STEAM CHALLENGE

WORKSHEET – HIGH SCHOOL

NAME: **DATE:**

Science & Engineering: Physics in Motion

The KC Wheel rotates in a vertical circle and is 150 feet (45.72 meters) tall.

1. The wheel completes one full rotation in 12 minutes. What is the approximate linear speed (in meters per second) of a gondola at the outer edge of the wheel?
Use:
Circumference = $2\pi r$
$r = 61 \div 2 = 30.5$ meters

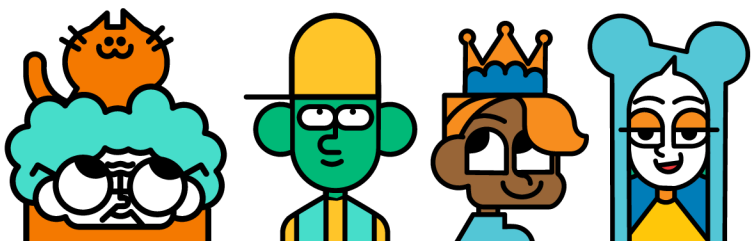
Show your work:

Speed = _____ m/s

2. Which type of energy conversion occurs during the ride? Explain the role of potential and kinetic energy during the ride.

3. Engineers must consider centripetal force acting on each gondola. Write the formula for centripetal force and identify the variables involved.
Formula: _____

What do each of the variables represent?



Technology: Automation & Safety

4. What types of sensors and monitoring systems do you think are essential for a 150ft observation wheel? Choose two and describe their function.
Sensor 1: _____
Function: _____
Sensor 2: _____
Function: _____

5. How do computerized systems enhance guest safety and operational efficiency?

_____

_____

_____

Art & Design: Experience Matters

6. The KC Wheel is a city landmark. How do lighting, structure, and placement influence its aesthetic and emotional appeal?

_____

_____

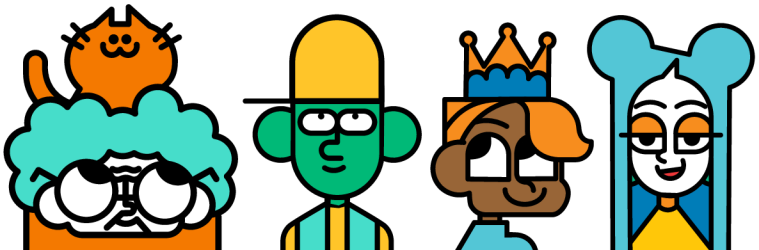
7. If you were hired to design a digital LED light show for the KC Wheel to represent your school or a holiday, what theme or colors would you choose?

_____

Why?

_____

_____



Math: Real-World Application

8. Each gondola holds up to 6 people. There are 36 gondolas.
a) What is the maximum number of guests per rotation?
A: _____

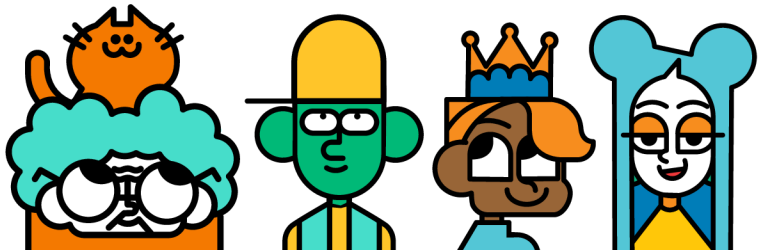
b) If the wheel completes 5 full rotations per hour and runs for 10 hours per day, what is the maximum number of total riders per day (assuming full capacity)?
A: _____

9. If your school group has 240 students and each gondola holds 6 people, how many gondolas will be needed at the same time?
A: _____

How many full rotations are required to accommodate the entire group (if only 36 gondolas run per rotation)?
A: _____

Reflection

10. Choose one STEAM career (Science, Technology, Engineering, Art, or Math) you think is most involved in building and operating the KC Wheel. Explain why.



ANSWER KEY

Science & Engineering: Physics in Motion

1.

- Radius = 45.72 ÷ 2 = 22.86 meters
- Circumference = $2\pi r = 2 \times \pi \times 22.86 \approx 2 \times 3.1416 \times 22.86 \approx 143.6$ meters
- Time = 12 minutes = 720 seconds
- Speed = Distance ÷ Time = 143.6 ÷ 720 ≈ 0.1994 m/s

Speed ≈ 0.20 meters/second

2. Energy conversion: Electrical → Mechanical

- As the wheel moves upward, riders gain potential energy.
- As they descend, that energy is converted to kinetic energy.
- The ride continuously shifts between the two due to vertical circular motion.

3. Centripetal Force Formula:

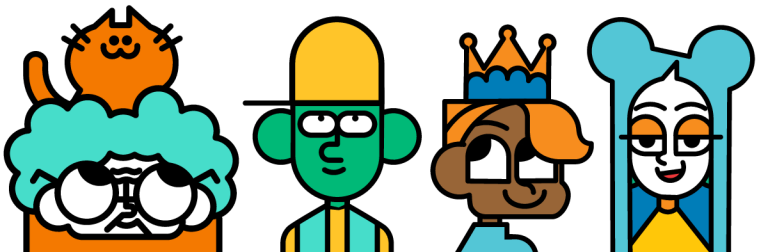
$F = (mv^2)/r$

- F = centripetal force
- m = mass of the object (gondola + people)
- v = velocity
- r = radius of the circle

Technology: Automation & Safety

4. Sample sensors:

- Proximity Sensor: Ensures gondolas are properly spaced
- Wind Speed Sensor: Shuts down the ride if winds are too strong
- Load Sensor: Measures weight in gondolas for balance/safety
- Temperature Sensor: Monitors motors and machinery for overheating



ANSWER KEY

Technology: Automation & Safety

5. Computerized systems automate:

- Start/stop sequences
- Monitoring mechanical performance
- Emergency safety protocols
- Operational efficiency and guest safety

Art & Design: Experience Matters

6.

- Structure's symmetry and size make it visually striking
- Lighting adds emotion, brand presence, and nighttime appeal
- Placement allows for panoramic views, creating lasting memories

7. Sample answer:

- Theme: School colors – blue and gold
- Why: Represents school pride, great for student night or graduation celebration

Math: Real-World Application

8a. 36 gondolas × 6 people = 216 guests per rotation

8b.

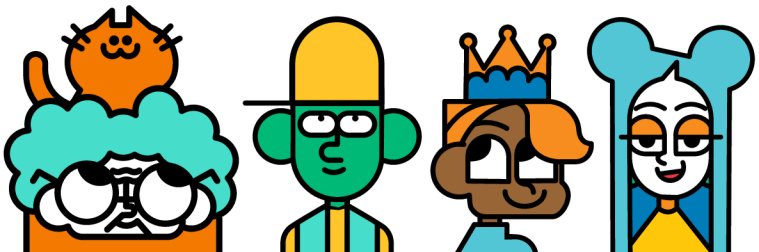
- 5 rotations/hour × 10 hours = 50 rotations/day
- 50 × 216 = 10,800 guests per day (at max capacity)

Answer: 10,800 riders/day

9.

- 240 students ÷ 6 per gondola = 40 gondolas needed
- Only 36 gondolas per rotation → 1 full rotation with 36
- Then 4 more students need another rotation

Answer: 2 rotations required to accommodate all



ANSWER KEY

Reflection

10. Open-ended, but strong answers include:

- Engineering – for structural safety and design
- Technology – for monitoring systems
- Math – for load calculations and operations
- Art – for lighting design and guest experience