Level 2: Circular Motion and Gravity

 The Carousel at Valleyfair has a radius of 3.42 m and takes 4.1 sec to circle once. What is the centripetal force you would feel if your mass was 95 kg and how many g's will you feel? (Find v first!) (763 N, 0.82 g's)

- 2. Two similar trucks each having a mass of 200,000 kg are 40 m apart.
 - a. What is the gravitational force of attraction between them? (ans. 0.00167 N)
 - b. What is the weight (how much gravity pulls on mass) of 1 truck? (1.96 x 10⁶ N)
 - c. Using the 2 numbers you just calculated, WHY do you think the two trucks do not become attracted to each other like a magnet?
- Calculate the <u>centripetal force</u> exerted by the sun on the earth. (The radius of the earth's orbit is 1.5 x 10¹¹ m. You will also need the mass of the earth and its period (T) in seconds.) (ans. 3.56 x 10²² N)
- 4.
- a. Find the **gravitational force** between the earth and the sun. (The radius of the earth's orbit is 1.5×10^{11} m.) (ans. 3.5×10^{22} N)

b. Compare your answers to number **3** and number **4a**. Explain what you notice.

5.

a. What is the acceleration due to gravity at a point 400,000 m above the earth's surface? (8.7 m/s^2) Don't forget the radius of the earth!

b. What velocity must a satellite maintain to stay in orbit at the distance from part a? (\approx 7,676 m/s)

6. How far away from the center of the Earth (r) would you (150 kg) need to go in order for the acceleration due to gravity to be equal to 7.65 m/sec²? (≈7,220,758 m)

- 7. What would your weight (in N) be if acceleration due to gravity was 7.65 m/sec²? (1147.5 N)
- 8. The space shuttle files at roughly 200 **miles** above the earth's surface. Calculate your weight in Newtons at that height if your mass is 110 kg. **Don't forget the radius of the earth and to find g first!** (ans. 979 N) (Find g at that location, then w=mg)

9. Use an equation to solve for the acceleration due to gravity at the earth's surface. Does this number look right?