Physicsaholics

Exercise

Newton's Laws of Motion & Friction

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Exercise-1

(Objective Type: Single Correct)

Level-2

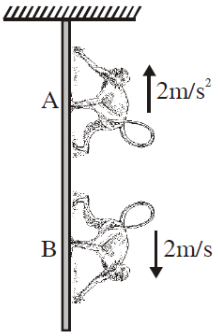
EXERCISE # O-2

Q 1. A homogeneous chain of length L lies on a table. The coefficient of friction between the chain and the table is μ. The maximum length which can hang over the table in equilibrium is: (The vertical portion of table is smooth)

(A) $\left(\frac{\mu}{\mu+1}\right)$ L (B) $\left(\frac{1-\mu}{\mu}\right)$ L

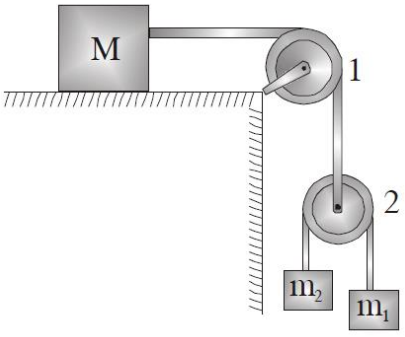
(C) $\left(\frac{1-\mu}{1+\mu}\right)$ L (D) $\left(\frac{2\mu}{2\mu+1}\right)$ L

Q 2. Two monkeys of masses 10 kg and 8 kg are moving along a vertical light rope, the former climbing up with an acceleration of 2 m/s^2, while the latter coming down with a uniform velocity of 2 m/s. Find tension in the rope at the fixed support.



(A) 180 N (B) 200 N (C) 80 N (D) 216 N

Q 3. In the arrangement shown in figure m_1 = 1kg, m_2 = 2kg. Pulleys are massless and strings are light. For what value of M the mass m_1 moves with constant velocity (Neglect friction)



(A) 6 kg (B) 4 kg

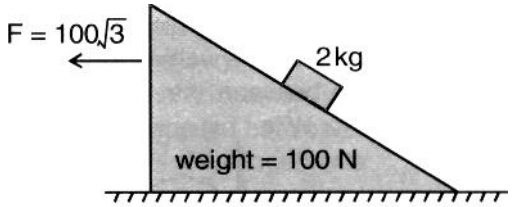
(C) 8 kg (D) 10 kg

Q 4. A flexible chain of weight W hangs between two fixed points A & B which are at the same horizontal level. The inclination of the chain with the horizontal at both the points of support is θ. What is the tension of the chain at the mid point?

(A) $\frac{W}{2}.cosec\,\theta$ (B) $\frac{W}{2}.tan\,\theta$

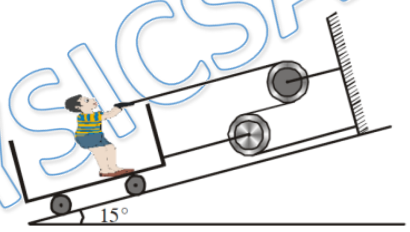
(C) $\frac{W}{2}.cot\,\theta$ (D) none

Q 5. An inclined plane of weight 100 N & angle of inclination 30° is acted upon by a horizontal force of $100\sqrt{3}$N as shown. A block of mass 2 kg was kept on the inclined plane initially. Assuming frictionless contacts. The acceleration of mass 2 kg w.r.t. ground is (take g = 10 m/s^2)



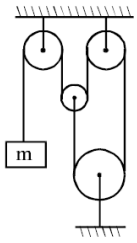
(A) 6.37 m/s^2 (B)12 m/s^2 (C)10 m/s^2 (D)5.77 m/s^2

Q 6. A trolley is being pulled up an incline plane by a man sitting on it (as shown in figure). He applies a force of 250 N. If the combined mass of the man and trolley is 100 kg, the acceleration of the trolley will be [sin15° = 0.26]



(A) 2.4 m/s^2 (B) 9.4 m/s^2 (C) 6.9 m/s^2 (D) 4.9 m/s^2

Q 7. If the string & all the pulleys are ideal, acceleration of mass m is :-



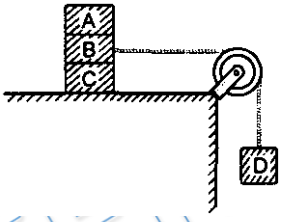
(A) $\frac{g}{2}$ (B) 0 (C) g (D) dependent on m

Q 8. The rear side of a truck is open and a box of mass 20 kg is placed on the truck 4 m away from the open end, $\mu = 0.15$ and $g = 10\ m/s^2$. The truck starts from rest with an acceleration of $2m/s^2$ on a straight road. The distance moved by the truck when box starts fall down is :-

(A) 4 m (B) 8 m

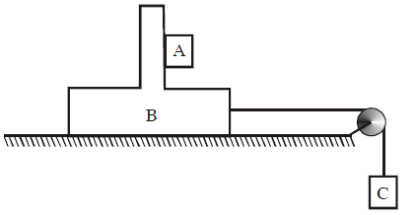
(C) 16 m (D) 32 m

Q 9. Three blocks 4 B and C of equal mass m are placed one over the other on a smooth horizontal ground as shown in figure. Coefficient of friction between any two blocks of A; B and C is 1/2. The maximum value of mass of block D so that the blocks 4 B and C move without slipping over each other is :



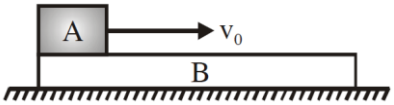
(A) 6 m (B) 5 m (C) 3 m (D) 4 m

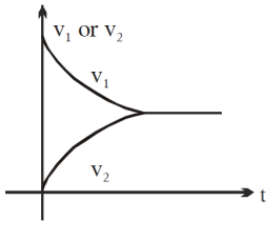
Q 10. In the arrangement shown in the figure, mass of the block B and A is 2m and m respectively. Surface between B and floor is smooth. The block B is connected to the block C by means of a string-pulley system. If the whole system is released, then find the minimum value of mass of block C so that A remains stationary w.r.t. B. Coefficient of friction between A and B is μ.

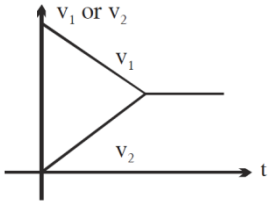


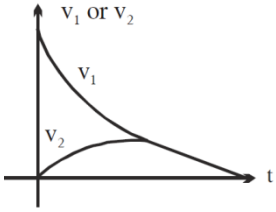
(A) $\frac{m}{\mu}$ (B) $\frac{2m+1}{\mu+1}$ (C) $\frac{3m}{\mu-1}$ (D) $\frac{6m}{\mu+1}$

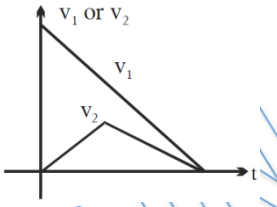
Q 11. A block A is placed over a long rough plank B of same mass as shown in figure. The plank is placed over a smooth horizontal surface. At time t = 0, block A is given a velocity v_0 in horizontal direction. Let v_1 and v_2 be the velocities of A and B at time t. Then choose the correct graph between v_1 or v_2 and t.



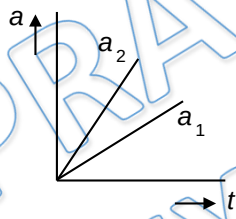
(A)


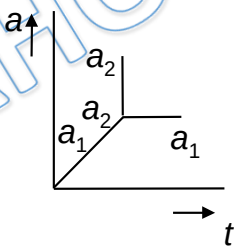
(B)


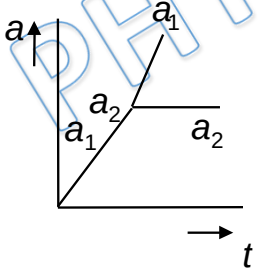
(C)


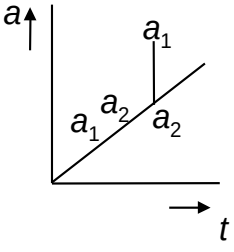
(D)


Q 12. Block *A* is placed on block *B* whose mass is greater than that of *A*. There is friction between blocks while the ground is smooth. A horizontal force *P* increasing linearly with time begins to act on *A*. The accelerations a_1 and a_2 of *A* and *B* respectively are plotted in a graph against time. Which of the following graphs represent the real situation?

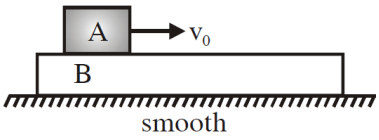
(A)


(B)


(C)


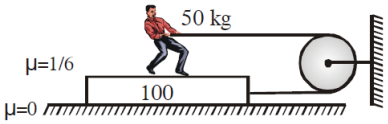
(D)


Q 13. A block A of mass m is placed over a plank B of mass 2 m. Plank B is placed over a smooth horizontal surface. The coefficient of friction between A and B is 0.5. Block A is given a velocity v_0 towards right. Acceleration of B relative to A is :-



(A) $\frac{g}{2}$ (B) g (C) $\frac{3g}{4}$ (D) Zero

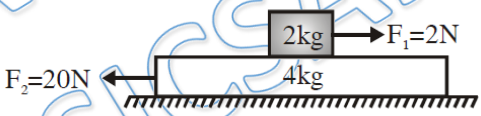
Q 14. A man of mass 50 kg is pulling on a plank of mass 100 kg kept on a smooth floor as shown with force of 100 N. If both man & plank move together, find force of friction acting on man.



(A) $\frac{100}{3}$ N towards left (B) $\frac{100}{3}$ N towards right

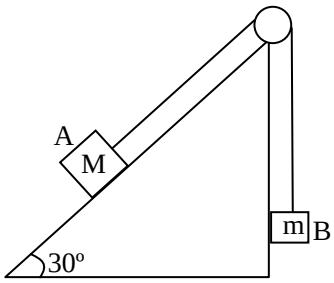
(C) $\frac{250}{3}$ N towards left (D) $\frac{250}{3}$ N towards right

Q 15. In the arrangement shown in figure, coefficient of friction between the two blocks is μ = 1/2. The force of friction acting between the two blocks is:-



(A) 8 N (B) 10 N (C) 6 N (D) 4 N

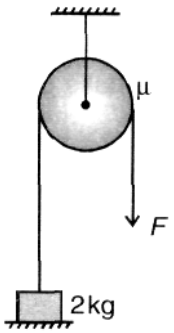
Q 16. Block A of mass M in the system shown in the figure slides down the incline at a constant speed. The coefficient of friction between block A and the surface is $\frac{1}{3\sqrt{3}}$. The mass of block B is –



(A) M/2 (B) M/3

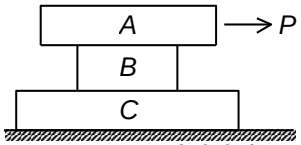
(C) 2M/3 (D) M /$\sqrt{3}$

Q17. A block of mass 2 kg is to be lifted with constant velocity by applying force F down the rope that passes over a pulley having coefficient of friction μ. The pull required is



(A)$2ge^{\frac{\pi\mu}{2}}$ (B)2g (C)$2ge^{\pi\mu}$ (D)$20e^{\frac{\pi\mu}{4}}$

Q 18. Find the least horizontal force *P* to start motion of any part of the system of the three blocks resting upon one another as shown in figure. The weight of blocks are *A* = 300N, *B* = 100 N and *C* = 200 N. Between *A* and *B*, μ = 0.3, between *B* and *C*, μ = 0.2 and between *C* and the ground μ = 0.1.



(A) 90 N (B) 60 N (C) 80 N (D) 100 N

Answer Key

Q.1) A	**Q.2) B**	**Q.3) C**	**Q.4) C**	**Q.5) C**
Q.6) D	**Q.7) C**	**Q.8) C**	**Q.9) C**	**Q.10) C**
Q.11) B	**Q.12) C**	**Q.13) C**	**Q.14) A**	**Q.15) A**
Q.16) B	**Q.17) C**	**Q.18) B**		