Dear student following is a Moderate level [O O ● O O] test paper. Score of 15 Marks in 10 Minutes would be a satisfactory performance. Questions 1-8 (+3, –1). (All Questions have Single Options correct)

Q.1 If μ_k is the coefficient of kinetic friction and μ_s is the coefficient of static friction then generally :

(A) $\mu_k < \mu_s$ (B) $\mu_s < \mu_k$

(C) $\mu_k = \mu_s$ (D) $\mu_s \le \mu_k$

Q.2 If angle of repose be 30º, then coefficient of friction will be :

(A) 1 (B) $\sqrt{3}$ (C) $\frac{1}{\sqrt{3}}$ (D) $\frac{\sqrt{3}}{2}$

Q.3 Ball bearings are used to :

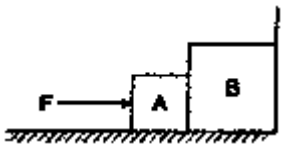
(A) convert static to dynamic friction

(B) convert limiting friction to dynamic friction

(C) convert sliding friction to rolling friction

(D) convert rolling friction to fluid friction

Q.4 Two blocks A and B of masses 5 kg and 10 kg are in contact with each other resting on a rough table against a rigid wall. A force of F = 125 N is applied horizontally on A. The coefficients of friction between the blocks and the table is 0.5 The contact force between the two blocks is



(A) 50 N (B) 100 N

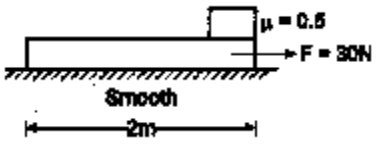
(C) 125 N (D) 75 N

Q.5 A block of mass m slides down an inclined plane of inclination θ with constant velocity. The coefficient of friction between the block and plane is μ. The contact force between the block and the plank is

(A) mg (B) mg $\sin\theta \sqrt{(1+\mu^2)}$

(C) mg $\sin\theta$ (D) $\sqrt{(mg\sin\theta)^2 + (\mu mg\cos\theta)^2}$

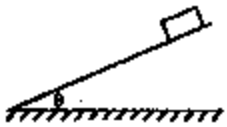
Q.6 A block of mass 1 kg is placed over a plank of mass 2 kg. The length of the plank is 2m. Coefficient of friction between the block and the plank is 0.5 and the ground over which plank is placed smooth. A constant force is F = 30N applied on the plank in horizontal direction. The time after which the block will separate from the plank is (g = 10 m/s^2)



(A) 0.73s (B) 1.2s

(C) 0.62s (D) 1.6s

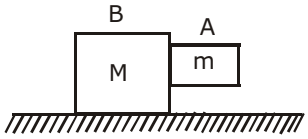
Q.7 The adjacent diagram shows a block sliding down a plane inclined at angle θ with the horizontal. As angle θ is increased, the coefficient of kinetic friction between the bottom surface of the block and the surface of the incline will



(A) Decrease (B) Increase

(C) Remain the same (D) Data not sufficient

Q.8 What minimum acceleration mass must be moved on frictionless surface so that m remains stick to it as show. The co-efficient of friction between M & m is N.



(A) μg (B) $\frac{g}{\mu}$ (C) $\frac{\mu m g}{M+m}$ (D) $\frac{\mu mg}{M}$

PHYSICS IIT JEE (JULY 1st WEEK CLASS TEST 5) (NLM & FRICTION) ANSWER KEY

Name : ..... **Roll No. :** .....

	A	B	C	D		A	B	C	D		A	B	C	D
1	○	○	○	○	4	○	○	○	○	7	○	○	○	○
2	○	○	○	○	5	○	○	○	○	8	○	○	○	○
3	○	○	○	○	6	○	○	○	○					

ANSWER KEY

Que.	1	2	3	4	5	6	7	8
Ans.	A	A	C	B	A	C	B	B

SOLUTIONS

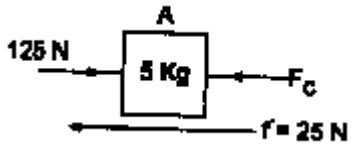
Sol.1 (A)

Sol.2 (C)

Sol.3 (C)

Ball bearings are helpful in converting the sliding friction into rolling friction. Remember rolling friction is negligible as compared to sliding friction.

Sol.4 (B)



FBD of A would be

$f = (0.5)(5)(10) = 25$ N

Equilibrium of A gives

$F_c = 125 - 25 = 100$ N

$\therefore$ Contact force between A and B is 100 N.

Sol.5 (A)

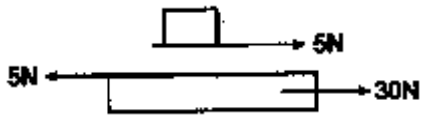
Block slides down with constant velocity. Hence, net force on the block is zero. Only two forces are acting on the block. One is weight (vertically downwards) and the other is contact force between the block and the incline. For net force to be zero, the contact force, (Friction + Normal reaction) should be equal to its weight (mg), in vertically upward direction.

Sol.6 (A)

Maximum frictional force between the block and the plank is

$f_{max} = \mu mg = (0.5)(1)(10) = 5$N.

The free body diagrams of the two will be as follows:



Acceleration of block,

$$a_1 = \frac{5}{1} = 5 \text{ m/s}^2$$

Acceleration of plank,

$$a_2 = \frac{30-5}{2} = \frac{25}{2} \text{ m/s}^2 = 12.5 \text{ m/s}^2$$

Relative acceleration of plank,

$$a = a_2 - a_1 = (12.5 - 5) \text{ m/s}^2$$

$\therefore$ $$t = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2\times 2}{7.5}} = 0.73\text{s}.$$

Sol.7 (C)

Coefficient of kinetic friction is independent of the angle. Therefore, the coefficient of kinetic friction between the bottom surface of the block and the surface of the incline will remain same.

Sol.8 (B)

The force acting on the block A are

pseudo force	$F = ma$
force of friction	$F_s = \mu N$
Weight	$W = mg$
normal reaction	$N = F$
or	$N = ma$

For A to be rest in block B frame i.e. no fall, we require

$$W = F_s$$

$$mg = \mu(ma)$$

Thus $$a = \frac{g}{\mu}.$$