Ap physics c coffee filter lab answers

by Josh Humpherys, Matt Hatch, Alex Merder and Gwen Keller The goal of this lab is to find the value of n for falling coffee filters and compare it with the accepted value, n=2. Also determine the value of b, the drag coefficient. We find two theoretical values. The first is n, the exponent to which the speed in the formula for force is increased due to the drag. We also find b, the air resistance coefficient, which is different for each object, depending on its shape. We found n 2.3. We found that b was 2.26 kg/s. Materials: 6 Coffee Filters A stopwatch A high chair A pen and paper to record data We started with a coffee filter. We held the coffee filter to the ceiling (3m above the floor) and dropped it and sat down the case. We have carried out three tests. We then repeated the process with 2 coffee filters, 3, 4, 5 and 6. Here is a video: Here is the theoretical analysis from the equations from the air resistance: Here is our table of calculations for the final speed of a coffee filter. Here is our table of calculations for the final speed of a coffee filter: Here is our hand-drawn terminal speed vs mass diagram: Here is our hand-drawn ln(Vf) versus ln(m) chart: Here is our excel-drawn ln(Vf) versus ln(m) graph: The slope of the tangent line is 1/ n. The y-intercept is the drag coefficient. It is where ln(m) = 0, so m = 1kg. Answers to 18 and 19 18. Our predictions were the same as the actual ones, as the LabQuest showed a constant speed for the time the filter fell. The acceleration would be zero for most of the chart, 19. Yes, the average is that because the straight part chart is the only part of the chart that shows data for the falling filter, and vi is equal to vf and all values in between. This is our labquest and motion sensor diagram for the technological application of our laboratory. This chart is our best result because it does not record the average speed. It records the current speed. We found n 2.3 and b 2.23 kg/s.Mr. Evers said that we don't have to make any mistakes. We don't know if the real value is displayed in the error area because we didn't calculate an error range, but n = 2 and 2.3 is close to 2, so we probably did the lab right. We came across the mistake of not dropping the coffee filter at exactly the right time. We could fix this by creating a discard mechanism. We also have times that are not entirely accurate. We could fix this by connecting the timer to the drop mechanism. There is also wind. We could do it in one place Wind setzen. Kelsey LachanceRoss Hamilton Stephen JonesPurpose:To find the value of n for falling coffee filters and compare to the accepted value, n = 2. Bestimmen Sie auch den Wert von b, den Ziehkoeffizienten. Fdrag = = 2 Upgraded Epic Rulers of Distance - Downgraded Electric Timer of Time— Wondrous Lab Quest of User Friendliness — Detector of Motion Ver.3.14 — 5 »+1 Epic Filters for Coffee»Process of Data Collection:Drop a »+1 Epic Filter for Coffee» from about 2.5m and time of his descent. Repeat this process with additive numbers of +1 epic filters for coffee (1 to 5 »+1 epic filters for coffee»). Then create a drop (the scientist's discretion) with the Detector of Motion Ver.3.14 under the drop to track the speed of the +1 epic filters(s) for coffee. Theoretical analysis:1. FNET = m • g - b • vn2. dv/dt = a = 0FNET = m • a = 0 = m • g - b • vnm • g = b • vn3. ln(m • g) = ln(b • vn)ln(g) + ln(m) = ln(b) = ln(vn)ln(v) = 1/n • ln(m) + [1/n • ln(g/b)]4a. y = ln(v) b. x = ln(m) c.m = 1/n d.b = 1/n • ln(g/b)Data acquisition:time to 2.47 m mass (kg) Attempt 1(s) Attempt 2(s)Attempt 3(s) Average(s) .0008 2.13 2.24 2.192.1 9 .00171.37 1.38 1.40 1.38 .0026 1.181.16 1.2 1.18 .0035 1.141.13 1.14 1.14 .0044 1.071.05 1.03 1.05 Error: ±0.0001 kg & ±0.1 sData analysis: mass (kg).0008 .0017 .0026 .0035 .0044 Distance (m)2.47 2.47 2.47 2.47 2.47.47 time (s)2.11 1.38 1.18 1.14 1.05 Terminal Velocity (m/s)1.17 1.79 2.09 2.17 2.35 View: Fdrag = b • vnThe slope of the natural terminal speed protocol by Natural Log of Mass Graph is the same : n-1The y-interception of the natural terminal speed log by Natural Log of Mass graph is the same: ln(b) - ln(g)Analysis questions:14. The drag is very low with balls, first of all (Bernoulli principle), and they have a higher mass that influences the force of pulling on them.15. It increases at increased speed until the object reaches the final speed. 16. Best with Newtonian model: n ≈ 2.42 —> closer to d than a. 17. Fd = B • a • v2 • CDA = π • r2.005(9.8)=.5(1.23)(π)(.1)2(2.42)2 • CDCD ≈ 0.4318. Our predictions were similar to actual results; Acceleration is near zero for most of the chart. 19. Yes, the straight part of the graph is the part that shows the data for the falling +1 epic filters for coffee and in this interval vi = vf. Technological application: The Wondrous Lab Quest of User Friendliness used the Detector of Motion Ver.3.14 to track the current speed of the +1 Epic Filter for Coffee. No averages were taken. Application at AP-C[omplete]:20. Fd = Fg = m • gm • g = C • vTMass of the filter stack, m (kg•10-3) 1.122.04 2.96 4.18 5.10 Terminal speed, vT (m/s)0.51 0.62 0.82 0.92 1.06 Terminal Speedsquared, vT (m2/s2) 0.26 0.38 0.67 0.85 1.12 21. g/C = slope = ΔvT2/Δm = 3.375•102 g/slope = C9.8/3.375•102 = 0.02922. Y = the area below the from t = 0 to t = T or ∫v(t) conclusion:We found that n is about 2.42 and b about 5.51 kg/s. The error area was out of date, so the correct value of g is not taken into account (although it is from The Picket Fence Lab 2.0). We didn't use the +2 Plastic Fence of Pickets, so we had no changes in acceleration (again... Evers copied the conclusion from Picket Fence Lab 2.0 with great dexterity, so we couldn't take this into account. Changes in air circulation could cause the +1 epic filters for coffee to fall at different speeds; also small elevation changes and errors in data collection (i.e. human error, HAL 9000 error, et cetera). You could isolate the attempts and have mechanisms for storing and recording the data (oh and making the most reliable computer that is foolproof and incapacitated). But what is final speed? I will answer this by considering a falling coffee filter. Suppose I drop it from a certain height. Immediately after release, the coffee filter does not move. Since it has a zero speed, the traction force is also zero. The only force on the filter is the gravitational force (i.e. the mass multiplied by the gravitational field g), so that it accelerates downwards with an acceleration of -9.8 m2 (like any other falling object). However, as the filter accelerates, it increases the speed. An increase in speed means that there is now a tensile force that pushes upwards (as it moves downwards). Now that there are two forces on the filter, the total force is smaller vertically than when you first released it. With a smaller force, it will have a smaller acceleration – but it will still accelerate. Finally, its velocity reaches a point where the drag force is the same as the gravitational force. At the same magnitude forces, the net force is zero. This means that the acceleration is also zero m/s2. At this point, the filter no longer accelerates and this is called the final speed. The terminal speed is very useful as it can be used to find the drawing coefficients. So at terminal speed, I can write the following expression. Note that since the drag force is proportional to the squared velocity, I will only combine all the other constants into a constant that I will write, since K.I can use this relationship to get some data. Here's what I'm going to do. I will drop a coffee filter and find its final speed. Then I stack two coffee filters and drop them. two filters, the mass and thus the final speed will be higher. If I repeat this, I can use mass and terminal velocity data for a chart that then gives me the drag coefficient. Experimental measurementHow exactly do I get the final speed for a falling coffee filter? There are several methods that would probably work, but in this case I will use a motion detector. This device sends sound pulse and measures the time until this pulse reflects an object and returns to the detector. It is a fairly useful device for measuring movements in a dimension. In this case, I can simply place the detector on the floor (facing upwards) and then drop a coffee filter on it. Here's the data I get. Note that the filter initially accelerates, but towards the end of its movement by 2.5 to 3.0 seconds it seems to move at a constant speed. By adjusting a linear function to this part of the data, I can get the speed of the filter – that would be the final speed. For this particular run you can see the slope is 1,730 m/s. Now I just have to repeat the same drop several times (I've done it five times) so I can get an average final speed. But I want to be a linear function (because linear functions are easier to handle). When I make a graph of mass vs. speed, it shouldn't be linear – but mass vs. velocity would be square. Here is this chart. The error bars in the chart are the standard deviation of the five passes. Besides, I'm not sure why – but that works much better in the end if I get the fit to go through the origin (rather than leave it a y-interception). The slope of this linear function is not the drag coefficient. However, we can find it from the piste. Since this is a diagram of the final velocity in square vs. mass, I could use this relationship like: