WORK DONE,THE ILLUSION(Misconception of Work and Energy Conservation)

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Abstract

As we know, the work done formula that the world uses nowadays is the Force dot product of displacement (i.e. W = F.d)[1, 2]. But there are some contradictions which are found. The work done formula which we use nowadays is not universally applicable. There are only some special cases where this formula is applicable . In this article we will find where this formula has failed. So the actually universally applicable formula is Force multiplied by time (i.e. W = Ft)[3].

Keywords: hypothesis of total transfer of momentum, hydraulic needle multi-collision kinetic converter, momentum universe and kinetic universe, potential energy as a Kinetic Universe, Illusion of work done for Earth.

1 Introduction

For simplicity suppose two bodies , one has mass 1 kg and another has 10 kg . we apply a 10 newton Force on both masses for a 10 metres of displacement . so if we calculate the work done for both masses, is equal to 100 joules for both cases .This means that work done is independent on the mass of body but how it is possible . So in this research paper we will prove that the real work done depend upon mass (.i.e., W=F.d is wrong equation of work done which we use nowadays). To prove this we generate a hypothetical setup,named **hydraulic needle multi-collision kinetic converter)**which we will discuss later. And then we see why $W = F.d$ create illusion for the world .

2 Particular Expression

Now let their are two mass m_1 and mass m_2(i.e.,$m_1 > m_2$) at rest . On both masses we apply same force F for Same displacement d. Thus, work done (W_1) for mass m_1 is equal to work done (W_2) for mass m_2 ;

$$W_1 = W_2$$

As the same work is to be done on both masses, the kinetic energy of both masses will be the same [4];

$$KE_{m_1} = KE_{m_2} = KE \tag{1}$$

But mass $m_1 > m_2$, so acceleration of mass m_1 is smaller than mass m_2.It means F_1 (force on mass m_1)applied for longer time than force F_2 (force on mass m_1)

$$t_1 > t_2$$

According to newton second law of motion, change in momentum is directly proportional to the force and time [5] ,so now

$$F_1 = F_2$$

but

$$t_1 > t_2$$
$$F_1 t_1 > F_2 t_2$$
$$F t_1 > F t_2$$
$$p_{m_1} > p_{m_2}$$

Now, let us make collision of mass m_1 (which has the same kinetic energy equal to mass m_2)with another mass m_3 which are at rest and have the same mass equal to m_2 (i.e.,$m_3 = m_2$), in such a way that after collision , mass m_1 totally transfers its momentum to mass m_3 (that is, mass m_1 becomes at rest and mass m_3 at motion) as shown in **Figure 1.**[6]. We name this process as **total momentum transfer process**. But how is this process achieved? By **hydraulic needle multi-collision kinetic converter** which we will discuss later.

so ***Before Collision*** :

Initial velocity of mass $m_1 = u_1$

Initial velocity of mass $m_3 = u_3 = 0$

Initial velocity of mass $m_2 = u_2$

Momentum of mass $m_1 = p_{m_1}$

Momentum of mass $m_2 = p_{m_2}$

Kinetic energy of mass $m_1 = KE_{m_1} = KE$

Kinetic energy of mass $m_2 = KE_{m_2} = KE$

After Collision:

Momentum of mass $m_1 = 0$

Momentum of mass $m_3 = p_{m_1}$

Momentum of mass $m_2 = p_{m_2}$

Kinetic energy of mass $m_2 = KE_{m_2} = KE$

Final velocity of mass $m_1 = 0$

Final velocity of mass $m_3 = v_3$

Now, according to conservation of energy(we can exclude potential energy for our simplicity, i.e., the whole set-up is in the space),

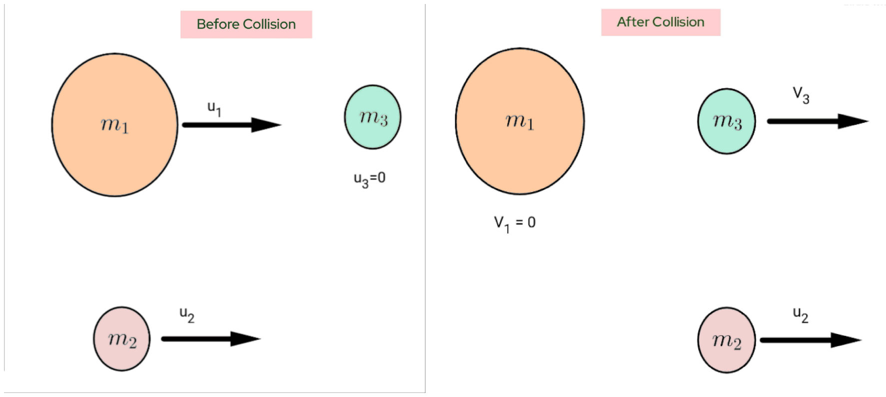

Figure 1: *Collision Diagram*

$$\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_3u_3^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_3v_3^2$$

$$\frac{1}{2}m_1u_1^2 + 0 = 0 + \frac{1}{2}m_3v_3^2$$

$$\frac{1}{2}m_1u_1^2 = \frac{1}{2}m_3v_3^2 \tag{2}$$

Now, according to conservation of momentum [7] ;

$$m_1u_1 + m_3u_3 = m_1v_1 + m_3v_3$$

$$m_1u_1 + 0 = 0 + m_3v_3$$

$$m_1u_1 = m_3v_3$$

$$v_3 = \frac{m_1}{m_3}u_1$$

$$v_3^2 = \frac{m_1^2}{m_3^2}u_1^2 \tag{3}$$

Now comparing equation 1 ans 2 we get;

$$\frac{1}{2}m_1u_1^2 = \frac{1}{2}m_3(\frac{m_1^2}{m_3^2}u_1^2)$$

$$\frac{1}{2}m_1u_1^2 = \frac{m_1}{m_3}(\frac{1}{2}m_1u_1^2)$$

$$KE_{m_1} = \frac{m_1}{m_3}KE_{m_1}$$

As $m_1 > m_3$, so the right term always greater than left term i.e., after collision, the mass m_3 energy increased by the factor m_1/m_3 (or m_1/m_2), and if $m_1 < m_2$ then energy decrease by factor m_1/m_3(or m_1/m_2) . This equation equal only if $m_1/m_3 = 1$.
Otherwise ; for $m_1 > m_2$

$$\frac{1}{2}m_1u_1^2 < \frac{m_1}{m_3}(\frac{1}{2}m_1u_1^2)$$

$$KE_{m_1} < \frac{m_1}{m_3}KE_{m_1}$$

OR

$$KE_{m_1} < \frac{m_1}{m_3}KE_{m_2}$$

but ,

$$KEm_1 = KEm_2\ ,$$

which is contradiction, Thus the conservation of Kinetics energy not hold [8],i.e., kinetic energy can be created and can be destroyed.

3 Conservation Possibilities

In the upper section, we assume that the law of conservation of momentum is always valid, but conservation of kinetic energy may or may not hold. But how do we know that the conservation of momentum always holds ?
NOTE : In the previous section we see that kinetic energy is not conserved, but according to the law of energy conservation, energy cannot be created or destroyed, so we use **Kinetic Term** instead of kinetic energy.
So there are **three Possibilities** , given below ;
1.)**CASE 1 :** Kinetic term is always conserved , but momentum cannot .
2.)**CASE 2 :** The momentum is conserved, but the kinetic term cannot.
3.)**CASE 3 :** Both momentum and kinetic term are conserved .
Now, we prove these three Possibilities whether true or false, one by one as given below ;

3.1 CASE 1:

Let the kinetic term be conserved, but momentum is not. So in this case the law of conservation of energy holds, but conservation of momentum does not hold. It means that total momentum before and after the collision is not equal (i.e., momentum increases or decreases after collision).
Let p_1 be the total momentum before collision of both the masses m_1 and m_3 , and p_2 be totally momentum after collision of both the masses m_1 and m_3
Thus ,

$$p_1 \neq p_2$$

$$p_1 = p_2 + \Delta p$$

WhereΔp is the change in momentum.
But we know that during collision , we can't exert any external force i.e.,$F = 0$, now remember newton second law of motion [9], net force acting on an object for time t is equal to the rate of change of momentum ;

$$F.t = \Delta p$$
$$0.t = \Delta p$$
$$\Delta p = 0$$

Thus

$$p_1 = p_2$$

If this is not so (i.e.,$p_1 \neq p_2$) , then this means that we change the momentum without exerting any external force, which is in contradiction to the Newton second law.
Thus our assumption is wrong , CASE 1 is **Not True** i.e., Momentum is always conserved but kinetic term may or may not .

3.2 CASE 2 : (Hydraulic Needle Multi-Collision Kinetic converter)

In the previous Case 1 we prove that the law of conservation of momentum is always hold true , but kinetic term may or may not . In this Case 2 , we prove that the kinetic term not always conserved . To prove this , we assume a ***hypothetical mechanism : hydraulic needle multi-collision kinetic converter*** . Obviously , their are many techniques which can be developed in future , but one techniques is sufficient to prove this .

3.2.1 Principle:

It's principle is transfer of momentum from one mass m_1 to another mass m_2 by proceeding multiple-collisions between them , until the momentum of one mass m_1 is zero .

3.2.2 Construction:

There are ***two main parts :***
1. Hydraulic needle cylinder bucket :It consist a large area piston P_1 in one side and another piston P_2 with very small cross-section area in other side . If large area's piston move very small displacement then the small cross-section area's piston will displaced very very large displacement . Between the two piston cylinders the **incompressible and zero viscosity fluid** (to prevent energy loss)is filled .Also the pistons are frictionless , as shown in **Figure 2**.

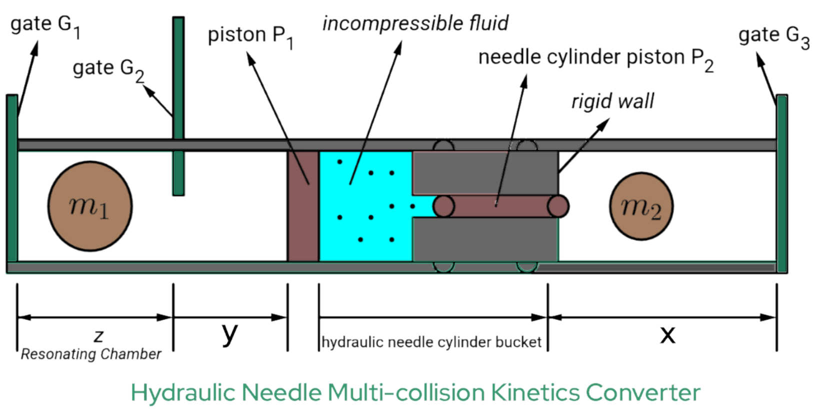

Figure 2: *Hydraulic Needle Multi-collision Kinetics Converter*

Let , Area of , large area pistons $P_1 = A_1$
Area of , small area piston $P_2 = A_2$
Displacement of large area piston = dx
Displacement of small piston = dy
Then volume will be same ;

$$A_1 dx = A_2 dy$$

$$\frac{A_1}{A_2} = \frac{dy}{dx}$$

$$\lim_{A_2 \to 0} (\frac{A_1}{A_2}) = \frac{dy}{dx}$$

Upper term becomes very large so , $dy >> dx$
2. Resonating Chamber :This is a chamber in which mass m_1 oscillating between gate G_1 and gate G_2 for a certain time of duration , which we calculate later . it consist Gate G_2 which is movable so the length of

Resonating Chamber (z) can be adjusted . Resonating Chamber works as a Resonating the time of mass m_1 and m_2 .

NOTE: It should be noted that Resonating Chamber can be made either side of the hydraulic needle cylinder bucket.

Other parts

***3. Gates*:** G_1 and G_3 are the gates which are placed at the ends of the both sides . When the gate G_1 and G_3 is opened , the mass m_1 and m_3 can enter or exit the system . When the gate G_1 and G_3 is closed , the collision between the masses and gates is purely elastic i.e., momentum is conserved.

4. ***Two way gate*** G_2 This is similar gate like G_1 and G_3 but the difference is that Gate G_2 is movable along x-axis , so that the length of Resonating Chamber can be adjusted .

5. Body insolation: The whole System is isolated from environment. so whole system is covered and generate vacuum inside the body to reduce the air resistance which can reduce the velocity/energy of masses.

3.2.3 Assumptions :

1. This mechanism do not transfer any momentum to masses i.e., machine do not give any energy to given masses , we just open/close or change the distance between the gates .
2. Piston cylinders are frictionless i.e., loss of energy of masses by machine is Zero .
3. Fluid filled between pistons cylinder is incompressible and zero viscosity as to inhibit loss of energy .
4. Every collision is purely elastic i.e., collision between masses, mass with gate or mass with cylinder is purely elastic .

In simple words, the system can neither drive outing energy from masses and nor give any energy to masses [10, 11, 12, 13, 14, 15].

3.2.4 Working :

1.Automatic Momentum Transfer : Let m_1 is the mass having velocity v_1 and mass m_2 has velocity v_2. let the mass m_1 come from left , then we open the gate G_1 and G_2 . similarly mass m_2 from right side we open the gate G_3 . Once the masses enter the system , gate G_1 and G_3 is closed . Let m_1 have greater momentum than m_2 , then when the m_1 hit the large piston cylinder, at the same time small piston cylinder emerge with high velocity and hit the mass m_2 and transfer some amount of momentum.

2. Resonance Condition : After Some collisions the momentum of m_1 and m_2 becomes equal i.e., $p_1 = p_2$, so no further transfer of momentum occur . As we know that momentum can't transfer when momentum is equal or momentum can't transfer from lower momentum to higher momentum until ; lower/equal momentum mass (i.e., m_1) collide with higher/equal momentum mass (i.e., m_2) from it's back position , we called this collision as ***Back collision*** . The collision in which the lower momentum mass i.e., m_1 transfer its momentum to higher momentum mass i.e., m_2 by collide back position of motion of lower momentum mass , is called *Back Collision* ,as shown in **Figure 3 .**

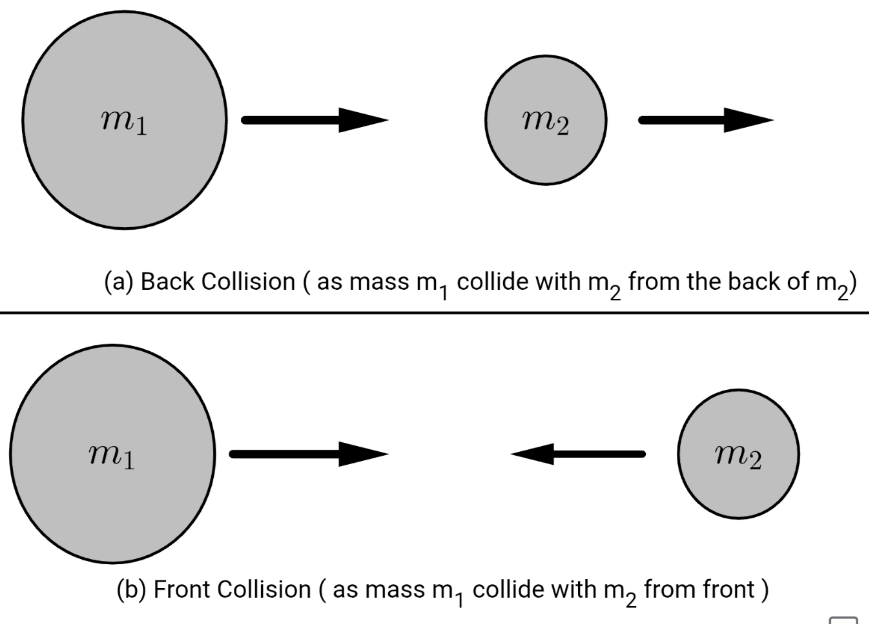

Figure 3: *(a)Back Collision (b)Front collision*

But we now that $m_1 > m_2$, so if the momentum of mass m_1 is equal to the momentum of m_2 then the velocity of mass m_1 is lower than the velocity of mass m_2 .

$$m_1 v_1 = m_2 v_2$$

As $m_1 > m_2$

$$v_1 < v_2$$

Then how mass m_1 collide at the back of mass m_2 i.e., how back collision take place ?
To achieve back collision , we introduce the hydraulic needle cylinder bucket . when the mass m_1 collide with large area piston , the piston move , and other side very small area piston emerge (having velocity higher than velocity of mass m_2) and hit the mass m_2 and transfer of momentum from m_1 to m_2 take place even m_1 has lower momentum. After collision piston again come to original position and masses go towards the gates . After collision with gates , mass m_1 and m_2 again goes *back collision* with the help of hydraulic needle cylinder bucket with the piston P_1 and piston P_2 . This process repeated again and again until mass m_1 totally transfer its momentum to mass m_2 .

3. Resonating chamber : In the upper part we see that how *back collision* transfer momentum from lower momentum mass to higher momentum mass with the help of hydraulic needle cylinder bucket . But still their is one problem that after every collision between masses and hydraulic needle cylinder bucket , the velocity of mass m_1 decrease whereas velocity of mass m_2 increased, so after every collision masses take different time to reach back to the hydraulic needle cylinder bucket, which lead to mismatching of time for *back collision* . It should be noted that ***collision must be back collision*** if by chance the collision is *front collision* then mass m_1 again gain some momentum from mass m_2 instead of loss . so it's important that masses reach at pistons at proper time . **Front Collision** is the collision in which two masses collide in front of each other . For this we made resonating chamber . The mass m_1 will oscillate in resonating Chamber for perfect matching of the time . The length of Resonating Chamber can be adjusted by gate G_2 .

Adjustment of length of Resonating Chamber

Let length of the resonating chamber = z

Total length of mass m_1 Chamber = l

Remaining length =$y = l - z$

Total length of mass m_2 chamber = x

Now, If v_1 and v_2 is initial velocity of mass m_1 and mass m_2 . Similarly , v_3 and v_4 is the final velocity after collision, then according to conservation of momentum ;

$$m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$$

Time for reach the piston for mass $m_2 = t_{m_2}$

$$t_{m_2} = \frac{2x}{v_4} + 0^+ \tag{4}$$

We add 0^+, which means a very small extra time to ensure that the collision must be *back collision* , so that m_2 just change direction of motion after colliding with a rigid wall surrounded by the small piston.

Time for the mass m_1 to reach the piston $P_1 = t_{m_1}$

$$t_{m_1} = \frac{2y}{v_3} + \frac{2nz}{v_3}$$

Where n is the number of oscillations (n = 1,2,3,4.....)

$$t_{m_1} = \frac{2(l - z)}{v_3} + \frac{2nz}{v_3}$$

$$t_{m_1} = \frac{2}{v_3}(l - z + nz)$$

$$t_{m_1} = \frac{2}{v_3}(l + z(n-1)) \tag{5}$$

For resonance ,

$$t_{m_1} = t_{m_2}$$

Thus from eq 4 and 5, we get,

$$\frac{2}{v_3}(l + z(n-1)) = \frac{2x}{v_4} + 0^+$$

$$l + z(n-1) = \frac{v_3}{v_4}x + 0^+$$

$$z(n-1) = (\frac{v_3}{v_4}x - l) + 0^+$$

This is the equation for adjusting the length of Resonating Chamber and number of oscillations (n) .
Similarly for successive collision z and n be calculated as ;

$$z(n-1) = (\frac{v_5}{v_6}x - l) + 0^+$$

where successive momentum conservation equation is given by ;

$$m_1v_3 + m_2v_4 = m_1v_5 + m_2v_6$$

By follow this process , after number of collisions , momentum of mass m_1 will be almost fully transferred to the mass m_2 . After transfer the desirable amount of momentum gate G_1 , G_2 and G_3 will be opened so that masses be free in space [16, 17] . Thus from *Particular Expression* (discussed previously) and *Hydraulic needle multi-collision kinetic converter* we prove that CASE 2 is **True** .

3.3 CASE 3 :

Case 3 says that both the momentum and the kinetic term are conserved [18, 19, 10, 20, 21, 22] . Remember the *particular expression* ;

$$\frac{1}{2}m_1u_1^2 = \frac{m_1}{m_3}(\frac{1}{2}m_1u_1^2)$$

$$KE_{m_1} = \frac{m_1}{m_3}KE_{m_1}$$

As $m_1 > m_3$,so the right term always greater than left term i.e., after collision, the mass m_3 energy increased by the factor m_1/m_3 (or m_1/m_2) . This equation equal only if $m_1/m_3 = 1$.
Otherwise ;

$$\frac{1}{2}m_1u_1^2 < \frac{m_1}{m_3}(\frac{1}{2}m_1u_1^2)$$

$$KE_{m_1} < \frac{m_1}{m_3}KE_{m_1}$$

Thus CASE 3 is true if and only if $m_1 = m_2$. Thus CASE 3 is also **TRUE** .
we concluded that case 1 is false whereas case 2 and 3 is true

4 General Expression :

In the previous *Particular Expression* we assume that initial velocity of mass m_3 is zero i.e., $u_3 = 0$ and the final velocity of mass m_1 is zero i.e., $v_1 = 0$, But this possibilities not always followed by nature . Usually their is some initial and final velocity before and after the collision , so we need to derive *General Expression* i.e., when $u_3 \neq 0$, $v_1 \neq 0$.
Let m_1 and m_2 i.e., $m_1 > m_2$ be two masses and v_1 , v_2 be the initial velocities and v_3 , v_4 be final velocities after collisions .
Now, conservation of momentum;

$$m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$$

$$v_4 = \frac{m_1v_1 + m_2v_2 - m_1v_3}{m_2} \tag{6}$$

Now, according to CASE 2, the kinetic term may or may not be conserved ;

$$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 * \frac{1}{2}m_1v_3^2 + \frac{1}{2}m_2v_4^2$$

We use the sign * because kinetic term may increase/decrease or equal , Let the momentum transfer from large mass m_1 to lower mass m_2 i.e., $v_1 > v_3$,then total kinetic term after collision may increase or equal , so * becomes $\leq$;

$$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 \leq \frac{1}{2}m_1v_3^2 + \frac{1}{2}m_2v_4^2$$

$$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 - \frac{1}{2}m_1v_3^2 \leq \frac{1}{2}m_2v_4^2$$

$$\frac{\frac{1}{2}m_2v_4^2}{\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2-\frac{1}{2}m_1v_3^2} \geq 1 \tag{7}$$

From equation 6 and 7, we get ;

$$\frac{\frac{1}{2}m_2(\frac{m_1v_1+m_2v_2-m_1v_3}{m_2})^2}{\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2-\frac{1}{2}m_1v_3^2} \geq 1$$

$$\frac{\frac{1}{m_2}(m_1v_1+m_2v_2-m_1v_3)^2}{\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2-\frac{1}{2}m_1v_3^2} \geq 1$$

This is the *General Equation* for **Gain in kinetic term** .
Similarly, if momentum transfers from lower mass m_2 to higher mass m_1 i.e. $v_1 < v_3$ or $v_2 > v_4$ then the equation becomes ;

$$\frac{\frac{1}{m_2}(m_1v_1+m_2v_2-m_1v_3)^2}{\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2-\frac{1}{2}m_1v_3^2} \leq 1$$

This is the *General Equation* for **Loss in kinetic term** .

5 Graphical Representation :

Let m_1 and m_2 i.e., $m_1 > m_2$ be two masses and v_1 , v_2 be the initial velocities before collision and v_3 , v_4 be final velocities after collision , then according to conservation of energy [23, 24, 25] ;

$$\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2=\frac{1}{2}m_1v_3^2+\frac{1}{2}m_2v_4^2$$

$$\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2=\frac{m_1}{2}(v_3^2+\frac{m_2}{m_1}v_4^2)$$

$$\frac{2}{m_1}(\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2)=v_3^2+\frac{m_2}{m_1}v_4^2$$

$$\frac{P}{m_1}=v_3^2+\frac{m_2}{m_1}v_4^2$$

Where

$$P = 2(\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2)$$

i.e.,

$$P = m_1v_1^2 + m_2v_2^2$$

$$1 = \frac{v_3^2}{\frac{P}{m_1}} + \frac{\frac{m_2}{m_1}v_4^2}{\frac{P}{m_1}}$$

$$1 = \frac{v_3^2}{(\sqrt{\frac{P}{m_1}})^2} + \frac{v_4^2}{(\sqrt{\frac{P}{m_2}})^2} \tag{8}$$

Which is equation of ellipse.
Now take conservation of momentum;

$$m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$$

$$Q = m_1v_3 + m_2v_4$$

Where, $Q = m_1v_1 + m_2v_2$

$$\frac{Q}{m_1} = v_3 + \frac{m_2}{m_1}v_4$$

$$\frac{m_2}{m_1}v_4 = -v_3 + \frac{Q}{m_1}$$

$$v_4 = \frac{-v_3}{\frac{m_2}{m_1}} + \frac{Q}{m_1(\frac{m_2}{m_1})}$$

$$v_4 = (-\frac{m_1}{m_2})v_3 + \frac{Q}{m_2} \tag{9}$$

Which is the equation of line .
So, the straight line represents the conservation of momentum, whereas the ellipse represents the conservation of the kinetic term and combine graph of equation 8 and 9 , is shown in *Figure 4* .

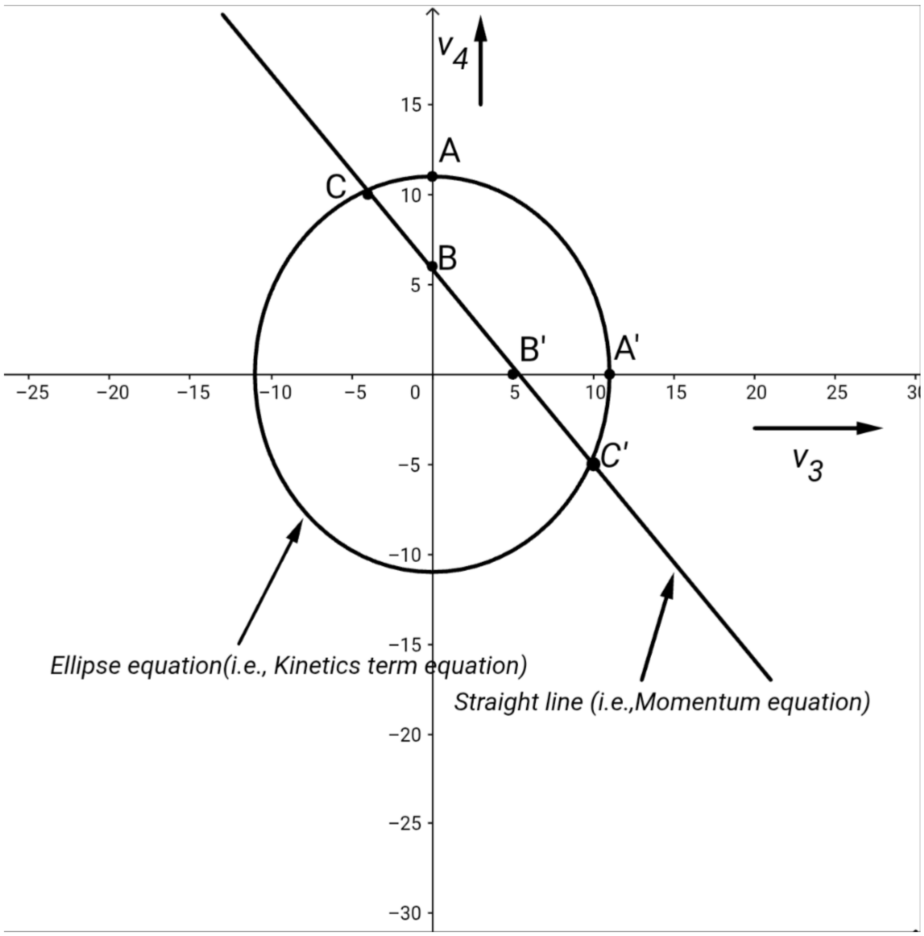

Figure 4: *Graphical representation of conservation of momentum and Kinetic term .*

Therefore, from section *conservation possibilities* we concluded that the straight line (that is, the momentum) is always true and the ellipse curve (that is, the kinetic term) may or may not be.
Points of figure 4 is below ;

$$A = (0, \sqrt{\frac{P}{m_2}}), A' = (\sqrt{\frac{P}{m_1}}, 0), B = (0, \frac{Q}{m_1}), B' = (\frac{Q}{m_1}, 0)$$

Observation :
1.) It is found that ellipse curve and straight line always intersect atleast one point .
2.) The point C and C' are the point where ellipse curve and straight line intersect, so at that value both conservation of kinetic term and conservation

of momentum laws are hold .

6 Momentum Universe vs Kinetics(Joules) Universe :

6.1
Momentum Universe :

As we see that law of conservation of momentum always hold true , but the kineic term not always conserved . So , the Universe which hold only conservation law of momentum , but not the conservation law of kinetics , we called its as *Momentum Universe* .We can see the whole line of Momentum in figure 4 except point C and C' is momentum universe , however in nature it difficult to see , and practically difficult to achieve .

6.2 Kinetic (Joules) universe :

The Universe which follows both the law of conservation of Momentum and kinetics term , we called its as *Kinetic or Joules universe* [26, 27, 22, 11], The points C and C' represent the Kinetic universe ,and we can see that even Kinetics universe is the Special case of Momentum universe , though nature prefer it more rather than momentum universe . The Gravitation law follow Kinetic universe until Momentum universe (i.e., hydraulic needle Multi-collision kinetic Converter) is not introduce with it .
(**Note :** In Momentum universe the work done $W = F.t = \Delta mv$ whereas in kinetic universe both $W = F.t$ or $W = F.d$ can be refered as energy unit . But , in Kinetic universe we refer $W = F.d$ because it easier to measure the distance as compared to time .)

7 Why Potential Energy is a Kinetic Universe :

Now , first we derive the equation for work done against gravitational force in reference to Momentum universe(we assume that , work done = F.t) , then we will found that why it created illusion for the world . Potential Energy means that energy stored during Workdone against gravitational force , electrostatic force ,etc . But for simplicity we consider now Gravitational force for earth [28] .

7.1 Fundamental Equation for Work done against gravitational force :

Let m is the mass of an object and M is the mass of earth i.e., $M >> m$. Let u is the initial velocity of the mass m and we apply opposite force F against

gravitational force for height h (Obiously applied force large than to gravitational force for work to be done) .
Now acceleration of mass m_1 can be written as ,

$$a = v\frac{dv}{dx} \tag{10}$$

Now , Net force = (Applied force) - (Gravitional force)

$$F_n = F - \frac{GMm}{x^2}$$

Now divide both side by m we get

$$\frac{F_n}{m} = \frac{F}{m} - \frac{GM}{x^2}$$

$$a = \frac{F}{m} - \frac{GM}{x^2} \tag{11}$$

From 10 and 11 , we get;

$$v\frac{dv}{dx} = \frac{F}{m} - \frac{GM}{x^2}$$

Now separate the variable and integrate both sides [29, 30].

$$\int_u^{v_i} v\,dv = \int_R^{R+h} (\frac{F}{m} - \frac{GM}{x^2})\,dx$$

Where R is the radius of earth , v_i is the final velocity at height h .

$$\left[\frac{v^2}{2}\right]_u^{v_i} = \left[\frac{F}{m}x\right]_R^{R+h} - \left[-\frac{GM}{x}\right]_R^{R+h}$$

$$\frac{v_i^2 - u^2}{2} = \frac{Fh}{m} - \frac{GMh}{R(R+h)}$$

$$v_i^2 = \frac{2Fh}{m} - \frac{2GMh}{R(R+h)} + u^2 \tag{12}$$

This is the equation for velocity v_i at height h .
Now the body is free from the applied force and has reached its maximum height and then again begins to accelerate downward i.e., towards the earth. At height h, the velocity is the same as v_i but downward in direction. Now the mass falls downward due to the gravitational force and the velocity is increased further.
Now , the acceleration of the mass m is given by ;

$$a = -\frac{GM}{x^2}$$

$$v\frac{dv}{dx} = -\frac{GM}{x^2}$$

Now separate the variable and integrate both sides,
Here ; at $x = R$, $v = \mathbf{v}$ and at $x = R + h$, $v = v_i$. The **v** is the final velocity of mass m at just reach the ground .

$$\int_{v_i}^{v} v\,dv = \int_{R+h}^{R} -\frac{GM}{x^2}\,dx$$

$$\left[\frac{v^2}{2}\right]_{v_i}^{v} = -GM\left[-\frac{1}{x}\right]_{R+h}^{R}$$

$$\frac{v^2 - v_i^2}{2} = \frac{GMh}{R(R+h)}$$

$$v^2 = \frac{2GMh}{R(R+h)} + v_i^2 \tag{13}$$

Now, from equations 12 and 13, we get;

$$v^2 = \frac{2GMh}{R(R+h)} + \frac{2Fh}{m} - \frac{2GMh}{R(R+h)} + u^2$$

$$v = \sqrt{\frac{2Fh}{m} + u^2}$$

Now, the Work done is equal to the change in momentum, is given by ;

$$W = \Delta p = mv - mu = m(v - u)$$

$$W = m(\sqrt{\frac{2Fh}{m} + u^2} - u)$$

This is the equation of Work done against Gravitational Force in reference to Momemtum universe .
Observations:
1.)Work done against the gravitational force in reference to the Momentum universe is independent on G (Gravitational constant) , R Radius of earth and M (Mass of the heavier body) when $M >> m$.
2.) It depends upon applied force F, object mass m, height h, and initial velocity u.

7.2 Illusion in Work done(Imaginary Work done) :

In te previous subsection we derive the equation of Work done against Gravitational Force in reference to Momemtum universe, that is ;

$$W_1 = m(\sqrt{\frac{2Fh}{m} + u^2} - u)$$

Let t be the time for mass m to reach the height h. Then, the work done (in reference to Momentum universe i.e., $W = F.t = \Delta p$) is given by ;

$$W_2 = F.t$$

By conservation of energy ;

$$W_1 = W_2$$

However this is ***Not True*** i.e, $W_1 \neq W_2$.

$$F.t \neq m(\sqrt{\frac{2Fh}{m} + u^2} - u)$$

In actual

$$W_1 < W_2$$

This is due to *Imaginary Work done.* The***Imaginary Work done*** is defined as the difference between the applied Work done and Real Workdone.

Imaginary Work done = (Applied Work done) − (Real work done)

$$W_{Imaginary} = F.t - m(\sqrt{\frac{2Fh}{m} + u^2} - u)$$

OR ;

$$W_{Applied} = W_{Real} + W_{Imaginary}$$

Cause of Imaginary Work done : Before understand the Imaginary Work done, first suppose that if we want the body to stay in air under the effect of gravitational force , then we need to continously apply equal and opposite force F to balance the gravitational force . After Some time t if we want to calculate the Work done (i.e.,F.t) , we know it's zero because body doesn't change its position , but where our applied Work done is gone ? . The Applied work done is totally converted into Imaginary Work done . Similarly, even, if the applied force greater than gravitational force(i.e., object is in motion) though , some portion of applied Wok done is continuously converted into Imaginary Work done.
Observation:

1.)We can easily see that Real Work done is independent on time whereas Imaginary Work done is depends upon time.
2.)The Imaginary Work done which is totally waste of energy(i.e.,can't be stored), doesn't effect potential energy .
3.)The Real Work done is the Work done which is stored and responsible for potential energy.
Thus , the Real Work done is responsible for potential energy and depends upon height but not on time. Therefore , potential energy follow Kinetic universe. That's why our earth follow Kinetic universe for gravitational potential energy and this create the illusion for the world that the work done $W = F.d$.

8 Conclusion :

We see in particular expression that when the momentum is fully transferred from mass m_1 to mass m_2, then total kinetic energy after collision may equal , increase or decrease by factor m_1/m_2. But how we fully transferred momemtum from one mass to another ? For this we generate **hydraulic needle multi-collision kinetic converter** mechanism as discussed in CASE 2. Then we find *General Expression* in which the momentum is not fully transferred though kinetic energy not conserved .Then we discussed *Graphical Representation* in which we made the graph of conservation of momentum and kinetic term . we see that how conservation of kinetic term is the special cases of conservation of momentum . Then we discussed *Kinetic universe* and *momentum universe* . Further we explained that why Potential Energy follows the Kinetic universe rather than momentum universe, and we discussed that earth follow Kinetic universe for gravitational potential energy that create the illusion for the world. So at the last we concluded that Real Formula for work done is Force multiplied by time, but not the Force dot product of displacement .
So,

$$W = F.t$$

$$W \neq F.d$$

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