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www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

Class: 9
Subject: Physics
Topic: Work, energy and power
No. of Questions: 29

Q1. Why do living beings and machines need energy?

Ans. To perform work

Q. 2. What is work? Derive expression for work done.

Ans. If force acting on a body and body causes displacement, we can say that work is done. Work has only magnitude and no direction so it is called a scalar quantity.

Let a constant force F displace a body through a distance, s in the direction of the force

Let W be the work done.

Work done = force × displacement => W = F s

if F = 1 N and s = 1 m then the work done by the force is said to be 1 N m or 1 joule

Work done against the gravity = W = mgh

Work done to keep body in motion = w = ½ mv2

Q3. What are the two factors needed to describe work?

Ans: (i) Force (ii) Displacement

Q4. Define 1 Joule?

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.

Q5. When can we say that work is positive or negative?

Ans. Work done is negative when the force acts opposite to the direction of displacement.

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Work done is positive when the force is in the direction of displacement.

Q6. Write the expression for work done when force is applied at an angle with the horizontal direction?

Ans. Work = FS cos q
Where 'q' is the angle between the Force and the direction of displacement.

Q7. Write the conditions when work done will be zero?

Ans. (i)if Force = 0 (ii) Displacement = 0 (iii) if q = 90 degree [If F acts right angle to the displacement]

Q8. Is work done if body rotates in circular path?

OR, is it possible that a force acts on a body still the work done is zero? Explain with an example.

Ans. When an object is in circular path, force acting on a body is always towards the centre of circular path. Since object does not displace towards the centre of circular path. So, no work is done.

Q9. How much work is done to raise 5 kg body by 2 m?

Ans. w = mgh = 5 x 9.8 x 2 = 98 J

Q10. How much work is done by a force of 10 N to displace a body by 2 m?

Ans. W = FS = 10 x 2 = 20N

Q11. Work done y a body of mass 10 kg to lift it through certain height is 490 J . Calculate the height through which the body is lifted?

Ans. W = mgh => h =w/(mg)= 490J/(10x9.8) = 5m

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Q12. A force of 10 N acting on at angle 60 degreee with the horizontal direction displaces body 2 m along the surface of floor. Calculate the work done?

Ans. W = FS cos q = 10 x 2 x cos 60 degreee = 20 x ½ = 10 J [q denotes angle]

Q13. Calculate the amount of work done in drawing a bucket of water weighing 15 kg from a well of depth 30m.

Ans. Given, mass m = 15 kg ;
Acceleration due to gravity, g = 9.8 m/s2 ;
Height h = 20 m

Here, work is done against gravity,
⇒ W =mgh = 15 × 9.8 × 30 = 4410 J or 4.41KJ

Q14. Calculate the work done to attain a car of velocity 30m/s having mass 100kg?

Ans. w = ½ mv2 = ½ x 100 x 30 x 30 = 45000J= 45 KJ

Q15. No work is done by a person moving on a road while carrying box on his head. Justify

Ans. Force applied on the box does not cause any displacement to the box. Hence no work is done.

Q16. What is energy? Write the kinds of energy?

Ans. Energy is the capacity of a body to do the work. If work is done on the body, energy of the body increases. If work is done by the body, energy of the body reduces.
Kinds of energy: Mechanical energy, Chemical energy, heat energy, Electrical Energy, nuclear energy, sound energy , Light energy etc

Q17. How much work is done by a man who tries to push the wall of house?

Ans. Since there is no displacement in wall there is no work done W = F x 0 = 0J

Q18. What are the kinds of mechanical energy?

Ans. There are two types of mechanical energy

(a) Energy possessed by an object due to its motion is called kinetic energy. Example -Kinetic energy of a hammer is used to drive a nail into the wall. Bullet fired from a gun can penetrate

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into a target due to its kinetic energy.

(b) The energy possessed by a body by virtue of its position or due to state of strain is called potential energy.

Example: The work done to lift a body above the ground level gives the potential energy of the body. Eg.Weight lifting.

Water stored in reservoir has large amount of potential energy due to which it can drive a water turbine when allowed to fall down. This is the principle of production of hydro electric energy.

Q19. Derive the expression for potential energy of a body above the ground level.

Ans. Consider an object of mass m. It is raised through a height "h" meter from the ground. By applying force F, the object gains energy to do the work done on it.

Work done = force x displacement

W = F x h (Since F= ma, a = g => F = mg)

W = m g h

Q20. Derive the expression for potential energy of a body above the ground level.

Ans. Let a body (ball) of mass m is moving with an initial velocity v. If it is brought to rest by applying a retarding (opposing) force F, then it comes to rest by a displacement S.

Let, E_k = work done against the force used to stop it.

E_k = F x S ---- (1)

But retarding force F = ma -----> (2)

Let initial velocity u = v, final velocity = 0

From III equation of motion

$v^2 = u^2 + 2aS$

Applying, 0 = v2 – 2aS (a is retardation)

$2aS = v^2$

Displacement, $S = v^2/2a$ ----> (3)

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Substituting (2) and (3) in (1)

$E_k = ma \times v^2/2a$

$E_k = ½\ mv2$

Q21. What kind of energy is possessed by the following

(a) Flowing water (b) Water stored in dam (c) Wrist watch

Ans. (a) KE (b) PE (c) PE

Q22. A horse and a calf are running with same speed. Which one of the two has more kinetic energy?

Ans. Horse, due to greater mass.

Q23. A bus and a car have the same kinetic energy. Which one of the two is moving fast?

Ans. Car as its mass is less than that of bus.

Q24. A ball is thrown vertically upward and its velocity keeps on changing. What happen to the KE when its velocity will be zero?

Ans. Since velocity is zero, kinetic energy will be zero

Q25. Is potential energy a vector or a scalar quantity?

Ans. Scalar Quantity

Q26. Give two examples where a body possesses both, kinetic energy as well as potential energy.

Ans. (i) Flying aeroplane has both K.E and P.E. (ii) A flying bird has both the energies

Q27. What do you mean by thermal Energy?

Ans. All matter contains particles, such as atoms or molecules. The particles in matter are always moving. As a result, these particles have energy that is due to their motion. The energy of the

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particles in matter due to their continual motion is thermal energy. The thermal energy in an object increases when the object's temperature increases.

Q28. When we cut a log of wood with a saw it becomes warm, why?

Ans. When we cut a log of wood with a saw mechanical energy converted into heat energy

Q29. Why do our hands become warm when rubbed against each other? Explain

Ans. When we run our hands it becomes warm as mechanical energy converted into heat energy