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PHY 201

Effects of object shape on decent through a fluid

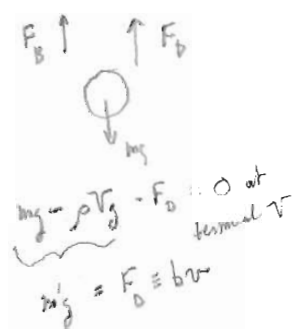
Objective: Observe the motion of an object through a fluid and changes that occur when the shape is changed.

Methods: A small clay ball weighted wtih a steel ball was dropped in to mineral oil and recorded with a digital camera. The clay was then molded to a cone shape and dropped again, point down and recorded as before. In the final trial the cone shape was impressed with grooves lengthwise. The video of each trial was digitized so that the velocity and acceleration of each trial could easily be analyzed for trends.

Results: The resistive force of the fluid was determined based on the observed terminal velocities. All object reached their terminal velocity at 0.2 seconds.

V_T sphere = 0.125 m/s
V_T cone = 0.151 m/s
V_T grooved cone = 0.178 m/s

estimate of uncertainty??



From these terminal velocities the fluid resistive constant (b) was determined.

$V_T = mg / b$

a drag force ~ v is for, generally, fast stiff. For slow viscous situations, v^2 is a better model

$b = mg / (V_T)$

Sphere: $b = 9.94g(9.8\ m/s^2) / (0.125\ m/s) = 779\ g/s$

Cone: $b = 9.88g(9.8\ m/s^2) / (0.151\ m/s) = 641\ g/s$

Grooved cone: $b = 9.94g(9.8\ m/s^2) / (0.178\ m/s) = 826\ g/s$

ave b = 749 g/s

The resistive force acting on each obect was calculated based on terminal velocity. At that point the resistive force acting on the ball equals the downward gravitational force.

$R = mg$

sphere: $R=.00994kg\ (9.8m/s^2) = .0974\ N$

cone: $R= .00988kg(9.8m/s^2) = .0968\ N$

grooved cone: $R = .00994kg(9.8m/s^2) = .0974\ N$

Average $R = .0972\ N$

Discussion: I would have expect the calcuted resistence coefficients to closer to the same value based on the similar masses of the objects. The variance in the calculated resistance coefficient could be due to inaccuracies in the observed terminal velocity. The shapes of the objects may also be factor on the force of the mineral oil acting on them. The cone shape would have reduced the cross sectional area and thus the drag affect on the object. Further experiments would need to be conducted using several more shapes and maintaining a constant mass to achieve more conclusive results.