Off-the-Wall question #7: Out your back door you have a back porch and three steps down to ground level. One day, you find a spider wondering around on a wall in your home. You captured the spider in a drinking glass, take it to the back porch and give it a toss. Oddly, it isn't moving very fast when it hits the ground (whereas you would be moving quite fast if you jumped off the stoop). Explain fully why this is the case.

--according to Newton's Second Law, the net force acting on a body in a particular direction is proportional to the acceleration of the object in that direction;

--the forces acting on the falling spider in the y-direction are gravity downward and a drag force due to air friction upward;

--the drag force is a function of velocity as it is produced by air hitting the spider—the more air that hits per unit time (i.e., the faster the spider is moving), the greater the force;

--when the body gets moving fast enough for the drag force and gravity to be the same, the net force becomes zero, the acceleration goes to zero and the velocity becomes constant (it is, additionally, called the terminal velocity);

--because the spider weighs is small, its gravitational force is small and it hits terminal velocity relatively soon after being thrown (which means its terminal velocity is small).

--this small terminal velocity is the velocity the spider lands with.

THE MORAL OF THE STORY: Use the ABCD's:

Answer the blinking question;
Basic physics that is always true—allude to it!
Connect the basic physics to the problem;
Discuss, answering the question!!! (in the old days, this used to stand for "Diagrams—use them," but for this AP test, that won't be appropriate.