PHYSICS

RESONANCE ENGLISH

WORK POWER AND ENERGY

Exercise

1. An object is moving along a straight line path from P to Q under the action of a force $\overrightarrow{F} = \left(4\hat{i} - 3\hat{j} + \hat{2}k\right)N$. If the co-ordinate of

P and Q in meters are (3,2,-1) and (2,-1,4) respectively. Then the work done by the force is

A. $-15J$

B. $+15J$

C. $1015J$

D. $\left(4\hat{i}-3\hat{j}+2\hat{k}\right)$

Answer: B

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2. A bucket tied to a string is lowered at a constant acceleration of $g/4$. If mass of the bucket is m and it is lowered by a distance l then find the work done by the string on the bucket.

A. (1/4) mgd

B. (-3/4) mgd

C. (-4/3) mgd

D. (4/3) mgd

Answer: B

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3. The block of mass m initially at $x = 0$ is acted upon by a horizontal force at any position x is given as $F = a - bx^2($ where $a > \mu mg)$, as shown in the figure. The co $-$ efficient of friction between the surface of contact is μ. The net work done on the block is zero, if the block travels a distance of

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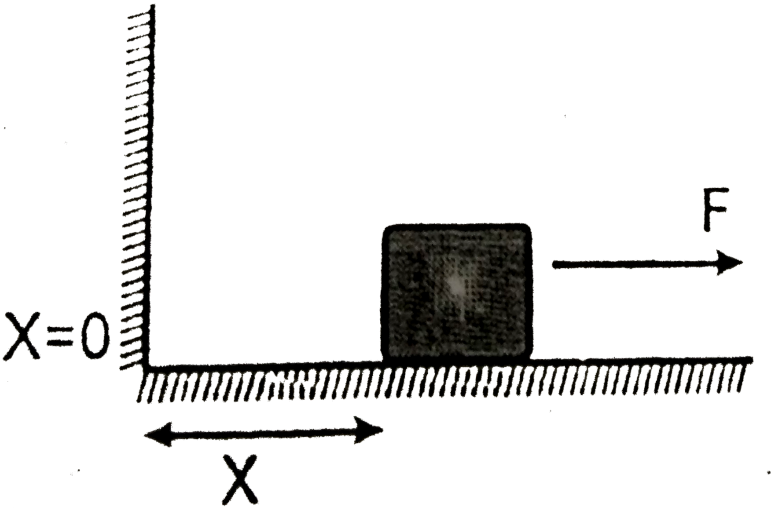

A. $\sqrt{\frac{3(b-\mu mg)}{a}}$

B. $\sqrt{\frac{3(a-\mu mg)}{b}}$

C. $\sqrt{\frac{a\mu mg}{b}}$

D. none of these

Answer: B

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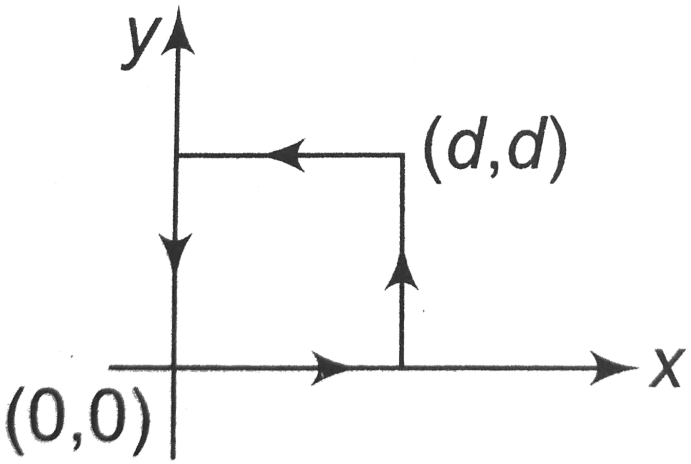
4. The work done by the force $= \vec{F} = A\left(y^2\hat{i} + 2x^2\hat{j}\right)$, where A is a constant and x and y are in meters around the

path shown is.



A. zero

B. Ad

C. Ad^2

D. Ad^3

Answer: D

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5. A chain is held on a frictionless talbe with $L/4$ hanging over. Knowing total mass of the chain is M and total length is L, the work required to slowly pull hanging part back to the table is :

A. $\frac{MgL}{16}$

B. $\frac{MgL}{8}$

C. $\frac{MgL}{32}$

D. $\frac{MgL}{24}$

Answer: C

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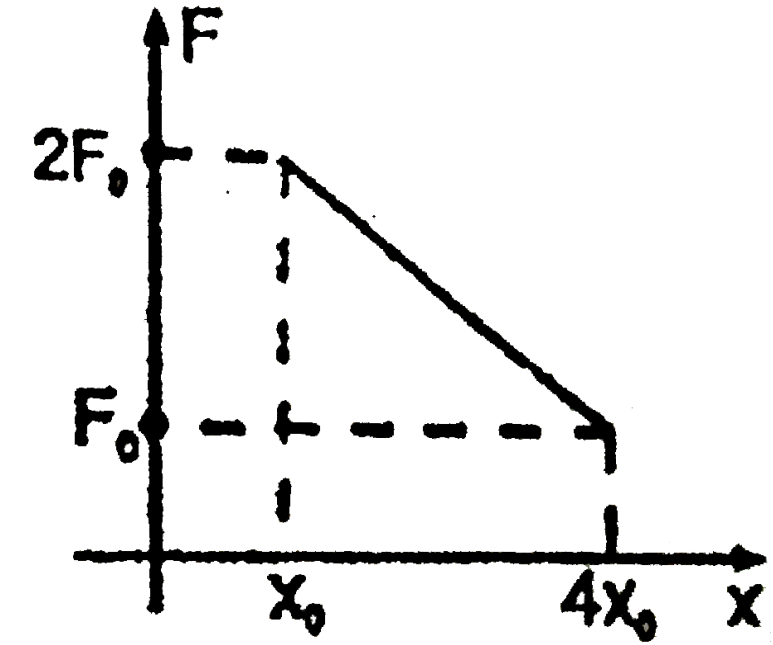
6. A particle of mass m moving along a straight line experiences force F which varies with the distance x travelled as shown in the figure. If the velocity of the particle at x_0 is

$\sqrt{\frac{2F_0x_0}{m}}$, then velocity at $4x_0$ is



A. $2\sqrt{\frac{2F_0x_0}{m}}$

B. $2\sqrt{\frac{F_0x_0}{m}}$

C. $\sqrt{\frac{F_0x_0}{m}}$

D. none of these

Answer: D

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7. Which of the following statements is not true?

A. Work done by conservative force on an object depends only on the initial and final states and not on the path taken.

B. The change in potential energy of a system corresponding to conservative intermal force is equal to negative of the work done by these forces.

C. If some of the internal force within a system are non-conservative, then the mechanical energy of the system is not constant.

D. If the internal forces are conservative, the work done by the internal forces is

equal to the change in mechanical energy.

Answer: D

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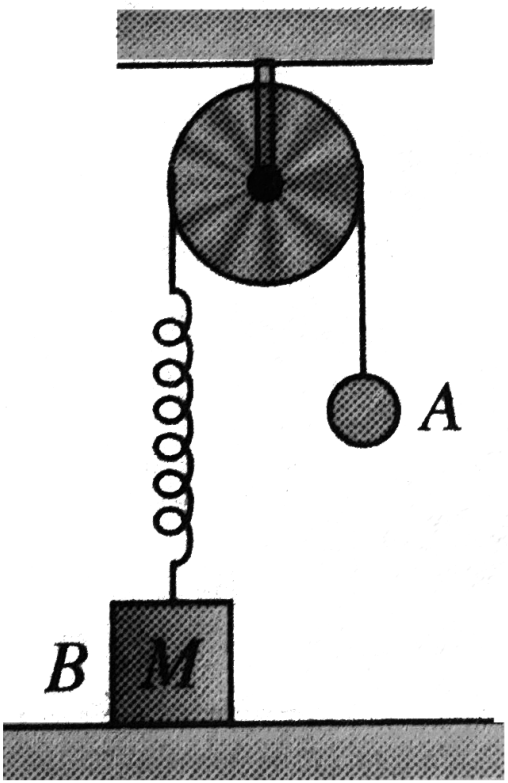
8. In figure, the ball A is released from rest, when the spring is at its natural (unstretched) length. For the block B of mass M to leave contact with ground at some stage, the

minimum mass of A must be



A. 2M

B. M

C. M/2

D. A function of M and the force constant of the spring

Answer: C

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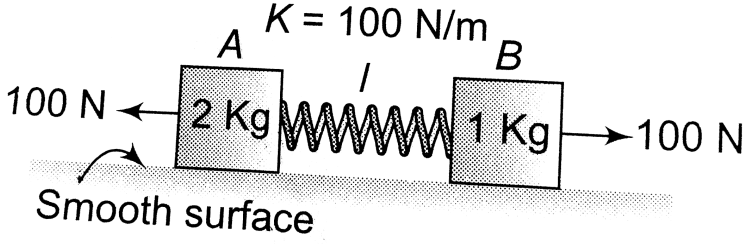
9. In the figure shown initial spring is in unstretched state and blocks are at rest. Now $100N$ force is applied on block A and B as shown in figure. After same time velocity of 'a' becomes $2m/s$ and that of 'B' $4m/s$ and

block A displaced by amount $10cm$ and spring is spring is streched by amount $30cm$. Then work done by spring force on A will be:



A. 9/3 J

B. $-6J$

C. 6J

D. None of these

Answer: B

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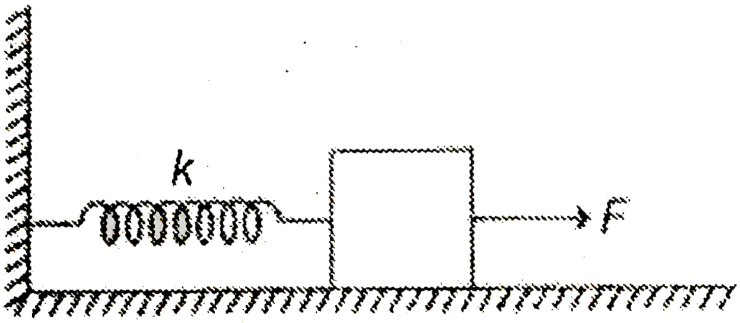
10. A block attached to a spring, pulled by a constant horizontal force, is kept on a smooth surface as shown in the figure. Initially, the spring is in the natural state. Then the maximum positive work that the applied force F can do is [Given that spring does not break]



A. $\frac{F^2}{K}$

B. $\frac{2F^2}{K}$

C. ∞

D. $\frac{F^2}{2K}$

Answer: B

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11. A body is projected with kinetic energy k at angle ϕ with the vertical. Neglecting friction,

its potential energy at the highest point will be

A. $k\cos^2\phi$

B. $k\sin^2\phi$

C. k

D. zero

Answer: A

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12. A man places a chain (of mass m and length l) on a table slowly. Initially, the lower end of the chain just touches the table. The main brings down the chain by length $l/2$. Work done by the man in this process is

A. $-mg\frac{l}{2}$

B. $-\frac{mgl}{4}$

C. $-\frac{3mgl}{8}$

D. $-\frac{mgl}{8}$

Answer: C

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13. Power supplied to a mass $2kg$ varies with time as $P = \frac{3t^2}{2}$ watt. Here t is in second . If velocity of particle at $t = 0 is v = 0$, the velocity of particle at time $t = 2s$ will be:

A. 1 m/s

B. 4m/s

C. 2m/s

D. $\sqrt{2} m / s$

Answer: C

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14. A constant power P is applied to a particle of mass m. The distance traveled by the particle when its velocity increases from v_1 to v_2 is (neglect friction):

A. $\frac{3P}{m}\left(v_2^2 - v_1^2\right)$

B. $\frac{m}{3P}\left(v_2^3 - v_1^3\right)$

C. $\frac{m}{3P}\left(v_2^2 - v_1^2\right)$

D. $\frac{m}{3P}(v_2 - v_1)$

Answer: B

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15. The force acting on a body is inversely proportional to the distance (x) covered. The work done is proportional to

A. Straight line path

B. s^2

C. $\sqrt{s}$

D. none of these

Answer: D

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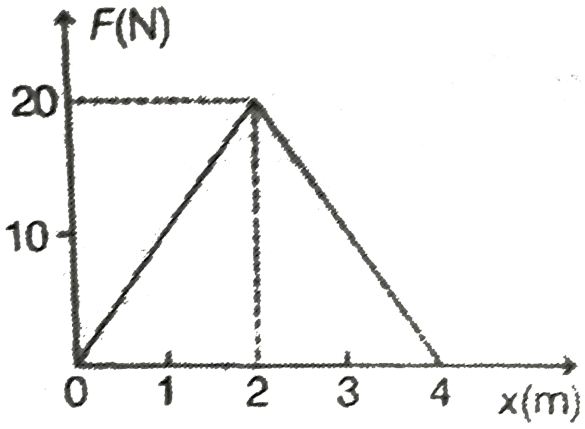
16. The graph between the resistance force F acting on a body and the distance covered by the body is shown in the figure. The mass of the body is 25kg and initial velocity is $2m/s^2$. When the distance covered by the body is 4m,

its kinetic energy would be



A. 50 J

B. 40J

C. 20J

D. 10 J

Answer: D

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17. 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^2

B. e^x

C. x

D. $\log_e x$

Answer: A

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18. A body is falling under gravity . When it loses a gravitational potential energy U, its speed is v. The mass of the body shell be

A. $2U/v^2$

B. $2v/U^2$

C. $2v/U$

D. $U^2/2v$

Answer: A

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19. A block of mass m is attached to two unstretched springs of spring constants k_1 and k_2 as shown in figure. The block is displaced towards right through a distance x and is released. Find the speed of the block as

it passes through the mean position shown.

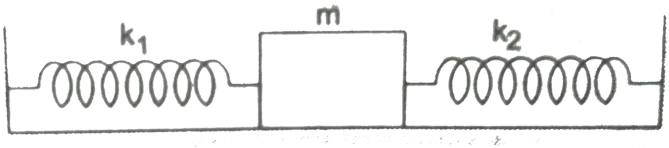

Figure 8-E9

A. $\sqrt{\frac{k_1 + k_2}{m}}x$

B. $\sqrt{\frac{k_1 k_2}{m(k_1 + k_2)}}x$

C. $\sqrt{\frac{k_1^2 k_2^2}{m\left(k_1^2 + k_2^2\right)}}x$

D. $\sqrt{\frac{k_1^3 k_2^3}{m\left(k_1^3 + k_2^3\right)}}$

Answer: A

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20. A body of mass m dropped from a certain height strikes a light vertical fixed spring of stiffness k. The height of its fall before touching the spring if the maximum compression of the spring is equal to $\frac{3mg}{k}$ is

A. $\frac{3mg}{2k}$

B. $\frac{2mg}{k}$

C. $\frac{3mg}{4k}$

D. $\frac{mg}{4k}$

Answer: A

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21. A particle moves with a velocity $5\hat{i} - 3\hat{j} + 6\hat{k}ms^{-1}$ under the influence of a constant force F=10hati+10hatj+20hatk N. The instantaneous power applied to the particle is

A. 200 J/s

B. 40J/s

C. 140 J/s

D. 170 J/s

Answer: C

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22. An electric motor creates a tension of 4500 newton in a hoisting cable and reels it at the rate of $2m / s$. What is the power of the motor ?

A. 9W

B. 9 KW

C. 225 W

D. 9000 H.P.

Answer: B

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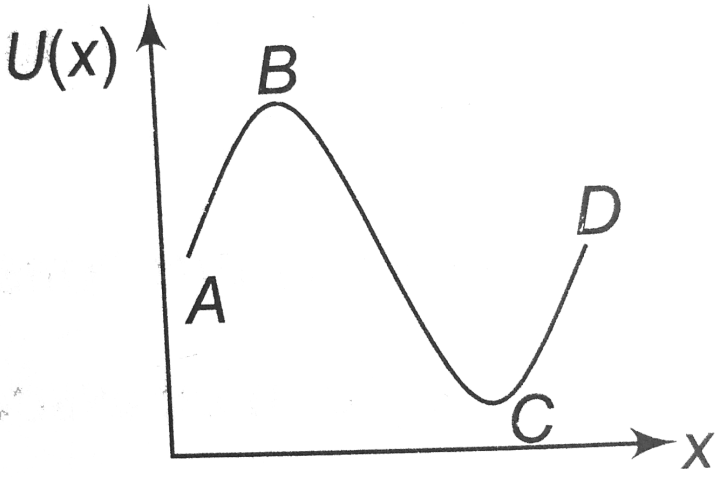
23. The potential energy of a partical veries with distance x as shown in the graph.



The force acting on the partical is zero at

A. C

B. B

C. B and C

D. A and D

Answer: C

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24. The potential energy of a force filed $\vec{F}$ 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

Answer: A

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25. A spring of force constant 800 Nm^{-1} has an extension of 5 cm. The work done in extending it from 5 cm to 15 cn is

A. 16J

B. 8J

C. 32J

D. 24 J

Answer: B

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26. A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to

A. $t^{3/4}$

B. $t^{3/2}$

C. $t^{1/4}$

D. $t^{1/2}$

Answer:

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27. The total work done on a particle is equal to the change in its mechanical energy

A. if the forces acting on are conservative

B. if gravitational force alone acts on it

C. if elastic alone acts on it.

D. none of these

Answer: D

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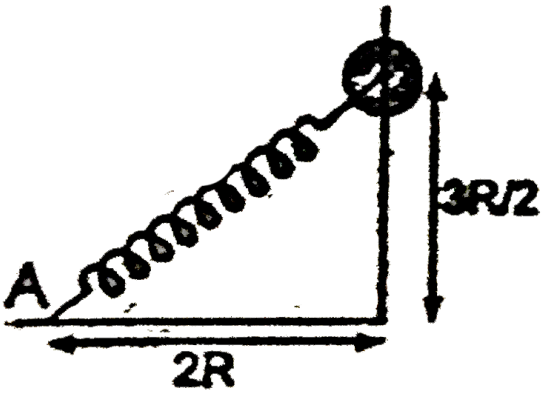
28. A ring of mass m can slide over a smooth vertical rod. The ring is connected to a spring of force constant $K = \frac{4mg}{R}$ where 2R is the natural length of the spring. The other end spring is fixed to the ground at a horizontal distance 2R from the base of the rod. the mass

is released at a height of 1.5 R from ground.



A. work done by the spring will be $\frac{mgR}{2}$

B. work done by the spring will be $9mgR$

C. the velocity of the ring when it reaches the ground will be $\sqrt{gR}$

D. the velocity of the ring when it reaches the ground will be $2\sqrt{gR}$

Answer: D

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29. The kinetic energy of a particle continuously increases with time. Then

A. the resultant force on the particle must be parallel to the velocity at all instants.

B. the resultant force on the particle must be at an angle less than 90° with the

velocity all the time

C. its height above the ground level must continuously decreases

D. the magnitude of its linear momentum is decreasing continuously

Answer: B

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30. If force is always parallel to motion

A. KE remains constant

B. work done =0

C. speed will increases

D. velocity is constant

Answer: C

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31. The given plot shows the variation of U, the potential energy of interation between two particles, with the distance separating them, r.

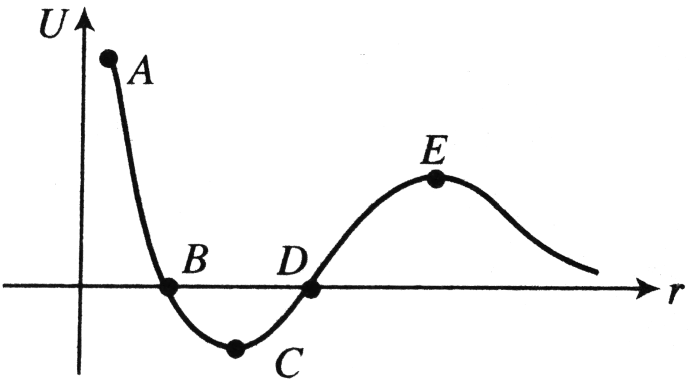
1. B and D are equilibrium points.

2. C is point of stable equilibrium.

3. The force of interaction between the two particles is attractive between points C and B, and repulsive between pionts D and E on the curve.

4. The force of interaction between the particle is repulsive between points C and A.

Which of the above statements are correct?



A. B and D are equilibrium points

B. C is point of unstable equilibrium

C. The force of interaction between the two particles is attractive between points C and D and repulsive between points D and E on the curve.

D. The force of interaction between the particles is repulsive between points E and F on the curve.

Answer: D

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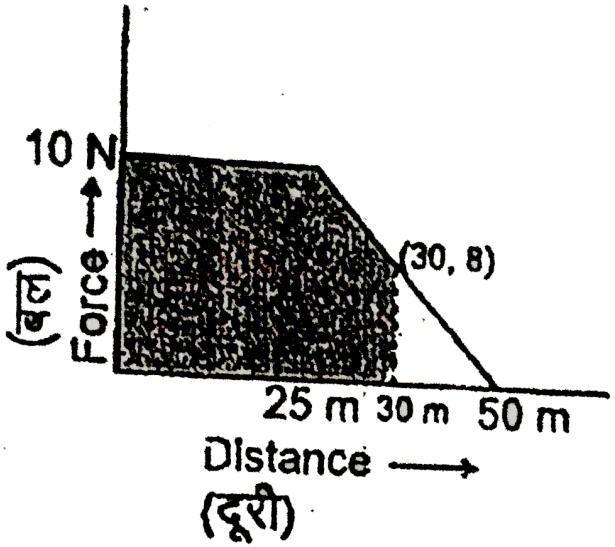
32. A body of mass 5 kg is acted upon by a variable force.the force varies with the distance covered by the body. Find the kinetic energy of the body when the body has covered 30 m distance ? Assume that the body starts

from rest.



A. 295 J

B. 105J

C. 300 J

D. 80 J

Answer: A

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33. An elevatore weighinig 500kg is to be lifted up at a constant velocity of $0 \cdot 4m / s$. What should be the minimum horse power of the motor to be used ?

A. 1000 W

B. 5000 W

C. 3000 W

D. 2000 W

Answer: D

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34. A car of mass m is driven with acceleration a along a straight level road against a constant external resistive force R. When the velocity of the car V, the rate at which the engine of the car is doing work will be

A. RV

B. maV

C. (R+ma)V

D. (ma-R)V

Answer: C

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35. The potential energy of a system increase,if work is done

A. upon the system by nonconservative force

B. by the system against a conservative force

C. by the system against a nonconservative force

D. upon the system by a conservative force

Answer: D

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36. Statement-1: A person walking on a horizontal road with a load on his head does no work on the load against gravity.

Statement-2: No work is said to be done, it directions of force and displacement of load are perpendicular to each other.

A. Statement-1 is true, Statement-2: is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2: is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is true, Statement-2 is false

D. Statement-1 is false, Statement-2 is true

Answer: A

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37. Statement-1: Graph between potential energy of spring versus the extension or comparision of the spring is a straight line.

Statement-2: Potential energy of a stretched or compressed spring is proportional to square of extension or comparission.

A. Statement-1 is true, Statement-2: is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2: is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is true, Statement-2 is false

D. Statement-1 is false, Statement-2 is true

Answer: D

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