On the Descent of Cotton Balls: a Theoretical Perspective

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ABSTRACT

Cotton balls fall more slowly than rocks in most situations. We present an extension to the traditional Newtonian view of objects to include free-falling cotton balls.

Cotton balls (which are sometimes made of Rayon) are puffs of fluff, roughly spherical, with a diameter of about 3 cm and a mass between 0.5g and 1.0g. If you drop them, they fall.

It has been observed, however (Galileo and Snerd, 1998) that if you drop a rock and a cotton ball simultaneously from the top of a tower, the rock hits first.

Evidently air resistance slows the cotton ball more than the rock. We suggest that its effect is greater because the cotton ball is lighter.

Our reasoning is this: Each air molecule, on impact, imparts a small force to a falling object. Using the traditional force formula $F = ma$ (Newton, 1687), we see that each collision effectively reduces the gravitational acceleration of any object falling through air by an amount that is inversely proportional to that object's mass (i.e., $a = F/m$). Thus the light cotton ball is slowed more than a comparably-sized (and heavier) rock.

Therefore we should modify the formula for the distance s fallen in time t. Instead of the traditional

$$s = \frac{1}{2}gt^2 \qquad \text{(EQ 1)}$$

Where g is the acceleration of gravity, we suggest that the correct model for falling cotton balls is

$$s = \frac{1}{2}kt^2 \qquad \text{(EQ 2)}$$

where k is an acceleration smaller than g.

Though the truth of our theory seems self-evident, we await confirmation from experiment.