CLASS XI

WORK , ENERGY AND POWER

SECTION – A CONCEPTUAL AND APPLICATION TYPE QUESTIONS

1. A body is moving at constant speed over a frictionless horizontal surface. What is the work done by gravitational force? 1

2. Does the work done in raising a suitcase on to a platform depend upon how fast it is raised up ? 1

3. Is it possible that a body be in accelerated motion under a force acting on the body , yet no work is being done by the force ? Explain with an example ? 1

4. A light body and a heavy body have same kinetic energy . Which one has greater linear momentum? 1

5. How does KE of a body change if its momentum is doubled ? 1

6. Is work done by a non conservative force always negative ?Comment . 1

7. Can a body have momentum without energy ? 1

8. Two masses one n times heavier than the other are dropped from same height . How do their momentum compare just before they hit the ground ? 1

9. A spring is cut into two halves .How is the spring constant of each half affected ? 1

10. Two springs A and B are identical but A is harder than B . On which spring more work will be done if they are stretched by same force ? 1

11. A lorry and a car with the same kinetic energy are brought to rest by the application of the brakes which provide equal retarding force . Which of them will come to rest in a shorter distance ? 1

12. What happens to the potential energy : 2
    a) Two dissimilar charges are brought near each other
    b) A body is taken away against the gravitational force .

13. Two persons lift same load from the road to the roof of a bus . One of them takes 1 minute and the other takes 2 minutes to do the same job . Who has done more work and whose power is more ? 1

14. Name the process in which 2
    (i)Momentum is conserved but KE is not conserved ?
    (ii)Momentum changes but KE does not change ?

15. Difference between conservative and non – conservative forces. 1

16. Show that power is equal to dot product of force and velocity . 1

17. What are head – on and oblique collisions ? 1

18. Is total energy conserved in an inelastic collision ? 1

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19. Why does a pilot looping a vertical loop not fall down even at the highest point ? 1

SECTION – B NUMERICAL PROBLEMS

1. In a ballistics demonstration,a police officer fires a bullet of mass 50 g with speed 200 m/s on a soft plywood of thickness 2 cm . The bullet emerges with only 10 % of its KE . What is the emergent speed of the bullet ? 2

2. A bullet of mass 50 g moving with velocity of 400 m/s strikes a wall and goes out from the other side with a velocity of 100 m/s . Calculate the work done in passing through the wall ? 2

3. The momentum of a body is increased by 100 % .What is the percentage increase in its KE ? 2

4. A train of mass 2000 quintal is drawn up an inclined plane of 2 in 100 at the rate of 72 km/h .If the resistance due to friction is 3000 N , calculate the power of the engine . 2

5. A ball is dropped from rest at a height of 12 m . If it loses 25 % of KE on striking the ground, what is the height to which it bounces ? 2

6. A mass of 2 kg attached to a spring is vibrated horizontally by displacing the mass 40 cm from its equilibrium position and releasing it . Find the maximum velocity of the mass. Spring constant is 24.5 N/m 2

7. 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 , the efficiency of the pump is 30 % ,how much electric power is consumed by the pump ? 2

8. A bullet of mass 0.012 kg and horizontal speed 70 m/s strikes a block of wood of mass 0.41 kg and instantly comes to rest with respect to the block. The block is suspended from the ceiling by means of thin wires . Calculate the height to which the block rises . Also estimate the amount of heat produced in the block. 2

9. A metal ball of mass 2 kg moving with speed of 36 km/h has a head on collision with a stationary ball of mass 3 kg . If after collision both the balls move as a single mass , what will be the loss in kinetic energy due to collision ? 2

10. If the kinetic energy of a body increases by 300 % , by what percent will the linear momentum of the body increase ? 2

11. A mass of 4 kg moving with 10 m/s comes to rest , after covering 2m on a horizontal surface . Calculate: 3

    (i)coefficient of kinetic friction between surfaces

    (ii) work done by frictional force

    (iii)work done by gravitational force.

12. A body of mass 2 kg is resting on a rough horizontal surface . A force of 20 N is now applied to it for 10 seconds , parallel to the surface . If the coefficient of kinetic friction between the surfaces in contact is 0.2 s , calculate 2
    (i)work done by the applied force in 10s
    (ii)change in kinetic energy of the object in 10 s

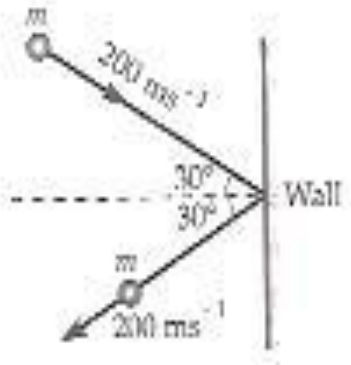
13. A girl of mass 50 kg sits in a swing formed by a rope of 8m length. A person pulls the swing to a side so that the rope makes an angle of 60^0 with the vertical .What is the gain in potential energy of the girl ? 2

14. A car of mass 1000 kg accelerates uniformly from rest to a velocity of 54 km/hr in 5 seconds. Calculate 3
(i)its acceleration
(ii)its gain in KE
(iii)average power of the engine during this period , neglect friction.

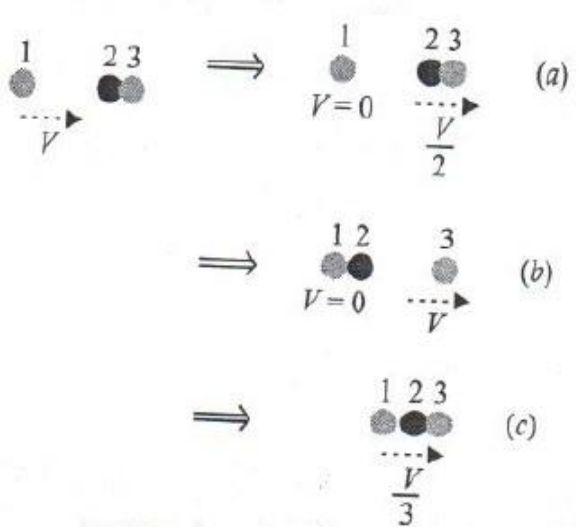
15. A molecule in a gas container hits a horizontal wall with speed 200 m/s and angle 30^{o} with the normal, and rebounds with the same speed. 2

(i)Is momentum conserved in the collision?

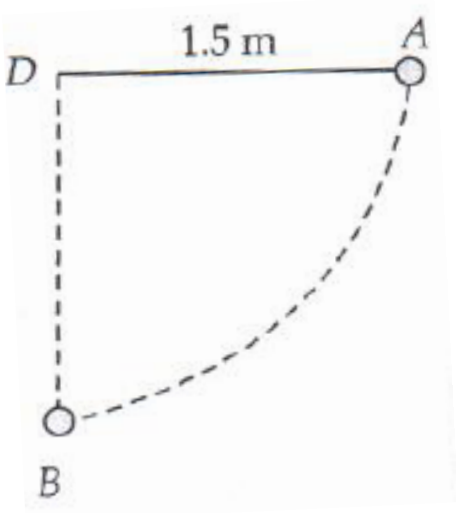
(ii)Is the collision elastic or inelastic ?



16. Two identical ball bearings in contact with each other and resting on a frictionless table are hit head on by another ball bearing of the same mass moving initially with a speed v . If the collision is elastic, which of the situations shown,is a possible result after collision ? 3



17. The bob of a pendulum isreleased from a horizontal position A as shown . If the length of the pendulum is 1.5 m , what is the speed with which the bob arrives at the lowermost point B , given that it dissipates 5 % of its initial energy against air resistance ? 2



18. A 1 kg block situated on a rough incline to a spring of spring constant 100 N/m as shown . The block is released from rest with the spring in the unstretched position. The block moves 10cm down the incline before coming to rest . Find the coefficient of friction between the block and the incline. Assume that the spring has negligible mass and the pulley is frictionless. 2