

Name: Solutions Period: ALL Date: _____

Amusement Park Physics- Free Fall Acceleration

The following exercise involves observing a free fall ride in an amusement park. Use formulas for free fall acceleration to assist in answering the following questions.

INSTRUCTIONS: You will work with a lab partner on the Physics Day Pre Lab Part 2. Each person in the group will keep individual records. All the information collected and calculated will be reviewed next class.

Click on the following Video Clip of the Six Flags Tower of Doom video for analysis:

<http://tinyurl.com/towerofdoomvideo>

Tower of Doom

Play the video clip. Notice that the ride doesn't free fall the entire time. You can hear when the ride begins to apply the brakes.

Total Height of Tower of Doom: 42.7 meters

Length of Free Fall: 21.6 meters

1. Time it takes the ride to reach the top: 1st trial 20 s Average of the 3 trials: 20 s

2nd trial 21 s

3rd trial 19 s

2. Time it takes the ride to fall 21.6 meters (listen for when the brakes kick in):

1st trial 2.1 s Average of the 3 trials: 2.0 s

2nd trial 2.0 s

3rd trial 1.9 s

3. Calculate the **velocity** of the ride as it goes to the top. Assume zero acceleration.

Variables (What you know/ need to know)	$\Delta x = 42.7 \text{ m}$ $v = ? \frac{\text{m}}{\text{s}}$ $t = 20 \text{ s}$
Formula	$V = \frac{\Delta x}{t}$
Substitution	$V = \frac{42.7 \text{ m}}{20 \text{ s}}$
Calculations & Answer	$V = 2.135 \frac{\text{m}}{\text{s}}$

4. Calculate the free fall acceleration of the ride.

Variables (What you know/ need to know)	$x_1 = 0\text{m}$ $v_1 = 0 \frac{\text{m}}{\text{s}}$ $a = ? \frac{\text{m}}{\text{s}^2}$ $x_2 = 21.6\text{m}$ $t = 2.0\text{s}$
Formula	$x_2 = x_1 + v_1 t + \frac{1}{2} a t^2$
Substitution	$21.6\text{m} = 0 + 0 \frac{\text{m}}{\text{s}} (2.0\text{s}) + \frac{1}{2} a (2.0\text{s})^2$
Calculations & Answer	$21.6\text{m} = \frac{1}{2} a (2.0\text{s})^2$ $a = -10.8 \frac{\text{m}}{\text{s}^2}$

How does your value for free fall acceleration compare to the acceleration due to gravity, -9.8 m/s^2 ?

This value is higher than acceleration due to gravity. This value is probably higher because of the times that were used in the calculations.

5. Calculate the velocity of the ride just before the brakes are applied.

Variables (What you know/ need to know)	$v_2 = ?$ $v_1 = 0$ $a = 10.8 \frac{\text{m}}{\text{s}^2}$ $t = 2.0\text{s}$
Formula	$v_2 = v_1 + a t$
Substitution	$v_2 = 0 + (10.8 \frac{\text{m}}{\text{s}^2}) (2.0\text{s})$
Calculations & Answer	$v_2 = 21.6 \frac{\text{m}}{\text{s}}$