# Class 9 Chapter Work and energy Solved Numerical problems

1. A force of 10N causes a displacement or 2m in a body in its own direction. Calculate the work done by force. 20j

Solution: the work done by force = F x S = 10 N x 2m = 20 J

2. How much force is applied on the body when 150 joule of work is done in displacing the body through a distance of 10m in the direction of force?(15 N)

Solution: W = F x S => F = w/s = 150/10 = 15 N

3. A body of 5kg raised to 2m find the work done(98j)

Solution: T he work done to raise a body = PE = mgh = 5kg x 9.8 x 2 = 98 joule

4. A work of 4900j is done on road of mass 50 kg to lift it to a certain height. Calculate the height through which the load is lifted. (10m)

Solution: work done on road to lift = mgh =>4900 = 50 x 9.8 h => h = 10m

5. An engine work 54,000J work by exerting a force of 6000N on it. What is the displacement of the force . (9m)

Solution: S = W/F = 54,000J/6000N = 9m

6. A force of 10N acting on a body at an angle of 60 deg. with the horizontal direction displaces the body through a distance of 2m along the surface of a floor. Calculate the work done.

Now let the force or pulling act on the body makes an angle of 30 deg. with the horizontal. What is the value of the force to displace the body through 2m along the surface of the floor? (Cos 60 =1/2. and Cos 30 = √3/2) [ ans. 10 J, 10√3 N]

Solution: w = F S cos Q = 10 x 2 x Cos 60 = 20 x ½ = 10 N

w = F S cos Q = 10 x 2 x Cos 30 = 20 x √3/2 = 10√3 N

7. A force of 5N acting on body at angle of 30 deg. with the horizontal direction displace it horizontally through of distance of 6 m . Calculate the work done. (15√3 J)

Solution: w = F S cos Q = 5 x 6 x √3/2 = 15√3 J

8. A body of mass 2kg is moving with a speed of 20m/s Find the kinetic energy. (400J)

Solution: KE = 0.5 mv^2 = 0.5 x 2 x 20 x 20 = 400 J

9. A moving body of 30kg has 60 J of KE. Calculate the speed.

Solution: KE = 0.5 mv^2 => 60 = 0.5 x 30 x v^2 => 60 = 15 v^2 => 60/15=> V = 2m/s

10. A hammer of mass 1kg falls freely from a height of 2 m .Calculate (I) The velocity and (II)

The KE. of the hammer just before it touches the ground. Does the velocity of hammer depend on the mass of hammer? (6.29m-2 , 19.6 J )

Solution: PE = mgh = 1 x 9.8 x 2 = 19.6 j

PE = KE = 0.5 mv^2 => 19.6 = 0.5 x 1 xv^2 => 39.6 = v^2 => v = 6.29 m/s

No, velocity of hammer does not depend on the mass of the mass of the hammer as v = u + at

11. Calculate the energy posses by a stone of mass 10kg kept at a height of 5m.

If 196 x10^2 J of energy were used to raise a 40kg boy above the ground, how high would he be raised? (50m)

Solution: The energy posses by a stone of mass 10kg kept at a height of 5m = PE = mgh = 10 x 5 x 9.8 = 490 j

PE = mgh => 196 x10^2 J = 40 x 9.8 x h => 50m

12. Calculate the change that should be affected in the velocity of a body to maintain the same KE, if mass of the body is increased to 4 times (half the original velocity)

Solution: New kE/Original KE = [½ x 4m x V^2]/[ ½ x m x v^2]

¼ = (V/v)^2 => ½ = (V/v) => V = v/2

New velocity will be half the original velocity

13. A machine does 192 J of work in 24 Sec. What is the power of the machine? (8w)

Solution: p = w/t = 192 J / 24Sec = 8w

14. A man of 50 kg runs up a hill rising himself vertically 10m in 20 Sec. Calculate power. given g = 9.8m-1 (245w)

Solution: p = w/t = mgh/t = (50 x 9.8 x 10) /20 = 245 w

15. A rickshaw puller pulls the rickshaw by applying a force of 100 N. If the rickaw moves with constant velocity of 36 kmh-1. Find the power of rickshaw puller. (1000w)

Solution: Force = 100 N

Velocity = 36 k m / h = 36 x 5 /18 = 10 m / s

Power = Force x Velocity Power = 100 x 10

Power = 1000 Watt

16. A athlete weighing 60kg runs up a staircase having 10 steps each of 1m in 30 sec.

Calculate power (g = 9.8ms-1 200W)

Solution: h = 10 x 1m = 10m

Work done = potential energy = mgh = 60 x 9.8 x 10 = 5880j

Power = 5880/30 = 196w

17. The heart does 1.5 J of work in each heartbeat. How many times per minute does it beat if its power is 2watt? (80 times)

Solution: Total work = p x t =120 J ,

Number times heartbeat in 1 min. = total work done / work done in each beat

= 120/1.5 = 80 times

18. Calculate the time taken 60 w bulb to consume 3000 J of energy. (50sec. )

Solution: Power = 60 W and Energy consumed = 3000 J

We know that Power=Energy/Time Taken

Time Taken = Energy Consumed/Power = 3000/60 = 50 sec.

19. A horse exerts a force of 200N to pull the cart. If the horse cart system moves with velocity 36kmh-1 on the level road., then find the power of horse in term of horse power (1hp=746W) Ans.2.68h.p

Solution: velocity = 36kmh-1 = 10m/s

w = f x s = 2000 x 10 = 2000j

P = w/t = 2000j/1sec = 2000 w

746W = 1hp So, 2000 w = 2000/746 = 2.68 h.p

20. An electric kettle of 500W is used to heat water every day for 2 hours. Calculate the number of unit of electrical energy consumed y it in 10 days. (Ans: 10 units)

Solution: E = Pt = 500 w x 10 x 2h = 10000wh = 10kwh = 10 unit

21. Calculate the cost of using a 2kwh immersion rod for heating water in a house for one hour each day for 60 days if the rate is Rs. 1.50 per unit kWh. (Rs. 180)

Solution: E = Pt = 2 kw x 60 x 1h = 120kwh = 120 unit

The cost of using a 2kwh immersion rod for heating water = 120 x 1.5 = Rs. 180

22. In an experiment to measure his power, a student records the time taken by him in running up a flight of steps on a staircase. Use the following data to calculate the power of the student : Number of steps = 28 ; Height of each step = 20 cm ; Time taken = 5.4 s.

Mass of student = 55 Kg ; Acceleration due to gravity = 9.8 m s−2

Solution. Power =w/t = mgh/t=55x9.8x(28x0.20) / 5.4 = 559J

23. A bullet of mass 15 g has a speed of 400 m/s. What is its kinetic energy ? The bullet strikes a thick target and is brought to rest in 2 cm, calculate the average net force acting on the bullet. What happens to kinetic energy originally in the bullet?

Solution. K.E = ½ mv^2 = 0.5 x 0.015 kg x (400 x 400) = 1200 J.

Work done = Change in K.E.

As final velocity = 0. Because change in KE = Kf–Ki = 1200 J

Therefore, F x d = 1200. (where F is the average force)

F=1200 / 2 x10^–2 = 6x10^4N.

The kinetic energy is eventually converted to heat energy.

24. The power of a heart which beats 72 times in a minute is 1.2kW. Calculate the work done by heart for each beat. ( 1 kJ)

Solution: P = 1200W and T = 60s

W = P x T = 1200 x 60 = 72000J

In 72 times heart beats 72000j energy used

In 1 time = 72000/72 = 1000J

Work done by the heart in every beat is 1KJ

25. When loading a truck, a man lifts boxes of 100 N each through a height of 1.5 m.

(a) How much work does he do in lifting one box ?

(b) How much energy is transferred when one box is lifted ?

(c) If the man lifts 4 boxes per minute, at what power is he working? (g = 10 m s–2)

Solution: (a) Work done in lifting one box = F x d = 100 x 1.5 = 150 J.

(b) W = E = 150 J.

(c) Power = Work done / Time = (150x4)/ 60=10W