CBSE Test Paper 05

Chapter 11 Work and Energy

1. Kilowatt hour is a unit of_____ **(1)**

   a. mass
   b. power
   c. energy
   d. joule

2. In case of negative work the angle between the force and displacement is: **(1)**

   a. 180^o
   b. 90^o
   c. 0^o
   d. 45^o

3. Which of the following statement are incorrect **(1)**

   A. A bird sitting on tree possess potential energy only
   B. A stationary object may have energy
   C. A flying bird has kinetic energy only
   D. An aero plane running on the run- way possess kinetic & potential energy both

   a. A, B, C and D
   b. B and D
   c. C and D
   d. A and C

4. If 1 newton of force displaces a body by 1 m, the work done is **(1)**

   a. 10 joule
   b. 5 joule
   c. Depends on time
   d. 1 joule

5. Work done is said to be negative if the applied force has a_____in the direction opposite to displacement. **(1)**

   a. energy
   b. position
   c. component
   d. compliment

6. Define 1 watt of power. **(1)**

7. Soni says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with her? Why? **(1)**

8. Define work. How is work measured? When is work done by a force negative? **(1)**

9. Name the two common forms of mechanical energy. **(1)**

10. Define 1 J or work. **(1)**

11. Give reason: A ship sinks to a great depth in river water than in sea water. **(3)**

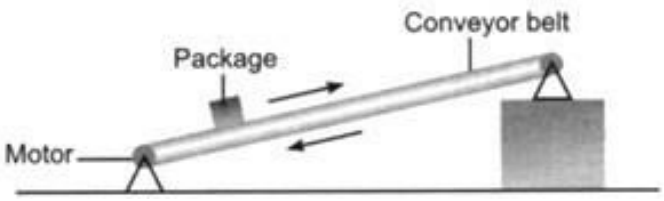
12. The kinetic energy of an object of mass, m moving with a velocity of $5ms^{-1}$ is 25 J. What will be its kinetic energy when its velocity is doubled? What will be its kinetic energy when its velocity is increased three times? **(3)**

13. A man of mass 50 Kg runs up a flight of stairs having a rise of 5 m, in 4 s. **(3)**

    a. What is the work done by the man?
    b. What is the average power developed by the man?

14. a. Give one example of each of the following: **(5)**
        i. Small mass but high kinetic energy
        ii. Large mass but low kinetic energy
    b. Prove mathematically that the total mechanical energy of a freely falling body in air is conserved.

15. Figure shows a conveyor belt transporting a package to a raised platform. The belt is driven by a motor. **(5)**



i. State three types of energy, other than gravitational potential energy, into which the electrical energy supplied to the motor is converted.

ii. The mass of the package is 36 kg. Calculate the increase in the gravitational potential energy (p.e.) of the package when it is raised through a vertical height of 2.4 m.

iii. The package is raised through the vertical height of 2.4 m in 4.4 s. Calculate the power needed to raise the package.

iv. Assume that the power available to raise package is constant. A package of mass greater than 36 kg is raised through the same height. Suggest explain the effect of this increase in mass on the operation of the belt.

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Answers

1. c. energy

   Explanation: Commercial unit of energy is kilowatt hour (kWh).

2. a. 180^o

   Explanation: When force is applied in opposite direction of displacement, the work done is considered as negative and the angle between the force and displacement is 180^o.

3. c. C and D

   Explanation:

   a. A bird sitting on tree possess potential energy only is correct statement.
   b. A stationary object may have energy is correct statement.
   c. A flying bird has kinetic energy only this is incorrect statement because A flying bird has kinetic energy as well as positional energy also.
   d. An aeroplane running on the run- way possess kinetic energy only. So given statement is incorrect.

4. d. 1 joule

   Explanation: 1 joule(J) is the amount of work done, when a force of 1 Newton(N) displaces a object 1 meter(m).

   1J = 1N × 1m or 1J = 1Nm.

5. c. component

   Explanation: Work can be either positive or negative: if the force has a component in the same direction as the displacement of the object, the force is doing positive work. If the force has a component in the direction opposite to the displacement, the force does negative work

6. When a work of 1 joule is done in 1 s, the power is said to be one watt.

7. Yes we agree with her statement. Because when many balanced forces act on the object its displacement becomes zero.

8. Work is said to be done if force acting on an object displaces it through a certain distance. It is measured as the product of force and displacement. Work done is negative if force and displacement are in the opposite direction.

9. Two forms of mechanical energies are Kinetic energy and potential energy.

10. When a force of 1N causes a displacement of 1m, in its own direction the work done is said to be one joule.

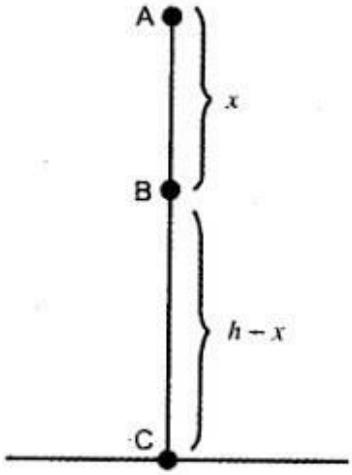
11. The density of sea water, due to the presence of impurities like salt, etc., is greater than that of river water. Therefore, lesser volume of ship will be immersed in sea water to balance its weight.

12. K.E. of the object = $\frac{1}{2} \times m \times 5^2$
$25 = \frac{1}{2} \times m \times 25$
$m = (25 \times 2)/25$ = 2 kg
If velocity is doubled
$K.E. = \frac{1}{2} \times 2 \times 10^2$ = 200/2 = 100 J i.e. K.E. will become four times
If velocity is increased three times
$K.E. = \frac{1}{2} \times 2 \times 15^2$ = 225 J i.e. K.E. will become nine times

13. Mass of Man = 50 Kg
Distance moved = 5m
Time Taken = 4 s

    a. work Done = Force × Acceleration
    In this case, Increase in Potential energy = Work done = Mgh
    $= 50 \times 10 \times 5$ = 2500 J
    b. Power = $\frac{\text{workDone}}{\text{TimeTaken}}$
    $= \frac{2500}{4}$ = 625 W

14. a. i. A cricket/hockey ball having small mass which has been hit hard and is travelling fast (possess high kinetic energy).
    ii. A shot put having large mass thrown by an athlete possess low kinetic energy.
    b. Let the body of mass m at height, h above the ground at point A.
    At point 'A'
    Its K.E. = 0 , P.E.= mgh



The total energy of the body at height h = P.E. +K.E.= mgh + 0 = mgh

At Point 'B' : After the body has fallen freely through a distance x (say) at point 'B', Its Kinetic Energy (KE) at point 'B' = mgh and Potential Energy (PE)= mg (h - x)

Total energy possessed by a ball at point 'B'= KE + PE = mgh + mg (h - x) = mgh

At Point C: When it reaches the ground at point 'C' ;

$v^2 - u^2 = 2aS$

$v^2 - 0^2 = 2gh$ Or, $v^2 = 2gh$

Its KE $= \frac{1}{2}$ m $v^2 = \frac{1}{2}$ m.2gh = mgh ($v^2 = 2gh$) and PE = 0

Total Energy at point 'C' = KE + PE = mgh

Thus, the total mechanical energy of a freely falling body is always conserved , i.e. (KE +PE)= mgh.

15. i. a. Kinetic energy of belt or the package.

b. Heat energy

c. Sound energy

ii. m = 36 kg, h = 2.4 m, g = 10 m/s^2

G.P.E.= $m \times g \times h$

$= 36 \times 10 \times 2.4$ = 864J

iii. $power = \frac{W}{t}$

$power = \frac{864}{4.4}$ = 196.36 W

iv. Mass is increased and power is constant, so increase in potential energy of mass is greater. Also, as mass is increased, speed is reduced and hence time taken by the conveyor is longer.