Name: _____

Class: _____

Due Date: _____

Physics Topic 12 - Vertical Motion in One Dimension with Air Resistance

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. C: True or false:

   a. According to Newton's second law of motion $\sum \vec{F}$ and $\vec{a}$ will always point in the same direction. In other words, the net force must be in the same direction as the acceleration of the object.

   b. According to Newton's second law of motion $\sum \vec{F}$ and $\vec{v}$ will always point in the same direction. In other words, the net force must in the same direction as the motion of the object.

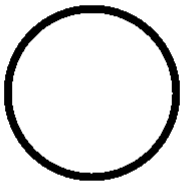
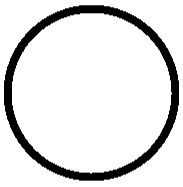
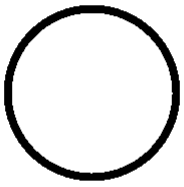
   c. According to Newton's second law of motion the $\vec{v}$ and $\vec{a}$ of an object will always point in the same direction.

2. C: Give an example of an object when its net force (or acceleration) and velocity point in opposite directions.

3. C: What is the meaning of *static equilibrium*? What is the meaning of *translational/dynamic equilibrium*?

4. C: **Use a pencil and ruler!** Define *free fall*. Draw a *displacement vs. time* graph, a *distance vs. time* graph, a *velocity vs. time* graph, a *speed vs. time* graph, and an *acceleration vs. time* graph for an object dropped from rest in free fall.

5. C: An object is thrown upwards in the presence of air resistance. Draw a free body diagram of the object when it is moving upward, at its peak, and moving downward.

Moving upwards	At the top	Moving downwards
		

6. C: **Use a pencil and ruler!** Define *terminal velocity*. What is the relationship between speed and the force of friction? Draw a *distance vs. time* graph, a *speed vs. time* graph, and an *acceleration vs. time* graph of an object being dropped from rest from a very high height above the surface of the Earth with both the force of friction and the force of gravity acting on it.

7. A parachutist jumps off a plane from a great height. After reaching terminal speed the parachutist opens his parachute. The parachutist obtains terminal speed for a second time and finally hits the ground. Draw a *speed vs. time* graph of the parachutist.

8. A 13.0 kg object falls in the air. Calculate the magnitude of the air resistance on the object when its acceleration is $4.00\ \frac{\mathrm{m}}{\mathrm{s}^2}$.

9. A 3.00 kg object falls from rest in the presence of air friction F_r. Determine its terminal speed if $F_\mathrm{r} = kv$ where $k = 7.00\ \frac{\mathrm{kg}}{\mathrm{s}}$.

10. Determine an equation for the speed and displacement of an object if it is dropped from rest in the presence of air friction $F_r = kv$.

11. Determine an equation for the speed of an object if it is dropped from rest in the presence of air friction $F_{\mathrm{r}} = kv^2$.