WORK ENERGY AND POWER:

SQs:

1. a. Two bodies of different masses are moving with the same kinetic energy of translation, which one has more momentum?

   b. State principle of conservation of energy and prove it.

2. a. Two bodies of different masses are moving with the same momentum, which one has more kinetic energy? Explain.
   b. A car of mass $1000kg$ moves at constant speed of $25m/s$ along a horizontal road where frictional force is $200N$. Calculate the power developed by the engine. $[\boldsymbol{Ans: 5kw}]$
3. a. Differentiate between conservative and non-conservative forces.
   b. State and explain work energy theorem.
4. a. A stationary mass suddenly explodes into two fragments, one heavy and another light. Which one has greater kinetic energy and why?
   b. An explosive of mass M placed at a points explodes into one-third and two-third parts. If the initial kinetic energy of smaller mass is $1000J$. What will be the initial kinetic energy of larger part? $[\boldsymbol{Ans: 500J}]$
5. a. How does the kinetic energy of a body change if its momentum is halved?
   b. Draw variation of kinetic energy with mass is momentum is constant.
   c. A bullet of mass $10g$ is fired from a gun of mass $1kg$ with a velocity of $100m/s$, calculate the ratio of the kinetic energy of the bullet and the gun.
6. a. What are elastic and inelastic collision? Give example of each.
   b. Show that in an elastic collision between two particles, the relative velocity of approach before collision is equal to relative velocity of separation after collision.
   c. A ball of mass 4kg moving with a velocity $10m/s$ collides with another body of mass $16kg$moving with $4m/s$ from the opposite direction and then coalesces into a single body. Compute the loss of energy on impact. $[\boldsymbol{313.6J}]$
7. a. If a moving bullet striking a block of wood on a frictionless table embeds inside it what happens to the KE of the bullet?
   b. A ball A of mass 0.1 kg moving with a velocity of $6m/s$ collides directly with a ball B of mass 0.2 kg at rest. Calculate their common velocity if both balls move off together. If ball A had rebounded with a velocity of $2m/s$ in the opposite direction after collision, what would be the new velocity of B?
8. a. A man carrying a bucket of water and walking on a rough level road with a uniform velocity. Does he do work while carrying the bucket?
   b. Define work. Derive an expression to calculate the work done by variable force.

9. a. What is the physical difference between elastic and inelastic collision? Prove that the colliding object having same masses exchange their velocities in one dimensional elastic collision.
   b. Write the energy and momentum equations for an inelastic collision.
10. a. What is work. Explain negative work with suitable example?
    b. A typical car weighs about 1200 N. If the coefficient of rolling friction is $\mu = 0.015$. What horizontal force is needed to make the car move with constant speed of 72 km/h on a level road? Also calculate the power developed by the engine to maintain this speed. $[\boldsymbol{Ans: 18N, 360watt}]$

Numerical:

1. Two tug boats pull a disabled super tanker. Each tug exerts a constant force of $1.80 \times 10^6 N$, one 14^0 west of north and the other 14^0 east of north, as they pull the tanker $0.75km$ towards the north. What is the total work they do on the super tanker? $[\boldsymbol{Ans: 2.62 \times 10^9 J}]$
2. How many joules of energy does a $100\ watt$ light bulb use per hour? How fast would a $70kg$ person have to run to have that energy? $[\boldsymbol{Ans: 101.4\ m/s}]$