



**Resonance**  
Educating for better tomorrow

**TARGET : JEE (Advanced) 2015**

Course: VIJETA & VIJAY (ADP & ADR)

Date : 11-04-2015

**PHYSICS**

**DPP**

DAILY PRACTICE PROBLEMS

**NO. 02**

**TEST INFORMATION**

TEST : PART TEST (PT)-1 (3 HOURS)

(Test Date : 15-04-2015)

Syllabus : Geometrical Optics, Electrostatics, Gravitation, Kinematics, Newton's laws of motion, Friction.

This DPP is to be discussed (14-04-2015)

PT-1 to be discussed (17-04-2015)

**DPP No. # 02**

**Total Marks : 155**

**Max. Time : 168 min.**

Single choice Objective ('-1' negative marking) Q.1 to Q.17

(3 marks 3 min.) [51, 51]

Multiple choice objective ('-1' negative marking) Q.18 to Q.24

(4 marks 4 min.) [28, 28]

Subjective Questions ('-1' negative marking) Q.25 to 31

(4 marks 5 min.) [28, 35]

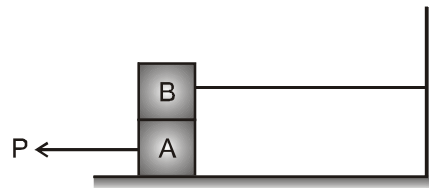
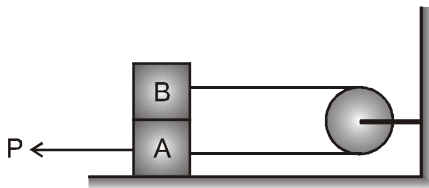
Comprehension ('-1' negative marking) Q.32 to Q.39

(3 marks 3 min.) [24, 24]

Match the Following (no negative marking) (2 × 4) Q. 40 to Q.42

(8 marks 10 min.) [24, 30]

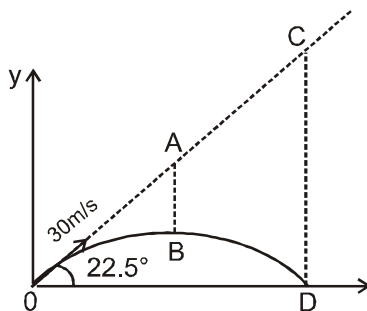
- A cannon fires successively two shells from the same point with velocity  $v_0 = 250\text{m/s}$  ; the first at the angle  $\theta_1 = 60^\circ$  and the second at the angle  $\theta_2 = 45^\circ$  to the horizontal, the azimuth being the same. Neglecting the air drag, find the approximate time interval between firings leading to the collision of the shells ( $g = 9.8\text{m/s}^2$ .)  
(A) 11 sec (B) 6 sec (C) 15 sec (D) 5 sec
- Each of the two block shown in the figure has mass  $m$ . The pulley is smooth and the coefficient of friction for all surfaces in contact is  $\mu$ . A constant horizontal force  $P$  applied in two cases shown in such a way that block A start just sliding then the value of minimum force  $P$  in case-I and case-II is :



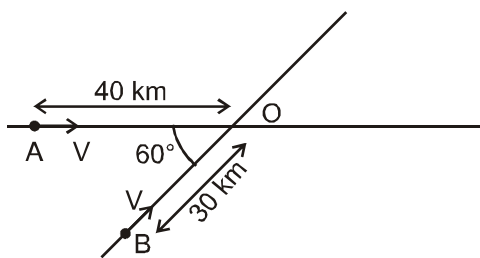
- (A)  $2\mu mg, 3\mu mg$   
(C)  $4\mu mg, 3\mu mg$

- (B)  $3\mu mg, 2\mu mg$   
(D)  $3\mu mg, 3\mu mg$

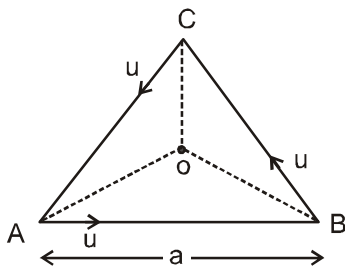
3. A particle is projected with speed 30m/s at angle  $22.5^\circ$  with horizontal from ground as shown. AB and CD are parallel to y-axis and B is highest point of trajectory of particle. CD/AB is



- (A) 3                      (B)  $3/2$                       (C) 2                      (D) 4
4. A block of mass  $m$  is pulled on an incline surface having coefficient of friction  $\mu = 1$  & angle of inclination  $\theta = 30^\circ$ , with the horizontal, such that required external force is minimum. The angle made by this force with the incline is :
- (A)  $45^\circ$                       (B)  $30^\circ$                       (C)  $75^\circ$                       (D)  $53^\circ$
5. Two cars A and B moving on two straight tracks inclined at an angle  $60^\circ$  heading towards the crossing initially their positions are as shown in the figure. Both cars have same speed. Minimum separation between them during their motion will be.

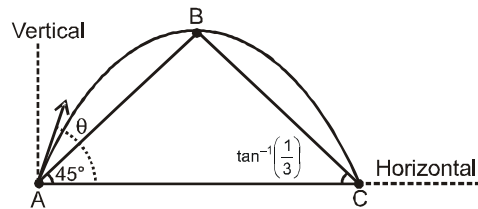


- (A) 10 km                      (B)  $5\sqrt{3}$  km                      (C) 5 km.                      (D)  $\frac{20}{\sqrt{3}}$  km
6. Three particles A, B and C situated at vertices of an equilateral triangle, all moving with same constant speed such that A always move towards B, B always towards C and C always towards A. Initial separation between each of the particle is  $a$ . O is the centroid of the triangle. Distance covered by particle A when it completes one revolution around O is



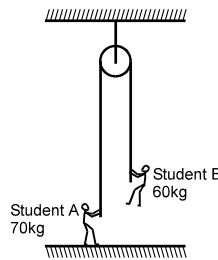
- (A)  $2a(1 - e^{-2\sqrt{3}\pi})$                       (B)  $\frac{2a}{3}(1 - e^{-2\sqrt{3}\pi})$                       (C)  $a(1 + e^{-2\sqrt{3}\pi})$                       (D)  $\frac{2a}{3}(1 - e^{-\sqrt{3}\pi})$

7. ABC is a triangle in vertical plane. Its two base angles  $\angle BAC$  and  $\angle BCA$  are  $45^\circ$  and  $\tan^{-1}(1/3)$  respectively. A particle is projected from point A such that it passes through vertices B and C. Find angle of projection in degrees:



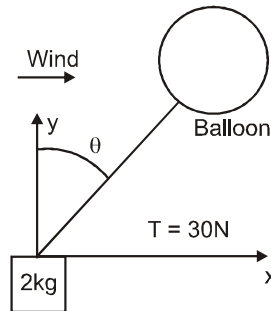
- (A)  $60^\circ$  (B)  $53^\circ$  (C)  $\tan^{-1}(5/4)$  (D)  $\tan^{-1}(5/3)$

8. A rope of negligible mass passes over a pulley of negligible mass attached to the ceiling, as shown in figure. One end of the rope is held by Student A of mass 70 kg, who is at rest on the floor. The opposite end of the rope is held by Student B of mass 60 kg, who is suspended at rest above the floor. The minimum acceleration  $a_0$  with which the Student B should climb up the rope to lift the Student A upward off the floor. ( $g = 10 \text{ m/s}^2$ )



- (A)  $\frac{1}{3} \text{ m/s}^2$  (B)  $\frac{2}{3} \text{ m/s}^2$  (C)  $\frac{4}{3} \text{ m/s}^2$  (D)  $\frac{5}{3} \text{ m/s}^2$

9. A balloon is tied to a block. The mass of the block is 2kg. The tension of the string between the balloon and the block is 30N. Due to the wind, the string has an angle  $\theta$  relative to the vertical direction.  $\cos\theta = 4/5$  and  $\sin\theta = 3/5$ . Assume the acceleration due to gravity is  $g = 10 \text{ m/s}^2$ . Also assume the block is small so the force on the block from the wind can be ignored. Then the x-component and the y-component of the acceleration  $a$  of the block.



- (A)  $9 \text{ m/s}^2, 2 \text{ m/s}^2$  (B)  $9 \text{ m/s}^2, 12 \text{ m/s}^2$  (C)  $18 \text{ m/s}^2, 2 \text{ m/s}^2$  (D)  $18 \text{ m/s}^2, 12 \text{ m/s}^2$

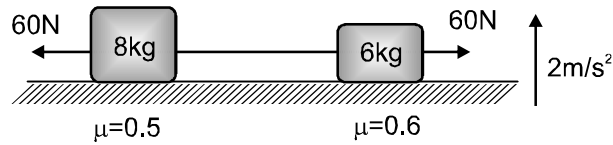
10. The maximum angle to the horizontal at which a stone can be thrown so that it always moves away from the thrower will be :

- (A)  $\sin^{-1}\left(\frac{\sqrt{2}}{3}\right)$  (B)  $\sin^{-1}\left(\frac{2\sqrt{2}}{3}\right)$  (C)  $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$  (D)  $\sin^{-1}\left(\sqrt{\frac{2}{3}}\right)$

11. A man starts walking on a circular track of radius R. First half of the distance he walks with speed  $V_1$ , half of the remaining distance with speed  $V_2$ , then half of the remaining time with  $V_1$  and rest with  $V_2$  and completes the circle. Average speed of the man during entire motion in which he completes the circle is.

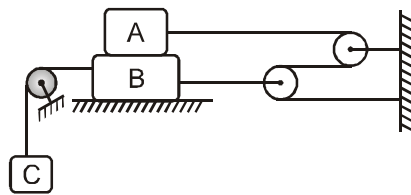
- (A)  $\frac{2V_1V_2(V_1 + V_2)}{V_2^2 + 2V_1^2 + 2V_1V_2}$  (B)  $\frac{4V_1V_2(V_1 + V_2)}{V_1^2 + 2V_2^2 + 5V_1V_2}$  (C)  $\frac{V_1V_2(V_1 + 2V_2)}{V_1^2 + V_2^2 + 4V_1V_2}$  (D)  $\frac{(V_1 + 2V_2)^2}{V_1 + V_2 + 2V_1^2V_2^2}$

12. Two blocks of masses 8 kg and 6 kg are connected with a string & placed on a rough horizontal surface. Surface itself is accelerating up with constant acceleration  $2 \text{ m/s}^2$ . Two forces 60 N each are acting on the two blocks as shown. Friction coefficient for 8 kg is 0.5 & that for 6 kg is 0.6. Tension in the string is : ( $g = 10 \text{ m/s}^2$ )



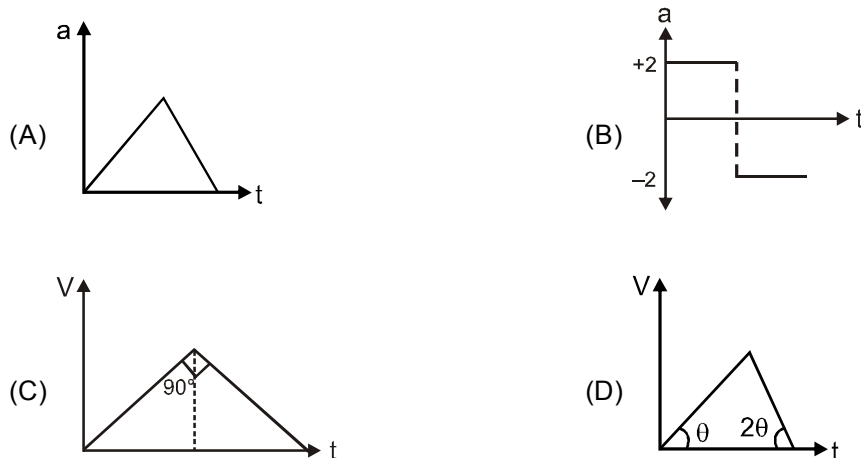
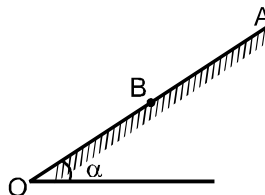
- (A) 60 N                      (B) 12 N                      (C) 43.2 N                      (D) 16.8 N

13. Block A of weight 500 N and block B of weight 700 N are connected by rope pulley system as shown. The largest weight C that can be suspended without moving block A and B is W. The coefficient of friction for all plane surfaces of contact is 0.3. The pulleys are ideal. Find  $\frac{W}{90}$ .



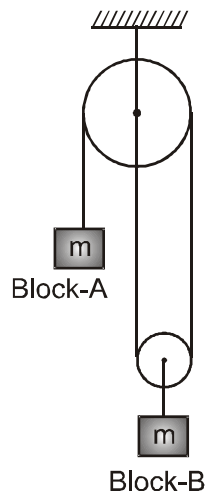
- (A) 12                      (B) 22                      (C) 9                      (D) 18

14. O is a point at the bottom of a rough plane inclined at an angle  $\alpha$  to the horizontal. Coefficient of friction between AB is  $\frac{\tan \alpha}{2}$  and between BO is  $\frac{3 \tan \alpha}{2}$ . B is the mid-point of AO. A block is released from rest at A. Then identify which graphs are correct during motion of block from point A to O taking direction down the incline plane as positive ( $\sin \alpha = 1/5$ ) :

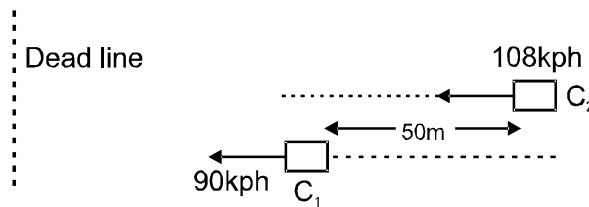




18. Both the blocks shown in figure have same mass 'm'. All the pulley and strings are massless.

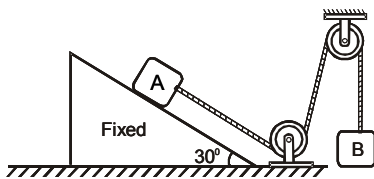


- (A) Acceleration of block A is  $\frac{2g}{5}$                       (B) Acceleration of block A is  $\frac{g}{5}$
- (C) Acceleration of block B is  $\frac{g}{5}$                       (D) Tension in the string attached with A is  $\frac{3mg}{5}$
19. Two cars  $C_1$  &  $C_2$  are moving in parallel lanes in the same direction at speeds 90 kph & 108 kph respectively. (see figure). As the traffic signal turns red, both apply brake (assume constant retardation) simultaneously. If they both stop together at the dead line :



- (A) distance of dead line from  $C_2$  is 300 m  
 (B) distance of dead line from  $C_1$  is 250 m  
 (C) time taken by the cars to end up after the signal turn red is 15 sec  
 (D) time taken by the cars to end up after the signal turn red is 20 sec
20. A man is standing on a road and observes that rain is falling at angle  $45^\circ$  with the vertical. The man starts running on the road with constant acceleration  $0.5 \text{ m/s}^2$ . After a certain time from the start of the motion, it appears to him that rain is still falling at angle  $45^\circ$  with the vertical, with speed  $2\sqrt{2} \text{ m/s}$ . Motion of the man is in the same vertical plane in which the rain is falling. Then which of the following statement(s) are true.
- (A) It is not possible  
 (B) Speed of the rain relative to the ground is 2 m/s.  
 (C) Speed of the man when he finds rain to be falling at angle  $45^\circ$  with the vertical, is 4m/s.  
 (D) The man has travelled a distance 16m on the road by the time he again finds rain to be falling at angle  $45^\circ$ .

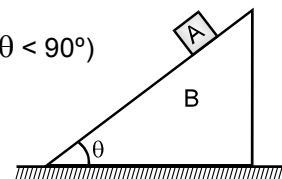
21. Two blocks A and B of equal mass  $m$  are connected through a massless string and arranged as shown in figure. The wedge is fixed on horizontal surface. Friction is absent everywhere. When the system is released from rest.



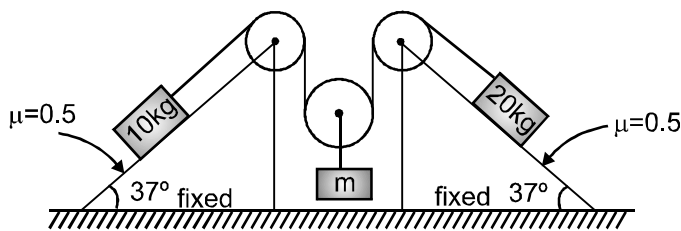
- (A) tension in string is  $\frac{mg}{2}$                       (B) tension in string is  $\frac{mg}{4}$   
 (C) acceleration of A is  $\frac{g}{2}$                       (D) acceleration of A is  $\frac{3}{4}g$

22. In the figure shown, A & B are free to move. All the surfaces are smooth. ( $0 < \theta < 90^\circ$ )

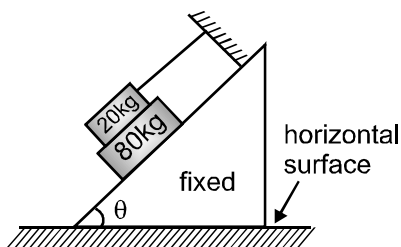
- (A) the acceleration of A will be more than  $g \sin \theta$   
 (B) the acceleration of A will be less than  $g \sin \theta$   
 (C) normal force on A due to B will be more than  $mg \cos \theta$   
 (D) normal force on A due to B will be less than  $mg \cos \theta$



23. In given arrangement, 10 kg and 20 kg blocks are kept at rest on two fixed inclined planes. All strings and pulleys are ideal. value(s) of  $m$  for which system remain in equilibrium are: ( $g = 10 \text{ m/s}^2$ )

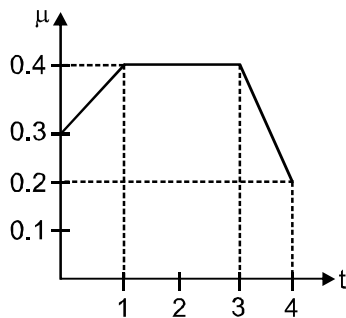


- (A)  $m = 6 \text{ kg}$                       (B)  $m = 13 \text{ kg}$                       (C)  $m = 9 \text{ kg}$                       (D)  $m = 12 \text{ kg}$
24. The system shown is in limiting equilibrium. The coefficient of friction for all contact surfaces is  $\frac{1}{4}$ .



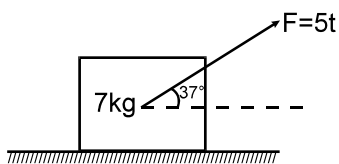
- (A)  $\tan \theta = \frac{3}{8}$   
 (B) Tension in the string =  $\left(\frac{100}{3}g \sin \theta\right) \text{ N}$   
 (C) Net frictional force on 80 kg block is  $(80g \sin \theta) \text{ N}$   
 (D) Force exerted by 20 kg block on 80 kg block is  $(20g \cos \theta)$

25. A small body is projected with a velocity of  $20.5 \text{ ms}^{-1}$  along rough horizontal surface. The coefficient of friction ( $\mu$ ) between the body and surface changes with time  $t$  (in s) as the body moves along the surface. Find the velocity at the end of 4s in m/s

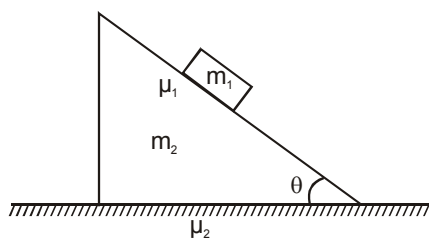


26. Position (in m) of a particle moving on a straight line varies with time (in sec) as  $x = t^3/3 - 3t^2 + 8t + 4$  (m). Consider the motion of the particle from  $t = 0$  to  $t = 5$  sec.  $S_1$  is the total distance travelled and  $s_2$  is the distance travelled during retardation. If  $s_1/s_2 = \frac{(3\alpha + 2)}{11}$  the find  $\alpha$ .

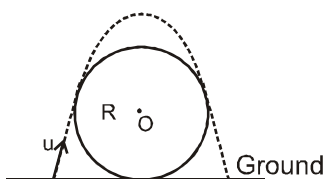
27. A block of 7 kg is placed on a rough horizontal surface and is pulled through a variable force  $F$  (in N) =  $5t$ , where 't' is time in second, at an angle of  $37^\circ$  with the horizontal as shown in figure. The coefficient of static friction of the block with the surface is one. If the force starts acting at  $t = 0$  s, Find the time at which the block starts to slide. (Take  $g = 10 \text{ m/s}^2$ ) :



28. A block of mass  $m_1$  is placed on a wedge of an angle  $\theta$ , as shown. The block is moving over the inclined surface of the wedge. Friction coefficient between the block and the wedge is  $\mu_1$ , whereas it is  $\mu_2$  between the wedge and the horizontal surface. If  $\mu_1 = \frac{1}{2}$ ,  $\theta = 45^\circ$ ,  $m_1 = 4 \text{ kg}$ ,  $m_2 = 5 \text{ kg}$  and  $g = 10 \text{ m/s}^2$ , find minimum value of  $\mu_2$  so that the wedge remains stationary on the surface. Express your answer in multiple of  $10^{-3}$ .

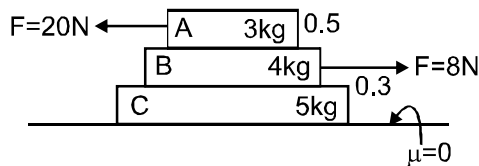


29. One has to throw a particle from one side of a fixed sphere, in diametrical plane to another side such that it just grazes the sphere. Minimum possible speed for this is  $\sqrt{2gR(\sqrt{\alpha} + \sqrt{\beta})}$ . Find  $\alpha + \beta$ .

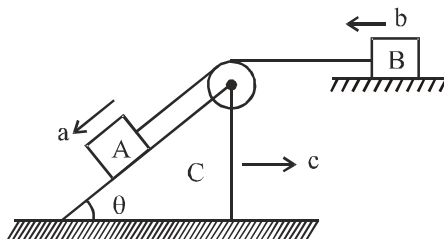




30. In the situation shown coefficient of friction between A and B is 0.5 and between B and C is 0.3. Friction acting between B and C is  $xN$  then  $\frac{9x}{7}$  is :

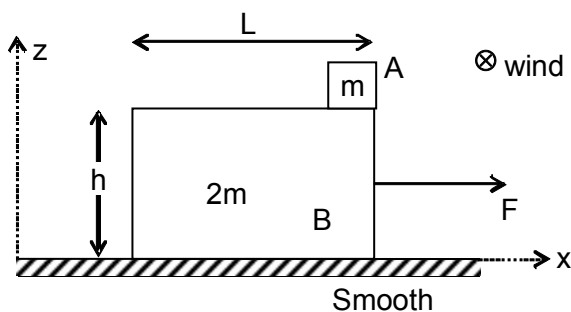


31. In the figure acceleration of bodies A, B and C are shown with directions. Values b and c are w.r.t. ground. Whereas a is acceleration of block A w.r.t. wedge C. Acceleration of block A w.r.t. ground is  $\sqrt{\beta}$  m/s<sup>2</sup>. Find  $\beta$ . (Use  $b = c = 1$  m/s<sup>2</sup>,  $\theta = 60^\circ$ )



### Comprehension-1

Two blocks A and B of masses  $m$  and  $2m$  are initially at rest. Length of block B is  $L$  and the block A is placed at the right end corner of block B and the friction coefficient between them is  $\mu = 1/2$ . At  $t = 0$  a constant force  $F = \frac{5mg}{2}$  begins to act on block B towards right. Just when the block A leaves B, wind begins to blow along  $y$ -direction which exerts a constant force  $\frac{mg}{2}$  on A. Assume the size of block A is small compared to B and neglect any rotational effects and toppling of block B. (Given  $h = 1/2$  m,  $L = 1$  m and  $g = 10$  m/s<sup>2</sup>)

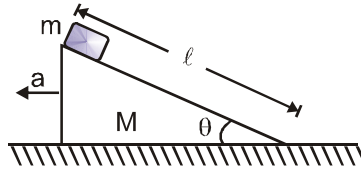


32. Find ratio of the displacements of block A along  $x$  and  $y$  directions  $S_x/S_y$  after the time block A leaves the surface of B till the time it reaches ground
- (A)  $\frac{1}{2}$       (B)  $\frac{1}{4}$       (C) 4      (D)  $\sqrt{\frac{8}{5}}$

33. The magnitude of relative acceleration of A with respect to B (in  $\text{m/s}^2$ ) just after the block A leaves B is (assume wind does not effects motion of B)
- (A)  $\sqrt{10}g$       (B)  $\frac{\sqrt{29}g}{4}$       (C)  $\frac{g\sqrt{5}}{4}$       (D)  $\frac{3\sqrt{5}}{4}g$

**Comprehension : 2**

A smooth wedge of mass M is pulled towards left with an acceleration  $a = g \cot \theta$  on a horizontal surface and a block of mass m is released w.r.t wedge. Then answer the following :

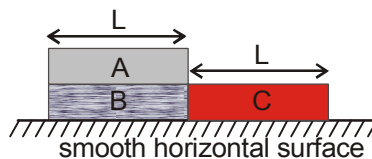


34. Time taken by the block to reach the ground is :
- (A)  $\sqrt{\frac{2l \sin \theta}{g}}$       (B)  $\sqrt{\frac{2l}{g \sin \theta}}$       (C)  $\sqrt{\frac{2l}{g \cos \theta}}$       (D)  $\frac{v}{g \sin \theta}$
35. Normal reaction between the wedge and block is :
- (A)  $mg \cos \theta$       (B)  $mg \sec \theta$       (C)  $mg \cot \theta$       (D) zero
36. Normal reaction offered by ground to the wedge is :
- (A)  $Mg$       (B)  $(M + m)g \cot \theta$       (C)  $mg \sin^2 \theta + Mg$       (D)  $(M + m)g$

**Comprehension : 3**

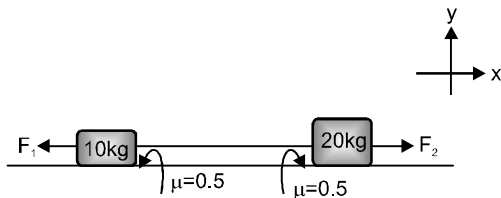
Three identical uniform blocks of mass m each and length L are placed on a smooth fixed horizontal surface as shown. There is friction between A and B (Friction coefficient  $\mu$ ) while there is no friction between A and C.

At the instant shown, that is at  $t = 0$ ; the block A has horizontal velocity of magnitude u towards right, whereas speed of B and C is zero. At the instant block A has covered a distance L relative to block B velocity of all blocks are same.



37. The speed of block A when it just loses contact with B is :
- (A)  $\frac{u}{2}$       (B)  $\frac{u}{3}$       (C)  $\frac{u}{4}$       (D)  $\frac{2u}{3}$
38. The magnitude of total work done by friction on system of three blocks is :
- (A)  $-\frac{1}{3} \mu u^2$       (B)  $-\frac{1}{4} \mu u^2$       (C)  $-\frac{2}{3} \mu u^2$       (D)  $\frac{1}{3} \mu u^2$
39. The value of  $\mu$  is
- (A)  $\mu = \frac{3 u^2}{2 gL}$       (B)  $\mu = \frac{1 u^2}{2 gL}$       (C)  $\mu = \frac{u^2}{gL}$       (D)  $\mu = \frac{2 u^2}{3 gL}$

40. Initially both blocks are at rest on a horizontal surface and string is just tight. At  $t = 0$ , two constant horizontal forces  $F_1$  and  $F_2$  start acting on blocks as shown.  $f_1$  and  $f_2$  are friction forces acting on 10 kg and 20 kg block (co-efficient of friction between blocks and ground are 0.5). Values of  $F_1$  and  $F_2$  are given in column-I. Then match magnitudes of  $f_1$ ,  $f_2$  and direction of  $\vec{f}_1$  with corresponding values of  $F_1$  and  $F_2$  given in column-II [ $g = 10 \text{ m/s}^2$ ].



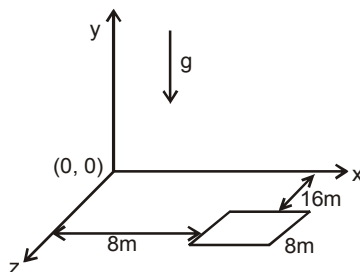
**Column-I**

- (A)  $F_2 = 120 \text{ N}$ ,  $F_1 = 40 \text{ N}$
- (B)  $F_2 = 160 \text{ N}$ ,  $F_1 = 40 \text{ N}$
- (C)  $F_2 = 60 \text{ N}$ ,  $F_1 = 90 \text{ N}$
- (D)  $F_2 = 20 \text{ N}$ ,  $F_1 = 90 \text{ N}$

**Column-II**

- (p)  $f_2 = 100 \text{ N}$ ,  $f_1 = 20 \text{ N}$
- (q)  $f_2 = 20 \text{ N}$ ,  $f_1 = 50 \text{ N}$
- (r)  $f_2 = 70 \text{ N}$ ,  $f_1 = 50 \text{ N}$
- (s) unit vector in direction of  $\vec{f}_1$  is  $\hat{i}$
- (t) unit vector in direction of  $\vec{f}_1$  is  $-\hat{i}$

41. A square platform of side length 8 m is situated in  $x$ - $z$  plane such that it is at 16 m from the  $x$ -axis and 8 m from the  $z$ -axis as shown in figure. A particle is projected with velocity  $\vec{v} = (v_2\hat{i} + 25\hat{j}) \text{ m/s}$  relative to wind from origin and at the same instant the platform starts with acceleration  $\vec{a} = (2\hat{i} + 2.5\hat{j}) \text{ m/s}^2$ . Wind is blowing with velocity  $v_1\hat{k}$ . ( $g = 10 \text{ m/s}^2$ )



**List I**

- (P) Least possible values of  $v_2$  (in m/s) so that particle hits the platform or edge of platform is
- (Q) Least possible value of  $v_1$  (in m/s) so that particle hits the platform or edge of platform is
- (R) If  $t$  is the time (in second) after particle hits the platform then  $2t$  is equal to
- (S) Value of displacement with respect to ground (in m) of the particle in  $y$ -direction, when  $v_2$  has its minimum possible value is (till particle hits the platform or edge of platform)

**List II**

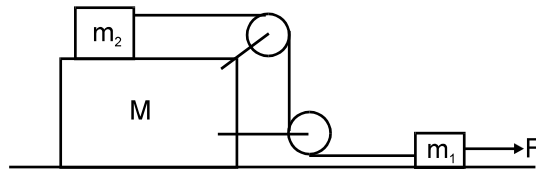
- (1) 4
- (2) 6
- (3) 8
- (4) 20

**Codes :**

	P	Q	R	S
(A)	2	4	3	1
(B)	2	1	3	4
(C)	2	3	4	1
(D)	2	1	4	3

42. Match the following :

Three blocks of masses  $m_1$ ,  $m_2$  and  $M$  are arranged as shown in figure. All the surfaces are frictionless and string is inextensible. Pulleys are light. A constant force  $F$  is applied on block of mass  $m_1$ . Pulleys and string are light. Part of the string connecting both pulleys is vertical and part of the strings connecting pulleys with masses  $m_1$  and  $m_2$  are horizontal.



- |                                |                               |
|--------------------------------|-------------------------------|
| (P) Acceleration of mass $m_1$ | (1) $\frac{F}{m_1}$           |
| (Q) Acceleration of mass $m_2$ | (2) $\frac{F}{m_1 + m_2}$     |
| (R) Acceleration of mass $M$   | (3) zero                      |
| (S) Tension in the string      | (4) $\frac{m_2 F}{m_1 + m_2}$ |

	P	Q	R	S
(A)	2	2	3	4
(B)	2	1	3	4
(C)	2	2	4	1
(D)	2	1	3	1

*Today's Quote : Enthusiasm is most powerful engines of success. When you do a thing, do it with all your might, Put your whole soul into it. Stamp it with your own personality. Be active, be energetic and faithful, and you will accomplish your object. Nothing great was ever achieve without enthusiasm.*

**ANSWER KEY OF DPP No. # 01**

1. (B)	2. (B)	3. (C)	4. (D)	5. (B)	6. (C)	7. (A)
8. (B)	9. (C)	10. (C)	11. (B)	12. (A)	13. (B)	14. (D)
15. (B)	16. (B)	17. (B)	18. (A,B,C)	19. (A,C)	20. (B,C)	21. (A,D)
22. (A,B,D)	23. (A,B,C,D)	24. 6	25. 40	26. 65	27. 1	
28. 6	29. 12	30. 60	31. 07	32. 6	33. (A)	34. (D)
35. (C)	36. (A)	37. (B)	38. (C)	39. (A)	40. (B)	41. (C)
42. (D)	43. (B)	44. (A)	45. (D)			