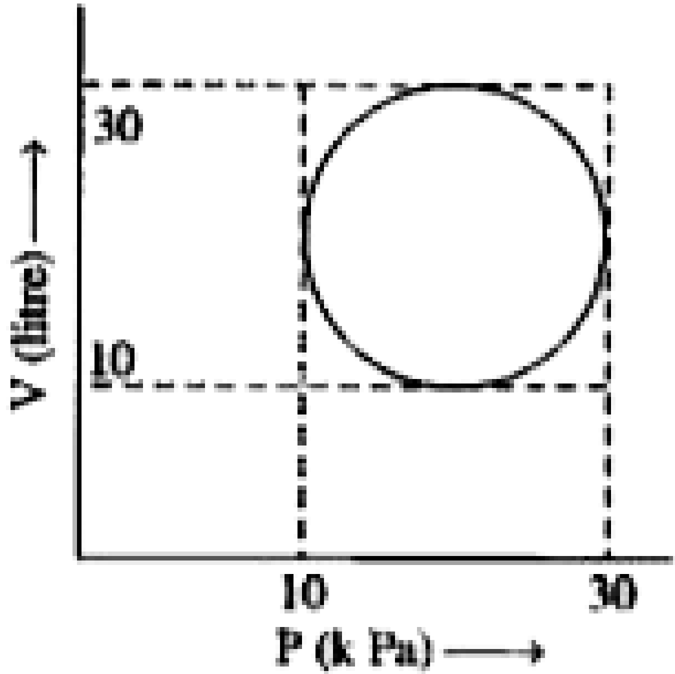
C. V

D. R

Answer: D

Watch Video Solution

9. Heat energy absorbed by a system is going through a cyclic process shown is Fig. 15.9.3.



A. $10^7 \pi J$

B. $10^4 \pi J$

C. $10^2 \pi J$

D. $10^{-3} \pi J$

Answer: C

Watch Video Solution

10. During an adiabatic expansion of 2 moles of a gas the chang in internal energy was found to be equal to -100 J. The work done during the process will be equal to

A. zero

B. -100 joule

C. 200 joule

D. 100 joule

Answer: D

Watch Video Solution

11. A monatomic gas on n molecules is heated from temperature T_1 to T_2 under two different conditions (i) constant volume, (ii) constant pressure. The change of internal energy of the gas

A. more of (i)

B. more of (ii)

C. same in both cases

D. independent of number of moles

Answer: C

Watch Video Solution

12. A Carnot engine operates with a source at 500 K and sink at 375 K. Engine consumes 600 kcal of heat per cycle. The heat rejected to sink per cycle is

A. 250 kcal

B. 350 kcal

C. 450 kcal

D. 550 kcal

Answer: C

Watch Video Solution

13. If R is universal gas constant , the amount of heat needed to raise the temperature of 2 moles of an ideal monatomic gas from 273 K to 373 K when no work id done is

A. 100 R

B. 150 R

C. 300 R

D. 500 R

Answer: C

Watch Video Solution

14. A frictionless heat engine can be 100% efficient only if its exhaust temperature is

A. $0^{\circ} C$

B. $0K$

C. equal to its input temerpature

D. half of its input temperature

Answer: B

Watch Video Solution

15. The temperateus of inside and outside of a refrigerator are 273 K and 303 K respectively. Assuming that the refrigerator cycle is reversible, for every joule of workdone, the heat delivered to the surrounding will be nearly

A. 10 J

B. 20 J

C. 30 J

D. 50 J

Answer: A

Watch Video Solution

16. An ideal gas heat engine operates in Carnot cycle between $227^\circ C$ and $127^\circ C$. It absorbs 6×10^4 cal of heat at highter temperature. Amount of heat converted to work is

A. 4.8×10^4 cals

B. 3.5×10^4 cals

C. 1.6×10^4 cals

D. 1.2×10^4 cals

Answer: A

Watch Video Solution

17. 1 cm^3 of waterr at its boiling point absorbs 540 calories of heat to become steam with a volume of 1671 cm^3. If the atmospheric pressure $= 1.013 \times 10^5 N/m^2$ and the mechanical equivalent of heat $= 4.19$ J/calorie, the energy spent in this process in overcoming inter molecular forces is

A. 540 calorie

B. 40 calorie

C. 500 calorie

D. zero

Answer: C

Watch Video Solution

18. If a refrigerator's door is kept open, will the room become cool or hot ?

A. rise

B. fall

C. remains the same

D. depends on area of the room

Answer: A

Watch Video Solution

19. A Carnot engine has an efficiency of $1/6$. When the temperature of the sink is reduced by $62^{\circ}C$, its efficiency is doubled. The temperature of the source and the sink are, respectively.

A. $95^{\circ}C, 37^{\circ}C$

B. $80^{\circ}C, 37^{\circ}C$

C. $99^{\circ}C, 37^{\circ}C$

D. $90^{\circ}C, 37^{\circ}C$

Answer: C

Watch Video Solution

20. When an ideal diatomic gas is heated at constant pressure the fraction of the heat energy supplied which increases the internal energy of the gas is

A. $2/5$

B. $3/5$

C. $3/7$

D. $5/7$

Answer: D

Watch Video Solution

21. A gas mixture coinsists of (2) moles of oxygen and (4) moles of argon at temperature (T). Neglecting all vibrational modes, the total internal energy of the system is (jee 1999)

(a) 4 RT (b) 15 RT (c) 9 RT (d) 11 RT.

A. 4 RT

B. 15 RT

C. 9 R T

D. 11 R T

Answer: D

Watch Video Solution

22. When an ideal diatomic gas is heated at constant pressure the fraction of the heat energy supplied which increases the internal energy of the gas is

A. $2/5$

B. $3/5$

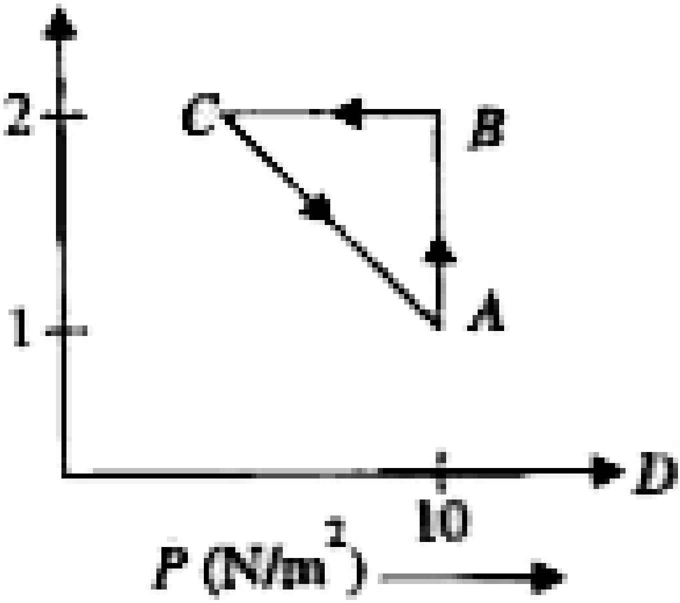
C. $3/7$

D. $5/7$

Answer: B

Watch Video Solution

23. An ideal gas is taken through cycle $A \rightarrow B \rightarrow C - A$, as shown in Fig. IF the net heat supplied to the gas in the cycle is 5 J, the work done by the gas in the process $C \rightarrow A$ is



A. $-5J$

B. $-10J$

C. $-15J$

D. $-20J$

Answer: A

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24. In a given process on an ideal gas, dW = 0 and $dQ < 0$. Then for the gas

A. the temperature will decrease

B. the volume will increases

C. the pressure will remain constant

D. the temperature will increase

Answer: A

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25. When a gas expands adiabatically

A. no energy is required for expansion

B. energy is required and it comes from the wall of the container of the gas

C. internal energy of the gas is used in doing work

D. law of conservation of energy does not hold.

Answer: C

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26. The specific heat of a gas in an isothermal process is

A. infinite

B. zero

C. negative

D. remains constant

Answer: A

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27. When the system does not exchange heat with the surroundings, the process is

A. isocaloric

B. isobaric

C. isothermal

D. adiabatic

Answer: D

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28. A diatomic gas initially at $18^{\circ}C$ is compressed adiabatically to one-eight of its original volume. The temperature after compression will be

A. $18^{\circ}C$

B. $887^{\circ}C$

C. $395^{\circ}C$

D. $144^{\circ} C$

Answer: C

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29. For a gas $\gamma = 5/3$ and 800 c.c, of this gas is suddenly compressed to 100 c.c. If the intial pressure is P, then final pressure will be

A. P/32

B. $(24/5)P$

C. 0.8333333333333

D. 32 P

Answer: D

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30. The pressure inside a tyre is 4 times that of atmosphere. If the tyre bursts suddenly at temperature. 300 K. What will be the new temperature ?

A. $300(4)^{7/2}$

B. $300(4)^{2/7}$

C. $300(2)^{7/2}$

D. $300(4)^{-2/7}$

Answer: D

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31. The gas law (PV/T) = constant is true for

A. isothermal changes only

B. adiabatic change

C. both isothermal and adiabatic

D. neither isothermal nor adiabatic

Answer: C

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32. Two identical samples of a gas are allowed to expand (i) isothermally (ii) adiabatically. Work done is

A. more in the isothermal process

B. more in the adiabatic process

C. neither of them

D. equal in both processes

Answer: A

Watch Video Solution

33. Certain perfect gas is found to obey $pV^{3/2}$ = constant during adiabatic process. If such a gas at intial temperature T, is adiabatically compressed to half the initial volume, its final temperature will be

A. $\sqrt{2}$ T

B. 2 T

C. $2\sqrt{2}T$

D. 4 T

Answer: A

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34. Two samples, A and B of a gas at the same initial temperature and pressure are compressed from volume V to V/2, A isothermally and B adiabatically. The final pressure of A will be

A. greater than that of B

B. equal to that of B

C. less than of B

D. twice that of B

Answer: C

Watch Video Solution

35. A mass of ideal gas at pressure P is expanded isothermally to four times the originl volume and then slowly compressed adiabatically to its original volume. Assuming γ to be 1.5 , the new pressure of the gas is

A. 0.5833333333333

B. P

C. 0.6666666666667

D. P/2

Answer: A

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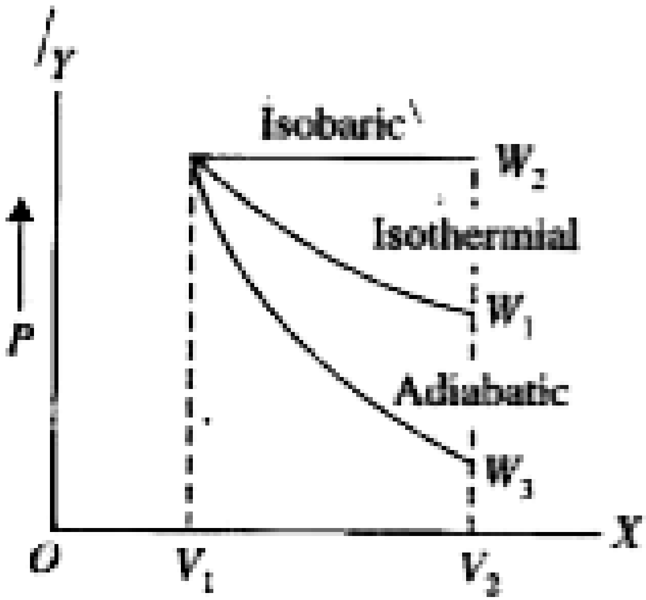
36. Starting from the same initial conditions, an ideal gas expands from volume $V_1 \rightarrow V_2$ in three different ways. The work done by the gas is W_1 if he process is purely isothermal, W_2 if purely isobaric and W_3 if purely adiabatic. Then



A. $W_2 > W_1 > W_3$

B. $W_2 > W_3 > W_1$

C. $W_1 > W_2 > W_3$

D. $W_1 > W_3 > W_2$

Answer: A

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37. A monatomic ideal gas, initially at temperature T_1 is enclosed in a cylinder fitted with a frictionless pistion. The gas is allowed to expand adiabatically to a temperature T_2. By releasing the piston suddenly. IF L_1 and L_2 are th lengths of the gas column before and after expansion respectively, then T_1 / T_2 is given by

A. $(L_1 / L_2)^{2/3}$

B. (L_1 / L_2)

C. (L_2 / L_1)

D. (L_2 / L_1)

Answer: D

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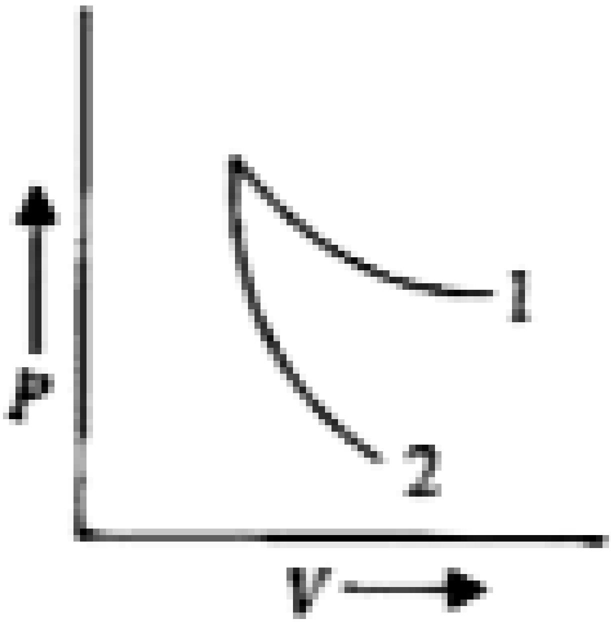
38. P-V plots for two gases during adiabatic processes are shown in Fig. 15.9.6. Plot 1 and 2 should correspond respectively to



A. He and O_2

B. O_2 and He

C. He and Ar

D. O_2 and N_2

Answer: A

Watch Video Solution

39. In an adiabatic change the pressure and temperature of monoatomic gas are related as $P \propto T^c$ where C equal

A. $2/5$

B. $5/2$

C. $3/5$

D. $5/3$

Answer: B

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40. Slope of PV and V for an isobaric process will be

A. -1

B. zero

C. $+1$

D. n R T

Answer: C

Watch Video Solution

THERMAL CONDUCTION

1. The thermal conductivity of a rod depends on

A. temperature difference between two sides

B. thickness of metal plate

C. area of the plate

D. none of the above factors.

Answer: D

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2. A sphere, a cube and a thin circular plate, all made of the same material and having the same mass are initially heated to a temperature of 3000° C. Which of these will cool fastest ?

A. sphere

B. cube

C. plate

D. none of these

Answer: C

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3. Two metal rods 1 and 2 of the same length have same temperature difference between their ends. Their thermal conductivities are K_1 and K_2 and cross-section areas A_1 and A_2 respectively. What is the required condition for the same rate of heat conduction in them?

A. $K_1A_2 = K_2A_1$

B. $K_1A_2 = K_2^2A_1$

C. $K_1A_1 = K_2A_2$

D. $K_1A_1^2 = K_2A_2^2$

Answer: C

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4. A metallic untensil which is most suitable for cooking, should have

A. low thermal conductivity and low specific heat

B. high thermal conductivity and high specific heat

C. low thermal conductivity and high specific heat

D. high thermal conductivity and low specific heat

Answer: B

Watch Video Solution

5. Heat is flowing through two cylindrical rods of the same material. The diamters of the rods are in the ratio $1:2$ and the length in the ratio $2:1$. If the temperature difference between the ends is same then ratio of the rate of flow of heat through them will be

A. $1:1$

B. $1:8$

C. $2:1$

D. $8:1$

Answer: B

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Watch Video Solution

6. Two cylinders P and Q have the same length and diameter and are made of different materials having thermal conductivities in the ratio $2:3$. These two cyinders ar combined to make a cylinder. One end of P is kept at $100^{\circ}C$ and another end of Q at $0^{\circ}C$. THe temperature at the interface of P and Q is

A. $30^{\circ}C$

B. $40^{\circ}C$

C. $50^{\circ}C$

D. $60^{\circ}C$

Answer: B

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7. IF two metallic plates of equal thickness and thermal conductivities K_1 and K_2 are put together face to face anda common plate is constructed, then the equivalent thermal conductivity of this plate will be

A. $\dfrac{K_1K_2}{K_1+K_2}$

B. $\dfrac{2K_1K_2}{K_1+K_2}$

C. $\dfrac{\left(K_1^2 - K_2^2\right)^{3/2}}{K_1K_2}$

D. $\dfrac{\left(K_1^2 + K_2^2\right)^{3/2}}{2K_1K_2}$

Answer: B

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8. A wall has two layers A and B, each made of different materials. Both the layers have the same thickness. The thermal conductivity of the material of A is twice that of B. Under thermal equilibrium , the temperature differeence across the wall is $36^\circ C$. The temperature difference across the layer A is

A. $6^\circ C$

B. $12^\circ C$

C. $18^\circ C$

D. $24^\circ C$

Answer: B

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9. Two walls of thickness d_1 and d_2 and thermal conductivites K_1 and K_2 are in contact. In the steady state, if the temperature at the outer surfaces are T_1 and T_2 the temperature at the common wall is

A. $\dfrac{K_1T_1d_2 + K_2T_2d_1}{K_1d_2 + K_2d_1}$

B. $\dfrac{K_1T_1 + K_2T_2}{d_2 + d_1}$

C. $\left(\dfrac{K_1d_1 + K_2d_2}{T_1 + T_2}\right)T_1T_2$

D. $\dfrac{K_1T_1d_1 + K_2T_2d_2}{K_1d_1 + K_2d_2}$

Answer: A

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10. Two spheres of different material one with double the radius and one fourth wall thickness of the other are filled with ice. If the time taken for complete melting of ice in the larger radius one is 25 minutes and that for smaller sphere is 16 minutes, the ratio of thermal conductivities of material of larger sphere to smaller sphere is

A. $4:5$

B. $5:4$

C. $25:8$

D. $8:25$

Answer: D

Watch Video Solution

11. Two vessels of different materials are similar in size in every respect. The same quantity of ice filled in them gets melted in 20 minutes and 40 minutes respectively. The ratio of thermal conductivities of the metals is

A. $5:6$

B. $6:5$

C. $3:1$

D. $2:1$

Answer: D

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12. The coefficients of thermal conductivity of copper, mercury and glass are respectively K_c, K_m and K_g such that $K_c > K_m > K_g$. If the same quantity of heat is to flow per second per unit area of each and corresponding temperature gradients are X_c, X_m and X_g

A. $X_c = X_m = K_g$

B. $X_c > X_m > X_g$

C. $X_c < X_m < X_g$

D. $X_m < X_c < X_g$

Answer: C

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13. A cylindrical rod having temperature T_1 and T_2 at its end. The rate of flow of heat Q_1 cal/sec. If all the linear dimension are doubled keeping temperature remain const. then rate of flow of heat Q_2 will be : -

A. $4Q_1$

B. $2Q_1$

C. $Q_1/4$

D. $Q_1/2$

Answer: B

Watch Video Solution

14. Two rods of length l_1 and l_2 and coefficients of thermal conductivities k_1 and K_2 are kept touching each other. Both have the same area of cross-section. The equivalent of thermal conductivity is

A. $K_1 + K_2$

B. $K_1 l_1 + K_2 l_2$

C. $\dfrac{K_1 l_1 + K_2 l_2}{l_1 + l_2}$

D. $\dfrac{l_1 + l_2}{(l_1 / K_1) + (l_2 / K_2)}$

Answer: D

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15. A cylinder of radius R made of a material of thermal conductivity K_1 is surrounded by a cylindrical shell of inner radius R and outer radius 2R made of a material of thermal conductivity K_2. The two ends of the combined system are maintained at two different temperatures. There is no loss of heat across the cylindrical surface and the system is in steady state. The effective thermal conductivity of the system is

(a) $K_1 + K_2$ (b) $K_1K_2 / (K_1 + K_2)$

(c)$(K_1 + 3K_2) / 4$

(d) $(3K_1 + K_2) / 4$.

A. $K_1 + K_2$

B. $\dfrac{K_1K_2}{K_1 + K_2}$

C. $K_1 + 3K_2$

D. $(K_1 + 3K_2) / 4$

Answer: D

Watch Video Solution

16. A wall is made of equally thick layers A and B of different matierals. Thermal conduvtivity of A is twice that of B. In the stedy state, the temperature difference across the wall is $36^{\circ} C$. The temperature difference across the layer A is

A. $6^{\circ} C$

B. $12^{\circ} C$

C. $18^{\circ} C$

D. $24^{\circ} C$

Answer: B

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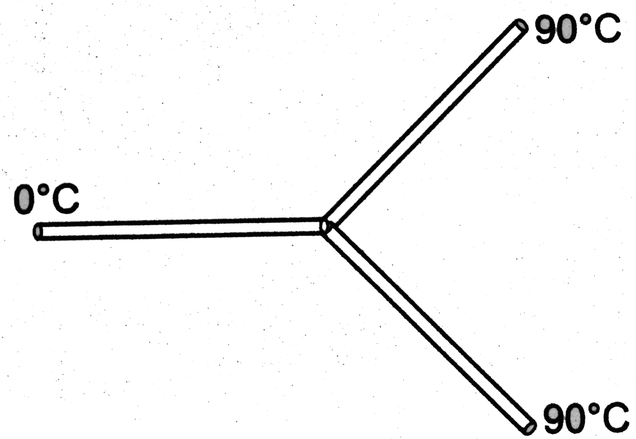
17. Three rods made of the same material and having the same cross-section have been joined as shown in the figure. Each rod is of the same length. The left and right ends are kept at $0^{\circ} C$ and $90^{\circ} C$, respectively. The temperature of junction of the three rods will be

(a) $45^{\circ} C$ (b) $60^{\circ} C$

(c) $30^{\circ} C$ (d) $20^{\circ} C$.



A. $45^{\circ} C$

B. $60^{\circ} C$

C. $30^{\circ} C$

D. $20^{\circ} C$

Answer: B

Watch Video Solution

THERMAL RADIATION

1. In which process, the rate of transfer of heat is maximum ?

A. Conduction

B. Convection

C. radiation

D. in all these, heat is transferred with the same speed.

Answer: C

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2. The energy supply being cut-off, an electric heater element cools down to a temperature of its surroundings but it will not cool further because

A. supply is cut off

B. it is made of metal

C. surrounding are radiating

D. elements and surrounding have same temperature

Answer: D

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3. A solid sphere and a hollow sphere of same material and size are heated to same temperature and allowed to cool in the same surroundings. If the temperature difference between each sphere and its surrounding is T, then

A. the hollow sphere will cool at a faster rate for all, values of T

B. the solid sphere will cool at a faster rate for all value of T

C. both spheres will cool at the same rate for all values of T

D. both spheres will cool at the same rate only for small value of T.

Answer: C

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4. A body in a room cools from 85°C to 80° C in 5 minutes. Calculate the time taken to cool from 80° C to 75° C if the surrounding temperature is 30°C.

A. 5 minutes

B. less than 5 minutes

C. more than 5 minutes

D. less or more than 5 minutes

Answer: C

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5. If the temperatures of a perfectly black body measured in Kelvin is doulbed, then the energy radiated per second becomes

A. twice the orginal value

B. 16 times the original value

C. half the original value

D. 4 times the original value

Answer: B

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6. A wire is heated gradually as temperature rises, at first it appears :

A. red

B. green

C. yellow

D. white

Answer: A

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7. The rate of heat radiation from two patches of skin each of area S, on a patient's chest differ by 2%. If the patch of the lower temperature is at 300 K and the emissivity of both the patches is assumed to be unity, the temperature of the other patch is closest to

A. 301.5 K

B. 306 K

C. 308. 5 K

D. 312 K

Answer: A

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8. IF the temperature of a black , body is doubled, the wavelength at which the spectral radiancy has its maximum is

A. doubled

B. halved

C. quadrupled

D. unchanged

Answer: B

Watch Video Solution

9. Two spheres of the same materials have radii 1 m and 4 m and temperatures 4000 K and 2000 K resectively the energy radiated per second by the first sphere is

A. greater than that by the second

B. less than that by the second

C. equal in both cases

D. the information is incomplete to draw any conclusion.

Answer: C

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10. An ideal black body at room temperature is thrown into a furnance.It is observed that

A. initially it is the darkest body and at later times the brightest

B. it is the darkest body at all times

C.

D.

Answer: D

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11. The wavelength λ_m of maximum intensity of emission of solar radiation is $\lambda_m = 4753\text{Å}$ and from moon is $\lambda_m = 14\mu m$ The surface temperature of sun and moon are (given $b = 2.898 \times 10^{-3}$ meter/Kelvin)

A. 6097 K, 207 K

B. 8097 K, 307 K

C. 10,000 K, 400 K

D. 3000 K, 100 K

Answer: A

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12. The earth receives its surface radiation from the sun at the rate of 1400 W/m^2. The distance of the centre of the sun from the surface of the earth is 1.5×10^{11} m and the radius of the sun is 7.0×10^8 m. Treating sun as a black body, it follows from the above data that its surface temeperature is

A. 5810 K

B. 10^6 K

C. 50.1 K

D. $5801^{\circ}C$

Answer: A

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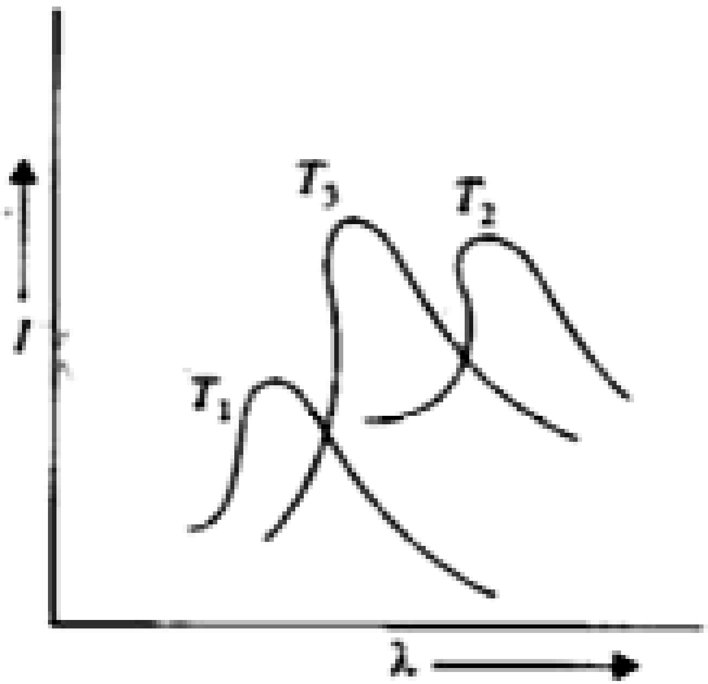
13. The plots of intensity versus wavelength fro three black bodies at temperatures T_1, T_2 and T_3 respectively and shown in Fig. 15.11.1. Their temperatures are such that



A. $T_1 > T_2 > T_3$

B. $T_1 > T_3 > T_2$

C. $T_2 > T_3 > T_1$

D. $T_3 > T_2 > T_1$

Answer: B

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OSCILLATIONS

1. A particle moves such that its accleration a is given by $a = -bx$, where x is the displacement from equilibrium position and b is a constant. The period of oscillation is

A. $\sqrt{2\pi} / b$

B. $2\pi / \sqrt{b}$

C. $2\pi / b$

D. $2\sqrt{(\pi / b)}$

Answer: B

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2. The motion of a particle executing simple harmonic motion is given by $X = 0.01 \sin 100\pi(t + 0.05)$, where X is in metres andt in second. The time period is second is

A. 0.01

B. 0.02

C. 0.1

D. 0.2

Answer: B

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3. The differential equation of a particle executing simple harmonic motion along y-axis is

A. $\frac{d^2y}{dt^2} + \omega^2 y = 0$

B. $\frac{d^2y}{dt^2} + \omega^2 y^2 = 0$

C. $\frac{d^2y}{dt^2} - \omega^2 y = 0$

D. $\frac{dy}{dt} + \omega y = 0$

Answer: A

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4. The kinetic energy and potential energy of a particle executing simple harmonic motion will be equal when displacement (amplitude = a) is

A. $a/2$

B. $a\sqrt{2}$

C. $a/\sqrt{2}$

D. $a\sqrt{2}/3$

Answer: C

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5. A pendulum suspended from the ceiling of train has a period T When the train is at rest. When the train si accelerating with a uniform acceleratio a, the period of oscillation will

A. increase

B. decrease

C. remained unaffected

D. becomes infinite

Answer: B

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6. A simple harmonic oscillation has an amplitude A and time period T. The time required to travel from $x = A$ to $x = \frac{A}{2}$ is

A. $T/6$

B. $T/4$

C. $T/3$

D. $T/2$

Answer: A

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7. A spring has force constant K and a mass m is suspended from it. The spring is cut in half and the same is suspended from one of the havles. IF the frequency of osicllation in the frst case is α, then the frequency in the second case will be

A. 2 a

B. a

C. $a/2$

D. $\alpha/\sqrt{2}$

Answer: D

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8. If the period of oscillation of mass M suspended. From a spring is one second, then the period of 4 M will be

A. $1/2$

B. $1/4$ sec

C. 2 sec

D. 4 sec

Answer: C

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9. Two masses M and m are suspended together by massless spring of force constant -k. When the masses are in equilibrium, M is removed without disturbing the system. The amplitude of oscillations.

A. m_1 / k

B. $2m_2 / k$

C. $m_1 g / k$

D. $m_2 g / k$

Answer: C

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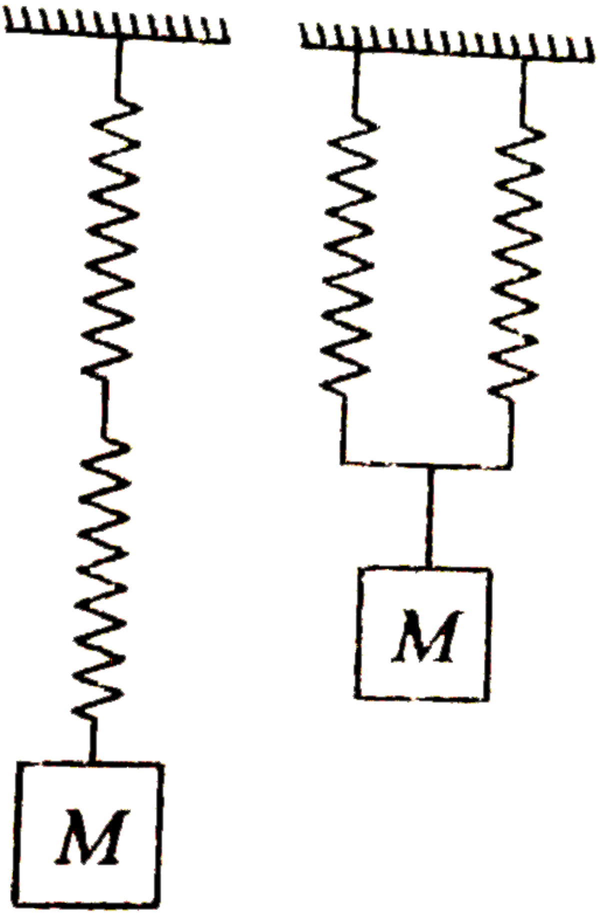
10. Two identical springs of spring constant k each are connected in series and parallel as shown in figure. A mass M is suspended from them. The ratio of their frequencies of vertical oscillation will be



A. $2:1$

B. 11

C. $1:2$

D. $4:1$

Answer: C

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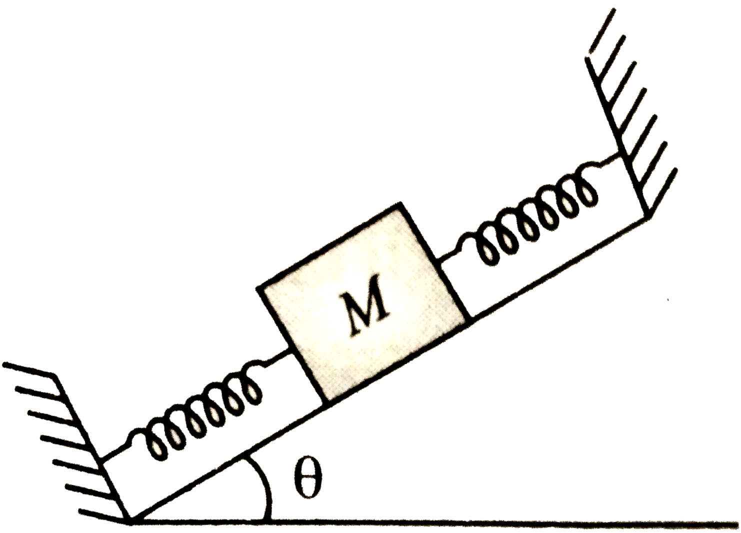
11. On a smooth inclined plane, a block of mass M is attached between two springs as shown in the figure. The other ends of the springs are fixed to firm supports. If each spring has spring constant k, the period of oscillation of the block is (Assuming the springs as massless)



A. $2\pi(M/2k)^{1/2}$

B. $2\pi(2M / k)^{1/2}$

C. $2\pi(Mg \sin\theta / 2k)$

D. `2pi [2M g//k]^(1//2)~

Answer: A

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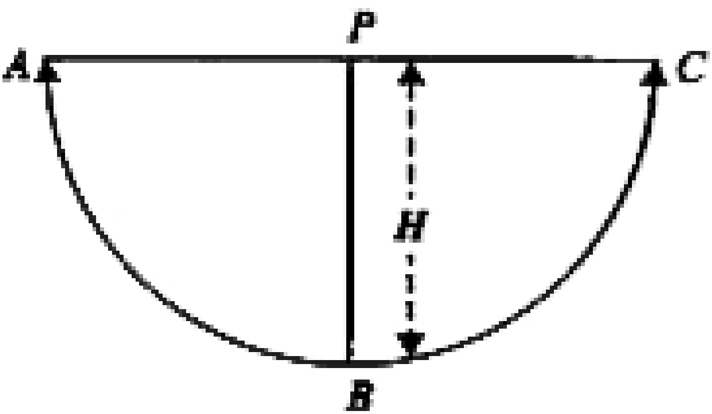
12. A simple pendulum with a bob of mass m oscillates from A to C and back to A such that PB is H. IF the acceleration due to gravity is g, the velocity of bob as it passes through B is



A. zero

B. 2g H

C. mgh

D. $\sqrt{(2gH)}$

Answer: D

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13. The kinetic energy of a particle, executing S.H.M. is 16 J when it is in its mean position. IF the amplitude of oscillation is 25 cm and the mass of the particle is 5.12 Kg, the time period of its oscillations is

A. $\pi/5$ sec

B. 2π sec

C. 20π sec

D. 5π sec

Answer: A

Watch Video Solution

14. Two masses m_1 and m_2 are suspended together by a massless spring of constant k. When the masses are in equilibrium, m_1 is removed without disturbing the system. Then the angular frequency of oscillation of m_2 is

A. $\sqrt{(k/m_1)}$

B. $\sqrt{(k/m_2)}$

C. $\sqrt{[k(m_1+m_2)]}$

D. $\sqrt{[k/(m_1 m_2)]}$

Answer: B

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15. The mass and diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet will be (if it is a second's pendulum on earth)

A. $1/\sqrt{2}$ second

B. $2/\sqrt{2}$ second

C. 2 second

D. (1/2) second

Answer: B

Watch Video Solution

16. The total energy of the body executing S.H.M. is E. Then the kinetic energy when the displacement is half of the amplitude is

A. $E/2$

B. $E/4$

C. $3E/4$

D. $\sqrt{3}/4E$

Answer: C

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17. A simple pendulum has a bob which is a hollow sphere full of sand and oscillated with certain period. If all that sand is drained out through a hole at its bottom, then its period

(a) increases

(b) decreases

(c) remains same

(d) is zero.

A. remain unchanged

B. increase

C. decrease

D. become erratic

Answer: B

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18. A linear harmonic oscillator of force constant $2 \times 10^6 Nm^{-1}$ and amplitude 0.01 m has a total mechanical energy of 160 J. Its

A. maximum potential energy is 100 J

B. maximum kinetic energy is 100 J

C. maximum potential energy is 160 J

D. maximum potential energy is zero

Answer: B::C

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19. Two bodies M and N of equal masses are suspended from two separate massless springs of spring constants k_1 and k_2 respectively . If the two bodies oscillate vertically such that their maximum velocities are equal, the ratio of the amplitude of vibration of M to that on N is

A. k_1 / k_2

B. $\sqrt{k_1 / k_2}$

C. k_2 / k_1

D. $\sqrt{k_2 / k_1}$

Answer: D

Watch Video Solution

20. A particle executes S.H.M. between $x = -A$ and $x = +A$. The time taken for it to go from 0 to A/2 is T_1 and to go from A/2 to A is T_2. Then

A. $T_1 < T_2$

B. $T_1 > T_2$

C. $T_1 = T_2$

D. $T_1 = 2T_2$

Answer: A

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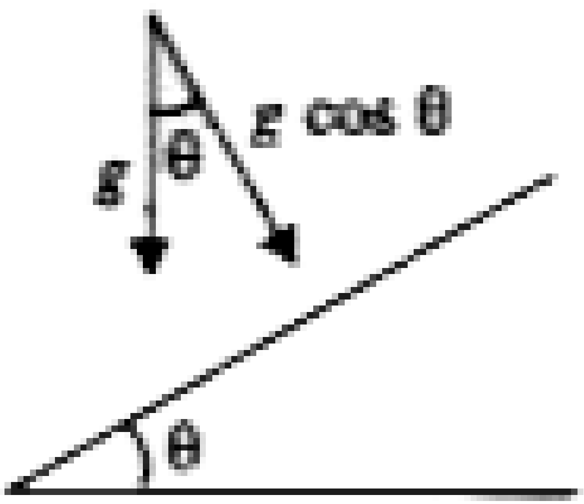
21. A simple pendulum of length l has been set up inside a railway wagon sliding down a frictionless inclined plane having an angle of inclination 0 with the horizontal. What will be its period of oscillation is recorded by an observer inside the wagon ? [Fig. 15.12.4]



A. $2\pi\sqrt{\left(\frac{l}{g\cos\theta}\right)}$

B. $2\pi\sqrt{\left(\frac{l}{g\sin\theta}\right)}$

C. $2\pi\sqrt{\left(\frac{l}{g}\right)}$

D. $2\pi\sqrt{\left(\frac{l\cos\theta}{g}\right)}$

Answer: A

Watch Video Solution

22. The mass and diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet will be (if it is a second's pendulum on earth)

A. $1/\sqrt{2}$ second

B. $2/\sqrt{2}$ second

C. $2\sqrt{2}$ seconds

D. $(1/2)$ seconds

Answer: B

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23. A block of mass M is attached to the lower end of a verticle spring. The spring is hung from a ceiling and has force constant value k. The mass is released form rest with the spring intially unstretched. The maximum extension produced in the length of the spring will be

A. 4 M g/k

B. 2 M g/k

C. M g/k

D. M g/2k

Answer: B

Watch Video Solution

WAVES

1. Transverse waves can propagate

A. both in a gas and a metal

B. in a gas but not in a metal

C. not in a gas but in a metal

D. neither in a gas nor in a metal

Answer: C

Watch Video Solution

2. A wave equation which given the dispplacement along the y-direction is given by ,

$y = 10^{-4} \sin(60t + 2x)$

where x and y are in matre and t is time in second. This represents a wave

A. travelling with a velocity of 30 m/s in the negative x direction

B. of wavelength π metre

C. of frequency $30 / \pi$ hertz

D. of amplitude 10^{-4} metre travelling along the negative x direction

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

Watch Video Solution

3. if $x = a\sin(\omega t + \pi/6)$ and $x' = a\cos\omega$, t, then what is the phase difference between the two waves

A. $\pi/3$

B. $\pi/6$

C. $\pi/2$

D. π

Answer: A

Watch Video Solution

4. Two waves are represented by the following equations

$y_1 = 5\sin 2\pi(10t - 0.1x)$

$y_2 = 10 \sin 2\pi(20t - 0.2x)$

Ratio of intensites I_2 / I_1 will be

A. 1

B. 2

C. 4

D. 16

Answer: C

Watch Video Solution

5. The equation of a wave travelling in a string can be written as $y = 3 \cos \pi(10t - x)$. Its wavelength is

A. 100 cm

B. 2 cm

C. 5 cm

D. none of the above

Answer: B

Watch Video Solution

6. The sound carried by air from a sitar to a listener is a wave of the following type

A. longitudinal stationary

B. transverse progressive

C. transverse stationary

D. longitudinal progressive

Answer: D

Watch Video Solution

7. The distance between two points differing in phase by 60° on a wave, velocity 360 m./s and frequency 500 Hz is

A. 24 cm

B. 12 cm

C. 6 cm

D. 1 cm

Answer: B

Watch Video Solution

8. Which of the following does not represent a travelling wave

A. $y = f(x - vt)$

B. $y = y_m \sin k(x + vt)$

C. $y = y_m \log(x - vt)$

D. $y = f(x^2 - vt^2)$

Answer: C

Watch Video Solution

9. Simple harmonic wave is represented by the relation

$$y(x, t) = a_0 \sin 2\pi \left(vt - \frac{x}{\lambda}\right)$$

If the maximum particle velocity is three times the wave velocity, the wavelength λ of the wave is

A. $\pi a_0 / 3$

B. $2\pi a_0 / 3$

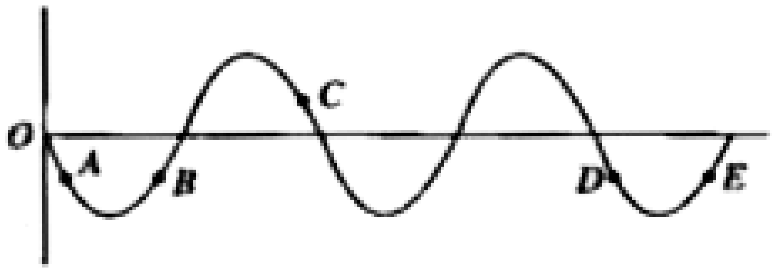
C. πa_0

D. $\pi a_0 / 2$

Answer: B

Watch Video Solution

10. The diagram below (Fig. 15.13.1) show the propagation of a wave. Which points are in phase ?



A. A, B

B. B, C

C. B, D

D. E, B

Answer: D

Watch Video Solution

11. When sound waves travel from air to water which of these remains constant ?

A. velocity

B. frequency

C. Wavelength

D. all the above

Answer: B

Watch Video Solution

12. In a sinusoidal wave, the time required for a particular point to move from maximum displacement to zero displacement is 0.17 sec. The frequency of the wave is

A. 1.47 Hz

B. 0.36 Hz

C. 0.73 Hz

D. 2.94 Hz

Answer: A

Watch Video Solution

13. A transverse wave is represented by the equation

$$y = y_0 \frac{\sin(2\pi)}{\lambda}(vt - x)$$

For what value of λ is the particle velocity equal to two time the wave velocity ?

A. $\lambda = 2\pi y_0$

B. $\lambda = 2\pi y_0 / 3$

C. $\lambda = \pi y_0 / 2$

D. $\lambda = \pi y_0$

Answer: D

Watch Video Solution

14. The velocity of a sound is largest in

A. water

B. air

C. steel

D. vacuum

Answer: C

Watch Video Solution

15. The temperature at which the speed of sound in air becomes double of its value at $27^{\circ}C$ is

A. $54^{\circ}C$

B. $327^{\circ}C$

C. $927^{\circ} C$

D. $-123^{\circ} C$

Answer: C

Watch Video Solution

16. The speed of sound in hydrogen at N.T.P. is 1270 metres per second. Thenthe speed in a mixture of hydrogen and oxygen containing hydrogen and oxygen in the ration $4:1$ by volume, will be

A. 317 metre/sec

B. 635 metre/sec

C. 830 metre/sec

D. 950 metre/sec

Answer: B

Watch Video Solution

17. The Laplace's correction in the expression for the velocity of sound given by Newton is needed because sound waves

A. are longitudinal

B. propagate isothermally

C. progagate adiabatically

D. are of long wavelength

Answer: C

Watch Video Solution

18. Velocity of sound waves in air is 330 m\s for a particular sound wave in air, path difference of 40 cm. is equivalent to phase difffernce of 1.6π the frequency of this wave is

A. 150 Hz

B. 165 Hz

C. 330 Hz

D. 660 Hz

Answer: D

Watch Video Solution

19. the velocity of sound in any gas deponds upon

A. wavelength of sound only

B. density and elasticity of gas

C. intensity of sound waves only

D. amplitude and frequency of sound

Answer: B

Watch Video Solution

20. velocity of sound is measured in hydrogen and oxygen gases at a given temperature. The ratio of two velocities will be (V_H / V_0)

A. $1:4$

B. $4:1$

C. $1:1$

D. $32:1$

Answer: B

Watch Video Solution

21. Ultrasonic, Infrasonic and Audible waves travel through a medium with speeds v_u, v_l, v_a respectively, then

A. v_u, v_i, v_a are nearly equal

B. $v_u \geq v_a \geq v_i$

C. $v_u \geq v_a \geq v_i$

D. $v_a \geq v_u$ and $v_u \approx v_i$

Answer: A

Watch Video Solution

22. Which of the following phenomenon is not shown by sound waves ?

A. diffraction

B. interference

C. polarisation

D. none of these

Answer: C

Watch Video Solution

23. If at same temperature and pressure the densities fro two diatomic gases are respectively d_1 and d_2, then the ratio of velocity of sound in these gases will be

A. $\sqrt{(d_2 / d_1)}$

B. $\sqrt{(d_1 / d_2)}$

C. $d_1 d_2$

D. $\sqrt{d_1 d_2}$

Answer: A

Watch Video Solution

24. The frequency of a sound wave is n and its velocity is v. If the frequency is increased to 4n, the velocity of wave will be

A. v

B. 2 v

C. 4 v

D. $v/4$

Answer: A

Watch Video Solution

25. Speed of sound is maximum in

A. air

B. water

C. vaccum

D. solid

Answer: D

Watch Video Solution

26. If at same temperature and pressure the densities fro two diatomic gases are respectively d_1 and d_2, then the ratio of velocity of sound in these gases will be

A. $\sqrt{\frac{d_2}{d_1}}$

B. $\sqrt{\frac{d_1}{d_2}}$

C. $d_1 d_2$

D. $\sqrt{d_1 d_2}$

Answer: A

Watch Video Solution

27. Energy is not carried by

A. transverse progressive wave

B. longitudinal progressive wave

C. stationary wave

D. electromagnetic wave

Answer: C

Watch Video Solution

28. In stationary wave, the strain is

A. maximum at nodes

B. maximum at antinodes

C. constant throughout

D. none of the above

Answer: A

Watch Video Solution

29. Beats are produced by two waves

$y_1 = a \sin 2000\pi t$

and $y_2 = a \sin 2008\pi t$

The number of beats heard per second is

A. zero

B. one

C. four

D. eight

Answer: C

Watch Video Solution

30. Three sound sources A, B and C have frequencies 400, 401 and $402 H_Z$, respectively. Cacluated the number of beats noted per second.

A. 0

B. 1

C. 2

D. 3

Answer: B

Watch Video Solution

31. Two tuning forks of frequencies 256 and 258 vibrations/second are sounded together. Then the time interval between two consecutive maxima heard by an observer is

A. 2 second

B. 0.5 second

C. 250 second

D. 252 second

Answer: B

Watch Video Solution

32. 56 tuning forks are so arranged in series that each fork give 4 beats per sec with the previous one. The frequency of the last fork is 3 times that of the first. The frequency of the first fork is

A. 110

B. 56

C. 60

D. 52

Answer: A

Watch Video Solution

33. IF two tuning forks A and B are sounded together, they produce 4 beats per second. A is then slightly loaded with wax, they produce two beats when sounded again. The frequency of A is 256. The frequency of B will be

A. 250

B. 252

C. 260

D. 262

Answer: B

Watch Video Solution

34. Two tuning forks A and B vibrating simultaneously produces, 5 beats. Frequency of B is 512. It is seen that if one arm of A is filed, then the number of beats increases. Frequency of A will be

A. 502

B. 507

C. 517

D. 522

Answer: C

Watch Video Solution

35. At a certain instant, a stationary transverse wave is found to have maximum kinetic energy. The appearance of string at that instant is

A. sinusoidal shape with amplitude A/3

B. sinusoidal with amplitude A/2

C. sinusoidal shape with amplitude A

D. straight line

Answer: D

Watch Video Solution

36. A standing wave is represeneted by $y = a\sin(100t)\cos(0.01)x$, t in second and x is in metre. Velocity of wave is

A. 10^4 m/s

B. 1 m/s

C. 10^{-4} m/s

D. not derived from above data

Answer: A

Watch Video Solution

37. Two waves are approaching each other with a velocity of $20m/s$ and frequency n. The distance between two consecutive nodes is

A. $\frac{16}{n}$

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

C. $\frac{n}{16}$

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

Answer: B

Watch Video Solution

38. Two sound sources produce progressive waves given by

$y_1 = 6 \cos 100\pi t$

and $y_2 = 4 \cos 102\pi t$

near the ears of an observer.

He will hear

A. 4 beats per second and intensity ratio of maxima to minima $= 3/2$

B. 2 beats per second and intensity ratio of maxima to minima $= 9/4$

C. 1 beat per second and intensity ratio of maxima and minima $= 25/1$

D. 1 beat per second and intensity ratio of maxima to minima $= 9/4$

Answer: C

Watch Video Solution

39. A standing wave having 3 node and 2 antinode is formed between two atoms having a distance 1.21 A between the wavelength of the standing wave is

A. 1.21Å

B. 2.42Å

C. 6.05Å

D. 3.63Å

Answer: A

Watch Video Solution

40. In the production of beats by 2 waves of same amplitude and nearly same frequency, the maximum intensity to each of the constituent waves is

A. same

B. 2 times

C. 4 times

D. 8 times

Answer: C

Watch Video Solution

41. two waves of wavelengths 2 m and 2.02 m respectively, moving with the same velocity superpose to produce 2 beats per second. The velocity of the wave is

A. 400.0 m/s

B. 404.4 m/s

C. 402.2 m/s

D. 406.0 m/s

Answer: B

Watch Video Solution

42. Equations of two progressive wave are given by $y_1 = a\sin(\omega t + \phi_1)$ and $y_2 = a\sin(\omega t + \phi_2)$. IF amplitude and time period of resultant wave is same as that of both the waves, then $(\phi_1 - \phi_2)$ is

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

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

C. $\frac{\pi}{6}$

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

Answer: B

Watch Video Solution

43. In a sonometer wire, the produced waves are

A. longitudinal

B. transverse, stationary and unpolarised

C. transverse, stationary and polarised

D. transverse, progressive and polarised

Answer: C

Watch Video Solution

44. The frequencies of the harmonic of the string are

A. unrelated

B. of the same pitch

C. in the ratio $1:2:3$

D. in the ratio $1:3:5$

Answer: C

Watch Video Solution

45. A wire under tension vibrates with a frequency of 450 per second. What would be the fundamental frequency if the wire were half as long, twice as thick and under one fourth tension.

A. 225 cps

B. 190 cps

C. 247 cps

D. 174 cps

Answer: A

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46. The length of a sonometer wire AB is 110 cm. Where should the two bridges be placed from A to divide the wire in 3 segments whose fundamental frequencies are in the ratio of $1 : 2 : 3$?

A. 30 cm and 90 cm

B. 40 cm and 80 cm

C. 60 cm and 90 cm

D. 30 cm and 60 cm

Answer: C

Watch Video Solution

47. A streteched string of length l fixed at both ends can sustain stationary waves of wavelength λ given by

A. $\lambda = n^2 / 2l$

B. $\lambda = l^2 / 2n$

C. $\lambda = 2l / n$

D. $\lambda = 2 \ln$

Answer: C

Watch Video Solution

48. A resonating column of air contains

A. stationary longitudinal waves

B. stationary transverse waves

C. transverse progressive waves

D. longitudinal progressive waves

Answer: A

Watch Video Solution

49. As an empty vessel in filled with water, its frequency

A. increases

B. decreases

C. remain the same

D. none of the above

Answer: A

Watch Video Solution

50. A tuning fork of frequency 480 Hz produces 10 beats per second when sounded with a vibrating sonometer wire. What must have been the frequency of string if a slight increase in tension produces fewer beats second than before.

A. 460 Hz

B. 470 Hz

C. 480 Hz

D. 490 Hz

Answer: B

Watch Video Solution

51. With the increase in temperature, the frequency of the sound from an organ pipe

A. decreases

B. increases

C. remains unchanged

D. changes erratically

Answer: B

Watch Video Solution

52. The speed of sound in air is 333 m/s. The fundamental frequency of the open pipe is 333 Hz. The second oevertone of the open organ pipe can be produced with a pipe of length

A. 0.5 m

B. 1.0 m

C. 1.5 m

D. 2.0 m

Answer: c

Watch Video Solution

53. An open organ pipe has a fundamental frequency of $300H_Z$. The first overtone of a closed organ pipe has the same frequency as the first overtone of this open pipe . How long is each pipe ? (Speed of sound in air = $330m/s$)

A. 10 cm

B. 41 cm

C. 82 cm

D. 164 cm

Answer: B

Watch Video Solution

Watch Video Solution

54. A closed organ pipe and an open organ pipe have their first overtones identical in frequency. Their lenghts are in the ratio

A. $1:2$

B. $2:3$

C. $3:4$

D. $4:4$

Answer: C

Watch Video Solution

55. An open pie is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is found to be heigth by $100H_Z$ than the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is

(a) $200H_Z$ (b) $300H_Z$ (c) $240H_Z$ (d) $480H_Z$

A. 100 Hz

B. 300 Hz

C. 150 Hz

D. 200 Hz

Answer: D

Watch Video Solution

56. A closed tube has a frequency n. If its length is doubled and radius is halved its frequency will become

A. n/3

B. n/2

C. not in a gas but in a metal

D. 2 n

Answer: B

Watch Video Solution

57. In a resonance tube, using a tuning fork of frequency 325 Hz, two successive resonance lengths are observed at 25.4 m and 77.4 cm respectively. The velocity of sound is air is

A. $338ms^{-1}$

B. $328ms^{-1}$

C. $330ms^{-1}$

D. $320ms^{-1}$

Answer: A

Watch Video Solution

58. Two wires of same material of radii 2r and r are welded together end to end The combination is used as a sonometer wire and is kept under tension T. The welded point lies midway between the bridges. What wil be the ratio of the number of loops formed in the wires, such that the joint is node when the stationary waves are set up in the wire?

A. $2:3$

B. $1:2$

C. $2:1$

D. $5:4$

Answer: B

Watch Video Solution

59. The vibrations of four air columns are represented in the figure below. The ratio of frequencies $n_p : n_q : n_r : n_s$ is

A. $12 : 6 : 3 : 4$

B. $1 : 2 : 4 : 3$

C. $4 : 2 : 3 : 1$

D. $6 : 2 : 3 : 4$

Answer: B

Watch Video Solution

60. If f_1, f_2 and f_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency f_0 of the whole string is

A. $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

B. $n = n_1 + n_2 + n_3$

C. $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{n_3}$

D. $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

Answer: A

Watch Video Solution

61. Two open organ pipes given 4 beats/sec, when sounded together in their fundamental notes. IF the length of the pipes are 100 cm and 102.5 cm respectively then the velocity of sound is

A. 160 m/s

B. 240 m/s

C. 328 m/s

D. 496 m/s

Answer: C

Watch Video Solution

62. To a stationary man the frequency of a sound source moving towards the man appears to be

A. lower than the original frequency

B. same as the original frequency

C. higher than the original frequency

D. lower as well as higher than the original frequency depending upon the speed of the source.

Answer: C

Watch Video Solution

63. A sound is moving towards a stationary listener with $\frac{1}{10^{th}}$ of the speed of sound. The ratio of apparent to real frequency is

A. $10/9$

B. $11/10$

C. $(11/10)^2$

D. $(9/10)^2$

Answer: A

Watch Video Solution

64. At what speed should a source of sound move so that observer finds the apparent frequency equal to half of the original frequency ?

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

B. $2v$

C. $v/4$

D. v

Answer: D

Watch Video Solution

65. A source of sound moves towards an observer

A. increases in velocity of sound only

B. decreases in velocity of soound

C. increase in frequency of sound only

D. increase in velocity as well as frequency of sound

Answer: C

Watch Video Solution

66. The freqency of a radar is 780 M hz. The frequency of the reflected wave from an aerolane is increased by 2.6 kHz. The velocity of aeroplane is

A. 0.25 km/sec

B. 0.5 km/sec

C. 1 km/sec

D. 2 km/sec

Answer: B

Watch Video Solution

67. A man is watching two trains, one leaving and the other coming in, with equal speed of 4 m/s. If they sound their whistles, each of natural frequency of 240 Hz, the number of beats beard by the man (velocity of sound in air = 300 m/s) will be equal to

A. 6

B. 3

C. zero

D. 12

Answer: A

Watch Video Solution

68. A rocket is going away from the earth at a speed of 10^6 m/s. If the wavelength of the light wave emited by it be 5700 Å, what will be its Dopper,s shift

A. 200 Å

B. 19 Å

C. 20 Å

D. 0.2 Å

Answer: B

Watch Video Solution

69. A person is observing two trains, one is approaching him with a velocity of of 4 m/s while the other is receding from him with the same velocity. IF both the trains blow their respective whistles of frequency 240 hertz, the beat frequency heard by the observer will be (speed of sound in air = 320 m/s)

A. 6

B. 3

C. zero

D. 12

Answer: A

Watch Video Solution

70. The difference between the apparent frequency of a source of sound as perceived by the observer during its approach and recession is 2% of the natural frequency of the source. If the velocity of sound in air is 300 m/s, the velocity of the source is

A. 6 m/s

B. 3 m/s

C. 1.5 m/s

D. 12 m/s

Answer: B

Watch Video Solution

71. If a star is moving towards the earth, then the lines are shifted towards

A. red

B. infra-red

C. blue

D. green

Answer: C

Watch Video Solution

72. A source having frequency of 240 Hz is moving towards an observer with a speed of 20 m/sec. When the observer is moving towards the source with a velocity of 20 m/sec, then apparent frequency heard by the observer, if velocity is 330 m/sec will be

A. 245 Hz

B. 268 Hz

C. 271 Hz

D. 260 Hz

Answer: C

Watch Video Solution

73. Intensity level of a sound of intensity I is 30 db. Then the ratio I / I_0 is (where I_0 is threshold of hearing)

A. 30

B. 10000

C. 1000

D. 3

Answer: C

Watch Video Solution

74. The walls of the halls built for music concerns should

A. amplify sound

B. reflect sound

C. transmit

D. absorb sound

Answer: D

Watch Video Solution

75. A musical scale is constructed by providing intermediate frequencies between a note and its octave which

A. form an arithmetic progression

B. form a geometric progression

C. bear a simple ratio with their neighbours

D. form a harmonic progression

Answer: C

Watch Video Solution

76. The intensity of sound wave while passing through an elastic medium falls down by 10% as it covers one metre distance through the medium. If the initial intensity of the sound wave was 100 decibels, its value after it has passes through 3 metre thickness of the medium will be

A. 70 decibel

B. 72.9 decibel

C. 81 decibel

D. 60 decibel

Answer: B

Watch Video Solution

77. The term reverberation time is generally understood to be the reverberation time at which of the following frequencies ?

A. 2048 Hz

B. 512 Hz

C. 1024 Hz

D. 256 Hz

Answer: A

Watch Video Solution

78. In a harmonium the intermediate notes between a note and its octave form

A. an arithmetic progression

B. a geometric progression

C. a harmonic progression

D. an exponential progression

Answer: B

Watch Video Solution

79. Two sounds, waves, having sinusoidal wave from but different wavelengths and different amplitudes are said to have

A. the same quality but different intensity

B. different quality but same intensity

C. same quality and same intensity

D. different quality and different intensity.

Answer: A

Watch Video Solution

80. When we hear a sound, we can identify its source from

A. amplitude of sound

B. intensity of sound

C. wavelength of sound

D. overtones present in the sound

Answer: D

Watch Video Solution

81. A transverse wave is described by the equatiion $Y = Y_0 \sin 2\pi(ft - x/\lambda)$. The maximum particle velocity is equal to four times the wave velocity if

$\lambda = \pi Y_0/4$

$\lambda = \pi Y_0/2$

$\lambda = \pi Y_0$

$\lambda = 2\pi Y_0$

A. $\lambda = \pi Y_0/4$

B. $\lambda = \pi Y_0/2$

C. $\lambda = \pi Y_0$

D. $\lambda = 2\pi Y_0$

Answer: B

Watch Video Solution

82. A wave is represented by the equation

$y = A \sin(10\pi x + 15\pi t + \pi/3)$

Where x is in metre and t is in second.

a wave travelling in the positive x-direction with a velocity of 1.5 m/s

a wave travelling in the negative x-direction with a velocity 1.5 m/s

a wave travelling in the negative x-direction with a wavelength of 0.2 m

a wave travelling in the positive x-direction with a wavelength 0.2 m

A. a wave travelling in the positive x-direction with a velocity of 1.5 m/s

B. a wave travelling in the negative x-direction with a velocity 1.5 m/s

C. a wave travelling in the negative x-direction with a wavelength of 0.2 m

D. a wave travelling in the positive x-direction with a wavelength 0.2 m

Answer: B::C

Watch Video Solution

83. As a wave propagates

A. the wave intensity remains constant for a plane wave

B. the wave intensity decreases as the inverse of the distance from the square for a spherical wave

C. the wave intensity decreases as the inversee squre of the distance from the source for a spherical wave

D. total intensity of the spherical wave over the spherical of the distance surface centered as the source remains constant at all times

Answer: A::C::D

Watch Video Solution

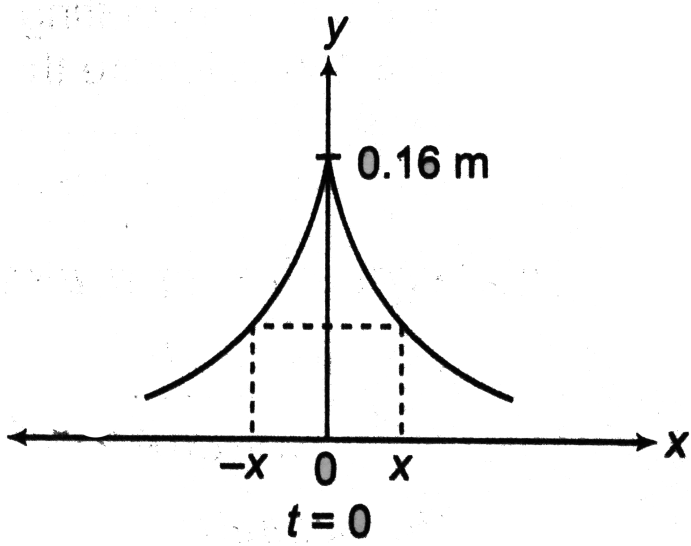
84. $y(x,t) = \dfrac{0.8}{\left[(4x+5t)^2+5\right]}$ represents a moving pulse where x and y are in metre and t in second. Then,choose the correct alternative(s):

(a) pules is moving in positive x- direction

(b) in $2s$ it will travel a distance of $2.5m$

(c) its maximum displacement is $0.16m$

(d) it is a sysmmetric pulse



A. pulse is moving in + x direction

B. in 2 s it will travel a distance of 2.5 m

C. its maximum displacement is 0.16 m

D. it is a symmetric pulse

Answer: B::C::D

Watch Video Solution

85. Two monatomic ideal gas 1 and 2 of molecular masses m_1 and m_2 respectively are enclosed in separate containers kept at same temperature. The ratio of the speed of sound in gas 1 to that in gas 2 is given by

A. $\sqrt{(m_1 / m_2)}$

B. $\sqrt{(m_2 / m_1)}$

C. m_1 / m_2

D. m_2 / m_1

Answer: B

Watch Video Solution

86. Two sound waves of equal intensity I generates beats. The maximum intensity of sound produced in beats will be

I

4I

2I

I/2

A. I

B. 4I

C. 2I

D. I/2

Answer: B

Watch Video Solution

87. An air column in a pipe, which is closed at one end, will be in resonance with a vibaring tuning fork of frequency 264 Hz, if the length of the column in cm is (Speed of sound = 330 m/s)

A. 31.25

B. 62.50

C. 93.75

D. 125

Answer: A::C

Watch Video Solution

88. A cylindrical tube, open at both ends, has a fundamental frequency v. The tue is dipped vertically in water so that half of its length is inside the water. The new fundamental frequency is

A. $f/2$

B. $3f/4$

C. f

D. $2f$

Answer: C

Watch Video Solution

89. An organ pipe P_1 closed at one end vibrating in its first harmonic and another pipe P_2 open at both ends vibrating in its third harmonic are in resonance with a given tuning fork. The ratio of the length of P_1 and p_2 is

(a) $8/3$ (b) $3/8$ (c) $1/6$ (d) $1/3$

A. $8/3$

B. $3/8$

C. $1/2$

D. $1/3$

Answer: B

Watch Video Solution

90. A tube closed at one end and containing air produced, when excited the fundamental note of frequency $512H_Z$. If the tube is opened at both ends, the fundamental frequency that can be exited is (in H_Z)

(a) 1024 (b) 512 (c) 256 (d) 128

A. 1024

B. 512

C. 256

D. 128

Answer: A

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91. The displacement of particles in a string stretched in the x-direction is represented by y.among the following expressions for y, those describing wave motion are

A. $\cos kx \sin \omega t$

B. $k^2 \omega^2 - \omega^2 t^2$

C. $\cos^2 (kx + \omega t)$

D. $\cos\left(k^2k^2 - \omega^2t^2\right)$

Answer: A::C

Watch Video Solution

92. Two identical straight wires are stretched so as to products $6beats/s$ when vibrating simultaneously. On changing the tension slightly in one of them, the beat frequency remains unchanged. Denoting by , T_1 the higher and T_2 the lower, initial tensions in the strings, then it could be said that that while making the above changes in tension

A. T_2 was decreased

B. T_2 was increased

C. T_1 was increased

D. T_1 was decreased

Answer: B::D

Watch Video Solution

93. Two vibrating strings of the same material but lengths L and 2L have radii 2 r and r respectively. They are strectched under the same tension. Both the strings vibrate in their fundamental modes, the one of length L with frequency n_1 and the other with frequency n_2. The ratio n_1 / n_2 is given by

2

4

8

1

A. 2

B. 4

C. 8

D. 1

Answer: D

Watch Video Solution

94. velocity of sound in air is 320 m/s. A pipe closed at one end has a length of 1 m. Neglecting end corrections, the air column in the pipe can resonates for sound of frequency

A. 80 Hz

B. 240 Hz

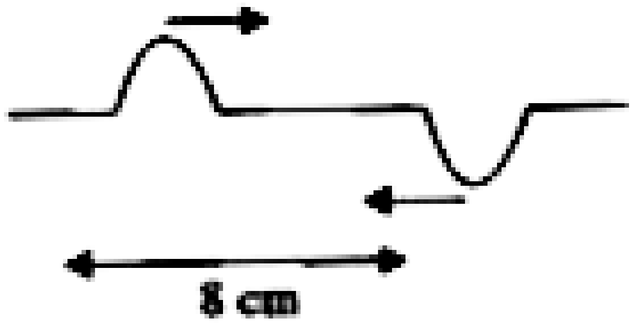
C. 320 Hz

D. 400 Hz

Answer: A::B::D

Watch Video Solution

95. Two pulses in a stretched string whose centres are initially 8 cm apart are moving towards each other as shown in Fig. (15.13.3) . The



Speed of each pulse is 2 cm/s. After two seconds, the total energy of the pulses will be

A. zero

B. purely kinetic

C. purely potential

D. party kinetic and partly potential

Answer: B

Watch Video Solution

96. A somoneter wire resonates with a given tuning fork forming standing waves with five antindoes between the two bridges when a mass of 9 kg is suspended from the wire. Resonates with the same tuning fork forming three antindoes for the same postions of the bridges. the value of M is

A. 25 Kg

B. 5 kg

C. 12.5 kg

D. 1/25 kg

Answer: A

Watch Video Solution

97. The ends of a stretched wire of length L are fixed at x = 0 and x = L, In one experiment, the displacement of wire is $y_1 = A\sin(\pi x / L)\sin\omega t$ and energy is E_1 and in another experiment its displacement is $y_2 = A\sin(2\pi x / L)\sin 2\omega t$ and energy is E_2. Then

A. $E_2 = E_1$

B. $E_2 = 2E_1$

C. $E_2 = 4E_1$

D. $E_2 = 16E_1$

Answer: C

Watch Video Solution

98. A siren placed at a railway platfrom is emitted sound of frequency $5kH_Z$, A passenger sitting in retun journey in a different train B he records a frequency of $6.0kH_Z$ while approaching the same siren. The ratio of the velocity of train B to that of train A is

A. 242/252

B. 2

C. $5/6$

D. $11/6$

Answer: D

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NDA EXAM QUESTIONS

1. A planet revolves around the sun in an elliptical orbit. Suppose that the gravitational attraction between the sun and the planet suddenly disappear then the planet would move

A. towards the sun in a spiral path

B. away from the sun along a straight path with continuously increasing speed

C. with constant speed along a tangential path to the oribt

D. towards the sun along a straight path with constant speed

Answer: C

Watch Video Solution

2. Real gases will approach the behaviour of ideal gases at

A. low temperature and high pressure

B. high temperature and low pressure

C.

D.

Answer: B

Watch Video Solution

3. The energy of a particle moving at 5 m/s is 125 J. The mass is

A. 4kg

B. 6 kg

C. 10 kg

D. 25 kg

Answer: C

Watch Video Solution

4. A body is just floating on the surface of liquid. The density of the body is same as that of the liquid. The body is slightly pushed down. Then it will

A. sink to the bottom

B. come back to the same position

C. come back to the same position shortly

D. start oscillating

Answer: A

Watch Video Solution

5. For a system of pulleys, the mechanical advantage is 4. Taking $g = 10 m/s^2$, the force required to lift a mass of 100 kg by it is

A. 50 N

B. 150 N

C. 200 N

D. 250 N

Answer: D

Watch Video Solution

6. A trolley of mass 10 kg carries 16 kg grain and moves on a horizontal smooth and straight track at $20 ms^{-1}$. If the grain start lenking out of a hole at the bottom at time t = 0_{sec}. At the rate of 0.5 kgs^{-1} the speed of the trolley at $t = 22s$ will be nearly

A. $13.5 ms^{-1}$

B. $15ms^{-1}$

C. $24ms^{-1}$

D. $26ms^{-1}$

Answer: C

Watch Video Solution

7. A hollow sphere and a solid sphere both having the same mass of 5 kg and radius 10 m are initially at rest. If they are made to roll down the same inclined plane without slipping, the ratio of their speeds when they reach the bottom of the plane $\frac{V_{\text{hollow}}}{V_{\text{solid}}}$, will be

A. 1

B. $\frac{7}{\sqrt{10}}$

C. $\frac{7}{\sqrt{12}}$

D. $\frac{21}{\sqrt{25}}$

Answer: D

Watch Video Solution

8. A particle is executing simple harmonic motion. Its total energy is proportional to its

A. displacement from equilibrium position

B. frequency of oscillation

C. square of amplitude of motion

D. velocity at equilibrium position

Answer: C

Watch Video Solution

9. A car travelling at a speed of 30 km per hour is brought to rest in 8 metres by applying brakes. If the same car is travelling at 60 km per hour, it can be brought tor est with the same braking force at a distance of

A. 16 m

B. 24 m

C. 32 m

D. 36 m

Answer: C

Watch Video Solution

10. A wave undergoes reflection from a rigid boundary. One of its characteristic parameters that changes is

A. frequency

B. phase

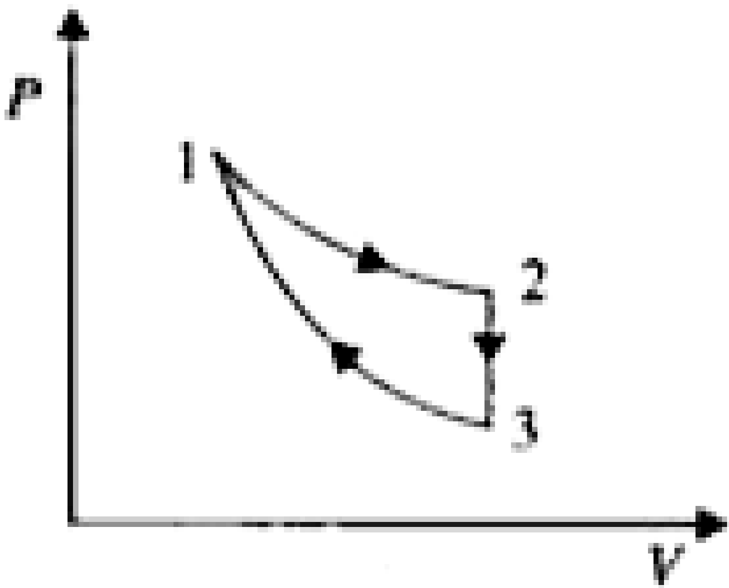
C. velocity

D. wavelength

Answer: B

Watch Video Solution

11. In the P-V diagram (Fig 15.14.1) given below, three thermodynamic processes occur for an ideal gas. Processes $1 \rightarrow 2, 2 \rightarrow 3$ and $3 \rightarrow 1$ are isothermal, isochoric and adiabatic processes respectively. The total amt of work done is 10 J. During the process $3 \rightarrow 1,$ 20 J of work is done on the system. The amount of heat added to the system during the process $1 \rightarrow 2$ is



A. 30 J

B. 20 J

C. 10 J

D. 0 J

Answer: A

Watch Video Solution

12. For the stability of a floating body. The metacentre must be

A. on the surface of the floating body

B. above the centre of gravity of the floating body

C. below the centre of gravity of the floating body

D. at the centre of gravity of the followig body

Answer: B

Watch Video Solution

13. How many calories of heat will be required to convert 1 g of ice at $0^\circ C$ into steam at $100^\circ C$

A. 720 cal

B. 640 cal

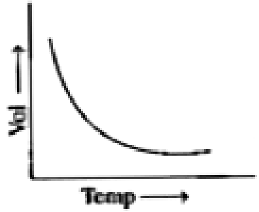
C. 540 cal

D. 180 cal

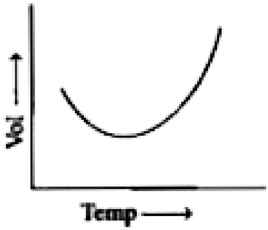
Answer: B

Watch Video Solution

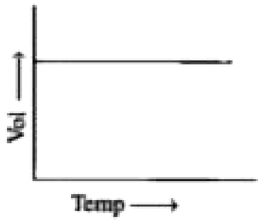
14. The relation between volume and temperature of a sample of water in the range $0^\circ C$ to $100^\circ C$ is best represented by



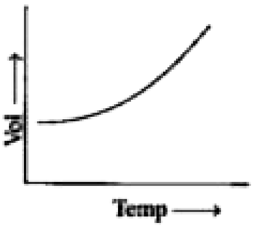
A.



B.



C.



D.

Answer: A

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15. Two bodies A & B have velocities in the ratio 2 : 1. Mass of the body A is half of the mass of the body B. The kinetic energies are in the ratio of

A. $4:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: B

Watch Video Solution

16. In the S.I. units the number of basic physical quantities is

A. 3

B. 7

C. 9

D. 21

Answer: B

Watch Video Solution

17. The volume occupied by 4.0 g of oxygen at 100 kPa and 300 K, given that the value of universal gas constant is 8.31 kPa $dm^3 mol^{-1}$ is nearly

A. $1.4 dm^3$

B. $2.0 dm^3$

C. $3.1 dm^3$

D. $4.3 dm^3$

Answer: C

Watch Video Solution

18. The power output of machine that lifts a 600 kg crate through a height of 20 m in 1 minute, is

A. 0.98 kW

B. 1.96 kW

C. 3.92 kW

D. 12 kW

Answer: B

Watch Video Solution

19. A projectile is fired at an angle θ with the horizontal in a resistance from atmosphere. Which of the following quantities does not change during the motion ?

A. Momentum

B. kinetic energy

C. vertical component of its velocity

D. Horizontal component of its velocity

Answer: D

Watch Video Solution

20. Consider the following statements in relation to the motion of a simple pendulum :

(1) The acceleration is always directed towards the mean position

(2) the maximum acceleration occurs at the mean position

(3) The maximum velocity occurs at the mean position

(4) The magnitude of maximum acceleration is equal to the maximum velocity

Which of the following statements are correct ?

A. 1 and 2

B. 1 and 3

C. 3 and 4

D. 2 and 4

Answer: C

Watch Video Solution

21. Bernoulli's equation pertains to the

A. flow of electric current

B. flow of heat

C. flow of liquids

D. photoelectric effect

Answer: C

Watch Video Solution

22. A sound wave having wavelength λ forms stationary waves after reflection from a surface. The distance between two consecutive nodes is

A. λ

B. $\lambda/2$

C. $\lambda/4$

D. $\lambda/8$

Answer: A

Watch Video Solution

23. Four hot metallic articles which are coloured blue, red, black and white, and have the same temperature, are allowed to cool. Which will have the fastest cooling rate ?

A. Black

B. Blue

C. Red

D. White

Answer: D

Watch Video Solution

24. What is the resulting temperature when 150 g of ice at $0^\circ C$ mixed with 300 g of water at $50^\circ C$?

A. $25^\circ C$

B. $33.3^\circ C$

C. $13.4^\circ C$

D. $6.6^\circ C$

Answer: B

Watch Video Solution

25. The quality of a musical note depends upon

A. its amplitude

B. its frequency

C. the wave velocity

D. its harmonic content

Answer: C

Watch Video Solution

26. The energy that travelling through a telephone line is

A. sound energy

B. radio energy

C. electrical energy

D. mechanical energy

Answer: C

Watch Video Solution

27. A body has a mass of 50 kg. Its velocity is brought down from 20 m/s to 5 m/s to m/s by a resisting froce in 5 seconds, the magnitude of resisting force is

A. 750 N

B. 375 N

C. 150 N

D. 50 N

Answer: C

Watch Video Solution

28. An aluminium sphere is dipped into water at $10^{\circ}C$. If the water is now heated, the force of buoyancy on the sphere

A. will remain the same

B. will increase

C. will decrease

D. may increase or decrease depending on the initial volume of sphere

Answer: B

Watch Video Solution

29. A car accelerates by `50 m//s^(2). It would, attain a speed of 100 km per hour from rest in

A. 0.28 s

B. 0.56 s

C. 1.12 s

D. 2.00 s

Answer: A

Watch Video Solution

30. A simple pendulum is suspended from the ceiling of a stationary elevator and it oscillates with a small amplitude if the elevator accelerates upwards, the

A. frequency of oscillation of pendulum increases

B. frequency of the oscillations of the pendulum decreases

C. pendulum stops oscillating

D. time period of oscillations remain same but the amplitude increases

Answer: C

Watch Video Solution

31. One gram of water at $100^\circ C$ is converted to steam at the same temperature. The amount of heat required is nearest to the value of

A. zero

B. 336 J

C. 540 J

D. 2257 J

Answer: C

Watch Video Solution

32. A satellite, rotating around the earth has water in a jar inside it. A cork is pushed into the water in the jar and then released. The cork will

A. rise up to the surface of the water

B. sink to the bottom of the jar

C. remain stable at the pushed position

D. stick to the wall of the jar

Answer: C

Watch Video Solution

33. Just before striking the ground a 5.0 kg body has a kinetic energy of 980 J. IF friction is ignored, from what height was it dropped ?

A. 9.8 m

B. 50 m

C. 20.0 m

D. 24 m

Answer: A

Watch Video Solution

34. When pressure on a piece of ice is increased, its melting point

A. decreases

B. increases

C. first increases and then decreases

D. remains unchanged

Answer: B

Watch Video Solution

35. Consider the following statements regarding particle executing simple harmonic motion :

(1) The total energy of the particle constant

(2) The restoring force is minimum at the extreme positions

(3) the velocity of the particle is minimum at the mean position

Which of the these statements are correct ?

A. 1 and 2

B. 1 and 4

C. 2 and 3

D. 3 and 4

Answer: A

Watch Video Solution

36. Match list (Physical Quantity) with List II (Dimensions) and select the correct answer using the codes givn below the list

List I	List II
(A) Relative density	(1) ML^2T^{-3}
(B) Potential energy	(2) MLT^{-1}
(C) Viscosity	(3) $M^\circ L^\circ T^\circ$
(D) Linear Momentum	(4) $ML^{-1}T^{-1}$
	(5) ML^2T^2

A. $\begin{matrix} A & B & C & D \\ 3 & 5 & 2 & 1 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 5 & 3 & 1 & 2 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 3 & 5 & 4 & 2 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 5 & 3 & 4 & 1 \end{matrix}$

Answer: B

Watch Video Solution

37. Consider the following statements in respect to an artifical satellite

(1) It should revolve in an orbit which is concentric and coplanar with equatorial plane

(2) It should be placed at an altitude of 3600 km from the earth

(3) Its period of revolution around the earth should be 24 hours

Which of the condition must be satisfied in order that it becomes a geostationary satellite

A. 1 and 2

B. 1, 2 and 3

C. 2 and 3

D. 1 and 3

Answer: C

Watch Video Solution

38. Acceleration due to gravity at any point inside the earth

A. varies inversely as the square of the distance from the centre

B. is independent of the distance from the centre

C. is directly proportional to the distance from the centre

D. is inversely proportional to the distance from centre

Answer: A

Watch Video Solution

39. The velocities of sound in air and water are 336 m/sec and 1470 m/sec respectively. Two sources producing waves of wavelength 6 m and 7 m sounded together will produce beats

A. than can be heard in both the media

B. that can be heard only in water and not in air

C. than can be heard only in air nd not in water

D. that cannot be heard in either of the media

Answer: A

Watch Video Solution

40. A constant pressure air thermometer gave a reading of 20 units of volume when immersedin ice and 22 units when immersed in hot water. The temperature of the hot water is

A. $27.3^{\circ} C$

B. $112.07^{\circ} C$

C. $0^{\circ} C$

D. $273^{\circ} C$

Answer: A

Watch Video Solution

41. A man walks 4 km towards the north in one hour and then 3 km towards the east in the next hour. His average velocity is

A. $3.5kmh^{-1}$

B. $2.5kmh^{-1}$

C. $5kmh^{-1}$

D. $6kmh^{-1}$

Answer: A

Watch Video Solution

42. A balloon made of rubber and filled with air is floating in water in such a way that its top surface just coincides with the level of the water. If the balloon is gently pushed a short distance downward in water and then released, it will

A. remain wherever it was left

B. move a short distance downward and then shot upward

C. move with a constant speed downward

D. sink and settle at the bottom

Answer: A

Watch Video Solution

43. A rocket works on the principle of conservation of

A. mass

B. angular momentum

C. energy

D. linear momentum

Answer: D

Watch Video Solution

44. The weight of a body will increase significantly it is taken

A. from the pole of the equator

B. from the equator to the pole

C. to the top of a momentum

D. to the centre of the earth

Answer: B

Watch Video Solution

45. Droplets of a liquid are usually more spherical in shape than larger drops of the same liquid because the force of

A. surface tension is equal and opposite to the force of gravity

B. gravity predominates over that of surface tension

C. surface tension predominates over gravity

D. gravity is equal to surface tension and is in the same direction

Answer: C

Watch Video Solution

46. The potential energy of a spring is the minimum when it is

A. compressed

B. extended

C. at its natural length

D. at its natural length but is kept at a height above the ground

Answer: C

Watch Video Solution

47. A ball weighing 4 kg and moving with velocity of 8 m/sec. Collides with a stationary ball of mass 12 kg. After the collision, the two balls move together. The final velocity is

A. 0

B. 2 m/sec

C. 8 m/sec

D. 16 m/sec

Answer: B

Watch Video Solution

48. Surface tension arises out of

A. repulsive forces

B. cohesive forces

C. electrostatic attraction

D. friction

Answer: B

Watch Video Solution

49. When a mass is rotating in a plane about a fixed point, it angular momentum is directed along

A. radius

B. tangent to the orbit

C. line at 45° to the plane of the rotation

D. axis of rotation

Answer: A

Watch Video Solution

50. A particle oscillating in simple harmonic motion has amplitude 'a'. The distance from the mean position at which its velocity will be one half of the maximum velocity is

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

B. $\sqrt{3}a$

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

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

Answer: C

Watch Video Solution

51. A beat of 10 Hz is heard when two tuning forks A and B are sounded together. If a small piece of wax is fixed on B, the beat frequency decreae. iF A has a frequency of 200 Hz, then the frequency of B will be

A. 200 Hz

B. 190 Hz

C. 210 Hz

D. 195 Hz

Answer: C

Watch Video Solution

52. The main difference between longitudinal and transverse waves in that

A. diffraction can be observed only in longitudinal waves

B. interference phenomenon is possible only for transverse waves

C. only the transverse waves can be polarised and not the longitudinal waves.

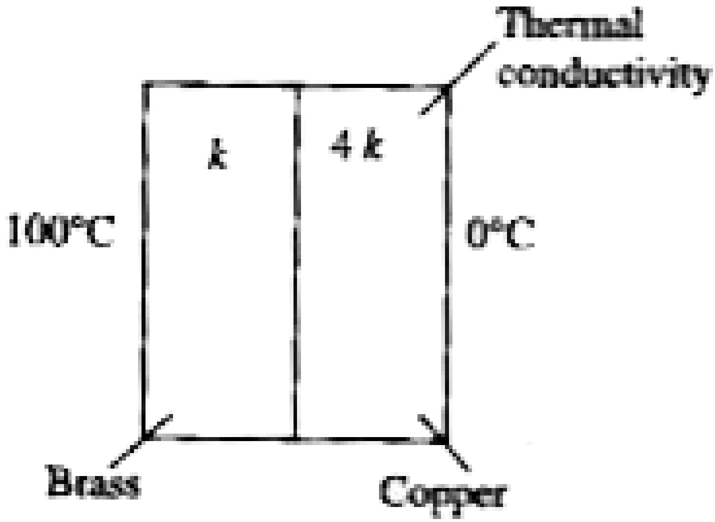
D. reflection is observed only for transverse waves and not for longitudinal waves.

Answer: A

Watch Video Solution

53. The slab shown in the figure consists of two parallel layers of cooper anb brass of same thickness and having thermal conductivites in the ratio

4: 1. IF the free face of the brass is at $100^{\circ} C$ and that of copper is at $0^{\circ} C$, then the temperature of the interface will be



A. $20^{\circ} C$

B. $30^{\circ} C$

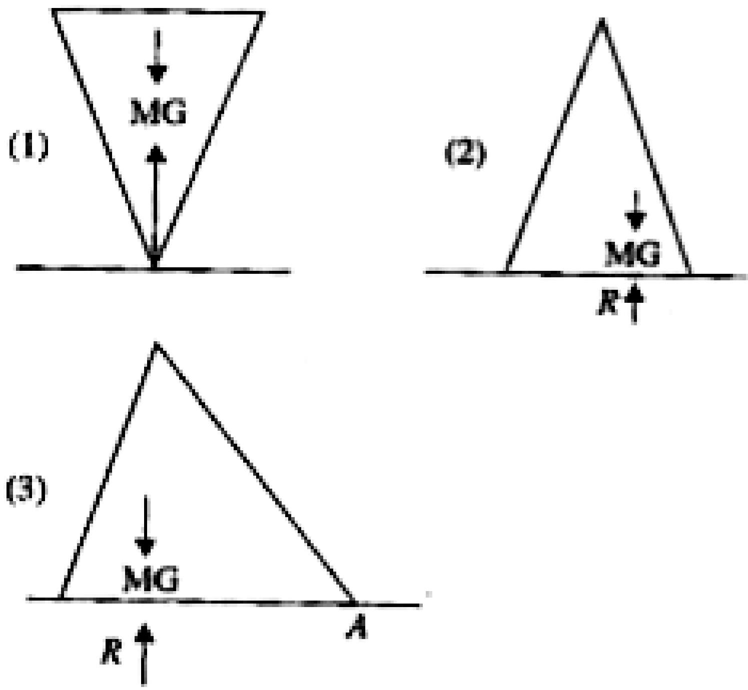
C. $40^{\circ} C$

D. $25^{\circ} C$

Answer: A

Watch Video Solution

54. The system shown in the figure diagrams labelled (1), (2) and (3) below represent respectively



A. neutral, stable and unstable equilibria

B. stable, unstable and neutral equilibria

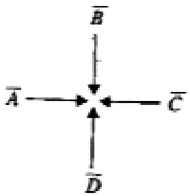
C. unstable, stable and neutral equilibria

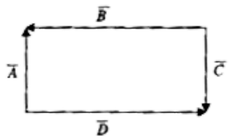
D. neutral, unstable and stable equilibria

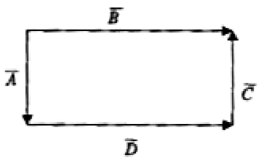
Answer: B

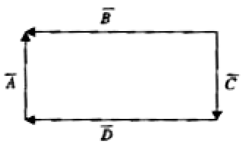
Watch Video Solution

55. The vectors A , B , C , D represents the forces acting on a body. Which one of the following Fig. 15.14.5. indicates that the body is in equilibrium.

A. 

B. 

C. 

D. 

Answer: B

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OBJECTIVE QUESTIONS FROM PREVIOUS IAS EXAMINATIONS

1. Match List I with List II and select the correct answer using the codes given below the lists.

List I (Physical Quantity)	List II (Dimension)
A. Angular momentum	(1) $ML^{-1}T^{-2}$
B. Torque	(2) MT^{-2}
C. Surface Tension	(3) ML^2T^{-1}
D. Coefficient of viscosity	(4) ML^2T^{-2}

A. $\begin{matrix} A & B & C & D \\ 4 & 3 & 2 & 1 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 3 & 4 & 2 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 1 & 4 & 2 & 3 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 3 & 1 & 4 & 2 \end{matrix}$

Answer: B

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2. The dimensions of centripetal acceleration is

A. L^2 / T^2

B. L^2 / T

C. L / T^{-2}

D. $1 / T^2$

Answer: C

Watch Video Solution

3. Two forces each of magnitude 2N, act at an angle of 60°. The magnitude of the resultant force

A. $\sqrt{1.1}$ Newton

B. $\sqrt{4}$ Newton

C. $\sqrt{12}$ Newton

D. $\sqrt{14.9}$ Newton

Answer: C

Watch Video Solution

4. A particle moves in the direction of east for 2s with velocity of 15m/s .Then it moves towards north for 8s with a velocity of 5m/s . The average velocity of the particle is (in m/s)

A. 1 m/s

B. 5 m/s

C. 7 m/s

D. 10 m/s

Answer: B

Watch Video Solution

5. Which of the following are correct with reference to energy ?

(1) It has dimensions of ML^2T^{-2}

(2) It is scalar

(3) Its S.I. unit of watt

(4) It can be neither created nor destroyed

Select the correct answer using the codes given below

A. 2, 3 and 4

B. 1, 2 and 3

C. 1, 2, and 4

D. 1, 3 and 4

Answer: C

Watch Video Solution

6. Work done in carrying a particle from A to B is independent of the path chosen implies that

A. the linear momentum is conserved

B. the angular momentum is conserved

C. the component of the angular momentum along the line joining A and B is conserved.

D. The potential function can be defined.

Answer: D

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7. If the earth is a point mass of 6×10^{24} kg revolving around the sun at a distance of 1.5×10^{8} km and in time $T = 3.14 \times 10^{7}$ s, then the angular momentum of the earth around the sun is

A. $1.2 \times 10^{18} kgm^2 / s$

B. $1.8 \times 10^{29} kgm^2 / s$

C. $1.5 \times 10^{37} kgm^2 / s$

D. $2.7 \times 10^{40} kgm^2 / s$

Answer: D

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8. A particle is moving in a circular orbit of radius r_1 with an angular velocity ω_1. It jumps to another circular orbit of radius r_2 and attains an angular velocity ω_2. IF $r_2 = 0.5r_1$ and assuming that no external torque is applied to that system, then, the angular velocity ω_2 is given by

A. $\omega_2 = 4\omega_1$

B. $\omega_2 = 3\omega_1$

C. $\omega_2 = 2\omega_1$

D. $\omega_2 = \omega_1$

Answer: A

Watch Video Solution

9. When a satellite moves around the earth, the quantity which remains constant is

A. angular veloctiy

B. kinetic energy

C. potential energy

D. aerial velocity

Answer: D

Watch Video Solution

10. If a planet revolves around the sun in a circular orbit of radius a with a speed of revolution T, then (K being a positive constant

A. $T = Ka^{2/3}$

B. $T = Ka^{3/2}$

C. $T = Ka^{2}$

D. $T = Ka^3$

Answer: B

Watch Video Solution

11. The maximum velocity of a simple harmonic motion represented by $y = 3\sin\left(100t + \frac{\pi}{6}\right)$ is given by

A. 300

B. $\frac{3\pi}{6}$

C. 100

D. $\frac{\pi}{6}$

Answer: A

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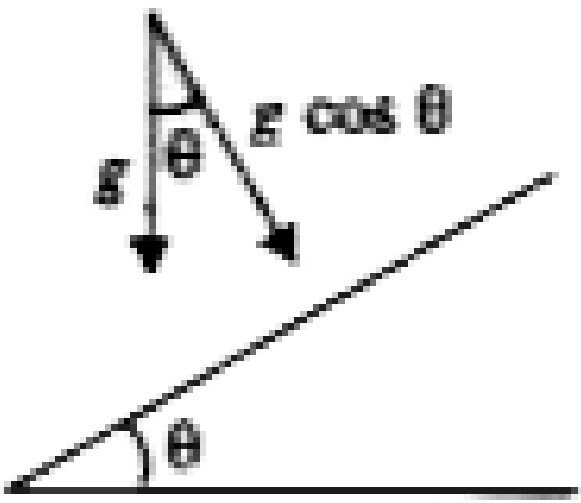
12. A simple pendulum of length l has been set up inside a railway wagon sliding down a frictionless inclined plane having an angle of inclination 0 with the horizontal. What will be its period of oscillation is recorded by an observer inside the wagon ? [Fig. 15.12.4]



A. $2\pi\sqrt{\dfrac{L}{g\cos\theta}}$

B. $2\pi\sqrt{\dfrac{L}{g\sin\theta}}$

C. $2\pi\dfrac{\sqrt{L}}{T}\Big)$

D. $2\pi\sqrt{\dfrac{L\cos\theta}{g}}$

Answer: A

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13. In an elastic one dimensional collision between two particles the relative veloctiy of approach before collision is

A. greater than the relative velocity of separation after collision

B. less than the relative velocity of separation after collision

C. equal to the relative velocity of separation after collision

D. less than the relative velocity of separation if the incoming particle is heavier than the target particle

Answer: C

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14. In the case of fluid, Bernoulli's theorem expresses the application of principle conservation of

A. Linear momentum

B. energy

C. mass

D. angular momentum

Answer: B

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15. The rain drops are in spherical shape due to

A. energy due to surface tension is lowest for a sphere

B. energy due to surface tension is highest for a sphere

C. velume energy is highest for a sphere

D. surface tension acts against the force of gravity

Answer: B

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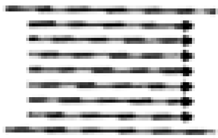
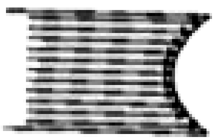
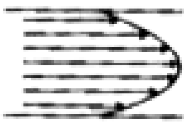
16. A viscous fluid is flowing through a cylindrical tube. The velocity distribution of the fluid is best

A. 

B. 

C. 

D. 

Answer: D

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17. The particles of a medium oscillate about their equilibrium position, whenever a wave travels through that medium. The phase difference between the oscillations of two such practices varies

A. with time but not with distance separating them

B. with distance separation them but not with time

C. with distance separating them as well as with time

D. neither with distance separating them nor with time

Answer: D

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18. A mass of 1 kg suspended from a spring whose force constant is 400 Nm^{-1}, executes simple harmonic motion. When the energy of the oscillator is 2J, the maximum acceleration experienced by maas will be

A. $2ms^{-2}$

B. $4ms^{-2}$

C. $40ms^{-2}$

D. $400ms^{-2}$

Answer: C

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19. Consider the following statements. The total energy of a particles executing simple harmonic motion depends on its

1. amplitude

2. Period

3. displacement of these :

A. 1 and 2 are correct

B. 2 and 3 are correct

C. 1 and 3 are correct

D. 1, 2 and 3 are correct

Answer: A

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20. Two tuning forks, A and B, produce notes of frequencies 258 Hz and 262 Hz. An unknown note sounded with A produces certain beats. When the same note is sounded with B, the beat frequency gets doubled. The unknown frequency is

A. 268 Hz

B. 260 Hz

C. 250 hz

D. 242 Hz

Answer: C

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21. A wire is stretched by one mm by a force of 1 kN. The work done is stretching the wire is

A. 5 ergs

B. 5 Joules

C. 0.5 ergs

D. 0.5 Joules

Answer: D

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22. A string of length 2 m is fixed at both ends. If this string vibrates in its fourth normal mode with a frequency of 500 Hz, then the waves would travel on its with a velocity of

A. 125 ms^{-1}

B. 250 ms^{-1}

C. 500 ms^{-1}

D. 1000 ms^{-1}

Answer: C

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23. A one meter long string of mass 4.9×10^{-4} kg is held under a tension of 19.6 N. IF the string vibrates in one segment, then the frequency of vibration will be

A. 200 Hz

B. 100 Hz

C. 50 Hz

D. 400 Hz

Answer: A

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24. A given amount of heat cannot be completely converted into work. However it is possible to convert a given amount of work

Completely into heat this apparently contradictory statement results from the

A. zeroth law of thermodynamics

B. second law of thermodynamics

C. second law of thermodynamic

D. third law of thermodynamics

Answer: B

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25. The work done, W, during an isothermal process in which the gas expands from an intial volume V_1, to a final volume V_2 is given by (R : gas constant, T : temperature)

A. $R(V_2 - V_1)\log_{e\frac{T_1}{T_2}}$

B. $R(T_2 - T_1)\log_e\left(\frac{V_1}{V_2}\right)$

C. $RT\log_e\left[\frac{V_2}{V_1}\right]$

D. $2RT\log_e\left[\frac{V_1}{V_2}\right]$

Answer: C

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26. The co-ordinates of a moving particles at time t, given by $x = at^2, y = bt^2$. The speed of the particle is

A. $2(a+b)t$

B. $(a^2 + b^2)^{1/2}$ t

C. $2(a^2 + b^2)^{1/2}t$

D. $(a+b)t$

Answer: c

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27. Body 1 of mass M is dropped from a height of 1 m and body 2 of mass 3 M is dropped from a height of 9 m. Ratio of time taken by bodies 1 and 2 to reach the ground is

A. $1:1$

B. $1:3$

C. $3:1$

D. $9:1$

Answer: B

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28. The resultant of two forces acting at an angle of 120° is 10 N. If one of the force is 10 N. The other force is

A. $20/\sqrt{3}$ N

B. $10\sqrt{3}$ N

C. 10 N

D. $20\sqrt{3}$ N

Answer: C

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29. A body of mass m, moving with velocity μ collides elasticity with another body at rest having mass M. If the body of mass M moves with velocity V, then the velocity of the body of mass m after the impact is

A. $\frac{m-M}{m+M}\mu$

B. $\frac{m-M}{m+M}V$

C. $\frac{m+MV}{m+M}$

D. $\frac{\text{m}u-MV}{m}$

Answer: A

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30. Match List I with List II and select the correct answer

List I	List II
(System)	(Expression for moment of ine
A. A ring about its axis	$(1) MR^2/2$
B. A uniform circular disc about its axis	$(2) 2/5MR^2$
C. A solid sphere about any diameter	$(3) 7/5MR^2$
D. A solid sphere about any tangent	$(4) MR^2$

Selec the answer from the codes given below

A. $\begin{matrix} A & B & C & D \\ 2 & 1 & 3 & 4 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 4 & 3 & 2 & 1 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 1 & 4 & 3 & 2 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 4 & 1 & 2 & 3 \end{matrix}$

Answer: D

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31. A stone of mass M tied at the end of a string, is moving in a circular of radius R, with a constant angular velocity ω. The work done on the stone, in any half circle I s

A. $\pi MR^2\omega^2$

B. $2MR^2\omega^2$

C. $MR^2\omega^2$

D. zero

Answer: D

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32. An elastic collision conserves

A. kinetic energy but not momentum

B. momentum but not kinetic energy

C. neither momentum nor kinetic energy

D. both kinetic energy and momentum

Answer: C

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33. Two planets A and B have the same material density. If the radius of A is twice that of B, then the ratio of the escape velocity V_A / V_B is

A. 2

B. $\sqrt{2}$

C. $1/\sqrt{2}$

D. $1/2$

Answer: B

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34. Water rises to a height 'h' in capillary tube. If the length of capillary tube above the surface of water is made less than 'h' then,

A. the water level will go down

B. the water level come to the top but the radius of curvature of the meniscus will increase

C. the water will flow out of capillary.

D.

Answer: A

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35. An oil drop of diameter 4×10^{-6} m falls through air. iF the densities of the oil and air are 900 kg/m^(3) $\text{and } 1.293k\frac{g}{m^3}$ respectively and the coefficient of viscosity of air is 2.0×10^{-5} Ns//m^(2)`, then the terminal velocity of oil drop will be

A. 0.2×10^{-4} m/s

B. 2×10^{-4} m/s

C. 4×10^{-4} m/s

D. 8×10^{-4} m/s

Answer: C

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36. When a harmonic wave is proppagating through a medium, the displacement 'y' of a particle of the medium is represented by $y =$ 10 sin (2pi)/(5)` (1800t- x). The time period will be

A. 1/360 sec

B. 1/36 sec

C. 36 sec

D. 360 sec

Answer: A

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37. The displacement of a particle executing simple harmonic motion is given by $y = 4\sin(2t + \phi)$. The period of oscillation is

A. $2/\pi$

B. $\pi/2$

C. π

D. 2π

Answer: C

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38. Which of the below figure (s) represent damped simple harmonic motion.

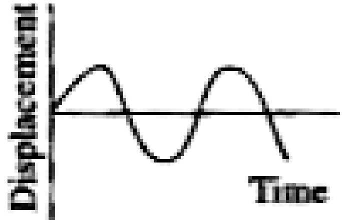


Fig. 15.15.2

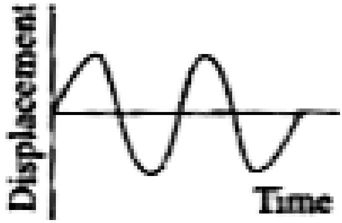
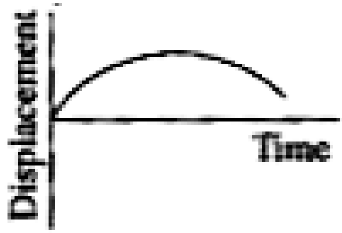
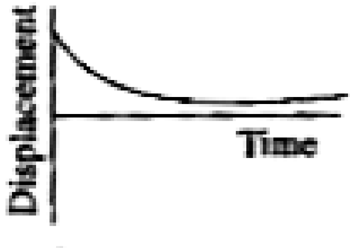


Fig. 15.15.3





Select the correct answer using the codes given below

A. Fig. 1 alone

B. Fig. 2 alone

C. Fig. 4 alone

D. Fig. 3 and 4

Answer: B

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39. A railway engine passes by the platform at a speed of 36 km/hr blowing its whistle having a frequency of 660 Hz. The different in the frequencies of the whistle heard by a person standing on the platform as the engine goes past the person is equal to

A. zero

B. 20 Hz

C. 40 Hz

D. 60 Hz

Answer: B

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40. A string 1m long is drawn by a 300 Hz vibrator attached to its end. The string vibrates in three segments. The speed of transverse waves in the string is equal to

A. 100 m/s

B. 200 m/s

C. 300 m/s

D. 400 m/s

Answer: B

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41. The Farensheit and the centrigrade scales have the same numerical value at a temperature of

A. -30°

B. -40°

C. -100°

D. $-273^{\circ}C$

Answer: B

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42. van der Waal's equation of state of a gas takes into account

A. the intermolecular forces only

B. the size of the molecule only

C. both the intermolecular forces and the size of the molecule

D. the velocity of the molecules only

Answer: C

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43. A beat engine work on a Cannot cycle with the heat sink in the temperature of $27^{\circ} C$. IF the efficiency is 20%, then the temperature (in Kelvin) of the heat source will be

A. 375

B. 300

C. 270

D. 150

Answer: A

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44. If the temperature of a black body is increased, then the maximum of the spectrum will

A. shift towards shorter wavelength

B. shift towards shorter frequency

C. shift towards shorter or longer wavelength depending on the nature of the black body

D. no shift

Answer: A

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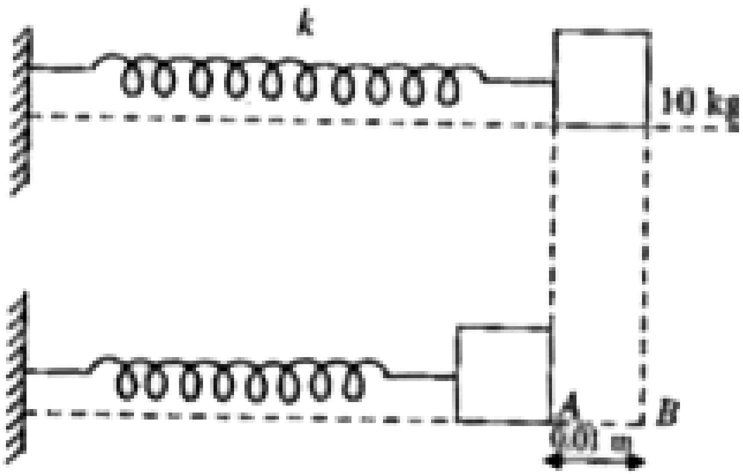
45. A 10 kg mass is connected at one end of a massless spring with force constant `k = 1000 N/m, keeping other end fixed in a horizontal plane as shown in the fig. 15.6



If the sytem is displaced by 0.01 m from its equilibrium position A to a point B, then the acceleration of the system is

A. $10ms^{-2}$

B. $1ms^{-2}$

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

D. $-10ms^{-2}$

Answer: B

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46. A particle is projected at an elevation `tan^(-1) ((4)/(3)) from a point O. The ratio of the range on the horizontal plane through O to the greatest height ascended above O is

A. 2

B. 3

C. 4

D. 5

Answer: B

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47. The escape velocity of a particle of mass 'm'

A. varies as m^2

B. varies as m

C. varies as m^{-1}

D. is independent of mass

Answer: D

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48. In an inelastic collision

A. momentum is conserved but energy is not conserved

B. momentum is not conserved but energy is conserved

C. neither momentum nor energy is conserved.

D. both momentum and energy are conserved.

Answer: A

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49. IF e is the coefficient of restitution then which one of the following gives the condition for perfectly elastic bodies ?

A. e = 0

B. e = 0.5

C. e = 0.8

D. e = 1.0

Answer: D

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50. Two soap bubbles A and B have radii $r_1 \text{ and } r_2$ respectively. If $r_1 < r_2$ than the excess pressure inside

A. bubbles A and B will be equal

B. bubbles A will be less than that in bubbles B

C. bubbles A will be greater than that in bubble B

D. bubbles A and B will be zero.

Answer: C

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