PHYSICS

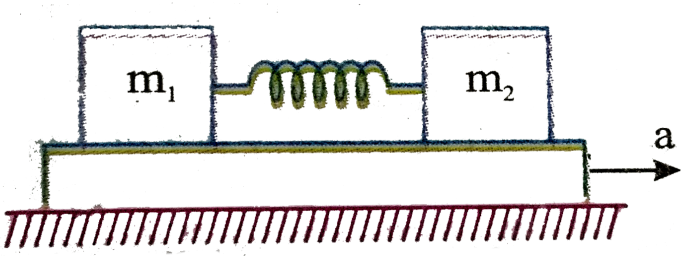
AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

FRICTION

Single Answer Questions

1. Two block of masses $m1$ and $m2$ are connected with a massless unstretched spring

and placed over a plank moving with an acceleration $'a'$ as shown in figure. The coefficient of friction between the blocks and platform is μ



A. spring will be stretched if $a > \mu g$

B. spring will be commpressed if $a \leq \mu g$

C. spring will neither be compressed nor be stretched for $a < \mu g$ only.

D. spring will be in its natural length under all conditions.

Answer: D

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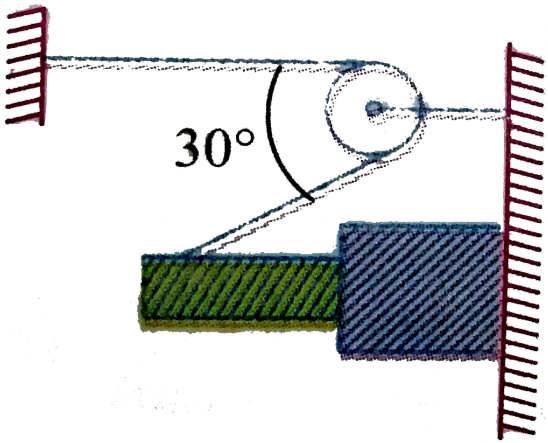
2. Two blocks with masses M_1 and M_2 of $10kg$ and $20kg$ respectively are placed as in fig. $\mu_s = 0.2$ between all surfaces, then tension in

string and acceleration of M_2 block will be:



A. $250N, 3m/s^2$

B. $200N, 6m/s^2$

C. $306N, 4.7m/s^2$

D. $400N, 6.5m/s^2$

Answer: C

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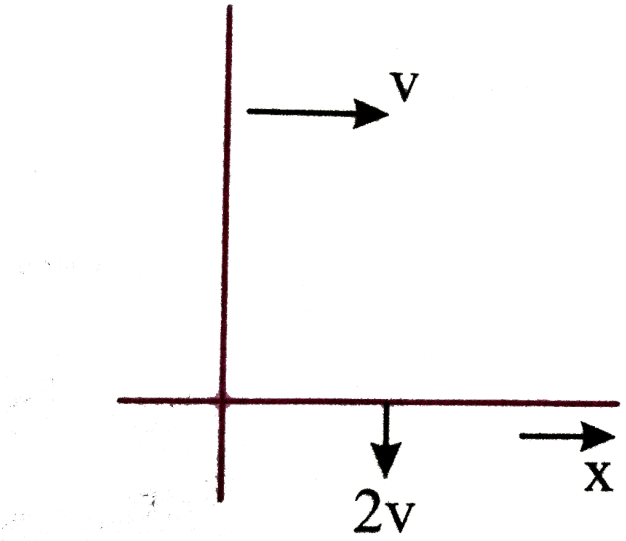
3. Two thin roads are moving perpendicularly as shown in the figure. If the friction acting between them is F_R then the unit vector in the direction of friction force acting on the rod lying along x-axis is



A. $\frac{\left(-\hat{i}-2\hat{j}\right)}{\sqrt{5}}$

B. $\frac{\left(\hat{i}+2\hat{j}\right)}{\sqrt{5}}$

C. $\frac{\left(3\hat{i}+2\hat{j}\right)}{\sqrt{3}}$

D. none of these

Answer: A

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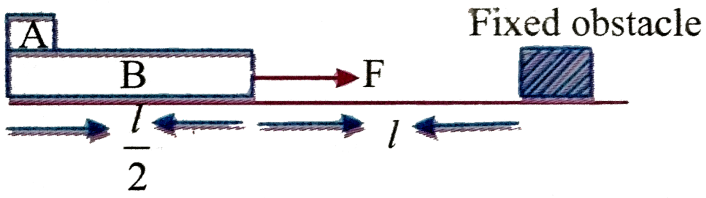
4. In a figure shown mass of A and B is equal to M each. Friction between B and lowermost

surface is negligible. Initially both the blocks are at rest. The dimensions of the block A are very small. A constant horizontal force F is applied on the blocks B and both the blocks start moving together without any relative motion. Suddenly, the block B encounters a fixed obstacle and comes to rest. The block A continues to slide on the block B. The block A just manages to reach the opposite end of the bolck B. What is the coefficient of friction between the two blocks? (Required length are

shown in figure)



A. F / Mg

B. $2F / Mg$

C. $F / 2Mg$

D. none

Answer: A

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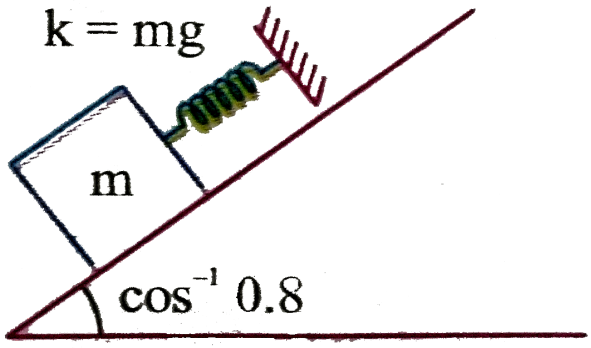
5. A block of mass m is gradually released so that at position shown it is in equilibrium with spring extended by $10cm$. The static and kinetic coefficients of friction differ by 0.1. When the spring is cut, m slide down with acceleration $\left(\text{in}ms^{-2}\right)$



A. 0.8

B. 1

C. 1.8

D. 2.1

Answer: B

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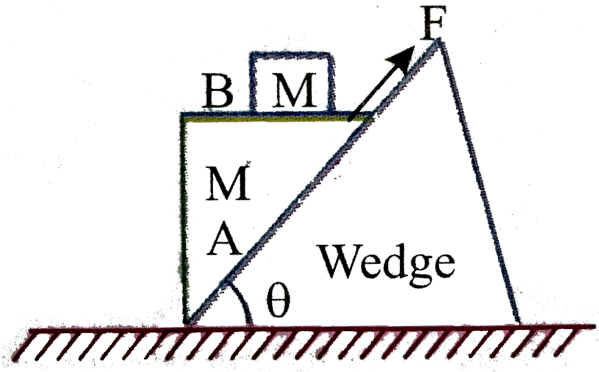
6. Wedge is fixed on horizontal surface. Block A is pulled upward by applying a force F as shown in figure and there is no friction between the wedge and the block A while coefficient of friction between A and B is μ. If

there is no relative motion between the block A and B then frictional force developed between A and B is



A. $\left[\frac{F+(m-M)g\sin\theta}{(m+M)}\right]m\cos\theta$

B. μmg

C. $\left[\frac{F-(m+M)g\sin\theta}{(m+M)}\right]m\cos\theta$

D. $\mu mg/2$

Answer: C

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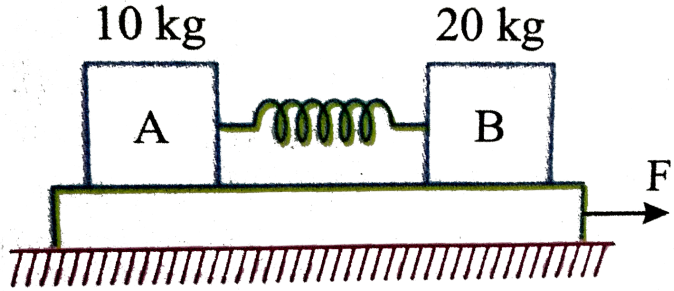
7. Two blocks $A\&B$ attached to each other by a mass-less spring, are kept on a rough horizontal surface $\mu = 0.1$. A constant force $F = 200N$ is applied on blcok B horizon tally as shown below. If a some instant the acceleration of $10kg$ mass is $12m/s^2$, then the

acceleration of $20kg$ mass is



A. $2.5m/s^2$ or $15.5m/s^2$

B. $4m/s^2$ or $10m/s^2$

C. $3.6m/s^2$ or $4.1m/s^2$

D. $1.2m/s^2$ or $1.3m/s^2$

Answer: A

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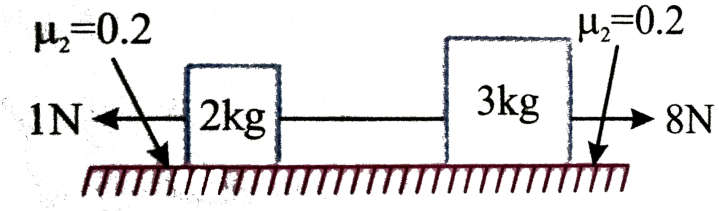
8. In the shown arrangement if f_1, f_2 and T be the frictional forces on $2kg$ block, $3kg$ block & tension in the string respectively, then their values are:



A. $2N, 6N, 3.2N$

B. $2N, 6N, 0N$

C. $1N, 6N, 2N$

D. data insufficient to calculate the required values.

Answer: C

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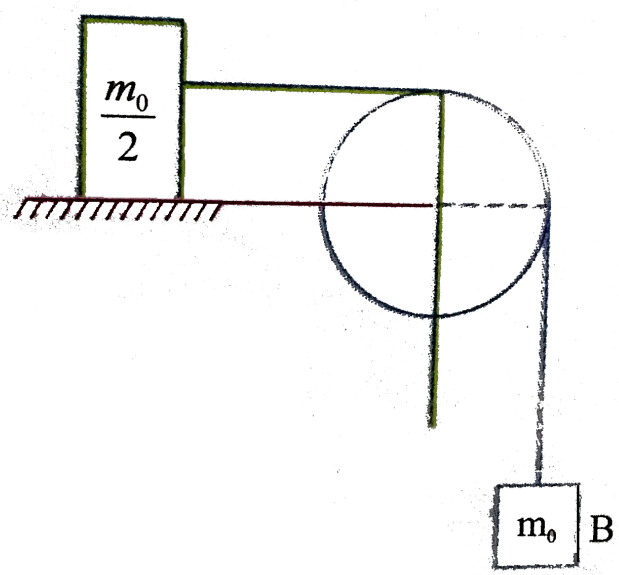
9. Coefficient of friction between pulley and light string is μ_1. Calculate minimum coefficient of friction between block A and

ground such that system can be in equibrium.



A. $\mu = 2$

B. $\mu = 2e^{\frac{-\mu\pi}{2}}$

C. $\mu = e^{\frac{\mu_1\pi}{2}}$

D. $\mu = \frac{3}{2}$

Answer: B

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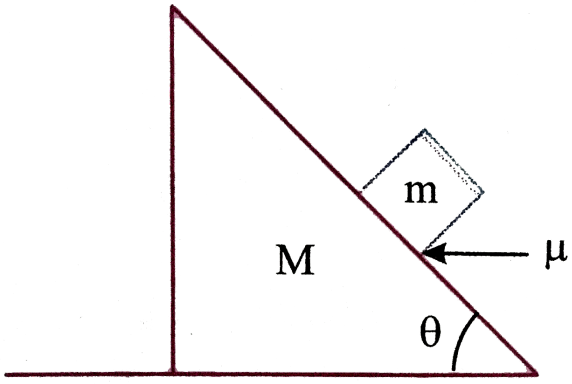
10. Calculate angle of friction between wedge and block system is at rest M coefficient of friction between wedge and block.



A. $\tan^{-1}\mu$

B. 2θ

C. θ

D. $\frac{\theta}{2}$

Answer: C

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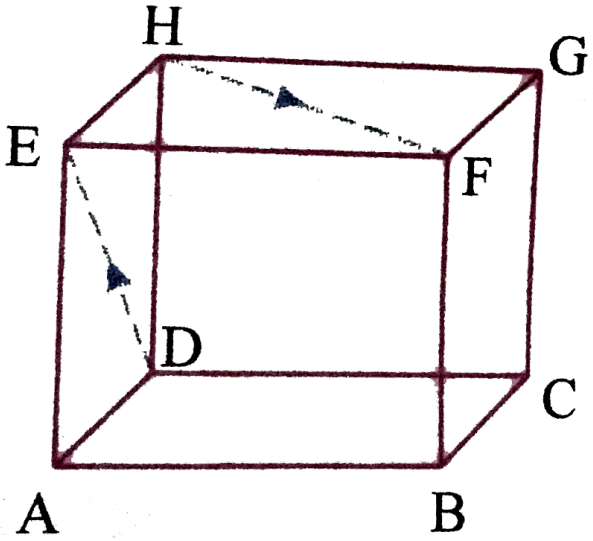
11. Cube of mass m kept on rough horizontal surface. Two insects each mass m. Moving in the cube with equal acceleration. a_0 from D to

E and H to F what is the frictional force by ground on the tube.



A. $(m + 2m)a_0$

B. $\frac{\sqrt{5}}{\sqrt{2}}ma_0$

C. $2ma_0$

D. $Ma_0\sqrt{2}$

Answer: B

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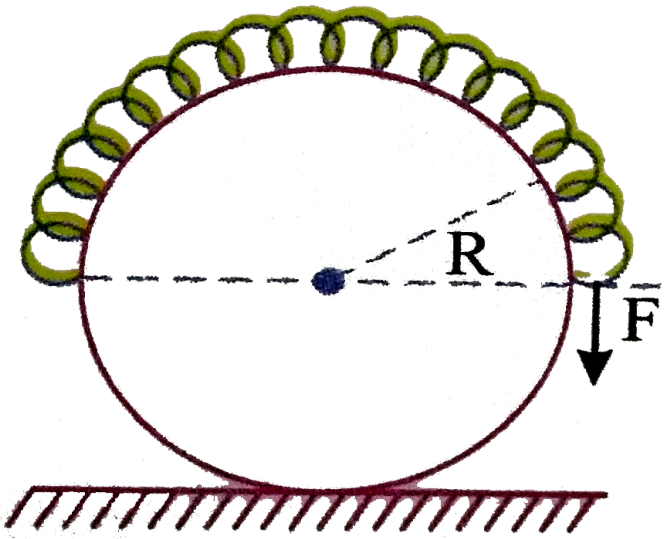
12. Chain of mass M length L kept on rough sphere. μ is coefficient if friction between sphere and chain F is minimum force required

to slide chain



A. $\frac{2\mu Mg}{\pi}$

B. μMg

C. $< \frac{2\mu Mg}{\pi}$

D. $2\mu Mg$

Answer: C

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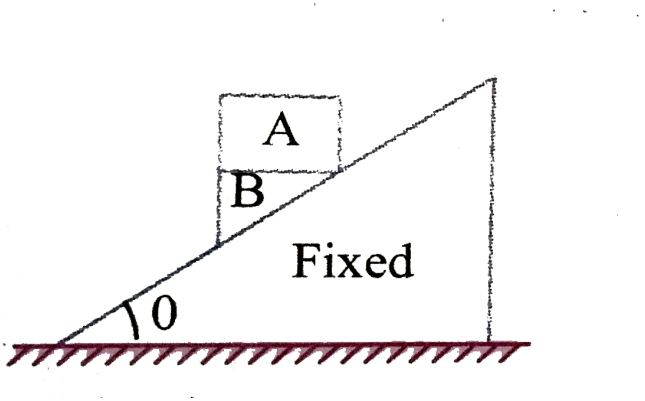
13. The coefficient of friction between the block A of mass m & block B of mass $2m$ is μ. There is no friction between $A\&B$ is released from rest & there is no slipping between $A\&B$

then:



A. $2\theta \leq \sin^{-1}(2\mu)$

B. $\theta \leq \tan^{-1}(\mu)$

C. $2\theta \leq \cos^{-1}(2\mu)$

D. $2\theta \leq \tan^{-1}(\mu/2)$

Answer: B

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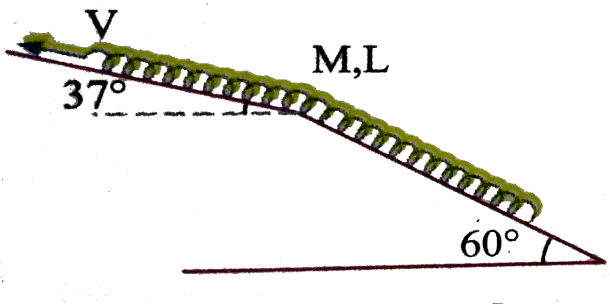
14. A long chain of mass of mass M length L is being pulled with constant velocity on a rough incline with coefficient of friction μ. What rate frictional force on chain is increasing



A. $\frac{3}{10}\mu\frac{M}{L}gv$

B. $\frac{5}{6}\mu\frac{M}{L}gv$

C. zero

D. $\mu \frac{M}{L} gv$

Answer: A

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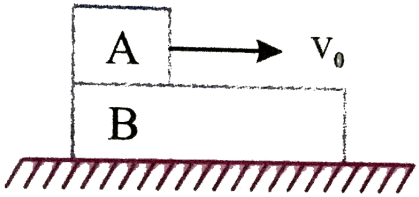
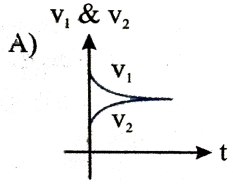
15. A block A is placed over a long rough plank B of same mass shown below. The plank is placed over a smooth horizontal surface. At time $t = 0$, block A is given a velocity v_o in horizontal direction. Let v_1 and v_2 be the

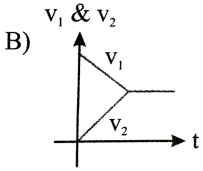
velocity of $A\&B$ at time $'t'$. Then choose the correct graph between v_1 or v_2 and t:



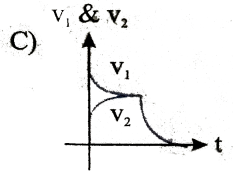
A.



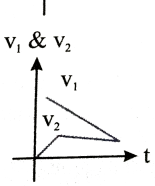
B.



C.



D)



D.

Answer: B

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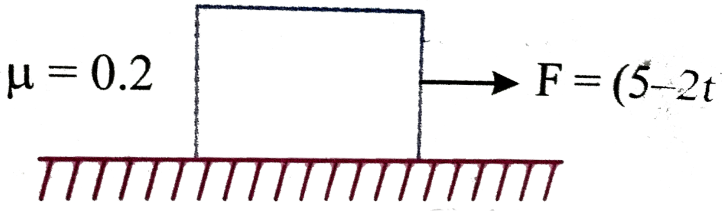
16. The force acting on the block of mass $1kg$ is given by $F = 5 - 2t$. The frictional force acting on the block after time $t = 2$ seconds

will be: $(\mu = 0.2)$



A. $2N$

B. $3N$

C. $1N$

D. zero

Answer: A

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17. A block of mass $2kg$ is placed on the floor of an elevator. The elevator is moving with an acceleration of

$6\hat{i} + 7\hat{j}m/s^2$. If $\bullet = 0.5, g = 10ms^{-2}$ and horizontal, vertically upward direactions are taken as $+vex$, y axes, find frictional force actiong on the block.

A. $12N$

B. $16N$

C. $10N$

D. $17N$

Answer: A

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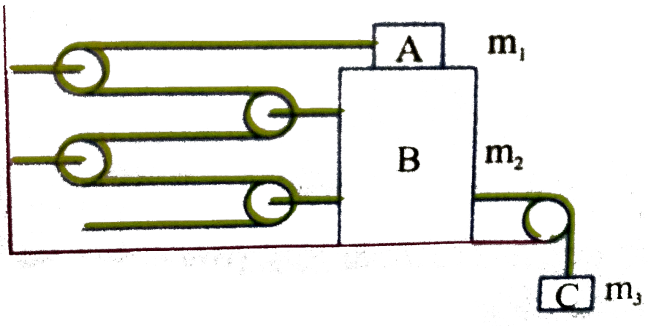
18. In the figure, $m_1 = m_2 = 10kg$. The coefficients of friction between A, B and B, surface are 0.2. Find the maximum value of m_3 so that no block slips (All the pullies are ideal

and strings are massless).



A. $16kg$

B. $10kg$

C. $18kg$

D. $14kg$

Answer: D

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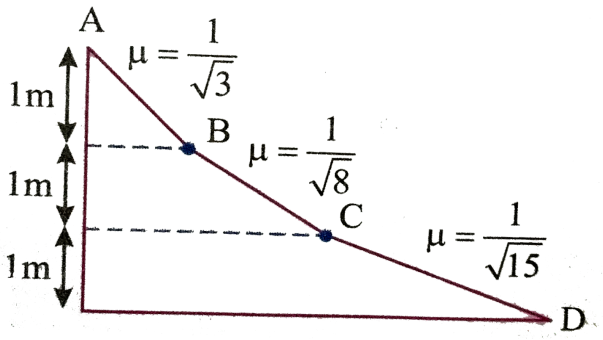
19. A composite inclined plane has three different inclined surfaces AB, BC and CD of heights $1m$ each and coefficients of friction $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{8}}$ and $\frac{1}{\sqrt{15}}$ respectively. A particle given an initial velocity at A along AB transverses the inclined surfaces with uniform speed, reaches D in $5s$. The initial speed given is $(\text{in} m/s)$



A. 1.6

B. 1.8

C. 2.4

D. 3

Answer: B

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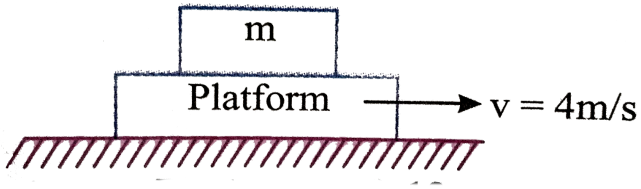
20. A stationary body mass m is slowly lowered onto a rough massive plat from moving at a constant velocity $v_o = 4m/s$. On

smooth surface. The distance the body will slide with respect to the plat from $(\mu = 0.2)$ is:



A. $4m$

B. $6m$

C. $12m$

D. $8m$

Answer: A

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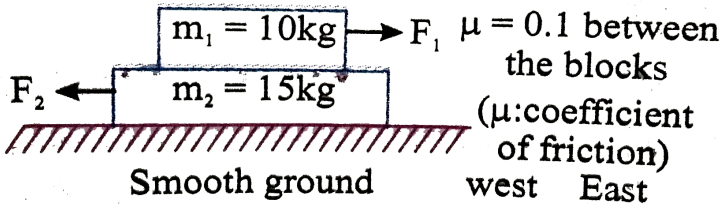
21. In the diagram shown the ground is smooth and $F_1 \& F_2$ are both horizontal forces. The mass of the upper blocks is $10kg$ while that of lower block is $15kg$. The correct statement is:



A. m_1 experiences frictional force towards west only if $F_1 > F_2$

B. If $F_1 \neq F_2$ then it is possible to keep the system in equilibrium for certain suitable values of $F_1 \& F_2$

C. If the system is to remain in equilibrium then F_1 must be equal to $F_2 \& F_2 < 10N$

D. If $\frac{F_1}{m_1} = \frac{F_2}{m_2}$, then frictional force between the blocks is zero

Answer: C

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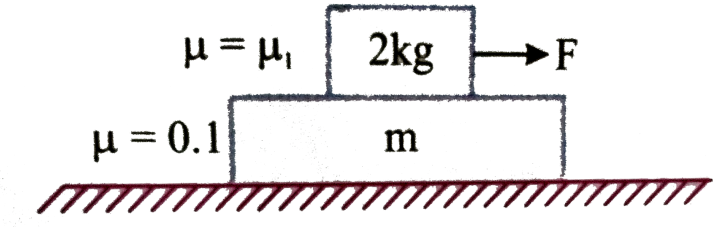
Multiple Answer Question

1. Initially the blocks are at rest with $F = 0$. F is gradually increased.



From $F = 0$ till $F = F_1$, no motion

From $F > F_1$ till $F = 2F_1$, motion with relative acceleration $= 0$

From $F > 2F_1$, relative acceleration non-zero

At $F = 3F_1$, relative acceleration $= 2ms^{-2}$

Then,

A. $m = 2Kg$

B. $\mu_1 = 0.4$

C. $F_1 = 6N$

D. At $F = 4F_1$, relative acceleration is $4ms^{-2}$

Answer: A::D

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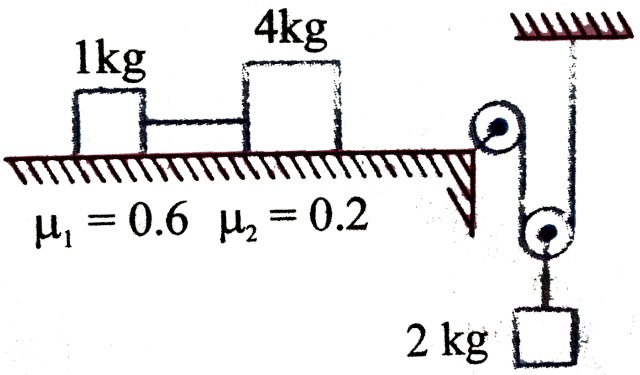
2. $1kg$ and $4kg$ blocks lie on a rough horizontal surface. The coefficient of friction between $4kg$ blocks and surface is 0.2 while the coefficient of firction between $1kg$ blocks and the surface is 0.6. All the pulley shown in the figure are massless and frictionless and all strings are massless and frictionless and all strings are massless.



A. The frictional force acting on $1kg$ blocks is $2N$.

B. The frictional force acting on $1kg$ block is $6N$

C. The tension in the string connecting $4kg$ block and $1kg$ blocks is $1N$

D. The tension in the string connecting $1kg$ block and $4kg$ blocks is zero.

Answer: C::D

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3. The force F_1 that is necessary to move a body up an inclined plane is double the force F_2 that is necessary to just prevent it form sliding down, then:

A. $F_2 = w\sin(\theta - \phi)\sec\phi$

B. $F_1 = w\sin(\theta - \phi)\sec\phi$

C. $\tan\phi = 3\tan\theta$

D. $\tan\theta = 3\tan\phi$ Where $\phi =$ angle of friction $\theta =$ angle of inclined plane

$w =$ weight of the body

Answer: A::D

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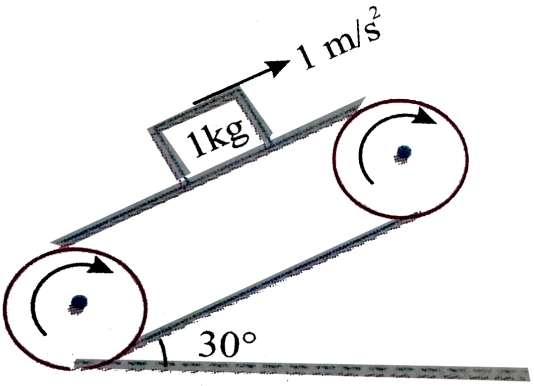
4. A block of mass $1kg$ is stationary with respect to a conveyer belt that is accelerating with $1m/s^2$ upwards at an angle of 30° as shown in figure. Which of the following is/are

correct?



A. Force of friction on block is $6N$ upwards.

B. Force of friction on block is $1.5N$ upwards.

C. Contract force between the block & belt is $10.5N$.

D. Contact force between the block & belt is $5\sqrt{3}N$.

Answer: A::C

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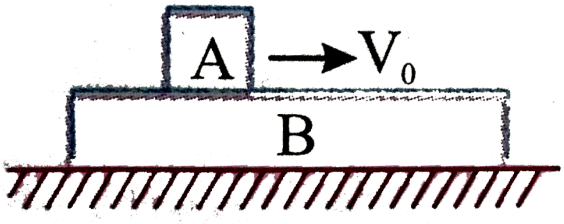
5. A block A of mass m is over a plank B of mass $2m$. Plank B si placed over a smooth horizontal surface. The coefficient of friction between A and B is $\frac{1}{2}$. Blocks A is given a

velocity V_0 towards right. Then



A. Acceleration of A is $\frac{g}{2}$

B. Acceleration of A is g

C. Acceleration of B relative to A is $\frac{3}{4}g$

D. Acceleration of A is zero

Answer: A::C

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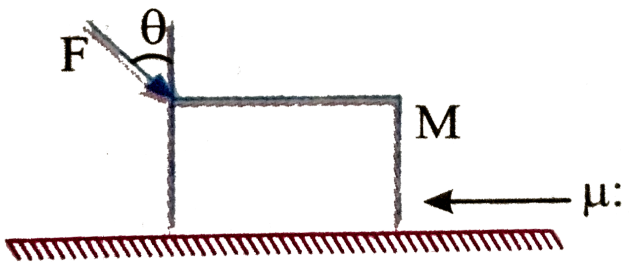
6. In the situration shown in the figure the friction coefficient between M and the horizontal surface is μ. The force F is applied at an angle θ with vertical. The correct statements are



A. If $\theta > \tan^{-1}\mu$ the block cannot be pushed forward for any value of F

B. If $\theta < \tan^{-1}\mu$ the block cannot be pushed forwards for any value of F

C. As θ decreases the magnitude of force needed to just push the block M forward increases

D. None of these

Answer: B::C

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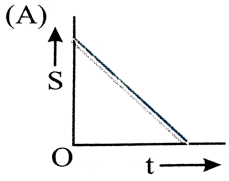
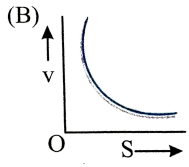
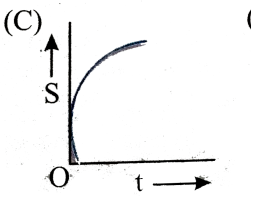
7. A block resting on a rough horizontal surface. A sharp horizontal impulse is applied on the block at $t = 0$. If at an instant t, its velocity be v and displacement up to this instant be s, then which of the following graphs is / are correct?

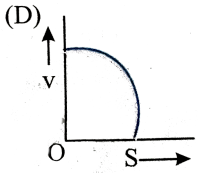
A.



B.



C. 

D. 

Answer: C::D

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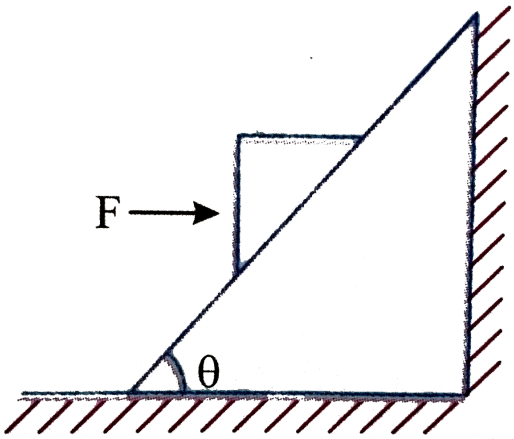
8. A triangular block of mass m rests on a fixed rough inclined plane having friction coefficient μ with the block. A horizontal forces F is

applied to it as shown in figure below, then the correct statements is:



A. Friction force is zero when

$$F\cos\theta = mg\sin\theta$$

B. The value of limiting friction is

$$\mu(mg\sin\theta + F\cos\theta)$$

C. Normal reaction on the block is

$$F \sin \theta + mg \cos \theta$$

D. The value of limiting friction is

$$\mu(mg \sin \theta - F \cos \theta)$$

Answer: A::C

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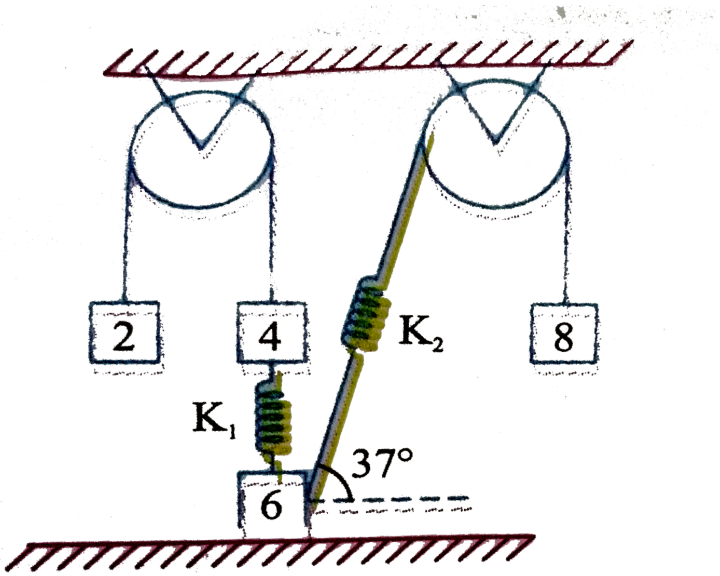
9. System is in equilibrium



A. Minimum coefficent of friction required between $6kg$ block and ground $\mu = 2$ such that system is in equilibrium.

B. Compression of vertical spring is $\frac{2g}{K_1}$

C. Elongation of vertical spring is $\frac{6g}{K_1}$

D. for $\mu = 1$ system can be in equilibrium

Answer: A::B

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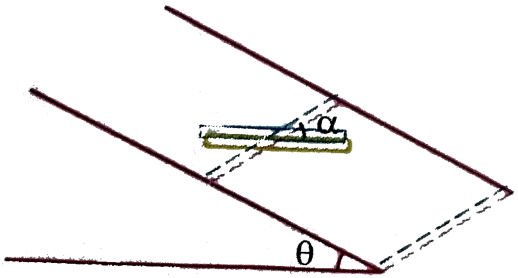
10. A small object is kept on a groove on rough incline plane of inclination θ. Groove wakes an angle α as shown in diagram. μ coefficient of

friction. Which of the following is correct



A. Normal force by incline plane.

$$N = mg\cos\theta$$

B. Normal force by incline is

$$N = mg\sqrt{\cos^2\theta + \sin^2\theta\sin^2\alpha}$$

C. maximum frictional force that can develop is $f_{\max} = \mu mg\cos\theta$

D. If $\mu = 0$ then acceleration of blocks is

$$g \sin \theta \cos \alpha$$

Answer: B::D

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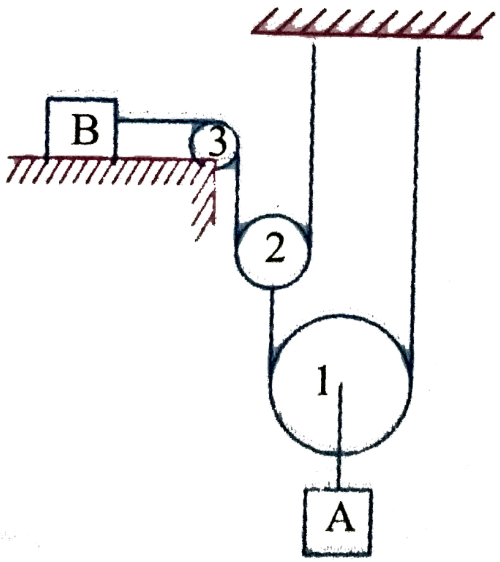
11. As shown in figure, A and B are two blocks of mass $5kg$ and $10kg$ connected by inextensible and massless strings. Pulleys $1, 2, 3$ are massless, no frction exists between pully and strings. The coefficient of friction

between blocks B and the surface is $\mu = 0.1$

Take $g = 10m/s^2$. Choose the correct statements.



A. The acceleration of block A is $0.06ms^{-2}$

B. The acceleration of block B is $0.24ms^{-2}$

C. The tension in the string connecting pulley 1 and block A is $24.7N$

D. The tension in the string connecting pulley 3 and block B is $6.175N$

Answer: A::B

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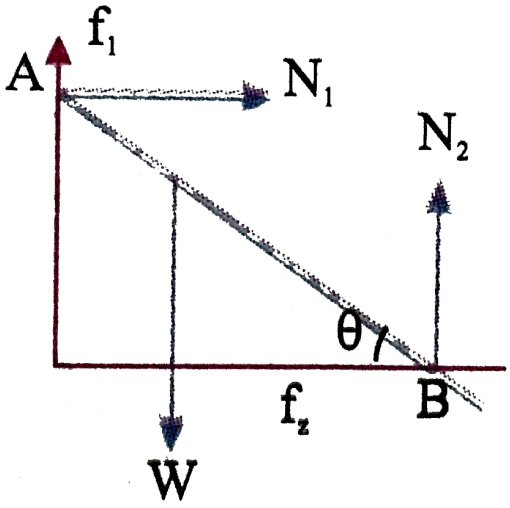
12. A uniform rod is made to lean between rough vertical wall and the ground. Friction coefficient between rod and walls is $\mu_1 = \frac{1}{2}$

and between the rod and the ground is $\mu_2 = \frac{1}{4}$. The rod is about to slip at contact surfaces. The correct options are:



A. The normal reaction between rod and wall is $\frac{\mu_2 W}{1 + \mu_1 \mu_2}$

B. Normal reaction between rod and ground is $\frac{W}{1+\mu_1\mu_2}$

C. $N_2 > N_1$

D. $N_1 > N_2$

Answer: A::B::C

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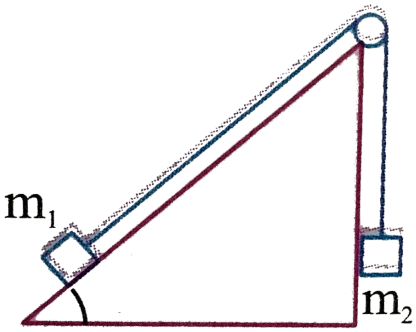
13. Two blocks of masses m_1 and m_2 are connected by a string of negligible mass which pass over a frictionless pulley fixed on the top

of an inclined plane as shown in figure. The coefficient of friction between m_1 and plane is μ.



A. If $m_1 = m_2$, the mass m_1 first begin to move up inclined plane when the angle of inclination θ, then $\mu = \sec\theta - \tan\theta$

B. If $m_1 = m_2$, then mass m_1 first begin to side down the plane if $\mu = \sec\theta - \tan\theta$.

C. If $m_1 = 2m_2$, then mass m_1 first begins to slide down the plane if $\mu = 2\tan\theta$.

D. If $m_1 = 2m_2$, then mass m_1 first begins to slide down the plane if $\mu = \tan\theta - \frac{1}{2}\sec\theta$.

Answer: A::D

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14. A plank $1m$ long is fixed with one end, $28cm$ above the level of other end. The top half of the plank is smooth and the bottom half is rough. When a small block of mass m is released at the top, it just reaches the bottom.

A. The coefficient of friction between the block and the part of plank is $1/2$.

B. On the rough part, the normal reaction on the block is $\frac{24}{25}mg$

C. Coefficient of friction between the block and the rough part of plank is $7/12$

D. On the rough part, the retardation of the block is $\frac{28}{100}g$

Answer: B::C::D

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15. Let F, F_N and f denote the magnitudes of the contact force, normal force and the

friction exerted by one surface on the other kept in contact. If none of these is zero,

A. $F > f$

B. $F_N > f$

C. $F > F_N$

D. $F_N - f < f < F_N + f$

Answer: A::C

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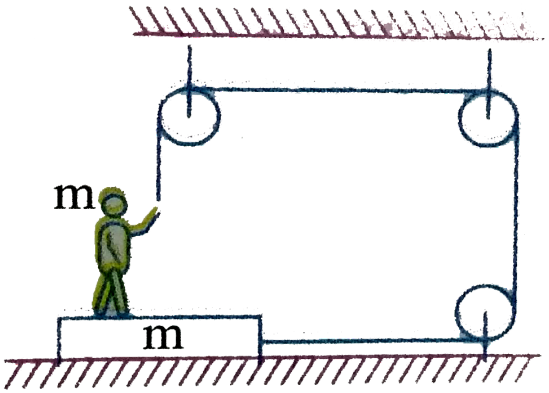
16. The friction coefficient between plank and flooe is μ. The man applies, the maximum possible foce on the string and the system remains at rest. Then



A. frictional force between plank and surface is $\frac{2\mu mg}{1+\mu}$

B. frcitional force on man is zero

C. tension is the string is $\frac{2\mu mg}{1+\mu}$

D. net force on man is zero

Answer: A::B::C::D

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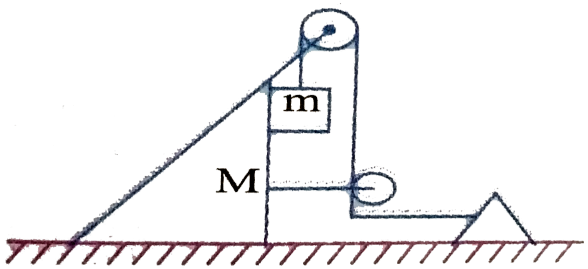
17. In the figure shown, friction exists between wedge and block and also between wedge and floor. The system is in equilibrium in the

shown position.



A. frictional force between wedge and surface is $\mu(M+m)g$

B. frictional force between wedge and surface is mg

C. frictional force between wedge and block is 0

D. minimum coefficient of friction required to hold the system in equilibrium is $\frac{m}{M+m}$

Answer: B::C::D

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18. When person cycling on rough horizontal surface then which of the following are correct

A. Friction on front wheel is towards left

B. Friction on front wheel is towards right

C. Friction on rear wheel towards right

D. Friction on rear wheel towards left

Answer: A::C

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19. A body is moving down a long inclined plane in inclination 45° with horizontal. The coefficient of friction between the body and the plane varies as $\mu = x/2$, where x is the

distance moved down the plane. Initially

$x = 0 \& v = 0.$

A. When $x = 2$ the velocity of the body is

$\sqrt{g\sqrt{2}} m / s$

B. The velocity of the body increases all the time

C. At an instant when $v \neq 0$ the instantaneous acceleration of the body down the plane is

$\frac{g(2 - x)}{2\sqrt{2}}$

D. The body first accelerates and then decelerates

Answer: A::C::D

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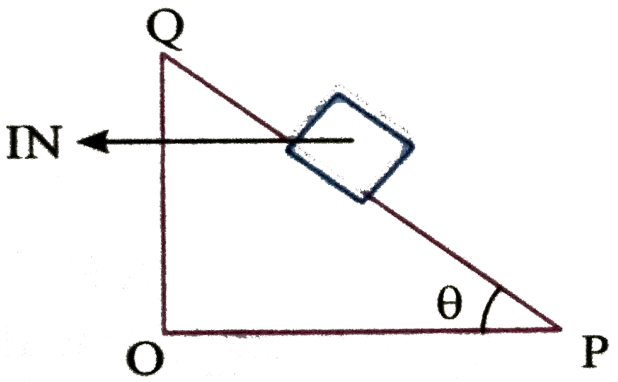
20. A small block of mass of $0.1kg$ lies on a fixed inclined plane PQ which makes an angle θ with the horizontal. A horizontal force of $1N$ acts on the block through its centre of mass as shown in the figure. The block remains

stationary if (take $g = 10m/s^2$)



A. $\theta = 45^\circ$

B. $\theta > 45^\circ$ and frictional force acts on the block towards P.

C. $\theta > 45^\circ$ and frictional force acts on the block towards Q.

D. $\theta < 45^\circ$ and frictional force acts on the block towards Q.

Answer: A::C

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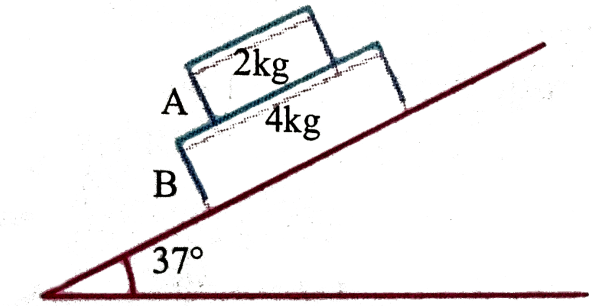
Passage Type Of Questions

1. Consider the situation shown in figure in which a book $'A'$ of mass $2kg$ is placed over a block $'B'$ of mass $4kg$. The combination of

the placed on a inclined plane of inclination 37° with horizontal. The coefficient of friction between blocks B and inclined plane is μ_2 and in between the two bolcks is μ_1, The system is released from rest.

(Take $g = 10m/\sec^2$)



If $\mu_1 = 0.8, \mu_2 = 0.8$ then:

A. Both block will move together

B. Only block A will move and blocks B remains at rest

C. Only block B will move and block A remains at rest

D. None of the blocks will move

Answer: D

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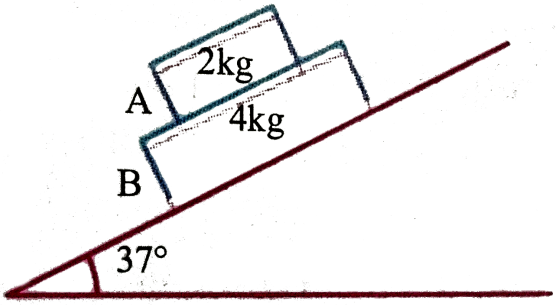
2. Consider the situation shown in figure in which a book $'A'$ of mass $2kg$ is placed over a block $'B'$ of mass $4kg$. The combination of the placed on a inclined plane of inclination 37° with horizontal. The coefficient of friction between blocks B and inclined plane is μ_2 and in between the two bolcks is μ_1, The system is released from rest.

(Take $g = 10m/\sec^2$)



In the previous question the frictional force between block B and plane is:

A. $36N$

B. $24N$

C. $12N$

D. $48N$

Answer: A

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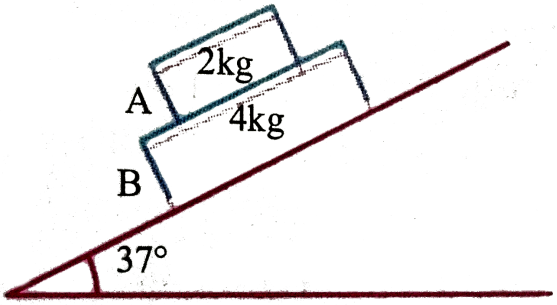
3. Consider the situation shown in figure in which a book $'A'$ of mass $2kg$ is placed over a block $'B'$ of mass $4kg$. The combination of the placed on a inclined plane of inclination 37° with horizontal. The coefficient of friction between blocks B and inclined plane is μ_2 and in between the two bolcks is μ_1, The system is released from rest.

(Take $g = 10m/\sec^2$)



If $\mu_1 = 0.5$, $\mu_2 = 0.5$, then:

A. Both blocks will move but with different accelerations

B. Both blocks will move together

C. Only block A will move

D. Onlyd block B will have

Answer: B

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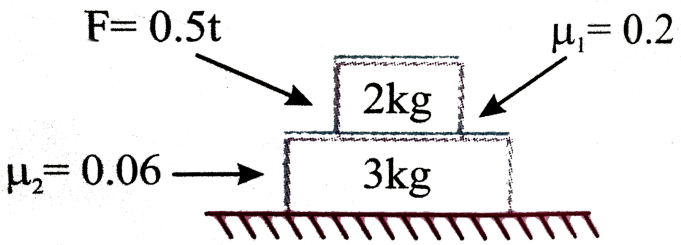
4. In the given figure, the blocks of mass $2kg$ and $3kg$ are placed one over the other as shown. The surface are rough with coefficient of friction $\mu_1 = 0.2, \mu_2 = 0.06$. A force $F = 0.5t$(where $'t'$ in sec) is applied on upper block in the direction shown. Based on above data answer the following questions.

$\left(g = 10m/\sec^2\right)$



The motion of blocks $2kg$ and $3kg$ will begin at time $t = \ - \ , \ - \$ respectively

A. $8, 8\,\text{sec}$

B. $6, 8\,\text{sec}$

C. $8, 6\,\text{sec}$

D. $6, 6\,\text{sec}$

Answer: D

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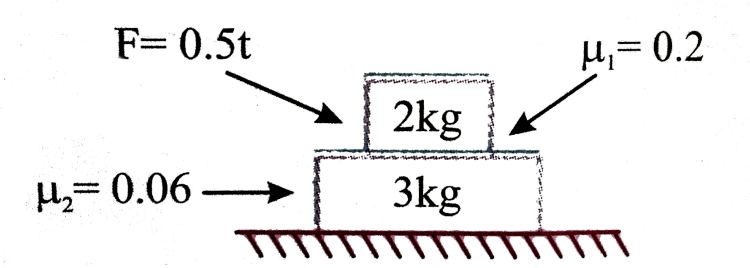
5. In the given figure, the blocks of mass $2kg$ and $3kg$ are placed one over the other as shown. The surface are rough with coefficient of friction $\mu_1 = 0.2, \mu_2 = 0.06$. A force $F = 0.5t$(where $'t'$ in sec) is applied on upper block in the direction shown. Based on above data answer the following questions.

$(g = 10m/\sec^2)$



The relative slipping between the blocks occurs at $t =$

A. $6\,\sec$

B. $8\,\sec$

C. $\frac{28}{3}\sec$

D. Never

Answer: C

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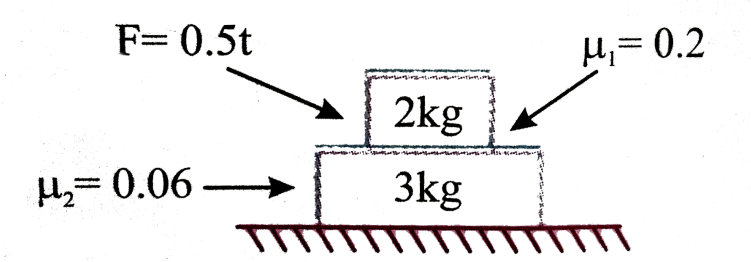
6. In the given figure, the blocks of mass $2kg$ and $3kg$ are placed one over the other as shown. The surface are rough with coefficient of friction $\mu_1 = 0.2, \mu_2 = 0.06$. A force $F = 0.5t$(where $'t'$ in sec) is applied on upper block in the direction shown. Based on above data answer the following questions.

$(g = 10m/\sec^2)$



The frictional force acting between the two blocks at $t = 8\,\text{sec}.$

A. $4N$

B. $3N$

C. $3.6N$

D. $3.2N$

Answer: C

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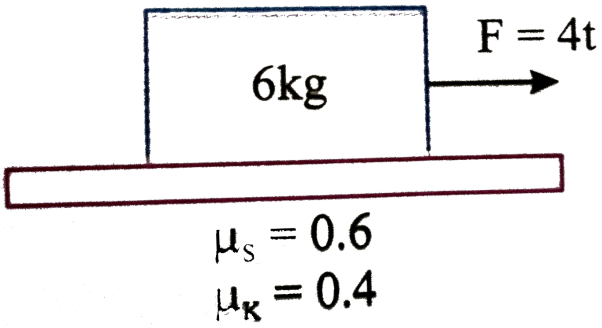
Integer Type Questions

1. A $6kg$ blocks is kept over a rough surface with coefficients of friction $\mu_s = 0.6$ and $\mu_k = 0.4$ as shown in figure. A time varying force $F = 4t$ (F in newton and t in second) is applied on the block as shown. Find the acceleration of block at $t = 5\,\text{sec.}$ (Taking $g = 10m/s^2$)



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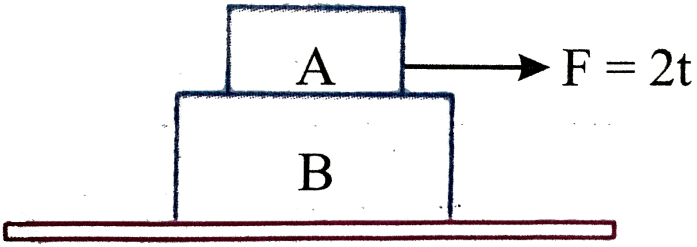
2. Two blocks A and B of mass $2kg$ and $4kg$ are placed one over the others as shown in figure. A time vaying horizontal force $F = 2t$ is applied on the upper blocks as shown in figure. Here t is in second and F is in newton. Coefficient of friction between A and B is $\mu = \frac{1}{2}$ and the horizontal surface over which B is placed is smmoth. $\left(g = 10m/s^2\right)$. If acceleration of blocks A as a function of time is given by $a_A = t/c$ then find value of c.

$(t \leq 7.5s)$



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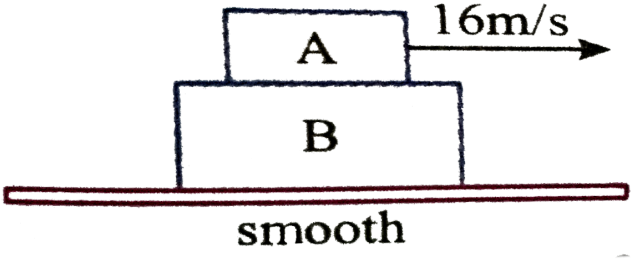
3. Block B of mass $2kg$ is placed on smooth horizontal plane. Block A to mass $1kg$ is placed on block B. The coefficient of friction between A and B is 0.40. The block A is imparted a velocity $16m/s$ "at" $t = 0$. Find the

time at which momentum of the twoblocks are equal (in seconds). $\left(g = 10m/s^2\right)$



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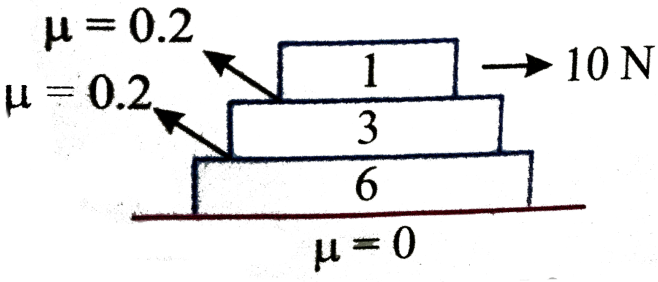
4. In the above diagram calculate frictional force acting on $6kg$ block



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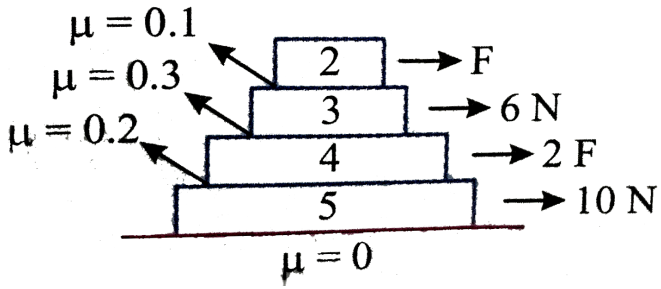
5. Calculate F such that frictional force acting on all blocks zero.



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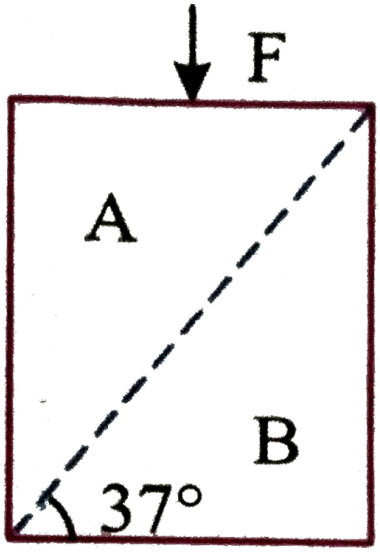
6. Two plates A and B kept on horizontal surface. Force F is applied as shown. If minimum coefficient of friction between them is $\frac{n}{4}$ to keep them in equilibrium. Calculate n.



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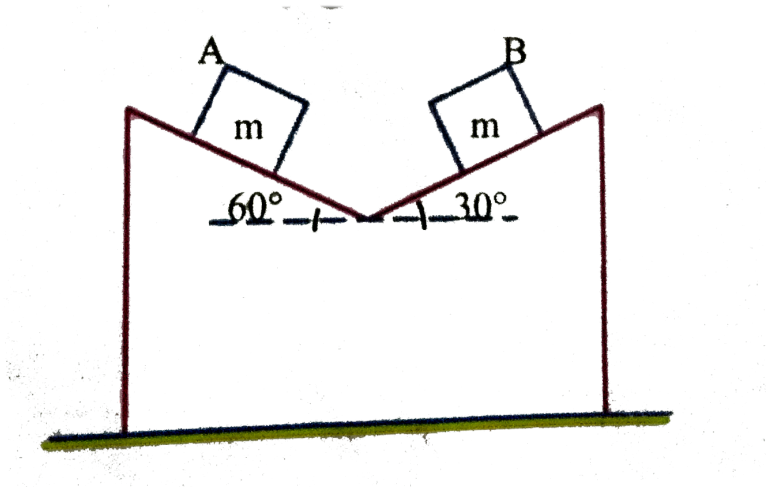
7. Two small blcok $m = 2kg$ each kept on wedge of mass $12kg$. There is no friction between blocks and wedge coefficient of friction between wedge and ground in $\mu = 0.3$. Calculate frictional force by ground on wedge.



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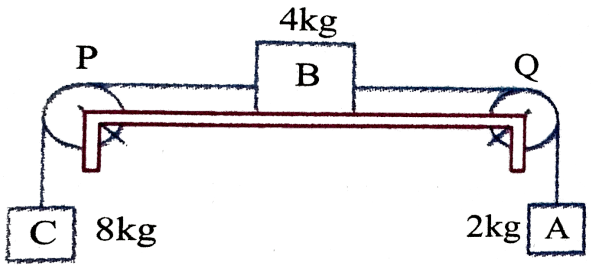
8. In the figure, the distance $BQ = 3m, BP = 14m$ at time $t = 0$. The system of blocks is released from rest at time $t = 0$. The string connecting B and C is suddenly cut at time $t = 2s$. Calculate the velocity of B at the instant when it hits the pulley Q. The coefficient of friction between B and the horizontal surface is $\mu_s = \mu_k = 0.25$.

Take $g = 9.8m/s^2$



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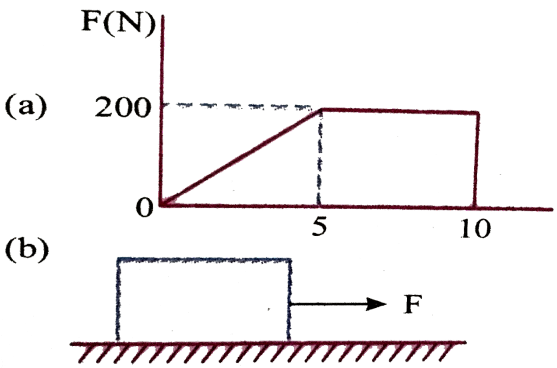
9. A $20kg$ block is originally at rest on a horizontal surface for which the coefficient of friction is 0.6. A horizontal force F is applied such that it varies with time as shown in the figure (a) & (b). If the speed of the block after

$10s$ is $8v$ then find v. (Take $g = 10m/s^2$)



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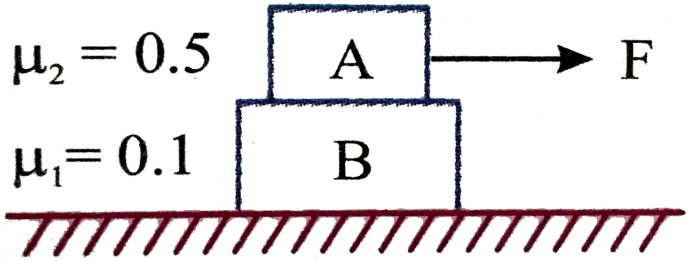
10. A block A of mass $10kg$ rests on a second block B of mass $8kg$. The coefficients of friction at various surfaces are shown in figure. A horizontal force of $100N$ is applied on upper block at $t = 0$. Determine the velocity of block

A relative to block B after $0.01s$ of application of force. The system is initially at rest. Express your answer in cm/s. Take $g = 10m/s^2$.



A. `

B.

C.

D.

Answer: 1

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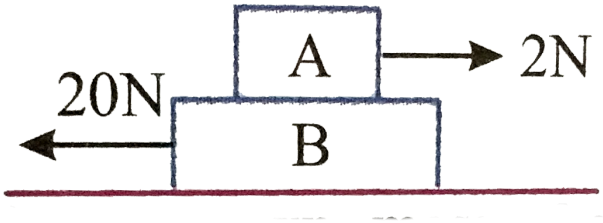
11. Block B is placed on a smooth surface. Block A is placed on rough surface of bolck B with coefficient of friction 0.60. The mass of A and B are $2kg$ and $4kg$ respectively. Find the frictional force between A and B (in N)



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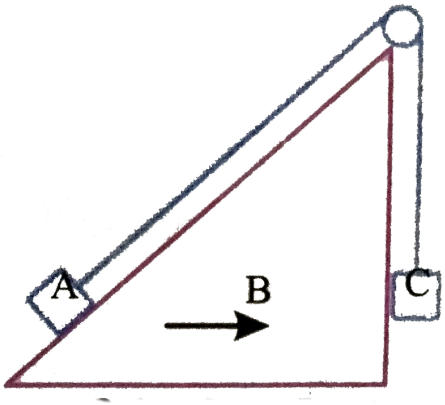
12. In the fig. as shown mass of each block is same. The surface are rough with coefficient of friction μ. The block B moves with acceleration a. The frictional force on the block C is $k \times \mu ma$. Calculate the value of K



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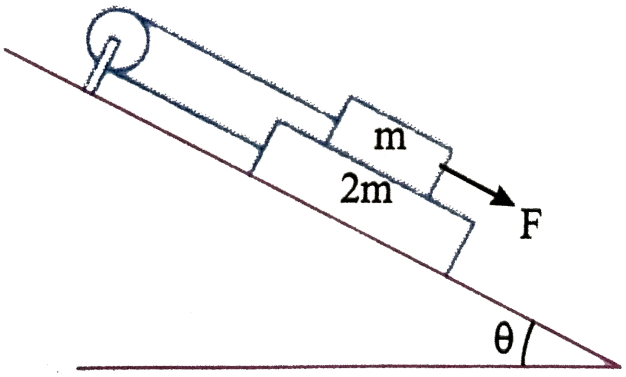
13. μ is coefficient of friction between all surface. Block A is kept of over block B on inclined plane. The minimum force required such that $'A'$ block can accelerate along applied force is $mg\sin\theta + n\mu g\cos\theta$ calculate n.



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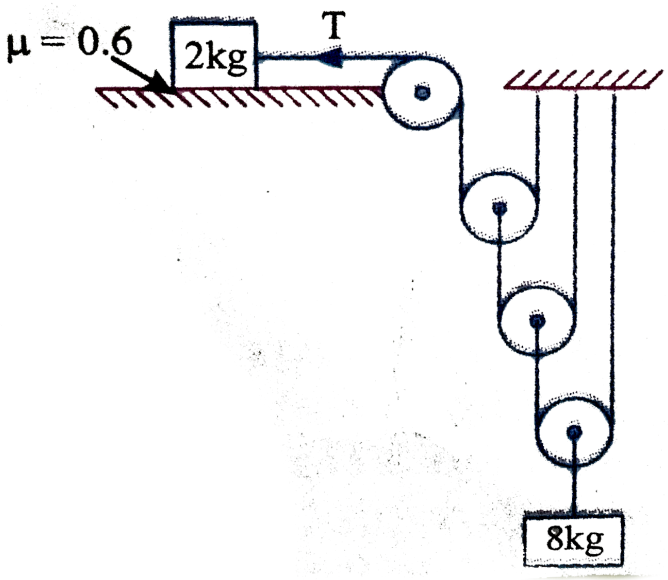
14. If friction develop between $2kg$ block and surface is K. Calculate the value of K



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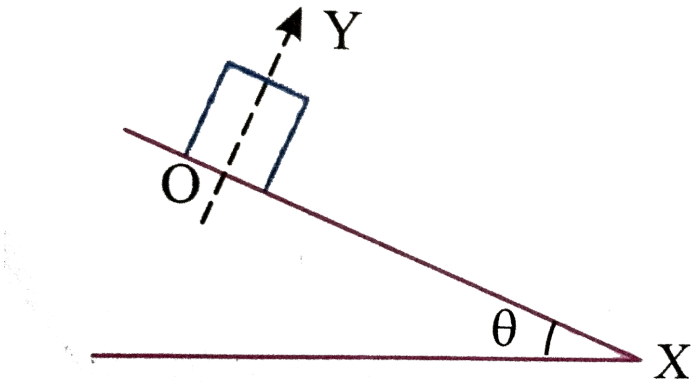
Passage Type Of Questions I

1. In the adjacent figure, x-axis has been taken down the inclined plane. The coefficient of friction varies with x as $\mu = kx$, where $k = \tan\theta$. A block is released at O.



The maximum velocity of block will be:

A. $\sqrt{g}$

B. $\sqrt{g\sin\theta}$

C. $\sqrt{g\cos\theta}$

D. $\sqrt{g\tan\theta}$

Answer: B

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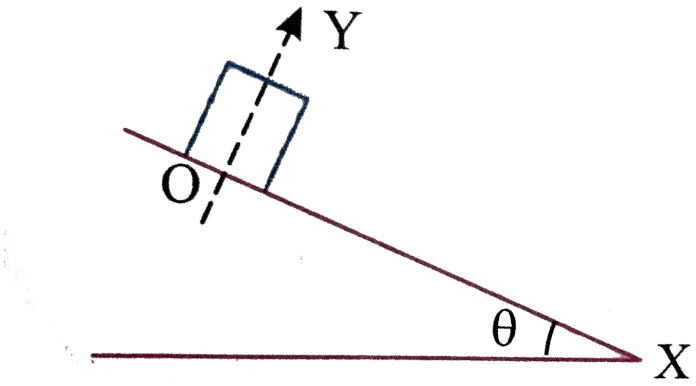
2. In the adjacent figure, x-axis has been taken down the inclined plane. The coefficient of friction varies with x as $\mu = kx$, where $k = \tan\theta$. A block is released at O



Maximum distance traveled by block:

A. $1m$

B. $2m$

C. $3m$

D. $\frac{1}{2}m$

Answer: B

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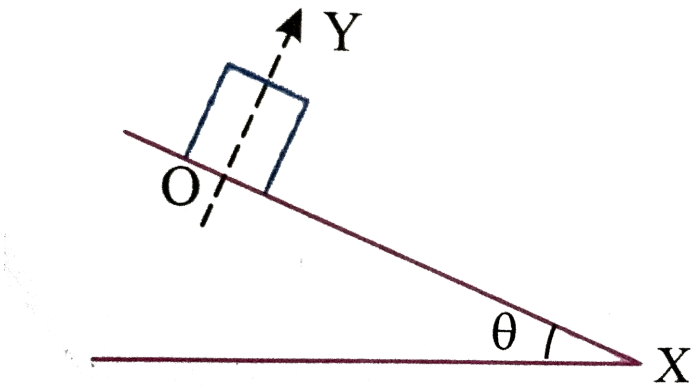
3. In the adjacent figure, x-axis has been taken down the inclined plane. The coefficient of friction varies with x as $\mu = kx$, where $k = \tan\theta$. A block is released at O



Frictional force acting on the block after it comes to rest:

A. $mg\sin\theta$

B. $2mg\sin\theta$

C. $\frac{mg\sin\theta}{2}$

D. $2mg\cos\theta$

Answer: A

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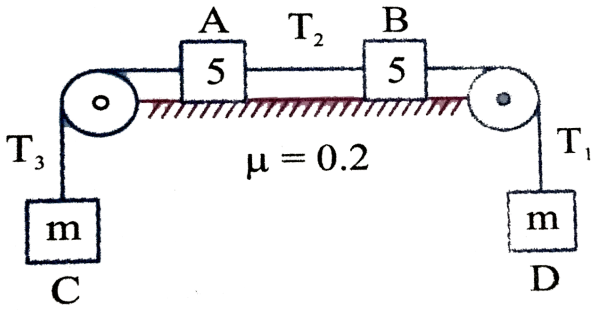
4. In the shown figure, four blocks A, B, C and D are connected by three ideal strings. Coefficient of friction between A, B and

surface is 0.2. The mass A, B and D are of $5kg$ and C is of mkg. f_A and f_B are the frictional forces action on A and B respectively. The system is allowed to move. Based on the above data answer

the following questions. (Take $g = 10m/s^2$)



If $m = 5kg$, then

A. $T_2 = 50N$, $f_A = f_B = 10N$

B. $T_2 = 40N$, $f_A = f_B = 10N$

C. $T_2 = 50N, f_A = f_B = 0$

D. $T_2 = 40N, f_A = f_B = 0$

Answer: C

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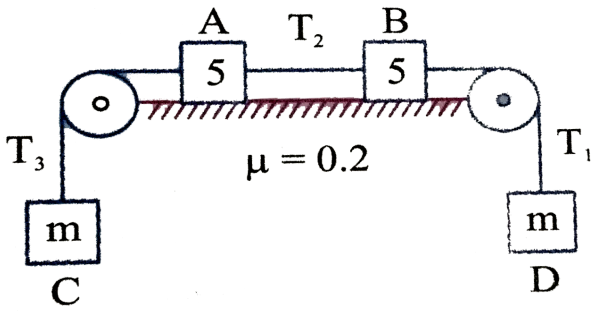
5. In the shown figure, four blocks A, B, C and D are connected by three ideal strings. Coefficient of friction between A, B and surface is 0.2. The mass A, B and D are of $5kg$ and C is of mkg. f_A and f_B are the frictional

forces action on A and B respectively. The system is allowed to move. Based on the above data answer

the following questions. (Take $g = 10m/s^2$)



If $m = 6kg$, then:

A. $T_2 = 40N$, $f_A = 10N$, $f_B = 0$

B. $T_2 = 40N$, $f_A = 20N$, $f_B = 10N$

C. $T_2 = 40N$, $f_A = 20N$, $f_B = 10N$

D. $T_2 = 50N$, $f_A = 10N$, $f_B = 0$

Answer: D

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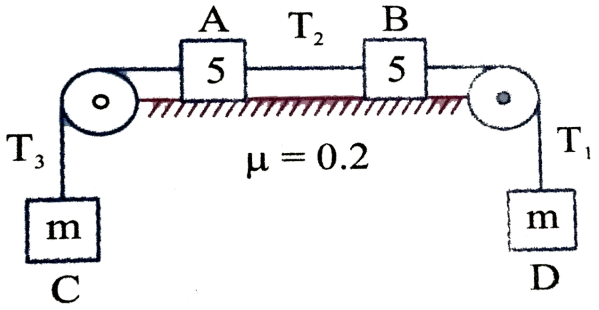
6. In the shown figure, four blocks A, B, C and D are connected by three ideal strings. Coefficient of friction between A, B and surface is 0.2. The mass A, B and D are of $5kg$ and C is of mkg. f_A and f_B are the frictional forces action on A and B respectively. The

system is allowed to move. Based on the above data answer the following questions. (Take $g = 10m/s^2$)



If $m = 4kg$ then :

A. $T_2 = 40N,\ f_A = 0,\ f_B = 10N$

B. $T_2 = 0,\ f_A = 10N,\ f_B = 10N$

C. $T_2 = 30n,\ f_A = 10N,\ f_B = 20N$

D. $T_2 = 30N,\ f_A = 10N,\ f_B = 10N$

Answer: A

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