Name: _____ **Period:**_____ **Date:**_____

Amusement Park Physics

The following exercises involve observing different types of circular motion rides in amusement parks. Use formulas from your Circular Motion Formula Sheet to assist in answering the following questions.

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

For each station go to the following web site and click on the link for each station to obtain the data.

http://vip.vast.org/Circ_Lab/index.htm

your time should be close to this. → 13.3 sec

Station 1: Ferris Wheel

1. Use a stopwatch to measure the period of motion for the Ferris Wheel. Period of Ferris Wheel: 13.3 sec

2. Calculate the Ferris Wheel's tangential speed

Variables (What you know/ need to know)	$V = ?$ $r = 9$ meters $T = 13.3$ sec
Formula	$V = \frac{2\pi r}{T}$
Substitution	$V = \frac{2\pi(9)}{13.3}$
Calculations & Answer	$V =$ 4.25 m/s ← your value should be close to this depending on what you put in for π.

3. Calculate the Ferris Wheel's centripetal acceleration

Variables (What you know/ need to know)	$a_c = ?$ $V = 4.25$ $r = 9$
Formula	$a_c = \frac{v^2}{r}$
Substitution	$a_c = \frac{(4.25)^2}{9}$
Calculations & Answer	$a_c = \frac{18.0625}{9}$ $a_c = 2.007\ m/s^2$

4. If the mass of a rider is 65 kg, what is the centripetal force exerted on the passenger by the Ferris Wheel?

Variables (What you know/ need to know)	$F_c = ?$ $m = 65\ kg$ $a_c = 2$
Formula	$F_c = ma_c$
Substitution	$F_c = (65)(2)$
Calculations & Answer	$F_c = 130\ N$

Station 2: Anti-Gravity Machine

your time should be close to this.

1. Use a stopwatch to measure the period of motion for the Anti-Gravity Machine. Period = 3.3 sec

2. Calculate the Anti-Gravity Machine's tangential velocity

Variables (What you know/ need to know)	$V = ?$ $r = 7\ m$ $T = 3.3\ sec$
Formula	$V = \frac{2\pi r}{T}$
Substitution	$V = \frac{2\pi(7)}{3.3}$
Calculations & Answer	$V = 13.33\ m/s$ ← your value should be close to this depending on what you put in for π.

3. Calculate the Anti-Gravity Machine's centripetal acceleration

Variables (What you know/ need to know)	$a_c = ?$ $V = 13.33_{m/s}$ $r = 7\ m$
Formula	$a_c = \frac{V^2}{r}$
Substitution	$a_c = \frac{(13.33)^2}{7}$
Calculations & Answer	$a_c = \frac{177.69}{7}$ $a_c = 25.38\ m/s^2$

4. If the mass of a rider is 55 kg, what is the centripetal force exerted on the passenger by the Anti-Gravity Machine?

4.

Variables (What you know/ need to know)	$F_c = ?$ $m = 55\,kg$ $a_c = 25.38\ m/s^2$
Formula	$F_c = ma_c$
Substitution	$F_c = (55)(25.38)$
Calculations & Answer	$F_c = 1395.9\ N$

Station 3: Roller Coaster

After you click on the Roller Coaster link, click on the how to estimate the coaster's velocity. Follow the measurement animation to understand the method being described. You will use this method.

Height of loop in the track: **35 meters;** **Length** of one car: **2 meters;** **Mass** of one car: **910 kg**

1. Number of cars in the train: 7
2. Length of the train: 14 m
3. Total Mass of the train: 6,370 kg
4. Use a stopwatch to measure the time for the front of the train to go from the bottom of the loop, B, to the top of the loop, C.
5. Measure the time for the entire train to pass the top of the loop, C. 1.4 sec
6. Measure the time for the entire train to pass the bottom of the loop, B. .8 sec
7. Calculate the velocity of the train at the top of the loop, C.

Variables (What you know/ need to know)	$V = ?$ # of cars = 7 $t = 1.4\,sec$ length of one car = 2m
Formula	$V = \frac{(\text{length of one car})(\text{\# of cars})}{(\text{time to pass point})}$
Substitution	$V = \frac{(2)(7)}{1.4}$
Calculations & Answer	$V = \frac{14}{1.4} = 10\ m/s$

your values should be close to these.

8. Calculate the velocity of the train at the bottom of the loop, B.

Variables (What you know/ need to know)	$V=?$ # of cars = 7 $t = .8$ sec length of one car = 2m
Formula	$V = \frac{(\text{length of one car})(\text{\# of cars})}{(\text{time to pass point})}$
Substitution	$V = \frac{(2)(7)}{(.8)}$
Calculations & Answer	$V = \frac{14}{.8}$ $V = 17.5\ m/s$

9. Calculate the Potential Energy of the train at the top of the loop, C.

Variables (What you know/ need to know)	$U_g = ?$ $m = 6370$ $g = 9.8\ m/s^2$ $h = 35m$
Formula	$U_g = mgh$
Substitution	$U_g = (6370)(9.8)(35)$
Calculations & Answer	$U_g = 2,184,910$ Joules

10. Calculate the Kinetic Energy of the train at the top of the loop, C.

Variables (What you know/ need to know)	$KE = ?$ $m = 6370\ kg$ $V = 10\ m/s$
Formula	$KE = \frac{1}{2}mv^2$
Substitution	$KE = \frac{1}{2}(6370)(10)^2$
Calculations & Answer	$KE = 318,500$ Joules

11. Calculate the Kinetic Energy of the train at the bottom of the loop, B.

Variables (What you know/ need to know)	$KE = ?$ $m = 6370\ kg$ $V = 17.5\ m/s$
Formula	$KE = \frac{1}{2}mv^2$
Substitution	$KE = \frac{1}{2}(6370)(17.5)^2$
Calculations & Answer	$KE = \frac{1}{2}(6370)(306.25)$ $KE = 975,406.25$ Joules