Exercise - I (Conceptual Questions) Build Up Your Understanding

WORK

1. A force $\vec{F}=\left(4\hat{i}-4\hat{j}-2\hat{k}\right)N$ displaces a particle by $\vec{d}=\left(3\hat{i}+2\hat{j}-2\hat{k}\right)m$, calculate work done.

(1) Zero (2) 8 J (3) 4 J (4) 12 J

PWP001

2. A force $\vec{F}=\left(3\hat{i}+2\hat{j}\right)N$ acts on a body and produces a displacement $\vec{S}=\left(4\hat{i}-\hat{j}+3\hat{k}\right)m$. The work done will be

(1) 13 J (2) 30 J (3) 10 J (4) 20 J

PWP002

3. A particle is moved from a position $\vec{r}_1=(2\hat{i}+\hat{j}-2\hat{k})$ metre to a position $\vec{r}_2=(4\hat{i}+3\hat{j}-\hat{k})$ metre under the action of a force $\vec{F}=(3\hat{i}+2\hat{j}+2\hat{k})$ N.

The work done is equal to :-

(1) 32 J (2) 12 J (3) 24 J (4) 16 J

PWP003

4. A body of mass m is displaced from point A(3, 1, 3) m to point B(1, 2, 1) m under the effect of a force $\vec{F}=(5\hat{i}+2\hat{j}-4\hat{k})$, calculate work done by the force.

(1) 57 J (2) 11 J (3) 0 (4) 22 J

PWP004

5. A person of mass m is standing on one end of a plank of mass M and length L floating in water. The person moves from one end to another and stops. Work done by normal force is –

(1) MgL (2) mgL (3) $\frac{mMgL}{M+m}$ (4) 0

PWP005

6. The work done against gravity in taking 5 kg. mass to 2 m height in 1 s will be :-

(1) 49 J (2) 98 J
(3) 196 J (4) None of these

PWP006

7. A stone of mass m is tied to a string of length ℓ at one end and by holding second end it is whirled into a horizontal circle with constant speed v, then work done by the string on the stone will be :–

(1) 0 (2) $\left(\frac{mv^2}{\ell}\right)2\pi\ell$
(3) $(mg)\cdot 2\pi\ell$ (4) $\left(\frac{mv^2}{\ell}\right)\ell$

PWP007

8. A student of Allen is going from samarth to sabal building holding his bag in his hand. Direct distance between these buildings is 50m. Calculate work done by gravity if mass of bag is 3 kg.

(1) 750 J (2) 1500 J
(3) Zero (4) Data insufficient

PWP008

9. You lift a heavy book from the floor of the room and keep it in the book–shelf having a height 2 m. In this process you take 5 seconds. The work done by you will depend upon :-

(1) Mass of the book and time taken.
(2) Weight of the book and height of the book-shelf
(3) Height of the book-shelf and time taken.
(4) Mass of the book, height of the book-shelf and time taken.

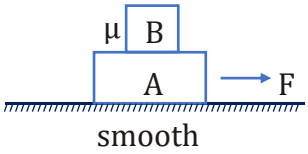
PWP009

10. Work done by static friction is :

(1) Always zero
(2) Always non-zero
(3) May be zero or non-zero
(4) None of these

PWP010

11. For the system shown in figure both the block A and B are moving together. If coefficient of friction between both the blocks is μ, the work done by friction on block B is :-



(1) Zero (2) Negative
(3) Positive (4) None of these

PWP011

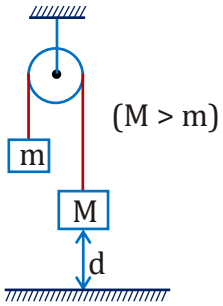
12. A body of mass M tied to a string is lowered at a constant acceleration of (3g/4) through a vertical distance h. The work done by the string will be.....

(1) $\frac{3}{4}$Mgh (2) $\frac{1}{4}$Mgh

(3) $\frac{-3}{4}$Mgh (4) $\frac{-1}{4}$Mgh

PWP012

13. The net work done by tension in the figure when the bigger block of mass M touches the ground is :-



(1) Mgd (2) –(M + m)gd

(3) –mgd (4) Zero

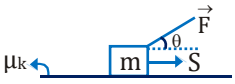
PWP013

14. The work done by the frictional force on a pencil in drawing a complete circle of radius r = 1/π metre on the surface by a pencil of negligible mass with a normal pressing force R = 5 N (μ = 0.5) is :

(1) + 4J (2) –3 J (3) – 2 J (4) – 5J

PWP014

15. Find work done by friction for displacement 'S' ?

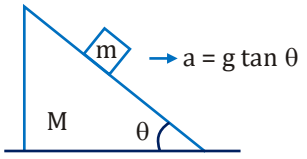


(1) $\mu_K(mg+F\sin\theta)S$ (2) $-\mu_K(mg+F\sin\theta)S$

(3) $\mu_K(mg-F\sin\theta)S$ (4) $-\mu_K(mg-F\sin\theta)S$

PWP015

16. The whole wedge and block system is moving as shown in the figure. Block of mass m is not slipping on the wedge. Then which of the following statement is correct (surface between M and m is rough) :-



(1) Work done by normal force on block is zero

(2) Work done by friction force on block is not zero

(3) Work done by normal force on block is not zero

(4) None of these

PWP016

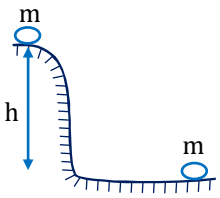
17. A particle is made to move from the origin in three spells of equal distances, first along the x-axis, second parallel to y-axis and third parallel to z-axis. Each time the force acting on it has constant magnitude of 50 N and always acts along the direction of motion. Work done by this force in the three spells of motion are equal and total work done in the three spells is 300 J. The final coordinates of the particle will be :-

(1) (2, 2, 2) m (2) (4, 4, 4) m

(3) (6, 6, 6) m (4) (10, 10, 10) m

PWP017

18. An object of mass m is sliding down a hill of arbitrary shape and after travelling a certain horizontal path stops because of friction. The work done that a force must perform to return the object to its initial position along the same path would be:-



(1) 0 (2) mgh

(3) 2mgh (4) None of these

PWP018

19. A force F = (x^2+3x-5) N acts on a 5 kg body along x-axis as a result of which the body gets displaced from x=0 to x=3 m. The work done by the force will be –

(1) 35 J (2) 15 J (3) 7.5 J (4) 70 J

PWP019

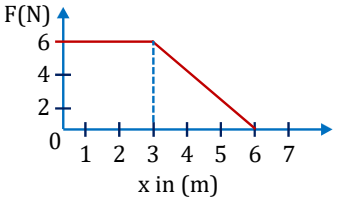
20. A force F = Kx^3 acts on a particle at an angle of 60° with the x–axis. The work done in displacing the particle from x_1 to x_2 will be –

(1) $\frac{kx^3}{3}$ (2) $\frac{k}{3}\left(x_2^2-x_1^3\right)$

(3) $\frac{k}{8}\left(x_2^4-x_1^4\right)$ (4) $\frac{k}{4}\left(x_2^4-x_1^4\right)$

PWP020

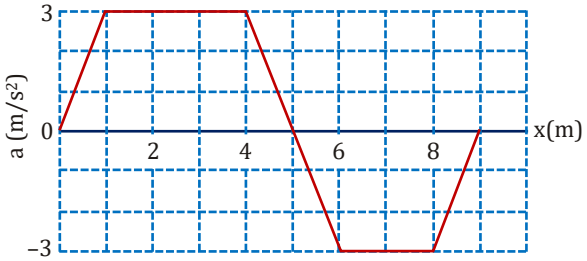
21. A force F acting on an object varies with distance x as shown here.
The work done by the force in moving the object from x = 0 to x = 6m is :-



(1) 18.0 J (2) 27 J
(3) 36 J (4) 9.0 J

PWP021

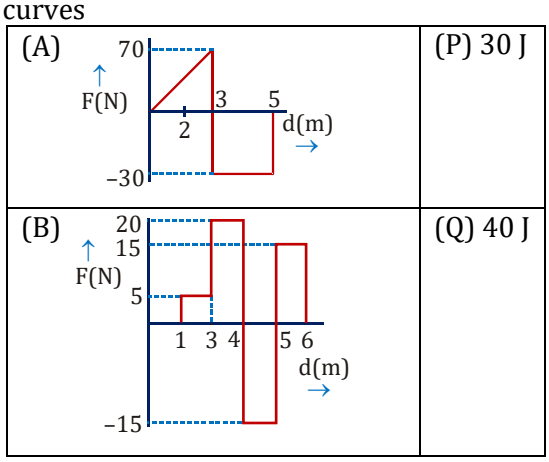
22. Figure gives the acceleration of a 4.0 kg body as it moves from rest along x axis while a variable force acts on it from x = 0m to x = 9m. The work done by the force on the body when it reaches
(i) x = 4m and
(ii) x = 7 m shall be as given below



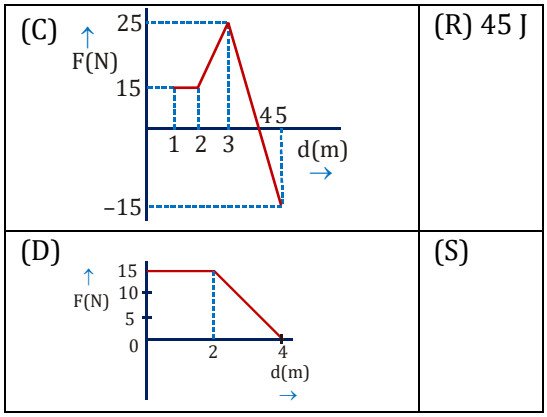
(1) 21 J and 33 J respectively
(2) 21 J and 15 J respectively
(3) 42 J and 60 J respectively
(4) 42 J and 30 J respectively

PWP022

23. Calculate the work done for following F-d curves



(P) 30 J	
(Q) 40 J	



(R) 45 J	
(S)	

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

PWP023

KINETIC ENERGY & WORK ENERGY THEOREM

24. The kinetic energy of a body becomes nine times of its initial value. The new linear momentum will be :-
(1) Four times the initial value
(2) Thrice the initial value
(3) Twice the initial value
(4) Same as the initial value

PWP024

25. If the momentum of a body is increased n times, its kinetic energy increases.
(1) n times (2) 2n times
(3) $\sqrt{n}$ times (4) n^2 times

PWP025

26. If the kinetic energy of a body becomes 4 times of its initial kinetic energy, then the momentum of the body will become :-
(1) $2\sqrt{2}$ times (2) $\sqrt{2}$ times
(3) 2 times (4) none of these

PWP026

27. Two bodies of mass 4kg and 9kg have equal K.E. then the ratio of their momentum is :-
(1) 3 : 2 (2) 2 : 3
(3) 4 : 9 (4) 16 : 8

PWP027

28. 2 particles of mass 3 Kg and 5 kg have same momentum, calculate ratio of their K.E.
(1) 5 : 3 (2) 3 : 5
(3) 25 : 9 (4) 9 : 25

PWP028

29. If K.E. of body is increased by 300%. Then % change in its 'P' will be

(1) 100% (2) 41.4%

(3) 17.3% (4) 200%

PWP029

30. If the kinetic energy of a body is increased by 800%, the momentum will increase by :-

(1) 100% (2) 200%

(3) 150% (4) 300%

PWP030

31. If K.E. of a body increases by 3%, then momentum will increase by :-

(1) 1.5% (2) 9%

(3) 3% (4) 2%

PWP031

32. If the momentum of a body increases by 2% then it's kinetic energy :-

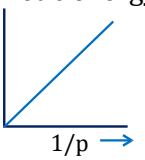
(1) increases by 2% (2) increases by 4%

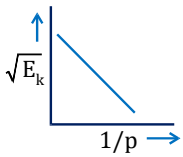
(3) increases by 8% (4) increases by 16%

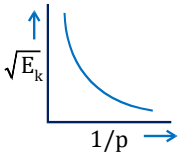
PWP032

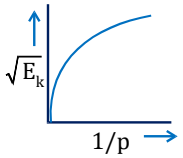
33. The graph between $\sqrt{E_k}$ and $\frac{1}{p}$ is

(E_K = kinetic energy and p = momentum) –

(1) 

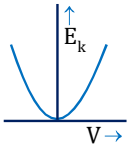
(2) 

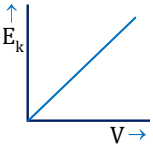
(3) 

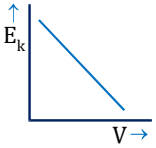
(4) 

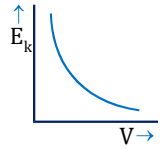
PWP033

34. The graph between kinetic energy E_K and velocity V is –

(1) 

(2) 

(3) 

(4) 

PWP034

35. A constant force F is applied to a body of mass m moving with initial velocity u. If after the body undergoes a displacement S, its velocity becomes v, then the total work done is :-

(1) $m[v^2 + u^2]$ (2) $\frac{m}{2}[u^2 + v^2]$

(3) $\frac{m}{2}[v^2 - u^2]$ (4) $m[v^2 - u^2]$

PWP035

36. A body of mass 6 kg is acted upon by a force which causes displacement in it given as $S = \frac{t^3}{4}$ metres where 't' is time. The work done by the force in 2 seconds is :-

(1) 18 J (2) 9 J (3) 27 J (4) 16 J

PWP036

37. A force acts on a 20 g particle in such a way that the position of the particle as a function of time is given by $x = 2t - 3t^2 + 2t^3$, where x is in metre and t is in second. The work done during the first 3 second is :-

(1) 5.28 J (2) 28.8 J (3) 14.4 J (4) 7.2 J

PWP037

38. A ball of mass 1 kg and another of mass 3 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of :-

(1) 1 : 3 (2) 1 : 2 (3) $1 : \sqrt{3}$ (4) $\sqrt{3} : 1$

PWP038

39. A 2 kg ball is thrown up with an initial speed 16 m/s and reaches a maximum height of 10 m. How much energy is dissipated by air drag acting on the ball during the ascent ?

(1) 40 J (2) 56 J (3) 36 J (4) 72 J

PWP039

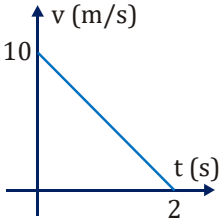
40. Three particles A, B and C are projected from the top of a tower with the same speed. A is thrown straight upwards, B straight down and C horizontally. They hit the ground with speeds V_A, V_B and V_C then:

(1) $V_A = V_B > V_C$ (2) $V_A = V_B = V_C$

(3) $V_A > V_B = V_C$ (4) $V_B > V_C > V_A$

PWP040

41. Velocity–time graph of a particle of mass 2 kg moving in a straight line is as shown in figure. Work done by all the forces acting on the particle is :



(1) 100 J (2) –100 J (3) –200 J (4) 200 J

PWP041

CONSERVATIVE FORCE & POTENTIAL ENERGY

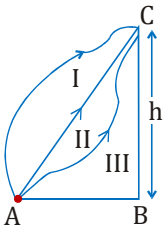
42. Which of the following statements is not true for work done by conservative forces :–
(1) It does not depend on path
(2) It is equal to the difference of initial and final potential energy function
(3) It can be recovered completely
(4) None of the above

PWP042

43. Which of the following statement is incorrect for a conservative field ?
(1) Work done in going from initial to final position is equal to change in kinetic energy of the particle.
(2) Work done depends on path but not on initial and final positions.
(3) Work done does not depend on path but depends only on initial and final positions
(4) Work done on a particle in the field for a round trip is zero.

PWP043

44. As shown in the diagram a particle is to be carried from point A to C via paths (I), (II) and (III) in gravitational field, then which of the following statements is correct :–



(1) Work done is same for all the paths
(2) Work done is minimum for path (II)
(3) Work done is maximum for path (I)
(4) None of the above

PWP044

45. Which of the following is a non conservative force :–
(1) Electric force
(2) Gravitational force
(3) Spring force
(4) Viscous force

PWP045

46. The relation between conservative force and potential energy U is given by :–

(1) $F = \frac{dU}{dx}$ (2) $F = \int U dx$

(3) $F = -\frac{dU}{dx}$ (4) $F = \frac{dU}{dx}$

PWP046

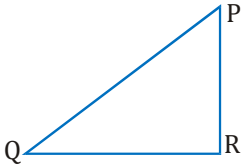
47. A 10 kg satellite completes one revolution around the earth at a height of 100 km in 108 minutes. The work done by the gravitational force of earth will be –

(1) 108 × 100 × 10 J (2) $\frac{108 \times 10}{100}$ J

(3) 0 J (4) $\frac{100 \times 10}{108}$ J

PWP047

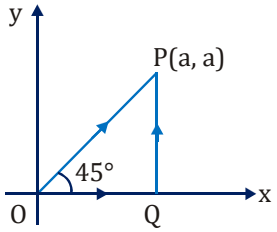
48. For the path PQR in a conservative force field the amount of work done in carrying a body from P to Q and from Q to R are 15 Joule and 5 Joule respectively. The work done in carrying the body from P to R will be –



(1) 20 J (2) 10 J (3) 5 J (4) Zero

PWP048

49. A particle is moved from (0, 0) to (a, a) under a force $\vec{F} = (3\hat{i} + 4\hat{j})$ from two paths. Path 1 is OP and path 2 is OQP. Let W_1 and W_2 be the work done by this force in these two paths. Then :



(1) $W_1 = W_2$ (2) $W_1 = 2W_2$
(3) $W_2 = 2W_1$ (4) $W_2 = 4W_1$

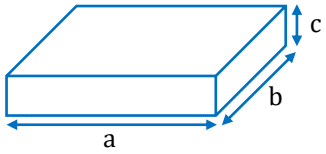
PWP049

50. A body of mass 3 kg falls from a height of 20 m. What is the loss in potential energy :-
(1) 400 J (2) 300 J
(3) 200 J (4) 600 J
PWP050

51. The mass of a bucket full of water is 13 kg. It is being pulled up from a 10 m deep well. Due to a hole in the bucket 4 kg water flows out of the bucket. The work done in drawing the bucket out of the well will be ($g = 10 m/s^2$)–
(1) 900 J (2) 1300 J
(3) 1100 J (4) 1700 J
PWP051

52. A uniform chain of length L and mass M is lying on a smooth table and $\frac{1}{3}$rd of its length is hanging down from the edge of the table. If g is the acceleration due to gravity, the work done to pull the hanging part on the table is :-
(1) MgL (2) $\frac{MgL}{18}$ (3) $\frac{MgL}{9}$ (4) $\frac{2MgL}{9}$
PWP052

53. A brick has 3 sides a, b, c {a > b > c}. The brick can be kept on ground on any face. The work required to be done to move slowly from minimum potential energy situation to maximum potential energy situation of brick is :



(1) $mg\left(\frac{a}{2}-\frac{b}{2}\right)$ (2) $mg\left(\frac{a}{2}-\frac{c}{2}\right)$
(3) $mg\left(\frac{b}{2}-\frac{c}{2}\right)$ (4) $mg\left(\frac{a+c}{2}-\frac{b}{2}\right)$
PWP053

54. If a spring extends by x on loading then energy stored in the spring is :- (T is tension in the spring, K = spring constant)
(1) $\frac{T^2}{2x}$ (2) $\frac{T^2}{2K}$ (3) $\frac{2K}{T^2}$ (4) $\frac{2T^2}{K}$
PWP054

55. A spring of force constant 1000 N/m has an extension of 15 cm. The work done in extending it from 15 cm to 25 cm is :-
(1) 16 J (2) 8 J (3) 32 J (4) 20 J
PWP055

56. In stretching a spring by 5 cm energy stored is given by U, then the energy stored if the spring is stretched by 10 cm will be :-
(1) U (2) 5U (3) 4U (4) 25U
PWP056

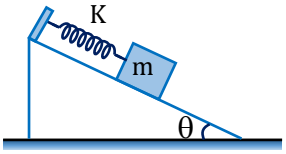
57. 5 J of work is required to stretch a spring through 5 cm beyond its unstretched length. The extra work required to stretch it through additional 5 cm shall be
(1) 5 J (2) 10 J (3) 15 J (4) 25 J
PWP057

CONSERVATION OF MECHANICAL ENERGY

58. A body is dropped from a height h. When loss in its potential energy is U then its velocity is v. The mass of the body is –
(1) $\frac{U^2}{2v}$ (2) $\frac{2v}{U}$ (3) $\frac{2v}{U^2}$ (4) $\frac{2U}{v^2}$
PWP058

59. A block of mass 4 kg is moving on a frictionless horizontal surface with velocity 2m/s and comes to rest after pressing a spring. If the force constant of the spring is 100 N/m then the compression in the spring will be –
(1) 0·8 m (2) 1·6 m
(3) 0·4 m (4) 3·2 m
PWP059

60. A system of smooth inclined plane and block is shown in figure block is released when the spring in its natural length. Maximum elongation in the spring will be :-



(1) $\frac{2mg\sin\theta}{K}$ (2) $\frac{mg\sin\theta}{K}$
(3) $\frac{4mg\sin\theta}{K}$ (4) $\frac{mg\sin\theta}{2K}$
PWP060

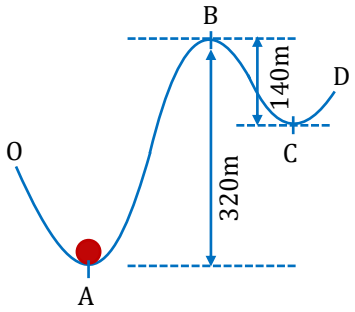
61. A ball of mass 2 kg is released from the tower of Pisa. The kinetic energy generated in it after falling through 10m will be –
(1) 20 J (2) 196 J (3) 49 J (4) 98 J
PWP061

62. A stone is projected vertically up to reach maximum height 'h'. The ratio of its kinetic energy to potential energy, at a height $\frac{h}{5}$ will be :-

(1) 5 : 4 (2) 4 : 5 (3) 1 : 4 (4) 4 : 1

PWP062

63. Track OABCD (as shown is figure) is smooth and fixed in vertical plane. What minimum speed has to be given to a particle lying at point A, so that it can reach point C ?



(1) 60 m/s (2) 100 m/s
(3) 70 m/s (4) 80 m/s

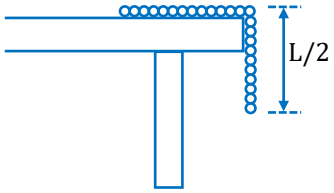
PWP063

64. A projectile is fired at 30^0 with momentum p, neglecting friction, the change in kinetic energy, when it returns back to the ground, will be :-

(1) zero (2) 30 %
(3) 60 % (4) 100 %

PWP064

65. A uniform chain (mass M, length L) is released from rest from a smooth horizontal surface as shown in the figure. Velocity of the chain at the instant it completely comes out of the table will be.

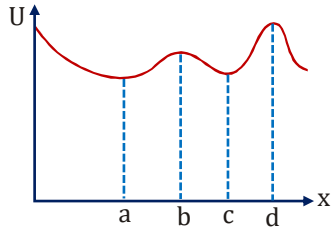


(1) $V = \sqrt{gL}$ (2) $V = \sqrt{\frac{3gL}{4}}$

(3) $V = \frac{1}{2}\sqrt{5gL}$ (4) $V = \frac{1}{2}\sqrt{gL}$

PWP065

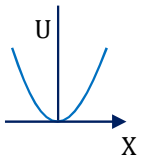
66. Figure shows a plot of the potential energy as a function of x for a particle moving along the x-axis:-

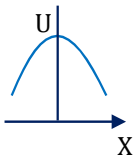


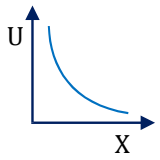
Which of the following statement(s) is/are true?
(1) a, c, and d are points of equilibrium
(2) a is a point of stable equilibrium
(3) b is a unstable equilibrium point
(4) All of the above

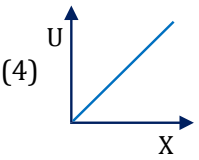
PWP066

67. The graph between potential energy U and displacement X in the state of stable equilibrium will be –

(1) 

(2) 

(3) 

(4) 

PWP067

68. A particle moves in a potential region given by $U = 2x^2 - 2x + 100$ J. Its state of equilibrium will be at :-

(1) x = 25 m (2) x = 0·25 m
(3) x = 0·05 m (4) x = 0·5 m

PWP068

69. If $F = 2x^2 - 3x - 2$, then choose correct option

(1) $x = -\frac{1}{2}$ is position of stable equilibrium

(2) x = 2 is position of stable equilibrium

(3) $x = -\frac{1}{2}$ is position of unstable equilibrium

(4) x = 2 is position of neutral equilibrium

PWP069

70. If the potential energy of system of two molecules is given by, $U = \frac{A}{r^{12}} - \frac{B}{r^6}$ then at equilibrium position, its potential energy is equal to :

(1) $\frac{A^2}{4B}$ (2) $-\frac{B^2}{4A}$ (3) $\frac{2B}{A}$ (4) 3A

PWP070

71. A particle in a certain conservative force field has a potential energy given by $U = \frac{2x^2y}{z^2}$. The force exerted on it is

(1) $\left(\frac{4xy}{z^2}\right)\hat{i} + \left(\frac{2x^2}{z^2}\right)\hat{j} + \left(\frac{4x^2y}{z^3}\right)\hat{k}$

(2) $-\left(\frac{4xy}{z^2}\right)\hat{i} - \left(\frac{2x^2}{z^2}\right)\hat{j} + \left(\frac{4x^2y}{z^3}\right)\hat{k}$

(3) $-\left(\frac{4xy}{z^2}\right)\hat{i} - \left(\frac{2x^2}{z^2}\right)\hat{j} - \left(\frac{4x^2y}{z^3}\right)\hat{k}$

(4) $\left(\frac{4xy}{z}\right)\hat{i} + \left(\frac{2x^2}{z}\right)\hat{j} - \left(\frac{4x^2y}{z^2}\right)\hat{k}$

PWP071

POWER

72. An electric motor produces a tension of 5000N in a load lifting cable and rolls it at the rate of 2 m/s. The power of the motor is –

(1) 10 kW (2) 15 kW
(3) 25 kW (4) 9×10^3 hp

PWP072

73. A motor of 50 hp is moving a car with a constant velocity of 36 km/hour. The forward force exerted by the engine on the car is – (1 hp = 746 W)

(1) $3{\cdot}73 \times 10^3$ N
(2) $3{\cdot}73 \times 10^2$ N
(3) $3{\cdot}73 \times 10^1$ N
(4) None of the above

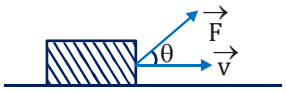
PWP073

74. A car is moving with a speed of 36 Km/hr. If the car engine generates 7 kilowatt power, then the resistance in the path of motion of the car will be –

(1) 300 newton (2) 700 newton
(3) Zero (4) 500 newton

PWP074

75. A constant force $\vec{F}$ is acting on a body of mass m moving with constant velocity $\vec{v}$ as shown in the figure. The power P exerted is



(1) Fv cosθ (2) $\frac{F\cos\theta}{mg}$
(3) $\frac{Fmg\cos\theta}{v}$ (4) $\frac{mg\sin\theta}{F}$

PWP075

76. A force $\vec{F} = \left(3\hat{i} + 4\hat{j}\right)$ N acts on a 2 kg movable object that moves from an initial position $\vec{d_i} = \left(-3\hat{i} - 2\hat{j}\right)$ m to final position $\vec{d_f} = \left(5\hat{i} + 4\hat{j}\right)$ in 6s. The average power delivered by the force during the interval is equal to :

(1) 8 watt (2) $\frac{50}{6}$ watt
(3) 15 watt (4) $\frac{50}{3}$ watt

PWP076

77. Two men with weights in the ratio 2 : 3 run up a staircase in times in the ratio 5 : 9. The ratio of power of first to that of second is –

(1) $\frac{6}{5}$ (2) $\frac{5}{6}$ (3) $\frac{10}{27}$ (4) $\frac{18}{15}$

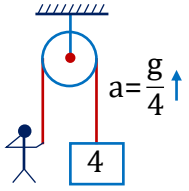
PWP077

78. A crane lifts 200 kg weight from earth's surface upto a height of 3m in 4 seconds. The average power generated by it will be – ($g = 9.8$ m/sec^2)

(1) 1470 W (2) 735 W
(3) 2940 W (4) 0 W

PWP078

79. Calculate power generated by tension in the string in first 2 seconds of motion :-



(1) 250 W (2) 125 W
(3) 500 W (4) 750 W

PWP079

80. What average horsepower is developed by a 50kg man while climbing in 10s flight of stairs that rises 10 m vertically ?

(1) 0.66 hp (2) 1.26 hp
(3) 1.8 hp (4) 2.1 hp

PWP080

81. A 2.0 hp motor pumps out water from a well of depth 8 m and fills a water tank of volume 1492 liters at a height of 16 m from the ground. The running time of the motor to fill the empty water tank is ($g = 10m/s^2$) :-
(1) 50 minutes (2) 10 minutes
(3) 4 minutes (4) 20 minutes
PWP081

82. Water is falling on the blades of a turbine at a rate of 50 kg/s from a certain spring. If the height of the spring be 50 metres, the power transferred to the turbine will be :-
(1) 100 KW (2) 25 KW
(3) 5 KW (4) 250 KW
PWP082

83. If the force applied is F and the velocity gained is v, then the average power developed is :-
(1) $\frac{F}{v}$ (2) $\frac{v}{F}$ (3) $\frac{Fv}{2}$ (4) Fv^2
PWP083

84. A small body of mass 'm' is located in a horizontal plane at point O. The body accelerates uniformly and acquires horizontal velocity u then mean power developed by the friction force during the whole time of motion, if friction coefficient is k. :-
(1) $\frac{3mu}{4kg}$ (2) $\frac{5}{6}mukg$
(3) $\frac{1}{2}mukg$ (4) $\frac{12}{7}mukg$
PWP084

85. A time varying power P = 2t is applied on a particle of mass 3kg. The change in kinetic energy of the particle at t = 4 sec is :-
(1) 4 J (2) 8 J (3) 16 J (4) 24 J
PWP085

86. Power supplied to a particle of mass 2 kg 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 = 2 s will be :-
(1) 1 m/s (2) 4 m/s
(3) 2 m/s (4) $2\sqrt{2}$ m/s
PWP086

87. A body of mass m starting from rest from origin moves along x-axis with constant power P. Calculate relation between velocity and distance :-
(1) $x \propto v^{1/2}$ (2) $x \propto v^2$
(3) $x \propto v$ (4) $x \propto v^3$
PWP087

88. A body of mass 2 kg is moving up an inclined plane rising 1 in 30 with velocity 60 m/sec. If efficiency is 40%, then calculate power required.
(1) 60 W (2) 40 W (3) 100 W (4) 20 W
PWP088

89. A pump is used to deliver water at a certain rate from a given pipe. To obtain n times water from the same pipe in the same time, by what factor, the force of the motor should be increased?
(1) n times (2) n^2 times
(3) n^3 times (4) $\frac{1}{n}$ times
PWP089

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	3	2	3	4	2	1	3	2	3	3	4	4	4	4
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	3	1	3	3	3	2	4	3	2	4	3	2	1	1	2
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	1	2	3	1	3	3	3	1	2	2	2	4	2	1	4
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	3	3	1	1	4	3	2	2	2	4	3	3	4	3	1
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	2	4	4	1	2	4	1	4	1	2	2	1	1	2	1
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	
Answer	1	1	1	2	1	3	2	3	3	3	3	4	3	2	

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2015

1. A block of mass 10 kg, moving in x direction with a constant speed of 10 m/s, is subjected to a retarding force F = 0.1x J/m during its travel from x = 20 m to 30 m. Its final KE will be :

(1) 450 J (2) 275 J (3) 250 J (4) 475 J

PWP102

2. A particle of mass m is driven by a machine that delivers a constant power k watts. If the particle starts from rest the force on the particle at time t is :-

(1) $\sqrt{mk}\, t^{-1/2}$ (2) $\sqrt{2mk}\, t^{-1/2}$

(3) $\frac{1}{2}\sqrt{mk}\, t^{-1/2}$ (4) $\sqrt{\frac{mk}{2}}\, t^{-1/2}$

PWP103

NEET-I 2016

3. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F}=(2t\hat{i}+3t^2\hat{j})N$, where $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axis. What power will be developed by the force at the time t ?

(1) $(2t^2 + 3t^3)W$ (2) $(2t^2 + 4t^4)W$

(3) $(2t^3 + 3t^4)W$ (4) $(2t^3 + 3t^5)W$

PWP104

NEET-II 2016

4. A particle moves from a point $(-2\hat{i}+5\hat{j})$ to $(4\hat{j}+3\hat{k})$ when a force of $(4\hat{i}+3\hat{j})N$ is applied. How much work has been done by the force ?

(1) 5 J (2) 2 J (3) 8 J (4) 11 J

PWP105

NEET(UG) 2017

5. Consider a drop of rain water having mass 1 g falling from a height of 1 km. It hits the ground with a speed of 50 m/s. Take 'g' constant with a value 10 m/s^2. The work done by the (i) gravitational force and the (ii) resistive force of air is :-

(1) (i) 1.25 J (ii) – 8.25 J

(2) (i) 100 J (ii) 8.75 J

(3) (i) 10 J (ii) – 8.75 J

(4) (i) –10 J (ii) – 8.25 J

PWP106

NEET(UG) 2019

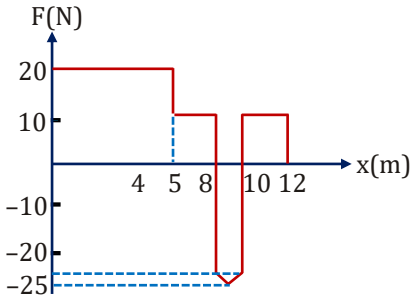
6. A force F = 20 + 10y acts on a particle in y-direction where F is in newton and y in meter. Work done by this force to move the particle from y = 0 to y = 1 m is :

(1) 30 J (2) 5 J (3) 25 J (4) 20 J

PWP107

NEET(UG) 2019 (Odisha)

7. An object of mass 500g, initially at rest is acted upon by a variable force, whose X component varies with x in the manner shown. The velocities of the object at point X = 8 m and X =12 m, would be the respective values of (nearly)



(1) 18 m/s and 24.4 m/s

(2) 23 m/s and 24.4 m/s

(3) 23 m/s and 20.6 m/s

(4) 18 m/s and 20.6 m/s

PWP108

NEET (UG) 2021

8. A particle is released from height S from the surface of the Earth. At a certain height its kinetic energy is three times its potential energy. The height from the surface of earth and the speed of the particle at that instant are respectively :

(1) $\frac{S}{4}, \frac{3gS}{2}$ (2) $\frac{S}{4}, \frac{\sqrt{3gS}}{2}$

(3) $\frac{S}{2}, \frac{\sqrt{3gS}}{2}$ (4) $\frac{S}{4}, \sqrt{\frac{3gS}{2}}$

PWP109

9. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional force are 10% of the input energy. How much power is generated by the turbine? (g = 10 m/s^2)

(1) 10.2 kW (2) 8.1 kW

(3) 12.3 kW (4) 7.0 kW

PWP110

NEET (UG) 2022

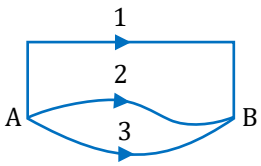
10. An electric lift with a maximum load of 2000 kg (lift + passengers) is moving up with a constant speed of 1.5 ms^{-1}. The frictional force opposing the motion is 3000 N. The minimum power delivered by the motor to the lift in watts is: ($g = 10\ ms^{-2}$)

(1) 20000 (2) 34500
(3) 23500 (4) 23000

PWP111

RE-NEET (UG) 2022

11. A gravitational field is present in a region and a mass is shifted from A to B through different paths as shown. If W_1, W_2 and W_3 represent the work done by the gravitational force along the respective paths, then :



(1) $W_1 = W_2 = W_3$ (2) $W_1 > W_2 > W_3$
(3) $W_1 > W_3 > W_2$ (4) $W_1 < W_2 < W_3$

PWP112

NEET (UG) 2023

12. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, potential energy stored in it will be :

(1) 4U (2) 8U
(3) 16U (4) 2U

PWP125

RE-NEET (UG) 2023

13. A particle moves with a velocity $\left(5\hat{i}-3\hat{j}+6\hat{k}\right)$ m s^{-1} horizontally under the action of constant force $\left(10\hat{i}+10\hat{j}+20\hat{k}\right)$ N. The instantaneous power supplied to the particle is :

(1) 200 W (2) Zero
(3) 100 W (4) 140 W

PWP126

NEET (UG) 2024

14. At any instant of time t, the displacement of any particle is given by 2t –1 (SI unit) under the influence of force of 5N. The value of instantaneous power is (in SI unit) :

(1) 10 (2) 5
(3) 7 (4) 6

PWP127

RE-NEET (UG) 2024

15. An object moving along horizontal x-direction with kinetic energy 10 J is displaced through $x = \left(3\hat{i}\right)$ m by the force $\vec{F} = \left(-2\hat{i}+3\hat{j}\right)$N . The kinetic energy of the object at the end of the displacement x is :

(1) 10 J (2) 16 J (3) 4 J (4) 6 J

PWP128

16. An object falls from a height of 10 m above the ground. After striking the ground it loses 50% of its kinetic energy. The height upto which the object can rebounce from the ground is :

(1) 7.5 m (2) 10 m (3) 2.5 m (4) 5 m

PWP129

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	4	4	4	1	3	3	3	4	2	2	1	3	4	1	3
Question	16														
Answer	4														

Exercise - III (Analytical Questions) Master Your Understanding

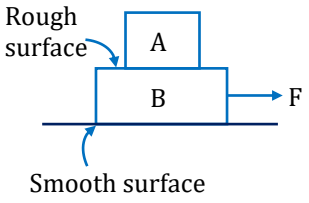
1. Select the correct statements –
(a) Work done by conservative force along closed path is zero.
(b) A body with negative energy can't have linear momentum
(c) Net work done by all the internal force of a system is independent of choice of reference frame
(d) Work done by a non conservative force is always negative
(1) a, b and c (2) a and c
(3) a, b and d (4) All

PWP115

2. Select the correct statements –
(a) Potential energy is defined only for gravitational force.
(b) Potential energy can be associated with frictional force.
(c) Work done by spring force is equal to change in potential energy of the spring.
(1) a and b
(2) a and c
(3) all
(4) none of these

PWP116

3.



If both blocks A and B are moving together, then select correct statements –
(a) Work done by the friction on block 'A' is zero
(b) Work done by the friction on block 'A' is positive
(c) Work done by the friction on block 'B' is negative
(d) Work done by friction forces on system (A) and (B) are zero
(1) a, c and d (2) b, c and d
(3) a and d (4) none of these

PWP117

4. For a system of particles –
(a) The work done by all external forces is equal to change in kinetic energy
(b) The work done by all forces is equal to change in mechanical energy
Select the correct statements :
(1) only a
(2) only b
(3) both a and b
(4) none of these

PWP118

5. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A) : Kinetic energy of a system can be increased without applying external force on the system.
Reason (R) : If external forces are absent then work done by internal forces is equal to change in kinetic energy.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PWP119

6. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A) : Work done is positive when force acts in the direction of displacement.
Reason (R) : Work done by frictional force cannot be positive.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

PWP120

7. Assume that in space potential energy U-depends on x-coordinate only by :

$$U = (x - 3)^2 (2 - x)$$

A mass m can be kept on x-axis. In each position indicated in column-I, comment on the situation from column-II.

Column I	**Column II**
(A) x = 7/3	(P) Stable equilibrium
(B) x = 2	(Q) Unstable equilibrium
(C) x = 3	(R) Neutral equilibrium
	(S) Not in equilibrium

Options :-

(1) A → P, B → S, C → R

(2) A → S, B → P, C → Q

(3) A → P, B → S, C → Q

(4) A → Q, B → S, C → P

PWP123

8. The potential energy (in joules) function of a particle in a region of space is given as :

$$U = (2x^2 + 3y^3 + 2z)$$

Here x, y and z are in metres. Find the magnitude of x component of force (in newton) acting on the particle at point P (1m, 2m, 3m).

(1) 4

(2) 2

(3) 6

(4) None

PWP124

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8
Answer	2	4	2	4	1	3	3	1