



PHYSICS

BOOKS - MAXIMUM PUBLICATION

LAWS OF MOTION

Exercise

1. Derive $F = ma$ from Newton's law.



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2. When we jump to hard soil there is greater discomfort than when we jump to loose soil.

Why?



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3. A cricketer draws his hand while catching a cricket ball. Why?



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4. Newton formulated the famous laws of motion.

Action and reaction are equal and opposite, yet they do not cancel each other. Why?



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5. Why surface of the road is kept inclined to the horizontal?



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6. Which one of the following is not a force?

A. Impulse

B. Tension

C. Thrust

D. Weight

Answer: A



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

- A. Inertia of motion
- B. Second law of motion
- C. Third law of motion
- D. Inertia of rest

Answer: A



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8. Which one of the following is not a contact force?

A. Viscous force

B. Magnetic force

C. Friction

D. Buoyant force

Answer: B



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9. A jet engine works on the principle of

A. Conservation of linear momentum

B. Conservation of mass

C. Conservation of energy

D. Conservation of angular momentum

Answer: A



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10. Newton's second and third laws of motion lead to the conservation of

- A. linear momentum
- B. angular momentum
- C. potential energy
- D. kinetic energy

Answer: A



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11. A large force is acting on a body for a short time. The impulse imparted is equal to the change in

A. acceleration

B. momentum

C. energy

D. velocity

Answer: B



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12. When a shell explodes, the fragments fly apart though no external force is acting on it.

Does this violate Newton's first law of motion?



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13. In taking a catch, a cricket player moves his hands backward on holding the ball. Why?



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14. Name the factor on which inertia depends.



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15. Why does a swimmer push the water backwards?



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16. Rocket works on the principle of conservation of _____.



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17. A man experience a backward jerk, while firing bullet from gun. Which law is applicable here?



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18. If you jerk a piece of paper under a book quick enough, the book will not move. Why?



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19. Why it is difficult to walk on a slippery road?



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20. A stone, when thrown on a glass window, smashes the window pan to pieces. But a bullet fired from the gun passes through it making a hole why?



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21. Why an athlete runs some distance before taking a jump?



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22. Why a horse can not pull a cart and run in empty space?



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23. Why parachute descends slowly?



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24. Sand is thrown on tracks with snow. Why?



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25. It is difficult to move a cycle along a road with its brakes on. Explain.



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26. What is inertia?



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27. Two masses are in the ratio $1:5$. What is the ratio of inertia of this case?



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28. More force is required to push a body than pull to get same speed on a ground with same

friction. Why?



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29. A lift in a multistoried building is moving from ground floor to third floor. What will happen to weight of a person sitting inside of the lift when starts to move up from ground floor.



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30. A lift in a multistoried building is moving from ground floor to third floor. What will happen to weight of a person sitting inside of the lift when the lift moves with constant speed.



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31. Why it is advisable to hold a gun tight to one's shoulder when it is being fired?



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32. Why shockers are used in vehicles?



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33. Give the magnitude and direction of net force on a drop of rain falling down with a constant velocity.



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34. 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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35. An external force is always required to break the inertia of a body which is either in the state of rest or state of uniform motion.

Which law governs this statement?





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36. An external force is always required to brake the inertia of a body which is either in the state of rest or state of uniform motion.

Can all forces produce acceleration? Why?



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37. An external force is always required to brake the inertia of a body which is either in the state of rest or state of uniform motion. A

boy holding a spring balance in his hand suspend a mass $2kg$ from it. If the balance slips from his hand and falls down, find the reading of the balance while it is in the air.



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38. A man weighs $70kg$. He stands on a weighing scale in a lift which is moving upward with a uniform speed of $10\frac{m}{s}$. (Take $g= 10\frac{m}{s^2}$). Find weight.



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39. A man weighs 70kg . He stands on a weighing scale in a lift which is moving downward with a uniform acceleration of $5\frac{m}{s^2}$. (Take $g = 10\frac{m}{s^2}$). What would be the reading of the scale?



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40. A man weighs 70kg . He stands on a weighing scale in a lift which is moving

upward with an uniform acceleration of $5 \frac{m}{s^2}$.

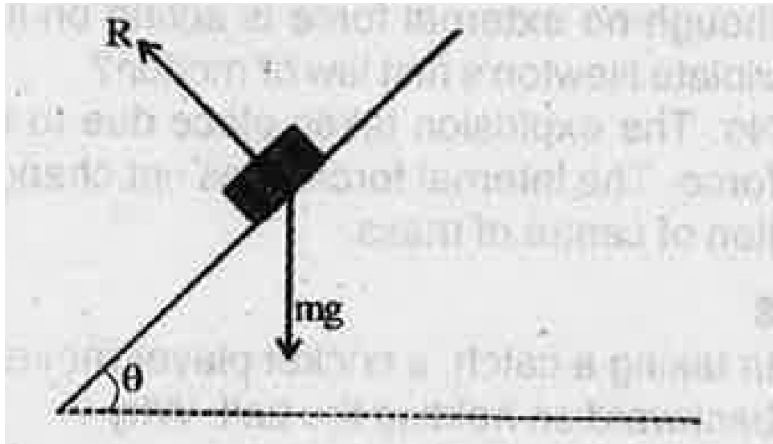
(Take $g = 10 \frac{m}{s^2}$). Find weight.



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41. A body of mass 'm' is placed on a rough inclined plane having coefficient of friction μ_s . The inclination of plane is given as ' θ '. Which component of weight brings the body towards

the bottom along the plane.



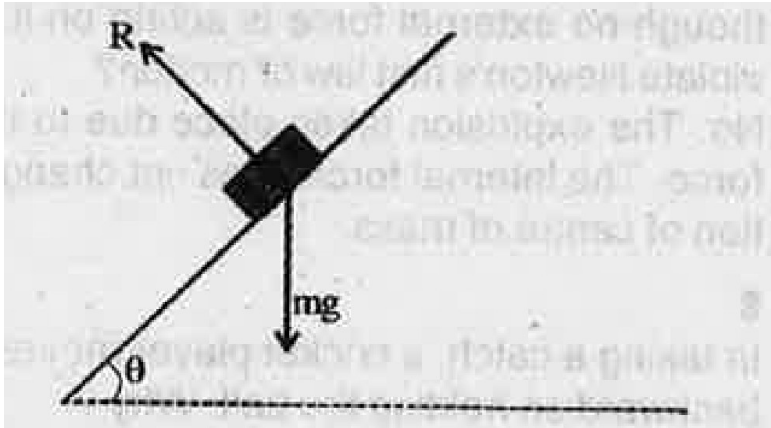
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42. A body of mass 'm' is placed on a rough inclined plane having coefficient of friction μ_s . The inclination of plane is given as ' θ '. Find how much force is required to pull the body

along

the

plane.



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43. What do you mean by impulsive force?

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44. Prove impulse-momentum theorem.



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45. A circular track of radius $300m$ is kept with outside of track raised to make $5degree$ with the horizontal.

Name the process in which outside of the road is raised little above the inner.



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46. A circular track of radius $300m$ is kept with outside of track raised to make 5° with the horizontal.

Obtain an expression for the optimum speed to avoid skidding (considering to friction).



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47. A circular track of radius $400m$ is kept with outer side of track raised to make 5° with the horizontal.(coefficient of friction 0.2).

Name such track. What is the (i) optimum

speed of the race car to avoid wear and tear on its tyres .

(ii) maximum permissible speed to avoid slipping ?



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48. A circular track of radius $400m$ is kept with outer side of track raised to make 5° with the horizontal.(coefficient of friction 0.2).

What is optimum speed to avoid wear and tear of tire? (take $g=10m/s^2$)



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49. A circular track of radius $400m$ is kept with outer side of track raised to make 5° with the horizontal.(coefficient of friction 0.2).

What is the maximum permissible speed to avoid skidding?



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50. A horse pulls a cart with constant force so that the cart moves with a constant speed.

Does it violate Newtons second law of motion?



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51. A horse pulls a cart with constant force so that the cart moves with a constant speed.

How will you account for the non-acceleration of the cart?



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52. A horse pulls a cart with constant force so that the cart moves with a constant speed.

Will the speed of the cart increase, decrease or remain the same if the horse applied more force?



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

magnitude and direction of the acceleration of the body.



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54. Friction is the force which opposes the relative motion between two surfaces in contact with each other.

What is a limiting static friction? State the laws related to this.



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55. 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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56. For a body of mass $5kg$ on a plane at a limiting static friction of $30degrees$.

What is the force of friction?



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57. The rate of change of linear momentum of a body is directly proportional to the external force applied on it, and takes place always in the direction of force applied.

Name this law.



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58. The rate of change of linear momentum of a body is directly proportional to the external force applied on it, and takes place always in

the direction of force applied.

Using the law obtain the expression for force.



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59. The rate of change of linear momentum of a body is directly proportional to the external force applied on it, and takes place always in the direction of force applied.

The motion of a particle of mass m is described by $y = ut + \frac{1}{2}gt^2$. Find the force acting on it.



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60. Recoil of a gun is based on the principle of conservation of momentum.

State the principle of conservation of momentum.



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61. Recoil of a gun is based on the principle of conservation of momentum.

Explain the recoil velocity of the gun.



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62. Recoil of a gun is based on the principle of conservation of momentum.

A bullet of mass $100g$ is fired from a rifle of mass $200kg$ with a speed of $50m/s$. Calculate the recoil velocity of the rifle.



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63. While firing a bullet, the gun must be held tight to the shoulder.

Which conservation law helps you to explain this.



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64. While firing a bullet, the gun must be held tight to the shoulder.

"In the firing process the speed of the gun is very low compared to the speed of the bullet."

Substantiate the above statement using mathematical expressions.



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65. A shell of 20kg moving at $50\frac{\text{m}}{\text{s}}$ bursts into two parts of masses 15kg and 5kg . If the larger part continues to move in the same direction at $70\frac{\text{m}}{\text{s}}$. What is the velocity and direction of motion of the other piece.



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66. While firing the bullet, the gun must be held tight to the shoulder.

This is a consequence of _____.



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67. While firing the bullet, the gun must be held tight to the shoulder.

Show that recoil velocity is opposite to the muzzle velocity of the bullet.



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68. While firing the bullet, the gun must be held tight to the shoulder.

A gun of mass 5 kg fire a bullet of mass 5 g vertically upwards to a height of 100 m . Calculate the recoil velocity of gun.



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69. A standing passenger falls backwards when the bus starts suddenly.

Explain why this happens.





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70. A standing passenger falls backwards when the bus starts suddenly.

Which Newtons law gives the above concept.State the law.



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71. Obtain an expression for force using Newtons law.



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72. Impulse has the unit similar to that of which of the following

(i) Momentum

(ii) force

(iii) time

(iv) energy.



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73. According to Newton's law of motion rate of change of momentum is directly proportional to applied force.

A man falling from certain height receives more injuries when he falls on a marble floor than when he falls on a heap of sand.Explain.Why?.



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74. Give the magnitude and direction of the net force acting on a rain drop of falling down with a constant speed.



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75. Give the magnitude and direction of the net force acting on a cork of mass 10g floating on water



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76. Give the magnitude and direction of the net force acting on a kite skillfully held stationary in the sky



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77. Give the magnitude and direction of the net force acting on a high - speed electron in space far from all material objects, and magnetic fields.



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



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79. A bob of mass $0.1kg$ hung from the ceiling of a room by a string $2m$ long is set into oscillation. The speed of the bob at its mean

position is 1ms^{-1} . What is the trajectory of the bob if the string is cut when the bob is

(a) at one of its extreme positions,

(b) at its mean position.



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80. A man of mass 70kg stands on a weighing scale in a lift which is moving upwards with a uniform acceleration of 10ms^{-2} . What would be the reading of the scale during their upward movement?



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81. A man of mass $70kg$ stands on a weighing scale in a lift which is moving downwards with acceleration of $5ms^{-2}$



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82. A man of mass $70kg$ stands on a weighing scale in a lift which is moving upwards with a uniform acceleration of

$$5ms^{-2}$$

What would be the reading on the scale?



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83. A man of mass $70kg$ stands on a weighing scale in a lift which is moving
what would be the reading if the lift mechanism failed and it hurtled down freely under gravity?



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84. 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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85. 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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86. A passenger of mass 30kg is standing in a lift which is moving vertically downwards with an acceleration of $1.8\frac{\text{m}}{\text{s}^2}$.

Will the passenger experience a decrease or an increase in his weight? Explain.



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87. A passenger of mass 30kg is standing in a lift which is moving vertically downwards with an acceleration of $1.8\frac{\text{m}}{\text{s}^2}$.

What will be the effect if the cable is cut and the lift falls freely?



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88. There are different type of forces in nature. We learnt their effects and applications. Give the exact reasons for the following.

Why does a satellite revolve around the earth in a circular path?



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89. There are different type of forces in nature. We learnt their effects and applications. Give the exact reasons for the following.

Why can't a horse pull a cart in empty space?



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90. There are different type of forces in nature. We learnt their effects and applications. Give the exact reasons for the

following.

Why are passengers thrown forward when a speeding bus stops suddenly?



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91. There are different type of forces in nature. We learnt their effects and applications. Give the exact reason for the following.

Why is it easy to lift a heavy stone in water?



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92. A man is standing at the centre of a large flat slab of ice. He can get himself to the edge of slab by spitting or blowing air in the forward direction. (assuming the ice to be frictionless)

Name the principle/law involved in this.



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93. A horse cannot pull a cart and run in empty space. Why?



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94. 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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95. Raising the outer edge of a curved road a little above the inner edge is called banking of curves.

Derive an expression for the safe speed with which a car can negotiate a banked road by taking into account the friction between the tyres and road.



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96. A machine gun fires bullets of mass $40g$ each with a speed $1200ms^{-1}$. The person can hold the gun with a maximum force of $144N$. What is the maximum number of bullets that can be fired per second from the gun?



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97. A thief jumps from the top of a house with a box of weight $25kg$ wt. on his head. What will be the weight of the box experienced by the

thief during his downward fall? Justify your answer.



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

State the principle behind it.



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

Prove the principle using Newton's law of motion.



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100. Friction is a force acting between two surfaces in contact, when there is a relative motion between them. Consider a car moving over a horizontal road. What will be the

direction of frictional force acting between the road and tyre?



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101. A stone, when thrown on a glass window, smashes the window pan to pieces. But a bullet fired from the gun passes through it making a hole why?



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102. 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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103. 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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104. According to Newton's law of motion, the force depends on the rate of change of momentum.

State whether the force is external or internal?

Justify your answer.



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105. According to Newton's law of motion, the force depends on the rate of change of momentum.

What happens to the linear momentum when the force is absent?



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106. According to Newton's law of motion, the force depends on the rate of change of momentum.

The motion of particle of mass m is described

$$\text{by } y = ut + \frac{1}{2}(gt^2)$$

Find the force acting on the particle.



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107. According to Newton's law of motion, the force depends on the rate of change of momentum.

Why is it more difficult to rotate a stone by tying it to a longer string than a shorter string?



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108. Write the reason for the following:

Action and reaction are equal and opposite. Yet

they do not cancel each other.



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109. Write the reason for the following:

A cricketer moves his hands backwards while holding a catch.



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110. According to Newton's law of motion, the force depends on the rate of change of

momentum.

Name the law that helps to measure force.



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111. According to Newton's law of motion, the force depends on the rate of change of momentum.

Using the law, deduce an expression for force.



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112. According to Newton's law of motion, the force depends on the rate of change of momentum.

A man jumping out of a moving bus with his head forward. What should he do in order to land safely?



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113. The outer side of a circular track of radius $200m$ is raised to make an angle of 15° with

the horizontal.

Which force provides the necessary centripetal force for a car taking the circular track?



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114. The outer side of a circular track of radius $200m$ is raised to make an angle of 15° with the horizontal.

Name the process by which the outer side of a curved track is raised a little above the innerside.



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115. The outer side of a circular track of radius 200m is raised to make an angle of 15° with the horizontal.

Using the data provided in this case, determine the maximum permissible speed to avoid skidding. (Given $\mu_s = 0.25$).



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116. A circular track of radius $400m$ is kept with outer edge raised to make $5degree$ with the horizontal.

What do you call this type of construction of tracks?



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117. A circular track of radius $400m$ is kept with outer edge raised to make $5degree$ with the horizontal.

Obtain an expression for the maximum permissible speed considering the force of friction.



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118. A circular track of radius $400m$ is kept with outer edge raised to make $5degree$ with the horizontal.

Calculate the maximum permissible speed of the car if the coefficient of the friction is 0.2 .



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119. We are familiar with Newton's laws of motion.

State Newton's second law of motion.



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120. We are familiar with Newton's laws of motion.

Using the Newton's second law, explain:

(i) impulse momentum principle.

(ii) Law of conservation of linear momentum.



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121. We are familiar with Newton's laws of motion.

A circular race track of radius $300m$ is banked at an angle of 15° . The coefficient of friction between the wheels of a race car and the road is 0.2 , find :

(i) The optimum speed of the race car to avoid wear and tear on its tyres.

(ii) Maximum permissible speed to avoid slipping.



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122. Newton formulated the famous laws of motion.

Give the significance of Newton's first law.



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123. Newton formulated the famous laws of motion.

Action and reaction are equal and opposite, yet they do not cancel each other. Why?



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124. Friction is defined as the force which opposes the relative motion between two surfaces in contact.

Friction is a necessary evil, explain.



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125. Friction is defined as the force which opposes the relative motion between two surfaces in contact.

What is meant by banking of roads?



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126. Friction is defined as the force which opposes the relative motion between two surfaces in contact.

Obtain an expression for maximum speed on a banked road without considering friction.



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127. State whether the following statements true or false. Correct the statement if it is false.

A spring balance gives the mass of a body while a common balance gives its weight.



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128. State Newton's second law and arrive at the equation of force.



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129. A motorcycle and a bus are moving with same momentum. Which of them has greater kinetic energy? Justify.



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130. A person drives a car along a circular track on a level ground.

Derive an expression for the maximum safe speed of the car.



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131. A person drives a car along a circular track on a level ground.

Why do we give banking to curved roads?



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132. When a horse suddenly starts moving, the rider falls backward.

Name and state the law used to explain the above situation.



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



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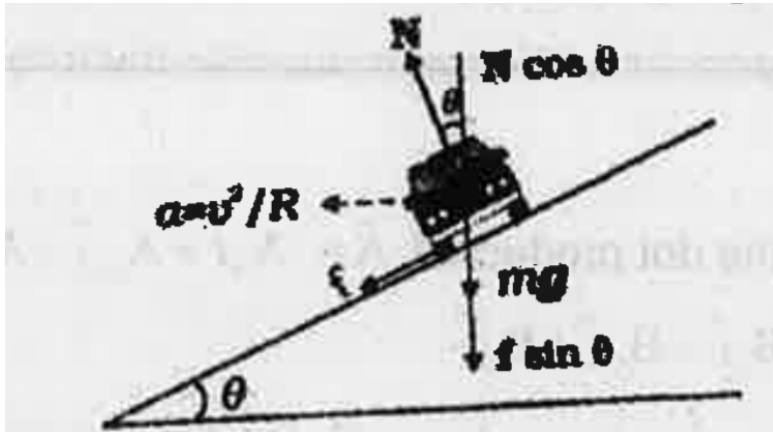
134. State true or false. An iron ball and a wooden ball of the same radius are released from a height in vacuum, the iron ball will reach the ground first.



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135. The schematic diagram of the circular motion of a car on a banked road is shown in the figure.

If the centripetal force is provided by the horizontal components of 'N' and 'f' arrived at expression for maximum safe speed.



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136. The schematic diagram of the circular motion of a car on a banked road is shown in

the figure.

The optimum speed of a car on a banked road to avoid wear and tear on its tyres is given by

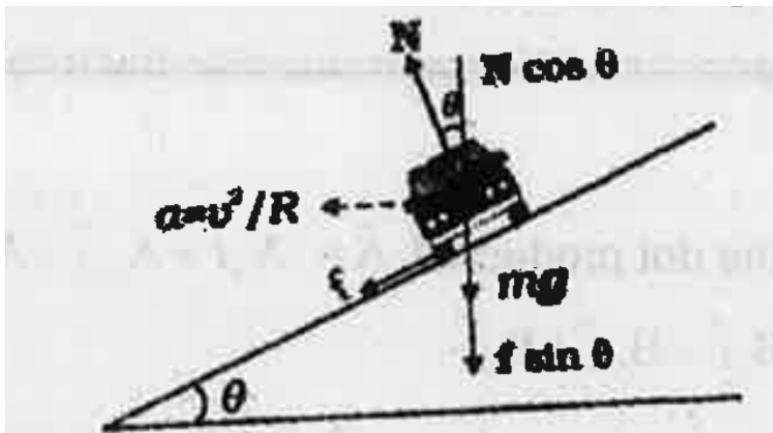
i) $\sqrt{Rg \tan \theta}$

ii) $\sqrt{Rg \cot \theta}$

iii) $\sqrt{Rg \sin \theta}$

iv)

$\sqrt{Rg \cos \theta}$



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