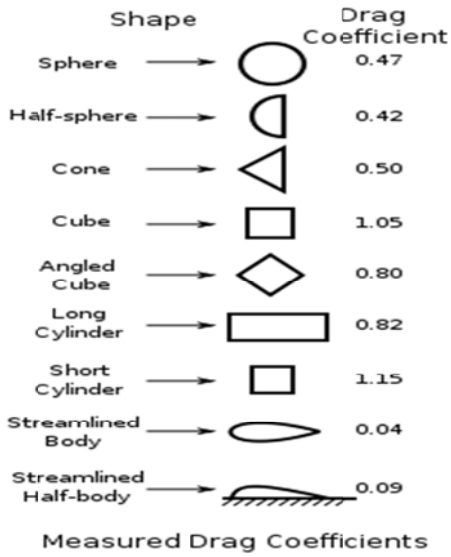
Name:_____ Date:_____

Mr. Croom's Physics Chapter 4: Force and the Law of Motion

Air Resistance and Terminal Velocity

Temperature T in °C	*Density of air ρ in kg/m³*
−25	1.423
−20	1.395
−15	1.368
−10	1.342
−5	1.317
0	1.292
+5	1.269
+10	1.247
+15	1.225
+20	1.204
+25	1.184
+30	1.164
+35	1.146



Measured Drag Coefficients

$$V_t = \sqrt{\frac{2mg}{\rho A C_d}} \qquad F_d = \frac{1}{2}\rho v^2 C_d A$$

Answer the Following Questions.

1. If 70 cm by 70 cm by 70 cm cube with a mass of 15kg was dropped from the top of a 20 m height building. It falls with 1 face down. How much Air resistance does it have on it when it is moving 2m/s if it is dropping with one of its faces pointed towards the ground? The current air Temperature is 15° C.

2. What is the acceleration of the box in problem 1 at 2 m/s based on the air resistance?

3. What is the terminal velocity of the block in problem 1?

4. Does the block in problem 1 have the chance to reach its terminal velocity before it hits the ground?

5. A baseball has a diameter of 7.4 cm and a mass of 145 g. What is its terminal velocity? The temperature is 25° C

6. If the minute a baseball is released air friction takes over. Based on the fact the world record pitch had an average velocity of 46m/s, what does this say about the velocity the ball as it left the pitchers hand?

7. What is the force of air friction on a 46m/s fastball?

8. A 1x2x3 m steal beam is dropped by a crane 30 m from the top of a building. steal has a density of 7.85 g/cm^3. What is the air resistance on the beam if it falls with the 2x3 face down? What if it falls with the 1x2 face down? Assume in each problem, that at the point looked at v=20m/s. The air temperature is 20° C Also assume the beam is a long cylinder.

9. What are the terminal velocities in each case above?

10. Now lets assume we have a feather of a "BIG" bird. The feather has the same data as problem 8, but the density of the feather 2.5×10^{-3} g/cm^3. What is the terminal velocity?

11. What is the force of air resistance for the feather is problem 10 if it is dropped with the 2x3 face down? What if it falls with the 1x2 face down?

12. A person drops the cube in #1, but now it is angled. What is the force of air friction at 2m/s? What is the terminal velocity?