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Question 11: Is not inertia the reason for objects same rate-of-fall?

Greetings Ethan:

Interesting site you have here. After reading the first article about inertia, I have uncovered a problem. I learned in school some time ago that different sized objects fall at the same rate for the following reason: a more massive object has more inertia that needs to be overcome so its greater weight is no more effective in causing acceleration than is the lesser weight of a less massive object with its lesser inertia. The problem is that now that I understand that inertia is a reaction force incapable of causing any event involving acceleration, I am left unsure as to the reason why objects fall at the same rate here on earth. Do you know the answer? J. T, Dallas, Texas.

Thanks for the question, J.T.:

One often reads of how inertia needs to be overcome before acceleration can commence. Now that we recognize the truth as presented in Article I, that inertia is an early and imperfect recognition of the acceleration/Reaction force, one may wonder exactly what is meant by this "overcoming" prediction. I wonder if there is some experiment that shows that a weak action force can be applied to the exterior of a weightless object in a vacuum with this force being insufficient to "overcome" the object's inertia resulting in no acceleration for the object. Logically this must be the case if only a stronger force is successful in "overcoming" the object's Newtonian version of inertia. Anything less than this stronger force should certainly be unable to cause acceleration for the object if there is any validity to this "overcoming" prediction.

I propose an experiment inside the enclosed cargo bay of the orbiting Space Shuttle. The test object is a massive cast iron blacksmith's anvil which is relatively easy to position in front of an astronaut since the anvil is weightless. Being weightless means that the anvil is not freely bearing with any force against any other object. Once the anvil, with its large Newtonian version of inertia or whatever that is thought to be in need of "overcoming", is in position before the astronaut, I will direct the astronaut to very gently push on the anvil with the tip of a bird's wing feather. Surely this miniscule Type 3 external (contact) stacking force from the feather's slightly-bent tip will be of a magnitude that is insufficient to "overcome" the massive cast iron anvil's Newtonian inertia. From my perspective, if the "overcoming" prediction is correct then no observable acceleration will occur to the weightless but massive anvil due to the steady but light push from the feather's tip.

Do you think this physical experiment will prove that the anvil will remain motionless in front of the astronaut while being pushed ever-so-gently by the feather? No? You are exactly right. Even the slightest force from the feather's tip will immediately begin causing slight acceleration for the cast iron anvil in full accord with Newton's grand formula acceleration = Force / mass. Here is proof that nothing is present within the anvil's matter that is attempting to prevent, or successful in preventing, acceleration from occurring up to the point where some imagined threshold of inertia force is exceeded or "overcome". Instead the slight force from the feather's tip reveals the truth of this event, that the "overcoming" prediction has no basis in reality making it every bit as unreal and Newton's forceless version of inertia.

While you may think that I have gotten lost in answering your question, J.T., I want you to know that you have already been presented with the answer as to why different objects on Earth fall at the same rate. It is not as complicated as one might think. But rather than point out the answer just yet, I want to discuss the reasoning behind the answer.

I propose an experiment on Earth where different objects will experience horizontal acceleration at the rate of 32 feet/sec/sec. The forces of air friction can be eliminated if the test object is accelerated on a rail-mounted cart with the object enclosed under the cart's plastic canopy. Each object tested will be spherical or ball-shaped and free to roll up to and bear against the rear bulkhead during the cart's forward-directed acceleration. A compression spring scale that is attached to this rear bulkhead will measure the forward-directed acceleration/Action force applied through the scale to the test object as well as the test object's rearward-directed acceleration/Reaction force of weight that it will freely and reactively bear back against the scale.

Sphere 1 will be composed of lead with a mass attribute of 1 lb.m. A weighing of Sphere 1 at the test site will indicate a weight of 1 lb.f. At this point we know that if suddenly left unsupported, Sphere 1's 1 lb non-acceleration/Action force of Earth gravitational weight will immediately become a 1 lb acceleration/Action force as it begins causing downward-directed acceleration for Sphere 1 at the rate of 32 ft/s/s. Accordingly, it is easy to predict that when being accelerated horizontally in the rail-mounted cart, if the onboard scale indicates that an exact 1 lb acceleration/Action force is being applied in the forward direction against the back of Sphere 1, then Sphere 1, along with the cart, is accelerating horizontally at the rate of 32 ft/s/s.

So far, it may seem that all I am doing is pointing out the obvious. If Newton's formula is applied to this event the U.S. lb.force units need to be converted to U.S. absolute Poundal force units at the ratio of 1 lb.f = 32 Poundal. Thus acceleration = Force / mass becomes acceleration = 32 P / 1 lb.m resulting in acceleration = 32 ft/s/s.

Now if Sphere 1 is replaced in the cart by Sphere 2 made of aluminum with its double mass rating of 2 lb.m, in order to achieve the same 32 ft/s/s rate of acceleration, the acceleration/Action force impressed against Sphere 2 will have to be doubled to 2 lb.f. Then Newton's formula, acceleration = Force / mass, will become acceleration = 64 P / 2 lb.m yielding the same acceleration rate of 32 ft/s/s. These two events are a restatement of Newton's LAW II where if the mass attribute of Sphere 2 is double that of Sphere 1 then it will require double the acceleration/Action force to cause Sphere 2 to accelerate at the same rate as Sphere 1.

So you see, if we artificially adjust the cart's acceleration/Action force so that this a/A force always remains proportional to the test object's mass attribute (at the ratio in Poundal / lb.m of 32 / 1), then the same rate of acceleration will occur to each object tested. Thus a 10 lb acceleration/Action force applied to a 10 lb.m object will cause an acceleration rate of 32 ft/s/s. Likewise, if a 160 lb a/A force is applied to a 160 lb.m object, the same 32 ft/s/s rate of acceleration will be the result. Here then it is no mystery as to why in each case the resulting acceleration rate remains a constant 32 ft/s/s. All that is needed for acceleration to remain constant is for the Force / mass ratio of each test event to remain constant.

Now I am ready to turn our attention from horizontal acceleration to vertical acceleration being caused by each test object's internally generated force of Earth gravitation. We already know that each object at Earth's surface falls initially at the same rate of 32 ft/s/s. From the above test we also know that in order for the acceleration rate of each object to remain at a constant 32 ft/s/s, the proportionality or ratio between the acceleration/Action force and the object's mass attribute must also remain constant. For example, if a 1 lb.m object loses its support at Earth's sea level, a 1 lb or 32 Poundal a/A force is required to be impressed against or within the object's matter to cause the object to accelerate toward Earth's center of mass at the initial rate of 32 ft/s/s. Since we know the 1 lb.m test object will freely bear against a scale with the 1 lb.f of its weight prior to losing the support of the scale, and further since we know that a 1 lb.f converts to an absolute 32 Poundal of force, we may conclude that the correct 32 / 1 ratio in Poundal / mass exists resulting in the 32 ft/s/s rate of acceleration just as predicted by Newton's formula, a = F / m.

If we double the mass of the test object to 2 lb.m, a measure of its weight will indicate a 2 lb.f or 64 P. Again 64 P / 2 lb.m yields the same proportion or ratio of 32 / 1. Again upon losing its support this second test object will initially accelerate toward Earth's center of mass at the same 32 ft/s/s rate as the first test object.

Conclusion

Given the same location on Earth, upon suddenly losing its support, each solid object tested will initially begin falling at the same 32 ft/s/s rate of acceleration simply due to the experimentally provable fact that the acceleration/Action force of Earth gravitation being generated within the matter of each object always remains proportional to the object's quantity of matter (mass) at the ratio in Poundal / lb.m of 32 / 1. Just as when we artificially adjusted the a/A force during the horizontal acceleration events in order to keep the 32 / 1 force-to-mass ratio constant, each test object's acceleration/Action force of Earth gravitation is automatically and naturally adjusted according to the quantity of each object's matter (mass) thereby keeping the force to mass ratio constant at 32 / 1.

Thus the clue I gave to you early on in this answer was simply the statement of Newton's formula, acceleration = Force / mass. This formula points the way to Newton's LAW II and the simple reason why all solid objects at a given location on Earth initially begin falling at the same rate of acceleration.

Your friend in understanding the nature of Physics,

Ethan Skyler
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P.S. Note that, as always, there is no role for Newton's imaginary "inertia" to fill. Objects always fall at the same rate due to the simple fact that the gravitational force that is causing their acceleration always remains proportional in magnitude to the quantity of the object's matter at the ratio in Poundal / lb.m of 32 / 1.