

# Work, Energy, Power

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1. A body, when acted upon by a force of 10 kgf, gets displaced by 0.5 m. Calculate the work done by the force, when the displacement is (i) in the direction of force, (ii) at an angle of  $60^\circ$  with the force, and (iii) normal to the force. ( $g = 10 \text{ N kg}^{-1}$ )
2. A boy of mass 40 kg climbs up the stairs and reaches the roof at a height 8 m in 5 s. Calculate :
  - (i) the force of gravity acting on the boy,
  - (ii) the work done by him against the force of gravity,
  - (iii) the power spent by the boy.(Take  $g = 10 \text{ m s}^{-2}$ )
3. A man spends 6.4 kJ energy in displacing a body by 64 m in the direction in which he applies force, in 2.5 s. Calculate : (i) the force applied, and (ii) the power spent (in H.P.) by the man.
4. A weight lifter lifted a load of 200 kgf to a height of 2.5 m in 5 s. Calculate : (i) the work done, and (ii) the power developed by him. Take  $g = 10 \text{ N kg}^{-1}$ .
5. A machine raises a load of 750 N through a height of 16 m in 5 s. Calculate :
  - (i) the energy spent by the machine,
  - (ii) the power of the machine if it is 100% efficient.
6. An electric heater of power 3 kW is used for 10 h. How much energy does it consume ? Express your answer in (i) kWh, (ii) joule.
7. A water pump raises 50 litre of water through a height of 25 m in 5 s. Calculate the power of the pump required.  
(Take  $g = 10 \text{ N kg}^{-1}$  and density of water =  $1000 \text{ kg m}^{-3}$ ).
8. A pump is used to lift 500 kg of water from a depth of 80 m in 10 s. Calculate :
  - (a) the work done by the pump,
  - (b) the power at which the pump works, and
- (c) the power rating of the pump if its efficiency is 40%. (Take  $g = 10 \text{ m s}^{-2}$ )
9. An ox can apply a maximum force of 1000 N. It is taking part in a cart race and is able to pull the cart at a constant speed of  $30 \text{ m s}^{-1}$  while making its best effort. Calculate the power developed by the ox.
10. The power of a motor is 40 kW. At what speed can the motor raise a load of 20,000 N ?
11. Rajan exerts a force of 150 N in pulling a cart at a constant speed of  $10 \text{ m s}^{-1}$ . Calculate the power exerted.
12. A boy weighing 350 N climbs up the 30 steps, each 20 cm high in 1 minute. Calculate : (i) the work done, and (ii) the power spent.
13. It takes 20 s for a person A of mass 50 kg to climb up the stairs, while another person B of same mass does the same in 15 s. Compare the (i) work done, and (ii) power developed by the persons A and B.
14. A boy of weight 40 kgf climbs up the 15 steps, each 15 cm high in 10 s and a girl of weight 20 kgf does the same in 5 s. Compare : (i) the work done, and (ii) the power developed by them. Take  $g = 10 \text{ N kg}^{-1}$ .
15. A man raises a box of mass 50 kg to a height of 2 m in 20 s, while another man raises the same box to the same height in 50 s.
  - (a) Compare : (i) the work done, and (ii) the power developed by them.
  - (b) Calculate : (i) the work done, and (ii) the power developed by each man. Take  $g = 10 \text{ N kg}^{-1}$ .
16. A boy takes 3 minutes to lift a 20 litre water bucket from a 20 m deep well, while his father does it in 2 minutes. (a) Compare : (i) the work, and (ii) power developed by them. (b) How much work each does ? Take density of water =  $10^3 \text{ kg m}^{-3}$  and  $g = 9.8 \text{ N kg}^{-1}$ .