CBSE Class 9 Work Energy and Power Solved test paper-06

1. Q. If you want to lift the water to damp against the force of gravity what is the energy used by motor. given that Mass=20Kg ; Height=20m;Gravity=9.8m/s; Time=20min

Ans: Work done by the motor against the gravity, W = mgh = 20×9.8×20 = 3920 J

Power delivered by the motor = W/t =3920/(20×60) = 3.27 J/s

2. Q. when a ball is lifted to a height of height h when it is drooped just before touching the ground, what would the kinetic energy acting on the ball.

Ans: mgh

According to the conservation of energy Potential energy is converted into kinetic energy just above the ground. Just before touching the ground the kinetic energy of the body is equal to mgh

3. Q. what are the conditions where the work can be zero?

Ans: Work done is said to be zero if the force is acting at right angles to the displacement of the body or when there is no displacement of the body.

Example: Work done by the force of gravity on box lying on a roof of a bus moving with a constant velocity on a straight road is zero.

4. Q. An object of mass 1 kg is raised through a height h. Its potential energy increases by 1 Joule. Find the height h.

Ans: Mass:- m = 1 kg, height = h m

PE = mgh, taking g = 10 m/s2

PE = (10h) J,

Now potential energy increases by 1 Joule,

PE' = (10h + 1) Joules

 PE' = mgh' = (10h + 1)

10h' = (10h + 1)

10(h'-h) = 1

(h'-h) = 1/10

if body is on the ground h=0 then, h' = 0.1m

5. Q. A rocket of mass 3x10^6 kg taken from a launching pad and acquires vertical velocity of 1 km/s and an altitude if 25m. Calculate its Potential Energy and Kinetic Energy.

Ans: Given: m = 3x10^6 kg, v = 1 km/s or 1000m/s and h = 25m.

Potential Energy = mgh = 3x10^6 kg x 10m/s2 x 25m =7.5x108 J

Kinetic Energy = ½ mv2 = ½ x 3x10^6 x1000m/s x1000m/s = 1.5x 1012J

6. Q. A car of mass, m = 2000 Kg is lifted up a distance, d = 30m by crane in t = 1 min or 60 sec. Second crane does the same job in t' = 2min or 120 sec. What is the power applied by each crane?

Do the cranes consume the same or different amount of fuels? Neglect power dissipation against friction.

Ans: Work done, W=mgh=2000 x 10 x 30=600000 J

Power, P = W/t = 600000J/(60) sec =10000 Watt

Similarly, W' = 2000 x 10 x 60=600000 J

P' = W/t' = 5000 Watt

First crane has the more power and consume more fuel.

7. Q. Why work done is zero in satellite moving in circular path?

Ans: Satellite moving in circular path applying perpendicular force towards the centre.

θ = 90⁰ and W= FS Cosθ = FSCos 90⁰ = FS x 0 = 0 J

8. Q. When a book is lifted up, is there any work done?

Ans: Yes, Positive work by man and negative by the Earth, when a book is lifted up. Book shows displacement in the direction of force. Here the work done is against the gravity.

9. Q. A person is climbing a palm tree

i) what is its work done against the force of gravity

ii) What is its work done due to the force applied by the person if the person climbs 10m and the mass of the person is 45kg?

Ans: (i) work done against the force of gravity = the amount of potential energy possessed by the man at height h

(ii) Work done due to the force applied by the person if the person climbs 10m and the mass of the person is 45kg. = m g h =45 x 10 x 10=4500J

10. Q. (a) State the law of conservation of energy.

(b) Name the type of energy possessed by stretched slinky, flowing water, stretched rubber band and a speeding car.

(c) An object of mass 50 kg is raised to a height of 600 cm above the ground. What is its potential energy? (g = 10m/s2)

Ans: (a) Law of conservation of energy: Total energy of this universe is conserved (is constant). Energy cannot be created nor be destroyed. But can be transformed from one form to another.

b) A stretched slinky and stretched rubber band possesses elastic potential energy. Flowing water and speeding car possesses kinetic energy.

c) Here, 'm' = 50 kg Height from ground, h = 600 cm = 6 m
So, PE = mgh = (50)(10)(6) = 3000 J

11. Q. A girl having a mass of 35 kg sits on a trolley of mass 5 kg. The trolley is given an initial velocity of 4m/s by applying a force. The trolley comes to rest after travelling a distance of 16m. How much work is done on the trolley? How much work is done by the girl?

Ans: Given that: mass of girl = 35 kg ; mass of trolley = 5 kg

Total mass, m = (35 + 5) = 40 kg u = 4 m/s, v = 0, s = 16 m.

Using kinematics equation,

$v^2 = u^2 + 2as \Rightarrow 0 = (4)^2 + 2a (16) \Rightarrow 32a = -16 \Rightarrow a = -0.5$ m/s2

Force exerted on trolley, F = ma = 40 × 0.5 = 20 N

(a) Work done on trolley W = FS = (20 N) (16 m) = 320 J

(b) Work done by the girl,

W = FS = (mass of girl) × retardation × S

= 35 × 0.5 × 16 = 280 J

12. Q. Define average power?

Ans: The amount of work performed during a period of time is called average power or simply power.

13. Q. two children A nad B each weighing 20 kg climb a rope upto the height of 10. child A take 10s child B takes 20s to climb. State whether the work done by both is equal or unequal. Who has more power?

Ans: Work done=mgh=20x9.8x10=1960J

Hence it will be same for both children because m,g and h are same.

But power=Work done/Time

For A, P=1960/10=196W

For B, P=1960/20=98W

Hence A has more power than B.

14. Q. At what position, pendulum acquires the maximum kinetic energy?

Ans: Mean position

When the pendulum reaches the very bottom of the swing i.e. the equilibrium/mean position, it is at its lowest point and greatest speed. This means that the pendulum has zero potential energy (with respect to its rest position) and maximum kinetic energy.

15.Q. Explain the transformation of energy in hydroelectric power plant?

Ans: In a hydroelectric power plant, the potential energy of water at higher level is converted to kinetic energy of the water by letting it flow at a faster rate. The fast falling water rotates the turbine of the generator. Thus, kinetic energy of the water is converted into mechanical energy of the turbine.

The axle of the turbine is connected to the armature of the electric generator. Thus the rotating turbine now rotates the armature in the magnetic field of the generator. As a result, mechanical energy of the rotating system of the generator is converted into electrical energy of the generator. Thus, we have electrical energy as output from the hydroelectric power plant.

16. Q. A boy weighing 50 kg climbs up a vertical height of 100m in 200 sec. Calculate the -

(a) amount of work done by him (b) potential energy gained by him

(c) power of the boy (g = 10m/s2)

Ans:

Mass of the boy, m = 50 kg Gravitational force on him = his weight = 50 × 10 = 500 N

(a) He has to apply a force equal to his weight to move upward.

$$\text{So, work done} = (500)(100) = 50000 \text{ J}$$

(b)The work done by him on himself in going upward is stored in his body as potential energy.

So, PE gained by him = 50000 J

(c) We know, Power = work done/time taken = 50000/200 = 250 W