Physics Fix 5

Name: _____

Date: _____

Hour: _____

Information: Free Fall

When a skydiver is falling a couple things are happening. 1) Gravity is pulling the skydiver downward. 2) Air resistance is slowing down the skydiver. When the skydiver opens his parachute, the air resistance slows him down a lot! The reason a feather doesn't fall straight down is because of <u>air resistance</u>. Air resistance has a big affect on light objects like feathers. For now, we are going to ignore air resistance and pretend it doesn't exist. Then we can examine just the pull of gravity on an object without getting too confused. <u>Free fall</u> is when an object falls and gravity is the only thing affecting the object; there is no air resistance.

Critical Thinking Questions

1. Of course, perfect "free fall" does not exist since there is always air resistance. But which of the following objects behaves most similarly to an object in free fall?

   a) confetti at a party   b) a vase falling off a table   c) a feather falling off a bird
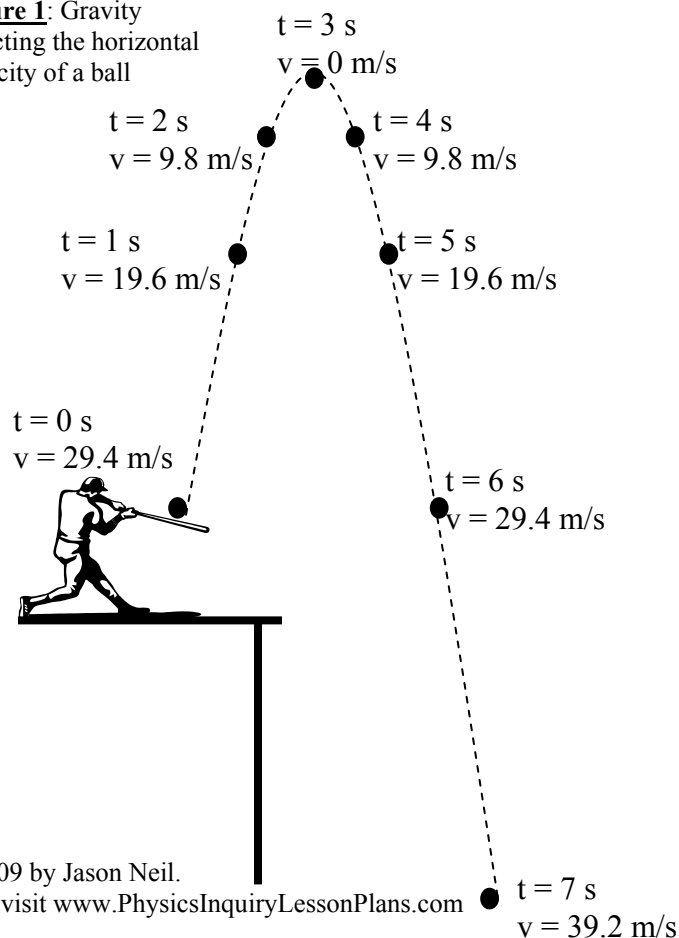
Information: Speed and Gravity

Gravity is constantly pulling downward. If you throw a ball up, it will be decelerated by gravity. As the ball moves upward, gravity will cause its speed to *decrease* by 9.8m/s each second.

If an object is moving downward, it will be accelerated by gravity. Its speed, v, will *increase* by 9.8 m/s each second.

The strength of the acceleration due to gravity is given the symbol, g, and it is equal to 9.8 m/s^2.

Figure 1: Gravity affecting the horizontal velocity of a ball

t = 3 s
v = 0 m/s

t = 2 s
v = 9.8 m/s

t = 4 s
v = 9.8 m/s

t = 1 s
v = 19.6 m/s

t = 5 s
v = 19.6 m/s

t = 0 s
v = 29.4 m/s

t = 6 s
v = 29.4 m/s

t = 7 s
v = 39.2 m/s

Critical Thinking Questions

2. The picture doesn't show us what happens after 7 seconds. At a time of 8 seconds, how fast would the ball be going?

3. The ball in figure one started out at a speed of 29.4 m/s and took 3 seconds to reach its maximum height. At a time of 3 seconds the speed of the ball was 0 m/s. If the beginning speed had been 39.2 m/s (instead of 29.4 m/s), how many seconds would it have taken to reach a speed of 0 m/s?

4. If a rock fell off of a cliff, how fast would the rock be going after 2 seconds?

5. If a rock fell off a cliff, how fast would it be traveling after 8 seconds?

6. Which equation could be used to answer questions 4 and 5?

     a) $v = g \cdot t$ b) $v = g + t$ c) $v = g \cdot t^2 + 2$ d) $v = 2(t + g)$

7. If a ball is thrown upward at an initial velocity of 45.6 m/s, how many seconds will it take for the ball to reach it's maximum height? (Hint: use the equation from question 6; you know v and g, so you can solve for t!)

8. Considering the same ball from question 7, how long will it take for the ball to come back down for you to catch it? (Hint: the ball will take the same amount of time to come down as it took to go up.)

Information: Gravity and How Far A Rock Falls

The following information was gathered by scientists observing a rock falling down a cliff. The rock was initially at rest with no speed and then began to fall:

Time (seconds)	Distance Fallen (meters)
0	0
1	4.9
2	19.6
3	44.1
4	78.4

Critical Thinking Questions

9. Which one of the following equations fits the data? (Note: d stands for distance fallen.)

   a) $d = g \cdot t$ b) $d = 2(g \cdot t)$ c) $d = \frac{1}{2} g \cdot t^2$ d) $d = t^2 + 2g$

10. A boy dropped a penny off a cliff. How many meters did the penny fall in 7 seconds?

11. Considering the penny from the previous question, how fast was the penny going after 7 seconds? (Hint: the equation from question 6 might help.)

12. How long would it take a rock to fall down a cliff that is 109 m tall? (Hint: use the equation from question 9 and solve for t.)