Because the magnitude of the viscous drag force increases rapidly for large speeds, two bodies of similar size and shape falling through the earth's atmosphere will reach a terminal speed which is

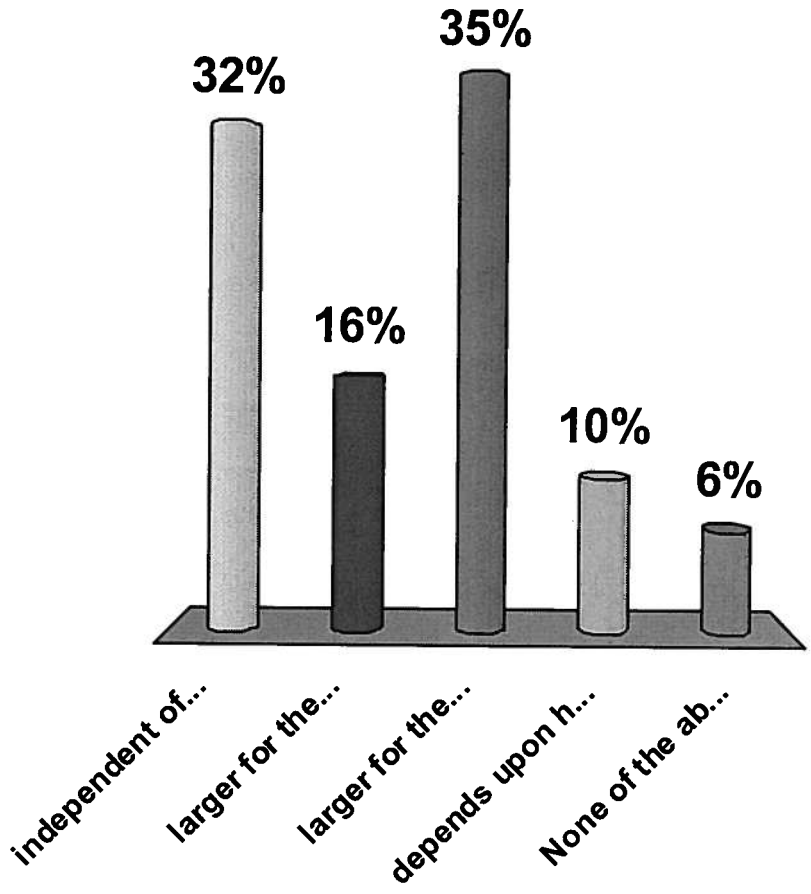
a) independent of their masses;

b) larger for the object of smaller mass;

✓ c) larger for the object of larger mass;

d) depends upon how long the objects have fallen.

e) None of the above is true.



The correct answer is c): The terminal speed is greater for the heavier object; as follows,

- Taking the drag force to be proportional to some power, p (e.g., p =2 or p = 3), of the velocity, the net force on the object is:

  $\mathbf{F_{NET}} = \mathbf{F_{Grav}} + \mathbf{F_{Drag}} = M\mathbf{a}$

  $= -M\mathbf{g} + c_D\mathbf{v}^p$.

  When this force equals zero, the acceleration, **a**, becomes zero and the velocity, **v**, becomes constant, equal to the terminal velocity, $\mathbf{v}_T$. Thus,

  $\mathbf{v}_T^p = (Mg/c_D)$,

  so that $\mathbf{v}_T$ increases with M, and c) is correct.