Work, Power and Energy

Periodic Test

Q.1. Define work.

Answer: Work is defined when a force produces motion. For doing a work energy is required. For example: a horse pulling a cart is doing a work.

Work done (W) in moving an object is equal to the product of force (F) and the displacement(s) of body in the direction of force. SI unit of work is Joule.

Work done= F×s

Q.2. Define energy.

Answer: The capability to do work is called energy. A person that can do a lot of work is said to possess a lot of energy. SI unit of energy is Joule.

For example: When a raised hammer falls on a nail placed on wood, it moves nail into the wood i.e. it did some work because it possessed some kind of energy.

Q.3. Define power.

Answer: Power is defined as the rate of doing work. For example: an old man takes 2 hour to do a work but a young man takes only 1 hour to do the same work, it means 'rate of doing work' by a young man is more than that of old man. So, young man has more power than the old man.

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$$

Q.4. What is kinetic energy?

Answer: Energy of a body due to its motion is called kinetic energy. For example: a running motorcycle has kinetic energy, a falling stone also possesses kinetic energy, but when the motion stops, kinetic energy is lost.

Kinetic energy (KE) of a body of mass m moving with velocity or speed v is given by the formula:

$KE = \frac{1}{2} m v^2$

Q.5. What is potential energy?

Answer: Energy of a body due to its higher position above the earth or due to change in the shape of body is called potential energy. For example: a brick lying on the roof of a house possess potential energy. A stretched rubber band is another example of potential energy.

For a body of mass m to raise to height h above earth,

POTENTIAL ENERGY = m × g × h

Q.6. Give reason for the following:

The potential energy of a freely falling object decreases progressively. Does this violate the law of conservation of energy? Why?

Answer: According to law of conservation of energy, Energy can neither be created nor be destroyed. It can only be transformed from one form to another. Total energy before and after transformation remains same.

So, if the potential energy of a freely falling object decreases progressively then it is transformed into an equal amount of kinetic energy and the sum of both energies remains constant all the time.

Q.7. Give reason for the following:

Pardeep says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with him? Why?

Answer: Yes, I agree with Pardeep. According to newton's law of motion for a body:

Net force = mass × acceleration

So, Acceleration = $\frac{\text{Net force}}{\text{Mass}}$

Every object on the Earth possesses some mass. So, if the resultant or net force due to several forces acting on the object is zero then acceleration of the body will be zero by the above-mentioned formula.

Q.8. Give reason for the following:

Why a coolie does not work, when he moves on a level road while carrying a box on his head?

Answer: Work done when force is applied at an angle to motion is given by:

$W = F \times S \cos \theta$

Where, F = force

S = displacement

θ = angle between direction of force and direction of motion.

Work done by a coolie in carrying load on his head is ZERO with respect to gravity. This is because the coolie applies force against force of gravity which acts in vertical downward direction and displacement of load takes place in horizontal direction hence angle between displacement and force becomes 90°.

cos 90°= 0 which means work done = 0

So, a coolie does not work, when he moves on a level road while carrying a box on his head.

Q.9. Give reason for the following:

Can a body have momentum without having energy? Explain.

Answer: Momentum = mass × velocity

A body can only possess velocity if it has kinetic energy and if does not have that energy than velocity = 0, using this value in above mentioned formula

Momentum = mass × 0

Momentum = 0

So, a body cannot have momentum without having energy.

Sometimes even if a body has energy, its momentum can be zero. For example: a brick lying on the roof of a building possess potential energy but no velocity so momentum will be zero.

Q.10. Give reason for the following:

Can there be displacement of an object in the absence of any force acting on it?

Answer: Yes, there can be displacement on an object even if there is no force acting on it.

Force = mass × acceleration

$$\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time}}$$

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

If a body possesses constant velocity then it will have some displacement but there is no change in velocity so the acceleration of body will be zero. If there is no acceleration then there will be no force acting on the body.

Q.11: Work and energy.

Answer:

WORK	ENERGY
Work is said to be done when a force produces motion.	The capability to do work is called energy.
Work cannot be transformed from one b form to another	Energy can be transformed from one form to another
If an object does not move on applying force no work is said to be done	If an object does not move on applying force even, then energy of the body is consumed.
There is only one type of work which can be positive, negative or zero	Energy can be of many types like potential energy, kinetic energy, heat energy, chemical energy etc.
Work done = force × displacement	Potential energy = m × g × h
By work energy theorem: Work done = change in kinetic energy	Kinetic energy = $\frac{1}{2}$ m v^2

Q.12. Potential energy and kinetic energy.

Answer:

POTENTIAL ENERGY	KINETIC ENERGY
Energy of a body due to its higher position above the earth or due to change in the shape of body is called potential energy.	The energy of a body due to its motion or velocity is called kinetic energy
Potential energy = m × g × h	Kinetic energy = $\frac{1}{2}$ m v^2
For example: a brick lying on the roof of a house at a height possess potential energy	For example: a running motorcycle has kinetic energy
Potential energy cannot be transferred between objects.	Kinetic energy can be transferred between objects.

Q.13. Power and horsepower.

Answer:

POWER	HORSEPOWER
Power is defined as the work done per unit time or rate at which energy is consumed.	Horsepower is a unit of measurement of power used to express power of engines or car.
Power = work/time SI unit of power is watts	Horsepower is itself a bigger unit of power.
1 watt = 1 joule/ sec	1 Horsepower = 746 Watt

Q.14. Energy and power.

Answer:

ENERGY	POWER
The capability to do work is called energy.	Power is defined as the work done per unit time or rate at which energy is consumed.
SI unit of energy is Joule. 1 joule = 1 Newton×1 meter	SI unit of power is Watt. 1 watt = 1 joule/ sec
Energy can change from one form to another	Power cannot be changed from one form to another.
Energy can be stored	Power cannot be stored

Q.15. Work and power.

Answer:

WORK	POWER
Work is said to be done when a force produces motion.	Power is defined as the work done per unit time or rate at which energy is consumed.
SI unit of work is Joule.	SI unit of power is Watt.
Work done = force × displacement	Power = work/time
Work done is independent of time taken.	Power of an object or body depends on the time taken.

Q.16. Illustrate the law of conservation of energy by discussing the free fall of a body.

Answer: According to law of conservation of energy, energy can neither be created nor be destroyed. It can only be transformed from one form to another. whenever energy changes from one form to another, the total amount of energy remains constant.

Law of conservation of energy is valid in all situations and for all kinds of energy transformations.

For example: When a body is at some height from earth it possess only potential energy, as the body falls downwards then its potential energy goes on decreasing but kinetic energy goes on increasing.

Just before hitting the ground entire potential energy is transformed into kinetic energy and it posesses only kinetic energy.

Total energy= kinetic + potential energy

At maximum height, kinetic energy = 0

Total energy = potential energy

On hitting ground, potential energy = 0

Total energy = kinetic energy

Q.17. Justify by giving proper reasoning whether the work done in the following cases is positive or negative:

(i) Work done by friction on a body sliding down an inclined plane.

(ii) Work done by a man in lifting a bucket from a well.

Answer: (i) When the body will slide down on an inclined plane then frictional force will acts upwards to the inclined plane, so angle between motion of body and the frictional force will be.

Since, Work= FS cos θ

F = force

S = displacement

θ = angle between direction of force and direction of motion = 180^o

So, work done = F×s cos 180^o

Cos 180^o = -1

So work done = - F×s

Work done by friction on a body sliding down an inclined plane will be negative.

(ii) In this case the man is doing work against the gravitational force, by applying force in upward direction to lift the bucket. Since the direction of force applied and direction of motion of bucket is same, work done will be positive.

Work= FS cos θ

θ = angle between direction of force and direction of motion = 0^o

Cos 0^o = 1

So, work done = F × s

Q.18. A man weighing 70 Kg carries a weight of 10 Kg to the top of tower 100 m high. Calculate the work done.

Answer: Given,

Mass of man = 70 kg

Weight carried = 10 kg

Height above ground h = 100 m

Work done =???

Total mass at top of tower = 70 + 10

M = 80 kg

For a body of mass m to raise to height h above earth,

Work done = potential energy stored

= M × g × h

Let g = 10 ms^{-2}

So, work done will be = 80×10×100

= 80,000 J

= 80 KJ

Q.19. A block of mass 5 Kg is lying on a frictionless table. A force of 20 N is applied on it for 10 seconds. Calculate its kinetic energy.

Answer: Given,

Mass of body = 5 kg

Force F = 20 N

Time t = 10 seconds

To find: kinetic energy??

Initial velocity u = 0

Let final velocity be v

We know, Acceleration = $\frac{\text{force}}{\text{Mass}}$

Acceleration = $\frac{20\ \text{N}}{5\ \text{Kg}}$

So, acceleration = 4 ms^{-2}

We also know that,

Acceleration = $\frac{\text{V} - \text{u}}{\text{t}}$

Substituting value of acceleration and u in this formula:

$$4\ \text{m}s^{-2} = \frac{\text{V} - 0}{10\ \text{s}}$$

v = 10 s × 4 ms^{-2}

v = 40 ms^{-1}

Kinetic energy = $\frac{1}{2}$ m v^2

Substituting value of v in the equation

Kinetic energy = $\frac{1}{2} \times 5 \times 40^2$

= 4000 J

= 4 KJ

Q.20. A man of mass 60 Kg runs up a flight of 30 steps in 40 seconds. If each step is 20 cm high, calculate the power of the man.

Answer: Given,

Mass m= 60 kg

Number of steps = 30

Height of each step = 20 cm

Time taken= 40 s

Total height h = 20×30

= 600 cm

= 6m

Total time (t) = 40×30

= 1200 s

We know,

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$$

Work done = potential energy stored

= m × g × h

Let g = 10 ms^{-2}

So, work done will be =60×10×6

=3600 J

Substituting value or work in above formula of power:

$$\text{Power} = \frac{3600\ \text{J}}{1200\ s}$$

Power of man = 3 J/s

= 3 W

Q.21. A girl of mass 40 Kg climbs a rope 6 m long at constant speed in 15 seconds. What power does she expend during the climb?

Answer: Given,

Mass m = 40 kg

Height h = 6m

Time = 15 s

Power =????

Let g = 10 ms^{-2}

Potential energy = m × g × h

= 40×10×6 J

= 2400 J

$$\text{Power} = \frac{\text{Energy consumed}}{\text{Time taken}}$$

$$\text{Power} = \frac{2400\ \text{J}}{15\ s}$$

Power = 160 J/s

So power spent by girl is 600 watts

Q.22. Calculate the kinetic energy of a body of mass 50 Kg moving with a velocity of 50 cm

Answer: Given,

Mass m = 50 kg

Velocity = 50 cms^{-1}

1 cm = 0.01 m

So, velocity = 50 ×0.01 ms^{-1}

v = 0.5 ms^{-1}

We know,

Kinetic energy = $\frac{1}{2}$ m v^2

Substituting value of m and v in the equation:

Kinetic energy = $\frac{1}{2} \times 50 \times 0.5^2$

= $\frac{1}{2} \times 12.5$ kgm^2s^{-2}

= 6 J

Q.23. Does a stationary body possess kinetic energy?

Answer: Kinetic energy of a body is due to its motion or velocity, if the body is stationary then velocity = 0

Kinetic energy = $\frac{1}{2}$ m v^2

Substituting value of velocity v in the equation we get kinetic energy = 0

So, a stationary body does not possess kinetic energy.

Q.24. When do you apply more power-when you lift a pen or when you lift a book?

Answer:

$$\text{Power} = \frac{\text{Energy consumed}}{\text{Time taken}}$$

A book has more mass than a pen, so when a book is lifted more energy will be consumed than that when the pen is lifted. Since power is directly proportional to energy so more power will be applied in lifting a book.

Q.25. Is any work done by a body moving along a circular path?

Answer: To keep a body moving in circular path, a force named 'centripetal force' acts towards the center of the path. This force acts along the radius and at right angle to the circular motion of body.

So, work done by body in going around the circular path is zero because displacement of body is perpendicular to the direction of centripetal force and by the formula:

Work= FS cos θ where θ=90°

And cos 90°= 0

So, work done = zero

Q.26. A rowing boat upstream is at rest with respect to the shore. Is he doing work?

Answer: Yes, the boat is doing work against the river current but there is no work done by boat against shore because there is no displacement taking place with respect to shore.

Q.27. You pay a coolie for carrying your luggage. Does he really do any work?

Answer: Work done by a coolie in carrying load on his head is ZERO. This is because the force of gravity acts in vertical downward direction and displacement of load takes place in horizontal direction hence angle between displacement and force becomes 90°.

Since, Work= FS cos θ

Work done in this case is zero because cos 90°=0

Note: Even if there is no work done but the energy of the coolie is still consumed in carrying the luggage.

Comprehensive Exercises (MCQ)

Q.1. When a coil spring is compressed, the work is done on the spring. The elastic potential energy:

A. increases

B. decreases

C. disappears

D. remains unchanged

Answer: Work done by a coil spring is given by,

$$\mathbf{W = \frac{1}{2}\, kX^2}$$

Where k is the spring constant/stiffness

X is the extension or compression produced

This work done is stored in spring as elastic potential energy (PE) when the spring is compressed and hence elastic potential energy decreases.

Q.2. Potential energy of a person is minimum when:

A. Person is standing

B. Person is sitting on a chair

C. Person is sitting on the ground

D. Person is lying on the ground

Answer: potential energy of a body is defined as energy of a body due to its higher position above the earth, Potential energy = M × g × h

Where h is the height above ground.

If the person will be lying on ground then it will have minimum or zero height above the ground therefore potential energy of the person will also be minimum.

Q.3. No work is done when:

A. a nail is hammered into a wooden box

B. a box is pushed along horizontal floor

C. there is no component of force, parallel to the direction of motion

D. none of these

Answer: formula for work done when the force is applied at an angle to the direction of motion is given by,

$W = FS \cos \theta$

When there will be no component of force, parallel to the direction of motion then force F in direction of motion is zero, so work done will also be zero.

Q.4. When the speed of a moving object is doubled, its:

A. acceleration is doubled

B. weight is doubled

C. kinetic energy is doubled

D. kinetic energy increases 4 times

Answer: Kinetic energy KE of a body of mass m moving with velocity or speed v is given by the formula:

$KE_1 = \frac{1}{2} mv_1^2$

If the speed of particle is doubled then

$KE_2 = \frac{1}{2} m\, v_2^2$ where, $v_2 = 2v_1$

Substituting the value of v_2 in the formula,

$KE_2 = \frac{1}{2} m\, (2v_1)2$

$= \frac{1}{2} (4\, mv_1^2)$

$KE_2 = 4\, KE_1$

So kinetic energy will become 4 times if the speed is doubled.

On other hand, acceleration depends on final as well as initial velocity, and here acceleration will be same.

Weight is independent of change in speed.

Q.5. When a stone of mass 'm' falls through a vertical height 'd', the decrease in the gravitational energy is:

A. mg/d

B. $mg^2/2$

C. mgd

D. md/g

Answer: potential energy stored in a body of mass m and height 'd' will be given by = m×g×d

This gravitational potential energy keeps on decreasing with the decrease in height on stone, and when the stone falls completely, this potential energy is lost = mgd

Q.6. A 1 kg mass has a kinetic energy of 1 joule when its speed is:

A. 0.45 m s^{-1}

B. 1 m s^{-1}

C. 1.4 m s^{-1}

D. 4.4 m s^{-1}

Answer: Given,

Mass of body m= 1 kg

Kinetic energy = 1 J

Velocity v=?

Kinetic energy = $\frac{1}{2}$ m v^2

Substituting the given values in the equation:

1 J = $\frac{1}{2}$ ×1× v^2

1×2 = v^2

v^2 = 2

v= $\sqrt{2}$

v= 1.4 ms^{-1}

Q.7. An iron sphere of mass 30 kg has the same diameter as an aluminum sphere whose mass is 10.5 kg. The spheres are dropped simultaneously from a cliff. When they are 10 m from the ground, they have the same:

A. acceleration

B. momentum

C. potential energy

D. kinetic energy

Answer: Given,

Mass of iron m = 30 kg

Mass of aluminium M = 10.5 kg

Height of iron h = 10m

Height of aluminum H = 10m

We know,

Kinetic energy = $\frac{1}{2}$ m v^2

Potential energy = m × g × h

Momentum = mass × velocity

So kinetic energy, potential energy, kinetic energy and momentum depends of the mass of the body, they can't be same for both spheres.

But acceleration due to gravity g = 10 ms^{-2} is same for all the objects at some height, irrespective of their mass and height.

Q.8. An object of mass 1 kg has a potential energy of 1 joule relative to the ground when it is at a height of:

A. 0.102 m

B. 1 m

C. 9.8 m

D. 32 m

Answer: Given,

Mass m= 1 kg

Potential energy = 1 J

Height h=?

Let g = 9.8 ms^{-2}

We know

Potential energy = m × g × h

Substituting the values in this formula

1 J = 1 kg× 9.8 ms^{-2} × h

h = $\frac{1\ \text{J}}{9.8\ \text{kgms}^{-2}}$

h = 0.102 m

Q.9. An object of mass 5 kg falls from a height of 5 m above the ground. The loss of potential energy of the mass is:

A. 250 J

B. 25 J

C. 2.5 kJ

D. 50 J

Answer: Given,

Mass = 5kg

Height = 5m

Let g = 10 ms^{-2}

Potential energy stored in a body of mass m and height ‘h’ will be given by

= m × g × h

= 5 kg×10 ms^{-2}×5m

= 250 J

When the mass falls completely, same potential energy is lost = 250 J

Q.10. A weightlifter lifts 240 kg from the ground to a height of 2.5 in 3 second. The average power is:

A. 1960 W

B. 19.6 KW

C. 1.96 MW

D. 196 W

Answer: Given,

Mass = 240 kg

Height = 2.5 m

Time = 3 s

Let g = 9.8 ms^{-2}

We know,

$$\text{Average power} = \frac{\text{Energy consumed}}{\text{Time taken}}$$

Energy consumed = m × g × h

= 240 kg×9.8 ms^{-2}×2.5 m

= 5880 J

Substituting the require values

$$\text{Average power} = \frac{5880\ \text{J}}{3\ \text{s}}$$

= 1960 W

Q.11. When a force retards the motion of a body, the work done is :

A. positive

B. zero

C. negative

D. uncertain

Answer: A force can retard the motion of an object only when it will acts in opposite direction of motion of body, this means that angle between the direction of motion of body and direction of force is 180°.

When force is applied at an angle to the direction of motion of object then the work in the direction of motion is given by: $W = Fs \cos \theta$

Since cos 180°= -1,

So, Work done = -F×s

which is negative.

Q.12. The work done by a force on a body will be positive if the:

A. body does not move

B. body moves perpendicular to the direction of motion

C. body moves along the direction of the applied force

D. body moves opposite to the direction of the applied force

Answer: Work done by a force will be positive when the direction of applied force and the direction of motion is same.

When force is applied at an angle to the direction of motion of object then the work in the direction of motion is given by: $W = Fs \cos \theta$

When F and s are in same direction then $\cos \theta$ will give positive value and work done will be positive.

Q.13. The cgs unit of work is:

A. joule

B. erg

C. dyne

D. watt

Answer: CGS unit means units of work in form of centimeter, gram and seconds.

$1 \text{ erg} = 1 \text{ g cm}^2\text{s}^{-2}$

One erg is defined as the amount of work done by a force of one dyne which produces the displacement of one centimeter.

Also $1 \text{ erg} = 10^{-7}$ J

Q.14. One joule work is said to be done when:

A. a force of 1 N displaces a body by 1 cm

B. a force of 1 N displaces a body by 1 m

C. a force of 1 dyne displaces a body by 1 m

D. a force of 1dyne displaces a body by 1 m

Answer: SI unit of work is joule which is denoted by J.

1 joule = 1 newton×1 meter

1 J = 1 Nm

1 joule of work is said to be done when a force of 1 Newton moves an object through a distance of 1 meter in direction of force.

Q.15. The speed of a particle is doubled, its kinetic energy:

A. remains same

B. becomes double

C. becomes four times

D. becomes half

Answer: Kinetic energy KE of a body of mass m moving with velocity or speed v is given by the formula:

$KE = \frac{1}{2} m v^2$

so kinetic energy is directly proportional to the mass of object and to the square of speed of the body.

If the speed of particle is doubled then kinetic energy becomes four time.

$KE_1 = \frac{1}{2} mv_1^2$

$KE_2 = \frac{1}{2} mv_2^2$ where, $v_2 = 2v_1$

Substituting the value of v_2 in the formula,

$KE_2 = \frac{1}{2} m (2v_1)^2$

$= \frac{1}{2} (4 mv_1^2)$

$KE_2 = 4 KE_1$

So kinetic energy will become 4 times if the speed is doubled.

Comprehensive Exercises (T/F)

Q.1. Write true or false for the following statements:

When energy changes from one form to another, the energy that disappears from one form, reappears in exactly equivalents amount in the other form.

Answer: True

Explanation: Yes, this is true according to law of conservation of energy, which says energy can neither be created nor be destroyed. It can only be transformed from one form to another. Whenever energy changes from one form to another, the total amount of energy remains constant.

Q.2. Write true or false for the following statements:

A force does not work, if it produces no motion.

Answer: False

Explanation: work is said to be done when a force produces motion.

Work done (W) in moving an object is equal to the product of force (F) and the displacement(s) of body in the direction of force.

Work done= F×s

If there is no motion then there will be no displacement, i.e. s=0, so work done will be zero.

Q.3. Write true or false for the following statements:

Kilowatt hour is the unit of power.

Answer: False

Explanation: kilowatt hour is the commercial unit of energy. 1 kilowatt hour is the amount of electrical energy consumed when the appliance have power rating of 1 kilowatt which is used for 1 hour.

SI Unit of power is watt and its larger unit is kilowatt.

Q.4. Write true or false for the following statements:

Work and energy have different units.

Answer: False

Explanation: Work is said to be done when a force produces motion. SI Unit of work is Joule and the capability to do that work is called energy. SI unit of energy is also Joule.

Energy required to do 1 joule of work is called 1 joule energy.

Q.5. Write true or false for the following statements:

In order to get minimum work, the angle between force and displacement should be 90.

Answer: True

Explanation: When force is applied at an angle to the direction of motion of object then the work in the direction of motion is given by: $W = Fs \cos \theta$

If angle θ between force and displacement is 90 then cos θ will be equal to zero.

So, work done will also be zero by the given formula which means minimum.

Q.6. Write true or false for the following statements:

When a body falls on the ground and stops, the principle of conservation of energy is violated.

Answer: False

Explanation: Initially that body contains only potential energy. When that body falls on ground then its potential energy is continuously being transferred into kinetic energy and the total energy which is the sum of kinetic and potential energy remains constant. So, the principle of conservation of energy is not violated.

Q.7. Write true or false for the following statements:

When velocity is halved, its kinetic energy becomes 1/4th.

Answer: True

Explanation: Kinetic energy KE of a body of mass m moving with velocity or speed v is given by the formula:

$KE = \frac{1}{2} m v^2$

so kinetic energy is directly proportional to the mass of object and to the square of speed of the body.

$KE_1 = \frac{1}{2} mv_1^2$

If the velocity of body is halved then kinetic energy

$KE_2 = \frac{1}{2} mv_2^2$ where, $v_2 = \frac{1}{2} v_1$

Substituting the value of v_2 in the formula,

$KE_2 = \frac{1}{2} m (\frac{1}{2} v_1)^2$

$= \frac{1}{4} (\frac{1}{2} mv_1^2)$

$\mathbf{KE_2 = \frac{1}{4} KE_1}$

So kinetic energy will become 1/4 if the speed is halved.

Q.8. Write true or false for the following statements:

When an arrow is released from a bow, potential energy changes into kinetic energy.

Answer: True

Explanation: When is arrow is pulled from the bow it attains potential energy but when this bow is released it starts moving with speed which means that the stored potential energy in arrow is progressively being converted into kinetic energy.

Q.9. Write true or false for the following statements:

Work done by a force depends upon how fast work is done.

Answer: False

Explanation: Power is defined as the rate of doing work so, how fast work is done depends on the power of a person.

If a person has more energy then he will have more power to do the work and faster he can do the work.

On other hand, if he does not have enough power, he would not be able to do the work faster.

Q.10. Write true or false for the following statements:

The rate of doing work is called power.

Answer: True

Explanation: Yes, the rate at which work is done is called power.

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$$

Power is also defined as the rate at which energy is being consumed. SI unit of power is Watt.

$$\text{Power} = \frac{\text{Energy consumed}}{\text{Time taken}}$$

Q.11. Write true or false for the following statements:

Work done by centripetal force is zero.

Answer: True

Explanation: Whenever a body is moving in a circular path, centripetal force is directed towards the center of circle and it acts at right angle to the direction of motion.

When force is applied at an angle to the direction of motion of object then the work in the direction of motion is given by: $W = F \times s \cos \theta$

If angle θ is 90 then cos θ will be equal to zero.

So, work done will also be zero

Q.12. Write true or false for the following statements:

The unit of work is watt.

Answer: False

Explanation: SI unit of work is Joule which is denoted by J and SI unit of power is watt which is denoted by W.

1 joule = 1 newton × 1 meter

1 J = 1 Nm

1 joule of work is said to be done when a force of 1 Newton moves an object through a distance of 1 meter in direction of force.

Q.13. Write true or false for the following statements:

If we know the speed and mass of an object, we can find out its kinetic energy.

Answer: True

Explanation: Kinetic energy KE of a body of mass m moving with velocity or speed v is given by the formula:

$KE = \frac{1}{2} m v^2$

The formula suggests that kinetic energy depends on mass and speed of the object.

So, if we know the speed v and mass m of an object, we can find out its kinetic energy.