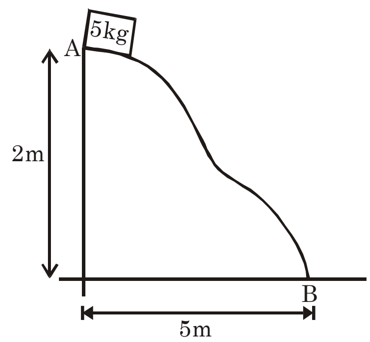
CLASS TEST

SECTION-I

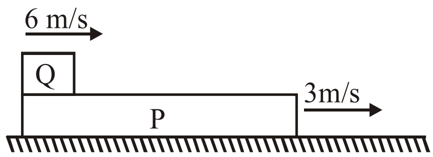
Single Correct Answer Type **9 Q. [3 M (–1)]**

1. A particle of mass 5kg is taken from point A to point B slowly with help of external force on a rough inclined surface as shown in figure. If coefficient of friction force between block & inclined plane is $\mu = 0.5$. Then find the work done by external force on block :-



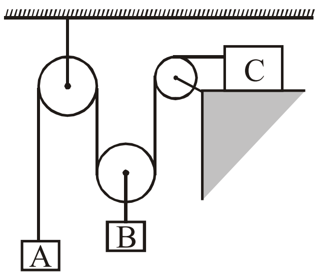
(A) 25 J (B) –225J (C) +225 J (D) –25 J

2. A plank P and block Q are arranged as shown on a smooth table top. They are given velocities 3 m/s and 6 m/s respectively. The length of plank is 1m and block is of negligible size. After some time when the block has reached the other end of plank it stops slipping on plank. The velocity of plank then is (coefficient of friction between plank and block is 0.3 and mass of plank is double of block).



(A) 4 m/s (B) 5 m/s (C) 4.5 m/s (D) zero

3. In the arrangement shown block A and C are of mass 2 kg and B is of unknown mass. When released, A moves downward by 0.5 m and C moves towards pulley by 0.5 m. Velocity of A after the displacement given is (friction is absent)

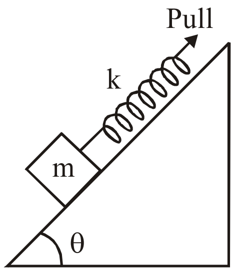


(A) $\sqrt{2}$ m/s (B) $\sqrt{3}$ m/s (C) $\sqrt{4}$ m/s (D) $\sqrt{5}$ m/s

4. Two bars of masses m_1 and m_2 connected by a non-deformed light spring rest on a horizontal plane. The coefficient of friction between the bars and the surface is equal to μ. What minimum constant force has to be applied in the horizontal direction to the bar of mass m_1 in order to shift the other bar?

(A) $\left(m_1 + \frac{m_2}{2}\right)\mu g$ (B) $\left(m_2 + \frac{m_1}{2}\right)\mu g$ (C) $\left(m_1 - \frac{m_2}{2}\right)\mu g$ (D) $\left(2m_2 + \frac{m_1}{2}\right)\mu g$

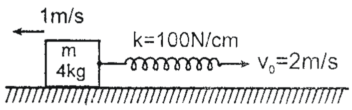
5. A block of mass m, connected to a spring of spring constant k, rests on a rough incline; the angle of incline is θ. The coefficients of friction are μ_s and μ_k respectively. The spring is slowly pulled up the incline until the block starts to move. What is the value of μ_k such that the block comes to rest when the spring is neither extended or compressed.



(A) $\mu_k = \frac{1}{2}(\mu_s - \tan\theta)$ (B) $\mu_k = (\mu_s - \tan\theta)$

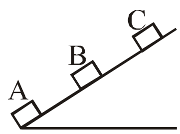
(C) $\mu_k = \frac{3}{2}(\mu_s - \tan\theta)$ (D) $\mu_k = \frac{1}{2}(\mu_s - 2\tan\theta)$

6. The spring block system lies on a smooth horizontal surface. The free end of the light spring is being pulled towards right with constant speed v_0 = 2m/s. At t = 0 sec, the spring of spring constant k = 100 N/cm is unstretched and the block has a speed 1 m/s to left. The maximum elongation in the spring is :-



(A) 2 cm (B) 4 cm (C) 6 cm (D) 8 cm

7. A block has an initial kinetic energy of 128 J. It slides up from point A at the bottom of the inclined plane with uniform deceleration. When it passes point B, its kinetic energy is reduced by 80 J, and its mechanical energy is reduced by 35 J. Calculate the work done against friction when the block moves from A to the highest point C on the inclined plane.

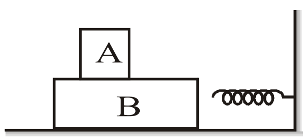


(A) 42 J (B) 48 J (C) 56 J (D) 72 J

8. A box of mass m is initially at rest on a horizontal surface. A constant horizontal force of $\frac{mg}{2}$ is applied to the box, directed to the right. The coefficient of friction changes with the distance pushed as $\mu = \mu_0 x$, where x is the distance from initial location. For what distance is the box pushed until it comes to rest again.

(A) $\frac{2}{\mu_0}$ (B) $\frac{1}{\mu_0}$ (C) $\frac{1}{2\mu_0}$ (D) $\frac{1}{4\mu_0}$

9. A block A is placed over block B having mass m & 2m respectively. Block B is resting on a frictionless surface and there is friction between block A and B . The system of blocks is pushed towards a spring with a velocity v_0 such that A doesn't slip on B by the time the system comes to momentary rest. The correct statement is :-

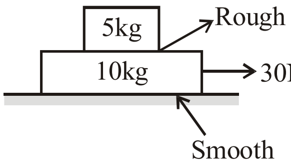


(A) Work done by friction on A is zero (B) Work done by friction on B is $-\frac{1}{2}mv_0^2$

(C) Work done by spring on B is $-\frac{3}{2}mv_0^2$ (D) None of these

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

10. In the figure shown ground is smooth, whereas surface between 10 kg block and 5 kg block is rough. A force of magnitude 30 N is applied on 10 kg block, horizontally. If net work done by friction on the system (on 10 kg and 5 kg blocks) in any time frame is zero, then cofficient of friction between 10 kg and 5 kg can be :



(A) 0.1 (B) 0.3 (C) 0.4 (D) 0.6

11. An ideal spring with spring-constant k is hung from the ceiling and a block of mass M is attached to its lower end. The mass is released with the spring initially unstretched. Then :-

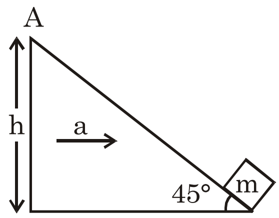
(A) The maximum extension in the spring is Mg/k

(B) The velocity of block is maximum when it has moved by distance of Mg/k

(C) The block returns to initial position with zero velocity

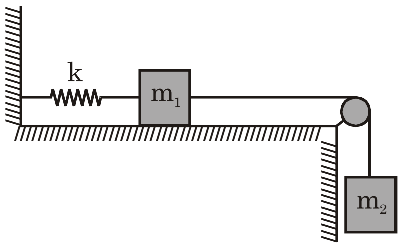
(D) The velocity of block is maximum when it has moved by a distance of $\frac{2Mg}{k}$

12. A block of mass m is kept on a smooth wedge of height h at rest. At t = 0, wedge starts moving with constant acceleration $a = \frac{3}{2}g$ as shown in figure. V represents the relative velocity of block w.r.t. wedge at A & H is the maximum height achieved by the block measured from ground.



(A) $V = \sqrt{2gh}$ (B) $V = \sqrt{gh}$ (C) $H = \frac{5h}{4}$ (D) $H = \frac{3h}{2}$

13. In the system in figure, the blocks have masses m_1 and m_2 the spring constant is k; coefficient of friction between the block 1 and the surface is μ. The system is released with zero initial speed from the position where the spring is not stretched.



(A) the maximum possible speed of the blocks is $\frac{g(m_2 - \mu m_1)}{\sqrt{k(m_1 + m_2)}}$

(B) the maximum possible speed of the blocks is $\frac{g(m_1 - \mu m_2)}{\sqrt{k(m_1 + m_2)}}$

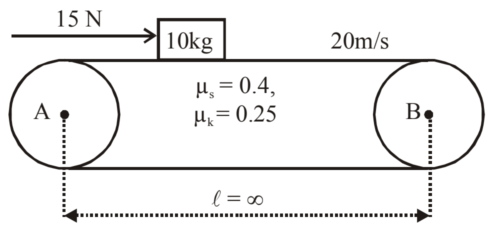
(C) the maximum possible speed of the blocks if friction is absent is $\frac{gm_2}{\sqrt{k(m_1 + m_2)}}$

(D) the maximum possible speed of the blocks if friction is absent is $\frac{gm_1}{\sqrt{k(m_1 + m_2)}}$

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

Paragraph for Question Nos. 14 & 15

A block of mass 10 kg is put gently on a belt-conveyor system of infinite length at t = 0 sec, which is moving with constant speed 20 m/sec rightward at all time, irrespective of any situation by means of a motor-system as shown in the figure. A constant force of magnitude 15 N is applied on the block continuously during its motion.



14. Work done by the kinetic friction on the block of mass 10 kg is :-

(A) 1250 Joule (B) 2500 Joule (C) –1250 Joule (D) Zero

15. The magnitude of acceleration of the block of mass 10 kg at t = 6 sec is :-

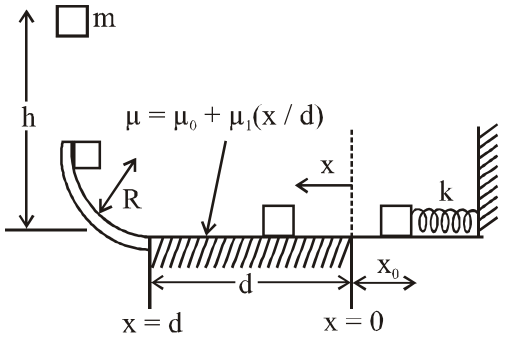
(A) 4 m/s^2 (B) 3 m/s^2 (C) 2 m/s^2 (D) Zero

Paragraph for Question no. 16 and 17

An object of mass m is released from an initial state of rest from a spring of constant k that has been compressed a distance x_0. After leaving the spring (at the position x = 0 when the spring is relaxed) the object travels a distance d along a horizontal track that has a coefficient of friction that varies with position as

$$\mu = \mu_0 + \mu_1(x / d)$$

Following the horizontal track, the object enters a quarter turn of a frictionless loop whose radius is R. Finally, after exiting the quarter turn of the loop the object travels vertically upward to a maximum height, h, (as measured from the horizontal surface).



16. Net work done by the friction force on block from x = 0 to x = d is :-

(A) $-mgd\,(\mu_0 + \mu_1)$ (B) $-mgd\,(\mu_0 + \mu_1/2)$ (C) $-2mgd\,(\mu_0 + \mu_1)$ (D) $-\frac{mgd}{2}(\mu_0 + \frac{\mu_1}{2})$

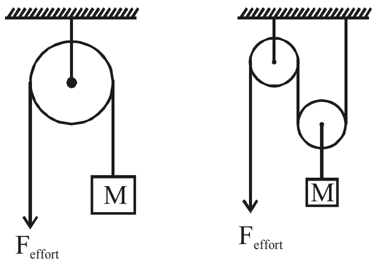
17. Maximum height (h) attained by the object is :

(A) $\frac{kx_0^2}{2mg} - d(\mu_0 + \mu_1 / 2)$ (B) $\frac{kx_0^2}{2mg} - d(\mu_0 + \mu_1)$

(C) $\frac{kx_0^2}{mg} - d(\mu_0 + \mu_1 / 2)$ (D) $\frac{kx_0^2}{2mg} - 2d(\mu_0 + \mu_1 / 2)$

Paragraph for Question no. 18 to 20

With almost four and half months are over in your present syllabus, it is foolish to ask "have you heard of pulleys". Of course you all know about pulleys, but have you really thought about utility of a pulley. The most important use of a pulley lies in the fact that a pulley not only can change direction of your effort (force), but can also make you lift a bigger weight with a smaller force. Let us consider figure 1 & 2. In both cases we have to just lift the block of mass M.

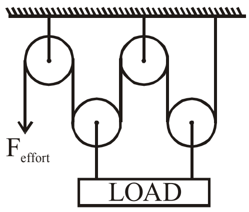


It is obvious that in case (2), F_{effort} will be half of F_{effort} in case (1) if we neglect mass of pulley and rope. This ability of pulley to lift greater weight by applying smaller force can be measured by quantity called "Mechanical Advantage". Mechanical advantage (M.A) of a pulley system can be defined as

$$\text{M.A} = \frac{\text{Weight of the load to be lifted}}{\text{Applied force to just lift the given load}}$$

So M.A. in figure (1) is 1 and in figure (2) is 2.

18. Mechanical advantage of system shown is (Assume pulleys and strings are massless and frictionless) :



(A) 2 (B) 3 (C) 4 (D) 6

19. A pulley system has M.A. = 3. If load moves up by 2cm, then distance moved by point at which effort force is applied is :

(A) 6 cm (B) 4 cm (C) 2 cm (D) 1 cm

20. Mark the **CORRECT** statement :

(A) A pulley system with higher MA indicates that we can obtain more work by doing less work
(B) A pulley system with higher MA indicates that we can obtain less work by doing more work
(C) A pulley system with lower MA indicates that we can obtain more work by doing less work
(D) None of the above options

CLASS TEST

CLASS TEST # 31			ANSWER KEY

SECTION-I

Single Correct Answer Type — **9 Q. [3 M (–1)]**

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

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

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

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

(Single Correct Answer Type)

14. Ans. (A)	**15. Ans. (D)**	**16. Ans. (B)**	**17. Ans. (A)**
18. Ans. (C)	**19. Ans. (A)**	**20. Ans. (D)**	