WORK, POWER & ENERGY, HOME WORK SHEET-1

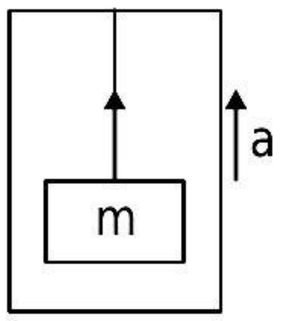
1. A rigid body of mass 6 kg is under a force which causes displacement in it given by $S = \frac{t^2}{4}$ metres where t is time. The work done by the force in first 2 seconds is

(A) 12 J (B) 9 J (C) 6 J (D) 3 J

2. A ball is released from the top of a tower. The ratio of work done by force of gravity in first, second and third second of the motion of the ball is

(A) 1 : 2 : 3 (B) 1 : 4 : 9 (C) 1 : 3 : 5 (D) 1 : 5 : 3

3. A block of mass m is suspended by a light thread from an elevator. The clevator start from rest and is accelrating upward with uniform accleration a. The work done by tension on the block during first t second is :



(A) $\frac{m}{2}(g+a)at^2$ (B) $\frac{m}{2}(g-a)at^2$ (C) $\frac{m}{2}gat^2$ (D) 0

4. A force $\vec{F} = -K(y\hat{i} + x\hat{j})$ where K is a positive constant, acts on a particle moving in the x-y plane. STarting from the origin, the particle is taken along the positive x-axis to the point (a, 0) and then parallel to the y-axis to the point (a, a). The total work done by the force $\vec{F}$ on the particle is :

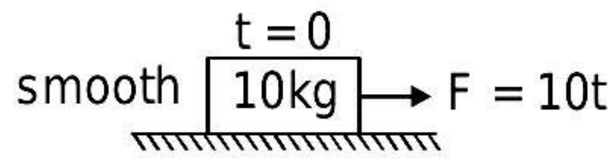
(A) $-2Ka^2$ (B) $2Ka^2$ (C) $-Ka^2$ (D) Ka^2

5. Calcualte the work done by a coolic in carrying a load of mass 10 kg on his head when he walks uniformly a distance of 5 m in the (i) horizontal direction (ii) vertical direction. (Take g = 10 m/s^2)

6. A particle moves along the x-axis from x = 0 to x = 5 m under the influence of a force F(in N) given by F = $3x^2$ – 2x + 7. Calculate the work done by this force.

7. A flexible chain of length ℓ and mass m is slowly pulled at constant speed up over the edge of a table by a force F parallel to the surface of the table. A ssuming that there is no friction between the table and chain, calculate the work done by force F till the chain reches to the horizontal surface of the table.

8. A time dependent force F = 10 t newtonis applied on 10 kg block as shownin figure.
Find out the work done by F in first 2 seconds. (block starts from rests)



ANSWERS

HOME WORK SHEET-1

1. D 2. C 3. A 4. C

5. (i) Zero (ii) 500J 6. 135 J 7. $\frac{mg\ell}{2}$ 8. 20 J

WORK, POWER & ENERGY, HOME WORK SHEET-2

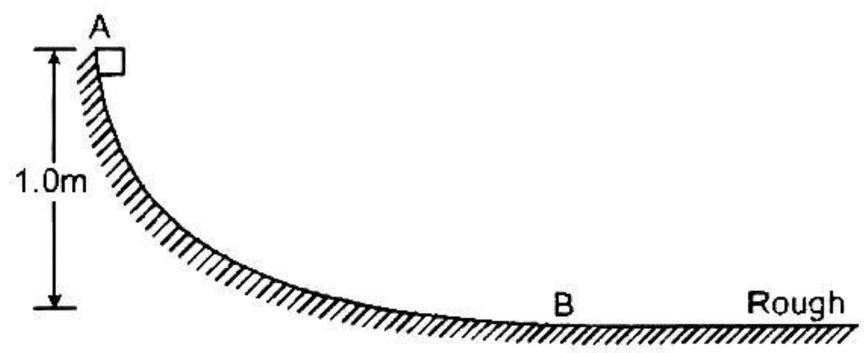
1. A body moving at 2 m/s can be stopped over a distance x. If its kinetic energy is doubled, how long will it go before coming to rest, if the retarding force remains unchanged?

(A) x (B) 2x (C) 4x (D) 8x

2. A rod of length 1 m and mass 0.5 kg hinged at one end, is initially hanging vertical. The other end is now raised slowly until it makes an angle 60º with the vertical. The required work is : (use $g = 9.8\ m/s^2$)

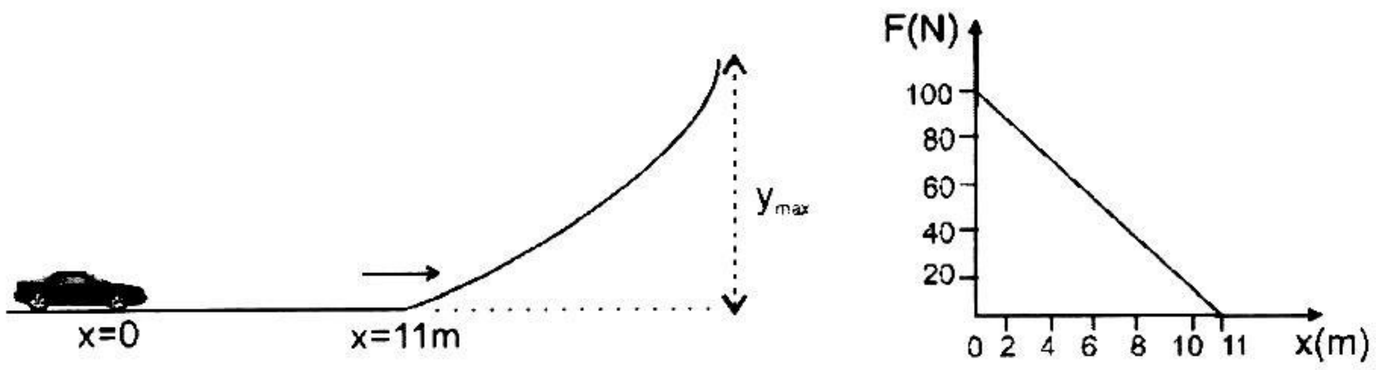
(A) 1.522 J (B) 1.225 J (C) 2.125 J (D) 3.125 K

3. A block weighing 10 N travles down a smooth curved track AB joined to a rough horizontal surface (figure). The rough surface has a friction coefficient of 0.20 with the block. If the block starts slipping on the track from a point 1.0 m above the horizontal surface, the distance it will move on the rough surface is :



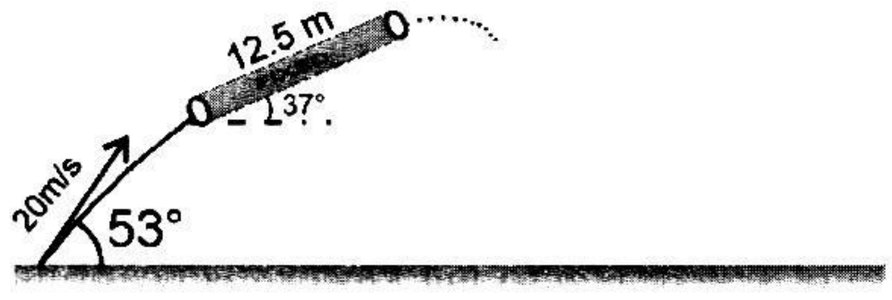
(A) 5.0 m (B) 10.0 m (C) 15.0 m (D) 20.0 m

4. A toy car of mass 5 kg moves up a ramp under the influence of force F plotted against displacement x. The maximum height attained is given by (neglect friction)



(A) $y_{max} = 20$ m (B) $y_{max} = 15$ m (C) $y_{max} = 11$ m (D) $y_{max} = 5$ m

5. A particle of mass 0.1 kg is launched at an angle of 53º with the horizontal. The particle cnters a fixed rough hollow tube whose length is slightly less than 12.5 m and which is inclined at an angle of 37º with the horizontal as shown in figure, It is known that the velocity of ball when it cnters the tube is parallel to the axis of the tube. The coeficient of friction between the particle and tube inside the tube is $\mu = \frac{3}{8}$. [Take $g = 10\ m/s^2$]



(i) The velocity of the particle as it enters the tube is :

(A) 12 m/s (B) 16 m/s (C) 9 m/s (D) 15 m/s

(ii) The kinetic energy of the particle when it comes out of the tube is approximately equal to :

(A) Zero (B) 4 J (C) 7.2 J (D) 11.2 J

(iii) The distance from the point of projection where the particle will land on the horizontal plane after coming out from the tube is approximately equal to :

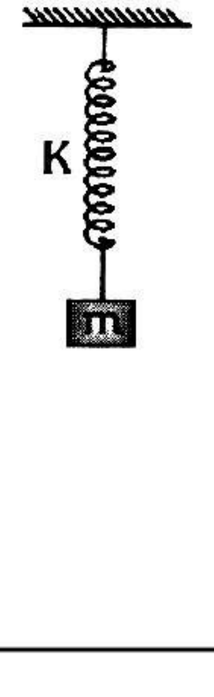
(A) 8.4 m (B) 10 m (C) 18.4 m (D) 36.8 m

6. A stone is projected with initial velocity u from a building of height h. After some time the stone falls on ground. Find out speed with it strikes the ground.

7. A force of 1000 N acts on a particle parallel to its direction of motion which is horizontal. Its velocity increases from 1 ms^{-1} to 10 ms^{-1}, when the acts through a distance of 4 metre. Calculate the mass of the particle. Given : a force of 10 newton is necessary for overcoming friction.

8. A block of mass m moving at a speed v compresses a spring through a distance x before is speed is halved. Find the spring constant of the spring.

9. Consider the situation shown in figure. Initially the spring is unstretched when the system is released from rest. Assuming no friction in the pulley, find the maximum clongation of the spring.



10. In the given figure, spring, string and pulley are massless. System released from rest when spring in its natural length. Find maximum clongation in the spring.

11. In the given figure initially spring in its natural lenght and system released from rest. Finally block again comes to at rest at mean position due to air resistance. Finally block again comes to at rest at mean position due to air resistance. Find total work done by

(i) gravitational force

(ii) spring force

(iii) force due to air resistance.

ANSWERS

HOME WORK SHEET-2

1. B 2. B 3. A 4. C

5. (i) D (ii) A (iii) C 6. $\sqrt{u^2 + 2gh}$ 7. 80 kg 8. $\frac{3mv^2}{4x^2}$ 9. 2mg/k

10. mg/K 11. (i) $\frac{m^2g^2}{K}$ (ii) $-\frac{m^2g^2}{2K}$ (iii) $\frac{-m^2g^2}{2K}$

WORK, POWER & ENERGY, HOME WORK SHEET-3

1. A stone projected up with a velocity u reaches a maximum height h. When it is at a height of 3h/4 from the ground, the ratio of KE and PE at that point is : (consider PE = 0 at the point of projectory)

(A) 1 : 1 (B) 1 : 2 (C) 1 : 3 (D) 3 : 1

2. Figure shows a particle sliding on a frictionles track which terminates in a straight horizontal section. If the particle starts slipping from the point. A how far away from the track will the particle hit the ground?

(A) At a horizontal distance of 1 m from the end of the track.
(B) At a horizontal distance of 2 m from the end of the track.
(C) At a horizontal distance of 3 m from the end of the track.
(D) Insufficient information

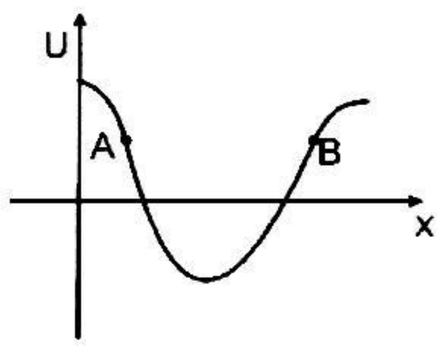
3. An electric motor creates a tension of 4500 N in hoisting eable and reels it at the rate of 2 m/s. What is the power of electric motor?

(A) 9 W (B) 9 KW (C) 225 W (D) 9000 H.P.

4. A man M_1 of mass 80 kg runs up a staircase in 15 s. Another man M_2 also of mass 80 kg runs up the star case in 20 s. The ratio of the power developed by them (P_1/P_2) will be :

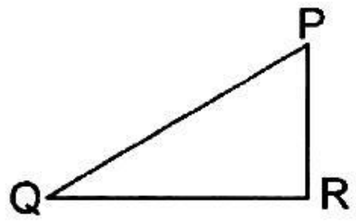
(A) 1 (B) 4/3 (C) 16/9 (D) None of the above

5. Potential energy v/s displacement curve for one dimensional conservative field is shown. Force at A and B is respectively.



(A) Positive, Positive (B) Positive, Negative (C) Negative, Positive (D) Negative, Negative

6. For the path PQR in a conservative force field (fig.), the amounts work done in carrying a body from P to Q & from Q to R are 5 J & 2 J respectively. The work done in carrying the body from P to R will be



(A) 7 J (B) 3 J (C) $\sqrt{21}$ J (D) zero

7. The potential energy for a force field $\vec{F}$ is given by U(x, y) – sin (x + y). The force acting on the particle of mass m at $\left(0, \frac{\pi}{4}\right)$ is

(A) 1 (B) $\sqrt{2}$ (C) $\frac{1}{\sqrt{2}}$ (D) 0

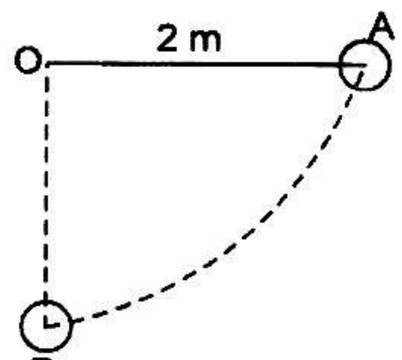
8. The negative of the work done by the conservative internal forces on a system equals the change in

(A) total energy (B) kinetic energy (C) potential energy (D) none of these

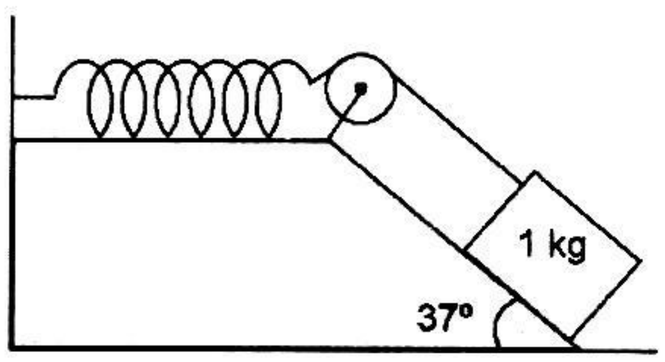
9. A spring of spring constant k placed horizontally on rought horizontal surface is compressed against a block of mass m placed on the surface so as to store maximum energy in the spring. If the coefficient of friction between the block and the surface is μ, the potential energy stored the spring is :

(A) $\frac{\mu^2 m^2 g^2}{k}$ (B) $\frac{2\mu m^2 g^2}{k}$ (C) $\frac{\mu^2 m^2 g^2}{2k}$ (D) $\frac{3\mu^2 mg^2}{k}$

10. The bob of a pendulum is released from a horizontal position A as shown in figure. If the length of the pendulum is 2 m, what is the speed with which the bob arrives at the lowermost point B, given that it dissipated 10% of its initial energy against air resistance? (gravitational potential energy is zero at B).



11. A 1 kg block situated on a rought inclined plane is connected to a spring of spring constant 100 N m^{-1} as shown. The block is released from rest with the spring in the unstreatched position. The block moves 10 cm down the incline before coming to rest. Find the coefficient of friction between the block and the incline assume that the spring has negligiblc mass and the pulley is frictionless. Take g = 10 ms^{-2}.



12. The potential energy function of a particle in a region of space is given as U – (2xy + yz)J Here x, y and z are in metre. Find the force acting on the particle at a general point P(x, y, z).

13. A lift is designed to carry a load of 4000 kg in 10 seconds uniformly through 10 floors of a building averaging 6 metre per floor. Calculate the hourse power of the lift. (Take g = 10 m s^{-2} and 1 hp = 750 watts).

14. An cngine lifts 90 metric ton of coal per hour from a mine whose depth is 200 metre. Calculate the power of the engine (use g = 9.8 m/s^2)

ANSWERS

HOME WORK SHEET-3

1. C	2. A	3. B	4. B	5. B
6. B	7. A	8. C	9. C	10. 6 m s^{-1}
11. 1/8	12. $F = -[2y\hat{i} + (2x+z)\hat{j} + y\hat{k}]$		13. 320 hp	14. 49 kW