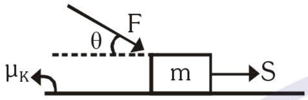
1. A body of mass m is displaced from point A(3, 1, 2) to point B(4, 2, 1) under the effect of a force $\vec{F} = (\hat{i} + 2\hat{j} + 3\hat{k})$ N, calculate W.D. by the force.

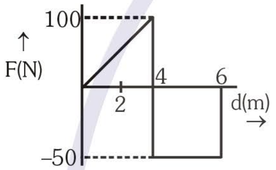
(1) 57 J (2) 11 J (3) 0 (4) 22 J

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

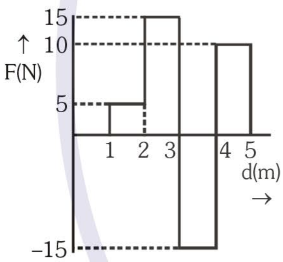


(1) μ_K(mg + Fsinθ).S (2) $-\mu_K$(mg + Fsinθ).S
(3) μ_K(mg – Fsinθ).S (4) $-\mu_K$(mg – Fsinθ).S

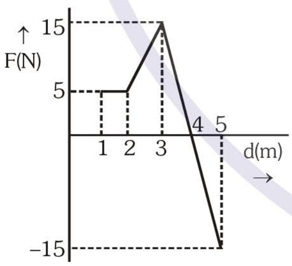
3. Calculate the work done for following F-d curves

(A) 

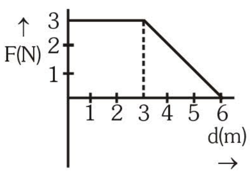
(P) 100 J

(B) 

(Q) 13.5 J

(C) 

(R) 15 J

(D) 

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

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

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

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

4. A force F = Kx² 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) $\frac{kx^2}{2}$ (2) $\frac{k}{2}\left(x_2^2 - x_1^2\right)$

(3) $\frac{k}{6}\left(x_2^3 - x_1^3\right)$ (4) $\frac{k}{3}\left(x_2^3 - x_1^3\right)$

5. A force acts on a 30 g particle in such a way that the position of the particle as a function of time is given by $x = 3t - 4t^2 + t^3$, where x is in metres and t is in seconds. The work done during the first 4 second is :-

(1) 5.28 J (2) 450 mJ (3) 490 mJ (4) 530 mJ

6. A force $\vec{F} = (3x^2+2x-7)$ N acts on a 2 kg body as a result of which the body gets displaced from x=0 to x=5m. The work done by the force will be–

(1) 35 J (2) 70 J (3) 115 J (4) 270 J

7. A person of mass m is standing on one end of a plank of mass M and length L and 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

8. A body of mass M tied to a string is lowered at a constant acceleration of (g/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

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

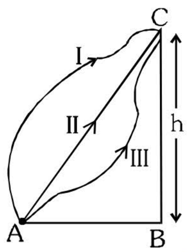
(1) 12J (2) 9J (3) 6J (4) 3J

10. 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, then work done will be :–

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

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

11. 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

12. A particle moves from a point $(-4\hat{i}+6\hat{j})$ to $(5\hat{j}+3\hat{k})$ when a force of $(2\hat{i}+3\hat{j})$ N is applied. How much work has been done by the force ?

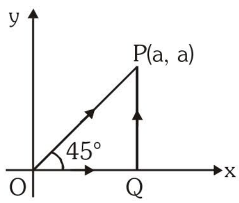
(1) 5 J (2) 2 J (3) 8 J (4) 11 J

13. The mass of a bucket full of water is 15 kg. It is being pulled up from a 15m deep well. Due to a hole in the bucket 6 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 Joule (2) 1500 Joule

(3) 1800 Joule (4) 2100 Joule

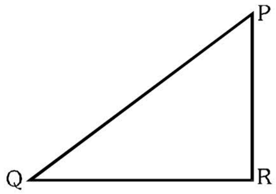
14. A particle is moved from (0, 0) to (a, a) under a force $\vec{F} = (3\hat{i}+4\hat{j})$ from two paths. Path 1 is OP and path 2 is OQP. Let W_1 and W_2 be the work done by this force in these two paths. Then :



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

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

15. For the path PQR in a conservative force field the amounts work done in carrying a body from P to Q and from Q to R are 8 Joule and 2 Joule respectively. The work done in carrying the body from P to R will be –



(1) 10 J (2) 6 J (3) $\sqrt{68}$ J (4) Zero

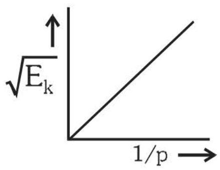
16. If K.E. increases by 4%. Then momentum will increase by :-

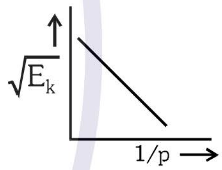
(1) 1.5% (2) 9%

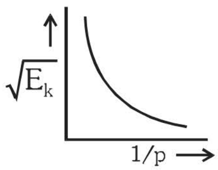
(3) 3% (4) 2%

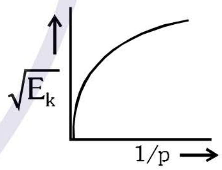
17. The graph between $\sqrt{E_k}$ and $\frac{1}{p}$ is

(E_K = kinetic energy and p = momentum) –

(1) 

(2) 

(3) 

(4) 

18. If the momentum of a body is increased n times, its kinetic energy increases.

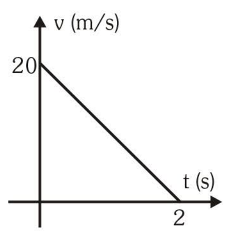
(1) n times (2) 2n times

(3) $\sqrt{n}$ times (4) n^2 times

19. If K.E. body is increased by 100%. Then % change in 'P'.

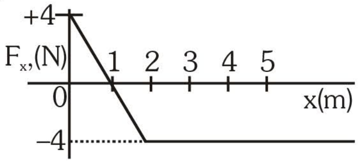
(1) 50% (2) 41.4% (3) 10% (4) 20%

20. 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 on the particle is :



(1) 400 J (2) –400 J (3) –200 J (4) 200 J

21. The only force F_x acting on a 2.0 kg body as it moves along the x-axis varies as shown in the figure. The velocity of the body along positive x-axis at x = 0 is 4 m/s. The kinetic energy of the body at x = 3.0 m is :-



(1) 4 J
(2) 8 J
(3) 12 J
(4) 16 J

22. A uniform chain of length L and mass M is lying on a smooth table and $\frac{2}{3}$ of its length is hanging down over 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) $\frac{MgL}{3}$ (3) $\frac{MgL}{9}$ (4) $\frac{2MgL}{9}$

23. A particle in a certain conservative force field has a potential energy given by $U = \frac{20xy}{z}$. The force exerted on it is

(1) $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{k}$

(2) $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{k}$

(3) $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{k}$

(4) $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{k}$

24. If the potential energy of two molecules is give 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

25. A 2 g ball of glass is released from the edge of a hemispherical cup whose radius is 20 cm. How much work is done on the ball by the gravitational force during the ball's motion to the bottom of the cup ?

(1) 1.96 mJ
(2) 3.92 mJ
(3) 4.90 mJ
(4) 5.88 mJ

26. 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) $\frac{2U}{v^2}$

27. A 0.5 kg ball is thrown up with an initial speed 14 m/s and reaches a maximum height of 8.0 m. How much energy is dissipated by air drag acting on the ball during the ascent ?

(1) 19.6 joules (2) 4.9 joules
(3) 10 joules (4) 9.8 joules

28. A ball of mass 4 kg and another of mass 8 kg are dropped together from a 100 feet tall building. After a fall of 50 feet each towards earth, their respective kinetic energies will be in the ratio of:-

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

29. A particle of mass m is moving in a horizontal ciricle of radius R under a centripetal force equal to $-\frac{A}{r^2}$ (A = constant). The total energy of the particle is :-

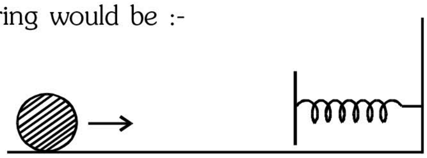
(Potential energy at very large distance is zero)

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

30. 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

31. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant k=50N/m. The maximum compression of the spring would be :-



(1) 0.12 m (2) 1.5 m

(3) 0.5 m (4) 0.15 m

32. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring, so that the spring is compressed by a distance d. The net work done in the process is:

(1) $mg(h+d)+\frac{1}{2}kd^2$

(2) $mg(h+d)-\frac{1}{2}kd^2$

(3) $mg(h-d)-\frac{1}{2}kd^2$

(4) $mg(h-d)+\frac{1}{2}kd^2$

33. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from a ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. the maximum extension produced in the length of the spring will be :-

(1) Mg/2k (2) Mg/k

(3) 2 Mg/k (4) 4 Mg/k

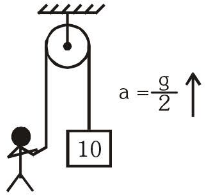
34. If a spring extends by x on loading then energy stored by the spring is :- (T is tension in the spring, K = spring const.)

(1) $\frac{T^2}{2x}$ (2) $\frac{T^2}{2k}$ (3) $\frac{2k}{T^2}$ (4) $\frac{2T^2}{k}$

35. Two men with weights in the ratio 2 : 3 run up a staircase in times in the ratio 10 : 7. The ratio of power of first to that of second is –

(1) $\frac{7}{15}$ (2) $\frac{15}{7}$ (3) $\frac{10}{7}$ (4) $\frac{7}{10}$

36. Calculate power generated by tension in the string in first 4 seconds of motion :-



(1) 250 W

(2) 750 W

(3) 1500 W

(4) 1000 W

37. 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) $x \propto v^3$

38. 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

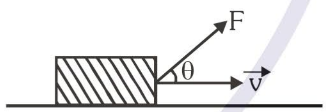
(3) n^3 times (4) $\frac{1}{n}$ times

39. Water is falling on the blades of a turbine at a rate of 100 kg/s from a certain spring. If the height of the spring be 100 metres, the power transferred to the turbine will be :-

(1) 100 kW (2) 10 kW

(3) 1 kW (4) 1000 kW

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



(1) $Fv\cos\theta$ (2) $\frac{F\cos\theta}{mg}$

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

41. An engine pumps water continuously through a hose. Water leaves the hose with a velocity v and m is the mass per unit length of the water jet. What is the rate at which kinetic energy is imparted to water :-

(1) $\frac{1}{2}m^2v^2$ (2) $\frac{1}{2}mv^3$

(3) mv^3 (4) $\frac{1}{2}mv^2$

42. 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) $\sqrt{\frac{mk}{2}}\, t^{-1/2}$

43. A body of mass m accelerates uniformly from rest to v_1 in time t_1. The instantaneous power delivered to the body as a function of time t is-

(1) $\frac{mv_1 t}{t_1}$ (2) $\frac{mv_1^2 t}{t_1^2}$ (3) $\frac{mv_1 t^2}{t_1}$ (4) $\frac{mv_1^2 t}{t_1}$

44. A body of mass 4 kg is moving up an inclined plane rising 1 in 40 with velocity 40 m/sec if efficiency is 50% the calculate power required.

(1) 38.4 W (2) 55 W

(3) 78.4 W (4) 108 W

45. A 1.0 hp motor pumps out water from a well of depth 20 m and fills a water tank of volume 2238 liters at a height of 10 m from the ground. The running time of the motor to fill the empty water tank is ($g = 10ms^{-2}$)

(1) 5 minutes (2) 10 minutes

(3) 15 minutes (4) 20 minutes

46. Work done in time t on a body of mass m which is accelerated from rest to a speed v in time t_1 as a function of time t is given by :-

(1) $\frac{1}{2}m\frac{v}{t_1}t^2$ (2) $m\frac{v}{t_1}t^2$

(3) $\frac{1}{2}\left(\frac{mv}{t_1}t\right)^2 t^2$ (4) $\frac{1}{2}m\frac{v^2}{t_1^2}t^2$

47. A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude P_0. The instantaneous acceleration of this car is proportional to :-

(1) $t^{1/2}$ (2) $t/\sqrt{m}$

(3) t^2P_0 (4) $t^{-1/2}$

48. The heart of a man pumps 10 litres of blood through the arteries per minute at a pressure of 75 mm of mercury. If the density of mercury be 13.6 $\times 10^3 kg/m^3$ and $g = 10 m/s^2$ then the power of heart in watt is:

(1) 1.50 (2) 1.70 (3) 2.35 (4) 3.0

49. 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) $(2t^3 + 3t^5)W$

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**3**	**2**	**2**	**3**	**1**	**3**	**4**	**3**	**4**	**1**	**1**	**1**	**3**	**1**	**1**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	**4**	**3**	**4**	**2**	**2**	**3**	**4**	**2**	**2**	**2**	**4**	**4**	**2**	**4**	**3**
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	**4**	**2**	**3**	**2**	**1**	**3**	**4**	**2**	**1**	**1**	**2**	**4**	**2**	**3**	**3**
Que.	46	47	48	49											
Ans.	**4**	**4**	**2**	**4**											