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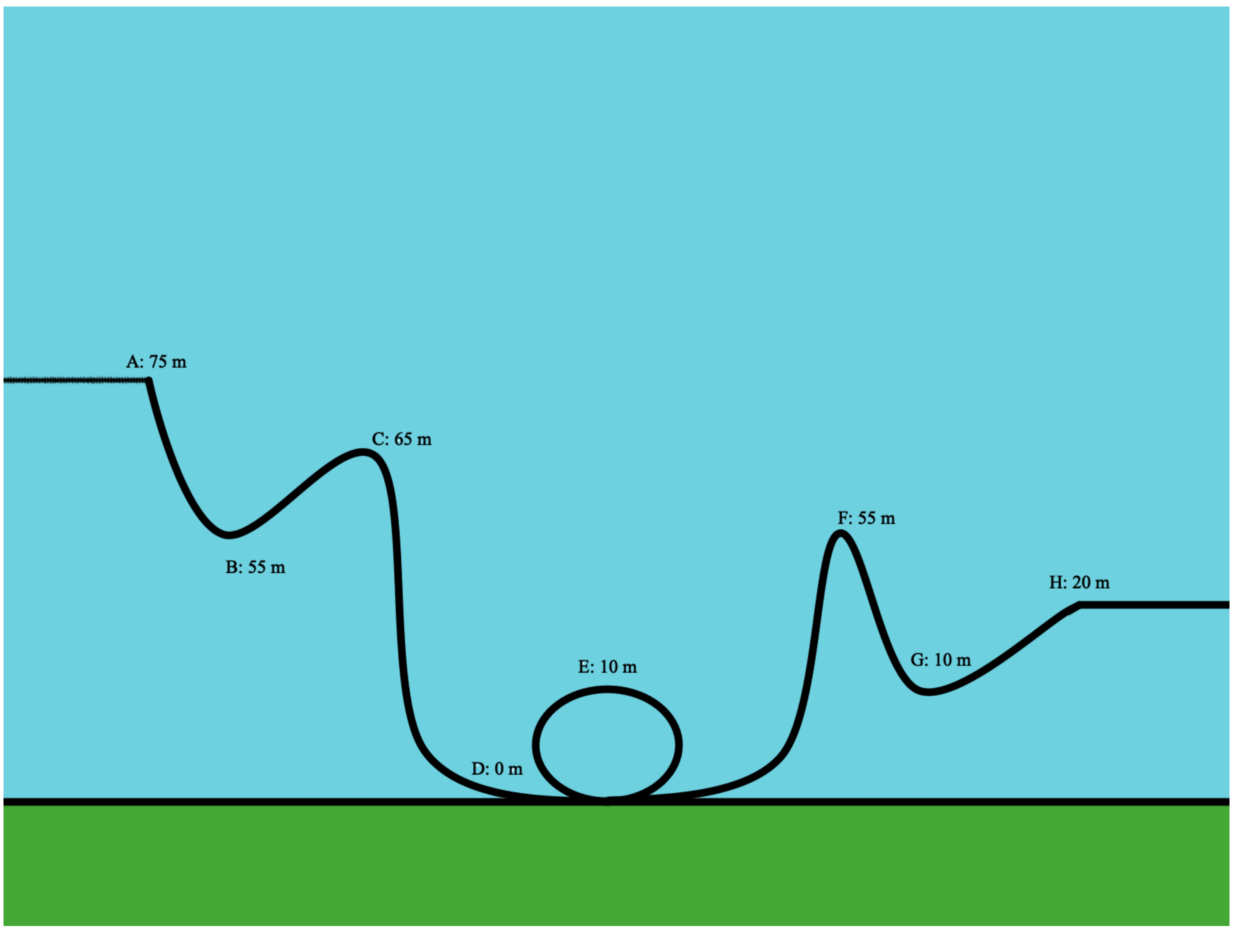
PHY 150
Project 7-3
Project 7-3: Energy and Momentum10-12-21



2. Calculate the kinetic energy, potential energy, and momentum of the cart

- Kinetic Energy (m = mass, v = velocity) $KE = \frac{1}{2}mv^2$
- Velocity/Speed (d = distance, t = time) $v = \frac{d}{t}$
- Potential Energy (g = gravity, h = height) $PE = mgh$
- Momentum (i = initial, f = final) p = $mAvAi + mBvBi = mAvAf + mAvAf$
- Work (F = force, s = displacement) $w = Fs$
- Force (a = acceleration) $F = ma$
- Acceleration $a = v/t$
- Displacement (u = initial velocity) $s = ut + \frac{1}{2}at^2$
- Mechanical Energy = $ME = \frac{1}{2} * m * v^2 + m * g * h$
- Perfectly Inelastic Collision (f = final) $v1f = v2f = \frac{1}{2}(v1f + v2f) = \frac{1}{2}v$

Weight of Cart (M) = 500 kg
Gravity (g) = 9.8 (m/s^2)

A.

- KE 0 J
- PE 367500 J
- P 0 J
- ME 367500 J
- V 0 m/s
- H 75 m

B.

- KE 98000 J
- PE 269500 J
- P 9895 J
- ME 367500 J
- V 19.79 m/s
- H 55 m

C.

- KE 49000 J

- PE 318500 J
- P 7000 J
- ME 367500 J
- V 14 m/s
- H 65 m

D.

- KE 367500 J
- PE 0 J
- P 19170 J
- ME 367500 J
- V 38.34 m/s
- H 0 m

E.

- KE 318500 J
- PE 49000 J
- P 17845 J
- ME 367500 J
- V 35.69 m/s
- H 10 m

F.

- KE 98000 J
- PE 269500 J
- P 9895 J
- ME 367500 J
- V 19.79 m/s
- H 55 m

G.

- KE 318500 J
- PE 49000 J
- P 17845 J
- ME 367500 J
- V 35.69 m/s
- H 10 m

H.

- KE 269500 J
- PE 98000 J
- P 16415 J
- ME 367500 J
- V 32.83 m/s

- H 20 m

3. Describe the energy transfers that occur as the cart moves along the track.

1. **At each of the identified points, how was kinetic energy transferred to potential energy, and vice versa?**

When I think of Kinetic Energy and Potential Energy, I think of the bigger picture when it comes to the application of the conservational energy we are talking about. At each of the identified points, we can see significant changes within the height, being that outside of this specific instant, it is non-constant and due to this, gives us different outcomes for each point. One exception to this statement is in the case that the heights are the same, which in that case shows that all of the variables are the same as the other instance we are comparing to. What I can deduct from this is that there is a gradient dependent on the height, and that this scale is used to show different states of being. Let's break this down. In the beginning of our roller coaster example, we are given a couple different parameters that we can affirm are correct, these values are the height of 75 meters, the initial velocity 0, the initial Kinetic Energy 0, the initial momentum 0, and lastly, the mass of our cart. With these values we are able to start looking around to deduce some other things as well. Right off the bat, we are able to find Mechanical Energy using Mass, Velocity, and Height showing there is a total amount of energy equal to 367500 J. In addition to this, we are also able to find PE which is equal to 367500 J What is important to note here is that these two values are the same and that is not a coincidence. What is happening here is that due to the gravity, the mass of the cart, and the height, we are able to calculate differential states of being between two points of space using our physical world, and the metaphysical constructs of mathematics. Not only that, but because we are at the specified height, we are also able to see the amount of effect gravity has on our object along our gradient scale, showing that there is a lot of potential energy to be made given the next traveled direction is pointed the same direction gravity pulls. In other words, we are at a kind of equilibrium as the full amount of energy is stored all onto one side, showing the ebb and flow of conflict within the communicative network of energy transference. As you can see the moment we change the height, the Kinetic Energy changes to that of Potential Energy, not only due to the placement, but the guided motion and movement of the trigonometric curvature we are following, guiding us along the outside of the standard deviation of the shaped supersymmetry that exists on the base level of this action. We can see what Sir Isaac Newton had been trying to show in Newton's

Cradle, as we are seeing the same exact ideology put into an applied sense showing that we are starting to fully understand the constructs of our universe and its effects on a larger scale.

2. **What happens to the total energy of the cart as it moves along the track? Why?**

The total energy of the cart as it moves along the track is conserved, and transferred through a type of encapsulated tube showing the creation of a metaphysical network that we are unable to see with our eyes. The pure fact that we are able to recreate the basic properties of graphed shapes is nothing short of amazing, as we can see this conservation and apply that to other potential ideological states of being to ask questions such as, does our own universe have the same type of total energy? On a much greater scale, do we also follow the laws of conservation? This really helps us understand why duality is so important, and how exactly it is that multiple dimensions, or multiple realities may actually be able to exist, AND phase with each other due to the very same principles expressed in this project. It is important to note that within this motion, that our energy conserved and that there is no type of exponential gradient of loss as it only turns into something different, and is able to be utilized for the totality of the problem until there is an inverse of singularity provided by collision, and in addition to this, friction.

3. **How is the principle of conservation of energy applied in this situation?**

To put it simply, the principles of conservation of energy are applied because the same amount of energy is used and converted throughout the entirety of the problem without the total loss of anything as the conservational properties of this motion are shown within the natural geometric supersymmetry it is bound to follow due to the gravitational pull of the earth in addition to the mass of the object in question.

4. **Calculate the momentum and kinetic energy of the cart before and after an inelastic collision**.

Before Collision Cart A/ After Collision Cart A / After Collision Cart B
Cart Mass 500 kg

Momentum before = 500 * 32.83 = 16415
KE 269500 J

Momentum after = 500 * 16.415 + 500 * 16.415 = 16415
KE = 269500 J

5. Describe the energy transfers that occur as a cart inelastically collides with an object of equal mass at rest.

- **What was the kinetic energy of each cart before and after the collision?**

As we can see the kinetic energy of each cart before and after the collision for cart A, had been 269500 J, and the kinetic energy for cart B had been 0. Specifically, what we are seeing within the part of the problem that says Momentum before is the omittance of cart B due to the non-factor it has on the problem at hand given it is not moving, and multiplies itself to 0. The kinetic energy after the impact due to the law of conservation shows again to be the same number of 269500 J. The difference here being that our velocities have been cut in half giving us less momentum of each cart, but the same overall Kinetic Energy.

- **What happens to the total energy of the system, now including both carts, as a result of the inelastic collision?**

The total energy of the system stays fully intact, and completely the same, the only difference is that another actor has been presented and the energy has been divided between two carts instead of just the one, meaning that when friction is met for both carts individually, it will be easier to slow them down, showing the apparent truth behind what we can considerably notice to be the beginning of our visual decrescendo within this instance. Just to clarify, we are only showing that we are able to reduce, and divide the momentum, meaning we can multiply it as well and that the ability for the kinetic energy to continue to fluctuate within different parameters still exists as the only thing that has happened is the multiplication of encapsulated instances, showing what we can possibly attest to be cytokinesis.

- **Describe how the principle of conservation of energy is applied in this situation.**

The principle of conservation of energy is incredibly important within this situation because the Kinetic Energy still remains intact, and still acts as a viable resource to draw from. This could lead to the possibility that the entirety of the action itself is encapsulated, and not just the different variables based off of set parameters. In other words, this action is one giant object-oriented program, given that there is an initial value that we can segment, change, and allow to flow through specific channels in order to create the specific outcome we are looking for.

5A. Following the inelastic collision of the carts, the two carts fuse into an object with double the mass of the original cart. There is then a frictional section of the track to slow the cart to a stop over 20 meters. Describe the amount of work due to friction and frictional force exerted to stop both carts over 20 meters.

1000kg
KE = 269500 J
W = 269500 J
D = 20 m
F = 13475 N

The amount of work done has to be equal to KE given that that is the amount of energy needed to be expressed in order for the carts to come to a stop. In addition to this if we were to delve deeper into the understanding of what exactly is happening, if you think about it in the sense of a rainbow, in the middle of said rainbow where the two arcs meet there has to be an equal amount of transferal amongst the projection of light in order to arc in such a way that there is a phantasmal emittance of energy that can be portrayed on the sky due to the multitude of elements converting within the air. In other words, the work done in the middle of the rainbow shows the equivalence to both the beginning, and the end, or it would not be shaped in such a way.

In addition to this, the frictional force done in this instance is 13475 N shown with the equation w = f * d. Knowing that the work has to be equivalent to KE creating a proportional ration between the two variables, we are able to convert from Joules, to Newtons, in addition to dividing both sides by the distance of 20 meters, showing the gradient needed to deduce the conversion. To show the ability to scale up to the past metric of Joules, we need to do nothing short of divide the total amount of Kinetic Energy by the Force, showing direct proof, as 13475 fits into 269500 20 times, meaning that over this extension of meters we can visualize a of multi-dimensional hourglass as the cone of this gradient reaches a singularity of conversion only to become more pulled out within its expression as it moves into the new encapsulation of its new found world.

1000kg
KE = 269500 J
W = 269500 J
D = 20 m
F = 13475 N

6. Calculate the work due to friction and frictional force.

1. **What is the kinetic energy of the cart system before and after it has been brought to a stop?**

The Kinetic Energy of the cart system before and after it has been brought to a stop is 269500 J, to a KE value of 0 J.

2. **What happens to the total energy of the system as a result of this change in motion?**

The total energy of the system remains the same, though it is important to note that the encapsulation around the instance has been broken, and transferred into a different system all together.

3. **Describe how the principle of conservation of energy is applied in this situation.**

The principle of conservation of energy is applied in this situation due to the fact that the total amount of energy still exists, yet the encapsulated form has again been broken into many pieces, and has now converted into different types of systems such as heat, friction, work done, and in some cases even noise. Just as when we had introduced the second cart into the equation, when we introduce different expressions of physics such as friction and work, we are creating a different type of placement. When we are boiling water, we can see this exact same idea in application, as the total amount of energy within the water does not change, yet the water is transformed into steam and we cannot look and measure that there is the same amount of water in the pot as it has been transferred to another state of being.

7. Describe the energy transfers that occur as the cart is brought to a stop.

This should be a narrative description of the energy transfers—written to describe these concepts to a nontechnical audience—that occur as the cart is brought to a stop. In your descriptions, address the following:

- **What is the kinetic energy of the cart system before and after it has been brought to a stop?**

The kinetic energy of the cart system before and after it has been brought to a stop shows that we are able to do nothing short of crack an egg, and make an omelet. Everyone knows when they are cooking that the ingredients go through a conversion process transforming into something completely different, and delicious than the ingredients that were first added originally into the recipe. We can see the same instance here with that generalization, as the only difference is that instead of kneading dough, we are kneading the kinetic energy, and getting it ready to be put into the oven, only to rise and show our work and force, or in this instance our incredibly delicious bread.

- **What happens to the total energy of the system as a result of this change in motion?**

To continue with our prior example, even though it seems as if we used a different amount of dough, and it seems crazy to believe that all of that turned into one loaf of bread, we all understand that everything put into the mix, is generally what you get out of it. Just like making cookies, we can see the cookie dough expand due to the heat from our conventional oven, we still space them out to account for the extra space we are going to need because we know of the underlying potential of the materials we are using to bake or cook with. This is a perfect example of how our total energy within this equation wholly does not change either, it simply is dispersed, and drawn out into many other parts of the processes introduced to the problem.

- **Describe how the principle of conservation of energy is applied in this situation.**

I really cannot vouch for the principle of conservation of energy here, because after we make our bread and cookies, we then eat them! But that shows the encapsulation of our power being transferred into a different system. We know that when we eat different types of things the systems inside of our body break everything down and are able to take all the different parts of the food converting them into different energies and chemicals that our body needs in order to continue living continuing along the same process with the excess energy that our body does not need which may be converted into fat, or protein dependent on whether you choose to exercise a lot, a little, or just the right amount. So, as we can see, the energy stays the same during the entire process, from the making of our food, to the eating of our food, and thereafter giving us a direct example of the process of this roller coaster, and why it is the continual energy stays the same all throughout, and even after.