CBSE

WORK ENERGY AND POWER WS 1

Class 11 - Physics

1. If the force and displacement of particle in the direction of force are doubled, then work done would be **[1]**

   a) $\frac{1}{4}$ times
   b) 4 times
   c) double
   d) half

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

   a) $(2t^2 + 3t^2)$ W
   b) $(2t^3 + 3t^4)$ W
   c) $(2t^3 + 3t^5)$ W
   d) $(2t^2 + 4t^4)$ W

3. If the linear momentum is increased by 50%, then kinetic energy will increase by **[1]**

   a) 125%
   b) 25%
   c) 50%
   d) 100%

4. In elastic collision, 100% energy transfer takes place when **[1]**

   a) $m_1 = m_2$
   b) $m_1 < m_2$
   c) $m_1 = 2\ m_2$
   d) $m_1 > m_2$

5. Power applied to a particle varies with time as P = $(3t^2 - 2t + 1)$ watt, where t is in second. Find the change in its kinetic energy between t = 2 s and t = 4 s. **[1]**

   a) 46 J
   b) 102 J
   c) 32 J
   d) 61 J

6. A body, constrained to move in y-direction, is subjected to a force given by $\vec{F}$ = $(-2\hat{i} + 15\hat{j} + 6\hat{k})$ N. The work done by this force in moving the body through a distance of 10 $\hat{j}$ m along y-axis, is **[1]**

   a) 160 J
   b) 20 J
   c) 190 J
   d) 150 J

7. If pendulum bob on a 2 m string is displaced 60^o from the vertical and then released, what is the speed of the bob as it passes through the lowest point in its path? **[1]**

   a) $\sqrt{2 \times 9.8}\,\frac{m}{s}$
   b) $\sqrt{2}\frac{m}{s}$
   c) 4.43 $\frac{m}{s}$
   d) $\frac{1}{\sqrt{2}}\frac{m}{s}$

8. The potential energy of particle in a force field is U = $\frac{A}{r^2} - \frac{B}{r}$, where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium, the distance of the particle is **[1]**

   a) $\frac{2A}{B}$
   b) $\frac{A}{B}$
   c) $\frac{B}{A}$
   d) $\frac{B}{2A}$

9. A body of mass 5 kg has a momentum of 10 kg ms^{-1}. When a force of 0.2 N is applied on it for 10 s, what is the change in kinetic energy? **[1]**

a) 4.4 J
b) 1.1 J
c) 3.3 J
d) 2.2 J

10. When a spring is stretched by 2 cm, it stores 100 J of energy. If it is stretched further by 2 cm, the stored energy will be increased by **[1]**

a) 200 J
b) 300 J
c) 400 J
d) 100 J

11. 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 network done in the process is **[1]**

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

12. A body of mass m_1 collides elastically with another body of mass m_2 at rest. If the velocity of m_1 after collision becomes $\frac{2}{3}$ times its initial velocity, the ratio of their masses is **[1]**

a) 1 : 5
b) 5 : 2
c) 5 : 1
d) 2 : 5

13. A man squatting on the ground gets straight up and stand. The force of reaction of ground on the man during the process is **[1]**

a) variable but always greater than mg.
b) constant and equal to mg in magnitude.
c) at first, greater than mg, and later becomes equal to mg.
d) constant and greater than mg in magnitude.

14. An unloaded car moving with velocity u on a frictionless road can be stopped in a distance s. If passengers add 40% to its weight and braking force remains the same, the stopping distance at velocity u is now **[1]**

a) 1.4 s
b) $\frac{1}{1.4}$ s
c) $\sqrt{1.4}$ s
d) $(1.4)^2$ s

15. A partly hanging uniform chain of length L is resting on a rough horizontal table. l is the maximum possible length that can be hung in equilibrium. The coefficient of friction between the chair and table is **[1]**

a) $\frac{lL}{L+l}$
b) $\frac{L}{l}$
c) $\frac{l}{L-l}$
d) $\frac{l}{L}$

16. A ball moves on a frictionless inclined table without slipping. The work done by the table surface on the ball is **[1]**

a) negative
b) One
c) positive
d) zero

17. An engine pumps water through a hosepipe. Water passes through the pipe and leaves it with a velocity of 2 $\frac{m}{s}$. The mass per unit length of water in the pipe is 100 $\frac{kg}{m}$. What is the power of the engine? **[1]**

a) 400 W
b) 800 W

c) 100 W d) 200 W

18. Two similar springs P and Q have spring constants K_P and K_Q, such that $K_P > K_Q$. They are stretched, first by the same amount (case a), then by the same force (case b). The work done by the springs W_P and W_Q are related as, in the case (a) and case (b), respectively **[1]**

a) $W_P > W_Q$; $W_Q > W_P$ b) $W_P = W_Q$; $W_P > W_Q$

c) $W_P = W_Q$; $W_P = W_Q$ d) $W_P < W_Q$; $W_Q < W_P$

19. In a head on elastic collision of a very heavy body moving with velocity v with a light body at rest. Then, the velocity of heavy body after collision is **[1]**

a) v b) $\frac{v}{2}$

c) zero d) 2v

20. A force of 10 N is applied on an object of mass 2 kg placed on a rough surface having coefficient of friction equal to 0.2. Work done by applied force in 4 s is **[1]**

a) 100 J b) 120 J

c) 240 J d) 250 J

21. What is the ratio of kinetic energy of a particle at the bottom to the kinetic energy at the top when it just loops a vertical loop of radius r? **[1]**

a) 5 : 2 b) 5 : 1

c) 2 : 3 d) 7 : 2

22. The bob of a pendulum is released from a horizontal position. If the length of the pendulum is 1.5 m, what is the speed with which the bob arrives at the lowermost point, given that it dissipated 5% of its initial energy against air resistance? **[1]**

a) 5.5 m/s b) 4.7 m/s

c) 5.3 m/s d) 4.9 m/s

23. A body of mass 2 kg is placed on a rough horizontal plane. The coefficient of friction between body and plane is 0.2. Then **[1]**

a) body will move in backward direction with acceleration 0.5 m/s^2, if force F = 3 N

b) body will move in forward direction if F = 5 N

c) body will move in the forward direction if F = 5 N and if F = 3 N, then the body will be in rest condition

d) if F = 3 N, then body will be in rest condition

24. A force $\vec{F} = 2\hat{i} + 3\hat{j} + \hat{k}$ acts on a body. The work done by the force for a displacement of $-2\hat{i} + \hat{j} - \hat{k}$ is **[1]**

a) -2 units b) 2 units

c) -4 units d) 4 units

25. A ball is bouncing down a flight of stairs. The coefficient of restitution is e. The height of each step is d and the ball descends one step in each bounce. After each bounce it rebounds to a height h above the next lower step. The height is large enough compared with the width of a step so that the impacts are effectively head-on. Find the relationship between h and d. **[1]**

a) h = $\frac{d}{1-e^2}$

b) h = $\frac{d}{1+e}$

c) h = $\sqrt{\frac{d}{1-e^2}}$

d) h = $\frac{d}{1+e^2}$

26. A particle of mass m_1 moves with velocity v_1 and collides with another particle at rest of equal mass. The velocity of the second particle after the elastic collision is **[1]**

a) v_1

b) $-v_1$

c) 0

d) $2v_1$

27. A simple pendulum hanging freely and at rest is vertical because in that position **[1]**

a) potential energy is zero

b) potential energy is minimum

c) kinetic energy is zero

d) kinetic energy is minimum

28. Two bodies of mass m and 4 m have equal kinetic energy. What is the ratio of their momentum? **[1]**

a) 2 : 1

b) 1 : 1

c) 1 : 4

d) 1 : 2

29. Adult cheetahs, the fastest of the great cats, have a mass of about 70 kg and have been clocked running at up to 72 mph (32 m/s). How many joules of kinetic energy does such a swift cheetah have? **[1]**

a) 34,000 J

b) 32,000 J

c) 29,000 J

d) 35840 J

30. A spring 40 mm long is stretched by the application of a force. If 10 N force is required to stretch the spring through 1 mm, then work done in stretching the spring through 40 mm is **[1]**

a) 23 J

b) 8 J

c) 68 J

d) 84 J

31. A block of mass m falls through a height h on a spring of spring constant k. The maximum displacement in the spring is **[1]**

a) none of these

b) $\frac{mg}{k}$

c) $\sqrt{\frac{2mgh}{k}}$

d) $\frac{2mgh}{k}$

32. The work done by an applied variable force $F = x + x^3$ from x = 0 m to x = 2 m, where x is displacement, is **[1]**

a) 8 J

b) 10 J

c) 6 J

d) 12 J

33. If $\vec{F} = (60\hat{i} + 15\hat{j} - 3\hat{k})$ N and $\vec{v} = (2\hat{i} - 4\hat{j} + 5\hat{k})\ \frac{m}{s}$, then instantaneous power is **[1]**

a) 45 watt

b) 195 watt

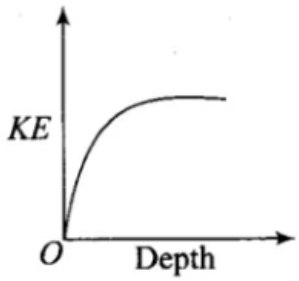
c) 100 watt

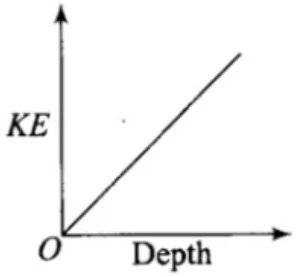
d) 75 watt

34. Which of the graph correctly shows the change in kinetic energy of an iron sphere falling freely in a lake having sufficient depth to impart it a terminal velocity? **[1]**

a)

b)





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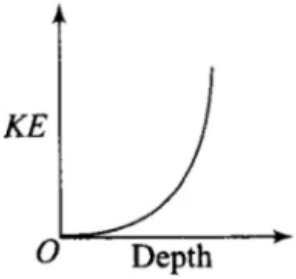
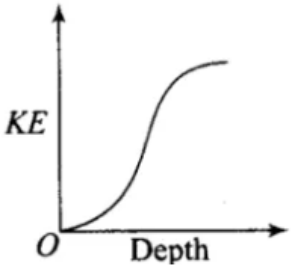


d)



35. The heart of a man pumps 5 litres of blood through the arteries per minute at a pressure of 150 mm of mercury. If the density of mercury be $13.6 \times 10^3 \frac{kg}{m^3}$ and g = 10, then the power of heart in watt is **[1]**

a) 1.50 b) 1.70

c) 3.0 d) 2.35

36. A bullet is fired from a rifle. If the rifle recoils freely, then the kinetic energy of the rifle is **[1]**

a) more than that of the bullet b) same as that of the bullet

c) less than that of the bullet d) equal or less than that of the bullet

37. The total mechanical energy of a system is conserved if the forces, doing work on it, are **[1]**

a) not conservative b) damped

c) conservative d) viscous

38. A constant force F is pushing a 5 kg mass on a horizontal surface at a constant velocity of 2 m/s. The coefficient of friction between the surface and the mass is 0.3 (Take g = 10 $\frac{m}{s^2}$). If F acts along the direction of motion, the rate at which F is doing work (in watt) **[1]**

a) 6 b) 30

c) 10 d) 3

39. A particle of mass m_1 moving with velocity v collides with a mass m_2 at rest, then they get embedded. At the instant of collision, velocity of the system **[1]**

a) increases b) decreases

c) remains constant d) becomes zero

40. Two particles A and B, move with constant velocities $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$. At the initial moment their position vectors are $\overrightarrow{r_1}$ and $\overrightarrow{r_2}$ respectively. The condition for particles A and B for their collision is **[1]**

a) $\frac{\vec{r_1}-\vec{r_2}}{|\vec{r_1}-\vec{r_2}|} = \frac{\vec{v_2}-\vec{v_1}}{|\vec{v_2}-\vec{v_1}|}$ b) $\vec{r}_1 - \vec{r}_2 = \vec{v}_1 - \vec{v}_2$

c) $\vec{r}_1 \cdot \vec{v}_1 = \vec{r}_2 \cdot \vec{v}_2$ d) $\vec{r}_1 \times \vec{v}_1 = \vec{r}_2 \times \vec{v}_2$

41. In which of the following cases is the work done positively? **[1]**

a) Work is done by gravitational force while a man in lifts a bucket out of a well by means of a rope tied to the bucket.

b) Work is done by friction on a body sliding down an inclined plane.

c) Work is done by the resistive force of air on a vibrating pendulum in bringing it to rest.

d) Work is done by an applied force on a body moving on a rough horizontal plane with uniform velocity.

42. 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]**

a) 11 J

b) 2 J

c) 8 J

d) 5 J

43. A block having a mass of 0.80 kg is given an initial velocity of 1.2 m/s to the right and collides with a spring of negligible mass and force constant k = 50 N/m. Assuming the surface to be frictionless, calculate the maximum compression of the spring after the collision. **[1]**

a) 0.15 m

b) 0.20 m

c) 0.10 m

d) 0.25 m

44. A mass of 5 kg is moving along a circular path of radius 1 m. If the mass moves with 300 revolutions per minute, its kinetic energy would be **[1]**

a) 0

b) $250\pi^2$ J

c) $5\pi^2$

d) $100\pi^2$

45. A bolt of mass 0.3 kg falls from the ceiling of an elevator moving down with a uniform speed of 7 m/s. It hits the floor of the elevator (length of the elevator = 3 m) and does not rebound. What is the heat produced by the impact? **[1]**

a) 9.22 J

b) 8.42 J

c) 8.82 J

d) 8.11 J

46. The force on a particle as the function of displacement x (in x-direction) is given by F = 10 + 0.5x **[1]**
The work done corresponding to displacement of particle from x = 0 to x = 2 unit is

a) 29 J

b) 21 J

c) 25 J

d) 18 J

47. 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]**

a) $\frac{1}{2}$ m^2v^2

b) $\frac{1}{2}$ mv^3

c) mv^3

d) $\frac{1}{2}$ mv^2

48. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be **[1]**

a) 0, 2

b) 1, 1

c) 1, 0.5

d) 0, 1

49. A 0.800-kg ball is tied to the end of a string 1.60 m long and swung in a vertical circle. (a) During one complete **[1]**

circle, starting anywhere, calculate the total work done on the ball by

i. the tension in the string and

ii. gravity

a) 25 J, -25 J

b) 10 J, 10 J

c) 30 J, 30 J

d) 0, 0

50. The work done in stretching a spring of force constant k from length l_1 to l_2 is **[1]**

a) $\frac{k}{2}$ ($l_2 + l_1$)

b) k($l_2 - l_1$)

c) $k\left(l_2^2 - l_1^2\right)$

d) $\frac{1}{2}k\left(l_2^2 - l_1^2\right)$

51. A particle moves with a velocity ($5\hat{i}$ - $3\hat{j}$ + $6\hat{k}$) $\frac{m}{s}$ under the influence of a constant force $\vec{F}$ = ($10\hat{i}$ + $10\hat{j}$ + 20 $\hat{k}$) N. The instantaneous power applied to the particle is **[1]**

a) 140 Js^{-1}

b) 170 Js^{-1}

c) 40 Js^{-1}

d) 200 Js^{-1}

52. A spacecraft of mass M and moving with velocity v suddenly breaks in two pieces of the same mass m. After the explosion one of the masses m becomes stationary. What is the velocity of the other part of craft? **[1]**

a) $\frac{Mv}{m}$

b) v

c) $\frac{Mv}{M-m}$

d) $\frac{M-m}{m}$v

53. Two billiard balls each with a mass of 150g collide head-on in an elastic collision. Ball 1 was travelling at a speed of 2 m /s and ball 2 at a speed of 1.5 m /s. After the collision, ball 1 travels away from ball 2 at a velocity of 1.5 m /s .What is the velocity of ball 2? **[1]**

a) ball 2 moves with a velocity of 3.5 m/s

b) ball 2 moves with a velocity of 2 m/s

c) ball 2 moves with a velocity of 2.5 m /s

d) ball 2 moves with a velocity of 3.7 m/s

54. A ball impinges directly on a similar ball at rest. The first ball is brought to rest by the impact. If half of the kinetic energy is lost by impact, the value of the coefficient of restitution is **[1]**

a) $\frac{1}{\sqrt{2}}$

b) $\frac{1}{2\sqrt{2}}$

c) $\frac{1}{\sqrt{3}}$

d) $\frac{\sqrt{3}}{2}$

55. The power (P) of an engine lifting a mass of 100 kg upto a height of 10 m in 1 min is **[1]**

a) 165 W

b) 162.3 W

c) 163.3 W

d) 164.3 W

56. An electric pump is used to fill an overhead tank of capacity $9m^3$ kept at a height of 10 m above the ground. If the pump takes 5 min to fill the tank by consuming 10 kW power, the efficiency of the pump should be **[1]**

a) 40%

b) 60%

c) 30%

d) 20%

57. A body of mass 5 kg, moving with a velocity 10 $\frac{m}{sec}$ collides with another body of the mass 20 kg at rest and comes to rest. The velocity of the second body due to collision is **[1]**

a) 2.5$\frac{m}{sec}$

b) 7.5$\frac{m}{sec}$

c) $5\frac{m}{sec}$ d) $10\frac{m}{sec}$

58. Which of the following is non-conservative force? **[1]**

a) Viscous force b) Electrostatic force

c) Interatomic force d) Gravitational force

59. In which case is the work done zero? **[1]**

a) Force and displacement are perpendicular to each other b) Force and displacement are in the same direction

c) Force and displacement are at an angle of 45 ° d) Force and displacement are at an angle of 75°

60. A gun fires a bullet of mass 50 g with a velocity of 30 ms^{-1}. Because of this, the gun is pushed back with a velocity of 1ms^{-1}. The mass of the gun is **[1]**

a) 1.5 kg b) 3.5 kg

c) 0.5 kg d) 5.5 kg

61. If the kinetic energy of a body is increased by 300%, then the percentage change in momentum will be **[1]**

a) 265% b) 73.2%

c) 150% d) 100%

62. The work done by a conservative forces depends **[1]**

a) on both the end points as well as the path b) depends on the path

c) only on the end points d) on the position of the forces

63. The earth, moving around the sun in a circular orbit, is acted upon by a force and hence work done on the earth by the force is **[1]**

a) One b) -ve

c) zero d) +ve

64. A shell, in flight, explodes into four unequal parts. Which of the following is conserved? **[1]**

a) Kinetic energy b) Potential and Kinetic energy

c) Momentum d) Potential energy

65. The decrease in the potential energy of a ball of mass 20 kg, which falls from a height of 50 cm is **[1]**

a) 1.980 J b) 98 J

c) 908 J d) 968 J

66. A bicyclist comes to a skidding stop in 10 m. During this process, the force on the bicycle due to the road is 200N and is directly opposed to the motion. The work done by the cycle on the road is **[1]**

a) -20,000J b) -200J

c) +2000J d) Zero

67. The dimension of k in the equation W = $\frac{1}{2}$ kx^2 is **[1]**

a) $[M^1L^0T^{-2}]$ b) $[M^1L^1T^{-2}]$

c) $[M^1L^0T^{-1}]$ d) $[M^0L^1T^{-1}]$

68. How much work must be done by a force on 50 kg body in order to accelerate it from rest to 20 $\frac{m}{s}$ in 10 s? **[1]**

a) 2×10^4 J b) 10^3 J

c) 10^4 J d) 2×10^3 J

69. Power can be expressed as **[1]**

a) $\vec{F} \times \vec{v}$ b) $\vec{F}$·t

c) $\vec{F} \cdot \vec{v}$ d) $\frac{1}{2}\vec{F} \cdot v^2$

70. A block of mass m is pulled along a horizontal surface by applying a force at an angle θ with the horizontal. If the block travels with a uniform velocity and has a displacement d and the coefficient of friction is μ, then the work done by the applied force is **[1]**

a) $\frac{\mu mgd}{\cos\theta+\mu\sin\theta}$ b) $\frac{\mu mgd\sin\theta}{\cos\theta+\mu\sin\theta}$

c) $\frac{\mu mgd\cos\theta}{\cos\theta-\mu\sin\theta}$ d) $\frac{\mu mgd\cos\theta}{\cos\theta+\mu\sin\theta}$

71. A ball falls from rest from a height h on to a floor and rebounds to a height $\frac{h}{4}$. The coefficient of restitution between the ball and the floor is **[1]**

a) $\frac{1}{2}$ b) $\frac{3}{4}$

c) $\frac{1}{4}$ d) $\frac{1}{\sqrt{2}}$

72. In a shotput event an athlete throws the shotput of mass 10 kg with an initial speed of $1ms^{-1}$ at 45° from a height 1.5 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be 10 ms^{-2}, the kinetic energy of the shotput when it just reaches the ground will be **[1]**

a) 5.0 J b) 2.5 J

c) 155.0 J d) 52.5 J

73. A stationary particle explodes into two particles of masses m_1 and m_2 which move in opposite directions with velocities v_1 and v_2. The ratio of their kinetic energies $\frac{E_1}{E_2}$ is **[1]**

a) $\frac{m_2}{m_1}$ b) 1

c) $\frac{m_1v_2}{m_2v_1}$ d) $\frac{m_1}{m_2}$

74. A proton is kept at rest. A positively charged particle is released from rest at a distance d in its field. Consider two experiments; one in which the charged particle is also a proton and in another, a positron. In the same time t, the work done on the two moving charged particles is **[1]**

a) less for the case of a positron, as the positron moves away more rapidly and the force on it weakens.

b) more for the case of a positron, as the positron moves away a larger distance.

c) same, as the same force law is involved in the two experiments.

d) more for the case of a positron, as the positron moves away from a larger distance.

75. 300 J of work is done in sliding a 2 kg block up an inclined plane of height 10 m. Taking g = 10 $\frac{m}{s^2}$, the work done against friction is **[1]**

a) 200 J

b) 100 J

c) 1000 J

d) zero