

# NCERT Physics Questions

## Chapter 10: Work and Energy

### Solutions

#### Theory questions

##### Short theory questions

1. Define work using both the formula and the sentence definition.

*Ans:*

*Formula definition:*

*(Defining variables and the setup first:)*

- *Let a constant force,  $F$  act on an object.*
- *Let the object be displaced through a distance  $s$ ,*
- *in the direction of the force.*
- *Let  $W$  be the work done.*

*(Actual definition:)*

- *We define work to be equal to the product of the force  $F$  and displacement  $s$ .*
- $W = F \cdot s$

*Sentence definition: Work done,*

- *by a force*
- *acting on an object*

- *is equal to the magnitude of the force multiplied by the distance moved*
  - *in the direction of the force.*
2. Mention the SI unit of work (both standalone unit, and in terms of work's constituents from the formula).  
*Ans: 1 Joule, or 1 N m.*
  3. Give the definition of SI unit of work.  
*Ans:*
    - *1 J is the amount of work done on an object when*
    - *a force of 1 N,*
    - *displaces it by 1 m,*
    - *along the line of action of the force.*
  4. Does work have direction? Can it be negative? Does it depend on the exact path taken?
  5. Mention the relation between work and energy (in one point).
  6. What are the two fundamental types of energy?
  7. Give the definition of kinetic energy.
  8. Define potential energy. Give a formula relation between potential energy and work done by an agent.
  9. Define gravitational potential energy.
  10. Define power and its formula. Does it have direction?
  11. Mention the SI unit of power (both standalone unit, and in terms of power's constituents from the formula).
  12. (*extra*) Difference between average power and instantaneous power.
  13. For problem solving purposes, can we apply conservation of energy formula when friction is involved? If no, how do we deal with energy lost by friction?

## Long theory questions

1. Derive the formula of kinetic energy.  
*Steps: a) State the variables and the setup, b) Mention the formulas to be used, c) Interconnect the formulas to get final result.*
2. Derive the formula for gravitational potential energy.
3. State the law of conservation of energy in 3 points. Give the formula in terms of kinetic and potential energy.

## Statement problems

1. A person is holding a ball on a string and it is swinging like a pendulum steadily.
  - (a) Does the person holding the string do any work at any given moment?
  - (b) (*extra*) What are the moments in the motion of pendulum where gravity is doing zero instantaneous power?

## Numericals

1. A 1kg block is launched sliding on a rough surface at 20m/s and reaches a stop in 2 seconds. What is the total work done by friction?
2. What is the work done by a clock between 12pm and 6pm? The length of the hour hand is 10cm and all its mass is focused at the tip, weighing 10g. Also calculate the average power of the clock.