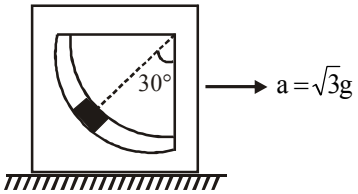
CLASS TEST

PHYSICS CLASS TEST # 26

SECTION-I

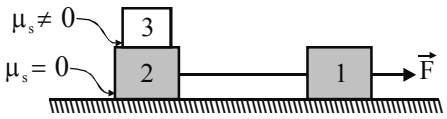
Single Correct Answer Type **8 Q. [3 M (–1)]**

1. A wedge with a rough groove in the shape of a quarter of a circle is kept on a smooth table (see figure). A disc is placed in the groove with a small clearance. Friction exists between groove and disc. The wedge is moved with an acceleration $\sqrt{3}\,g$. If disc is to remain stationary relative to groove, the coefficient of friction required can be.



(A) $\frac{1}{3}$ (B) $\frac{1}{4}$ (C) $\frac{1}{5}$ (D) $\frac{9}{10}$

2. Three blocks of equal mass M are initially at rest on smooth floor. A force $\vec{F}$ is applied to the system so that the three blocks are to move together. Mark the correct option.



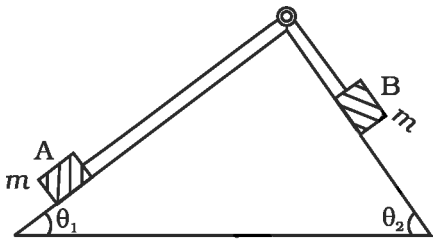
(A) The minimum coefficient of friction required is $\frac{F}{3Mg}$.

(B) The minimum coefficient of friction required is $\frac{F}{Mg}$.

(C) The minimum coefficient of friction required is $\frac{F}{2Mg}$.

(D) The minimum coefficient of friction required is $\frac{3F}{2Mg}$.

3. In figure, a body A of mass *m* slides on plane inclined at angle θ_1 to the horizontal and μ_1 is the coefficent of friction between A and the plane. A is connected by a light string passing over a frictionless pulley to another body B, also of mass *m*, sliding on a frictionless plane inclined at angle θ_2 to the horizontal. Which of the following statements is **INCORRECT** ?



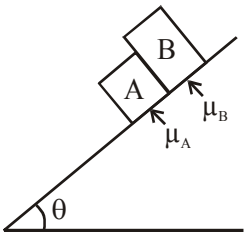
(A) B will never move up the plane.

(B) A will just start moving up the plane when $\mu_1 = \frac{\sin\theta_2 - \sin\theta_1}{\cos\theta_1}$

(C) For A to move up the plane, θ_2 must always be greater than θ_1

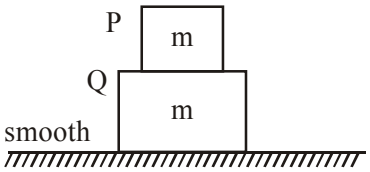
(D) B will always slide down with constant speed.

4. For given situation select the **INCORRECT** statement



(A) If $\mu_A > \mu_B$ then contact force depends on mass as well as angle of inclination of inclined plane.
(B) In every condition contact force depends on mass and the inclination of the inclined plane
(C) If $\mu_A = \mu_B$ then contact force between the blocks is zero
(D) If $\mu_A = \mu_B = 0$ then contact force between them will be zero

5. Two blocks P and Q of same mass 'm' are placed over one another, on a smooth horizontal surface. The lower block Q is held fixed and force is applied to P. The minimum force required to slide P on Q is 12N. Now if Q is free to move and force is applied to Q, then the minimum force required to slide P on Q is:

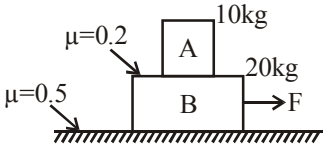


(A) 12 N (B) 18 N (C) 24 N (D) 30 N

6. A block of mass 2.5 kg is kept on a rough horizontal surface. It is found that the block does not slide if a horizontal force less than 15 N is applied to it. Also it is found that it takes 5 seconds to slide through the first 10 m if a horizontal force of 15 N is applied and the block is gently pushed to start the motion. Taking $g = 10\ m/s^2$, calculate the ratio of coefficients of static and kinetic friction between the block and the surface :-

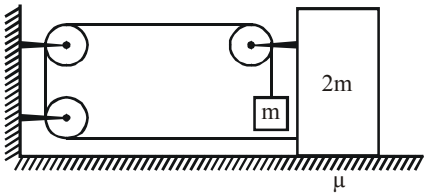
(A) $\frac{3}{5}$ (B) $\frac{13}{15}$ (C) $\frac{15}{13}$ (D) $\frac{4}{5}$

7. Two blocks A and B are as shown in figure. The minimum horizontal force F applied to the block B for which slipping begins between B and ground is :



(A) 20 N (B) 120 N (C) 150 N (D) 170 N

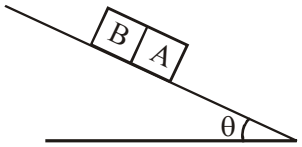
8. In the system shown in figure the friction coefficient between ground and bigger block is μ. There is no friction between both the blocks. The string connecting both the block is light, all three pulley are light and frictionless. Then the minimum limiting value of μ so that the system remains in equilibrium is :-



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

Multiple Correct Answer Type 6 Q. [4 M (–1)]

9. Two blocks having same mass are placed on rough incline plane and the coefficient of friction between A and incline is $\mu_1 = 1.0$ and between block B and incline is $\mu_2 = \frac{3}{4}$. As the inclination of the plane 'θ' with respect to horizontal increases, choose the correct answer (s).



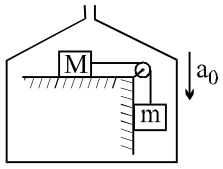
(A) There is no contact force between block A and B for $\theta \le 37°$

(B) There is no contact force between block A and B for $\theta \le 45°$

(C) As $\mu_1 > \mu_2$ both the blocks move together

(D) They start moving at an angle $\theta = \tan^{-1}\frac{7}{8}$

10. Imagine a situation in which the given arrangement is placed inside an elevator that can move only in the vertical direction and compare the situation with the case when it is placed on the ground. When the elevator accelerates downward with $a_0 (< g)$. Coefficient of friction between M and surface in contact is μ while m is smooth, then (pulley and string are ideal)



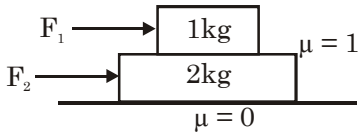
(A) the limiting friction force between the block M and the surface decreases

(B) the system can accelerate with respect to the elevator even when $m < \mu M$

(C) the system does not accelerate with respect to the elevator unless $m > \mu M$

(D) the tension in the string decreases

11. Two blocks of masses 1 kg and 2 kg are placed one over another on a smooth surface as shown. Coefficient of friction between the blocks is $\mu = 1$. Horizontal forces F_1 and F_2 are acting on 1 kg and 2kg respectively :-



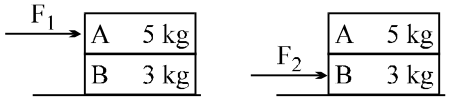
(A) If $F_1 = 9N$ and $F_2 = 0$, then both the blocks move together with common acceleration $3 m/s^2$

(B) If $F_1 = 9N$ and $F_2 = 0$, then frictional force on 1 kg will be along the direction of force.

(C) If $F_1 = 0$ and $F_2 = 36$ N, both the blocks move together with common acceleration $12 m/s^2$.

(D) If $F_1 = 1N$ and $F_2 = 2N$, frictional force will not be acting on both the blocks.

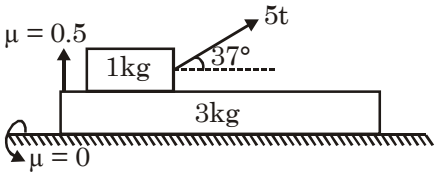
12. A block A (5 kg) rests over another block B (3 kg) placed over a smooth horizontal surface. There is friction between A and B. A horizontal force F_1 gradually increasing from zero to a maximum is applied to A so that the blocks move together without having motion relative to each other. Instead of this, another horizontal force F_2 gradually increasing from zero to a maximum is applied to B so that the blocks move together without relative motion. The magnitudes of friction between the blocks in the two cases are f_1 & f_2 respectively during the variation of F_1 and F_2 respectively. Then



(A) $f_{1max} > f_{2max}$ (B) $F_{1max} : F_{2max} = 3 : 5$

(C) $F_{1max} : F_{2max} = 5 : 3$ (D) $f_1 < F_1$

13. A block of mass 1kg is placed over a long plank of mass 3kg. The friction coefficient between block and plank is 0.5. The system is placed over a smooth horizontal surface. A time varying force F = 5t Newton starts acting on the block as shown in figure. Select the **CORRECT** alternative:-



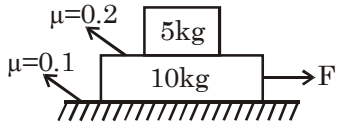
(A) Block loose contact from the plank before relative motion starts between two blocks.

(B) Block loose contact from the plank after the starts of relative motion.

(C) Relative motion between block and plank starts at $t = \frac{10}{9}$ sec.

(D) Relative motion between block and plank starts at $t = \frac{30}{9}$ sec.

14. Mass of the blocks and coefficient of friction between each surfaces are shown in the figure. Choose **CORRECT** statements :-



(A) Minimum force required to move the system is F = 10 N.

(B) For F = 30 N, both the blocks move together.

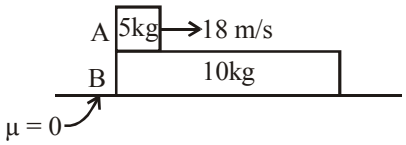
(C) For 15N < F ≤ 45N, both blocks moves with same acceleration.

(D) For F ≤ 50N, there is no relative slipping between blocks.

Linked Comprehension Type (2 Para × 2Q.) [3 M (-1)]
(Single Correct Answer Type)

Paragraph for Question No 15 and 16

Block A of mass 5kg is on a plank of mass 10kg. There is no friction between plank and ground but coefficient of friction between block and plank is 0.4. Block is given velocity 18 m/s as shown in the figure at t = 0.



15. After how much time relative motion stops between block and plank :-

(A) 4.5 sec (B) 3 sec (C) 6 sec (D) 5 sec

16. Minimum length of plank so that block does not fall off the plane :-

(A) 27 m (B) 36 m (C) 18 m (D) 24 m

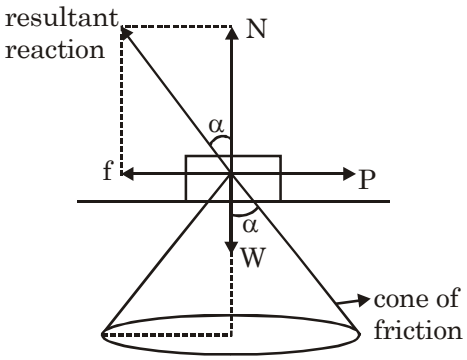
Paragraph for Questions 17 and 18

When a body is about to move on a surface in the direction of applied force, the resultant reaction force makes a limiting angle α with normal. If direction of applied force is gradually changed through an angle 360°, keeping the force in the same plane the resultant reaction of the surface, generates a right circular cone with semicentral angle α. This inverted cone with semicentral angle α is called cone of friction. If the resultant reaction force of the surface is

(i) within this cone the body is stationary

(ii) on the surface of cone, the motion of body is impending.

(iii) outside the cone of friction, the body is in motion.

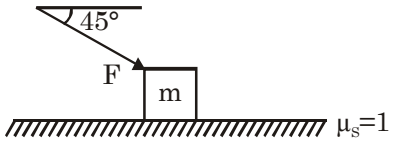


It can be inferred easily that if direction of net force [force of gravity + applied force] exerted on object placed on a surface is such that its line of action is inside the frictional cone, then object will not move regardless of magnitude of force.

17. An object is kept on a rough horizontal surface having coefficient of static friction $\mu_S = \sqrt{3}$. The semicentral angle of frictional cone will be :-

(A) 30° (B) 45° (C) 60° (D) 90°

18. An object is kept on rough horizontal surface having coefficient static friction $\mu_S = 1$, as shown. A force F is applied on the block at an angle 45°.



(A) Object may move if F is sufficiently large

(B) Object must move for all values of F

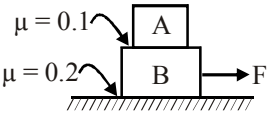
(C) Object will not move, irrespective of value of force F

(D) More information is needed.

SECTION-IV

Matrix Match Type (4 × 5) 1 Q. [8 M (for each entry +2(0))]

1. In the figure shown, the coefficient of friction between the two blocks is 0.1 and coefficient of friction between the block B and ground is 0.2, masses of A and B are 20 kg and 40 kg respectively then match the following, where a_A = acceleration of A and a_B = acceleration of B.



	Column-I		Column-II
(A)	F = 10 N	(P)	$a_A = 0$ m/s^2
(B)	F = 50 N	(Q)	$a_A = 0.5$ m/s^2
(C)	F = 150 N	(R)	$a_B = 0.5$ m/s^2
(D)	F = 300 N	(S)	$a_A = 1$ m/s^2

CLASS TEST # 26 **ANSWER KEY**

SECTION-I

Single Correct Answer Type **8 Q. [3 M (–1)]**

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

Multiple Correct Answer Type **6 Q. [4 M (–1)]**

9. Ans. (A, C, D) **10. Ans. (A,C,D)** **11. Ans. (A, D)** **12. Ans. (C, D)**
13. Ans. (B, C) **14. Ans. (B,C)**

Linked Comprehension Type **(2 Para × 2Q.) [3 M (-1)]**
(Single Correct Answer Type)

15. Ans. (B) **16. Ans. (A)** **17. Ans. (C)** **18. Ans. (C)**

SECTION-IV

Matrix Match Type (4 × 5) **1 Q. [8 M (for each entry +2(0)]**

1. Ans. (A)-P, (B)-P, (C)-Q,R, (D)-S