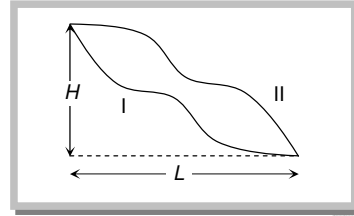


**Work, Power, Energy Assignment**

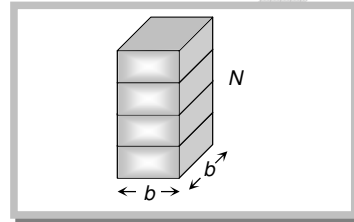
1. A body is lifted over route I and route II such that force is always tangent to the path. Coefficient of friction is same for both the paths. Work done

- (a) On both routes is same  
 (b) On route I is more  
 (c) On route II is more  
 (d) On both routes is zero



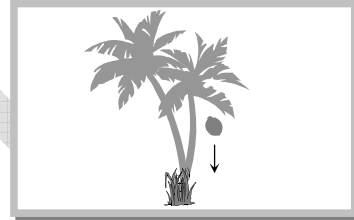
2.  $N$  similar slabs of cubical shape of edge  $b$  are lying on ground. Density of material of slab is  $D$ . Work done to arrange them one over the other is

- (a)  $(N^2 - 1)b^3 Dg$   
 (b)  $(N - 1)b^4 Dg$   
 (c)  $\frac{1}{2}(N^2 - N)b^4 Dg$   
 (d)  $(N^2 - N)b^4 Dg$



3. A coconut of mass  $m$  kg falls from its tree through a vertical distance  $m$  and could reach ground with a velocity of  $v$   $\text{ms}^{-1}$  due to air resistance. Work done by air resistance is

- (a)  $-\frac{m}{2}(2gs - v^2)$   
 (b)  $-\frac{1}{2}mv^2$   
 (c)  $-mgs$   
 (d)  $mv^2 + 2mgs$



4. If the kinetic energy of a body is directly proportional to time  $t$ , the magnitude of the force acting on the body is

- (a) Directly proportional to  $\sqrt{t}$  (b) Inversely proportional to  $\sqrt{t}$   
 (c) Directly proportional to the speed of the body (d) Inversely proportional to the speed of the body

5. A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement  $x$  is proportional to

- (a)  $x$  (b)  $x^2$  (c)  $\ln x$  (d)  $e^x$

6. An engine pumps a liquid of density  $d$  continuously through a pipe of area of cross-section  $A$ . If the speed with which the liquid passes the pipe is  $V$ , then the rate at which kinetic energy is being imparted to the liquid, is

- (a)  $\frac{1}{2}AdV^3$  (b)  $\frac{1}{2}AdV^2$  (c)  $\frac{1}{2}AdV$  (d)  $AdV^2$

7. A man of mass  $m$  is standing on a stationary flat car of mass  $M$ . The car can move without friction along horizontal rails. The man starts walking with velocity  $v$  relative to the car. Work done by him

- (a) Is greater than  $\frac{1}{2}mv^2$  if he walks along rails (b) Is less than  $\frac{1}{2}mv^2$  if he walks along rails  
 (c) Is equal to  $\frac{1}{2}mv^2$  if he walks normal to rails (d) Can never be less than  $\frac{1}{2}mv^2$

8. A chain of length  $l$  and mass  $m$  lies on the surface of a smooth sphere of radius  $R$  ( $R > l$ ) with one end tied on the top of the sphere. Then the gravitational potential energy of the chain with reference level at the center of sphere is given by

- (a)  $\frac{mR^2g}{l} \sin\left(\frac{l}{R}\right)$  (b)  $\frac{mR^2g}{l} \cos\left(\frac{l}{R}\right)$  (c)  $\frac{mR^2g}{l} \cot\left(\frac{l}{R}\right)$  (d)  $\frac{mR^2g}{l} \tan\left(\frac{l}{R}\right)$

9. The attractive force between the two particles is  $F = -G \frac{m_1 m_2}{x^2}$ . The work done in changing the distance between them from  $x$  to  $x + d$  would be

- (a)  $\frac{Gm_1 m_2}{x^2} d$  (b)  $\frac{Gm_1 m_2}{d}$  (c)  $\frac{Gm_1 m_2 d}{x(x + d)}$  (d)  $\frac{Gm_1 m_2 d}{(x + d)^2}$

## GRAVITY CLASSES

10. A rope ladder with a length  $l$  carrying a man with a mass  $m$  at its end is attached to the basket of balloon with a mass  $M$ . The entire system is in equilibrium in the air. As the man climbs up the ladder into the balloon, the balloon descends by a height  $h$ . Then the potential energy of the man

- (a) Increases by  $mg(l-h)$  (b) Increases by  $mg l$   
 (c) Increases by  $mgh$  (d) Increases by  $mg(2l-h)$

11. In above question, the potential energy of the balloon

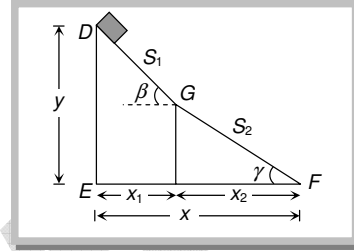
- (a) Decreases by  $mgh$  (b) Increases by  $mgh$  (c) Increases by  $mg(1-h)$  (d) Increases by  $mg l$

12. In above question, the work done by the man is

- (a)  $mg l$  (b)  $mgh$  (c)  $\frac{1}{2}mg l$  (d)  $mg(1-h)$

13. A small block mass  $m$  is released from rest from point  $D$  and slides down  $DGF$  and reaches the point  $F$  with speed  $v_F$ . The coefficient of kinetic friction between block and both the surface  $DG$  and  $GF$  is  $\mu$ , the velocity  $v_F$  is

- (a)  $\sqrt{2g(y-x)}$   
 (b)  $\sqrt{2g(y-\mu x)}$   
 (c)  $\sqrt{2gy}$   
 (d)  $\sqrt{2g(y^2+x^2)}$

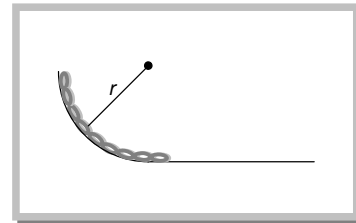


14. A mass  $m$  is thrown vertically upward into air with initial speed  $u$ . A constant force  $F$  due to air resistance acts on the mass during its travel. Taking into account the work done against air drag the maximum distance covered by the mass to reach the top is

- (a)  $\frac{u^2}{2g}$  (b)  $\frac{u^2}{2g+(2F/m)}$  (c)  $\frac{u^2}{2g+F/m}$  (d)  $\frac{u^2}{g+F/m}$

15. A smooth chain  $PQ$  of mass  $M$  rests against a  $\frac{1}{4}$ th circular and smooth surface of radius  $r$ . If released, its velocity to come over the horizontal part of the surface is

- (a)  $\sqrt{2gr} \times \frac{1}{4}$   
 (b)  $\sqrt{2gr\left(1-\frac{1}{\pi}\right)}$   
 (c)  $\sqrt{2gr\left(1-\frac{2}{\pi}\right)}$   
 (d)  $\sqrt{gr\left(1-\frac{2}{\pi}\right)}$



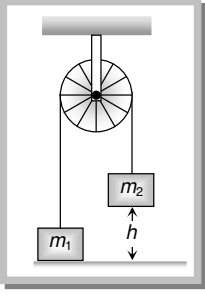
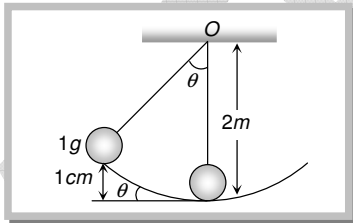
16. A hammer of mass  $M$  falls from a height  $h$  repeatedly to drive a pile of mass  $m$  into the ground. The hammer makes the pile penetrate in the ground to a distance  $d$  in single blow. Opposition to penetration is given by

- (a)  $\frac{m^2 gh}{M+md}$  (b)  $\frac{M^2 gh}{(M+m)d} + (M+m)g$  (c)  $\frac{M^2 gh}{M+md}$  (d)  $\frac{m^2 gh}{(m+M)d} - (M+m)g$

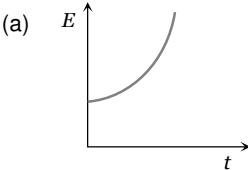
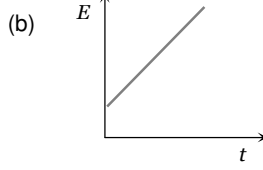
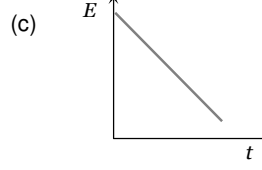
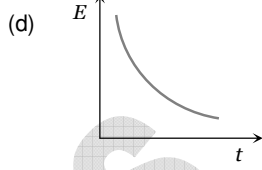
17. The height  $h$  from which a car of mass  $m$  has to fall to gain the kinetic energy equivalent to what it would have gained when moving with a horizontal velocity of  $(u+v)$  is given by

- (a)  $\frac{v}{2g}$  (b)  $\frac{v^2}{2g}$  (c)  $\frac{(u+v)^2}{2g}$  (d)  $\frac{(u+v)^2}{g}$

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18. Two masses  $m_1$  and  $m_2$  ( $m_2 > m_1$ ) are positioned as, shown in figure,  $m_1$  being on the ground and  $m_2$  at a height  $h$  above the ground. When  $m_2$  is released, the speed at which it hits the ground will be
- (a)  $\sqrt{\frac{2ghm_1}{m_2}}$   
 (b)  $\sqrt{\frac{2gh(m_1 - m_2)}{(m_1 + m_2)}}$   
 (c)  $\sqrt{\frac{2gh(m_1 + m_2)}{(m_1 - m_2)}}$   
 (d)  $\sqrt{\frac{2gh(m_2 - m_1)}{(m_1 + m_2)}}$
- 
19. A particle of mass  $1\text{ gm}$  executes an oscillatory motion on a concave surface of radius of curvature  $2m$ . If the particle starts its motion from a point at a height of  $1\text{ cm}$  from the horizontal and the coefficient of friction is  $0.01$ , then the total distance covered by the particle before it comes to rest, will be
- (a)  $5.001\text{ m}$   
 (b)  $0.015\text{ m}$   
 (c)  $1.005\text{ m}$   
 (d) None of these
- 
20. Two particles having position vectors  $\vec{r}_1 = (3\hat{i} + 5\hat{j})$  metres  $\vec{r}_2 = (-5\hat{i} - 3\hat{j})$  metres are moving with velocities  $\vec{v}_1 = (4\hat{i} + 3\hat{j})\text{ m/s}$  and  $\vec{v}_2 = (a\hat{i} + 7\hat{j})\text{ m/s}$ . If they collide after 2 seconds, the value of 'a' is
- (a) 2 (b) 4 (c) 8 (d) 1
21. Two particles of masses  $m_1$  and  $m_2$  in projectile motion have velocities  $\vec{v}_1$  and  $\vec{v}_2$  respectively at time  $t = 0$ . They collide at time  $t_0$ . Their velocities become  $\vec{v}_1$  and  $\vec{v}_2$  at time  $2t_0$  while still moving in air. The value of  $|(m_1\vec{v}_1 + m_2\vec{v}_2) - (m_1\vec{v}_1 + m_2\vec{v}_2)|$  is
- (a) Zero (b)  $[m_1 + m_2]gt_0$  (c)  $2(m_1 + m_2)gt_0$  (d)  $\frac{1}{2}(m_1 + m_2)gt_0$
22. A moving neutron is deflected by an angle of  $45^\circ$  after colliding with a stationary proton (assuming the masses of both particles equal). Then it again collides with another stationary proton and so on. In this way the particle is deflected through an angle  $45^\circ$  in each collision. When its energy becomes  $10^{-6}$  times the initial energy, the approximate number of collision must have been
- (a) 20 (b) 40 (c) 80 (d) 100
23. A body of mass  $3\text{ kg}$  is under a force which causes a displacement in it given by  $s = \frac{t^2}{3}$  (in  $m$ ) find the work done by the force in first 2 seconds
- (a)  $2\text{ J}$  (b)  $3.8\text{ J}$  (c)  $5.2\text{ J}$  (d)  $2.6\text{ J}$
24. A particle moves along the  $x$ -axis from  $x = x_1$  to  $x = x_2$  under the influence of a force given by  $F = 2x$ . Then work done in the process is
- (a) Zero (b)  $x_2^2 - x_1^2$  (c)  $2x_2(x_2 - x_1)$  (d)  $2x_1(x_1 - x_2)$
25. The force on a particle varies as  $F = \frac{9}{x^2}$ . The work done in displacing the particle from  $x = 1$  to  $x = 3$  is
- (a)  $4\text{ J}$  (b)  $3\text{ J}$  (c)  $5\text{ J}$  (d)  $6\text{ J}$
26. The energy which an electron acquires when accelerated, through a potential difference of  $1\text{ volt}$  is called
- (a)  $1\text{ Joule}$  (b)  $1\text{ eV}$  (c)  $1\text{ erg}$  (d)  $1\text{ watt}$
27. If a  $5\text{ kg}$  body falls to the ground from a height of  $30\text{ metres}$  and if all its mechanical energy is converted into heat, the heat produced will be
- (a)  $350\text{ cal}$  (b)  $150\text{ cal}$  (c)  $60\text{ cal}$  (d)  $6\text{ cal}$
28. A wound watch spring
- (a) Has no energy stored in it (b) Has kinetic energy stored in it  
 (c) Has mechanical potential energy stored in it (d) Has electrical energy stored in it
29. A bomb of  $12\text{ kg}$  explodes into two pieces of masses  $4\text{ kg}$  and  $8\text{ kg}$ . The velocity of  $8\text{ kg}$  mass is  $6\text{ m/sec}$ . The kinetic energy of the other mass is

**GRAVITY CLASSES**

- (a) 48 J                      (b) 32 J                      (c) 24 J                      (d) 288 J
30. The kinetic energy of a body is numerically equal to thrice the momentum of the body. The velocity of the body is  
 (a) 2 units                      (b) 3 units                      (c) 6 units                      (d) 9 units
31. A particle is dropped from a height  $h$ . A constant horizontal velocity is given to the particle. Taking  $g$  to be constant everywhere, kinetic energy  $E$  of the particle w. r. t. time  $t$  is correctly shown in
- (a)       (b)       (c)       (d) 
32. A neutron moving with a constant speed passes two points 3.6 m apart in  $1.8 \times 10^{-4}$  s. The kinetic energy of the neutron is  
 (a)  $2.1 \times 10^3$  eV                      (b) 2.1 eV                      (c) 21 eV                      (d)  $2.1 \times 10^{-3}$  eV
33. A body initially at rest explodes suddenly into three equal parts. The momenta of two parts are  $\hat{p}_i$  and  $2\hat{p}_j$  and their kinetic energies are  $E_1$  and  $E_2$  respectively. If the momentum and kinetic energy of the third part are  $p_3$  and  $E_3$  respectively, then the ratio  $\frac{E_2}{E_3}$  is  
 (a)  $\frac{4}{5}$                       (b)  $\frac{3}{5}$                       (c)  $\frac{2}{5}$                       (d)  $\frac{1}{5}$
34. The potential energy of a certain spring when stretched through a distance 'S' is 10 Joule. The amount of work (in joule) that must be done on this spring to stretch it through an additional distance 'S' will be  
 (a) 30                      (b) 40                      (c) 10                      (d) 20
35. A spring of force constant 800 N/m has an extension of 5 cm. The work done in extending it from 5 cm to 15 cm is  
 (a) 16 J                      (b) 8 J                      (c) 32 J                      (d) 24 J
36. If a spring extends by  $x$  on loading, then energy stored by the spring is (if  $T$  is the tension in the spring and  $k$  is the spring constant)  
 (a)  $\frac{T^2}{2x}$                       (b)  $\frac{T^2}{2k}$                       (c)  $\frac{2k}{T^2}$                       (d)  $\frac{2T^2}{k}$
37. Two springs have their force constants  $K_1$  and  $K_2$ . Both are stretched till their elastic energies are equal. If the stretching forces are  $F_1$  and  $F_2$  then  $F_1 : F_2$  is equal to  
 (a)  $K_1 : K_2$                       (b)  $K_2 : K_1$                       (c)  $\sqrt{K_1} : \sqrt{K_2}$                       (d)  $K_1^2 = K_2^2$
38. A wound watch spring  
 (a) Has no energy stored in it                      (b) Has mechanical kinetic energy stored in it  
 (c) Has mechanical potential energy stored in it                      (d) Has electrical energy stored in it
39. A force  $F = Kx^2$  acts on a particle at an angle of  $60^\circ$  with the  $x$ -axis. The work done in displacing the particle from  $x_1$  to  $x_2$  will be  
 (a)  $\frac{kx^2}{2}$                       (b)  $\frac{k}{2}(x_2^2 - x_1^2)$                       (c)  $\frac{k}{6}(x_2^3 - x_1^3)$                       (d)  $\frac{k}{3}(x_2^3 - x_1^3)$
40. When a body of mass  $m$  is taken from the surface of the earth to a height  $n$  times the earth's radius, the change in its potential energy would be  
 (a)  $mgR \left( \frac{n}{n-1} \right)$                       (b)  $mgnR$                       (c)  $mgR \left( \frac{n}{n+1} \right)$                       (d)  $mgR \left( \frac{n^2}{n^2+1} \right)$
41. A cord is used to lower vertically a block of mass  $M$  by a distance  $d$  with constant downward acceleration  $\frac{g}{4}$ . Work done by the cord on the block is  
 (a)  $Mg \frac{d}{4}$                       (b)  $3Mg \frac{d}{4}$                       (c)  $-3Mg \frac{d}{4}$                       (d)  $Mgd$
42. A boy pulls a chain of mass  $M$  and length  $L$  hanging vertically downwards from a roof top. The work done by him is  
 (a)  $\frac{1}{2} MgL$                       (b)  $MgL$                       (c)  $\frac{1}{2} MgL^2$                       (d)  $MgL^2$
43. In above question if transfer kinetic energy to  $B$  is maximum then

## GRAVITY CLASSES

- (a)  $M_B \gg M_A$  (b)  $M_B \ll M_A$   
(c)  $M_A = M_B$  (d) Can not be predicted as information is incomplete
44. In an elastic collision of two particles the following is conserved  
(a) Momentum of each particle (b) Speed of each particle  
(c) Kinetic energy of each particle (d) Total kinetic energy of both the particles
45. A particle of mass  $m$  moving with a velocity  $V$  makes a head on elastic collision with another particle of same mass initially at rest. The velocity of the first particle after the collision will be  
(a)  $V$  (b)  $-V$  (c)  $-2V$  (d) Zero
46. A particle  $P$  moving with speed  $v$  undergoes a head - on elastic collision with another particle  $Q$  of identical mass but at rest. After the collision  
(a) Both  $P$  and  $Q$  move forward with speed  $\frac{v}{2}$  (b) Both  $P$  and  $Q$  move forward with speed  $\frac{v}{\sqrt{2}}$   
(c)  $P$  comes to rest and  $Q$  moves forward with speed  $v$  (d)  $P$  and  $Q$  move in opposite directions with speed
47. A ball of mass  $10\text{ kg}$  is moving with a velocity of  $10\text{ m/s}$ . It strikes another ball of mass  $5\text{ kg}$  which is moving in the same direction with a velocity of  $4\text{ m/s}$ . If the collision is elastic, their velocities after the collision will be, respectively  
(a)  $6\text{ m/s}, 12\text{ m/s}$  (b)  $12\text{ m/s}, 6\text{ m/s}$  (c)  $12\text{ m/s}, 10\text{ m/s}$  (d)  $12\text{ m/s}, 25\text{ m/s}$
48. A body with velocity  $50\text{ m/s}$  collides with another body at rest. After collision this body moves with a velocity of  $30\text{ m/s}$ . The velocity of second body after collision in  $\text{m/s}$  is : [Suppose collision is elastic]  
(a) 30 (b) 20 (c) 50 (d) 80
49. An alpha particle collides with a stationary nucleus and continues moving at an angle of  $60^\circ$  with respect to the original direction of motion. The nucleus recoils at an angle of  $30^\circ$  with respect to this direction. Mass number of the nucleus is  
(a) 2 (b) 4 (c) 6 (d) 8
50. A sphere has a perfectly elastic oblique collision with another identical sphere which is initially at rest. The angle between their velocities after the collision is  
(a)  $30^\circ$  (b)  $45^\circ$  (c)  $60^\circ$  (d)  $90^\circ$