



PHYSICS

BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

LAWA OF MOTION

Problems

1. The linear momentum of a particle as a function of time 't' is given by , $p = a + bt$, where

a and b are positive constants . What is the force acting on the particle ?



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2. Calculate the time needed for a net force of 5 N to change the velocity of a 10 kg mass by 2 m/s .



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3. A ball of mass 'm' is thrown vertically upward from the ground and reached a height 'h' before momentarily coming to rest , If 'g' is acceleration due to gravity . What is the impulse received by the ball due to gravity force during its flight ? (neglect air resistance)



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4. A constant force acting on a body of mass 3.0 kg changes its speed from

2.0m/s^{-1} to 3.5m/s^{-1} in 25 s . The direction of motion of the body remains unchanged .
What is the magnitude and direction of the force ?



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5. A man in a lift feels an apparent weight W when the lift is moving up with a uniform acceleration of $1/3$ rd of the acceleration due to gravity. If the same man were in the same lift now moving down with a uniform

acceleration that is $1/2$ of the acceleration due to gravity, then his apparent weight is



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6. A container of mass 200 kg rests on the back of an open truck . If the truck accelerates at $1.5m/s^2$,what is the minimum coefficient of static friction between the container and the bed of the truck required to prevent the container from sliding off the back of the truck ?



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7. A bomb initially at rest at a height of 40 m above the ground suddenly explodes into two identical fragments . One of them starts moving vertically downwards with an initial speed of 10 m /s .If acceleration due to gravity is $10m / s^2$, What is the separation between the fragments 2s after the explosion?



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8. A fixed pulley with a smooth groove has a light string passing over it with a 4 kg on the other side . Another 3 kg is hung from the other 3 kg as shown with another light string . If the system is released from rest , find the common acceleration ? ($g = 10m / s^2$)



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9. A block of mass of 2 kg slides on an inclined plane that makes an angle of 30° with the horizontal . The coefficient of friction between the block and the surface is $\sqrt{3}/2$.

What force should be applied to the block so that it moves down without any acceleration ?



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10. A block of mass of 2 kg slides on an inclined plane that makes an angle of 30° with the

horizontal . The coefficient of friction between the block and the surface is $\sqrt{3}/2$.

What force should be applied to the block so that it moves up without any acceleration ?



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11. A block is placed on a ramp of parabolic shape given by the equation $y = x^2 / 20$, see Figure.



If $\mu_s = 0.5$, what is the maximum height

above the ground at which the block can be placed without slipping ?

$$\left(\tan \theta = \mu_s = \frac{dy}{dx} \right)$$



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12. A block of metal of mass 2 kg on a horizontal table is attached to a mass of 0.46 kg by a light string passing over a frictionless pulley at the edge of the table. The block is subjected to a horizontal force by allowing the 0.45 kg mass to fall . The coefficient of sliding

friction between the block and table is 0.2.

Calculate

the initial acceleration



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13. A block of metal of mass 2 kg on a horizontal table is attached to a mass of 0.46 kg by a light string passing over a frictionless pulley at the edge of the table. The block is subjected to a horizontal force by allowing the

0.45 kg mass to fall . The coefficient of sliding friction between the block and table is 0.2.

Calculate

the tension in the string .



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14. A block of metal of mass 2 kg on a horizontal table is attached to a mass of 0.46 kg by a light string passing over a frictionless pulley at the edge of the table. The block is

subjected to a horizontal force by allowing the 0.45 kg mass to fall . The coefficient of sliding friction between the block and table is 0.2.

Calculate

the distance the block would continue to move if , after 2 s of motion , the string should break .



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15. On a smooth horizontal surface a block A of mass 10 kg is kept . On this block a second block B of mass 5 kg is kept . The coefficient of friction between the two blocks is 0.4 . A horizontal force of 30 N is applied on the lower block as shown . The force of friction between the blocks is (take $g = 10m / s^2$)



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16. A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 ms^{-1} . If the mass of the ball is 0.5 kg ., determine the impulse imparted to the ball. (Assume linear motion of the ball)



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17. A force $2\bar{i} + \bar{j} - \bar{k}$ Newton acts on a body which is initially at rest . At the end of 20 seconds the velocity of the body is

$4\bar{i} + 2\bar{j} - 2\bar{k}$ m/s . What is the mass of the body ?



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Additional Problems

1. 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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2. 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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3. The driver of a three -wheeler moving with a speed of 36 km/ h sees a child standing in the middle of the road and brings his vehicle to rest in 4. 0 s just in time to save the child .

What is the average retarding force on the vehicle ? The mass of the three wheeler is 400 kg and the mass of the driver is 65 kg .



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4. A rocket with a lift -off mass 20 , 000 kg is blasted upwards with an initial acceleration of 5.0ms^{-2} . Calculate the initial thrust (force) of the blast .



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5. A man of mass 70 kg stands on a weighing scale in a lift which is moving up wards with a uniform speed of 10ms^{-1} .



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6. A man of mass 70 kg stands on a weighing scale in a lift which is moving downwards with a uniform acceleration of 5ms^{-1} ,



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7. A man of mass 70 kg stands on a weighing scale in a lift which is moving upwards with a uniform acceleration of 5ms^{-2} ,

What would be the readings on the scale in each case ?



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8. A man of mass 70 kg 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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9. Two bodies of masses 10 kg and 20 kg respectively kept on a smooth , horizontal surface are tied to the ends of a light string a horizontal force $F = 600 \text{ N}$ is applied to (i) A, (ii) B along the direction of string What is the tension in the string in each case ?



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10. Two masses 8 kg and 12 kg are connected at the two ends of a light in extensible string that goes over a frictionless pulley . Find the acceleration of the masses , and the tension in the string when the masses are released .



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





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13. A shell of mass 0.02 kg is fired by a gun of mass 100 kg . If the muzzle speed of the shell is 80 m s^{-1} , What is the recoil speed of the gun ?



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14. 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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15. Explain why (a) a horse cannot pull a cart and run in empty space, (b) passengers are thrown forward from their seats when a speeding bus stops suddenly, (c) it is easier to pull a lawn mower than to push it, (d) a cricketer moves his hands backwards while holding a catch.



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16. Explain why

passengers are thrown forward from their seats when a speeding bus stops suddenly



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17. Explain why

it is easier to pull a lawn mover than to push it



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18. Explain why

a cricketer moves his hands backwards while holding a catch .



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19. A stream of water flowing horizontally with a speed of 15ms^{-1} pushes out of a tube of cross-sectional area 10^{-2}m^2 , and hits a vertical wall nearby . What is the force exerted on the wall by

the impact of water , assuming it does not rebound ?

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20. Ten one -rupee coins are put on top of each other on a table . Each coin has a mass m .

Give the magnitude and direction of the force on the 7^{th} coin (counted from the bottom) due to all the coins on its top

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21. Ten one -rupee coins are put on top of each other on a table . Each coin has a mass m .

Give the magnitude and direction of

the force on the 7^{th} coin (counted from the bottom) due to all the coins on its top



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22. Ten one -rupee coins are put on top of each other on a table . Each coin has a mass m .

Give the magnitude and direction of

the reaction of the 6^{th} coin on the 7^{th} coin .



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