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TOPIC : 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?
2. Does the work done in raising a suitcase on to a platform depend upon how fast it is raised up?
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.
4. A light body and a heavy body have same kinetic energy. Which one has greater linear momentum?
5. How does KE of a body change if its momentum is doubled?
6. Can a body have momentum without energy?
7. Name the process in which
  - (i)Momentum is conserved but KE is not conserved?
  - (ii)Momentum changes but KE does not change?
8. Difference between conservative and non – conservative forces.
9. Show that power is equal to dot product of force and velocity.
10. Why does a pilot looping a vertical loop not fall down even at the highest point?

**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. 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?
3. The momentum of a body is increased by 100 % .What is the percentage increase in its KE?
4. 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 ?
5. 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
6. A pump on the ground floor of a building can pump up water to fill a tank of volume  $30\text{m}^3$  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 ?
7. 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.
8. 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 ?
9. A mass of 4 kg moving with 10 m/s comes to rest , after covering 2m on a horizontal surface . Calculate
  - (i)coefficient of kinetic friction between surfaces
  - (ii) workdone by frictional force
  - (iii)workdone by gravitational force.
10. A body of mass 2 kg is resting on a rough horizontal surface. A force of 20 N is now applied to it 10 seconds , parallel to the surface . If the coefficient of kinetic friction between the surfaces in contact is 0.2 s , calculate
  - (i)work done by the applied force in 10s
  - ii)change in kinetic energy of the object in 10 s
11. 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  $60^\circ$  with the vertical . What is the gain in potential energy of the girl?
12. A car of mass 1000 kg accelerates uniformly from rest to a velocity of 54 km/hr in 5 seconds.

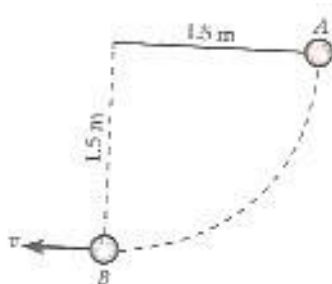
Calculate

(i) its acceleration

(ii) its gain in KE

(iii) average power of the engine during this period, neglect friction.

13.



The bob of a pendulum is released 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 ?

14. A 1 kg block situated on a rough incline is connected to a spring of spring constant  $100 \text{ N m}^{-1}$  as shown in figure. The block is released from rest with the spring in the unstretched position. The block moves 10 cm down the incline before coming to rest. Find the coefficient of friction between the block and the incline. Assume that the spring has a negligible mass and the pulley is frictionless.

