CBSE Class 11 Physics

Practice Paper

Chapter-6 (Work Energy and Power)

Numericals

1. A body is moving along z-axis of a coordinate system under the effect of a constant force $F = (2\hat{i} + 3\hat{j} - \hat{K})$ N. Find the work done by the force in moving the body a distance of 2 m along z-axis. /2. In lifting a 10kg weight to a height of 2m, 230 J energy is spent. Calculate the acceleration with which it was raised?
2. A bullet of mass 0.02 kg is moving with a speed of $10m^{-1}s$. It can penetrate 10 cm of a wooden block, and comes to rest. If the thickness of the target would be 6 cm only find the KE of the bullet when it comes out. (Ans: 0.4J)
3. A man pulls a lawn roller with a force of 20 kgF. If he applies the force at an angle of 60° with the ground. Calculate the power developed If he takes 1 min in doing so.
4. A ball bounces to 80% of its original height. Calculate the mechanical energy lost in each bounce.
5. A pendulum bob of mass 0.1 kg Is suspended by a string of 1 m long. The bob is displaced so that the string becomes horizontal and released. Find its kinetic energy when the string makes an angle of (i)0°, (ii) 30° with the vertical.
6. A particle of mass m is moving in a horizontal circle of radius r under a centripetal force equal to k/r2, k is a constant. What is the total energy of the particle. (—k/2r>
7. The K.E. of a particle moving along a circle of radius R depends on the distance covered S as T = a S2 where a is constant. Find the force acting on the particle as a function of S. [F = 2 x S $\sqrt{1 + s^2 / R^2}$]
8. Derive the relation E = Δmc2.

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1 Marks Questions

1. Define the conservative and non-conservative forces. Give examples of each.
2. A light body and a heavy body have same linear momentum. Which one has greater K.E? (Ans.: lighter body has more K.E.)
3. The momentum of the body is doubled what does its K.E change? (300%)
4. How can we change the momentum of a body without change in its K.E.?
5. Which spring has greater value of spring constant - a hard spring or a delicate spring?
6. Two bodies stick together after collision. What type of collision Is in b/w these two bodies?
7. State the two conditions under which a force does no work?
8. How will the momentum of a body changes If its K.E is doubled?
9. K.E of a body is increased by 300 %. Find the % Increase in its momentum? (100%)
10. A light and a heavy body have same K.E. which of the two have more momentum and why? (heavier body)
11. Mountain roads rarely go straight up the slop, but wind up gradually. Why?
12. A truck and a car moving with the same K.E on a straight road. Their engines are simultaneously switched off which one will stop at a lesser distance?
13. What happens to the P.E of a bubble when it rises in water? (decrease)
14. A body is moving at constant speed over a friction surface. What is the work done by the weight of the body? (W = 0)
15. What type of energy is stored in the spring of a water?
16. Define spring constant of a spring?
17. What happens when a sphere collides head on elastically with a sphere of same mass initially at rest?

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2 Marks Questions

1. A elastic spring is compressed by an amount x. Show that its P.E is $\frac{1}{2}kx^2$ Where k is the spring constant?
2. Derive an expression for it K.E of a body of mass m moving with a velocity v by calculus method.
3. Show that the total mechanical energy of a body falling freely under gravity is conserved.
4. How high must a body be lifted to gain an amount of RE equal to the K.E it has when moving at speed $20ms^{-1}$ (The value of acceleration due to gravity at a place is $9.8ms^{-2}$). (20.2 m)
5. Calculate the work done in moving the object from x =2tox = 3m from the graph given
6. After bullet is fined, gun recoils freely. Compare the K.E. of bullet and the gun. ($KE_b > KE_g$)
7. A bob Is pulled sideway so that string becomes parallel to horizontal and released. Length of the pendulum is 2 m. If due to air resistance loss of energy is 10% what is the speed with which the bob arrived at the lowest point.
8. Two springs A and B are identical except that A is harder than B (KA > KB) if these are stretched by the equal force. In which spring will more work be done?
9. Explain the term work? show that work done is equal to the dot product of force and displacement.
10. Find the work done if a particle moves from position to a position T2 = (14l + 13j — 9k) under the effect of force $\vec{r}_1 = (3\hat{i} + 2\hat{j} - 6\hat{k})$ to a position $\vec{r}_2 = (14\hat{i} + 13\hat{j} - 9\hat{k})$ under the effect force $\vec{F} = (4\hat{i} + \hat{j} + 3\hat{k})N.$
11. A particle of mass I g moving with a velocity $\vec{V}_1 = (3\hat{i} - 2\hat{j})$ has elastic collision with another particle of mass 2 g moving with a velocity $\vec{V}_2 = (4\hat{i} - 6\hat{k})$ Find the velocity of the particle formed. ($V=4.6ms^{-1}$)
12. A body of mass m accelerate uniformly from rest to velocity vl, in time tl. Derive an expression for the instantaneous power delivered to the body asa function of time (P =

$mv^2t/tl2$)

13. How much energy is related when 1 mg of U is completely destroyed in an atomic bomb? ($9x10^{10}$) j
14. 20 J work is required to stretch a spring through 0.1 m. Find the force constant of the spring. If the spring Is further stretched through 0.1 m. Calculate work done. (4000 Nm^{-1},60j)
15. For a particle executing S.H.M, potential energy function is given by $V_{(x)}= 1/2\ kx^2$, K = 0.5 Nm^{-1} is force constant of the oscillator. If the total energy of the particle is 1J, show that particle turn back when x=± 2m from its mean position.
16. A pump on the ground floor of a building can pump up water to fill a tank of volume $30m^3$ in 15 min. If the tank is 40 m above the ground, how much electric power is consumed by the pump. The efficiency of the pump is 30%. (43.567 Kw)
17. A force $\vec{F} = 2 \times \hat{j}N$ acts in a region, where a particle moves clock wise along the sides of a square of length 2m. Find the total amount of work done? (8 J)
18. A mass less pan is placed on an elastic spring. Spring is compressed by 0.01 m when a sand bag of mass 0.1 kg is dropped on it from a height 0.24 m. From what height should the sand bag be dropped to cause a compression of 0.04 m? (3.96 m)
19. State and prove Work Energy Theorem.
20. Show that in an elastic one dimensional collision the relative velocity of approach before collision is equal to the relative velocity of separation after collision.
21. Show that in a head on collision between two balls of equal masses moving along a straight line the balls exchange their velocities.
22. A force acting on a body along Y axis the direction of motion of the body. If this force produces a potential energy $U = Ax^4$ when A = 1.2 Jm^{-4}. What is the force acting on the body when the body is at x=0.8 m. (2.46N)
23. A spring of free constant K is cut into two equal pieces. Calculate force constant of each part.
24. How vibration of a simple pendulum does illustrate the principle of energy conservation?
25. A spring is first stretched by x by applying a force F. Now the extension of the spring is increases to 3x. What will be the new force required to keep the spring in this condition? Calculate the work done in increasing the extension.

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5 Marks Questions

1. Show that at any instant of time during the motion total mechanical energy of a freely falling body remains constant. Show graphically the variation of K.E. and P.E. during the motion.
2. Define spring constant, Write the characteristics of the force during the elongation of a spring. Derive the relation for the PE stored when it is elongated by X. Draw the graphs to show the variation of P.E. and force with elongation.
3. How does a perfectly inelastic collision differ from perfectly elastic collision? Two particles of mass m_1 and m_2 having velocities U_1 and U_2 respectively make a head on collision. Derive the relation for their final velocities.
   Discuss the following special cases.
   i. $m_1=m_2$
   ii. $m_1>>m_2$ and $U_2=0$
   iii. $m_1<<m_2$ and $U_1=0$