SHIKSHA CLASSES

Sub : Science **Answer Paper** **Total Marks : 30**

Class : IX (CBSE) **11. Work and Energy**

SECTION A (EACH 1 MARKS)

Q.1 : In the dams water is stored in the high reservoirs and then made to fall down. This falling water then rotates the turbines to generate electricity. In this energy conversion process can you tell the initial and final energies respectively?

Ans : a) Kinetic energy and electrical energy

OR

The type of energy possessed by a simple pendulum, when it is at the mean position is:

Ans : a) Kinetic energy

Q.2 : A car weighing 1200 kg and travelling at a speed of 20 m/s stops at a distance of 40 m retarding uniformly. Calculate the work done by the brakes.

Ans : c) -24×10^3 J

OR

Pravin has applied a force of 100 N on an object, at an angle of 600 to the horizontal. The object gets displaced in the horizontal direction and 400 J work is done. What is the displacement of the object? (cos 60^0 = 1/2)

Ans : a) 8 m

For question numbers 3 two statements are given- one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

Q.3 : Assertion(A) : No work is done when a woman carrying a load on her head, walks on a level road with a uniform velocity.

Reason (R): No work is done if force is perpendicular to the direction of displacement.

Ans : a) Both A and R are true, and R is correct explanation of the assertion.

Q.4 : Assertion : The kinetic energy, with any reference, must be positive.

Reason : In the expression for kinetic energy, the velocity appears with power 2 and mass is a scalar quantity.

Ans : a) Both A and R are true, and R is correct explanation of the assertion.

Q.5 : Assertion : A spring has potential energy, both when it is compressed or stretched.

Reason : In compressing or stretching, work is done on the spring against the restoring force.

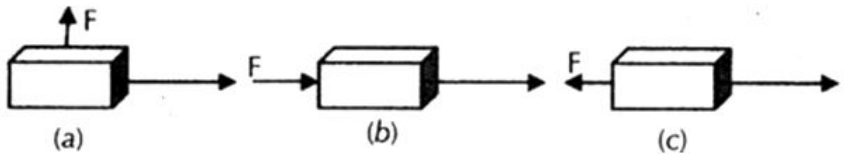
Ans : a) Both A and R are true, and R is correct explanation of the assertion.

Q.6 : A body is falling from a height h. After it has fallen to a height of h/2, it will possess :

Ans : d) More kinetic and less potential energy

Q.7 : **Observe the figure and answer the following questions. (Any Two)** **2**

In each of the following a force, F is acting on an object of mass, m. The direction of displacement is from west to east shown by the longer arrow.



i) What is the work done in fig(a)?

Ans : c) zero

ii) What is the direction of the force in fig (b)?

Ans : b) In the direction of the displacement

iii) What is the work done in fig(c)?

Ans : b) Negative

Q.8 : Which one of the following is not the unit of energy?

Ans : a) Kilowatt

Q.**9 : The work done on an object does not depend on ….**

a) displacement b) applied force

c) initial velocity of the object d) the angle between force and displacement

Q.10 : The kinetic energy of an object is K. If its velocity is doubled than its kinetic energy will be -

Ans : d) 4K

Q.11 : If a force acting on a body causes no displacement, the work done is-----

Ans : c) 0

Q.12 : The energy used in one hour at the rate of 1kW is known as -----

Ans : b) 1kWh

Q.13 : What are the various factors affecting kinetic energy?

Ans : d) All the above options

Q.14 : The sum of kinetic energy and potential energy is -----

Ans : a) Mechanical energy

SECTIONB (EACH 2 MARKS)

Q.15 : Write down the type of energy stored in

a) spring of a watch **b) flowing water**

c) rolling stone **d) raised hammer**

Ans : (a) potential energy (b) kinetic energy

(c) kinetic energy (d) potential energy

Q.16 : If we lift a body of 7 kg vertically upwards to a height of 10 m, calculate the work done in lifting the body.

Ans : Given,

m = 7 kg

s = 10m

Workdone, W = F x s

E = mg x s

W = 7 x 10 x 10 J

w = 700 J

OR

Write down the energy transformation taking place

a) In electric bulb **b) In torch**

c) In the thermal power station **d) In solar cell**

Ans : a) Electrical energy into light energy

b) The chemical energy of the cell into light and heat energy

c) The chemical energy of fuel into electrical energy.

d) Solar energy into electrical energy.

SECTION C (EACH 3 MARKS)

Q.17 : Certain force acting on a 20 kg mass changes its velocity from $5ms^{-1}$ to $2ms^{-1}$. Calculate the work done by the force.

Ans : Mass of the Object, M = 20 kg.

Suppose v_f - Final kinetic energy.

v_i - Initial Kinetic Energy

Total work done by the force = Change in the kinetic energy of the object.

$$= \frac{1}{2} \text{ m x } \Delta(v)^2 = \frac{1}{2} m x (v_f^2 - v_i^2)$$

$$= \frac{1}{2} x\, 20\, x [(2)^2 - (5)^2] = \frac{1}{2} \times 20 \times (4 - 25)$$

= 10 x (-21) = -210 J

The force will do work equivalent to 210 J. Here the direction of force is opposite to the dircection of motion.

OR

If the velocity of a body is doubled, how will its kinetic energy change? Compare new kinetic energy with the old one.

Ans : Consider a body of mass 'm' moving with a velocity 'v_1'.

Then, its K.E. = $\frac{1}{2} mv_1^2$ $\quad \therefore E_1 = \frac{1}{2} mv_1^2$ ..... (i)

Now, its velocity is doubled. So, $v_2 = 2v_1$

$\therefore$ Its new kinetic energy $E_2 = \frac{1}{2} mv_2^2 = \frac{1}{2} m(2v_1^2) = 4 \cdot \frac{1}{2} mv_1^2 = 4E_1$ from (i)

Thus, its kinetic energy becomes four times.

Q18 : An object of mass 40 kg is raised to a height of 5m above the ground. What is its potential energy? If the object is allowed to fall, find its kinetic energy when it is half way down.

Ans : Potential energy of the object = m x g x h

$= 40 \text{ kg} \times 10 \text{ m s}^{-2} \times 5\text{m} = 2000\text{J}$

let v be the velocity of the object at half the way

i.e; after travelling 2.5m.

Then, $v^2 - u^2 = 2as$

$V^2 - o^2 = 2 \times 10 \times 2.5$

$= 50 \text{ m/s}^2$

$\therefore$ Kinetic energy $= \frac{1}{2} mv^2 = \frac{1}{2} \times 40 \times 50$

$= 1000$ J.

SECTION D (5 MARKS)

Q.19 : Derive an expression for the kinetic energy of a body.

Ans : Consider a body of mass 'm' at rest. Let a constant force F act on the body producing an acceleration 'a' for a distance 's'. Let the velocity of the body be changed to v.

In this case, initial velocity =0.

Final velocity =v.

Using, $v^2=u^2+2as$ $\quad v^2=0+2as$

$v^2=2as \quad s = \frac{v^2}{2a}$

Work done= F × s $\quad = ma\ s = ma \times \frac{v^2}{2a}$

Work done $= \frac{1}{2} (m\ v^2)$

By definition this work done is equal to the kinetic energy.

$\therefore$ kinetic energy of the body, $E_k = \frac{1}{2} (m\ v^2)$.

OR

Solve the following :

a) A certain household has consumed 250 units of energy during a month. How much energy is this in joule?

Ans : Energy consumed in a month = 250 units

$= 250 \text{ kWh} = 250 \text{ kW} \times 1 \text{ h}$

$= 250 \times 1000 \text{ W} \times 3600 \text{ s}$

$= 90,00,00,000 = 9 \times 10^8$ J.

b) An electric heater is rated 1500 W. How much energy does it use in 10 hours?

Ans : Energy used by heater = Power × Time = 1500 W × 10 h

$= \frac{1500 \times 10}{1000} = 15 \text{ kWh}$.

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