Zachary Meisner

Physics 150

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1.

As we are testing the drop of a phone case without and with different types of cases, we must first understand the laws of motion acting behind the scenes of the drop.

First Law

Inertia

A body at rest remains at rest, or, if in motion, remains in motion at a constant velocity unless acted on by a net external force.

This law is important for the task as we are coming from a state of rest in our hand, and then when the phone is dropped, gravity pulls it down, in addition to wind resistance if there is any, and then finally returns to a state of rest after it hits the ground. If it were not for the first rule, when the phone hit the ground the variable impact would not matter, meaning the phone potentially could bounce up into space and never come back as there would be absolutely nothing to soften the impact of the meeting of two forces. The other possibility is that the phone may phase right through the ground, and that the concept of material space maybe not so material.

Second

Concept of a system

The acceleration of a system is directly proportional to and in the same direction as the net external force acting on the system, and inversely proportional to its mass.

The second law is important because it is speaking to a multi linear instance that scales along time, the reason this is important is to show the accumulation of energy due to many variables working together. If we were to take a closer look at this on a microscopic level, we could even see instances of the third law showing it's truth within the second law as well, that is that the shapes of each type of energy can be thought of as a gradient lattice, or many triangles tightly ingrained with one another somewhat similar to a weighted graph.

The reason this is so important is due to the understanding that without each force working together we would be lacking of a type of snowball effect that is the entire reason that anything that falls in the proper way to begin with. If the second law had been broken in any way, or for example if we did not have gravity present, it would not matter at all what something was, because everything would float in the air. This is not good because for example, blood pressure relies on gravity to an extent to help the body regulate its own systems, and if these basic systems were not working, who knows what other systems additionally would fail.

Third

Symmetry in Forces

Whenever one body exerts a force on a second body, the first body experiences a force that is equal in magnitude and opposite in direction to the force that it exerts.

Finally, the third law is one of the most important. It shows there is a type of communication between the two objects in question, helping us see, monitor, and react accordingly to what we can describe as the physical manifestation of our universe. This is what happens when the phone makes contact with the ground and what we will need to test for while the phone is under the duress and compression of the fall. In addition to that, it shows the linear constant of communication in a real way, that we can see if we zoom in on the meeting of the phone and the ground. What I mean when I say linear constant is that we are able to see that everything on our plane of existence to some extent follow the same law, even when we communicate with one another no matter what way it maybe. What we can pull from this, is that within the specifications of the parameters we are given, we can see that even humans when talking to each other follow these laws of physics, and just like wearing earplugs to protect your ears from loud noises, or armor to protect yourself in battle, phones need a way to protect themselves as well.

Fourth

Newtons Law of Universal Gravitation

Every particle in the universe attracts every other particle with a force along a line joining them. The force is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

As a special mention, I wanted to state this law. Though I am not directly using the math within the test case of dropping phones, I thought it was important to state due to the fact that it has a huge factor towards why things drop the way they do, why they fall at the same rate of time and draws the whole three prior rules together that make sense of a seemingly, possibly confusing relation to objects, and the earth. If we were to imagine two groups of kids at school playing a game of tug of war we could say group A, has 10 children, and group B, has 5. It would seem quite obvious that the group with 10 children would win over the group of 5, but what we are seeing here has similarities to the law of universal gravitation, the similarity being that although one object is bigger than the other, they are both connected from their points of center, and for a short time being pulled towards one another. This tether also acts as a line, or a pathway that helps the objects towards one another, based off of which gravitational pull is greater than the other until there either is something blocking the way, or even in the case other agents of gravity are acting against the path, such as friction in the air creating resistance during a fall, deviating the outcome. In other words, this is one of the most important laws because it shows us that there is the basis of a structure that is created in which all other rules follow, if you were to think of this rule as the house, and the prior three as features of the house, it is much easier to understand.

2, 3, 4.

No Case

Gravity = 9.80 m/s^2

Mass = 0.175767 kg

Height = 1 m

Velocity before impact = 4.42718 m/s

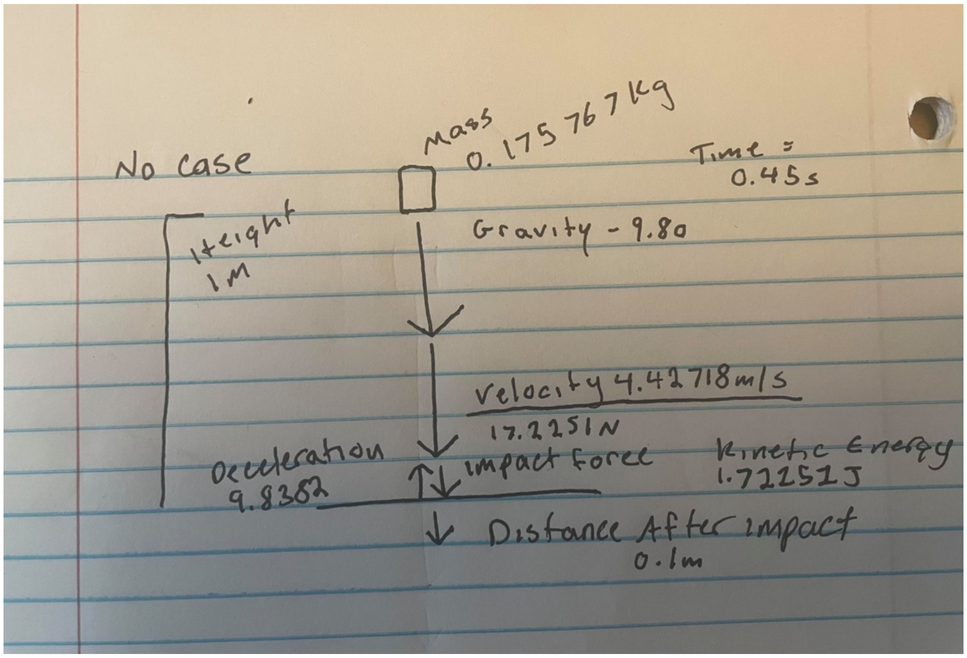
Kinetic Energy = 1.72251 J

Distance Traveled after impact = 0.1 m

Average Impact Force = 17.2251 N

Deceleration at Impact = 9.8382

Time = 0.45 s



Silicone Case

Gravity = 9.80 m/s^2

Mass = 0.206952 kg

Height = 1 m

Velocity before impact = 4.42718 m/s

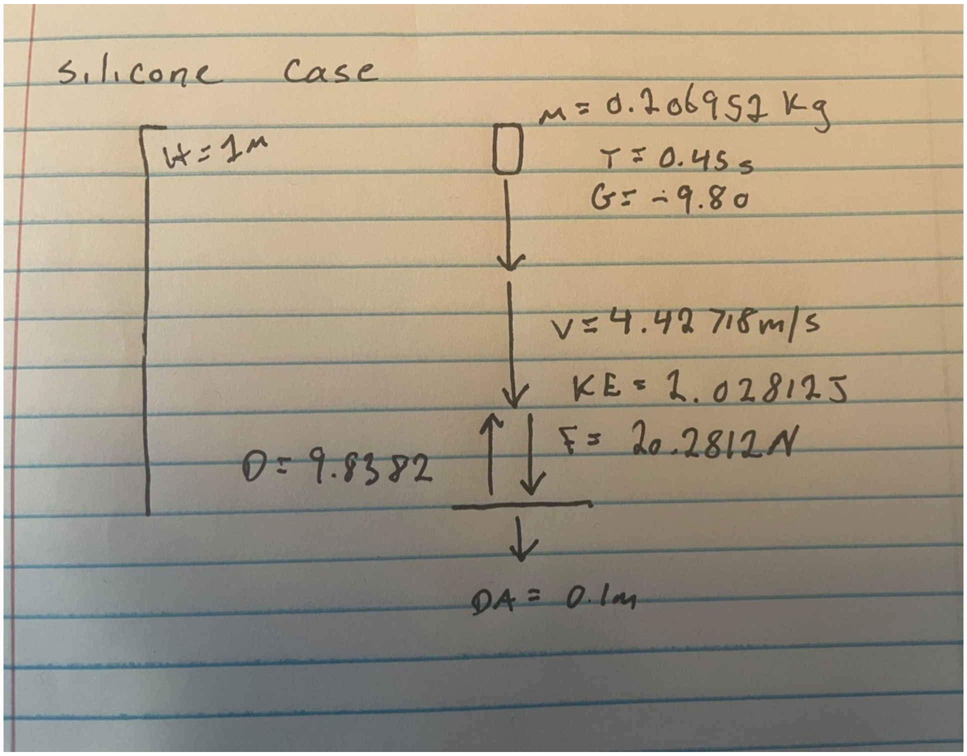
Kinetic Energy = 2.02812 J

Distance Traveled after impact = 0.1 m

Average Impact Force = 20.2812 N

Deceleration at Impact = 9.8382

Time = 0.45 s



Hard Plastic Case

Gravity = 9.80 m/s^2

Mass = 0.223961 kg

Height = 1 m

Velocity before impact = 4.42718 m/s

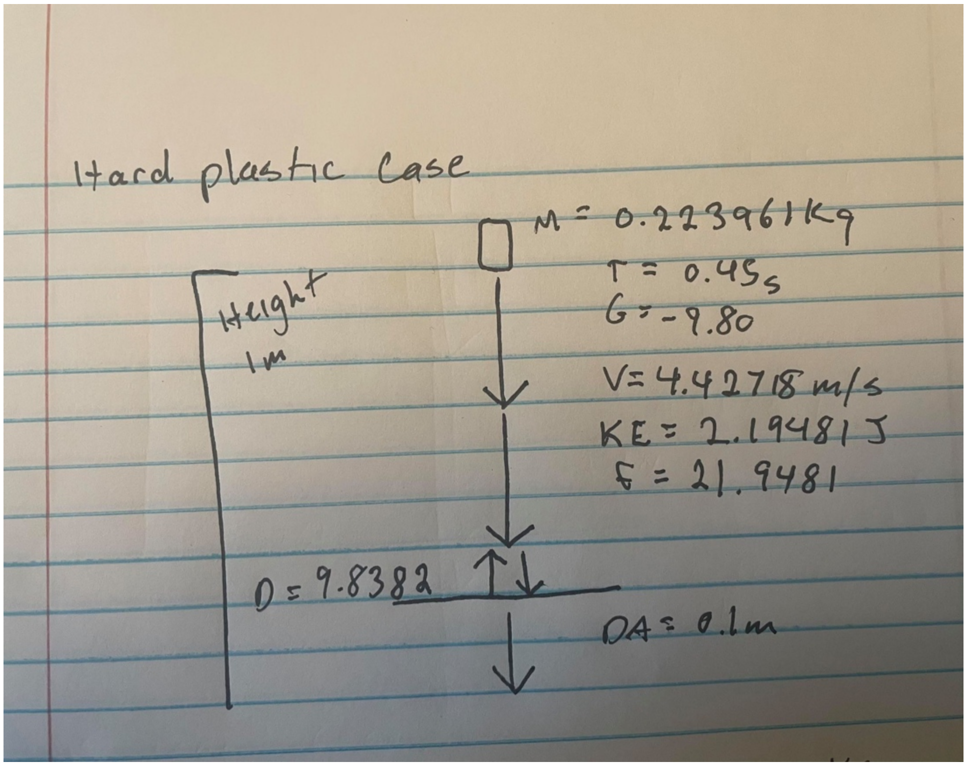
Kinetic Energy = 2.19481 J

Distance Traveled after impact = 0.1 m

Average Impact Force = 21.9481 N

Deceleration at Impact = 9.8382

Time = 0.45 s



Rubber Case

Gravity = 9.80 m/s^2

Mass = 0.266486 kg

Height = 1 m

Velocity before impact = 4.42718 m/s

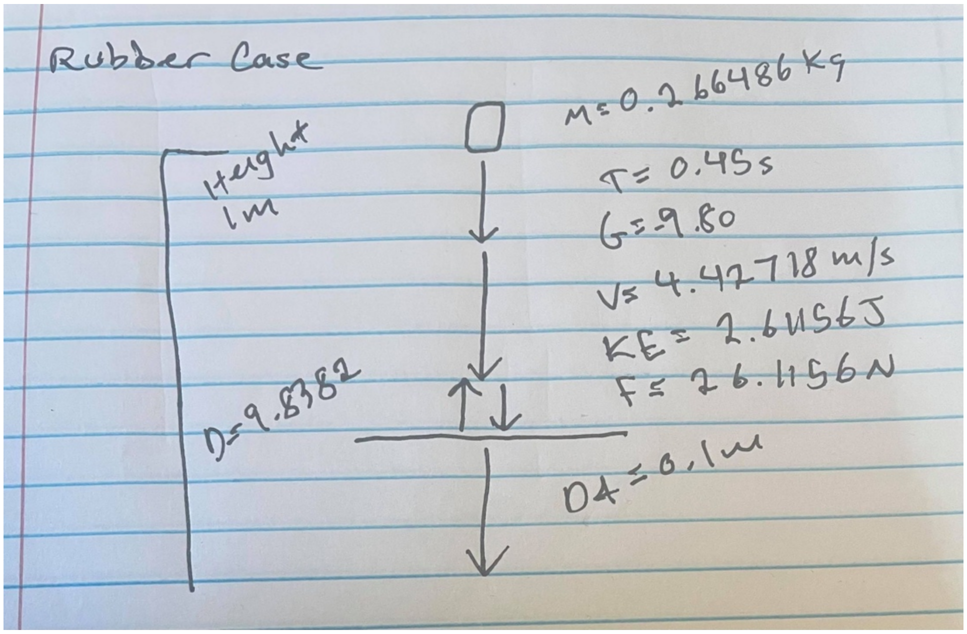
Kinetic Energy = 2.61156 J

Distance Traveled after impact = 0.1 m

Average Impact Force = 26.1156 N

Deceleration at Impact = 9.8382

Time = 0.45 s



5.

When it comes to force equations that are modeling the specific scenario, the three that we need to stress the most are Velocity before impact, Acceleration, and Force. The reason these are so important are due to the actuality of what is happening amongst the action of dropping the phone, and the interactions it has with the ground in addition to the systems at play.

To start with Velocity, the contribution is incredibly important, mostly due to the need for a constant amongst the system in order for us to logically deduce what the other answers are. Without a constant, we would not have a basis of truth as it describes the area surrounding the project, and shows us the differences between different enviornments and what changes them. Impact Velocity is calculated by taking the square root of 2 * 9.80(gravity) * height and as you can see, we have the basic constant of the area, in addition to a variable to help us the exponentiality of velocity and its growth.

Secondly, Acceleration is just as important because it dictates our deceleration at impact. To calculate Acceleration, we subtract final velocity from starting velocity, and divide the sum by elapsed time. Deceleration at impact is important because when an object that is accelerating impacts something, the transferral of this force has to distribute in some way and convert into something alternative. Acceleration converts into deceleration as it acts as the inverse which shows the connection between properties that otherwise may have no connection with one another, and shows a real life example of what we could consider to be data pipelines on a computer, or even explain how computers communicate with one another, and even explain the basis of our systems when commuting to and from work.

Lastly, Force is the communication from A to B, or the dispersal of energy we have just talked about from the conversion. We are able to take the acceleration, and multiply it by the mass of the item in order to get the force, which shows that we have scalar abilities due to the existence of velocity, and time. Like I said previously, we have a conversion ratio here that serves a purpose, this helps the systems at play balance out, making it able for a multitude of physical properties come into play with one another, helping us really draw out and grow our universe giving us the room, and ability to mimic, and grow from the basis of those conversion properties. In other words, I am saying nothing more complicated than the fact that we ourselves at the basis of our existence are just perpetuations of what may have come before, due to a large scale spectrum of communication as we can see here in these present examples.

6.

Using Data from my analysis, the best material for a cell phone case between the three options we are given has to be the silicone case. As it has the least amount of force on impact. The issue with this though is that there are many other factors to take into consideration other than just the force of impact. For example, I believe that a huge factor to this would be wether or not the material would be able to hold the force of impact, and transfer it with the least amount of contact to the phone using the case as the material to transfer instead of the phone itself, so it was less likely to break. For example, in the case the silicone was brittle, and could not hold up and maintain its structure at impact, the case may shatter. On the other hand, the rubber case may bounce, making it less likely for your phone to break in the case that it did not bounce additionally hitting the floor, or flying out the window.