PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 30

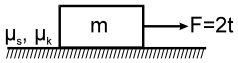
Total Marks : 21

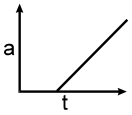
Max. Time : 21 min.

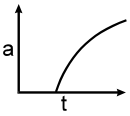
Topic : Friction

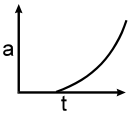
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks, 3 min.)	[9, 9]

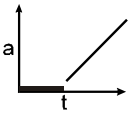
1. A force F = 2t (where t is time in seconds) is applied at t = 0 sec. to the block of mass m placed on a rough horizontal surface. The coefficient of static and kinetic friction between the block and surface are μ_s and μ_k respectively. Which of the following graphs best represents the acceleration vs time of the block. ($\mu_s > \mu_K$)



(A) 

(B) 

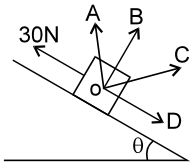
(C) 

(D) 

2. A body of mass m is kept on a rough fixed inclined plane of angle of inclination θ = 30°. It remains stationary. Then magnitude of force acting on the body by the inclined plane is equal to:

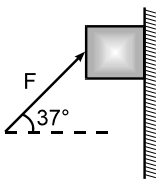
(A) mg (B) mg sin θ (C) mg cos θ (D) none of these

3. A body of mass 10 kg lies on a rough inclined plane of inclination $\theta = \sin^{-1}\frac{3}{5}$ with the horizontal. When a force of 30 N is applied on the block parallel to & upward the plane, the total reaction by the plane on the block is nearly along:



(A) OA (B) OB (C) OC (D) OD

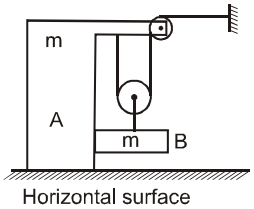
4. A 1 kg block is being pushed against a wall by a force F = 75 N as shown in the Figure. The coefficient of friction is 0.25. The magnitude of acceleration of the block is:



(A) 10 m/s² (B) 20 m/s² (C) 5 m/s² (D) none

COMPREHENSION

Figure shows an arrangement of pulleys and two blocks. All surfaces are frictionless. All pulleys and strings are massless. All strings are smooth and massless.



5. The acceleration of block A is :

(A) $\frac{2g}{9}$ (B) $\frac{g}{9}$ (C) $\frac{g}{5}$ (D) None of these

6. Normal reaction between A and ground is :

(A) mg (B) $\frac{17mg}{9}$ (C) $\frac{16mg}{9}$ (D) None of these

7. Normal reaction between A and B is :

(A) mg (B) $\frac{mg}{9}$ (C) $\frac{2mg}{9}$ (D) None of these

Answers Key

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

Hint & Solutions

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1. Let t_o be the time when friction force is maximum

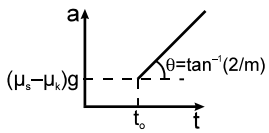
$F = 2t_o = \mu_s mg$

The block just starts moving immediately after this instant, with acceleration

$$= \frac{\mu_s mg - \mu_k mg}{m} = (\mu_s - \mu_k)\, g \text{ है ।}$$

For $t > t_o$ the acceleration of the block is

$$a = \frac{2t_o - \mu_k mg}{m}$$



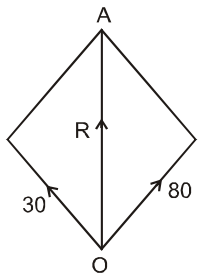
2. $N = mg\cos\theta$, $f_s = mg\sin\theta$

$R^2 = N^2 + f_s^2$

$\Rightarrow$ $R = mg$ (A).

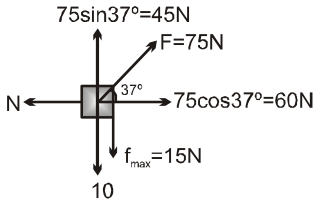
3. Frictional force along the in upward direction = $10\ g\sin\theta - 30 = 30$ Nt

$N = \log\cos\theta = 80$ Nt



Direction of R is along OA.

4.



As the upward force (45N) is greater than total downward force (25N) hence, it has an upward acceleration.

$\Sigma F_x = 0 \quad \Rightarrow \quad N = 60\ N$

$\Sigma F_y = ma_y$

$\Rightarrow \quad 45 - 25 = (1)a$

$a = 20\ m/s^2$.

Sol.(5,6,7)

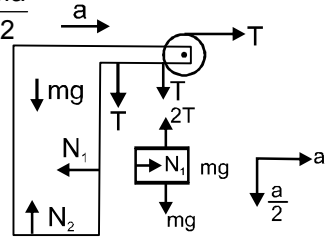
$T = 2ma$

$$mg - 2T = \frac{ma}{2}$$

$$mg - 4ma = \frac{ma}{2}$$

$$mg = \frac{9ma}{2}$$

$$a = \frac{2g}{9}$$



$$T = \frac{4mg}{9}$$

$$N_1 = ma = \frac{2mg}{9}$$

$N_2 = mg + 2T$

$N_2 = mg + 2T$

$$= mg + \frac{8mg}{9} = \frac{17mg}{9}.$$