MULTI-LEVEL MATH AND SCIENCE WORKSHEET

THE CAPITAL WHEEL FACTS:

- 41 gondolas, seats 8 per
- 1 VIP gondola, seats 4
- 2 min per rotation
- 180' tall (54.86 meters)
- 21 spokes
- Distance between spokes: 22 feet
- 4 50-Hp (horsepower) drive motors
- Wheel structure weighs 320 tons
- 1.6 million LED lights
- Each gondola weighs 1,500 lbs

Use 3.14 for π, 9.8m/sec^2 for gravitational constant, and 735.50 J/sec for 1 Hp


QUESTIONS

Q. The Capital Wheel has 41 regular gondolas with eight seats and one VIP gondola with four seats. How many passengers can ride on The Capital Wheel at one time? A: 41*8 +1*4= 332 people

Q. What is the radius of The Capital Wheel? What is the distance between the gondolas (the length of the arc X)?
A. Radius is diameter divided by 2—54.86m/2 = 27.43m.
The wheel's circumference is $2\pi r$ = 2*3.14.*27.43= 172.26 meters around the wheel.
The distance between the gondolas (the length of arc X) is 172.26/21 = 8.20meters
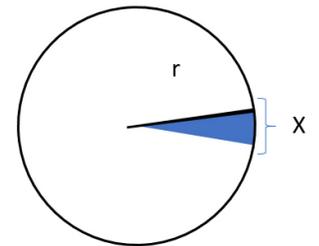
Q. Gears and motors pull The Capital Wheel gondolas up. What pulls the gondolas down?
A. gravity

Q: What is the linear velocity of a car when The Capital Wheel is at top speed?
A: Linear velocity (v) = ω *r (ω is angular velocity). Wheel completes a rotation in 2 minutes.
$2\pi r$ (distance of rotation) in 2 mins $\omega = 2\pi r/2mins$ or $\omega = \pi r/1min$ or $\omega = \pi r/60$ sec
$\omega = (\pi*27.43)/60$ sec = 1.436 rad/sec
v = 1.436 rad/sec * 27.43m = 39.38 m/s

Q. What is the centripetal acceleration on a passenger at top speed? What is the direction of this acceleration?
A. angular acceleration(α) = ω^2*r
α = (1.436 rad/sec)2 * 27.43 m= 56.56 m/sec2
Centripetal Acceleration is always inwards along the radius vector of the circular motion (toward the pivot point or wheel hub).

Q: How much work does the The Capital Wheel do on a group of riders to raise them from the lowest point to the highest point on the wheel? The riders are in the same gondola and they have a combined mass of 300 kg.
A: Work = gravity * Mass * Height
Work (Joules) = 9.8 m/sec2 * 300 kg * 54.86 meter = 161.288 J or Kg*m2/sec2