

PHY 113 – Peer Instruction 1)

This question concerns an analysis of the force of air resistance. As an object moves through the air with a velocity \mathbf{v} , the air surrounding the object supplies a resistive force which experimentally is found to have the form

$$\mathbf{F} = -b\mathbf{v}. \quad (1)$$

Therefore, Newton's second law, describing the vertical motion of an object of mass m near the surface of the Earth takes the form:

$$ma_y \equiv m \frac{dv_y}{dt} = -mg - bv_y, \quad (2)$$

where b is a constant that depends on the properties of the air and of the bubble. Suppose you sent a soap bubble upward with an initial velocity v_{yi} , which of the following statements most closely describe the subsequent motion of the soap bubble:

- (a) The bubble will have a trajectory as a function of time of the form

$$y(t) = v_{yi}t - \frac{1}{2}gt^2. \quad (3)$$

- (b) The bubble will continue to move upward until it reaches a constant speed.
- (c) The bubble will continue to move upward until it reaches a maximum height and then start to move downward, eventually reaching a constant speed. The constant speed depends upon the value of v_{yi} and the constant b .
- (d) The bubble will continue to move upward until it reaches a maximum height and then start to move downward, eventually reaching a constant speed. The constant speed depends upon the value of the constant b , but not on the value of v_{yi} .