PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 34

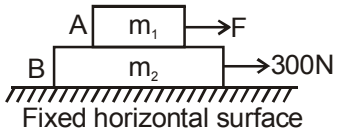
Total Marks : 25

Max. Time : 25 min.

Topics : Friction, Work, Power and Energy , Relative Motion, Newton's Law of Motion

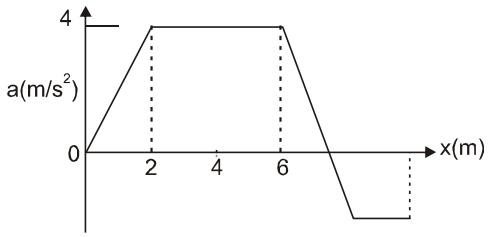
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. The coefficient of friction between block A of mass m_1 = 5 kg and block B of mass m_2 = 10 kg is μ = 0.5. There is no friction force between block B and fixed horizontal surface. A force of 300 N acts on block B in horizontal direction and a horizontal force of magnitude F acts on block A as shown, both towards right. Initially there is no relative motion between the blocks. The minimum value of F such that relative motion starts between A and B is :



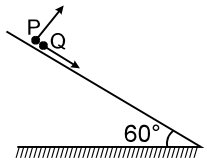
(A) 200N
(B) 187.5N
(C) 150 N
(D) 0

2. Graph shows the acceleration of a 3 kg particle as an applied force moves it from rest along x axis. The total work done by the force on the particle by the time the particle reaches x = 6 m, is equal to



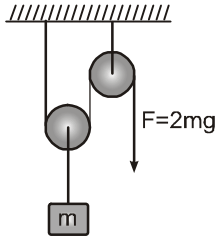
(A) 20 J
(B) 30 J
(C) 40 J
(D) 60 J

3. A particle P is projected from a point on the surface of long smooth inclined plane (see figure). Simultaneously another particle Q is released on the smooth inclined plane from the same position. P and Q collide after t = 4 second. The speed of projection of P is



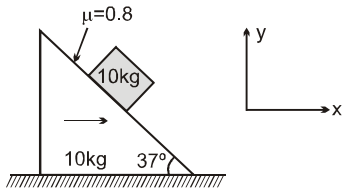
(A) 5 m/s
(B) 10 m/s
(C) 15 m/s
(D) 20 m/s

4. In the shown mass pulley system, pulleys and string are massless. The one end of the string is pulled by the force F = 2mg. The acceleration of the block will be



(A) g/2 (B) 0
(C) g (D) 3g

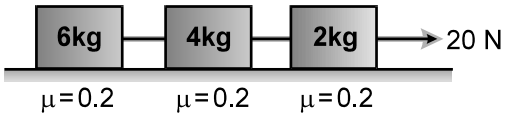
5. A wedge is moving rightwards on which a block of mass 10kg is placed on it. Friction coefficient between the wedge and the block is 0.8. [take g = 10 m/s^2]. Select correct alternative(s) among the following options



(A) If wedge is moving with constant velocity then friction acting on block is 64N.
(B) If wedge is moving with constant velocity then acceleration of block is zero.
(C) If wedge is moving with $\vec{a} = 2(\hat{i})$ m/s^2 then friction acting on block is 44N.
(D) If wedge is moving with $\vec{a} = 10(\hat{i})$ m/s^2 then friction is 20N, downward on the wedge along the inclined.

COMPREHENSION

Three blocks of masses 6 kg, 4kg & 2 kg are pulled on a rough surface by applying a constant force 20N. The values of cofficient of friction between blocks & surface are shown in figrue.



6. In the arrangement shown tension in the string connecting 4kg and 6kg masses is
(A) 8N (B) 12N (C) 6N (D) 4N

7. Friction force on 4 kg block is
(A) 4N (B) 6 N (C) 12 N (D) 8 N

8. Friction force on 6 kg block is
(A) 12 N (B) 8 N (C) 6 N (D) 4 N

Answers Key

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1. (D) **2.** (D) **3.** (B) **4.** (D)
5.(B), (C), (D) **6.** (A) **7.** (D) **8.** (B)

Hint & Solutions

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1. If F = 0

Then assuming no relative motion acceleration of

$A + B = \frac{300}{15} = 20\ m/s^2$

$\because 20\ m/s^2 > \mu g$

where $\mu = 0.5$ and $g = 10\ m/s^2$

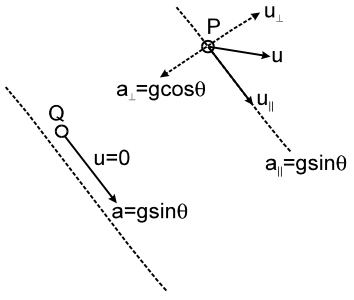
$\therefore$ relative motion shall exist. Hence F = 0 N.

यदि F = 0

2. Acceleration as shown in the graph can be converted into force by multiplying with m = 3 kg. Therefore area under the curve (F – x curve) is

$[\frac{1}{2} \times 2 \times 12] + [4 \times 12] = 60\ J.$

3. It can be observed from figure that P and Q shall collide if the initial component of velocity of P along incline. $u_{||} = 0$ that is particle is projected perpendicular to incline.



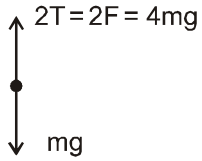
$\therefore$ Time of flight $T = \frac{2u_\perp}{g\cos\theta} = \frac{2u}{g\cos\theta}$

$\therefore$ $u = \frac{gT\cos\theta}{2} = 10\ m/s.$

4. F.B.D. of block

$\Rightarrow$ $2T - mg = ma$

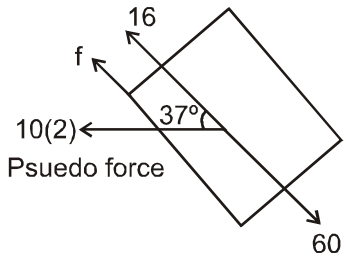
$a = 3g$



5. (A, B) If moving with constant velocity then a = 0

so friction available = $\mu mg\cos\theta$

= (0.8) (10) (10) (4/5) = 64 N.



but $mg\sin\theta = 60N$

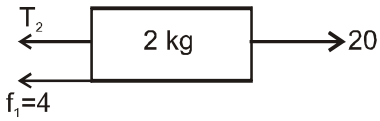
so required friction is 60N.

So net force is zero.

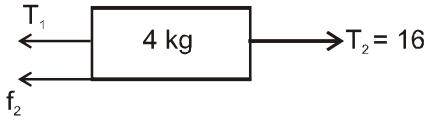
(C) $a = 2\hat{i}$ $f = mg \sin 37^\circ - m\,a \cos 37^\circ = 44$ N

(D) $f = mg \sin 37^\circ - ma \cos 37^\circ = -20$ N

6 to 8.

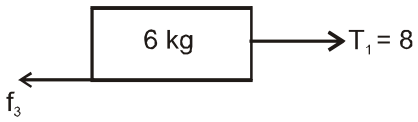


$T_2 + 4 = 20$, $T_2 = 16$ Nt



$f_2 = 8$, $T_2 = T_1 + f_2$, $T_2 = T_1 + 8$

$T_1 = 8$



$f_3 = 8$.