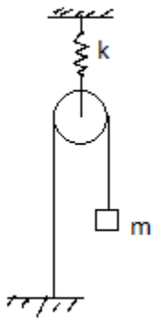
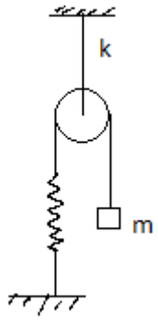
Mains Test:



1. Initially the mass m is held and the spring is relaxed. Pulley is mass less and frictionless. The mass is slowly released and is found to descend a distance x before it hangs in equilibrium. The stretch in the spring is y by this time. Relation between x and y is

a) x = y *b) x = 2y c) y = 2x d) depends on m



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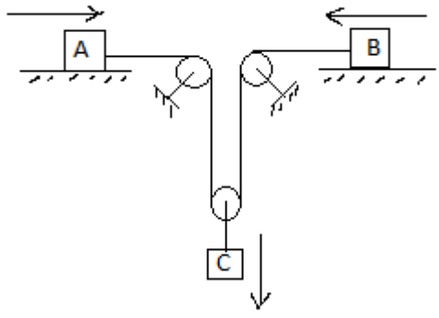
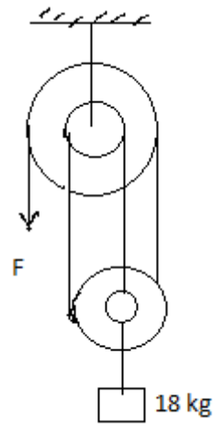


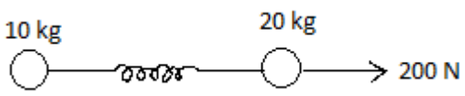
3. A, B and C have accelerations a_1, a_2 and a_3 respectively with their directions marked as shown. The relation between them is

a) $a_1 + a_3 = 2a_2$ *b) $a_1 + a_2 = 2a_3$ c) $a_3 + a_2 = 2a_1$ d) depends on masses



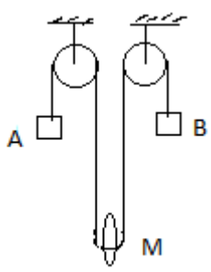
4. What force F applied at the free end of the light string passed over system of pulley's will keep 18 kg mass in equilibrium?

*a) 60 N b) 180 N c) 90 N d) 240 N



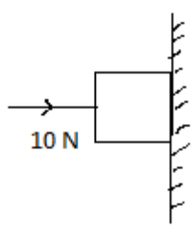
5. Two masses are connected by a mass less spring as shown. A force of 200 N acts on 20 kg mass at the instant when the 10 kg mass has an acceleration of 12 ms^{-2} towards right. The acceleration of 20 kg at the same instant is

a) 2 ms^{-2} b) 16 ms^{-2} *c) 4 ms^{-2} d) 20 ms^{-2}



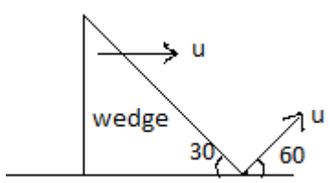
6. A smooth ring of mass M is threaded over a string which is passed onto two fixed pulley's with masses A = m and B = m_1 also connected at the free ends as shown. The various portions of the strings are vertical. Under what conditions will M alone remain at rest?

a) $\frac{2}{M}=\frac{1}{m}+\frac{1}{m_1}$ b) $\frac{1}{M}=\frac{1}{m}+\frac{1}{m_1}$ c) $\frac{3}{M}=\frac{1}{m}+\frac{1}{m_1}$ *d) $\frac{4}{M}=\frac{1}{m}+\frac{1}{m_1}$



7. A horizontal force of 10 N is necessary to just hold a block stationary against a rough wall. The coefficient of friction between the block and the wall is 0.2 The weight of the block is

a) 20 N b) 50 N c) 100 N *d) 2 N



8. A particle is projected from the bottom of the wedge at an angle of 60 with a speed u = $10\sqrt{3}$ m/s as shown. At the same instant the wedge also starts moving towards the right with the same speed. The time after which the particle will strike the wedge is

*a) 2 s b) $2\sqrt{3}$ s c) $\frac{4}{\sqrt{3}}$ s d) none

9. The distance between two moving particles at an instant is a. If v be their relative velocity and v_1, v_2 be the components of v along and perpendicular to a, respectively, the time after which they are closest to each other is

*a) $\frac{av_1}{v^2}$ b) $\frac{av_2}{v^2}$ c) $\frac{av}{v_1^2}$ d) $\frac{av}{v_2^2}$

10. Let $\vec{v}$ & $\vec{a}$ be the instantaneous velocity and acceleration of a particle moving in a plane. The rate of change of speed $\frac{dv}{dt}$ of the particle is equal to

a) magnitude of acceleration *b) $\frac{\vec{v}\cdot\vec{a}}{v}$

c) the component of $\vec{a}$ perpendicular to $\vec{v}$ d) zero

11. Let $\vec{r}$ be the radius vector of a particle in motion about some reference point and r be its magnitude. Similarly $\vec{v}$ be the velocity vector and v be its magnitude, then which of the option is wrong?

a) $v \neq \frac{dr}{dt}$ *b) $v = \frac{dr}{dt}$ c) $v = \left|\frac{d\vec{r}}{dt}\right|$ d) $|d\vec{r}| \neq dr$

12. Two particle A and B are located at points (0,0) and (0, 4m). They simultaneously start moving with velocities $\vec{v}_A = 2\hat{j}$ and $\vec{v}_B = 2\hat{i}$ m/s. Select the wrong option.

*a) the distance between them is constant.

b) the distance between them first decreases and then increases.

c) the shortest distance between them is $2\sqrt{2}$ m

d) time after which they are at minimum distance is 1 sec.

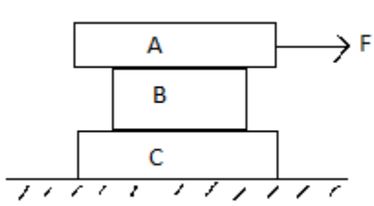
13. River is flowing with a velocity $\vec{v}_R = 4\hat{i}$ m/s. A boat is moving with a velocity of $\vec{v}_{BR} = (-2\hat{i} + 4\hat{j})$ m/s relative to water. The width of the river is 100 m along y-direction. chose the correct alternative.

*a) the boat will cross the river in 25 sec.

b) absolute velocity of the boat is $\sqrt{5}$ m/s

c) drift of the boat along the river flow is 50 cm.

d) the boat can never cross the river.



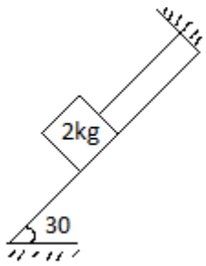
14. Given A = 30 kg, B = 10 kg and C = 20 kg. Between A and B, μ = 0.3 Between B and C, μ = 0.2 and between C and ground μ = 0.1
The least horizontal force F to start motion of any part of the system of three blocks shown is
(g = 10 ms^{-2})

a) 150 N b) 80 N *c) 60 N d) 90 N

15. An elevator accelerates upward at a constant rate. A uniform string of length L and mass m supports a small block of mass M that hangs from the ceiling of the elevator. The tension at a distance l from the ceiling is T. The acceleration of the elevator is

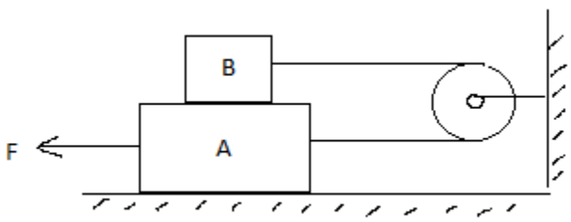
*a) $\frac{T}{M+m-\frac{ml}{L}} - g$ b) $\frac{T}{2M+m-\frac{ml}{L}} + g$ c) $\frac{T}{M+\frac{ml}{L}} - g$ d) $\frac{T}{2M-m-\frac{ml}{L}} - g$

16. If all the matter were made of electrically neutral particles such as neutrons, which of the options would be wrong?
a) there would be no tension in the string
b) there would be no force of friction
c)it would not be possible to sit on the chair
*d) the earth could not move around the sun.

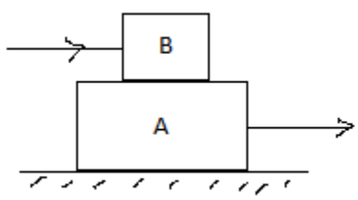


17. A block of mass 2 kg is kept on an inclined plane as shown. The tension in the string is (μ between the plane and the block is 0.7)
a) 20 N b) 7 N c) 10 N *d) 0

18. The free end of a simple pendulum is attached to the ceiling of a box. The box is taken to a height and the pendulum is oscillated. When the bob is at its lowest point, the box is released to fall freely. As seen from the box during this period, the bob will
a) continue its oscillation as before
b) stop
*c) will go in a circular path
d) move on a straight line



19. Blocks A and B are connected by a light cord passing over a smooth pulley as shown. A weighs 4 N and blocks B weighs 8 N. The friction between A and B is f_2 and between A and the ground is f_1 The coefficient of kinetic friction for all the surfaces is 0.25 On applying the force F the block B slides at a constant speed. Which of the options is wrong?
*a) f_1 is 2 N b) f_2 is 2 N c) the tension in the string is 2 N d) F = 5 N



20. The block B of mass m acted upon by a horizontal force is accelerating on a large slab A of mass M moving with a uniform velocity on a horizontal surface as shown. μ_1 & μ_2 are the friction coefficients between block and slab and between slab and horizontal surface respectively. Then
a) $\frac{\mu_1}{\mu_2}=1$ *b) $\frac{\mu_1}{\mu_2}=\frac{M+m}{m}$ c) $\frac{\mu_1}{\mu_2}=\frac{m}{M+m}$ d) $\frac{\mu_1}{\mu_2}=\frac{M}{m}$

21. Which of the following is a correct statement?
a) displacement should be in the direction of acceleration of the body.
b) displacement must not be in the direction of velocity.
c) displacement is always less than distance.

*d) displacement must always be in the direction of average velocity of the body.

22. When the height attained by a projectile is largest, which of the following is largest?
a) angle of projection with the vertical
b) range *c) time of flight d) radius of curvature

23. A particle is projected from the ground at an angle θ with the horizontal with a speed u. Then
*a) tangential acceleration at the point of projection is gsinθ.
b) tangential acceleration at the highest point is gcosθ.
c) radius of curvature at the highest point is $\frac{u^2 \sin^2 \theta}{g}$
d) radius of curvature at the highest point is $\frac{u^2 \cos^2 \theta}{2g}$

24. Two tennis balls are projected simultaneously from the top of the tower such that they move in the same vertical plane. Their speeds of projection are $10\sqrt{3}$ and $5\sqrt{3}$ m/s and angles of projection are 60 and zero with the horizontal respectively. Then they will
*a) not collide in the air
b) collide in the air
c) collide if the height of the tower is more than 15 m
d) collide if the height of the tower is equal to 15 m

Reasoning:

(A) Statement - 1 is true, Statement - 2 is True, Statement - 2 is a correct explanation for Statement – 1.

(B) Statement - 1 is True, Statement - 2 is True, Statement - 2 is NOT a correct explanation for Statement - 1.

(C) Statement - 1 is True, Statement - 2 is False.

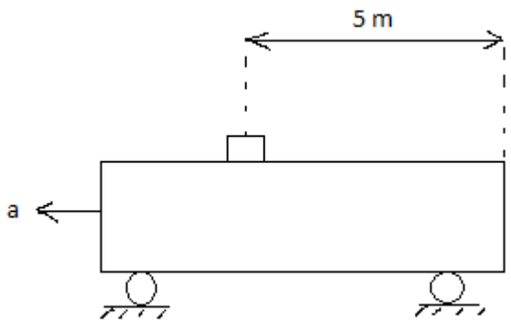
(D) Statement - 1 is False, Statement - 2 is True.

1.
Assertion: An object having a constant acceleration, can come to a momentary halt.
Reason: An object having a constant acceleration, can come to a permanent halt.
Ans: C

2.
Assertion: The average velocity for a trip has a positive value. It is possible that the instantaneous velocity at a point during the trip can have a negative value.
Reason: An object can have non-zero acceleration without having variable velocity.
Ans: C

3.
Assertion: If $v > 0 \,\&\, a < 0$, the particle is moving with decreasing speed along the positive x-axis.
Reason: If $v < 0 \,\&\, a < 0$, the particle is moving with increasing speed along negative x-axis.
Ans: B

Numerical:

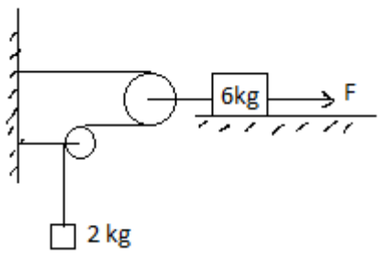
1. 

A block of mass 10 kg is placed at a distance of 5 m from the rear end of a long trolley as shown. The coefficient of friction between the block and the surface below is 0.2 Starting from rest the trolley is accelerated uniformly with a = 3 ms^{-2} At what distance from the starting point will the block fall off the trolley. Take g = 10 ms^{-2}

*a) 15 m b) 20 m c) 25 m d) 30 m

2. A mass of 8 kg is suspended by a mss less string of length 5 m from a ceiling. A force of 80 N is applied in a horizontal direction at the midpoint of the string. The angle made by the string with the vertical in equilibrium condition will be (g = 1o ms^{-2})

a) 90^0 b) 60^0 *c) 45^0 d) 30^0

3. 

The system starts from rest and 6 kg block attains a velocity of 5 m/s after it has moved 5 m towards the right. Assuming all surfaces are frictionless and pulleys and strings are light, the value of F is

a) 50 N *b) 75 N c) 100 N d) 96 N