PHYSICS

BOOKS - JBD PUBLICATION

LAWS OF MOTION

Exercise

1. State if each of the following statements is true or false. Give reasons for your answer:- In an elastic collision of two bodies, the

momentum and energy of each body is conserved.

A. Both momentum and K.E. ar conserved

B. Both momentum and K.E. are not conserved

C. Momentum is conserved and K.E. is not conserved

D. Momentum is not conserved and K.E. is conserved

Answer:

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2. The following particles are moving with the same velocity.The particle with maximum momentum is :

A. β-particle

B. Proton

C. α-particle

D. Neutron

Answer:

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3. A body is moving unidirectionally under the influence of a source of constant power. Its displacement in time tis proportional to

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

B. t

C. $\frac{t^3}{2}$

D. t^2.

Answer:

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4. During inelastic collision between two bodies, which of the following quantities always remain conserved?

A. Kinetic Enery only

B. Momentum only

C. Both Kinetic Energy and Momentum

D. None of the above.

Answer:

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5. One end of a string of length t is connected to a particle of mass m and the other to a small peg on a smooth horizontal table. If the particle moves in a circle with speed v the net force on the particle (directed towards the centre) is : T is the tension in the string. [Choose the correct alternative].

A. T

B. $tT - \frac{mv^2}{l}$

C. $t + \frac{mv^2}{l}$

D. 0

Answer:

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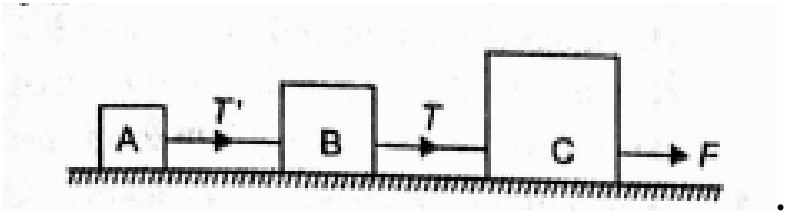
6. Three blocks A,B and C weighing 1 kg, 8 kg, and 27 kg respectively are connected a shown in the figure with inextensible string and are

moving on smooth surface.If F=36 N,then T is :



A. 18 N

B. 9 N

C. 27 N

D. 3 N

Answer:

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7. The linear momentum of a body varies with time as $p = \alpha + \beta t^2$ where α and β are constants .The net force acting on the body is proportional to :

A. t^2

B. t

C. l/t^2

D. $l/t.$

Answer:

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8. Two bodies with masses m_1 and m_2 , $(m_1 > m_2)$ are joined by a massless string passing over a fixed pulley.The downward acceleration of mass m_1 is :

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

B. $\frac{m_1 g}{m_1 + m_2}$

C. $\frac{m_2 g}{(m_1 + m_2)}$

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

Answer:

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9. Rocket works on the principle of conservatin of:

A. mass

B. linear momentum

C. angular momentum

D. energy

Answer:

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10. A machine gun of mass M fires n bullets per second .The mass and speed of each bullet is m and v respectively. Then force exerted on the machine gun is :

A. zero

B. mvn

C. Mvn

D. Mvnlm

Answer:

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11. A rope of length L is pulled with a constant force F.The tension T in the rope at u point at distance x from the end where the force is applied ,is :

A. $\frac{FL}{x}$

B. $\frac{FL}{L-x}$

C. $\frac{f(l-x)}{L}$

D. $\frac{F-x}{L-x}$.

Answer:

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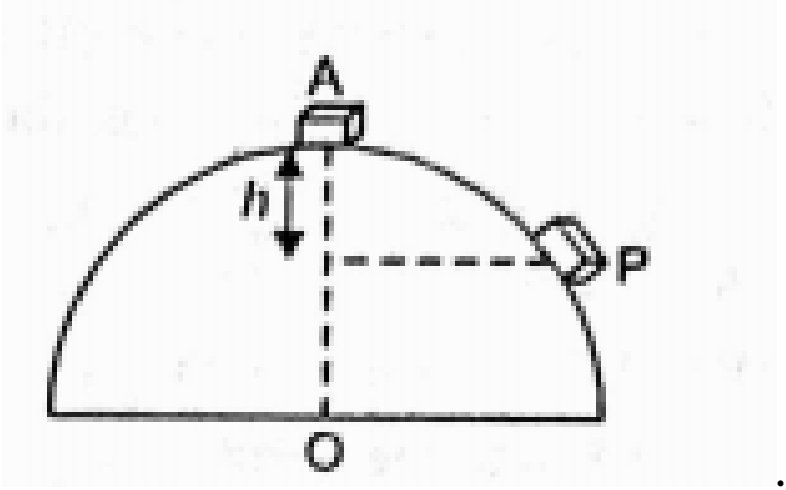
12. A small body of mass m slides down from the top of a frictionless hemispherical surface of radius r as shown in the figure.The vertical height h below the highest point at which the body gets separated from the hemispherical

surface.



A. $r/3$

B. $2r/3$

C. $3r$

D. $2r$.

Answer:

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13. A cyclist is moving on a circular track of radius 80 m with a velocity of $72km/h$.He leans from the direction through an angle of :

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

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

C. $\tan^{-1}(1)$

D. $\tan^{-1}(20$

Answer:

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14. During motion in the vertical circle, what is the difference in tension at the top and bottom of the circle?

A. 6 mg

B. 4 mg

C. 2 mg

D. zero

Answer:

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15. the ratio of angular speed of minute hand and hour hand of a clock is :

A. $1:12$

B. $6:1$

C. $12:1$

D. $1:6.$

Answer:

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16. Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively with the same time period .The ratio fo the centripetal force is :

A. r_1 / r_2

B. $(r_1 / r_2)^2$

C. r_2 / r_2

D. $(r_2 / r_1)^2$.

Answer:

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17. A block is in limiting equilibrium on an inclined plane of angle theeta ,Then ,the coefficient of friction is :

A. $\sin\theta$

B. $\cos\theta$

C. $\tan\theta$

D. $\cot\theta$.

Answer:

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18. The ratio of interial mass to gravitational mass is :

A. $1:1$

B. $1:2$

C. $2:1$

D. zero

Answer:

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19. A 50 kg man is standing on a flat boat at rest in a river.He moves 5 m to north and halts.If the boat has a mass of 450 kg,then the boat will moves through a distance :

A. $0.5m$ to the south

B. `(5//9) m to the south

C. $\odot$ 5 m to the north

D. zero

Answer:

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20. With what minimum acceleration can a fireman slide down a rope whose breaking strength is $\frac{2}{3}rd$ of his weight?

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

B. $\frac{1}{3}g$

C. g

D. $2g$.

Answer:

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21. Cream gets separated out of milk when it is churved ,it is due to :

A. centripetal force

B. gravitational force

C. centrifugal force

D. frictional force.

Answer:

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22. A gramophone record is revolving with an angular speed .A coin is placed at a distance r from the centre of the record.RThe coefficient of static friction is u.the coin will revolve with the record if :

A. $r > \mu g / \omega$

B. $r \leq \mu g / \omega^2$

C. $r > \mu / \omega$

D. $\mu > ug / \omega.$

Answer:

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23. Pseudoforce is a force that exists in :

A. an inertial frame of reference

B. non-inertial frame of refernce

C. both inertial and non-inertial frames

D. None of the above.

Answer:

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24. For a particle moving in vertical circle,the:

A. Kinetic energy is constnt

B. Potential Energy is costant

C. both Kinetic Energy and Potential Energy are constant

D. neither Kinetic Energy nor Potential Energy is constant.

Answer:

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25. A man sitting in a train which is in motion is facing the engine. He tosses a coin up. the coin falls behind him. The train is :

A. moving forward and gaining speed

B. moving forward and losing speed

C. moving forward with uniform speed

D. moing backward with uniform speed.

Answer:

26. Which of the following statements is false?

A. A body can have zero velocity and still be accelerated.

B. A body ca have a constant velocity and still have a varying speed.

C. A body can have a costant speed and stil hae a aryig velocity.

D. The direction of the velocity of a body can change when its acceleration is constant.

Answer:

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27. Essential characteristic of equilibrium is :

A. momentum equal to zero

B. acceleration equa to zero

C. kinetic energy equal to zero

D. None of the above.

Answer:

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28. The resultant of two forces is 20 N.When one of the forces is $20\sqrt{3}N$ and angle between two forces is 150°,then what is the value of second force?

A. 10 N

B. 20 N

C. $20\sqrt{3}N$

D. $10\sqrt{3}N$

Answer:

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29. A car when passes through a convex bridge exert a force on it which is equal to :

A. $Mg - \frac{Mv^2}{r}$

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

C. mg

D. None of the above.

Answer:

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30. The triangular block is moving on a frictionless surface with $3m/s^2$ towards right such that the mass m does not slide on the tiangular block.Find the coefficient of friction between mass m and the block.

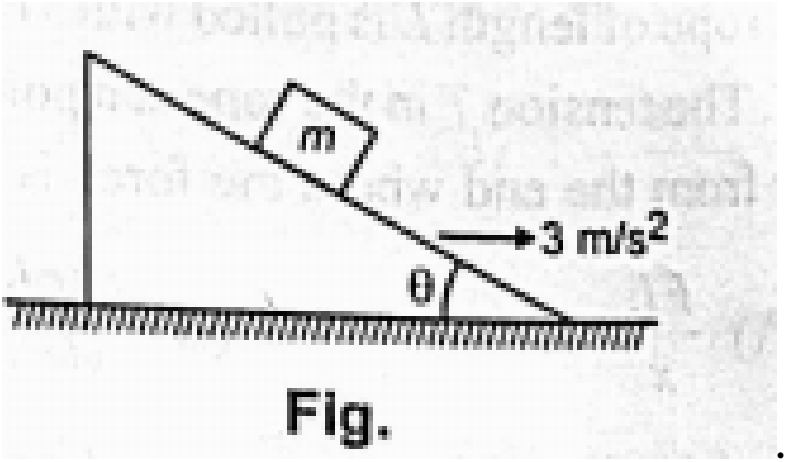

Fig.

A. 0.25

B. 0.31

C. 0.41

D. 0.2

Answer:

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31. A mass M of 100 kg is suspended with the use of strings A,B and C as shown in the figure,where W is the vertical wall and R is a rigid horizontal rod.The tension in the sttring

B is :

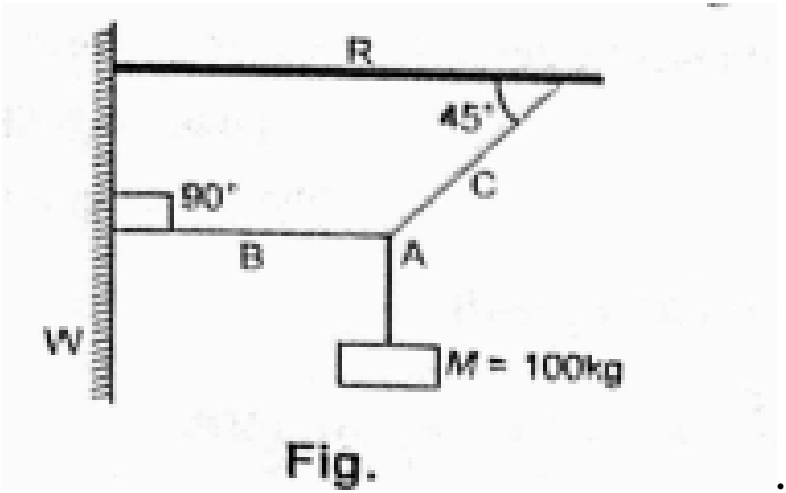

Fig.

A. 100 g

B. 0

C. $100\sqrt{2}$

D. $\frac{100}{\sqrt{2}}g.$

Answer:

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32. Three blocks of masses m_1, m_2 and m_3 are connected by massless strings on a frictionless table.They are pulled with a force $T_3 = 40N$.If $m_1 = 10kg, m_2 = 6kg$ and $m_3 = 4kg$. th tension T_2 will be :

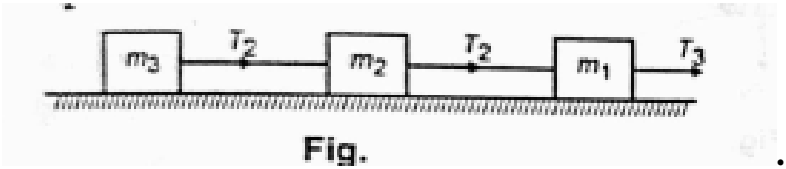

Fig.

A. 20 N

B. 40 N

C. 10 N

D. 32 N

Answer:

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33. If momentum is increased by 20% ,then K.E.increases by :

A. 0.44

B. 0.55

C. 66

D. 77

Answer:

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34. A bullet $(m_1 = 25g)$ fired with a velocity of $400m/s$gets embedded into a bag of sand $(m_2 = 4.975kg)$ suspended by a rope.The velocity gained by the bag is nearly:

A. $0.2m/s$

B. $8m/s$

C. $4m/s$

D. $2m/s.$

Answer:

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35. Three equal weights of mass 2 kg each are hangning os string passing over a fixed pulley as shown in fig.What is the tension in the

string connectig weights B and C?

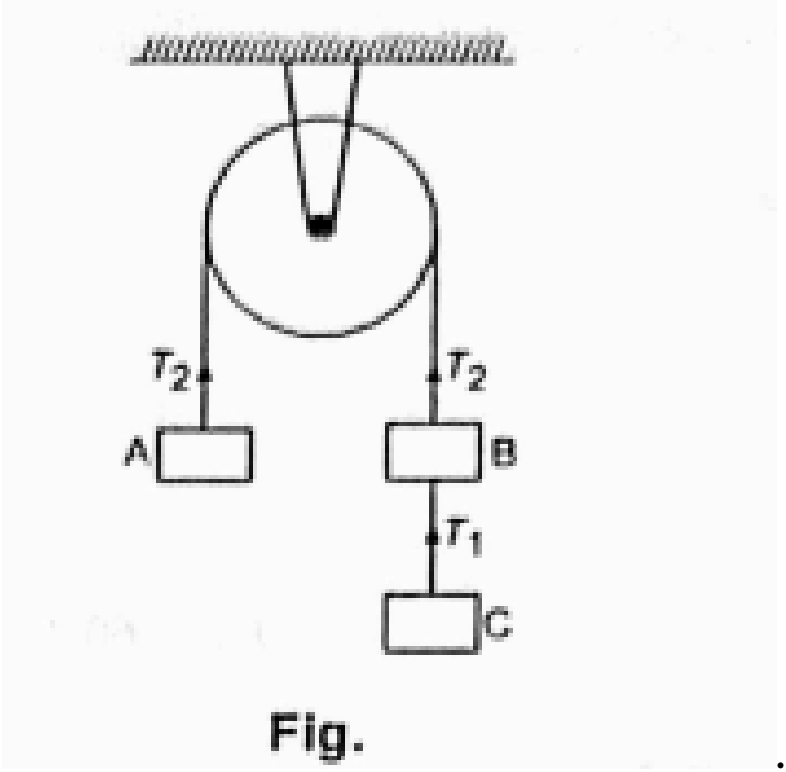

Fig.

A. Zero

B. 13.3 N

C. 3.3 N

D. 19.6 N

Answer:

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36. A bullet of mass a moving with a velocity b is made to hit a target of mass c and got embedded into it .Find the velocity of the final system.

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

B. $\frac{ab}{a+c}$

C. $\frac{ab}{a-c}$

D. $\frac{ab}{a-b}$.

Answer:

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37. A bomb of mass 1 kg is thrown vertically upwards with a speed of $100m/s$ .After 5 seconds it explodes into two fragments .One fragment of mass 400 g is found to go down

with a speed of 25 m//s .the second fragment just after the explosion will go $\left(g = 10m/s^2\right)$.

A. upward with speed $40m/s$

B. upward with speed $100m/s$

C. upward with speed $60m/s$

D. downward with speed $40m/s$.

Answer:

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Example

1. Give one example each of

position depedent force

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2. Give one example each of

time dependent force.

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3. Give one example each of

constant force

 Watch Video Solution

4. Give one example each of

velocity dependent force.

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5. Does equilibrium mean that a body is at rest?

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6. Why do we prefer a heavy hammer to drive a nail into wood?

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7. Action and reaction forces do not balance each other. Why?

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8. What is the principle of working of a rocket?

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9. What is the measure of inertia of a body?

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10. A meteorite burns in the atmosphere before it reaches the earth's surface. what happens to its momentum?

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11. What is the relation beteen coefficient fo friction and angle of friction (ϕ) ?

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12. What is the relation between coefficient of friction and angle of repose?

Watch Video Solution

13. What are the methods of reducing friction?/

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14. The angle of friction betwen two surfaces is 30° ,what is coefficient of friction?

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15. What type of friction is involved when axle rotates in a wheel?

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16. Arrange μ_s, μ_k and μ_r in descending order.

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17. We slip easily on a rainy day because coefficient of friction

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18. Why are ruber tyres preffered to iron tyres?

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19. Why are aeroplanes given conical shape?

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20. Define coefficient of friction.

Watch Video Solution

21. Can force of friction on a body be zero even if it is placed on a rough surface?

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22. At what place on earth, the centirpetal force is maximum?

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23. Write an expression for the centripetal force.

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24. Write an expression for the centripetal acceleration.

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25. What is the acceleration of a train travelling at $40ms^{-1}$ as it goes round a cuve of $160m$ radius?

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26. When a bucket full of water is rotated,water does not fall from it.Why?

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27. The Kinetic Energy of a body moving along a horizontal circle remains same at every point .Is it true for a vertical circle also/

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28. When mud flies off the tyre of a bicycle,in what direction does it fly ?

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29. Name the pseudo-force which is regarded as a reaction to the centripetal force.

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30. Write an expression for maximum velocity of a vehicle on an unbanked circular road.

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31. Why is a curved road banked on the outer side?/

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32. What is the need of banking a circular road?

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33. State Newton's second law of motion. How it helps us to measure force ? State its CGS and SI units.

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34. Is the tension in a string on either side of a pulley the same throughout its length ?if yes,under what condition?

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35. Can we predict the direction of motion of a body for the direction of the force acting on it ?Explain.

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36. A bird is in a wire cage hanging from a spring balance.Is the reading indicated on the balance,when the bird is flying out in the cage greater than ,less than or the same as that when the bird is sitting in the cage ?Explain.

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37. Why does a gun(when fired)given a greater 'kick' when the butt ,is held loosely against shoulder than when held tightly?

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38. define SI unit of force.

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39. Is weight of a body scalar or vector ?

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40. What is the concept of inertia mass?

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41. Are Newton's first law of motion and Galileo's law on inertia different?

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42. A person sitting in the comprtment of a train moving with the force at an angle of 120° w.r.t velocity vector .what is the angle between the impulse vector and change in momentum vector?

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43. For a spring,what will be the graph between

force and extension

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44. For a spring,what will be the graph between

potential energy stored and extension?

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45. What is an impulse? How is it related to the change in momentum?

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46. On what factors the thrust of a rocket may depend?

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47. What do Newton's laws of motion tell about force?

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48. Show that $1N = 10^5$ dyne.

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49. What are action -reaction pairs in the following cases

A person swimmin in water

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50. What are action -reaction pairs in the following cases

A horse pulling a cart?

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51. Is earth an inertial frame of reference?

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52. When a ball is thrown upwards, its momentum first decreases and then increases. Is conservation of linear momentum violated in this process?

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53. A person mass M is hanging from rope fastened to a stationary balloon mass m. and if the person climbs along the rope then with

what velocity the balloon will move and in what direction?

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54. Two persons having the same mass are standing on ice-skates some distance apart on a frictionless surface.a rope is fastened around the body of a person,the other end of which si in the hand of the second person.What would happen if the second person pulls the rope?

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55. Two stones of different sizes are dropped simultaneously from the top of a bulding.Which stone would reach the ground earlier?

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56. A constant force acting on a body of mass 3.0 kg changes its speed from $2.0ms^{-1}$to $3.5ms^{-1}$ in 25 s. The direction of the motion

of the body remains unchanged. What is the magnitude and direction of the force ?

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57. Coefficient of friction depends on

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58. Friction is a self- adjusting force. Is it correct?

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59. How does coefficient of friction is altered when the weight of body is doubled?

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60. A cube is resting on an inclined plane and the angle fo inclination is gradually increased.For what angles will the cube slide before toppling?

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61. A cube is resting on an inclined plane and the angle fo inclination is gradually increased.For what angles will the cube slide before toppling?

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62. Is force of friction always given as $f = \mu R$?

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63. 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 train's floor is 0.16.

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64. A mass of 4 kg rests on a horizontal plane. The plane is gradually inclined at an angle $\theta = 15^\circ$ with the horizontal, the mass just

begins to slide. What is the coefficient of static friction between the block and the surface?

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65. State whether the following statement is true or false-"When a person walks on a rough surface,the frictional force exerted by the surface on the person is opposite to the direction of his motion".

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66. Polishing beyond certain limit may increase friction between the surfaces. Explain.

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67. When brakes are applied in a car,the brake-shoes apply frictional force on the wheels.these forces are internal for the system(car).For retardation,external forces ust act on the system.The force of friction at the road surface remains the same before and

after teh brakes are applied $(f = \mu N)$.How does the car stop?

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68. Why is it difficult to walk on sand?

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69. Automobile tyres have generally irregular projections over their surfaces. Why?

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70. Sand is thrown on trakcs covered with snow to

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71. How can we save petrol by properly inflating the tyres of vehicles ?Explain.

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72. Why are tyres made circular?

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73. Is a large brake on a bicycle wheel more effective than small one ? Explain.

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74. Arrange coefficient of limitin friction (μ_1) ,coefficient of kinetic friction (μ_k) and

coefficient of rolling ffriction (μ_r) in scending order.

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75. It is difficult to start motion than to maintain it .Explain.

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76. If angle of friction is 30°,calculate the coefficient of friction.

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77. A force of 50 kg is requird to pull a roller weighing 500 kg over ice.What is ceofficient of friction?

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78. A force of 3 kg weight is just sufficient to pull a block of 4 kg over a horizontal surface.What is the angle of friction?

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79. A cubical block rests on an inclined plane with four edges horizontal.If $\mu = \frac{1}{\sqrt{3}}$ determine the angle when the block just slides down the plane.

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80. An automobile is moving on a horizontal road with a speed of v.If teh coeficient of friction between the tyres nd the road is μ

,show that the shortest distance in whih the automobie can be stopped is $v^2 l 2\mu g$.

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81. A suitcase us gently dropped on a coneyor belt moving at $3m/$.If th coefficientt of friction between the belt and the surface is 0.5 ,how far will the suitcase move on the belt before coming to rest?

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82. A motor car running at the rate of 7 m s^-1` can be stopped by its brakes in 10m.Prove that total resistance to the motion when braeks are on is one-fourth of the weight of the car.

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83. A 4 kg block A is placed onn 8 kg block B which rests on a smooth table,A just slips on when a force of 12 N is applied on A.What is the maximum horizontal force ,F required to make bothy A and B move together?

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84. A body weighing 20 kg just slides down a rough inclined plane that rises 5 m in every 12 m.What is the coefficeint of friction?

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85. Why are mountain roads generally made winding upwards rather than going straight up?

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

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87. A nucleus is at rest in the laboratory frame of reference. Show that if it disintegrates into

two smaller nuclei the products must move in opposite directions.

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88. What provides the centripetal force in the following cases

electron revolving around the nucleus

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89. What provides the centripetal force in the following cases

earth revolving around the sun

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90. What provides the centripetal force in the following cases

car taking a turn?

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91. A particle has a uniform circular motion .Is work is being done on the particle?

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92. If both the speed of the body and the radius of its circular path are doubled ,what will happen to the centripetal force?

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93. A gramophone disc rotates at 60 revolutions per minute. A coin of mass 13 g is placed at the disc at a distance of 8.0 cm from the centre. Calculate centrifugal force on the coin.

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94. A body of mass 0.8 kg is whirled uniformlyt at the end of a string 2 m long.If teh string

makes 3 revolutins in 1.5 sec,calculate the tension in the string.

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95. A bend in a level road has radius of 100 m.Find the maximum speed with which a car turning this bend may have without skidding ,if the coefficient of friction between the tyres and road is 0.8.

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96. Calculate the angle through which the cyclist bends with the vertical when he crosses a circular path 34.3 m in circumference in $\sqrt{22}$ second.

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97. A cyclist goes round a circular path of radius 20.0 m with a speed of 14 m s^{-1}.Find the angle through which his cycle makes with vertical.$\left(g = 9.8ms^{-2}\right)$.

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98. A cyclist speeding at $18kmh^{-1}$ on a level road makes a sharp circular turn of radius 3 m without reducing the speed. The coefficient of static friction between the tyres and the road is 0.1 will the cyclist slip while taking the turn?

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99. A motorcyclist loops the loop of radius 8 m.From what minimum height must he start in

order to roll down and go around the loop?

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100. A 100 g mass is going in a vertical circle of rdius 1 m.What is the minimum speed that mass will reach at the top of the circle ?what is is speed at the bottom of circle?

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101. A small stone of mass 200 g is tied to one end of a string of length 80 cm . Holding the other end in hand , the stone is whirled into a vertical circle What is the minimum speed that needs to be imparted at the lowest point of the circular path , so that the stone is just able to complete the vertical circle ? what would be the tension at the lowest point of circular path ? (Take $g = 10m/s^2$) .

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102. During motion in the vertical circle, what is the difference in tension at the top and bottom of the circle?

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103. What must be the minimum speed of the body at the lowest point ,so that it may complete the vertical circle?

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104. You may have seen in a circus a motorcyclist driving in vertical loops inside a 'death- well' (a hollow spherical chamber with holes, so the spectators can watch from outside). Explain clearly why the motorcyclist does not drop down when he is at the uppermost point, with no support from below. What is the minimum speed required at the uppermost position to perform a vertical loop if the radius of the chamber is 25 m?

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105. Why does a child in a merry - go - round press the side of his seat rdially outward?

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106. Why does a cyclist lean to one side while going along a curve? In which direction does he lean?

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107. Why does the total energy remain constant during motion in a vertical circle?

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108. Does the kinetic enregy of a body remain constant during motion in a vertical circle?

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109. A body is moving on a curved path with a constant speed.What is the nature of its acceleration?

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110. For uniform circular motion,does the direction of the centripetal force depend on th sense of rotation clockwise or anti-clockwise)?

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111. What happens to a stone tied to the end of a string and whirled in a circle if the string suddenly breaks?

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112. When a bus suddenly takes a turn, the passengers are thrown outward, because of :

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113. When centripetal force acts on a body towards centre of the circle,why does the body not move towards the centre?

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114. Can centripetal force produce rotation?

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115. Why is a curved road banked on the outer side?/

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116. A gramophone disc rotates at 60 revolutions per minute. A coin of mass 13 g is placed at the disc at a distance of 8.0 cm from the centre. Calculate centrifugal force on the coin.

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117. A particle of mass 14 g attached to a string of 70 cm long is rotated in horizontal circle. If the period of revolution is 2 sec, find the tension in the string.

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118. A ball of 0.03 m diameter and 0.3 kg in weight is attached to the end of a thin string of 0.46 m length. If it is rotate uniformly in a horizontal circle at the rate of 15 revolutions

per second, what is the tension in the string? Take $\pi^2 = 9.87$).

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119. A particle of mass 1 kg is whirled uniformly at the end of a string 2 m long.If the string makes 3 revolutins in 1.2 sec., find the tension in the string.

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120. A ball weighing 5 kg is being rotated by means of a cord 2 m long.if its velocity is $6ms^{-1}$,find the force that tends to break the cord.

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121. An aeroplane travelling at a speed of $500kmh^{-1}$ banks at an angle of 30° as it makes a turn .What is the radius of the curve?

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122. An aircraft executes a horizontal loop at a speed of $720km/h$ with its wings banked at 15°. What is the radius of the loop ?

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123. The radius of curvature of a railway line at a place is 40000m.the train is running at $20ms^{-1}$ .the distance between the two rails is 1.5 m.Find the elevation of the outer rail over

the inner one so that the train may be able to run safely.

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124. A cyclist goes round a circular path of radius 20.0 m with a speed of 14 m s^{-1}.Find the angle through which his cycle makes with vertical.$\left(g = 9.8ms^{-2}\right)$.

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125. A cyclist going at a speed of $24kmh^{-1}$,takes a turn of 6.70 m radius .Find the inclination of his cycle to vertical.

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126. A cyclist goes round a circular path of radius 20.0 m with a speed of 14 m s^{-1}.Find the angle through which his cycle makes with vertical.$\left(g = 9.8ms^{-2}\right)$.

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127. What is the relation between coefficient of friction and angle of repose?

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128. Why is limiting friction greater than kinetic friction?

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129. What are the methods of reducing friction?/

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130. The angle of friction betwen two surfaces is 30° ,what is coefficient of friction?

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131. Arrange μ_s, μ_k and μ_r in descending order.

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132. Prove: the impulse: momentum theorem.

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133. A bullet of mass 0.04 kg moving with a speed of $90ms^{-1}$ enters a heavy wooden

block and is stopped after a distance of 60 cm. What is the average resistive force exerted by the block on the bullet?

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134. A batsman hits back a ball straight in the direction of the bowler without changing its speed of $12ms^{-1}$. If the mass of the ball is 0.15 kg, determine the impulse imparted to the ball.

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135. Three equal weights of mass 2 kg each are hangning os string passing over a fixed pulley as shown in fig.What is the tension in the string connectig weights B and C?

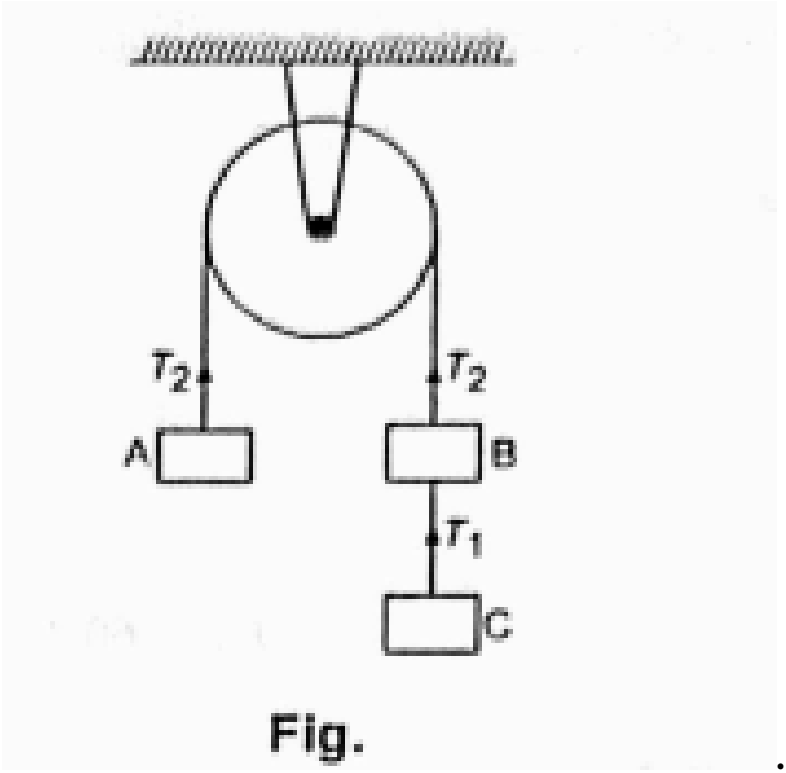

Fig.

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136. Two bodies of masses m_1 and m_2 are connected byh a ight string passing over a smooth light pulley fixed at the end of an inclined plane.the mass m_1 lies on the inclined plne nd m_2 bags vertically.The system is at rest.Find the angle of the inclination of the inclined plane and the force exerted by the inclined plane on the body of mass m_1.

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137. Can a sailing boat be propelled by air blown at the sails from a fan attached to the boat?Explain.

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138. A fast moving bullet when hits the window pane makes a round hole while a stone strikes and shatters it, why ?

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139. A constant retarding force of 50 N is applied to a body of mass 20 kg moving initially with a speed of $15ms^{-1}$. How long does the body take to stop ?

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140. Deduce the relation between torque and moment of inertia.

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141. A body of mass m moves in a circular path of radius r with a velocity v. Find the expression for the centripetal force F acting on the body by using method of dimensions.

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142. When walkin on ice,is it better to take short or long steps?Explain.

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143. What are the methods of reducing friction?/

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144. A train of 150 metre ton is drawn up a rough inelined plane of 1 in 100 at the rate of 36 km. if the frictional force is 12 N ton^-1 ,calculate the power of the engine.

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145. A train weghing 1000 quintals is running on a level road ith a uniform speed of 72 km/h.If teh frictional resistance amounts to 50 g wt.per quintal,find power in watt,take $g = 9.8ms^{-2}$.

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146. A block slides down an inclined plane of slope angle 0 with constant velocity .It is then projected up the same plane with an initial velocity v_0 .How far up the incline will it move?

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147. A railway engine weghing 40 metric ton is travelling along a level track at a speed of $54km/h$.What additional power is required to maintain the same speed up an incline rising 1 in 49,given $\mu = 0.1, g = 9.8ms^{-2}$?

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148. A body of mass 5 kg is acted upon by two perpendicular forces 8 N and 6 N. Give the magnitude and direction of the acceleration of the body.

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149. A body of mass 0.40 kg moving initially with a constant speed of $10ms^{-1}$ to the north is subject to a constant force of 8.0 N directed towards the south for 30 s. Take the instant

the force is applied to be t = 0, the position of the body at that time to be x = 0, and predict its position at t = -5 s, 25 s, 100 s.

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150. Explain why a centrifugal force is not a reaction of centripetal force.

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151. Why does a cyclist lean to one side while going along a curve? In which direction does he lean?

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152. What do you mean by banking of road?

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153. Derive an expression for the angle of bending of a cyclist on a curved track.

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154. A stone of mass 0.25 kg tied to the end of a string is whirled round in a circle of radius 1.5 m with a speed of $40 rev./\min$ in a horizontal plane. What is the tension in the string ? What is the maximum speed with which the stone can be whirled around if the

string can withstand a maximum tension of 200 N ?

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155. If, in Exercise 5.21, the speed of the stone is increased beyond the maximum permissible value, and the string breaks suddenly, which of the following correctly describes the trajectory of the stone after the string breaks :- the stone moves radially outwards.

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156. If, in Exercise 5.21, the speed of the stone is increased beyond the maximum permissible value, and the string breaks suddenly, which of the following correctly describes the trajectory of the stone after the string breaks :- the stone flies off tangentially from the instant the string breaks.

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157. If, in Exercise 5.21, the speed of the stone is increased beyond the maximum permissible value, and the string breaks suddenly, which of the following correctly describes the trajectory of the stone after the string breaks :- the stone flies off at an angle with the tangent whose magnitude depends on the speed of the particle ?

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158. What is centripetal force?

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159. Define centrifugal force.

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160. Find the expression for velocity at highest point in a vertical circle.

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161. A bucket containing water is tied to a rope of length 2.5 m and rotated in a vertical circle in wuch a way that the winter in it does not spill,what is the minimum velocity of the bucket at which this happens and how many rotations per minutes is it making then?(Take $g = 10ms^{-2}$).

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162. The radius of curvature of a railway track at a place where the train is moving at a speed of $72 kmh^{-1}$ is 625 m.The distance between the rails is 1.5 m.Find the angle and the elevation of the outer rail so that there may be no side pressure on the rails. $\left(g = 9.8 ms^{-2}\right)$.

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163. The stone of mass 100 g is suspended from the end of a weightless string of length 100 cm and is allowed to swing in a vertical plane.The speed of the mass is $2ms^{-1}$ when the string makes an angle of 60° with the vertical .Calculate the tension in the string at $\theta = 60^{\circ}$.Also,caculate the speed of the stone when it is in the lowest poition. $\left(g = 9.8ms^{-2}\right)$.

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164. A body weighing 0.4 kg is whirled in a vertical circle making 2 revolutions per second .If the radius of the circole is 1.2m,fing the tension in the sting when the body is (a) at thge top of the circle .(b) at the bottom of the circle.

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165. A small stone, of mass 0.2 kg, tied to a massless, inextensible string, is rotated in vertical circle of radius 2 m. if the particle is

just able to complete the vertical circle, what is its speed at the highest point of its circular path? How would this speed get effected if the mass of the stone is increased by 50%? (Take $g = 10ms^{-2}$)

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166. A massless string of length 1.2 m, has a breaking strength of 2 kg wt. A stone of mass 0.4 kg, tied to one end of the string, is made to move in a vertical circle, by holding the

other end in the hand. Can the particle describe the vertical circle? (Take $g = 10ms^{-2}$)

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167. A particle of mass 150 g is attached to one end of a massless inextensible string It is made to describe a vertical circle of radius 1 m When the string is making an angle of 48.2° with the vertical , its instantaneous speed is 2 m//s What is the tension in the string in this

position ? Would this particle be able to complte its circular path?(Take $g = 10ms^{-2}$).

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168. A bucket containing water is tied to a rope of length 2.5 m and rotated in a vertical circle in wuch a way that the winter in it does not spill,what is the minimum velocity of the bucket at which this happens and how many rotations per minutes is it making then?(Take $g = 10ms^{-2}$).

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