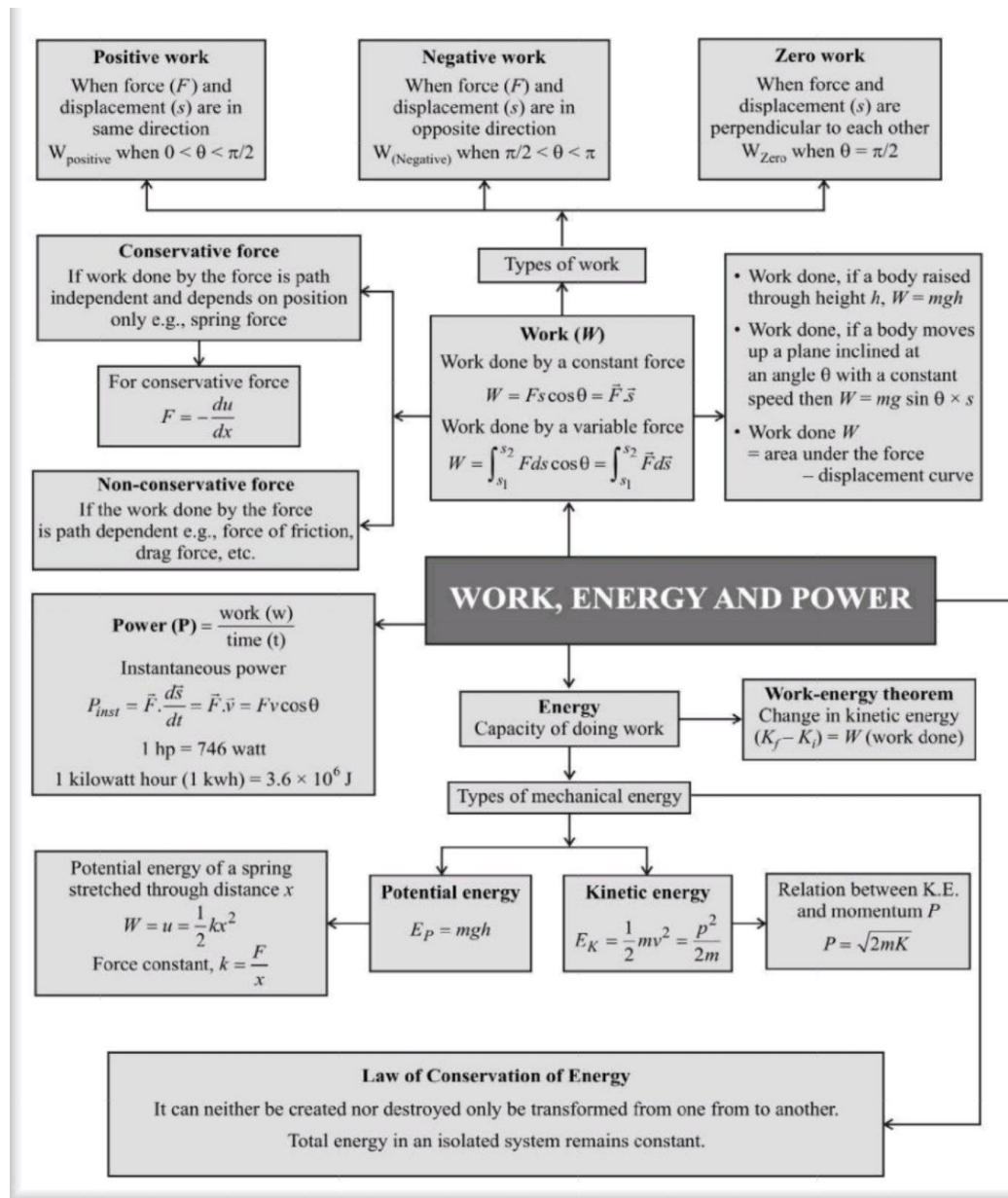


Work Energy and Power:

Summary:



SQs:

- Two bodies of different masses are moving with the same kinetic energy of translation, which one has more momentum?
 - State principle of conservation of energy and prove it.
- Two bodies of different masses are moving with the same, which one has more kinetic energy? Explain.
 - 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. **[Ans: 5kw]**
- Differentiate between conservation and non-conservative forces.
 - State and explain work energy theorem.
- A stationary mass suddenly explodes into two fragments, one heavy and another light. Which one has greater kinetic energy and why?
 - An explosive of mass M placed at a point 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? **[Ans: 500J]**
- How does the kinetic energy of a body change if its momentum is halved?
 - Draw variation of kinetic energy with mass if momentum is constant.
 - 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.
- What are elastic and inelastic collision? Give example of each.
 - 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.
 - 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. **[313.6J]**
- If a moving bullet striking a block of wood on a frictionless table embeds inside it what happens to the KE of the bullet?
 - A ball A of mass 0.1kg moving with a velocity of 6m/s collides directly with a ball B of mass 0.2kg 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?
- 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?
 - 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. **[Ans: 18N, 360watt]**

Numerical:

- Two tug boats pull a disabled super tanker. Each tug exerts a constant force of $1.80 \times 10^6 N$, one 14° west of north and the other 14° east of north, as they pull the tanker 0.75km towards the north. What is the total work they do on the super tanker? **[Ans: $2.62 \times 10^9 J$]**
- 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? **[Ans: 101.4 m/s]**
- A force of 20N is applied to a body of mass 10kg, initially at rest on a smooth horizontal surface for a time of 5sec. Calculate
 - The final velocity **[Ans: 10m/s]**
 - The distance travelled **[Ans: 25m]**
 - The work done **[Ans: 500J]**
- A horse is towing a canal boat, the tow rope making an angle of 10° with the tow path. If the tension in the rope is 20N, how many joules of work are done while moving 50m tow path? **[Ans: 984.8J]**
- A 0.15kg glider is moving to the right on a frictionless horizontal air track with a speed of 0.80m/s. It has a head on collision with a 0.30kg glider that is moving to the left with a speed of 2.2m/s. Find the final velocity of each glider if the collision is elastic. **[Ans: -3.2m/s and -0.2m/s]**
- Calculate the energy of,
 - A 2kg object moving horizontally with a velocity of 10m/s. **[Ans: 100J]**
 - A 10kg object held stationary 5m above the ground. **[Ans: 500J]**
- A ball of mass 0.1kg is thrown vertically upwards with a velocity of 20m/s. What is the potential energy at the maximum height? What is the potential energy of the ball when it reaches three quarters of the maximum height while moving upwards? **[Ans: 20J and 15J]**
- A meter-stick is pivoted about a horizontal axis through its centre has a body of mass 2kg attached to one end and a body of mass 1kg attached to the other. The

system is released from rest with the stick horizontal. What is the velocity of each body as the stick swings through a vertical position? Use acceleration due to gravity ($g = 9.8m/s^2$). **[Ans: 1.81m/s]**

- A 1kg object moving with velocity 4m/s collides with a stationary object of mass 2kg. Assuming that the collision is perfectly elastic, Calculate the velocity of each object after the collision. **[Ans: -1.34m/s & 2.67m/s]**
- A bomb explodes into two parts of masses 6kg & 2kg respectively. If the combined kinetic energy of the two parts be $4.8 \times 10^3 J$, find the combined kinetic energy of each part. **[Ans: 1200J & 3600J]**
- A water reservoir tank of capacity 250 m³ is situated at a height of 20 m from the water level. What will be the power of an electric motor to be used to fill the tank in 3 hours? Efficiency of motor is 70%. **[Ans: 6614watt]**
- You throw a 20 N rock vertically into the air from ground level. You observe that when it is 15 m above the ground, it is travelling at 25 m/s upward. Use the work-energy theorem to find (i) its speed as it left the ground and (ii) its maximum height. **[Ans: 30.41m/s, 46.25m]**
- A 650 KW power engine of a vehicle of mass $1.5 \times 10^5 Kg$ is rising on an inclined plane of inclination 1 in 100 with a constant speed of 60 km/hr. Find the frictional force between the wheels of the vehicle and the plane. **[Ans: $\frac{7.07m}{s}$]**
- A block of weight 150N is pulled 20m along a horizontal surface at constant velocity. Calculate the work done by the pulling force if the coefficient of Kinetic friction is 0.20 and the pulling force makes an angle of 60° with the vertical. **[Ans: 537.9J]**

Graphical type Questions:

- Force versus displacement curve is shown in the diagram. Find the change in kinetic energy by the force at the end of 30 m.
- Adjacent figure shows the force-displacement graph of a moving body, the work done in displacing body from $x=0$ to $x=35m$ is equal to,

