



PHYSICS

BOOKS - MAXIMUM PUBLICATION

SAY-2017 QUESTION PAPER

Exercise

1. The weakest force found in nature



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2. The work done during an isochoric process is



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3. Highway police detect over speeding vehicles by using

A. Magnus effect

B. Pascal's law

C. Doppler effect

D. Bernoulli's theorem

Answer: C



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4. Two forces 3N and 4N are acting perpendicular to each other. The magnitude of the resultant force is

A. 7N

B. 1N

C. $\sqrt{49N}$

D. 5N

Answer: D



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5. Say true/false: "Trade winds are produced due to conduction"



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6. The displacement(S) of a body in a time t is given by $S = at^2 + bt$. Find the dimensions of a and b .



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7. Give the magnitude and direction of net force on a stone of mass 0.1kg just after it dropped from the window of a train accelerating at 1ms^{-2} .



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8. Give the magnitude and direction of the net force on a stone of mass 0.1 kg, lying on the floor of train which is accelerating with 1ms^{-2} , the stone being at rest relative to the train.



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9. A body is rolling on a horizontal surface. Derive an equation for its kinetic energy.



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10. "A heavy and light body have same kinetic energy." Which one has greater momentum?
Why?



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11. The side of a cube is measured as 3.405 cm.
How many significant figures are there in the measurement.



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12. The side of a cube is measured as 3.405 cm. If the percentage error in the measurement of the side of the cube is 3%, find the percentage error in its volume.



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13. State and prove the law of conservation of energy for a freely falling body.



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14. What will be the weight of a body at the centre of earth.



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15. Acceleration due to gravity on earth changes with depth and height. Find the height at which the acceleration due to gravity is $\frac{1}{4}$ th that at the surface of earth.



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16. A metal sphere of density ρ and radius 'a' is falling through an infinite column of liquid of density σ and coefficient of viscosity η . Name any two forces acting on the sphere.



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17. Derive an expression for the terminal velocity of a ball in terms of coefficient of viscosity of the medium.



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18. Conduction is the mode of transfer of heat in solids. Write the unit of thermal conductivity.



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19. Conduction is the mode of transfer of heat in solids. "Burns produced by steam is severe than that produced by boiling water" Why?



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20. A gas has 'f' degrees of freedom. Calculate its C_p , C_v and γ .



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21. A gas has 'f' degrees of freedom. Define mean free path.



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22. The velocity of a satellite in its orbit is called orbital velocity. find the relationship between orbital velocity and escape velocity.



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23. A saturn year is 29.5 times the earth year. How far is the saturn from the sun if the earth is $1.50 \times 10^8 \text{ km}$ away from the sun?



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24. In simple harmonic motion, force is directly proportional to the displacement for the mean position. Give an example of harmonic oscillator.



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25. In simple harmonic motion, force is directly proportional to the displacement for the mean position. Derive equations for the Kinetic and potential energies of a harmonic oscillator.



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26. In simple harmonic motion, force is directly proportional to the displacement for the mean position. Show graphically the variation of kinetic energy and potential energy of a harmonic oscillator.



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27. A stretch string can be used as a musical instrument. What is the fundamental frequency of a stretched string?



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28. A stretch string can be used as a musical instrument. What is the fundamental frequency of a stretched string?



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29. A body having an initial velocity V_0 has an acceleration a . Using velocity-time graph derive an equation for displacement of the above body.



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30. A body having an initial velocity V_0 has an acceleration a . Using velocity-time graph derive an equation for displacement of the above body.



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31. A javelin is thrown with an initial velocity v_0 at an angle θ with the horizontal. What is the horizontal and vertical velocities of the body I) at the point of projection II) at maximum height



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32. A javelin is thrown with an initial velocity v_0 at an angle θ with the horizontal. Find the

angle of projection at which the maximum height attained by the javelin is equal to the horizontal range.



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33. What is meant by banking of roads?



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34. What is the optimum speed of the car along the banked road?



[Watch Video Solution](#)

35. What is the optimum speed of the car along the banked road?



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36. The moment of intertidal of a thin rod of mass M and length l about an axis perpendicular to the rod at its midpoint is

$\frac{M_l^2}{12}$. what is the radius of gyration in the above case?



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37. The moment of intertidal of a thin rod of mass M and length l about an axis perpendicular to the rod at its midpoint is $\frac{M_l^2}{12}$. A student has to find the moment of of inertia of the above rod about an axis(AB) perpendicular to the rod and passing through

one end of the rod. Name and state the law used for this case.



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38. The moment of intertidal of a thin rod of mass M and length l about an axis perpendicular to the rod at its midpoint is $\frac{Ml^2}{12}$. Using the theorem, find the moment of the rod about AB.



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39. Small drops of water assumes spherical shape due to surface tension. Define surface tension.



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40. Obtain an expression for excess of pressure inside a drop of radius r and surface tension S .



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41. Small drops of water assumes spherical shape due to surface tension. Why do farmers plough the fields before summer?



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42. Camot engine is considered as an ideal heat engine. Draw the P-V graph of Camot's cycle.



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43. Thermodynamics deals with the concept of heat and the exchange of heat energy.

Obtain the expression for the work done during an adiabatic process.



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44. Carnot engine is considered as an ideal heat engine. Calculate the efficiency of a heat engine working between ice point and steam point.



45. The branch of physics that was developed to understand and improve the working heat engines is.....

- A. Optics
- B. Thermodynamics
- C. Electronics
- D. Electrodynamics

Answer: B



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46. State the parallel axes theorem on moment of inertia.



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47. Select a TRUE statement from the following

A. Year and light year have the same dimensions.

B. Intensity of gravitational field has same dimensions as that of acceleration.

C. One angstrom is the mean distance between sun and earth.

D. Parsec is a unit of time.

Answer: B



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48. If the zero of potential energy is at infinity, the total energy of an orbiting satellite is negative of its..... energy.



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49. What is the time period of a second's pendulum?



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50. A body having an initial velocity V_0 has an acceleration a . Using velocity-time graph derive an equation for displacement of the above body.



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51. A boy throws a ball of mass 200g with a velocity 20m.s^{-1} at an angle of 40° with the horizontal. What is the kinetic energy of the ball at the highest point of the trajectory?





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52. Write the work done in each of the following cases as zero positive or negative.

(a) Work done by centripetal force in circular motion. (b) Work done by friction. (c) Work done by gravitational force on a freely falling object. (d) Work done by the applied force in lifting an object.



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53. Derive an expression for the escape velocity of an object from the surface of a planet.



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54. The terminal velocity of a copper ball of radius 2mm falling through a tank of oil at $20^{\circ}c$ is $6.5cms^{-1}$. Calculate the viscosity of the oil at $20^{\circ}c$. (Hints: Density of oil is is

$1.5 \times 10^3 \text{kgm}^{-3}$, density of copper is
 $8.9 \times 10^3 \text{kgm}^{-3}$)



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55. Free fall is a uniformly accelerated motion.

Draw the velocity time graph of free fall.



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56. Define uniform acceleration.



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57. When a shot is fired from a gun, the gun moves in the backward direction.

State the principle behind it.



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58. A shell of mass 0.020kg is fired by a gun of mass 100kg . If the muzzle speed of the shell is 80m s^{-1} , what is the recoil speed of the gun?



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59. Acceleration due to gravity decreases with depth Prove the above statement by deriving proper equation.



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60. Acceleration due to gravity decreases with depth Using the equation, show that acceleration due to gravity is maximum at the surface and zero at the center of the earth.



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61. A hydraulic lift is designed to lift a maximum, mass of 3000kg and area of the piston carrying it is 425cm^2 . What is the maximum pressure that should be applied to the smaller piston?



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62. When 0.15kg of ice at $(\text{deg}0\text{C})$ is mixed with 0.30kg of water at $(\text{deg}50\text{C})$ in a

container, the resulting temperature is 6.70°C . Calculate the latent heat of fusion of ice. Given specific heat capacity of water $4186\text{Jkg}^{-1}\text{K}^{-1}$.



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63. The accuracy in measurement depends on the limit or the resolution of the measuring instrument. State whether the above statement is TRUE or FALSE.



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64. The accuracy in measurement depends on the limit or the resolution of the measuring instrument. A physical quantity P is related to four observables a, b, c and d as $P = (a^3) \frac{b^2}{(cd)^{\frac{1}{2}}}$. The percentage errors in measurements of a, b, c and d are 1% , 3% , 2% and 3% respectively. What is the percentage errors in the measurement of P ?



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65. A stone tied to the end of a string 80cm long is whirled in a horizontal circle with a constant speed. What is the angle between velocity and acceleration at any instant of motion?



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66. A stone tied to the end of a string 80cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14

revolutions in 25s, what is the magnitude of acceleration of the stone?



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67. If \vec{A} is perpendicular to \vec{B} , what is the value of $(\vec{A}) \cdot (\vec{B})$?



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68. Find the angle between the force $(\vec{F} = (3\hat{i} + 4\hat{j} + 5\hat{k})N$ and displacement

$$(\bar{d}) = (5\hat{i} + 4\hat{j} + 3\hat{k})m$$



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69. If in the case of a Carnot's engine, $T_1 = 100^\circ\text{C}$, $T_2 = 0^\circ\text{C}$ and $Q_1 = 4200\text{J}$, find the value of Q_2 .



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70. Which one of the following relationships between the acceleration a and

displacement x of a particle involve simple harmonic motion.



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72. Which one of the following relationships between the acceleration a and displacement x of a particle involve simple harmonic motion.



[Watch Video Solution](#)

73. Which one of the following relationships between the acceleration a and displacement x of a particle involve simple harmonic motion.





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74. A simple harmonic motion is represented as $x = A \cos \omega t$. Obtain the expression for velocity and acceleration of the object and hence prove that acceleration is directly proportional to the displacement.



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75. What is the condition for the equilibrium of concurrent forces?



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76. A mass of 6 kg is suspended by a rope of length 2 m from the ceiling. A force of 50 N in the horizontal direction is applied at the midpoint P of the rope as shown. What is the angle, the rope makes with the vertical in equilibrium? Take $g = 10\text{ m s}^{-2}$. Neglect the mass of the rope.



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77. Write the equation connecting torque with force.



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78. A meter stick is balanced at its centre (50cm). When two coins each of mass 5g are put on the top of the other at the 12cm mark, it is found to be balanced at 45cm . What is the mass of the stick?



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79. Derive the mathematical relation between angular momentum and torque.



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80. Water rises up in a narrow tube inspite of gravity. This phenomenon is called...



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81. Derive an expression for the rise of the liquid in a capillary tube.



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82. Water with detergent dissolved in it should have...angle of contact. (small/large)



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83. The angle between $\vec{A} = \vec{i} + \vec{j}$ and $\vec{B} = \vec{i} - \vec{j}$ is

A. 45°

B. 90°

C. 60°

D. 180°

Answer: B



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84. Three objects with a mass of 40 kg each are placed in a straight line 50 cm apart. What is the net gravitational force at the centre object due to the other two?



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85. Which one of the following relationships between the acceleration a and displacement x of a particle involve simple harmonic motion.

A. $a = 5x$

B. $a = -200x^2$

C. $a = -5x$

D. $a = 100x^3$

Answer: C



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86. The stress required to double the length of a wire of Young's modulus Y is

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

B. $2Y$

C. y

D. $4Y$

Answer: C



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87. A car travelling at a speed of 54 km/hr is brought to rest in 90 s. Find the distance travelled by the car before coming to rest.



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88. A parallelogram law helps to find the magnitude and direction of the resultant of two forces. If the magnitude of two vectors and their resultant are the same, what is the angle between the two vectors?



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89. Choose the correct alternative: When a conservative force does positive work on a body, the potential energy of the body increases/decreases/remains unaltered.

A. increases

B. decreases

C. remains unaltered

D.

Answer:



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90. Work done by a body against friction always result in a loss of its

- A. kinetic energy
- B. potential energy
- C.
- D.

Answer: B



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91. The rate of change of total momentum of a system of many particle system is proportional to the . . . on the system

- A. external force
- B. sum of internal forces
- C.
- D.

Answer: A



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92. Choose the correct alternative: In an inelastic collision of two bodies, the quantities which do not change after the collision are the total kinetic energy/total linear momentum of the system of two bodies.

A. total kinetic energy

B. total linear momentum

C.

D.

Answer: A



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93. A steel wire of length 1.5 m and diameter 0.25 cm is loaded with force of 98N. The increase in length of the wire 1.5×10^{-4} m. Calculate the tensile stress and fractional change in length of the wire.



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94. According to the kinetic theory of gases gas molecules are always in random motion.

State the law of equipartition of energy.



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95. According to the kinetic theory of gases gas molecules are always in random motion.

Write the average value of energy of a molecule for each vibrational mode.



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96. Two parallel rail tracks run north-south.

Train A moves north with the speed of $15\frac{m}{s}$

and train B moves south with the speed of

$25\frac{m}{s}$. What is the velocity of B with respect to

A?



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97. Two parallel rail tracks run north-south.

Train A moves north with the speed of $15\frac{m}{s}$

and train B moves south with the speed of

$25 \frac{m}{s}$. What is the velocity of ground with respect to B?



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98. Two parallel rail tracks run north-south. Train A moves north with the speed of $15 \frac{m}{s}$ and train B moves south with the speed of $25 \frac{m}{s}$. What is the velocity of a monkey running on the roof of the train A against its motion (with a velocity of $5 \frac{m}{s}$ with respect to

the training A) as observed by a man standing on the ground?



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99. An insect trapped in a circular groove of radius 12cm moves along the groove steadily and completes 7 revolutions in 100s. What is the linear speed of the motion?



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100. An insect trapped in a circular groove of radius 12cm moves along the groove steadily and completes 7 revolutions in 100s. Is the acceleration vector a constant vector? What is its magnitude?



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101. A car and a truck have the same kinetic energies at a certain instant while they are moving along two parallel roads. (Assume

that the truck is heavier than the car). Which one will have greater momentum?



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102. A car and a truck have the same kinetic energies at a certain instant while they are moving along two parallel roads . (Assume that the truck is heavier than the car). If the mass of the truck is 100 times greater than that of the car ,find the ratio between their velocities.



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103. A girl rotates on a swivel chair. What happens to her angular speed when she stretches her arms?



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104. A solid sphere of mass m and radius R starts from rest and rolls down along an inclined plane of height h without slipping.

Calculate the kinetic energy of the sphere when it reaches the ground.



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105. A solid sphere of mass m and radius R starts from rest and rolls down along an inclined plane of height h without slipping. Find the velocity when it reaches the base.



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106. A man jumping out of a slow bus falls forward. This is due to



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107. A man jumping out of a slow bus falls forward. Which Newton's law gives the above concept? State the law.



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108. What are the balanced forces acting on a book at rest on a table ?



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109. What is meant by banking of roads?



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110. Banking of road helps to increase the centripetal force and thereby increases the

limit of maximum speed of vehicle with it can take the curve.

Sketch the schematic diagram of a vehicle on a banked road and mark the various force acting on it.



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111. Banking of road helps to increase the centripetal force and thereby increases the limit of maximum speed of vehicle with it can take the curve.

Give the expression for the maximum allowed speed of a vehicle on a banked road with friction.



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112. Obtain an expression for excess of pressure inside a drop of radius r and surface tension S .



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113. For a liquid-gas interface, the convex side has a high pressure than the concave side.

Which is better, washing of cloth in cool soap water or warm soap water? Why?



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114. Linear expansion is change in length of an object with temperature. Write the equation for coefficient of linear expansion.



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115. Linear expansion is change in length of an object with temperature. Show that the coefficient of volume expansion is thrice its coefficient of linear expansion.



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116. Linear expansion is change in length of an object with temperature. The absolute zero is

.....

A. $273.15 \text{ } ^\circ C$

B. $-273.15K$

C. $-273.15 \text{ } ^\circ F$

D. $0 \text{ } ^\circ C$

Answer: A



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117. Deduce an expression for the period of oscillation of a simple pendulum.



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118. The simplest example of simple harmonic motion is the oscillations of a simple pendulum. In a simple pendulum made of a metallic wire, what will happen to the period when temperature increases? Give a reason.



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119. The centripetal force depends on mass of the body, velocity and radius of circular path.

Find the expression for the centripetal force acting on the body using the principle of dimensional analysis. (Take constant $k=1$)



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120. When the planet Jupiter is at a distance of 824.7 million kilometers from the Earth, its angular diameter is measured to be 35.72 of arc. Calculate the diameter of the Jupiter.



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121. Satellites are objects which revolve around the earth. The direction of revolution of geosynchronous satellite is from

- A. east to west
- B. west to east
- C. north to south
- D. south to north

Answer: B



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122. Satellites are objects which revolve around the earth. Derive an expression for total energy of an orbiting satellite.



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123. Satellites are objects which revolve around the earth. What is the magnitude of the angular velocity for a geosynchronous satellite?



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124. A steam engine delivers $5.4 \times 10^8 J$ of work per minute and services $3.6 \times 10^9 J$ of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute?



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125. A transverse harmonic wave on a string is described by

$$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right) \quad \text{where}$$

'x' and 'y' are in cm and 't' is in s. The positive direction of 'x' is from left to right. Is this a travelling wave or a stationary wave? If it is travelling, what are the speed and direction of its propagation?



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126. A transverse harmonic wave on a string is described by

$$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right) \quad \text{where}$$

'x' and 'y' are in cm and 't' is in s. The positive

direction of 'x' is from left to right. What are its amplitude and frequency?



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127. A transverse harmonic wave on a string is described by

$$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right) \quad \text{where}$$

'x' and 'y' are in cm and 't' is in s. The positive direction of 'x' is from left to right. What is the least distance between two successive crests in the wave?



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128. 'the weak nuclear force is stronger than gravitational force" state whether this statement is true or false.



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129. write any two properties of conservative force.



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130. Thermodynamics deals with energy changes of macroscopic system.

a) Consider a chemical reaction taking place in a closed insulated vessel. To which type of thermodynamic system does it belong?

b) State the first law of thermodynamics.

c) 3 mol of an ideal gas at 1.5 atm and $25^{\circ}C$ expands isothermally in a reversible manner to twice its original volume against an external pressure of 1 atm. Calculate the work done.

$$[R = 8.314JK^{-1}mol^{-1}]$$



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131. draw a graph showing the variation of volume of a given mass of water with temperature from $0^{\circ}C$. In the graph mark the temperature at which water has maximum density.



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132. what is sublimation? write an example of a material.



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133. the lengths of two bodies measured by a metre scale are $I_1 = (20 \pm 0.5)$ cm and $I_2 = (15 \pm 0.2)$ cm. Calculate: some of these lengths



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134. the lengths of two bodies measured by a metre scale are $I_1 = (20 \pm 0.5)$ cm and

$I_2 = (15 \pm 0.2)\text{cm}$. Calculate: difference between the lengths



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135. Match the following. A{a.torque ($\bar{\tau}$), b. Angular momentum (\bar{L}), c. rotational equilibrium, d. Linear velocity (\bar{b})}. B{(i) perpendicular to \bar{r} & \bar{P} , (ii) $\sum \bar{F} = 0$, (iii) $\bar{\omega} \times \bar{r}$, (iv) $\bar{r} \times \bar{F}$, (v) $\sum \bar{\tau}$



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136. Derive an expression for the escape velocity of an object from the surface of a planet.



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137. A wave travelling along a string is described by,

$y(x, t) = 0.005 \sin(80.0x - 3.0t)$ in which the numerical constant are in SI units. Calculate the wavelength and frequency of the wave.



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138. Draw a diagram showing the first and third harmonics produced in a closed pipe.



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139. write the equation for the fundamental frequency in terms of length of the pipe



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140. "Velocity cannot be added to temperature". this is in accordance with which law of physics?



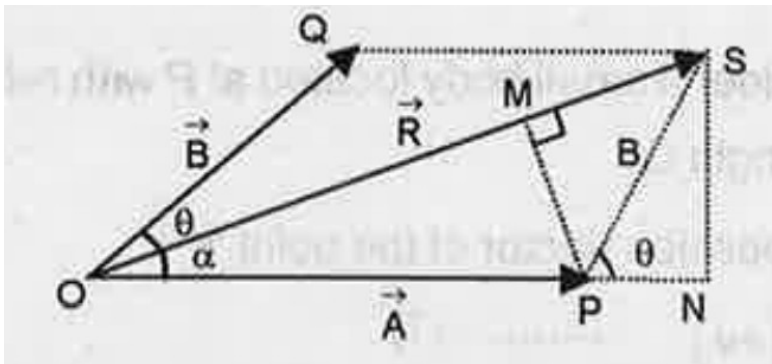
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141. "Velocity cannot be added to temperature" check the dimensional correctness of the equation $PV = Fx$ where P is the pressure V is the volume F is force and x is displacement



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142. Find the magnitude and direction of the resultant of two vectors \vec{A} and \vec{B} in terms of their magnitudes and angle between them.



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143. An object moving uniformly in a circular path of radius 12cm completes 7 revolutions in 100s . What is the angular speed, and the linear speed of the motion?



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144. A light bullet is fired from a heavy gun. Choose the CORRECT.

A. Speed of the gun and the bullet are equal.

B. Momenta of the bullet and gun are equal in magnitude and opposite in direction.

C. Momenta of the gun and bullet are equal in magnitude and are in the same direction.

D. Velocity of gun and bullet are equal.

Answer:



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145. A light bullet is fired from a heavy gun.

Choose the CORRECT.



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146. By using the law of equipartition of energy, derive the value of ratio of specific heats of a mono atomic gas.



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147. Young's modulus of Aluminium is $70 \times 10^9 Nm^{-2}$ and that of copper is $120 \times 10^9 Nm^{-2}$. Same strain is to be produced on an aluminium wire and a copper wire of equal cross section. Which wire requires more force?



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148. Free fall is a uniformly accelerated motion.

Draw the velocity time graph of free fall.





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149. Free fall is a uniformly accelerated motion.

A ball is thrown vertically upwards with a velocity of 20ms^{-1} from the top of a building.

The height of the point from where the ball is thrown is 25.0m from the ground. How high will the ball rise?



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150. Free fall is a uniformly accelerated motion.

A ball is thrown vertically upwards with a velocity of 20ms^{-1} from the top of a building.

The height of the point from where the ball is thrown is 25.0m from the ground. How long will it be before the ball hits the ground?



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151. Power is the rate at which work is done.

Express power in terms of force and velocity.





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152. An elevator of total mass 1800 kg is moving up with a constant speed of $2\frac{m}{s}$. A frictional force of 4000 N acts on this motion. Determine the minimum power delivered to the elevator.



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153. Power is the rate at which work is done. Express power in terms of force and velocity.



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154. a) Find the moment of inertia of a sphere about a tangent to the sphere, given the moment of inertia of the sphere about any of its diameters to be $\frac{2MR^2}{5}$, where M is the mass of the sphere and R is the radius of the sphere.

b) Given the moment of inertia of a disc of mass M and radius R about any of its diameters to be $M\frac{R^2}{4}$, find its moment of

inertia about an axis normal to the disc and passing through a point on its edge.



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155. A solid sphere of mass m and radius R starts from rest and rolls down along an inclined plane of height h without slipping. Find the velocity when it reaches the base.



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156. Earth satellites are objects which revolve around the earth.

Time period of a geostationary satellite is _____.



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157. Earth satellites are object which revolve around the earth. consider a satellite at a height 'h' from the surface of the earth. obtain an equation for the period of above satellite.





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158. Water does not wet the feathers of ducks.

A physical quantity called angle of contact determines whether a liquid will spread on the surface of a solid or it will form droplets on it.

Define angle of contact.



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159. Water proofing agents are added to create a _____ (large/small) angle of contact

between the water and fibres.



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160. Calculate the excess of pressure inside an air bubble of radius 1mm formed just below the free surface of water. Given surface tension of water $72 \times 10^{-3} \text{Nm}^{-1}$



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161. Write the equation for the coefficient of performance of a refrigerator.



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162. In case of a heat engine, $T_1 = 900K$,
 $T_2 = 300K$ `Q_1=6400J Find Q_2



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163. Static friction opposes impending motion.

Write the mathematical equation connecting the limiting value of static friction with normal reaction.



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164. Static friction opposes impending motion.

Choose the CORRECT statement:

(i) Both kinetic friction and static friction are independent of the area of contact.

(ii) Kinetic friction depends on area of contact but static friction do not.

(iii) Static friction depends on area of contact but kinetic friction do not.

(iv) Both kinetic friction and static friction depend on the area of contact.



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165. Show that the coefficient of the friction is equal to the tan of the angle between the resultant and normal reactions.



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166. Bernoulli's equation for steady non viscous incompressible flow expresses the



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167. Deduce an expression for the period of oscillation of a simple pendulum.



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168. What is the length of a simple pendulum, which ticks seconds?



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169. The rotational analogue of mass is.....



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170. Which among the following possesses the highest specific heat capacity?

A. Metals

B. Ice

C. Water

D. Glass

Answer: B



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171. "A heavy and light body have same kinetic energy." Which one has greater momentum?

Why?



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172. Select the strongest force from the following list:

(Electromagnetic force, Gravitational force, Weak nuclear force).



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173. The moment of intertidal of a thin rod of mass M and length l about an axis

perpendicular to the rod at its midpoint is $\frac{M_l^2}{12}$. Using the theorem, find the moment of the rod about AB.



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174. The acceleration due to gravity (g) on the surface of the earth is $9.8 \frac{m}{s^2}$. Derive an expression an expression for the variation of g with height (h) above the surface of the earth.



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175. For an ideal gas, ' C_p ' and ' C_v ' are related as



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176. What do you mean by Mean free path?
Give an equation for Mean free path.



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177. A particle executes SHM of amplitude A . At what distance from the mean position is its kinetic energy equal to its potential energy?



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178. A large force acting for a short interval of time is called impulsive force.

What is the SI unit of impulse?



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179. A large force acting for a short interval of time is called impulsive force.

Two billiard balls each of mass 0.05kg moving in opposite direction with speed $6\frac{m}{s}$ collide and rebound with the same speed. What is the impulse imparted to each ball due to the other?



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180. A body cools from 80°C to 50°C in 5 minutes, Calculate the time it taken to cool

from 60°C to 30°C . The temperature of the surrounding is 20°C .



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181. Derive an expression for period of oscillation of a loaded spring.



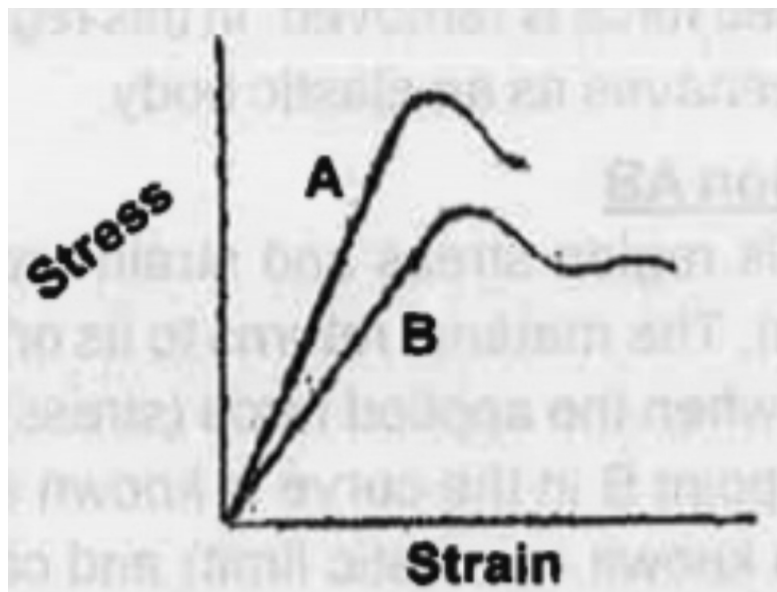
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182. Stress - Strain graph of two materials is shown below: State the law which relates

stress

with

strain.



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183. A solid cylinder of mass 20kg rotates about its axis with angular speed 100rads^{-1} .

The radius of the cylinder is 0.25m . What is

the kinetic energy associated with the rotation of the cylinder? What is the magnitude of the angular momentum of the cylinder about its axis?



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184. Can a Carnot engine work if its sink and source are interchanged? Explain.



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185. a) Obtain expression for Time of flight for a projectile motion.

b) What is the angle of projection for maximum horizontal range?

c) The ceiling of a long hall is $25m$ high. What is the maximum horizontal distance that the ball thrown with a speed of $40\frac{m}{s}$ can go without hitting the ceiling of the hall?



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186. Several games such as billiards, marbles or carrom involve collision.

What is meant by completely inelastic collision?



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187. Show that in a perfectly elastic collision in one dimension, relative velocity after collision is equal to relative velocity before collision.



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188. Kepler formulated three laws of planetary motion.

State the Kepler's law of periods.



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189. A saturn year is 29.5 times the earth year.

How far is the saturn from the sun if the earth

is $1.50 \times 10^8 km$ away from the sun?



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190. A small metal sphere is falling through castor oil. Write down the expression for terminal velocity in terms of coefficient of viscosity.



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191. The terminal velocity of a copper ball of radius 2mm falling through a tank of oil at $20^{\circ}c$ is $6.5cms^{-1}$. Calculate the viscosity of the oil at $20^{\circ}c$. (Hints: Density of oil is is

$1.5 \times 10^3 \text{kgm}^{-3}$, density of copper is
 $8.9 \times 10^3 \text{kgm}^{-3}$)



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192. When a metallic sphere falls through castor oil, its velocity becomes uniform, called terminal velocity.

Rain drops falling under gravity do not acquire very high velocity. Why?



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193. The correctness of equations can be checked using the principle of homogeneity. State the principle of homogeneity.



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194. The correctness of an equation can be checked using the principle of homogeneity in dimensions.

Using this principle check whether the

equation, $f = 2\pi\sqrt{\frac{l}{g}}$ is dimensionally

correct, where f -frequency, l -length, g

acceleration due to gravity.



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195. The correctness of an equation can be checked using the principle of homogeneity in dimensions.

The velocity V of a particle depends on time t as $V = At^2 + Bt$. Find the dimensions and units of A and B .



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196. The static friction comes into play at the moment the force is applied.

Write the relation with static friction and normal reaction.



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197. The static friction comes into play at the moment the force is applied.

Determine the maximum acceleration of the train in which a box lying on its floor will

remain stationary, given that the coefficient of static friction between the box and the train's floor is 0.15.



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198. The static friction comes into play at the moment the force is applied.

State the laws of limiting friction.



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199. While conducting a resonance column experiment in the laboratory you can hear the maximum sound at a certain height.

Which phenomenon is responsible for this?



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200. While conducting a resonance column experiment in the laboratory you can hear the maximum sound at a certain height.

Is resonance column apparatus an open pipe or a closed pipe?



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201. Find the ratio of frequencies of the first three harmonics in the resonance column apparatus.



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202. Differentiate between streamline flow and turbulent flow.



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203. Which one of the following fundamental forces in nature binds protons and neutrons in a nucleus?

A. Gravitational force

B. electromagnetic force

C. strong nuclear force

D. weak nuclear force

Answer: C



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204. four pairs of initial and final positions of a body along an x-axis are given. which pair gives a positive displacement of the body?

A. $-10m, +15m$

B. $-5m, -12m$

C. $2m, -5m$

D. $2m, 1m$

Answer: A



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205. Newton's first law of motion describe the

A. energy

B. work

C. Inertia

D. Momentum

Answer: C



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206. The rotational analogue of force is

A. Energy

B. Work

C. Inertia

D. Torque

Answer: D



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207. the young's modulus of rubber is

A. Greater than that of steel

B. Less than that of steel

C. Equal to that of steel

D.

Answer: B



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208. The centripetal force on a body in circular

motion is given by $F = \frac{mv^2}{r}$.

Write the dimension of force.



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209. The centripetal force on a body in circular motion is given by $F = \frac{mv^2}{r}$.

Using the above formula, write an equation to find % error in centripetal force.



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210. State the law of conservation of linear momentum and prove it on the basis of second law of motion.



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211. The sign of work done by a force on a body is important to understand. State carefully if the following quantities are positive or negative: work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket.



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212. The sign of work done by a force on a body is important to understand. State

carefully if the following quantities are positive or negative: work done by friction on a body moving sliding down an inclined plane.



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213. find out the sign of work done in the following cases: work done by an applied force on a moving on a rough horizontal plane.



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214. The sign of work done by a force on a body is important to understand. State carefully if the following quantities are positive or negative: work done by the resistive force of air on vibrating pendulum in bringing it to rest.



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215. A cord of negligible mass is wound round the rim of flywheel of mass 20 kg and radius

20cm mounted on a horizontal axis Calculate the angular acceleration of the wheel if a steady pull of $25N$ is applied on the cord.

Moment of inertia of flywheel about its axis=

$$M\frac{R^2}{2}$$



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216. The escape speed for an object from the earth is $11.2k\frac{m}{s}$. What is meant by escape speed?



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217. The escape speed for an object from the earth is $11.2k\frac{m}{s}$. Arrive at an expression for the escape speed. Does it depend on the mass of the object or not?



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218. In a hydraulic lift the radius of small piston is $5.0cm$ and that of larger piston is $15cm$. Calculate the force F , if the mass of the car to be lifted is $1350kg$ ($g = 9.8ms^{-2}$)



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219. What do you mean by capillary rise? What is the phenomenon responsible for it?



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220. Show that the function of $(\sin \omega t - \cos \omega t)$ represents simple harmonic motion.



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221. A steel wire has a length of $12.0m$ and a mass of $2.10kg$. What is the tension in the wire if speed of a transverse wave on the wire is $343ms^{-1}$?



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222. A company manufacturing PVC pipes claims in an advertisement that the volume of water flowing out through the pipe in a given time is as per the equation $V = KA^2ut$ where A is the area of cross section of the

pipe, u is the speed of flow, t is the time and K is a dimensionless constant.

Name the principle that can be used to check the dimensional correctness of this equation.



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223. A company manufacturing PVC pipes claims in an advertisement that the volume of water flowing out through the pipe in a given time is as per the equation $V = KA^2ut$ where A is the area of cross section of the

pipe, u is the speed of flow, t is the time and K is a dimensionless constant.

Check the equation and state whether the claim is correct.



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224. For two vectors \vec{A} and \vec{B} are acting at a point with an angle α between them, find the magnitude and direction of the resultant vector.



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225. Write the 4 steps of operation in the Carnot cycle.



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226. A refrigerator is to maintain eatables kept inside at $9^{\circ}C$. If room temperature is $36^{\circ}C$, calculate the coefficient of performance.



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227. Prove that the average kinetic energy of a molecule is proportional to the absolute temperature of the gas.



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228. A transverse harmonic wave on a string is described by

$$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right) \quad \text{where}$$

'x' and 'y' are in cm and 't' is in s. The positive direction of 'x' is from left to right. Is this a travelling wave or a stationary wave? If it is

travelling, what are the speed and direction of its propagation?



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229. A transverse harmonic wave on a string is described by

$$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right) \quad \text{where}$$

'x' and 'y' are in cm and 't' is in s. The positive direction of 'x' is from left to right. What are its amplitude and frequency?



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230. A transverse harmonic wave on a string is described by

$$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right) \quad \text{where}$$

x and y are in cm and t in s. What is the initial phase at the origin?



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231. A transverse harmonic wave on a string is described by

$$y(x, t) = 3.0 \sin\left(36t + 0.018x + \frac{\pi}{4}\right) \quad \text{where}$$

'x' and 'y' are in cm and 't' is in s. The positive direction of 'x' is from left to right. What is the least distance between two successive crests in the wave?



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232. Consider moment of inertia of a uniform thin circular disc about a diametrical axis of the disc. There is a theorem which helps to find the moment of inertia of the disc about

another axis parallel to this axis. Give the statement of this theorem.



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233. Temperature is the degree of hotness' of the body. Temperature of normal human body is $deg98.6F$ What is the coresponding temperature shown in the Celcius scale?



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234. Temperature is the degree of hotness of body.

Define latent heat.



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235. A brass tumbler feels much colder than a wooden tray on a chilly day. Why?



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236. With the help of a free body diagram represent various forces acting on a vehicle moving on a banked road. Neglecting frictional force obtain the expression for the maximum safe speed of the vehicle on the banked road.



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237. The static friction comes into play at the moment the force is applied.

State the laws of limiting friction.



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238. Choose the correct alternative:

i) Acceleration due to gravity

increases/decreases with increasing altitude.

ii) Acceleration due to gravity

increases/decreases with increasing depth.

iii) The total energy of an orbiting satellite is

negative of its kinetic/potential energy.

iv) The polar satellite goes around the earth in a north-south direction/east-west direction.



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239. State Kepler's law of time periods.



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240. Consider a fluid moving in a pipe of varying cross-sectional area where a_1, a_2 are cross-sectional areas of pipe and v_1, v_2 are the

velocities of fluid.

State Bernoulli's Principle.



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241. Write the equation of Stoke's law.



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