	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	**Department: SCIENCE 2021 - 22** **SUBJECT: PHYSICS**	**Date of submission:** **07.10.21**
Worksheet No:06	**Topic: WORK ENERGY AND POWER**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT-	**CLASS & SECTION**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS

1. **When a body falls freely under gravity, then the work done by the gravity is _____**
   a) Positive
   b) Negative
   c) Zero
   d) Infinity
2. **For a body moving in a circular path, the work done by the centripetal force is _____**
   a) Negative
   b) Positive
   c) Constant
   d) Zero
3. **What is the unit of energy in c. g. s system?**

   a. Dyne b. erg c. Newton-meter/second d. dyne-cm/second
4. **The rate of change of work is _____ .**

   a) Power b) Force c) Momentum d) Energy
5. **A gardener pushes a lawn roller through a distance of 20m. If he applies a force of 20kg weight in a direction inclined at 60° to the ground, find the work done by him. ($g=9.8m/s^2$)**
   a) 400J
   b) 1960J
   c) 250J
   d) 2514J

6. **Which of the following is equal with Newton-meter?**

   a)Joule b) Horse Power c) Watt d)Pascal

7. **A person is holding a bucket by applying a force of 10N. He moves a horizontal distance of 5m and then climbs up a vertical distance of 10m. Find the total work done by him?**
   a) 50J
   b) 150J
   c) 100J
   d) 200J

8. **Joule/second is related to –**

   a) Watt b) Newton c) Pascal d) Torr

9. **A bullet fired from a gun can pierce a target due to its _____**
   a) Potential energy
   b) Heat energy
   c) Kinetic energy
   d) Acceleration

10.1 joule = _____ erg.

a)10^9 b) 10^5 c)10^7 d) 10^{10}

Ans. 1) a) positive 2) d) zero 3) b) erg 4) a) power 5) b) 1960J 6) a) Joule

7) c) 100J 8) a) Watt 9) c) Kinetic energy 10) c) 10^7

VERY <u>SHORT ANSWER QUESTIONS (1MARK)</u>

11. **The momentum of an object is doubled. How does its K.E. change?**
    (Hint: K.E. =P^2/2m)
12. **A spring is cut into two equal halves. How is the spring constant of each half affected?**
    (Ans. When a spring is cut into two halves of equal length, the spring constant of each half doubles. The product of spring constant and length remains constant. Thus, K multiplied by length must be same. Thus, the new spring constant will be twice of the original spring constant.)

13. **How much power does it take to lift 30.0 kg 10.0 m high in 5.00 s?**

(Ans. Power = mgh/t)

14. **The momentum of a body is reduced to half. What will be the new kinetic energy?**

Ans. For any given object momentum along a straight path being halved, derives its velocity to be halved as mass may be assumed constant. So, velocity being halved finds its kinetic energy to be one fourth.

15. **Is K.E. conserved during the short time of collision (collision time) during an elastic collision. (No)**

16. **If two bodies stick together after collision will the collision be elastic or inelastic? (Ans. Perfectly inelastic)**

SHORT ANSWER QUESTIONS (2 MARKS)

17. **A light body and a heavy body have the same kinetic energy. Which one will have the greater momentum? (Ans. Heavier body)**

18. **Springs A and B are identical except that A is stiffer than B, i.e, force constant $k_A > k_B$. In which spring is more work expended if they are stretched by the same amount? (Ans. $W_A > W_B$)**

19. **Derive the expression for the potential energy stored in a spring?(As given in the notes)**

20. **Show that the total linear momentum of the system of particles is conserved in any collision? (As given in the notes)**

21. **Show that the kinetic energy of the particle is $\frac{1}{2}mv^2$. (As given in the notes)**

SHORT ANSWER QUESTIONS (3 MARKS)

22. **A ball of mass 0.3kg is dropped from rest at a height of 20m. If it loses 30% of its kinetic energy on striking the ground, what is the height to which it bounces? How do you account for this loss in kinetic energy?**

Ans. Suppose the ball acquires a velocity 'v' after falling through a height of 20m.

Because the ball is dropped from rest, hence u = 0.

Hence, $v^2 = u^2 + 2as$

$= 0 + (2 \times 10 \times 20) = 400$

So, v = 20 m/s

Kinetic energy of the ball just before hitting the ground

$= (1/2)mv^2$

Because the ball loses 30% of the kinetic energy on striking the ground, hence kinetic energy retained by the ball after striking the ground = 70% of initial K.E

= 140 x .3 J

The energy loss is due to the inelastic collision with the ground.

23. The length of a steel wire increases by 0.5cm, when it is loaded with a weight of 5kg.calculate the force constant of the wire and work done in stretching the wire [g =10m/s^2] (Hint- k =F/x

W = ½ kx^2) (Ans- 0.125J)

24. The force constant of a spring is 60N/m. If a bullet of 30gm is shot by the gun, so that its spring is compressed by 12cm. calculate the velocity of the ball? [5.36m/s]

25. A body of mass 2kg is resting on a rough horizontal surface. A force of 20N is applied on it for 10s, parallel to the surface. If the coefficient of kinetic friction between the surfaces in contact is 0.2, calculate (a) Work done by the applied force in 10s. (b) Change in kinetic energy of the object in 10s.

(W1 = 8000J, W2 = 64000J- Hint – Change in kinetic energy = work done by the net force

LONG ANSWER TYPE QUESTIONS (5 MARKS)

26. Define elastic collision and discuss it for two bodies in one dimension. Calculate the velocities of bodies after collision. A lighter body collides with a much more massive body at rest. Prove that the direction of the lighter body is reversed and massive body remains at rest.

27. State and prove principle of conservation of mechanical energy by taking the example of a freely falling body.

28. Discuss the conservation of energy in an elastic spring. Hence write an expression for the maximum speed of a body of mass m oscillating at its one end.

29. Derive an expression for the potential energy of an elastic stretched spring.

30. A ball of mass 100g is thrown vertically upward at a speed of 25m//s. If no energy is lost, determine the height it would reach. If the ball only rises to 25m, calculate the work done against the air resistance. Also calculate the force of air resistance.

(Ans.

I: Given **Initial velocity, $v_i = 25\ ms^{-1}$, Final velocity, $v_f = 0\ ms^{-1}$**
Acceleration, $g = -9.8\ ms^{-2}$
Find **Distance, s = h.**
Formula **$2as = v_f^2 - v_i^2$**
Put the values,

$2(-9.8)h = 0^2 - (25)^2$ OR $-19.6h = -625$
OR $h = 625/19.6 = 31.88 = 31.9$ m

Therefore, the ball goes 31.9 m high in the air.

II: Given **$v_i = 25$ m/s** **$v_f = 0$ m/s**
s = h = 25 m

Find Air resistance, f
Here, when the ball is thrown up, it has some K.E which converts to P.E and work against the air resistance. According to the law of conservation of energy, the K.E, at any instant of time, will be equal to the gain in P.E plus work done against the air resistance.

K.E = Gain in P.E + Work done against the air resistance. ... (A)

Now, $K.E = \frac{1}{2} mv^2 = \frac{1}{2} \times (100 \times 10^{-3}) \times 25 \times 25 = 31.2$ J ... (1)
$(100 \times 10^{-3} = 0.1)$ is the mass of the ball converted to kilograms.
$P.E = mgh = 0.1 \times 9.8 \times 25 = 24.5$ J ... (2)

Put values from (1) and (2) in (A)

31.2 = 24.5 + Work done against air resistance

∴ Work done against air resistance = 31.2 − 24.5 = 6.7 J

III: Now work done = W = F d, or F = W/d. Put values of W and d to calculate the force due to air resistance,
F = 6.7/25 = 0.268 = 0.3 N

ASSERTION REASONING QUESTIONS

1) **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

2) **Assertion:** A man rowing a boat upstream is at rest with respect to the bank. He is doing no external work.
Reason: Work done does not depend on the relative displacement.

Ans. C- If relative displacement is zero work done is zero. In this case, s = 0, and so W = 0.

3) **Assertion:** The work done in moving a body over a closed loop is zero for conservative force.
Reason: Work done in moving a body over a closed loop is not zero for a non-conservative force.

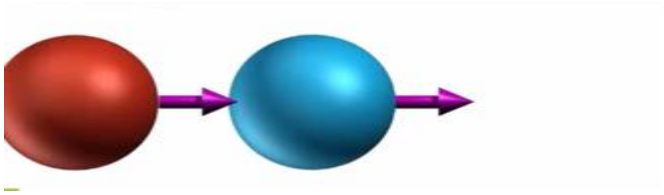
Ans. b

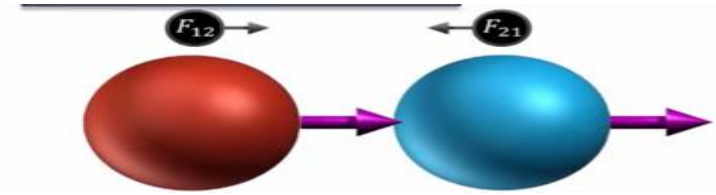
4) **Assertion:** The rate of change of total momentum of a many particle system is proportional to the sum of the internal forces of the system.
Reason: Internal forces can change the kinetic energy but not the momentum of the system.

Ans. d

CASE BASE STUDY QUESTIONS

COLLISION:- A collision is said to occur between two bodies, either if they physically collide against each other or if the path of one is affected by the force exerted by the other. For a collision to take place, the actual physical contact is not necessary. There are different types of collisions occurring in nature.





Answer the following questions based on collisions.

1) If two bodies stick together after the collision and move as a single body with a common velocity, then the collision is said to be

a) elastic collision

b) Perfectly elastic collision

c) Perfectly inelastic collision

d) Inelastic collision

Ans.C

2) In an inelastic collision

a) Kinetic energy is conserved

b) Forces involved are conservative

c) Total energy is not conserved

d) Total momentum is conserved

3) In an elastic collision in one dimension, the final velocities v1 and v2 are given by the formula

a) $v1 = \frac{m1-m2}{m1+m2}$ **u1 +** $\frac{2m2}{m1+m2}$ **u1** , $v2 = \frac{m2-m1}{m1+m2}$ **u2 +** $\frac{2m1}{m1+m2}$ **u2**

b) $v1 = \frac{m1-m2}{m1+m2}$ **u1 +** $\frac{2m2}{m1+m2}$ **u2** , $v2 = \frac{m2-m1}{m1+m2}$ **u2 +** $\frac{2m1}{m1+m2}$ **u1**

c) $v1 = \frac{m1-m2}{m1+m2}$ **u1 +** $\frac{2m2}{m1+m2}$ **u2 ,** $v2 = \frac{m2+m1}{m1-m2}$ **u2 +** $\frac{2m1}{m1+m2}$ **u1**

d) $v1 = \frac{m1+m2}{m1-m2}$ **u1 +** $\frac{2m2}{m1+m2}$ **u2 ,** $v2 = \frac{m2-m1}{m1+m2}$ **u2 +** $\frac{2m1}{m1+m2}$ **u1**

Ans- b

4) When two bodies of equal masses suffer one dimensional elastic collision, their velocities

a) remain the same after the collision.

b) become zero after the collision.

c) get exchanged after the collision.

d) increases by equal amounts after the collision.

Ans- c

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